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Draft Environmental Impact Statement

Flint Foothills Vegetation Management - Volume 1

Pintler Ranger District, Beaverhead-Deerlodge National Forest
Granite and Powell Counties, Montana

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Flint Foothills Vegetation Management Project
Draft Environmental Impact Statement
Beaverhead-Deerlodge National Forest, Granite and Powell Counties, Montana

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Abstract: The Beaverhead-Deerlodge National Forest (BDNF), Pintler Ranger District, is proposing the Flint Foothills Vegetation Management Project to address the vegetation conditions in the project area resulting from current insect and disease infestations. The Flint Foothills Vegetation Management Project area encompasses 44,522 acres located on the north end of the Flint Range in the Clark Fork Flint Landscape (Forest Plan pp. 108-109), about 6 miles southeast of Drummond, Montana (figure 1). Eighty-three percent of the area (37,010 acres) is managed by the Beaverhead-Deerlodge National Forest; the remainder is private inholdings (7,512 acres). This Draft Environmental Impact Statement considers the environmental effect of proposed activities including salvage by clearcut harvest regeneration, commercial thinning, and seed tree harvest with reserves, prescribed burning and precommercial thinning, on 5,703 acres.

Alternative 2-Proposed Action is intended to:

- Salvage by clearcut regeneration harvest dead and dying lodgepole pine stands on 1,163 acres.
- Commercial thin ponderosa pine and Douglas-fir stands, including 121 acres of old growth, on 1,149 acres.
- Regenerate by seed tree harvest Douglas-fir and ponderosa pine stands on 353 acres.
- Collectively, the commercial vegetation treatments would provide 16,042 MBF (32,083 CCF) in sawtimber; and 4,010 MBF (8,021 CCF) in non-saw timber.
- Prescribe burn mid-elevation lodgepole pine and low-elevation Douglas-fir and ponderosa pine stands on 1,990 acres.
- Precommercial thin naturally regenerated, lodgepole pine and Douglas-fir stands on 1,048 acres.
- Construct 1.3 miles of new National Forest System road.
- Construct 7.2 miles of new temporary road.
- Add 2.4 miles of road (1.3 miles of new NFS road construction and 1.1 miles of open and closed unauthorized routes) to the Forest transportation system.

Alternative 3 addresses public concerns over new road construction, and logging within old-growth stands. This alternative proposes no new system or temporary roads constructed to access units or accommodate logging within units. No commercial thinning would occur within the understory of old-growth stands. As a result, alternative 3 includes fewer acres of salvage by clearcut regeneration harvest, 666 acres, and commercial thinning, 1,022. All other vegetation treatments remain the same as alternative 2.

This DEIS is made available for a 45-day Comments Period under the provisions of the National Environmental Policy Act (40 CFR 1500-1508), and Notice, Comment, and Appeal Procedures for National Forest System Projects and Activities (36 CFR 215). The Forest Service will accept comments as provided in §215.6(a)(4), beginning on the day following the date of publication of the Notice of Availability (NOA) in the Federal Register.

It is important that reviewers provide their comments to the Forest Service at such times and in such a way that they are useful to the Agency's preparation of the EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names postal and email addresses and telephone numbers of those who comment, will be part of the public record and available for public inspection. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

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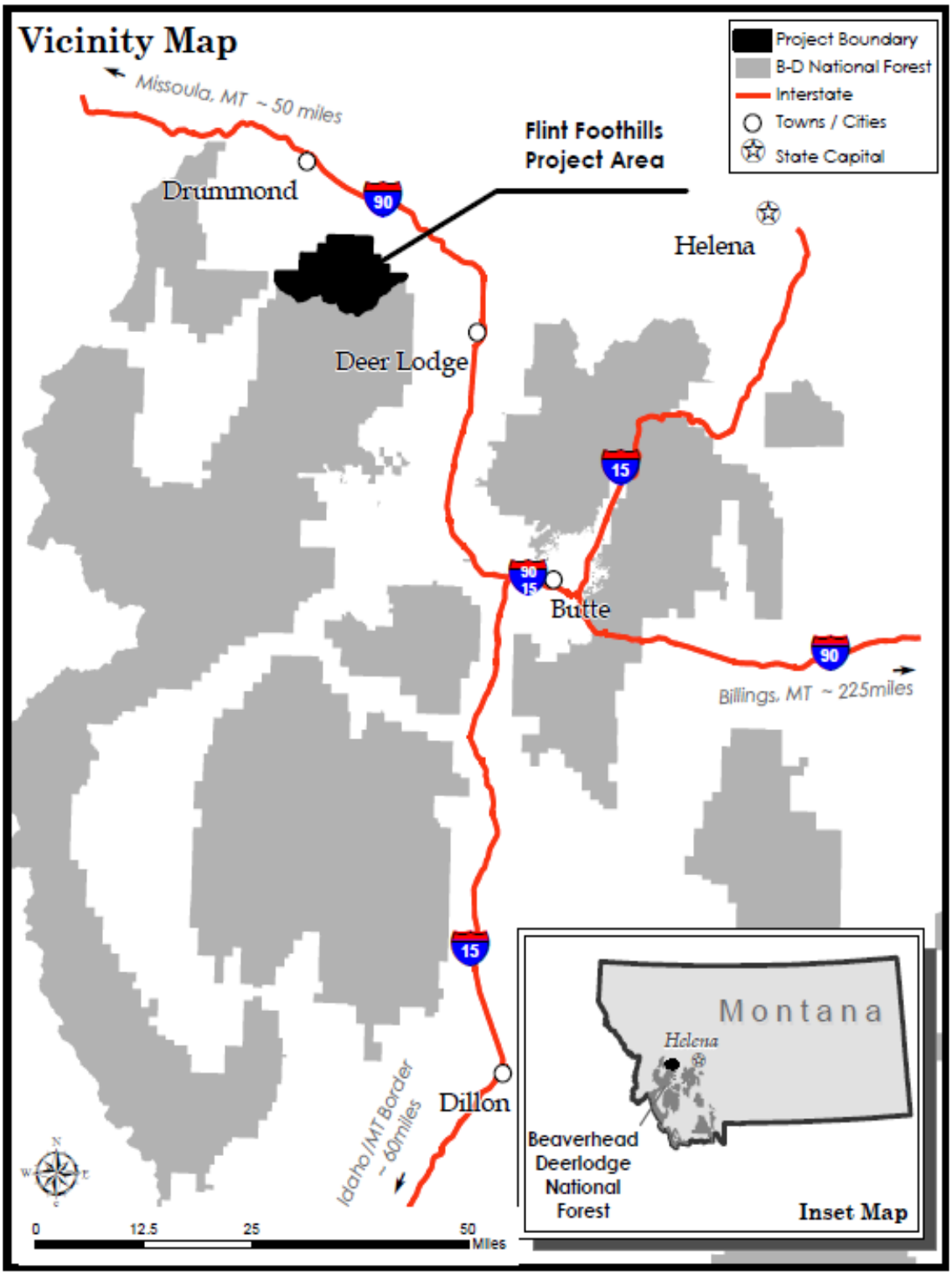

Figure 1. Vicinity map

The USDA Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. Using GIS products for purposes other than those for which they were intended may yield inaccurate or misleading results. The USDA Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. The maps in this document were prepared by TEAMS Enterprise Unit using Beaverhead-Deerlodge National Forest data as of 1/20/2012.

Summary

Introduction

This section is a brief summary of the contents of this Draft Environmental Impact Statement (DEIS). The DEIS begins with chapter 1.

The Beaverhead-Deerlodge National Forest (BDNF), Pintler Ranger District, is proposing the Flint Foothills Vegetation Management Project to address the vegetation conditions in the project area resulting from current insect and disease infestations, or at risk from future infestations. Proposed activities include salvage by clearcut harvest regeneration, commercial thinning, seed tree harvest, precommercial thinning and prescribed burning.

The Flint Foothills Vegetation Management Project area encompasses 44,522 acres located on the north end of the Flint Range in the Clark Fork Flint Landscape (Forest Plan pp. 108-109), about 6 miles southeast of Drummond, Montana (figure 1). Eighty-three percent of the area (37,010 acres) is managed by the Beaverhead-Deerlodge National Forest; the remainder is private inholdings (7,512 acres). Proposed activities for the project follow direction for the Flint Foothills and Flint Uplands Management Areas as described in the 2009 Beaverhead-Deerlodge Forest Plan (Forest Plan, pp. 108-109; 112-115).

Other plans, policies and regulations provide management direction for this project, including but not limited to:

- The National Forest Management Act of 1976 (NFMA) and implementing regulations - The Flint Foothills Project is consistent with the findings required when making project-level decisions involving timber harvest.
- Forest Service Policy - The Flint Foothills Project is consistent with the Forest Service Manual and Handbook direction outlined in this analysis.
- Forest Plan Consistency - The Flint Foothill Project is consistent with the Forest Plan management area direction, and also is designed to meet vegetation goals and objectives within the plan.
- The Endangered Species Act of 1973 - Requires federal agencies to ensure that any agency actions (any action authorized, funded or carried out by the agency) are not likely to jeopardize the continued existence of any threatened, endangered or proposed species.
- Sensitive Species - The sensitive species analysis in this document meets the requirements for a biological evaluation as outlined in FSM 2672.42. Sensitive species are administratively designated by the Regional Forester and managed under the authority of the National Forest Management Act.

Background - Existing Vegetation Conditions in the Project Area

The Flint Foothills area is part of a larger mountain pine beetle (Dendroctonus ponderosae) epidemic occurring across the majority of the Beaverhead-Deerlodge National Forest and on other forests in the Northern Region. Mountain pine beetle has been active in the Flint Foothills area since about 2000, reaching epidemic proportions beginning in 2007. This has resulted in extensive areas of dead and dying lodgepole pine, and the mortality of more individually scattered ponderosa pine and whitebark pine. Within the Flint Foothills Project area on National Forest System (NFS) lands, it is estimated that all (100 percent) of the pine stands 5 inches d.b.h. and larger have been affected by mountain pine beetle. Beetle infestations are a regular force of natural change in forested ecosystems; however, several current outbreaks occurring simultaneously across western North America are the largest and most severe in recorded history (Bentz 2008).

Surveys show that mortality of individual Douglas-fir trees is occurring in the project area due to western spruce budworm (Choristoneura occidentalis). The recent drought conditions and dense stand conditions cause the late-successional stands of Douglas-fir to be susceptible to western spruce budworm because these stands are often stressed by competition. Areas of higher mortality due to western spruce budworm in contiguous stands of Douglas-fir are evident in the Gird Creek to Douglas Creek areas within the project area.

An increase in individual numbers of Douglas-fir trees killed by Douglas-fir bark beetle (Dendroctonus pseudotsugae) has been noted in the Dunkleberg Ridge, Jackson Park and Blum Creek areas. An increase of mortality due to Douglas-fir bark beetle may be attributed to the heavy and repeated defoliation from western spruce budworm, which may lead to increases in Douglas-fir bark beetle activity.

Fire frequency determines the vegetation successional stage and fuel conditions; the shape and size of past fires play a role in fuel connectivity and landscape heterogeneity or homogeneity (Arno et al. 2000, Turner et al. 1998). Forest structure and composition in the Flint Foothills Project area have been most significantly altered due to the lack of fire disturbance. The mid- to high-elevation forests are currently homogeneous, mature stands lacking stand-age diversity. Past fire disturbances suggest a more heterogeneous landscape. Blister rust (Cronartium ribicola) and mountain pine beetle have accelerated succession to subalpine fir by killing mature whitebark pine. Mountain pine beetle has killed the majority of lodgepole pine in the project area. Additionally, mortality of very large ponderosa pine from mountain pine beetles has been noted in the project area through stand exams. Coupled with the lack of fire, these disturbances have caused a major shift in landscape composition and structure from pine to fir and spruce (Keane 2000).

Purpose and Need

The purpose and need of the Flint Foothills Vegetation Management Project is to contribute to achievement of the following Forest Plan goals and objectives:

1. **Forest Plan Timber Management Goals**
   a. *Lands Suitable for Timber Production:* Manage lands suitable for timber production for the growth and yield of sawtimber, crop trees, pulpwood, and other forest products, including salvage harvest.
   b. *Product Utilization:* Forest products would be used to provide economic benefits where project objectives, forest plan objectives, and forest plan standards can be met.
2. **Forest Plan Timber Management Objectives on Lands Suitable for Timber Production**
   a. Bring 10 percent of lands suitable for timber production into a managed condition.[1]
   b. Manage those stands already in a managed condition to maintain long term sustained yield.
3. **Forest Plan Vegetation Management Objectives**
   a. Reduce forest density in the large size classes of dry forest communities and some lodgepole pine communities to maintain or improve forest conditions.
   b. Douglas-fir Type: Increase the number of acres in the 0- to 5-inch d.b.h. class on approximately 20,000 acres.
   c. Lodgepole Pine Type: Increase the number of acres in the 0-to 5-inch d.b.h. class by approximately 74,000 acres.

[1] The Corrected Final Environmental Impact Statement (FEIS) for the Forest Plan identifies 284,000 acres of suitable timber ground (FEIS p. 38). The Forest Plan objective applies to ten percent—28,400 acres of suitable lands on a Forestwide basis for the ten-year planning period of the Plan.

All project treatment units have been proposed on lands classified as "Suitable for Timber Production" using the Forest Plan's Timber Harvest Classification Protocol (Forest Plan Pg. 42), which includes both coarse-scale GIS modeling and site-specific on the ground reconnaissance. The following table cross-walks proposed treatments with the corresponding Forest Plan Goal/Objectives.

Table S- 1. Cross-walk between the purpose and need Forest Plan goals and objectives, and the proposed action

Purpose and Need (See Numbered Forest Plan Goals/Objectives Above)	Vegetation Treatment Type	Acres of Treatment	Volume Saw/non-saw MBF	Number of Units	Range in Unit Size by Acres
1A and B 2A 3C	Salvage by clearcut harvest dead and dying lodgepole pine (S) Salvage harvest dead and dying LP. Retain all other conifers and FP required snags.	1,163	9,304 /2,326	30	2-94
1A and B 3A	Commercial Thinning ponderosa pine and Douglas-fir (C) Thin low to mid-elevation units to reduce density from an average of 100-140 to 40-60 basal area.	1,149*	5,502/1,376	29	9-175
1A and B 2A 3B	Seed Tree with Reserves (ST) Seed Tree harvest for ponderosa pine regeneration. Reserve trees are larger diameter Douglas-fir and ponderosa pine, in addition to seed trees	353	1,236/309	6	8-139
3A	Prescribed Burn (B) Use ignited fire to burn low elevation dry forest units	731	N/A	5	15-298
3C	Prescribed Burn (B) Use ignited fire to burn in mid-elevation mixed conifer units	1,259	N/A	3	251-710
1A 2B	Precommercial Thinning (P) Thin sapling-sized trees in old harvest units	1,048	N/A	20	9-187
	Total	**5,703**		**93**	**2-710**

*Includes 121 acres of old-growth

Changes to the Proposed Action since Publishing the Notice of Intent

Field reviews of the proposed treatment units were completed by the interdisciplinary team members subsequent to publishing the Notice of Intent (NOI) in June 2011 and mailing the June 7, 2011 scoping letter. These reviews resulted in updates to the proposed action, including changes in treatment prescriptions, unit boundary changes, and the addition and deletion of units. Many of the originally proposed precommercial thinning units were identified as previously thinned, and therefore, dropped from the list of units proposed for treatment. Other units were identified for density reduction, and therefore, added to the list of units proposed for treatment. Overall, the net changes resulted in the addition of 92 acres of commercial treatments, and a reduction of 98 acres of precommercial thinning, for a net change of 6 fewer acres in the updated DEIS proposed action.

June 2011 scoping identified approximately 10 miles of temporary road construction and 72 miles of National Forest System roads (NFS roads) needed for access and hauling. Haul route needs were refined in the updated

proposed action presented in this DEIS. A distinction is made between NFS roads[2], and existing open and closed unauthorized routes (UR)[3] [4] One segment of new temporary road construction in the June 2011 scoping was determined to need construction specifications due to steep slopes and is now proposed as new National Forest System road construction (1.3 miles).

Table S- 2 displays the changes in activity acreages and haul route mileages between the proposed action presented in June 2011, and the updated proposed action in this document.

Table S- 2. Comparison of the June 2011 proposed action and the updated action proposed in the DEIS

Treatment Type	**June 2011 Scoping Proposed Action Acres**	**Updated DEIS Proposed Action Acres**
Salvage by clearcut	863	1,163
Commercial thinning	1,007	1,149
Seed tree with reserves	0	353
Combination salvage by clearcut and commercial thinning	703	0
Prescribed burning	1,990	1,990
Precommercial thinning	1,146	1,048
Total Acres	**5,709**	**5,703**
Haul Routes within the Project Boundary	**June 2011 Scoping Miles**	**DEIS Miles**
NFS roads, existing	72	68.2
NFS roads, proposed on open and closed URs	0	1.1
NFS roads, proposed new construction	0	1.3
Temporary roads, on open and closed URs	0	4.4
Temporary roads, proposed new construction	10	7.2
Total Miles	**83**	**82.2**

Alternatives

Alternative 1 – No Action

Under the no-action alternative, no salvage of lodgepole pine by clearcut harvest, commercial thinning, seed tree harvest, prescribed burning, or precommercial thinning would be implemented to accomplish project and Forest Plan objectives.

Alternative 2 and Alternative 3

Treatments

Alternatives 2 and 3 differ by the number of units and total acreages for salvage by clearcut harvest, and commercial thinning of ponderosa pine and Douglas-fir stands. There is no difference in treatment acres

[2] A National Forest System road is a forest road other than a road which has been authorized by a legally documented right-of-way held by a State, county or other local public road authority.

[3] An unauthorized road is a road that is not a forest road or a temporary road and that is not included in a forest transportation atlas.

[4] A route is a road or a trail.

between the alternatives for seed tree harvest, prescribed burning and precommercial thinning treatments. Table S- 3 displays the proposed activities for alternative 2 and alternative 3 and clearly shows the differences associated with each alternative.

Table S- 3. Comparison of vegetation treatment acreages and number of units for Alternatives 2 and 3

Vegetation Treatment	Alternative 2 (Proposed Action) Acres	Alternative 3 Acres	Difference in Acres	Alternative 2 Number of Units	Alternative 3 Number of Units	Difference in Number of Units
Salvage by clearcut harvest	1,163	1,022	141	30	25	5
Commercial thinning	1,149	666	483	29	24	5
Seed tree with reserves	353	353	0	6	6	0
Prescribed burning	1,990	1,990	0	8	8	0
Precommercial thinning	1,048	1,048	0	20	20	0
Totals	**5,703**	**5,079**	**624**	**88**	**83**	**10**

Logging Systems

Treatments would generally be accomplished with conventional, ground-based timber harvest equipment such as rubber-tired skidders, and would be limited to slopes less than 35 percent. Cable logging systems would be used where slopes are greater than 35 percent.

Trees would be whole tree logged and skidded to central landing areas adjacent to roads where they would be processed into logs and loaded on trucks for transport to area sawmills. Unmerchantable material brought to the landing would be piled for chipping or burning. Burning would occur when weather and ground conditions are suitable to maintain air quality, and burning can be controlled.

Haul Routes

Existing Forest roads,[5] NFS roads, and unauthorized routes would be utilized as haul routes. The total mileage varies by alternative.

All unauthorized routes currently exist on the ground. The open unauthorized routes are currently open to public motor vehicle travel, and displayed on the Beaverhead-Deerlodge National Forest North Map 2010 as open roads, consistent with the Forest Plan. The closed unauthorized routes are currently closed to public motor vehicle travel, and are not displayed on the Beaverhead-Deerlodge National Forest North Map 2010. Physically, the existing and closed routes are similar.

Two unauthorized routes, UR8-260 (open) and UR8-253 (open and closed segments) would be added to the Forest transportation system and would be managed as maintenance level 2 roads (high clearance vehicles recommended).They are designated as “NFS roads proposed” on the summary tables and alternative maps[6].

[5] A Forest road is wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources.

[6] Forest Service Manual (FSM) 7703.26 provides direction on adding roads to the forest transportation system, including unauthorized routes. Decisions must be informed by travel analysis; in this case, the Pintler RD conducted an internal travel analysis in 2008. The analysis is on file at the Pinter RD. This process is distinguished from designating routes and

Route UR8-260 accesses private land. All of UR 8-253, including the closed section, is currently displayed on the Beaverhead-Deerlodge National Forest North Map 2010 as an open road. The closed section is proposed to be added to the Forest transportation system, consistent with the Beaverhead-Deerlodge National Forest North Map 2010. The routes and mileages of other unauthorized routes proposed for use, both open and closed are provided in the alternative descriptions.

New temporary roads[7] constructed for project use would be decommissioned following project implementation of authorized activities, consistent with Forest Service policy (FSM 7703.24) which states that temporary roads are to be decommissioned. Decommissioning is an activity that results in stabilization and restoration of unneeded roads (or trails) to a more natural state (FSM 7705). The roads would be closed with a combination of signs and berms to allow for a subsequent travel management planning effort to consider these routes for addition to the system or more physical methods of decommissioning such as obliteration.

Road maintenance or reconstruction would occur on the haul route portions of all NFS roads and Forest roads associated with the project, either during or prior to commercial harvest activities. The open and closed unauthorized routes would be reconstructed. These activities would bring the roads to a standard complying with BMPs and also allow for safe product removal. Road maintenance typically involves grading, drainage features such as culverts, ditches, drainage dips, and spot surfacing as needed to meet Best Management Practices (BMPs). Reconstruction activities would include the maintenance items as well as more significant roadway improvement and/or realignment: embankment and slump repair, curve widening, subgrade boulder or cobble excavation and removal, and upgrades to accommodate safe timber haul. Timing of project activities would comply with existing travel management direction.

Alternative 2 – Proposed Action

The proposed action would achieve project objectives through a mix of vegetation treatments. A map of the proposed action is available in chapter 2 of this DEIS.

Alternative 2-Proposed Action would:

Treatments

- Salvage by clearcut regeneration harvest dead and dying lodgepole pine stands on 1,163 acres.
- Commercial thin ponderosa pine and Douglas-fir stands, including 121 acres of old growth, on 1,149 acres.
- Regenerate by seed tree harvest Douglas-fir and ponderosa pine stands on 353 acres.
- Collectively, the commercial vegetation treatments would provide 16,042 MBF (32,083 CCF) in sawtimber; and 4,010 MBF (8,021 CCF) in non-saw timber.
- Prescribe burn mid-elevation lodgepole pine and low-elevation Douglas-fir and ponderosa pine stands on 1,990 acres.
- Precommercial thin naturally regenerated, lodgepole pine and Douglas-fir stands on 1,048 acres.
- Construct 1.3 miles of new National Forest System road.
- Construct 7.2 miles of new temporary road.

areas for motor vehicle use under the travel management regulations, which results in a MVUM (motor vehicle use map).

[7] A temporary road is a road necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or a forest trail and that is not included in a forest transportation atlas.

- Add 2.4 miles of road (1.3 miles of new NFS road construction and 1.1 miles of open and closed unauthorized routes) to the Forest transportation system.

Table S- 4. Proposed activities for alternative 2 by acres, number of units and range in size of units

Vegetation Treatment Type	Acres of Treatment	Number of Units	Range in Unit Size by Acres
Salvage by clearcut harvest dead and dying lodgepole pine (S): Salvage harvest dead and dying LP. Retain all other conifers and FP required snags.	1,163	30	2-94
Commercial thinning ponderosa pine and Douglas-fir (C): Thin low to mid-elevation units to reduce density from an average of 100-140 to 40-60 basal area.	1,149*	29	9-175
Seed tree with reserves (ST): Seed Tree harvest for ponderosa pine regeneration. Reserve trees are larger diameter Douglas-fir and ponderosa pine, in addition to seed trees.	353	6	8-139
Prescribed burning (B): Use ignited fire to burn in mid-elevation mixed conifer units and low elevation dry forest units.	1,990	8	15-710
Precommercial thinning (P): Thin sapling-sized trees in old harvest units.	1,048	20	9-187
Totals	**5,703**	**93**	**2-710**

* Includes 121 acres of old growth in 4 units

Haul Routes

Under alternative 2, 109.1 miles of road would be used as haul routes. Table S-2 identifies the roads and associated mileages.

- A total of 100.6 miles of existing roads, including unauthorized routes, would be utilized as haul routes. This includes 68.2 miles within the project area boundary that are displayed in figure 5 in chapter 2. The remaining 26.9 miles are private, county, and NFS road outside the project area (figure 3). Approximately 58.9 miles would be maintained, and 41.7 miles would be reconstructed.
- Approximately 1.3 miles of new roads would be constructed for haul to access units 36S and 47S. The site conditions require the need for specified road construction, as opposed to temporary road. These roads would be added to the Forest transportation system as NFS roads. They would be put into storage (maintenance level 1) for future access following implementation of the Flint Foothills project. These roads would be closed to all motor vehicle use during the time they are in storage.
- Approximately 7.2 miles of new temporary road would be constructed, utilizing construction measures such as outsloping, drainage dips, and water-spreading ditches. Following completion of the vegetation projects, the new temporary roads would be decommissioned by obliteration, in which the road prism is recontoured; cut and fill slopes are restored to natural grades; and slash, stumps, and woody debris are placed on top of the corridor to effectively block vehicle travel
- Approximately 4.4 miles of open and closed unauthorized routes would be reconstructed and utilized as haul routes. Following project implementation, these routes would be decommissioned by various methods (table 6).
- Just over 1 mile of open and closed unauthorized routes would be reconstructed, utilized as haul routes and added to the Forest transportation system following reconstruction. They would be managed as maintenance level 2 roads (high clearance vehicles recommended).

Table S- 5. Proposed haul routes, miles and road/route number

Haul Routes	Alternative 2-Proposed Action Miles	Road/Route Numbers
Forest roads and NFS roads, existing (outside of the project area)	26.9	State Highway 1 Forest Road 676 (Finley Basin Road). NFS Road 1500 (Eureka Ridge Road) NFS Road 8402 (Gird Creek Road) Douglas Creek Road Forest Road 8454 (East Gird Creek) NFS Road 8454 Gold Creek and Mullan Trail Roads Forest Road 636 (Gold Creek)
NFS roads existing (inside of the project area)	68.2	NFS roads: 1522, 1522A, 1544, 1550, 1557, 1589, 19752, 5023, 5123, 5151, 5152, 5153, 5160, 5161, 5162, 5167, 5168, 636, 666,707, 73549, 78434, 78442, 78461, 78462, 78463, 78464, 78468, 78469, 78470, 78472. 78475, 78476, 78480, 78484, 78489, 78494, 78617, 8402, 8454, 8506, 8510, 8615
NFS roads proposed (on open UR)	0.7	UR8-253 UR8-260
NFS road proposed (on closed UR)	0.4	UR8-253
NFS roads proposed (new construction)	1.3	N1, N2
Temporary roads (on open URs)	1.0	UT8-110 UR8-246 UR8-271
Temporary roads (on closed UR)	3.4	T17, T19, T24, T26 (UR8-270), T28 (UR8-284), T32 (UR8-257), T34, T35 (78422)
Temporary, proposed (new construction)	7.2	T1-T16; T18; T20-T23; T27; T33; T36-T39
Total Miles	**109.1**	

Alternative 3

Treatments

Alternative 3 addresses public concerns about new road construction and the associated potential for increased sediment delivery to streams and invasive plant expansion and establishment; and managing (commercial thinning) within old-growth stands. This alternative proposes no new NFS or temporary road construction to access units or to accommodate logging within units. No commercial thinning would occur within the understory of old-growth stands. As a result, alternative 3 includes fewer acres of salvage by clearcut regeneration harvest, 666 acres, and commercial thinning, 1,022 acres. All other vegetation treatments remain the same as alternative 2. Collectively, the commercial vegetation treatments would provide 12,686 MBF (25,372 CCF) in sawtimber; and 3,172 MBF (6,343 CCF) in non-saw timber.

Alternative 3 eliminates eight units (36S, 47S, 72S, 48C, 56C, 57C, 68C, and 71C) requiring new temporary road construction for access to the unit, thereby eliminating the need for new temporary road construction. Five units (52S, 73S, 12C, 23C, and 80C) utilize open and closed unauthorized routes to and within the unit to accommodate logging; no new temporary roads would be constructed. Instead, longer skidding distances, which average 1,425 feet, would be utilized to log the unit with ground-based systems.

In addition, four units are reduced in size (23C, 25C, 55C, and 6C) by a total of 121 acres to eliminate commercial understory thinning of old-growth stands under alternative 3. A map displaying the location of activities proposed for alternative 3 is available in chapter 2.

Table S- 6. Proposed activities for alternative 3 by acres, number of units and range in size of units

Vegetation Treatment	Alternative 3 Acres	Number of Units	Range in Unit Size by Acres
Salvage by clearcut harvest	666	25	2-94
Commercial thinning	1,022	24	9-118
Seed tree with reserves	353	6	8-139
Prescribed burning	1,990	8	15-710
Precommercial thinning	1,048	20	9-187
Totals	**5,070**	**83**	**2-710**

Haul Routes

Under alternative 3, 85.5 miles road would be utilized as haul routes. No new roads would be constructed Table S- 7 identifies the roads and associated mileages. Two open and closed unauthorized routes would be added to the Forest transportation system. Other unauthorized routes proposed for use would be reconstructed then decommissioned following project implementation.

- A total of 85.5 miles of existing roads, including unauthorized routes, would be utilized as haul routes. This includes 66.4 miles within the project area boundary. The remaining 15.7 miles are private, county, and NFS road outside the project area. Approximately 47.1 miles would be maintained, and 38.3 miles would be reconstructed.
- Approximately 2.3 miles of open and closed unauthorized routes would be reconstructed and utilized as haul routes. Following project implementation, these routes would be decommissioned by various methods.
- Just over 1 mile of open and closed unauthorized routes would be reconstructed, utilized as haul routes and added to the Forest transportation system. They would be managed as maintenance level 2 roads (high clearance vehicles recommended).

Table S- 7. Haul route mileage summaries for alternative 3

Haul Routes	Alternative 3 Miles	Road/Route Numbers
Forest roads and NFS roads, existing (outside of the project area)	15.7	State Highway 1 Forest Road 676 (Finley Basin Road). NFS Road 1500 (Eureka Ridge Road) NFS Road 8402 (Gird Creek Road) Douglas Creek Road Forest Road 8454 (East Gird Creek) NFS Road 8454 Gold Creek and Mullan Trail Roads Forest Road 636 (Gold Creek)
NFS roads, existing (inside of the project area)	66.4	NFS roads: 1522, 1522A, 1544, 1550, 1557, 1589, 19752, 5023, 5123, 5151, 5152, 5153, 5160, 5161, 5162, 5167, 5168, 636, 666,707, 73549, 78434, 78442, 78461, 78462, 78463, 78464, 78469, 78470, 78472. 78475, 78476, 78480, 78489, 78494, 78617, 8402, 8454, 8506, 8510, 8615
NFS roads, proposed (on open UR)	0.7	UR8-253 UR8-260
NFS roads, proposed (on closed UR)	0.4	UR8-253
Temporary road (on open UR)	0.4	UR8-246
Temporary roads (on closed UR)	1.90	T17. T19, T24, T34, T35 (78442)
Total Miles	**85.5**	

Project Design Features and Mitigation Measures

The Forest Service developed project design features and mitigation measures that are part of the action alternatives. Project design features and mitigation measures are incorporated as an integrated part of alternatives 2 and 3, and are nondiscretionary once approved in a decision. They are based upon standard practices and operating procedures that have been employed in similar circumstances and conditions. The line officer and Forest specialists would review project design features and mitigation measures that would be applied through a timber sale contract, prior to contract advertisement.

Decision Framework

The Forest Supervisor of the Beaverhead-Deerlodge National Forest is the responsible official for this project, and will decide whether to implement the proposed action, one of the other alternatives (including the no-action alternative), subsets of an alternative, or combination of alternatives that would best meet the purpose and need.

The Forest Supervisor will determine that the selected alternative complies with relevant management direction and existing policies, programs and plans, whether risks to people and the environment are properly mitigated and whether project-specific monitoring measures are necessary.

Public Involvement

Initial scoping for the Flint Foothills Vegetation Management Project began in July 2010, when the Forest solicited public comment on a proposal to use clearcut salvage logging, commercial and precommercial thinning, and prescribed burning to harvest timber and restore resiliency on about 5,600 acres. The proposal

was to analyze the effects of the proposed action and any alternatives in an environmental assessment to determine if there would be significant effects.

The Forest received seven response letters in the initial round of scoping. Based on the controversial nature of these letters, we decided to prepare an environmental impact statement, and initiated the second round of scoping in June 2011. The Forest received eight response letters from the second round of scoping, two of which were duplicates from initial scoping. Several issues and concerns were raised about the project and resulted in refinement of the proposal.

The Flint Foothills Vegetation Management Project has appeared on the NEPA Schedule of Proposed Actions (SOPA) since June 1, 2011. The quarterly SOPA provides information about ongoing and planned project proposals. This report is available on the BDNF website.

Influence of Scoping Comments on Alternative Development

The responsible official and the interdisciplinary team (IDT) reviewed all public comments submitted during both scoping periods to determine how they would be considered in the analysis. Several comments requested that alternatives be developed in response to expressed resource concerns. Comments about road construction and old-growth were identified by the responsible official and the IDT as issues to formulate an alternative to the proposed action. Other comments were used to refine the proposed action while still meeting the purpose and need for the project. Many comments were addressed in the analysis; and still others were previously decided by law or regulations, the Forest Plan, or were not related to the purpose and need of the project. All scoping comments and the Forest's responses are in appendix B of this document. Original letters are available in the project file. Several suggestions for alternatives to be considered were submitted during public comment.

The following discussion describes how comments influenced the development of alternatives.

Issues Used to Formulate an Alternative

Comments about road construction and old growth were used to develop an alternative to the proposed action.

Road Construction

Several scoping comments expressed concerns that road construction and subsequent use could negatively affect water quality through sediment delivery to streams, or would create ideal conditions for weed establishment. The commenters encouraged minimizing or eliminating construction of both temporary and NFS roads. To address this concern, alternative 3 was developed to exclude new road construction.

Old Growth

Several scoping comments identified concerns about managing and retaining old growth in the project area, specifically requesting a 20-25 percent retention level of old growth for wildlife. Alternative 3 was developed to address the concerns for managing and retaining old growth in the Flint Foothills area. Alternative 3 retains all existing old growth in a multi-storied condition; no understory thinning would occur in old-growth stands. This is in contrast to the proposed action, which thins the understory of 121 acres in existing old growth, retaining the old growth in a single-storied stand condition. Both action alternatives retain all of the existing old-growth acres within the project area.

Providing old growth at a prescribed level (e.g. the suggested 20-25 percent recommendation) can be done if old growth exists at that level in the project area. Forest Plan Standard 1 for Vegetation states: Mechanical vegetation treatments and prescribed fire in old-growth stands (see FP Glossary) do not reduce the age and number of large trees and basal area below the 'minimum criteria' required for Eastern Montana old growth in Green et al. table 3. Removing hazardous fuels within old growth stands is allowed if conducted in a manner

that meets this requirement. This requirement does not apply to hazard tree removal and other public safety needs (Forest Plan, p. 44).

Comments Addressed through Project Design

Whitebark Pine

Include an alternative that excludes burning in the presence of whitebark pine regeneration: One scoping comment requested an alternative that excludes burning in the presence of whitebark pine regeneration, and that 'daylighting' of seedlings and saplings be an alternative method to the use of prescribed fire. 'Day-lighting' is directional falling of competing conifer trees around whitebark pine; in essence, thinning around whitebark pine trees. Whitebark pine is known to occur in three proposed mid-elevation units (Units 3B, 4B and 5B), based on formal surveys.

Specific design criteria were added to exclude prescribed burning in the presence of whitebark pine regeneration. A project design feature was created for hand felling of conifers prior to prescribed fire activities to facilitate underburning; areas with concentrations of whitebark pine would be avoided. Additionally, ignition patterns would avoid the use of fire directly in areas where whitebark pine occurs in groups or clumps. This would provide a means of protecting live, mature trees and established whitebark pine regeneration, and would create favorable ecological conditions for regeneration on areas of existing whitebark pine, without the effects of fire. While there is potential for individual whitebark pine trees to be killed with prescribed burning treatments, the resulting canopy openings would be conducive for seeding by Clarks nutcrackers.

Spread of Invasive Plants

Provide an alternative that eliminates units that have invasive plant species present on roads within units from fire management proposals: All proposed treatment units and access routes were surveyed in 2011 for presence of invasive plants. Based on these surveys, there are no prescribed burn units that have invasive plants present along roads within the units.

Units 2B and 7B have a moderate amount of spotted knapweed (*Centaurea maculosa*) populations (estimated 4-7 acres). Three other units have small infestations (0.01 acre or less): Unit 5B has a small infestation of yellow toadflax (*Linaria vulgaris)* adjacent to NFS Road 5167, which serves as the unit boundary; and units 6B and 8B have small (0.01acre) infestations of spotted knapweed along NFS roads 78493 and 8615, respectively, which serve as the unit boundaries. A project design feature was created to aggressively treat prescribed burn units containing invasive plant species following prescribed fire activities. The invasive plants would be controlled following procedures in the Noxious Weed Control Program Record of Decision for the Beaverhead-Deerlodge National Forest (USDA Forest Service 2002, appendix H). A map of the 2011 survey findings of all of the units and access roads is found in the Invasive Plant section, figure 25.

Provide an alternative that includes land management standards that will prevent new invasive plant species infestations by addressing the causes of weed infestation: Invasive plant design criteria and mitigation measures have been incorporated into the action alternatives to ensure an overall low risk of invasive plant establishment and spread from proposed activities. These practices comply with existing law, Executive Order, and Forest Service policy as discussed in the Invasive Plants section of this DEIS. The alternatives apply the policies and procedures in a site-specific manner to minimize the likelihood of invasive plant establishment and spread during project implementation.

Summary Comparison of Alternatives

Table S- 8. Comparison of alternatives showing how well project purpose and need is achieved and predicted preliminary effects on issues and resource concerns

Comparison Values	Alternative 1-No Action	Alternative 2 Proposed Action	Alternative 3
Purpose and Need			
1A: Manage lands suitable for timber production for the growth and yield of sawtimber, crop trees, pulpwood, and other forest products, including salvage harvest. ***1B: Forest products would be used to provide economic benefits where project objectives, forest plan objectives, and forest plan standards can be met.***			
Acres of lodgepole pine regenerated	0 acres	1,163 acres	1,022 acres
Lodgepole pine volume (salvage by clearcut harvest)	0	Sawtimber: 9,304 MBF (18,608 CCF) Non-sawtimber 2,326 MBF (4,652 CCF)	Sawtimber: 8,176 MBF (16,352 CCF) Non-sawtimber 2,044 MBF (4,088 CCF)
Acres of Douglas –fir /ponderosa pine stands commercial thinned to 40-60 basal area	0 acres	1,149 acres (including 121 acres old-growth)	666 acres (0 acres old-growth
Commercial thinning volume	0	Sawtimber: 5,502 MBF (11,004 CCF) Non-sawtimber 1,376 MBF (2,751 CCF)	Sawtimber: 3,275 MBF (6,549 CCF) Non-sawtimber 819 MBF (1,637 CCF)
Acres of Douglas-fir/ponderosa pine seed tree harvest	0 acres	353 acres	353 acres
Seed tree volume	0	Sawtimber: 1,236 MBF (2,471 CCF) Non-sawtimber 309 MBF (618 CCF)	Sawtimber: 1,236 MBF (2,471 CCF) Non-sawtimber 309 MBF (618 CCF)
2A: Bring 10% of lands suitable for timber production into a managed condition			
Acres of mid- to high-elevation lodgepole pine stands treated with prescribed burning.	0	1,259	1,259
Acres of low-elevation Douglas-fir and ponderosa pine stands treated with prescribed burning.	0	731	731
Total	0	1,990	1,190
2B: Manage those stands already in a managed condition to maintain long term sustained yield.			
Acres of precommercial thinning	0 acres	1,048 acres	1,048 acres

Comparison Values	Alternative 1-No Action	Alternative 2 Proposed Action	Alternative 3
Issues			
Miles of Road Construction			
Specified Road	0 miles	1.3 miles	0 miles
Temporary road, new construction	0 miles	7.2 miles	0 miles
Acres of old-growth thinned	0 acres	121 acres	0 acres
Predicted Project Effects			
Threatened or Endangered Plant Species	No effect	No effect	
Sensitive Plant Species			
Wavy moonwort Peculiar and western moonwort Whitebark pine	No impact	May impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species	
Threatened or Endangered Wildlife Species			
Grizzly bear	No effect	No determination at this time; consulting will be conducted with USFWS	
Sensitive Wildlife Species			
Black-backed woodpecker, Bighorn sheep Fisher Gray wolf North American wolverine Townsend's big-eared bat	No impact	May impact individuals or habitat but would not likely result in a trend toward federal listing or reduced viability of the population or species	
Flammulated owl	May impact individuals or habitat but would not likely result in a trend toward federal listing or reduced viability of the population or species		
Threatened or Endangered Aquatic Species			
Bull trout	No effect	No effect	
Sensitive Aquatic Species			
Westslope cutthroat trout	No impact	May impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species.	
Western toad	No impact	May impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species.	
Invasive Plant Species			
Invasive Plants	Risk of continued spread: low	Risk of continued spread: low risk of increasing density and spread into uninfested lands; and moderate risk of spreading and establishing into areas of concern, including haul routes.	
Soils			
Projected range of detrimental disturbance for harvest units and temporary roads (percentage of field plots classified as detrimentally disturbed)	0 – 8.7 percent	10.0 – 15.0 percent following restoration (subsoiling)	10.0-15.0 percent following restoration (subsoiling)
Stream Sediment Delivery			

Comparison Values	Alternative 1-No Action	Alternative 2 Proposed Action	Alternative 3
Road-stream crossings based on WEPP modeling (average pounds (lb.)/year)	2,761 lb./ year	2,145 lb./yr. during project implementation 1,459 lb./yr. post project implementation	Sediment delivery would be less than alternative 2, because new road segments would not be constructed and there would be less log haul. The greatest input of sediment from roads generally occurs during construction and active log haul during timber harvest.
Air Quality			
Air quality	No effects	Short-term impacts in project vicinity; in full compliance with MDEQ air program with coordination through the Montana/Idaho Airshed Group.	
Scenic Resources			
Scenic integrity	The high mortality of lodgepole pine would increase and have negative effects on the scenic resources. In the immediate foreground and foreground viewing distances, the amount of dead trees can often dominate the viewshed and landscape character, negatively affecting the scenic integrity.	No treatments would be seen from Concern Level 1 (CL1) platforms —Phillipsburg, Drummond, Maxville, Garrison, Grant Kohr's Ranch, Deer Lodge, Pintler Scenic Loop and I-90—areas with a High SIO management objective. Several treatment units would be visible from the Concern Level 2 platforms (NFSRs) within the project area—areas with a Moderate SIO objective. Scenic Integrity Objectives would be met at some point in the future, consist with Forest Plan scenic resource standards.	
Cultural and Heritage Resources			
Cultural and heritage resources	No effects	No effects	
Estimated Present Net Value			
Timber harvest and required design criteria	$0	$912,114	$584,513
All activities	$0	($162,131)	($427,481)

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List of Acronyms

Acronyms	
AMP	Allotment Management Plan
ARM	Administrative Rules of the State of Montana
BDNF	Beaverhead-Deerlodge National Forest
BMPs	Best Management Practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWD	Coarse Woody Debris
d.b.h.	Diameter Breast Height
DEIS	Draft Environmental Impact Statement
DSD	Detrimental Soil Disturbance
EPA	Environmental Protection Agency
ERG	Ecosystem Research Group
FACTS	Forest Service Activity Tracking System
FEIS	Final Environmental Impact Statement
FIA	Forest Inventory Analysis
FSDMP	Forest Soil Disturbance Monitoring Protocol
FSM	Forest Service Manual
GIS	Geographic Information Systems
GPS	Global Positioning Systems
HUC	Hydrologic Unit Code
LAU	Lynx Analysis Unit
MA	Management Area

Acronyms	
MDEQ	Montana Department of Environmental Quality
MNHP	Montana National Heritage Program
MOU	Memorandum of Understanding
NEP	Net Ecosystem Productivity
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NFSR	National Forest System Road
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
OMRTDs	Open Motorized Road and Trail Densities
PVA	Population Viability Analysis
RCA	Riparian Conservation Areas
SHPO	State Historic Preservation Office
SQS	Soil Quality Standards
SWCP	Soil and Water Conservation Practice
TES	Threatened, Endangered and Sensitive
TMDL	Total Maximum Daily Loads
UR	Unauthorized Route
U.S.	United States
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCT	Westslope Cutthroat Trout
WEPP	Watershed Erosion Prediction Project
WQL	Water Quality Limited
WRCC	Western Regional Climate Center

Chapter 1. Purpose of and Need for Action

Introduction

The Beaverhead-Deerlodge National Forest (BDNF), Pintler Ranger District, is proposing the Flint Foothills Vegetation Management Project to address the vegetation conditions in the project area resulting from current insect and disease infestation, or at risk from future infestations. Proposed activities include salvage by clearcut harvest regeneration, commercial thinning, seed tree harvest, and precommercial thinning and prescribed burning.

The Forest Service has prepared this draft environmental impact statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations[8]. This environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. Additional documentation is provided in the project file, located at the Pintler Ranger District, 88 Business Loop, Philipsburg, Montana, 59858.

Project Area

The Flint Foothills Vegetation Management Project area encompasses 44,522 acres located on the north end of the Flint Range in the Clark Fork Flint Landscape (Forest Plan p. 108-109), about 6 miles southeast of Drummond, Montana (figure 1). Eighty-three percent of the area (37,010 acres) is managed by the Beaverhead-Deerlodge National Forest; the remainder is private land (inholdings) (7,512 acres). Proposed activities for the project follow direction for the Flint Foothills and Flint Uplands Management Areas (MA's) as described in the 2009 Beaverhead-Deerlodge Forest Plan (Forest Plan, pp. 108-109; 112-115). The Flint Foothills MA comprises 85 percent of the project area and is managed for timber production, livestock grazing and dispersed recreation. The Flint Uplands MA comprises the remaining 15 percent. This area is managed for a mix of semi-primitive motorized and nonmotorized recreation and secure high elevation wildlife habitat. In this management area, "…timber harvest is permitted, but other resource objectives are primary" (Forest Plan, p. 42).

The project area lies within the Clark Fork River-Gold Creek and the Lower Flint Creek watersheds. Lands in the watersheds include National Forest System lands, private lands and lands managed by other agencies (state of Montana, and the United States Department of the Interior (USDI) Bureau of Land Management). Figure **2** shows the spatial relationships between the watersheds, the Clark Fork Flint Landscape, the Flint Foothills and Flint Uplands MA's, the Flint Foothills project area, and all other ownerships.

The project area includes portions of both Powell and Granite Counties. The project area is bounded by private and State-owned lands along the Flint Creek Valley to the west, the Clark Fork River Valley to the north, the Deer Lodge Valley to the east, and the Flint Creek Range to the south. Elevations range from approximately 4,430-9,250 feet. The legal description of lands in the project area follows: T. 8 N., R. 10 W., sec 6; T. 8 N., R. 11 W., sec 1 -11, 15-21, 29, 30; T. 8 N., R. 12 W., sec 1 -19, 21 -26; T. 8 N., R. 13 W., sec 1-3, 10 – 14, 24; T. 9 N., R. 10 W., sec 31; T. 9 N., R 11 W., sec 17 -21, 26 – 36; T. 9 N., R. 12 W., sec 10 – 16, 19 – 36; T. 9 N., R. 13 W., sec 25, 36.

[8] This project tiers to the Beaverhead-Deerlodge National Forest Land and Resource Management Plan Final Environmental Impact Statement (BDNF 2009) and the Beaverhead-Deerlodge National Forest Noxious Weed Control Final Environmental Impact Statement (BDNF 2002).

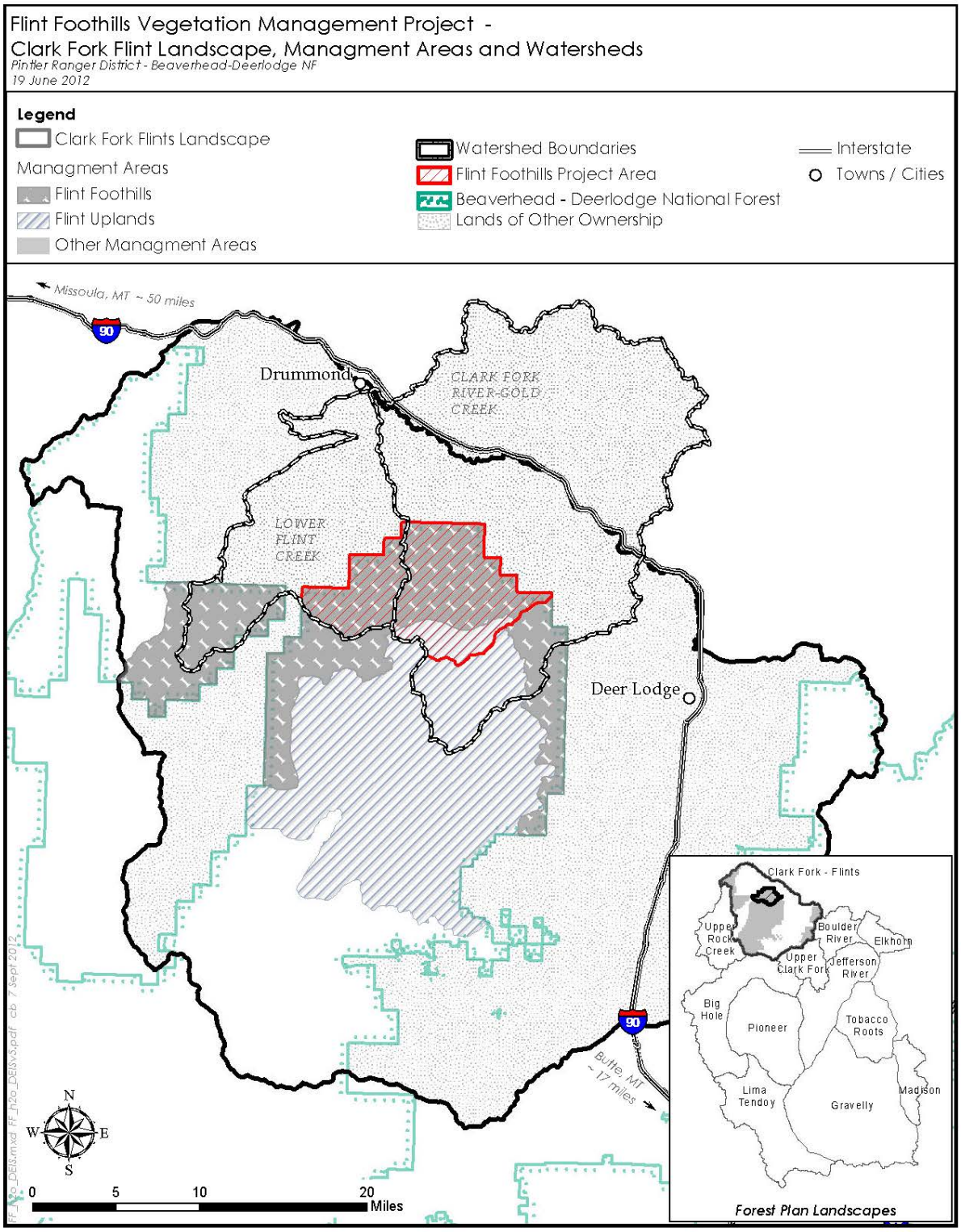

Figure 2. Watersheds, Forest Plan landscape and management areas, and the project area

Background- Existing Vegetation Conditions in the Project Area

The Flint Foothills area is part of a larger mountain pine beetle (Dendroctonus ponderosae) epidemic occurring across the majority of the Beaverhead-Deerlodge National Forest and on other forests in the Northern Region. Mountain pine beetle has been active in the Flint Foothills area since about 2000, reaching epidemic proportions beginning in 2007. This has resulted in extensive areas of dead and dying lodgepole pine, and the mortality of more individually scattered ponderosa pine and whitebark pine. Within the Flint Foothills project area on National Forest System (NFS) lands, it is estimated that all (100 percent) of the pine stands 5 inches diameter breast height (d.b.h.) and larger have been affected by mountain pine beetle. Beetle infestations are a regular force of natural change in forested ecosystems; however, several current outbreaks occurring simultaneously across western North America are the largest and most severe in recorded history (Bentz 2008).

Fire frequency determines the vegetation successional stage and fuel conditions; the shape and size of past fires play a role in fuel connectivity and landscape heterogeneity or homogeneity (Arno et al. 2000, Turner et al. 1998). Forest structure and composition in the Flint Foothills Project area have been most significantly altered due to the lack of fire disturbance. The mid- to high-elevation forests are currently homogeneous, mature stands lacking stand-age diversity. Past fire disturbances suggest a more heterogeneous landscape. Blister rust (Cronartium ribicola) and mountain pine beetle have accelerated succession to subalpine fir by killing mature whitebark pine. Mountain pine beetle has killed the majority of lodgepole pine in the project area. Additionally, mortality of very large ponderosa pine from mountain pine beetles has been noted in the project area through stand exams. Coupled with the lack of fire, these disturbances have caused a major shift in landscape composition and structure from pine to fir and spruce (Keane 2000).

The disruption of the natural fire intervals of the past have resulted in higher stand densities, multi-layered stands of mostly one species, Douglas-fir. In contrast to the open, grown, larger-diameter stands of Douglas-fir and ponderosa pine of the early 1900s, current Douglas-fir stands in the project area are continuous, mid-successional, densely stocked and establishing into dry grassland and quaking aspen communities. The increase in extent and continuity of this vegetation type has effectively reduced landscape vegetation diversity, associated biodiversity, and put unique habitat types in the Flint Foothills Project area (most importantly aspen and seral ponderosa pine communities) at risk of irreversible habitat conversion.

Surveys show that mortality of individual Douglas-fir trees is occurring in the project area due to western spruce budworm (Choristoneura occidentalis). The recent drought conditions and dense stand conditions cause the late-successional stands of Douglas-fir to be susceptible to western spruce budworm because these stands are often stressed by competition. Areas of higher mortality due to western spruce budworm in contiguous stands of Douglas-fir are evident in the Gird Creek to Douglas Creek areas within the project area (figure 10).

An increase in individual numbers of Douglas-fir trees killed by Douglas-fir bark beetle (Dendroctonus pseudotsugae) has been noted in the Dunkleberg Ridge; Jackson Park and Blum Creek areas (figure 11). An increase of mortality due to Douglas-fir bark beetle may be attributed to the heavy and repeated defoliation from western spruce budworm, which may lead to increases in Douglas-fir bark beetle activity.

Purpose and Need for Action

The purpose and need of the Flint Foothills Vegetation Management Project9 is to contribute to achievement of the following Forest Plan goals and objectives:

1. **Forest Plan Timber Management Goals:**
   d. *Lands Suitable for Timber Production:* Manage lands suitable for timber production for the growth and yield of sawtimber, crop trees, pulpwood, and other forest products, including salvage harvest.
   e. *Product Utilization:* Forest products would be used to provide economic benefits where project objectives, forest plan objectives, and forest plan standards can be met.
2. **Forest Plan Timber Management Objectives on Lands Suitable for Timber Production:**
   f. Bring 10 percent of lands suitable for timber production into a managed condition.[10]
   g. Manage those stands already in a managed condition to maintain long term sustained yield.
3. **Forest Plan Vegetation Management Objectives:**
   h. Reduce forest density in the large size classes of dry forest communities and some lodgepole pine communities to maintain or improve forest conditions.
   i. Douglas-fir Type: Increase the number of acres in the 0 to 5 inch DBH class on approximately on approximately 20,000 acres.
   j. C.) Lodgepole Pine Type: Increase the number of acres in the 0 to 5 inch DBH class by approximately 74,000 acres.

All project treatment units have been proposed on lands classified as "Suitable for Timber Production" using the Forest Plan's Timber Harvest Classification Protocol (Forest Plan Pg. 42), which includes both coarse scale GIS modeling and site-specific on the ground reconnaissance. The following table cross-walks proposed treatments with the corresponding Forest Plan Goal/Objectives:

[9] Referred to from this point forward as the Flint Foothills Project

[10] The Corrected Final Environmental Impact Statement (FEIS) for the Forest Plan identifies 284,000 acres of suitable timber ground (FEIS p. 38). The Forest Plan objective applies to ten percent—28,400 acres of suitable lands on a Forestwide basis for the ten-year planning period of the Plan.

Table 1. Cross-walk between the purpose and need Forest Plan goals and objectives, and the proposed action

Purpose and Need (See Numbered Forest Plan Goals/Objectives Above)	Vegetation Treatment Type	Acres of Treatment	Volume Saw/non-saw MBF	Number of Units	Range in Unit Size by Acres
1 A and B 2A 3C	Salvage by clearcut harvest dead and dying lodgepole pine (S) Salvage harvest dead and dying LP. Retain all other conifers and FP required snags.	1,163	9,304 /2,326	30	2-94
1 A and B 3A	Commercial Thinning ponderosa pine and Douglas-fir (C) Thin low to mid-elevation units to reduce density from an average of 100-140 to 40-60 basal area.	1,149*	5,502/1,376	29	9-175
1 A and B 2A 3B	Seed Tree with Reserves (ST) Seed Tree harvest for ponderosa pine regeneration. Reserve trees are larger diameter Douglas-fir and ponderosa pine, in addition to seed trees	353	1,236/309	6	8-139
3A	Prescribed Burn (B) Use ignited fire to burn low elevation dry forest units	731	N/A	5	12-298
3C	Prescribed Burn (B) Use ignited fire to burn in mid-elevation mixed conifer units	1,259	N/A	3	251-710
1A 2 B	Precommercial Thinning (P) Thin sapling-sized trees in old harvest units	1,048	N/A	20	9-187
	Total	5,703		93	2-710

*Includes 121 acres of old-growth

Proposed Action

The proposed action would achieve project objectives through a mix of vegetation treatments as outlined in this section.

Table 2 displays the treatment types by acres, the number of units and the range of unit sizes. Table 3 displays the roads associated with the haul routes, including construction of 1.3 miles of new National Forest System road[11], and 7.2 miles of new temporary road[12]. In addition, approximately 1 mile of

[11] A National Forest System road is a forest road other than a road which has been authorized by a legally documented right-of-way held by a State, county or other local public road authority.

[12] A temporary road is a road necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or a forest trail and that is not included in a forest transportation atlas.

existing open and closed unauthorized routes (UR)[13][14] would be added to the forest transportation system[15]. Detailed descriptions are provided in the Alternatives section in Chapter 2. The proposed action would:

- Salvage by clearcut regeneration harvest dead and dying lodgepole pine stands on 1,163 acres.
- Commercial thin ponderosa pine and Douglas-fir stands to reduce stand densities including 121 acres of old growth, on 1,149 acres.
- Regenerate by seed tree harvest Douglas-fir and ponderosa pine stands on 353 acres.
- Provide 16,042 MBF (32,083 CCF) in sawtimber; and 4,010 MBF (8,021 CCF) in nonsaw timber.
- Prescribe burn mid-elevation lodgepole pine and low-elevation Douglas-fir and ponderosa pine stands on 1,990 acres.
- Precommercial thin naturally regenerated lodgepole pine and Douglas-fir stands to reduce stand densities on 1,048 acres.
- Construct 1.3 miles of new National Forest System road.
- Construct 7.2 miles of new temporary road.
- Add 2.4 miles of road (1.3 miles of new National Forest System road and 1.1 miles of open and closed unauthorized routes) to the Forest transportation system.

Table 2. Proposed action vegetation treatments, acres of treatment, number of units and range of unit size by treatment type

Alternative 2 – Proposed Action Vegetation Treatment Type	Acres of Treatment	Number of Units	Range in Unit Size by Acres
Salvage by clearcut harvest dead and dying lodgepole pine	1,163	30	2-94
Commercial thin ponderosa pine and Douglas-fir	*1,149	29	9-175
Seed tree with reserves, Douglas-fir and ponderosa pine	353	6	8-139
Prescribed burn	1,990	8	15-710
Precommercial thin	1,048	20	9-187
Total	**5,703**	**93**	**2-710**

* Includes 121 acres of old growth in 4 units

[13] An unauthorized road is a road that is not a forest road or a temporary road and that is not included in a forest transportation atlas.

[14] A route is a road or trail.

[15] Forest Service Manual (FSM) 7703.26 provides direction on adding roads to the forest transportation system, including unauthorized routes. Decisions must be informed by travel analysis. The Pintler Ranger District completed a preliminary transportation (travel) analysis in 2008, which included the Flint Foothills project area (USDA Forest Service 2008). This analysis assessed inventoried routes within the project area based on resource risks and values. Recommended changes were site specific, route by route, and included: adding routes to the Forest transportation system, decommissioning unneeded routes, closing and storing roads for future use, converting roads to trails, and mitigating resource concerns through road maintenance and reconstruction. The recommendations pertinent to the Flint Foothills Project are incorporated into this analysis. The documentation of the preliminary travel analysis is on file at the Pintler Ranger District office.

Table 3. Proposed haul routes, including existing roads within the project area, and construction of new system and temporary roads.

Haul Routes	Alternative 2-Proposed Action Miles
NFS roads, existing	68.2[16]
NFS roads, proposed (existing open and closed UR)	1.1
NFS roads, proposed (new construction)	1.3
Temporary road (on existing open and closed URs)	4.4
Temporary road proposed (new construction)	7.2
Total Miles	**82.2**

For salvage by clearcut harvest, commercial thin and seed tree treatments, approximately 1.3 miles of new National Forest System road construction and an estimated 11.6 miles of temporary roads would be needed to access and harvest the units. Of the temporary road mileage, about 7.2 miles of newly constructed temporary roads would be needed, and 4.4 miles of open and closed unauthorized routes (UR) would be utilized. Two unauthorized routes, totaling 1 mile, UR 8-260 (0.43 miles) and UR 8-253(0.62 miles) are proposed to be added to the transportation system.

Salvage by clearcut harvest, commercial thinning and seed tree treatments would be accomplished primarily using conventional, ground-based timber harvest equipment such as rubber-tired skidders, and would be limited to slopes less than 35 percent. Approximately 110 acres of commercial harvest in eight units is proposed on slopes greater than 35 percent. Cable logging systems would be used in these areas.

Fifteen proposed units—12 lodgepole pine salvage and 3 Douglas-fir/ponderosa pine seed tree units—exceed 40 acres in size, ranging from 41 to 139 acres. Forest Plan timber standard 2 (Forest Plan, p. 39) allows openings created by one regeneration unit to exceed 40 acres on lands suitable for timber production when a natural event created an undesirable opening. This requires public notification and Regional Forester approval.

Prescribed burning treatments would use aerial ignition for mid-elevation burns; and hand lighting for both mid- and low-elevation and understory burns. Hand falling or slashing of trees may occur to facilitate burning objectives. Burning would occur when weather and ground conditions are suitable to maintain air quality and burning can be controlled. Ignitions may occur over multiple years.

In precommercial thin treatment units, ponderosa pine, Douglas-fir and lodgepole pine (in order of preference) would be retained at 300 to 500 trees per acre to enhance species diversity, improving the long-term resiliency of these stands. Cut trees would be lopped and scattered.

Changes to the Proposed Action since Publishing the Notice of Intent

Field reviews of the proposed treatment units were completed by the interdisciplinary team members subsequent to publishing the Notice of Intent (NOI) in June 2011 and mailing the June 7, 2011 scoping letter. These reviews resulted in updates to the proposed action, including changes in treatment prescriptions, unit boundary changes, and the addition and deletion of units. Many of the originally proposed precommercial thin units were identified as previously thinned, and therefore,

[16] Road mileages are generally rounded to the nearest 1/10 mile in this statement; though rounding to the whole mile is sometimes used in the narratives.

dropped from the list of units proposed for treatment. Other units were identified for density reduction, and therefore, added to the list of units proposed for treatment. Overall, the net changes resulted in the addition of 92 acres of commercial treatments, and a reduction of 98 acres of precommercial thinning, for a net change of 6 fewer acres in the updated DEIS proposed action.

Scoping (June 2011) identified approximately 10 miles of temporary road construction and 72 miles of National Forest System roads needed for access and hauling. Haul route needs were fine-tuned in the updated proposed action presented in the DEIS, as shown in table 4. A distinction is made between NFS roads and existing open and closed unauthorized routes. One segment of new temporary road construction in the June 2011 scoping was determined to need construction specifications due to steep slopes and is now proposed as new National Forest System road construction (1.3 miles).

Table 4 displays the changes in acreages and haul route mileages between the proposed action presented in June 2011, and the updated proposed action in this document. Unit-specific changes from the June 2011 proposed action are described in appendix A.

Table 4. Comparison of the June 2011 proposed action and the updated action proposed in the DEIS

Treatment Type	June 2011 Scoping Proposed Action Acres	Updated DEIS Proposed Action Acres
Salvage by clearcut	863	1,163
Commercial thinning	1,007	1,149
Seed tree with reserves	0	353
Combination salvage by clearcut and commercial thinning	703	0
Prescribed burning	1,990	1,990
Precommercial thinning	1,146	1,048
Total Acres	**5,709**	**5,703**
Haul Routes within the Project Boundary	**June 2011 Scoping Miles**	**DEIS Miles**
Forest Roads (existing)	72	68.2
NFS roads, proposed on URs	0	1.1
NFS roads, proposed new construction	0	1.3
Temporary roads, proposed on URs	0	4.4
Temporary roads, proposed new construction	10	7.2
Total Miles	**83**	**82.2**

Decision Framework

The Forest Supervisor of the Beaverhead-Deerlodge National Forest is the responsible official for this project, and will decide whether to implement the proposed action or one of the other alternatives (including the no action), subsets of an alternative, or combination of alternatives that would best meet the purpose and need.

The Forest Supervisor will determine that the selected alternative complies with relevant management direction and existing policies, programs and plans, whether risks to people and the environment are properly mitigated and whether project-specific monitoring measures are necessary.

Public Involvement

Scoping

A Notice of Intent to Publish an Environmental Impact Statement was published in the Federal Register on June 2, 2011 asking for public comment on the proposal from June 2 to July 5, 2011. In addition, as part of the public involvement process, the Forest mailed a scoping letter to interested parties on June 7, 2011.

Initial scoping for the Flint Foothills Vegetation Management Project began in July 2010, when the Forest solicited public comment on a proposal to use clearcut salvage logging, commercial and precommercial thinning, and prescribed fire to harvest timber and restore resiliency on about 5,600 acres. The proposal was to analyze the effects of the proposed action and any alternatives in an environmental assessment to determine if there would be significant effects.

The Forest received seven response letters in the initial round of scoping. Several of the letters supported the proposal; others strongly disagreed with components of the proposal and contended there was potential for significant cumulative effects.[17] Based on the controversial nature of these letters, we decided to prepare an environmental impact statement, and initiated the second round of scoping in June 2011. The Forest received eight response letters from the second round of scoping, two of which were duplicates from initial scoping.

The Flint Foothills Vegetation Management project has appeared on the NEPA Schedule of Proposed Actions (SOPA) since June 1, 2011. The quarterly SOPA provides information about ongoing and planned project proposals. This report is available on the BDNF website http://www.fs.fed.us/nepa/nepa_project_exp.php?project=33238

Influence of Scoping Comments on Alternative Development

The responsible official and the interdisciplinary team (IDT) reviewed all public comments submitted during both scoping periods to determine how they would be considered in the analysis. Several comments requested alternatives be developed in response to expressed resource concerns. Comments on road construction and old growth were identified by the responsible official and the IDT as issues to use to formulate an alternative to the proposed action. Other comments were used to refine the proposed action while still meeting the purpose and need for the project. Many comments were addressed in the analysis; and still others were previously decided by law or regulations, the Forest Plan, or were not related to the purpose and need of the project (scoping comments and responses are in appendix B). Original letters are available in the project file located at the Pintler Ranger District. Several suggestions for alternatives to be considered were submitted during public comment.

Issues Used to Formulate an Alternative

Comments on road construction and old growth were identified as issues that were used to develop an alternative to the proposed action.

Road Construction

Several scoping comments expressed concerns that road construction and subsequent use could negatively affect water quality through sediment delivery to streams, or would create ideal conditions

17 As used in the Council on Environmental Quality's guidelines for implementing NEPA, the term 'controversial' refers to whether substantial dispute exists as to the size, nature, or effects of the major federal action. Controversy is one intensity factor to determine significance (40 CFR 1508.27).

for weed establishment. The commenters encouraged minimizing or eliminating construction of both temporary and system roads. To address this concern, alternative 3 was developed to exclude new road construction. The action alternatives differ by the miles of specified road construction, and the miles of new temporary road construction.

Old Growth

Several scoping comments identified concerns about managing and retaining old growth in the project area, specifically requesting a 20-25 percent retention level of old growth for wildlife. Alternative 3 was developed to address the concerns for managing and retaining old growth in the Flint Foothills area. Alternative 3 retains all existing old growth in a multi-storied condition; no understory thinning would occur in old-growth stands. This is in contrast to the proposed action, which thins the understory of 121 acres in existing old growth, retaining the old growth in a single-storied stand condition. Both action alternatives retain all of the existing old-growth acres within the project area.

Providing old growth at a prescribed level (e.g. the suggested 20-25 percent recommendation) can be done if old growth exists at that level in the project area. Forest Plan Standard 1 for Vegetation states: Mechanical vegetation treatments and prescribed fire in old growth stands (see FP Glossary) do not reduce the age and number of large trees and basal area below the 'minimum criteria' required for Eastern Montana old growth in Green et al, table 3. Removing hazardous fuels within old growth stands is allowed if conducted in a manner that meets this requirement. This requirement does not apply to hazard tree removal and other public safety needs. FP, p. 44).

Comments Addressed through Project Design

Whitebark Pine

Include an alternative that excludes burning in the presence of whitebark pine regeneration: One scoping comment requested an alternative that excludes burning in the presence of whitebark pine regeneration, and that 'day-lighting' of seedlings and saplings be an alternative method to the use of prescribed fire. 'Day-lighting' is directional falling of competing conifer trees around whitebark pine; in essence, thinning around whitebark pine trees. Whitebark pine is known to occur in three proposed mid-elevation units (Units 3B. 4B and 5B), based on formal surveys.

Specific design criteria were added to exclude prescribed burning in the presence of whitebark pine regeneration. A project design feature was created for hand felling of conifers prior to prescribed fire activities to facilitate underburning; areas with concentrations of whitebark pine would be avoided. Additionally, ignition patterns would avoid the use of fire directly in areas where whitebark pine occurs in groups or clumps. This would provide a means of protecting both live mature trees and established whitebark pine regeneration, and would create favorable ecological conditions for regeneration on extensive areas of existing whitebark pine, without the effects of fire. While there is potential for individual whitebark pine trees to be killed with prescribed burning treatments, the resulting canopy openings would be conducive for seeding by Clarks nutcrackers.

Spread of Invasive Plants

Provide an alternative that eliminates units that have invasive plant species present on roads within units from fire management proposals: All proposed treatment units and access routes were surveyed in 2011for presence of invasive plants[18]. Based on these surveys, there are no prescribed burn units that have invasive plants present along roads within the units.

Units 2B and 7B have a moderate amount of spotted knapweed (*Centaurea maculosa*) populations (estimated 4-7 acres). Three other units have small infestations (0.01 acre or less): Unit 5B has a small infestation of yellow toadflax (*Linaria vulgaris*) adjacent to NFS Road 5167, which serves as the unit boundary; and units 6B and 8B have small (0.01acre) infestations of spotted knapweed along NFS roads 78493 and 8615, respectively, which serve as the unit boundaries. A project design feature was created to aggressively treat prescribed burn units containing invasive plant species following prescribed fire activities. The invasive plants would be controlled following procedures in the Noxious Weed Control Program Record of Decision for the Beaverhead-Deerlodge National Forest (USDA Forest Service 2002, appendix H). A map of the 2011 survey findings of all of the units and access roads is found in the Invasive Plant section, figure 25.

Provide an alternative that includes land management standards that will prevent new invasive plant species infestations by addressing the causes of weed infestation: Invasive plant design criteria and mitigation measures have been incorporated into the alternatives to ensure an overall low risk of invasive plant establishment and spread from proposed actions. These practices comply with existing law, Executive Order, and Forest Service policy as discussed in the Invasive Plants section of this EIS. The alternatives apply the policies and procedures in a site-specific manner to minimize the likelihood of invasive plant establishment and spread during project implementation.

18 To simplify terminology for this statement, all noxious weed and invasive plant species will collectively be called invasive plants. This will include all the species listed on the Federal and Montana Noxious Weed lists as well as cheatgrass (*Bromus tectorum*) and musk thistle (*Carduus nutans*).

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Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the Flint Foothills Vegetation Management Project. It includes a description of each alternative (including the no action), and presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice by the decision maker and the public. Some of the information used to compare the alternatives is based on the issues (i.e., acres of thinning old-growth understories versus not thinning old-growth understories) and some of the information is based on the environmental, social and economic effects of implementing each alternative (i.e., the effect to old-growth stands in the short and long term, with and without commercial thinning.).

Alternatives Considered in Detail

The Forest Service developed three alternatives, including the no action (alternative 1), the proposed action (alternative 2), and alternative 3, developed in response to road construction and old growth issues raised during scoping by the public.

Alternative 1 – No Action

Under the no-action alternative, no salvage of lodgepole pine by clearcut harvest, commercial thinning, seed tree harvest, prescribed burning, or precommercial thinning would be implemented to accomplish project and Forest Plan objectives.

Alternative 2 – Proposed Action, and Alternative 3

Vegetation Treatments Common to the Action Alternatives

Alternatives 2 and 3 differ by the number of units and total acreages for salvage by clearcut harvest, and commercial thinning of ponderosa pine and Douglas-fir stands. There is no difference in treatment acres between the alternatives for seed tree harvest, prescribed burning and precommercial thinning treatments.

Table 5. Comparison of vegetation treatment acreage and number of units for Alternatives 2 and 3

Vegetation Treatment	Alternative 2 (Proposed Action) Acres	Alternative 3 Acres	Difference in Acres	Alternative 2 Number of Units	Alternative 3 Number of Units	Difference in Number of Units
Salvage by clearcut harvest	1,163	1,022	141	30	25	5
Commercial thinning	1,149	666	483	29	24	5
Seed tree with reserves	353	353	0	6	6	0
Prescribed burning	1,990	1,990	0	8	8	0
Precommercial thinning	1,048	1,048	0	20	20	0
Total Acres	**5,703**	**5,079**	**624**	**88**	**83**	**10**

Salvage of Lodgepole Pine Stands by Clearcut Harvest

Dead and dying lodgepole pine (from 4 inches up to 20 inches d.b.h.) would be salvaged by clearcut harvest. All other species would be retained. Most of the lodgepole pine that is currently alive is expected to be dead or dying by the time the project is implemented. All trees (alive or dead) greater than 20 inches d.b.h. would be retained in all units to meet Forest Plan snag retention standards (Forest Plan, p. 48). Additional snag and live tree retention information to meet snag standards is provided in table 17.

Commercial Thinning of Ponderosa Pine and Douglas-fir Stands

Ponderosa pine and Douglas-fir stands would be commercially thinned. The large-diameter ponderosa pine trees are infested by western and mountain pine beetle; and the Douglas-fir trees are affected by Douglas-fir bark beetles. Not all of these stands are pure ponderosa pine/Douglas-fir type and contain a component of lodgepole pine infected with mountain pine beetle, which would also be harvested. Light underburning after commercial thinning would target understory trees left after harvest to lower stand densities. All trees (alive or dead) greater than 20 inches d.b.h. would be retained in all units to meet Forest Plan snag retention standards (Forest Plan, p. 48). Additional snag and live tree retention information to meet snag standards is provided in table 17.

Seed Tree Harvest

A seed-tree harvest would be implemented in Douglas-fir and ponderosa pine stands to create an early seral component of each species, leaving large diameter ponderosa pine and Douglas-fir as seed trees. Five to 15 trees per acre across the treatment unit would be retained as seed trees. The seed tree harvest would remove much of the understory; light underburning would further reduce understory trees left after harvest. Collectively, these actions would reduce stand density, which would lower the hazard for mountain pine beetles on the remaining ponderosa pine. Some stands contain a component of lodgepole pine infected with mountain pine beetle, which would also be harvested. All trees (alive or dead) greater than 20 inches d.b.h. would be retained in all units to meet Forest Plan snag retention standards (Forest Plan, p. 48). Additional snag and live tree retention information to meet snag standards is provided in table 17.

Prescribed Burn of Mid-elevation Lodgepole Pine and Low-elevation Douglas-fir and Ponderosa Pine Stands

Prescribed fire would be used on mid-elevation lodgepole pine and low-elevation Douglas-fir and ponderosa pine stands to reduce stand densities and create a mosaic of age classes.

Prescribed burning would use either aerial ignition (for mid-elevation burns) or hand lighting (both mid-elevation mixed-intensity and understory light-intensity burns). Burning would occur in either the spring or fall when weather and ground conditions are suitable to maintain air quality, and burning can be controlled. Ignitions may occur over multiple years.

In low-elevation Douglas-fir and ponderosa pine stands, low-intensity understory burns would occur across all acres.

In mid-elevation lodgepole pine stands, mixed-intensity fires would be ignited on approximately 40 percent of the unit. Up to 10 percent of each unit would have small-diameter (4 to 12 inches d.b.h.) conifers cut down. Slash created as a result of these activities would be strategically located to facilitate a mosaic of mixed-severity burned areas. Ignition patterns would be designed so that the concentrations would burn with fire carried into the crown of the

trees for areas up to 20 acres in size, with the objective of mortality in 50 percent of the overstory trees within the unit. Fire would not be carried throughout the unit. The unburned portions of the units would primarily include riparian areas.

The mosaic stand conditions created by the prescribed fire are described in the Desired Condition section of the Vegetation section, p.82.

Precommercial Thinning of Lodgepole Pine and Douglas-fir Stands

Precommercial thinning would treat naturally regenerated, previously harvested stands in 20 units. Retaining ponderosa pine, Douglas-fir and then lodgepole pine (in order of preference) would enhance species diversity improving long-term resiliency of these stands. Trees would be thinned to a 9-foot to 16-foot spacing (500 to 300 trees per acre).

Logging Systems

Treatments would generally be accomplished with conventional, ground-based timber harvest equipment such as rubber-tired skidders, and would be limited to slopes less than 35 percent. Cable logging systems would be used where slopes are greater than 35 percent.

Trees would be whole tree logged and skidded to central landing areas adjacent to roads where they would be processed into logs and loaded on trucks for transport to area sawmills. Unmerchantable material brought to the landing would be piled for chipping or burning. Burning would occur when weather and ground conditions are suitable to maintain air quality, and burning can be controlled.

Haul Routes

Existing Forest roads,[19] National Forest System (NFS) roads and unauthorized routes (UR) would be utilized as haul routes. The total mileage varies by alternative. Figure 3 displays the common haul routes that would be used outside of the project area.

All unauthorized routes currently exist on the ground. The open unauthorized routes are currently open to public motor vehicle travel, and displayed on the Beaverhead-Deerlodge National Forest North Map 2010 as open roads, consistent with the Forest Plan. The closed unauthorized routes are currently closed to public motor vehicle travel, and are not displayed on the Beaverhead-Deerlodge National Forest North Map 2010. Physically, the existing and closed routes are similar. Two unauthorized routes, UR8-260 (open) and UR8-253 (open and closed segments) would be added to the Forest transportation system and would be managed as maintenance level 2 roads (high clearance vehicles recommended).They are designated as "NFS road proposed" on the summary tables and alternative maps. Route UR8-260 accesses private land; all of UR 8-253, including the closed section, is currently displayed on the Beaverhead-Deerlodge National Forest North Map 2010 as an open road. The routes and mileages for the other unauthorized routes proposed for use, both open and closed are provided in the alternative descriptions.

Temporary roads constructed for project use would be decommissioned following project implementation of authorized activities, consistent with Forest Service policy (FSM 7703.24), which states that temporary roads are to be decommissioned. Decommissioning is an activity

19 A Forest road is wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources.

that results in stabilization and restoration of unneeded roads (or trails) to a more natural state (FSM 7705). The roads would be closed with a combination of signs and berms to allow for a subsequent travel management planning effort to consider these routes for addition to the system or more physical methods of decommissioning such as obliteration. The road-specific decommissioning methods for both alternatives are displayed in table 6.

Road maintenance or reconstruction would occur on the haul route portions of all National Forest System roads (NFSR) and forest roads associated with the project, either during or prior to commercial harvest activities. The unauthorized routes would be reconstructed. These activities would bring the roads to a standard complying with Best Management Practices (BMPs) and also allowing for safe product removal. Road maintenance typically involves grading, drainage features such as culverts, ditches, drainage dips, and spot surfacing as needed to meet BMPs. Reconstruction activities would include the maintenance items as well as more significant roadway improvement and/or realignment: embankment and slump repair, curve widening, subgrade boulder or cobble excavation and removal, and upgrades to accommodate safe timber haul. Timing of project activities would comply with existing travel management direction unless modified by the responsible official for implementation.

Table 6. Decommissioning methodology for unauthorized routes

Previous Route Inventory ID*	Map Designation	Pintler Travel Analysis Comments	Decommissioning Method
UR8-271	UR8-271 Temporary, on open UR (Alt 2 only)	"not needed - low use"; low risks and values except for moderate wildlife/plant and heritage risks	close with sign, natural revegetation
UR8-270	T-26 Temporary, on closed UR (Alt 2 only)	"not needed - low use"; low risks and values except for moderate wildlife/plant and heritage risks	close with sign, natural revegetation
UR8-284	T-28 Temporary, on closed UR (Alt 2 only)	"may be scheduled for obliteration under timber sale"; low risks and values except for moderate wildlife/plant	restore to current condition, rip & disguise (obliterate) entrance
UR8-246	UR8-246 Temporary, on open UR	“private land has other access and area is a yearlong closure"; moderate private access value, wildlife/plant risk and heritage risk, otherwise low risks and values	close with sign, natural revegetation
UT8-110	UT8-110 Temporary, on open UR (Alt 2 only)		close with sign, natural revegetation
UR8-257	T-32 Temporary, on closed UR (Alt 2 only)	"not needed for resource management, low rec use"; moderate heritage risk, otherwise low values and risks	close with sign, natural revegetation
	T17 Temporary, on closed UR		block road/sign; remove drainage; recontour drainages at structures being removed; after all treatments including prescribed burning

Previous Route Inventory ID*	Map Designation	Pintler Travel Analysis Comments	Decommissioning Method
	T-19 Temporary, on closed UR		close with sign, natural revegetation
	T-24 Temporary, on closed UR		close with berm, natural revegetation
	T-34 Temporary, on closed UR		close with sign, natural revegetation
	T-35 Temporary, on closed UR		close with sign, natural revegetation

* Not all unauthorized routes were previously inventoried and assigned route numbers.

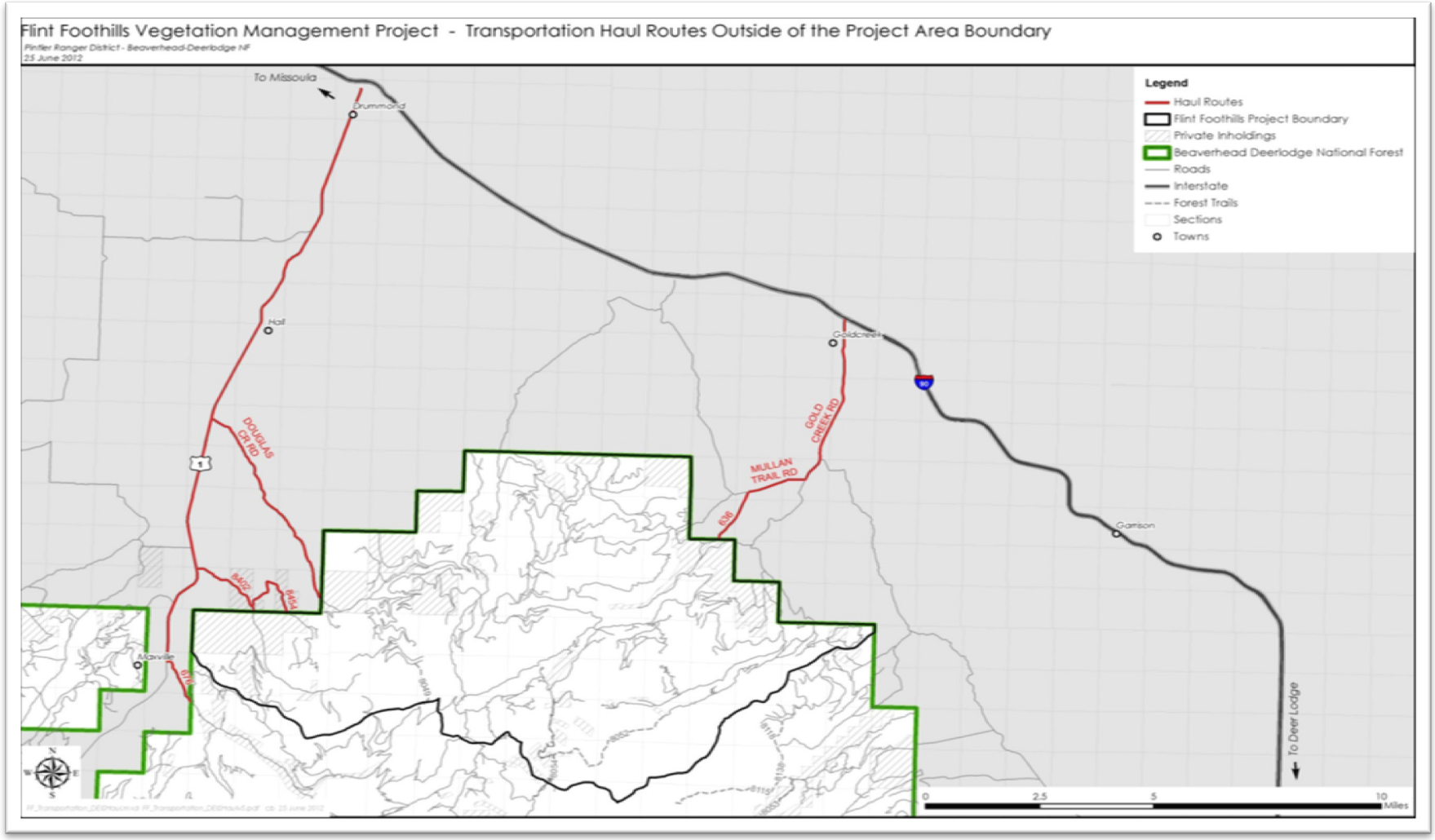

Figure 3. Haul routes located outside of the project area boundary

Alternative 2 - Proposed Action

The proposed action utilizes the full range of several silvicultural treatments described in the previous section to meet the purpose and need for action. Table 7 displays the proposed vegetation treatments. Figure 4 displays the location of proposed activities for alternative 2 followed by treatment- and unit-specific details. Collectively, the commercial vegetation treatments would provide 16,042 MBF (32,083 CCF) in sawtimber; and 4,010 MBF (8,021 CCF) in non-saw timber.

Table 7. Proposed action vegetation treatments, acres of treatment, number of units and range of unit size by acres

Vegetation Treatment Type	Acres of Treatment	Number of Units	Range in Unit Size by Acres
Salvage by clearcut harvest dead and dying lodgepole pine (S): Salvage harvest dead and dying LP. Retain all other conifers and FP required snags.	1,163	30	2-94
Commercial thin ponderosa pine and Douglas-fir (C): Thin low to mid-elevation units to reduce density from an average of 100-140 to 40-60 basal area.	1,149*	29	9-175
Seed tree with reserves (ST): Seed tree harvest for ponderosa pine regeneration. Reserve trees are larger diameter Douglas-fir and ponderosa pine, in addition to seed trees.	353	6	8-139
Prescribed burning (B): Use ignited fire to burn in mid-elevation mixed conifer units and low elevation dry forest units.	1,990	8	15-710
Precommercial thin (P): Thin sapling-sized trees in old harvest units.	1,048	20	9-187
Total	**5,703**	**93**	**2-710**

* Includes 121 acres of old growth in 4 units

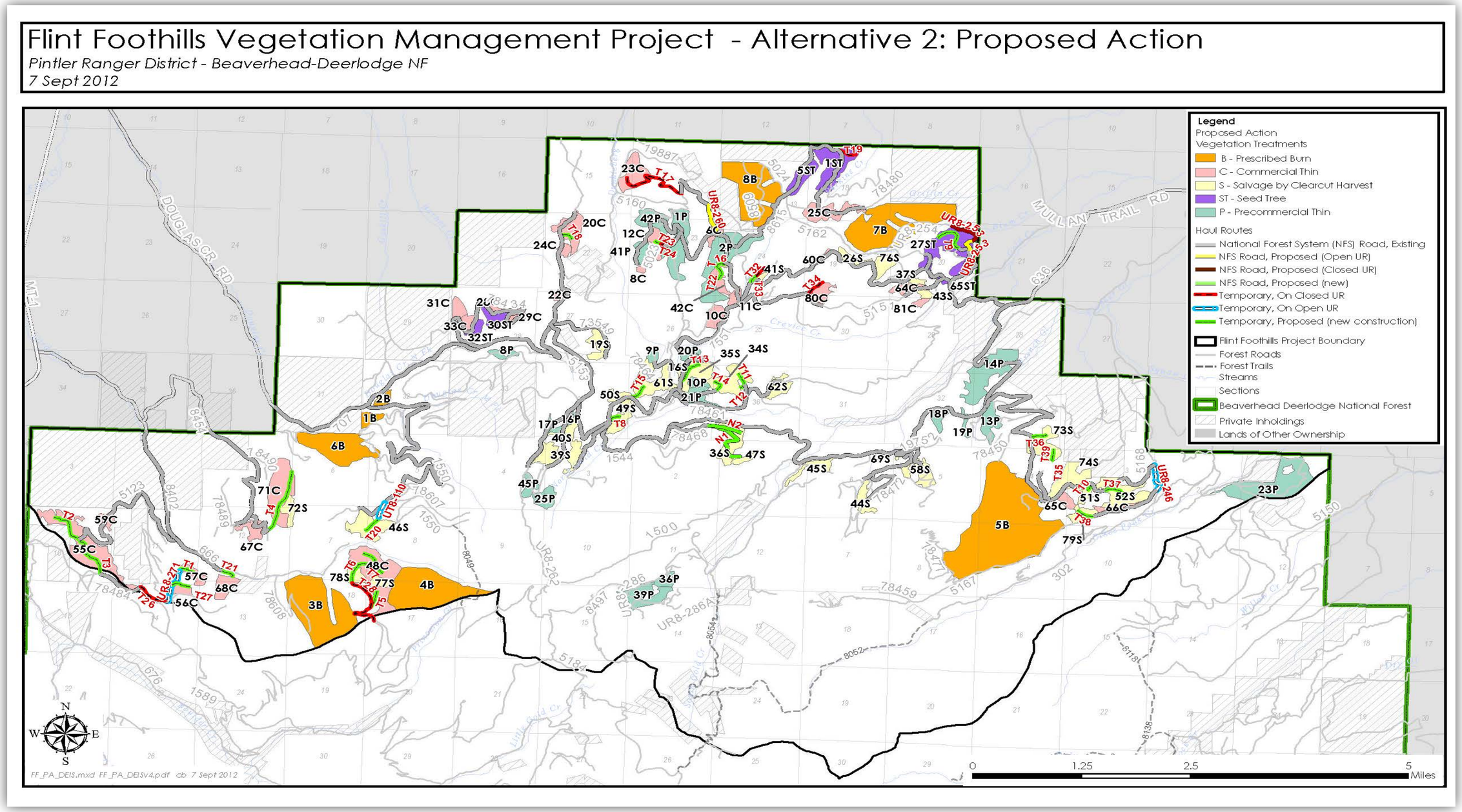

Figure 4. Proposed activities for alternative 2-proposed action

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Vegetation Treatments – Commercial Harvest

Salvage of Lodgepole Pine Stands by Clearcut Harvest

Dead and dying lodgepole pine would be salvaged by clearcut harvest on 1,163 acres. Salvage harvest would occur on 26 units ranging in size from 2 to 94 acres.

Twelve proposed lodgepole pine salvage units (19S, 34S, 35S, 36S, 39S, 46S, 49S, 52S, 58S, 61S, 73S, and 74S) exceed 40 acres in size, ranging from 41 to 94 acres (table 9). Forest Plan timber standard 2 (Forest Plan, p. 39) allows openings created by one regeneration unit to exceed 40 acres on lands suitable for timber production when a natural event created an undesirable opening. This requires public notification and Regional Forester approval.

Commercial Thin of Ponderosa Pine and Douglas-fir Stands

Twenty-nine ponderosa pine and Douglas-fir stands would be commercially thinned on 1,149 acres, with the 29 units ranging in size from 9-175 acres. A total of 121 acres of old-growth stands are included in four commercial thin treatment units (6C, 23C, 25C and 55C); thinning these areas would meet minimum criteria for old growth after treatment, consistent with Forest Plan standards (Forest Plan, p.44).

Light underburning after commercial thinning would reduce understory vegetation not removed during harvest to lower stand densities. The commercial thin units that contain old-growth stands would be excluded from burning.

Seed Tree Harvest of Douglas-fir and Ponderosa Pine Stands

Douglas-fir and ponderosa pine stands would be seed tree harvested on 353 acres within 6 units ranging in size from 8 to 139 acres.

Light underburning after the seed tree harvest would reduce the understory vegetation not removed during harvest to lower stand densities.

Three proposed seed tree units exceed 40 acres in size (units 1ST, 5ST, 27ST). Forest Plan timber standard 2 (Forest Plan, p. 39) allows openings created by one regeneration unit to exceed 40 acres on lands suitable for timber production when a natural event created an undesirable opening. This requires public notification and Regional Forester approval

Logging Systems

Temporary roads and landings constructed within the units would reduce yarding distances. External yarding distances[20] would range from 250-1,600 feet with an average external yarding distance of 999 feet.

Approximately 110 acres of commercial harvest using cable logging systems in units 26S, 36S, 28C, 29C, 33C, 28CS, 60C, 68C and 30ST would occur on slopes greater than 35 percent.

Haul Routes

Under alternative 2,109.1 miles of road would be used as haul routes. Table 8 identifies the roads and associated mileages. Figure 5 displays the haul routes proposed inside the project area boundary.

20 External yarding distance is the slope distance from the landing to the furthest reachable point within the treatment unit boundary.

- A total of 100.6 miles of existing roads, including unauthorized routes, would be utilized as haul routes. This includes 68.2 miles within the project area boundary that are displayed on the alternative 2 map (figure 4) and the transportation map (figure 5). The remaining 26.9 miles are private, county, and NFS road outside the project area. Approximately 58.9 miles would be maintained, and 41.7 miles would be reconstructed.
- Approximately 1.3 miles of new road would be constructed for haul to access units 36S and 47 S. The site conditions require the need for specified road construction, as opposed to temporary road. These roads would be added to the Forest transportation system as NFS road. They would be put into storage (maintenance level 1) for future access following implementation of the Flint Foothills project. These roads would be closed to motor vehicle use during the time they are in storage.
- Approximately 7.2 miles of new temporary road would be constructed, utilizing construction measures such as outsloping, drainage dips, and water-spreading ditches. Following completion of the vegetation projects, the new temporary roads would be decommissioned by obliteration, in which the road prism is recontoured; cut and fill slopes are restored to natural grades; and slash, stumps, and woody debris are placed on top of the corridor to effectively block vehicle travel
- Approximately 4.4 miles of existing open and closed unauthorized routes would be reconstructed. Following implementation, these routes would be decommissioned by various methods, as displayed in table 6, previously.
- Just over 1 mile of open and closed unauthorized routes would be reconstructed, utilized as haul routes and added to the Forest transportation system. They would be managed as maintenance level 2 roads (high clearance vehicles recommended).

Table 8. Haul route mileage summaries for alternative 2

Haul Routes	Alternative 2-Proposed Action Miles	Road/Route Numbers
Forest roads and NFS roads, existing (outside of the project area)	26.9	State Highway 1 Forest Road 676 (Finley Basin Road). NFS Road 1500 (Eureka Ridge Road) NFS Road 8402 (Gird Creek Road) Douglas Creek Road Forest Road 8454 (East Gird Creek) NFS Road 8454 Gold Creek and Mullan Trail Roads Forest Road 636 (Gold Creek)
NFS roads, existing (inside of the project area)	68.2	NFS roads: 1522, 1522A, 1544, 1550, 1557, 1589, 19752, 5023, 5123, 5151, 5152, 5153, 5160, 5161, 5162, 5167, 5168, 636, 666,707, 73549, 78434, 78442, 78461, 78462, 78463, 78464, 78468, 78469, 78470, 78472, 78475, 78476, 78480, 78484, 78489, 78494, 78617, 8402, 8454, 8506, 8510, 8615
NFS roads, proposed (open UR)	0.7	UR8-253 UR8-260
NFS road, proposed (closed UR)	0.4	UR8-253

Haul Routes	Alternative 2-Proposed Action Miles	Road/Route Numbers
NFS road, proposed (new construction)	1.3	N1, N2
Temporary road (on open UR)	1.0	UT8-110 UR8-246 UR8-271
Temporary road (on closed UR)	3.4	T17, T19, T24, T26 (UR8-270), T28 (UR8-284), T32 (UR8-257), T34, T35 (78422)
Temporary road, proposed (new construction)	7.2	T1-T16; T18; T20-T23; T27; T33; T36-T39
Total Miles	**109.1**	

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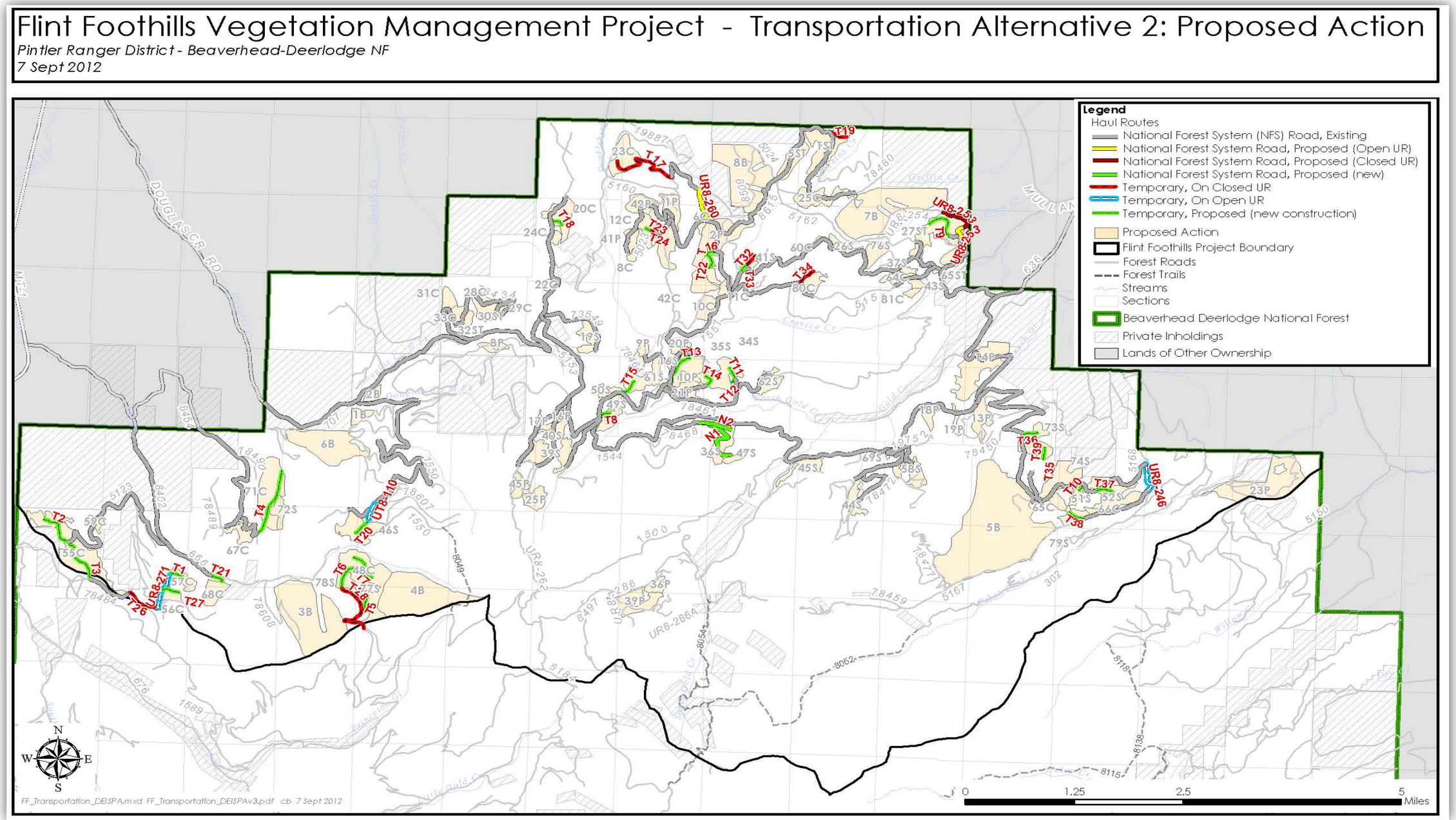

Figure 5. Proposed transportation system for alternative 2-proposed action

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Unit Summaries

Table 9 displays the acres of proposed salvage by clearcut, commercial thin, and seed tree harvest by unit. It also displays the associated logging system(s), temporary road haul route mileages, and limited operating periods and the rationale for the restrictions. The project design features and mitigation measures in chapter 2 identify other implementing restrictions based on environmental conditions, i.e. soil conditions. Table 10 and table 11 display the acres of proposed prescribed burning and precommercial thinning respectively. The alpha code associated with each unit number in the following tables and on the alternative maps represents the treatment type: S = salvage by clearcut; C = commercial thinning; ST = seed tree with reserves; B = prescribed burn; and P = precommercial thinning.

Table 9. Alternative 2 proposed salvage by clearcut, commercial thinning, and seed tree treatment units with LOPs (Units greater than 40 acres requiring Regional Forester approval are highlighted)

Alternative 2 (Proposed Action)					
Unit number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Temp Road Miles N = New E= Existing**	**Dates and Reasons that Activities are Restricted (limited operating period)**
Proposed Salvage with Clearcut Harvest Treatment					
16S	7	7			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
19S	41	41			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
26S	25	0	25		Oct. 15- Dec. 2 Area closure[2] Fall secure area[4]
34S	78	78		0.42 N	Apr. 1 – June 15 Oct. 15 - Dec. 2 Motorized access on NFS Road 78461 closed[3] - Fall secure area[4]
35S	50	50		0.35 N	Oct. 15 - Dec. 2 Fall secure habitat[4]
36S	61	47	14		Oct. 15 - Dec. 2 Fall secure habitat[4]
37S	8	8			
39S	79	79			Apr. 1 – June 15 Oct. 15 - Dec. 2 Motorized access on NFS Roads 5153, 78469 and 78470 closed[3] Fall secure area[4]
40S	29	29			Apr. 1 – June 15 Oct. 15 - Dec. 2 Motorized access on NFS Road 5153 closed3 Fall secure area[4]
41S	4	4		0.10 N 0.15E	Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] Motorized access on UR8-257 (T32) closed year round[5]
43S	11	11			April 15-Aug 15[1] Goshawk

Alternative 2 (Proposed Action)					
Unit number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Temp Road Miles N = New E= Existing**	**Dates and Reasons that Activities are Restricted (limited operating period)**
					Oct. 15 - Dec. 2 Motorized access on NFS Road 5151closed year round[5]
44S	31	31			Oct. 15 - Dec. 2 Motorized access on NFS Roads 78472, 78475 closed year round[5] Fall secure area[4]
45S	31	31			Oct. 15 - Dec. 2 Motorized access on NFS Road 19755 closed year round [5] Fall secure area[4]
46S	79	79		0.25 N 0.20 E	Oct. 15 - Dec. 2 Motorized access on NFS Roads 1550, 78494 closed[3] Fall secure area[4]
47S	13	13			Oct. 15 - Dec. 2 Fall secure area[4]
49S	43	43		0.16 N	Mar 15 -July 15 Great gray owls[1]
50S	17	17			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
51S	19	19		0.11 N	
52S	94	94		0.27N 0.39 E	
58S	49	49			Oct. 15 - Dec. 2 Motorized access on NFS roads 19752, 78472, 78476 closed year round[5], Fall secure area[4]
61S	88	88		0.24 N	Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
62S	36	36			Apr. 1 – June 15 Oct. 15-Dec. 2 Motorized access on NFS Road 5152 closed[3] - Fall secure area[4]
69S	2	2			Oct. 15-Dec. 2 Motorized access on NFS Road 19752 closed year round [5] Fall secure area[4]
72S	28	28			Oct. 15-Dec 2 Motorized access on NFS Road 8454 closed[3] - Fall secure area[4]
73S	64	64		0.72N	
74S	74	74			
76S	32	32			Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
77S	16	16			Sept. 1 – June 15 Oct. 15 – Dec. 2 Motorized vehicle access on NFS Road1500 closed[3] - Fall secure area[4]

Alternative 2 (Proposed Action)					
Unit number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Temp Road Miles N = New E= Existing**	**Dates and Reasons that Activities are Restricted (limited operating period)**
					Motorized access on UR8 -284 (T5) closed year round[5]
78S	23	23			Sept. 1 – June 15 Oct. 15-Dec. 2 Motorized vehicle access on NFS Road1500 closed[3] Fall secure area[4] Motorized access on UR8 -284 (T5) closed year round5
79S	31	31		0.21N	
Total	**1,163**	**1,124**	**39**	**3.57 (2.83N) (0.74E)**	
Proposed Commercial Thinning Treatments					
6C	14[6]	14			Apr. 1 – June 15 Oct. 15 – Dec. 2 Area closure[2] - Fall secure area[4]
8C	13	13			Apr. 1 – June 15 Oct. 15 – Dec. 2 Area closure[2] - Fall secure area[4]
10C	31	31			Mar 15-July 15 Great gray owls[1] Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
11C	17	17			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
12C	33	33		0.09 N 0.03 E	Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
20C	64	64		0.16 N	Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] May 15 – August 15 Flammulated owls[1]
22C	16	16			Oct. 15-June 15 Area closure[2] - Fall secure area[4]
23C	69[6]	69		1.04 E	Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] May 15 – August 15 Flammulated owls[1]
24C	14	14			Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]

Alternative 2 (Proposed Action)					
Unit number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Temp Road Miles N = New E= Existing**	**Dates and Reasons that Activities are Restricted (limited operating period)**
					May 15 – August 15 Flammulated owls[1]
25C	64[6]	64			Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] May 15 – August 15 Flammulated owls [1]
28C	13	4	9		Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
29C	17	10	7		Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
31C	24	24			Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
33C	18	11	7		Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
42C	31	31		0.37N	Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
48C	157	157		1.09 N 0.94 E	Sept. 1 – June 15 Motorized vehicle access on NFS Road1500 closed[3] Fall secure habitat[4] Motorized access on UR8 -284 (T5) closed year round5
55C	175[6]	175		1.10 N	Mar. 15-July 15[1]. Great gray owls Oct. 15-June 15 Area closure[2] - Fall secure area[4]
56C	18	18		0.22 N 0.81 E	Apr. 15-Aug. 15 Goshawks [1] Oct 15 – Jun 15 Motorized vehicle access on NFS Road 5123 closed[3] Fall secure area[4]
57C	27	27		0.20 N	Apr. 15-Aug. 15 Goshawks[1] Oct 15 – June 15 Motorized vehicle access on NFS Road 5123 closed[3] Fall secure area[4]
59C	20	20			Mar. 15- July 15. Great gray owls[1] Oct. 15-June 15 Area closure[2] - Fall secure area[4]
60C	14	0	14		Apr. 1 – June 15 Oct. 15-Dec. 2

Alternative 2 (Proposed Action)					
Unit number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Temp Road Miles N = New E= Existing**	**Dates and Reasons that Activities are Restricted (limited operating period)**
					Area closure[2] - Fall secure area[4]
64C	25	25			Oct. 15-Dec. 2 Motorized access on NFS Road 5151closed year round[5] Fall secure area[4]
65C	18				
66C	24				
67C	33				Oct. 15-June 15 Motorized vehicle access on NFS Road 78489, 8454 closed[3] - Fall secure area[4]
68C	38	20	18	0.17 N	Apr.15-Aug.15 Goshawks[1] Oct. 15-June 15 Motorized vehicle access on NFS Road 666 closed[3] - Fall secure area
71C	122	122		0.87 N	Oct. 15-June 15 Motorized vehicle access on NFS Road 8454 closed[3]- Fall secure area[4]
80C	31	31		0.21 E	Apr. 1 – June 15 Oct. 15-Dec. 2 Motorized access on NFS Road 5151 closed[3] - Fall secure area[4]
81C	9	9			Oct. 15-Dec. 2 Motorized access on NFS Road 5151 closed year round[5] - Fall secure area[4]
Total	**1,149**	**1,094**	**55**	**7.3 (4.27N) (3.03E)**	
Proposed Seed Tree with Reserves (ST)					
1ST	102	102		0.24 E	Mar. 15-Aug.15 Great gray owl[1] May 15-Aug 15 Flammulated owl[1] Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
5ST	47	47			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
27ST	139	139		0.62 E 0.48 N	Apr 15.-Aug.15 Goshawks[1] Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
30ST	39	23	16		Oct. 15-June 15 Area closure[2] - Fall secure area[4]

Proposed Seed Tree with Reserves (ST)					
32ST	18	18			Oct. 15-June 15 Area closure[2] - Fall secure area[4]
65ST	8	8			Oct. 15 – Dec. 2 Motorized access on NFS Road 5152 closed year round[5]
Total	**353**	**337**	**16**	**1.34**	

[1] Activities are prohibited during the breeding season (limited operating period); survey prior to implementation if activities are scheduled to occur during the breeding season:

- Goshawk limited operating period is April 15 – August 15; (USFWS R6 2007).
- Great gray owl limited operating period is March 15 – July 15;
- Flammulated owl limited operating season is May 15 – August 15;

[2] Area closed to motorized traffic (Forest Travel map); therefore, the haul routes for the associated units are not open designated routes during these timeframes;

[3] Road closed to motorized traffic (Forest Travel map); therefore, the haul routes for the associated units are not open designated routes during these timeframes;

[4] A project design feature restricts access on existing or proposed roads that would reduce fall secure habitat during the hunting season, October 15 – December 2;

[5] Roads closed year round (Forest Travel map) would have authorized use outside of October 15 – December 2;

[6] Unit contains –old-growth.

Vegetation Treatments – Prescribed Burning and Precommercial Thinning

Prescribed Burning Mid-elevation Lodgepole Pine and Low-elevation Douglas-fir and Ponderosa Pine Stands

Prescribed burning would treat 1,990 acres within eight units ranging in size from 15 to 710 acres: 1,259 acres of mid-elevation lodgepole pine in three units, and 731 acres of low-elevation Douglas-fir and ponderosa pine stands in five units. Table 10 displays the proposed acres of prescribed burning by unit, and distinguishes between the mid and low elevation units.

Table 10. Units and acres of proposed prescribed burning (low and mid elevation) for alternative 2

Proposed Prescribed Burning Treatments (B)		
Units	**Acres**	**Dates and Reasons that Activities are Restricted (limited operating period)[1]**
1B (Low)	22	None
2B (Low)	15	None
3B (Mid)	298	Apr. 1 – June 15; Oct. 15-Dec. 2 Motorized access on NFS Roads 666 and 78608 closed[1] Fall secure areas[2] Sept. 1 – June 15 Motorized access on NFS Road 1500 closed[1]
4B (Mid)	251	Sept. 1 – June 15 Motorized access on NFS Road 1500 closed[1] Fall secure area[2]
5B (Mid)	710	Oct. 15 -Dec. 2 Fall secure area[2]

Proposed Prescribed Burning Treatments (B)		
Units	**Acres**	**Dates and Reasons that Activities are Restricted (limited operating period)[1]**
6B (Low)	164	Oct. 15 -Dec. 2 Fall secure area[2]
7B (Low)	298	Oct. 15 -Dec. 2 Unit in Area closure[3] Fall secure area[2]
8B (Low)	232	Oct. 15-Dec. 2 Unit in Area closure[3] Fall secure area[2]

[1] Road closed to motorized traffic (Forest Travel map); therefore, the access routes for the associated units are not open designated routes during these timeframes;
[2] A project design feature restricts access on existing or proposed roads that would reduce fall secure habitat during hunting season, October 15 – December 2;
[3] Area closed to motorized traffic (Forest Travel map).

Vegetation Treatments—Prescribed Burning and Precommercial Thinning

Pre-Commercial Thin of Lodgepole Pine and Douglas-fir Stands

Precommercial thinning would treat 1,381 acres of naturally regenerated, previously harvested stands in 20units to address the need for density reduction. Table 11 displays the proposed units and acreage for precommercial thinning treatments.

Table 11. Units and acres proposed for precommercial thinning treatment

Proposed Precommercial Thinning Treatments			
Units	**Acres**	**Units**	**Acres**
1P[1,2]	115	19P[2]	12
2P[1,2]	154	20P	24
8P[3]	17	21P[1,2]	49
9P[1, 2]	11	23P [1,2]	187
10P [2]	16	25P [1,2]	35
13P	50	36P	21
14P	138	39P	73
16P[1]	15	41P[1]	24
17P[1]	9	42P [2]	52
18P[2]	23	45P [1,2]	23
Sub-total	**548**		**500**
Total Acres: 1,048			

[1] Area and access road closed to motorized traffic (Forest Travel map) Apr. 1 – June 15; Oct. 15 – Dec. 2;
[2]. A project design feature restricts access on existing or proposed roads that would reduce fall secure habitat during hunting season, October 15 – December 2;
[3]. Area closed to motorized traffic (Forest Travel map) Oct. 15 – June 15.

Alternative 3

Alternative 3 addresses public concerns over new road construction, and logging within old-growth stands. This alternative proposes that no new NFS or temporary roads be constructed to access units or to accommodate logging within units. No commercial thinning would occur within the understory of old-growth stands.

Alternative 3 eliminates eight units (36S, 47S, 72S, 48C, 56C, 57C, 68C, and 71C) requiring new temporary road construction for access to the unit, thereby eliminating the need for new temporary road construction. Six units utilize existing open and closed unauthorized routes to and within the unit to accommodate logging (52S, 73S, 12C, 20C, 23C, and 80C); no new temporary roads would be constructed. Instead, longer skidding distances, which average 1,425 feet, would be utilized to log the unit with ground-based systems. In addition, four units are reduced in size (23C, 25C, 55C, and 6C) by a total of 121 acres to eliminate commercial understory thinning of old-growth stands under alternative 3.

All other vegetation treatment proposals for this alternative are the same as for the proposed action. Collectively, the commercial vegetation treatments would provide 12,686 MBF (25,372 CCF) in sawtimber; and 3,172 MBF (6,343 CCF) in non-saw timber. Figure 6 displays the location of proposed activities for alternative 3. Table 12 displays the vegetation treatment acres.

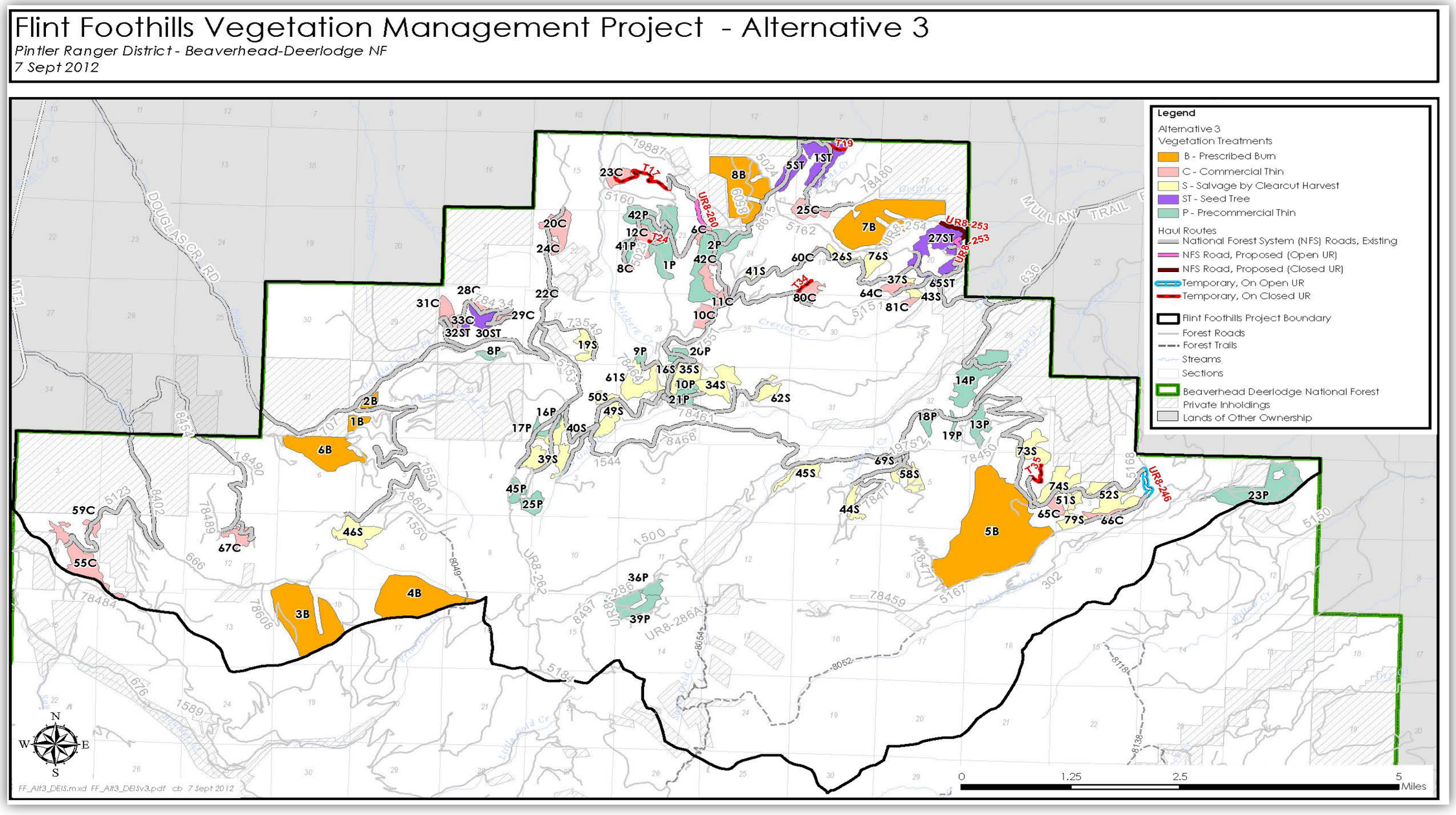

Figure 6. Proposed activities for alternative 3

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Table 12. Alternative 3 vegetation treatments, acres of treatment, number of units and range of unit size by acres

Vegetation Treatment	Alternative 3 Acres	Number of Units	Range in Unit Size by Acres
Salvage by clearcut harvest	666	25	2-94
Commercial thinning	1,022	24	9-118
Seed tree with reserves	353	6	8-139
Prescribed burning	1,990	8	15-710
Precommercial thinning	1,048	20	9-187
Total	**5,070**	**83**	**2-710**

Vegetation Treatments—Commercial Harvest

Salvage of Lodgepole Pine Stands by Clearcut Harvest

Dead and dying lodgepole pine would be salvaged by clearcut harvest on 666 acres. Salvage harvest would occur on 25 units ranging in size from 2 to 94 acres.

Eleven proposed lodgepole pine salvage units (19S, 34S, 35S, 39S, 46S, 49S, 52S, 58S, 61S, 73S, and 74S) exceed 40 acres in size, ranging from 41 to 94 acres (table 14). Forest Plan timber standard 2 (Forest Plan, p. 39) allows openings created by one regeneration unit to exceed 40 acres on lands suitable for timber production when a natural event created an undesirable opening. This requires public notification and Regional Forester approval.

Commercial Thin of Ponderosa Pine and Douglas-fir Stands

Twenty-four ponderosa pine and Douglas-fir stands would be commercially thinned on 1,022 acres, with the 24 units ranging in size from 9-118 acres.

Light underburning after commercial thinning would reduce understory vegetation not removed during harvest to lower stand densities.

Seed Tree Harvest of Douglas-fir and Ponderosa Pine Stands

Douglas-fir stands and ponderosa pine stands would be seed tree harvested on 353 acres within six units ranging in size from 8 to 139 acres.

Light underburning after the seed tree harvest would reduce understory vegetation not removed during harvest to lower stand densities.

Three proposed seed tree units exceed 40 acres in size (1ST , 5ST, 27ST) Forest Plan timber standard 2 (Forest Plan, p. 39) allows openings created by one regeneration unit to exceed 40 acres on lands suitable for timber production when a natural event created an undesirable opening. This requires public notification and Regional Forester approval

Logging Systems

Logs would be skidded to landings located adjacent to existing system roads. External yarding distances would range from 250-4,080 feet with an average external yarding distance of 1,425 feet.

Approximately 78 acres of commercial harvest using cable logging systems, in units 26S, 28C, 29C, 33C, 60C, would occur on slopes greater than 35 percent.

Haul Routes

Under alternative 3, 85.5 miles road would be utilized as haul routes. No new roads would be constructed. Table 13 identifies the roads and associated mileages. Figure 7 displays the haul routes within the project area boundary.

Two open and closed unauthorized routes would be added to the Forest's Transportation system. Other unauthorized routes would be reconstructed, used as haul routes, and then decommissioned following project implementation Refer to table 8 for a detailed listing.

- A total of 85.5 miles of existing roads, including existing unauthorized routes, would be utilized as haul routes. This includes 66.4 miles within the project area boundary that are displayed on the activities for alternative 3 map (figure 6), and on the transportation map for alternative 3, figure 7. The remaining 15.7 miles are private, county, and NFS roads outside the project area. Approximately 47.1 miles would be maintained, and 38.3 miles would be reconstructed.
- Approximately 2.3 miles of existing open and closed unauthorized routes would be reconstructed. Following project implementation, these routes would be decommissioned by various methods, as displayed in table 6.
- Just over 1 mile of unauthorized routes would be utilized as reconstructed, utilized as haul routes and added to the Forest transportation system. They would be managed as maintenance level 2 roads (high clearance vehicles recommended).

Table 13. Haul route mileage summaries for alternative 3

Haul Routes	Alternative 3-Miles	Road/Route Numbers
Forest roads and NFS roads, existing (outside of the project area)	15.7	State Highway 1 Forest Road 676 (Finley Basin Road). NFS Road 1500 (Eureka Ridge Road) NFS Road 8402 (Gird Creek Road) Douglas Creek Road Forest Road 8454 (East Gird Creek) NFS Road 8454 Gold Creek and Mullan Trail Roads Forest Road 636 (Gold Creek)
NFS roads, existing (inside of the project area)	66.4	NFS roads: 1522, 1522A, 1544, 1550, 1557, 1589, 19752, 5023, 5123, 5151, 5152, 5153, 5160, 5161, 5162, 5167, 5168, 636, 666,707, 73549, 78434, 78442, 78461, 78462, 78463, 78464, 78469, 78470, 78472. 78475, 78476, 78480, 78489, 78494, 78617, 8402, 8454, 8506, 8510, 8615
NFS road, proposed (on open UR)	0.7	UR8-253 UR8-260
NFS road, proposed (on closed UR)	0.4	UR8-253
Temporary road (on open UR)	0.4	UR8-246
Temporary road (on closed UR)	1.9	T17. T19, T24, T34, T35 (78442)
Total Miles	**85.5**	

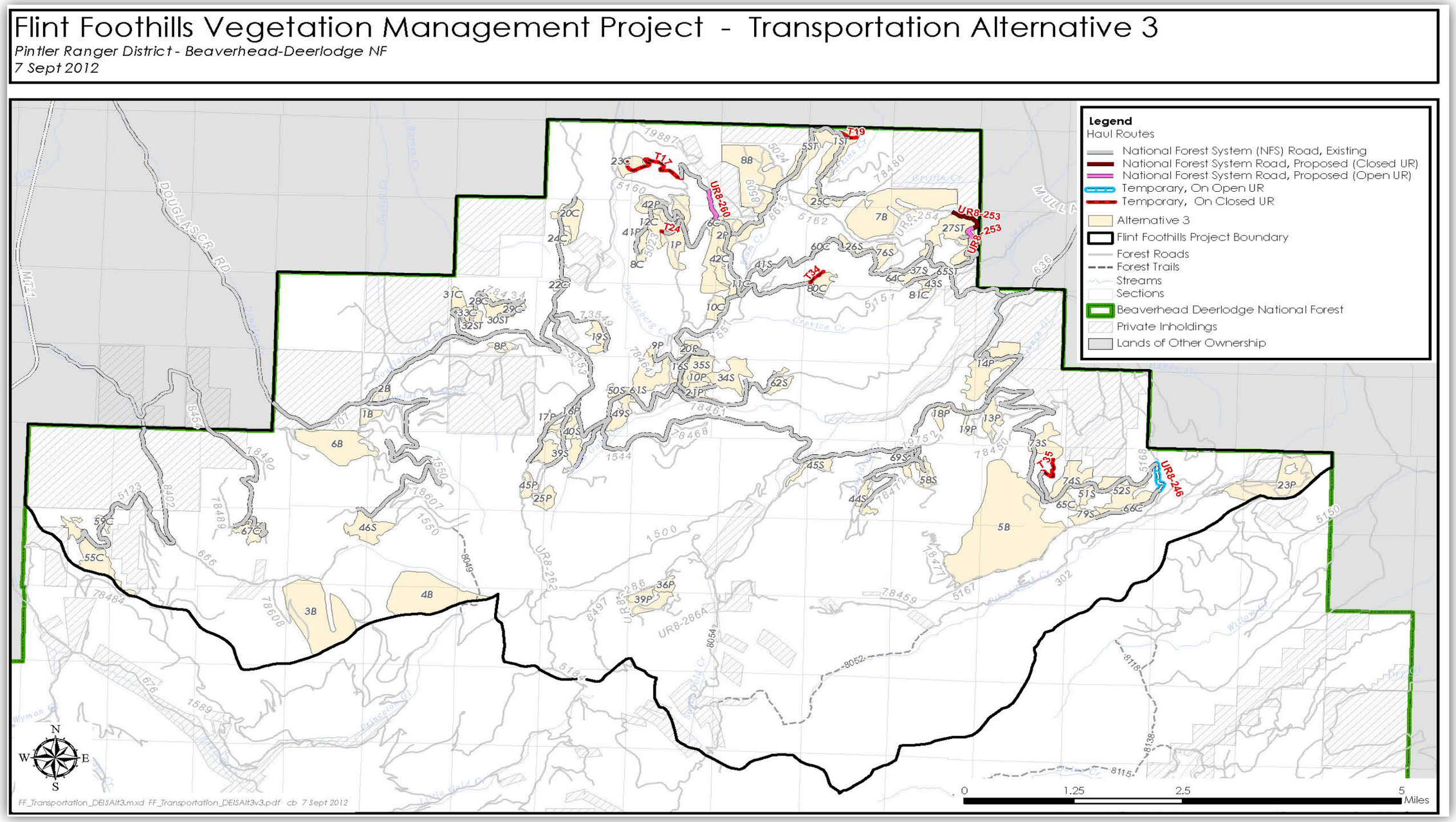

Figure 7. Proposed transportation system for alternative 3

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Unit Summaries

Table 14 displays the acres of proposed salvage by clearcut, commercial thinning and seed tree harvest by unit. It also displays the associated existing unauthorized haul route mileages, limited operating seasons. The project design features and mitigation measures that follow identify other implementation restrictions based on environmental conditions (i.e. soil conditions). Table 15 and table 16 display the acres of precommercial thinning and prescribed burning. The alpha code associated with each unit number in the following tables and on the alternative maps represents the treatment type: S = salvage by clearcut; C = commercial thin; ST = seed tree with reserves; B = prescribed burn; and P = precommercial thin.

Table 14. Alternative 3 proposed salvage by clearcut, commercial thinning, and seed tree treatment units with LOPs (units greater than 40 acres requiring Regional Forster approval are highlighted in gray).

Alternative 3					
Unit Number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Open and Closed Unauthorized Route Miles**	**Dates and Reasons Activities are Restricted(limited operating period)[1]**
Proposed Salvage by Clearcut Harvest Treatment					
16S	7	7	0		Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
19S	41	41	0		Apr. 1 – June 15; Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
26S	25	0	25		Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
34S	78	78	0		Apr. 1 – June 15 Oct. 15 - Dec. 2 Motorized access on NFS Road 78461 closed[3] - Fall secure area[4]
35S	50	50			Oct. 15 - Dec. 2 Fall secure habitat[4]
37S	8	8			
39S	79	79			Apr. 1 – June 15 Oct. 15 – Dec. 2 Motorized access on NFS Roads 5153, 78469 and 78470 closed[3] Fall secure area[4]
40S	29	29			Apr. 1 – June 15 Oct. 15 - Dec. 2 Motorized access on NFS Road 5153 closed[3] Fall secure area[4.]
41S	4	4			Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] Motorized access on UR8-257 (T32) closed year round5
43S	11	11			April 15-Aug 15 Goshawk[1] Oct. 15 - Dec. 2 Motorized access on NFS Road

Alternative 3					
Unit Number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Open and Closed Unauthorized Route Miles**	**Dates and Reasons Activities are Restricted(limited operating period)[1]**
					5151closed year round[5]
44S	31	31			Oct. 15 - Dec. 2 Motorized access on NFS Roads 78472, 78475 closed year round [5] Fall secure area[4]
45S	31	31			Oct. 15 - Dec. 2 Motorized access on NFS Roads 19755 closed year round [5] Fall secure area[4]
46S	79	79			Oct. 15 - Dec. 2 Motorized access on NFS Roads 1550, 78494 closed[3] Fall secure area[4]
49S	43	43			Mar 15 -July 15 Great gray owls[1]
50S	17	17			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
51S	19	19			
52S	94	94		0.39	
58S	49	49			Oct. 15 - Dec. 2 Motorized access on NFS Roads 19752, 78472, 78476 closed year round[5] - Fall secure area[4]
61S	88	88			Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
62S	36	36			Apr. 1 – June 15 Oct. 15-Dec. 2 Motorized access on NFS Road 5152 closed[3] - Fall secure area[4]
69S	2	2			Oct. 15-Dec. 2 Motorized access on NFS Road 19752 closed year round [5] Fall secure area[4]
73S	64	64		0.38	
74S	74	74			
76S	32	32			Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
79S	**31**	**31**			
Total	**1022**	**997**	**25**	**0.77**	
Proposed Commercial Thinning Treatments					
6C	12	12			Apr. 1 – June 15 Oct. 15 – Dec. 2 Area closure[2] - Fall secure area[4]
8C	13	13			Apr. 1 – June 15 Oct. 15 – Dec. 2 Area closure[2] - Fall secure area[4]

Alternative 3					
Unit Number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Open and Closed Unauthorized Route Miles**	**Dates and Reasons Activities are Restricted(limited operating period)[1]**
10C	31	31			Mar 15-July 15 Great gray owls[1] Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
11C	17	17			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
12C	33	33		0.03	Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
20C	64	64			Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] May 15 – August 15 Flammulated owls[1]
22C	16	16			Oct. 15-June 15 Area closure[2] - Fall secure area[4]
23C	33	33		1.04	Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] May 15 – August 15 Flammulated owls[1]
24C	14	14			Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] May 15 – August 15 Flammulated owls[1]
25C	38	38			Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4] May 15 – August 15 Flammulated owls [1]
28C	13	4	9		Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
29C	17	10	7		Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
31C	24	24			Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
33C	18	11	7		Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
42C	31	31			Oct. 15 – June 15 Area closure[2] - Fall secure area[4]
55C	118	118			Mar. 15-July 15.

Alternative 3					
Unit Number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Open and Closed Unauthorized Route Miles**	**Dates and Reasons Activities are Restricted(limited operating period)[1]**
					Great gray owls[1] Oct. 15-June 15 Area closure[2] - Fall secure area[4]
59C	20	20			Mar. 15-July 15. Great gray owls[1] Oct. 15-June 15 Area closure[2] - Fall secure area[4]
60C	14	0	14		Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
64C	25	25			Oct. 15-Dec. 2 Motorized access on NFS Road 5151closed year round[5] Fall secure area[4]
65C	18	18			
66C	24	24			
67C	33	33			Oct. 15-June 15 Motorized vehicle access on NFS Roads 78489, 8454 closed[3] Fall secure area[4]
80C	31	31		0.21	Apr. 1 – June 15 Oct. 15-Dec. 2 Motorized access on NFS Road 5151 closed[3] - Fall secure area[4]
81C	9	9			Oct. 15-Dec. 2 Motorized access on NFS Road 5151 closed year round[5] - Fall secure area[4]
Total	**666**	**629**	**37**	**1.28E**	
1ST	102	102		0.24	Mar 15 – July 15 Great gray owl[1] May 15-Aug 15 Flammulated owl[1] Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
5ST	47	47			Apr. 1 – June 15 Oct. 15 - Dec. 2 Area closure[2] - Fall secure area[4]
27ST	139	139			Apr 15.-Aug.15 Goshawks[1] Apr. 1 – June 15 Oct. 15-Dec. 2 Area closure[2] - Fall secure area[4]
30ST	39	23	16		Oct. 15-June 15

Alternative 3					
Unit Number	**Acres**	**Tractor Logging Acres**	**Cable Logging Acres**	**Open and Closed Unauthorized Route Miles**	**Dates and Reasons Activities are Restricted(limited operating period)[1]**
					Area closure[2] - Fall secure area[4]
32ST	18	18			Oct. 15-June 15 Area closure[2] - Fall secure area[4]
65ST	8	8			Oct. 15 – Dec. 2 Motorized access on NFS Road 5152 closed year round[5]
Total	**353**	**337**	**16**	**0.24**	

[1] Activities are prohibited during the breeding season (limited operating period); survey prior to implementation if activities are scheduled to occur during the breeding season:

- Goshawk limited operating period is April 15 – August 15; (USFWS R6 2007).
- Great gray owl limited operating period is March 15 – July 15;
- Flammulated owl limited operating season is May 15 – August 15;

[2] Area closed to motorized traffic (Forest Travel map); therefore, the haul routes for the associated units are not open designated routes during these timeframes;

[3;] Road closed to motorized traffic (Forest Travel map); therefore, the haul routes for the associated units are not open designated routes during these timeframes;

[4] A project design feature restricts access on existing or proposed roads that would reduce fall secure habitat during the hunting season, October 15 – December 2;

[5] Roads closed year round (Forest Travel map) would have authorized use outside of October 15 – December 2.

Vegetation Treatments—Prescribed Burning and Precommercial Thinning

Prescribed Burning of Mid-elevation Lodgepole Pine and Low-elevation Douglas-fir and Ponderosa Pine Stands

Prescribed fire would treat 1,990 acres within eight units ranging in size from 15 to 710 acres: 1,259 acres of mid-elevation lodgepole pine in three units, and 731 acres of low-elevation Douglas-fir and ponderosa pine stands in five units. Table 15 displays the proposed acres of prescribed burning by unit, and distinguishes between the mid- and low-elevation units.

Table 15. Proposed prescribed burning units (low and mid-elevation) for alternative 3

Proposed Prescribed Burning Treatments (B)		
Units	**Acres**	**Dates and Reasons that Activities are Restricted (limited operating period)[1]**
1B (low)	22	None
2B (low)	15	None
3B (mid)	298	Apr. 1 – June 15; Oct. 15-Dec. 2 Motorized access on NFS Roads 666 and 78608 closed[1] Fall secure areas[2] Sept. 1 – June 15 Motorized access on NFS Road 1500 closed[1]
4B (mid)	251	Sept. 1 – June 15 Motorized access on NFS Road 1500 closed[1] Fall secure area[2]

Proposed Prescribed Burning Treatments (B)		
Units	**Acres**	**Dates and Reasons that Activities are Restricted (limited operating period)[1]**
5B (mid)	710	Oct. 15 -Dec. 2 Fall secure area[2]
6B (low)	164	Oct. 15 -Dec. 2 Fall secure area[2]
7B (low)	298	Oct. 15-Dec. 2 Unit in Area closure[2] Fall secure area[2]
8B (low)	232	Oct. 15-Dec. 2 Unit in area closure[3] Fall secure area[2]
Total Acres: 1,990		

[1] Road closed to motorized traffic (Forest Travel map); therefore, the access routes for the associated units are not open designated routes during these timeframes;

[2] A project design feature restricts access on existing or proposed roads that would reduce fall secure habitat during hunting season, October 15 – December 2;

[3] Area closed to motorized traffic (Forest Travel map).

Precommercial Thinning Lodgepole Pine and Douglas-fir Stands

Precommercial thinning would treat 1,381 acres of naturally regenerated, previously harvested stands in 30 units to address the need for density reduction.

Table 16 displays the proposed units and acreage for precommercial thinning treatments.

Table 16. Units and acres proposed for precommercial thinning treatment

Proposed Precommercial Thinning Treatments			
Units	**Acres**	**Units**	**Acres**
1P[1, 2]	115	19P[2]	12
2P[1, 2]	154	20P	24
8P[3]	17	21P[1, 2]	49
9P[1, 2]	11	23P[1, 2]	187
10P [2]	16	25P[1, 2]	35
13P	50	36P	21
14P	138	39P	73
16P[1]	15	41P[1]	24
17P[1]	9	42P[2]	52
18P[2]	23	45P[1, 2]	23
Sub-total	**548**		**500**
Total Acres: 1,048			

[1]Area and access road closed to motorized traffic (Forest Travel map) Apr. 1 – June 15; Oct. 15 – Dec. 2;

[2]A project design feature restricts access on existing or proposed roads that would reduce fall secure habitat during hunting season, October 15 – December 2;

[3]Area closed to motorized traffic (Forest Travel map) Oct. 15 – June 15.

Project Design Features and Mitigation Measures

The Forest Service developed the following project design features and mitigation measures as part of all of the action alternatives. Both project design features and mitigation measure are incorporated as an integrated part of alternatives 2 and 3, and are nondiscretionary once approved in a decision. They are based upon standard practices and operating procedures that have been employed in similar circumstances and conditions. The line officer and Forest specialists would review project design features and mitigation measures that would be applied through a timber sale contract, prior to contract advertisement.

Project Design Features and Mitigation Measures Common to Alternative 2 and Alternative 3

Vegetation

- In salvage units, lodgepole pine (from 4 inches up to 20 inches d.b.h.) would be salvage clearcut harvested using mechanized ground-based equipment. All other species that occur in the units (Douglas-fir, spruce, subalpine fir, and aspen) would be retained.
- In Douglas-fir commercial thinning units, Douglas-fir stands would be thinned to a density of 40 to 60 square feet of basal area per acre where it exists.
- In the Douglas-fir, ponderosa pine seed tree units, seed trees would be left that are greater than 20 inches d.b.h. and additional trees left to leave 5-15 trees per acre across the unit with the preference being ponderosa pine over Douglas-fir where they exist.
- In Douglas-fir commercial thinning units, and Douglas-fir, ponderosa pine seed tree units, a low intensity understory burn would target reducing understory trees left after harvest to lower stand densities, with fire carried over 60 to 100 percent of each unit. Ignition for the understory burn of harvest units would be by hand-lighting, with the firing operations preferably conducted in the fall; though spring burning would be acceptable.
- In the precommercial thinning units of old harvest units (from the 1960s and the 1970s); the units would be thinned on a variable spacing between 12 and 16 feet apart. The best trees (defined as free growing and full crowned) would be retained; however, where species other than lodgepole pine occur, they would have priority for retention to promote a diversity of species (with the exception of subalpine fir in Douglas-fir and ponderosa pine units).
- Live dwarf mistletoe-infected lodgepole pine within harvest units would be felled to reduce the spread of disease to the new stand. Slash from the trees would be scattered on site or piled and burned at central log landings.
- All trees (live or dead) greater than 20 inches d.b.h. would be retained in all units. An exception would occur in harvest units if they are defined a hazard to harvest operations and designated for felling by a Forest officer.
- All whitebark pine would be retained in all harvest units where it occurs.
- In precommercial thin units, full-crowned trees with green branches down to within 12 inches of the ground would be retained to maintain winter snowshoe habitat (cover and forage).

Prescribed Fire

- In the mid-elevation prescribed fire units, up to 10 percent of each unit would have small-diameter (4 to 12 inches d.b.h.) conifers slashed (cut down). Slash created as a

result of these activities would be strategically located to facilitate a mosaic of mixed severity burned areas with the objective of 50 percent mortality in the overstory trees within the unit. The concentrations would burn with fire carried into the crown of the trees for areas up to 20 acres in size, but fire is not carried throughout the unit. Ignition for the mid-elevation burn units would be a combination of aerial ignition and hand-lighting. Approximately 40 percent of each unit would be targeted with fire ignitions. A spring-time burn would be preferable, when the spread of fire over the ground vegetation would be minimal, but a fall burn would be acceptable.

- Whitebark pine is known to occur in three mid-elevation units (Unit3B, 4B and 5B). The felling of conifers prior to burning activities would avoid areas of units that have concentrations of whitebark pine. Additionally, ignition patterns would avoid the use of fire directly in areas of units that have concentrations of whitebark pine.
- Control lines for the mid-elevation prescribed fire units would principally be natural features that provide adequate fuel breaks. In the Mount Princeton area, Units 3B and 4B would require about 2,000 feet of lightly constructed hand fire-line to control the prescribed fire along the ridge. These lines would be rehabilitated if necessary after activities are complete, and monitored for weed infestations.
- In the low-elevation prescribed fire units, a low intensity understory burn would target reducing understory trees to lower stand densities, with fire carried over 100 percent of each unit. Ignition for the low-elevation burn units would be by hand-lighting, with the firing operations preferably conducted in the fall, though a spring burn would be acceptable.
- Control lines for the low-elevation prescribed fire units would be lightly constructed hand fire-lines and existing road systems. These lines would be rehabilitated if necessary after activities are complete, and monitored for weed infestations.

Air Quality

- All prescribed burning would comply with the State Requirements of the State Implementation Plan and the Smoke Management Plan (USDA Forest Service 1987, pages II-26). Prescribed burning is reported to the Airshed Coordinator on a daily basis. If ventilation problems are forecast by the monitoring unit, prescribed burning is either restricted by elevation or curtailed until good ventilation exists (Story and Dzomba 2005).
- A prescribed burn plan would be completed prior to any burning. The burn plan would address mitigation measures to minimize smoke impacts and to comply with state and Federal air quality regulations.
- Best Available Control Technologies (BACT) would be implemented during prescribed burning operations to limit emissions to the maximum degree that Montana Department of Environmental Quality (DEQ) determines for that source on a case-by-case basis. Techniques and methods may include, but are not limited to: scheduling burn periods, applying dispersion forecasts, fuel preparation and configuration, and limiting the amount of burning, ignition and burning techniques that minimize smoke production.

Harvest Operations

- Harvested trees would be whole-tree yarded to landing sites. Slash and logging debris would be burned or chipped.

- The use of roads that are currently closed and would be opened for harvest access, including unauthorized routes, would be restricted to motorized access by Forest personnel and those involved in vegetation treatment harvest operations.
- All temporary roads on open and closed unauthorized routes and constructed skid trails and landings would be decommissioned upon completion of the authorized activities. Decommissioning the unauthorized routes is consistent with Forest Service policy and would reduce the chance of unauthorized use. The proposed method of the decommissioning would vary by road, as displayed in table 6.
- All newly constructed temporary roads, skid trails, and landings would be obliterated upon completion of harvest operations. Temporary roads would not remain open for post-harvest treatments including reforestation exams and pile burning. Obliterating the temporary roads upon completion of harvest operations would reduce the chance of unauthorized use and allow the reestablishment of vegetation. Obliterating temporary roads would consist of recontouring the road prism, including all cut and fill slopes. Logging slash, stumps, and woody debris would be placed on top of obliterated road corridors to effectively prevent vehicle travel.
- Landings would not be located in natural openings such as meadows or grass-shrub parks, or in riparian areas, to avoid impacts to the vegetation and the introduction and spread of noxious weeds.

Transportation

- Travel restrictions identified on the map titled Beaverhead-Deerlodge National Forest North Map 2010 and the Beaverhead-Deerlodge Forest Plan Record of Decision II Addendum to Travel Route Restrictions would be imposed (table 9 and table 14). Travel during restricted periods would be authorized outside the period Oct. 15 - Dec. 2 for the following NFS roads with year round closures:

  5151 (units 43S, 64C, 80C, and 81C)

  5152 (unit 65ST)

  19752 (unit 69S)

  19755 (unit 45S)

  78472 (unit 58S)

  78475 (unit 44S)

  78476 (unit 58S)

  UR8-257 (T32) (unit 41S)

  UR8-284 (T5) (units 77S, 78S, and 48C)
- Signs, gates, cattleguards and other features damaged or removed during harvest activities would be repaired or replaced.
- Temporary traffic control measures would be implemented for public safety in accordance with Forest Service signing policy and the Manual on Uniform Traffic Control Devices (MUTCD).
- Hazard trees would be felled as necessary to provide for safe use of project haul routes.

Invasive Plant Species

- Invasive plants would be controlled following procedures in the Noxious Weed Control Program Record of Decision for the Beaverhead-Deerlodge National Forest (USDA Forest Service 2002, appendix H) to limit infestation and spread.
- Log landings would be located in invasive plant-free areas. If no such areas are available, the site would be treated prior to use to minimize weed seed production and spread.
- All heavy equipment would have an undercarriage wash and inspection prior to entering National Forest System lands to reduce the spread of invasive plants.
- Slash and chipped material generated from the project can be spread over bare soil. Debris would be placed to deter public motorized vehicle use on landings.
- Disturbed areas as determined by the Forest Service would be monitored to ensure soil stabilization occurs through natural revegetation from the soil seed bank. If additional plant seed is required, only native seed mix approved by the Forest Service would be used. Seed would be broadcast-spread over disturbed areas in the fall of the year, prior to snowfall. Seeded areas would be monitored closely to ensure successful establishment of desired vegetation. All seed and mulch material would be certified noxious weed seed free. In addition, invasive plants would be monitored and treated as necessary to reduce the potential spreading into new areas.
- Piling and burning slash would be avoided on invasive plant infestations. Jack-pot burn pile locations would be monitored and treated as necessary to prevent establishment and spread of invasive plants.
- Prescribed burning would be accomplished in a manner to ensure a low severity burn. This can be accomplished by burning in the spring or fall because fuel and soil moisture are higher during these times of year compared to summer, which would reduce the intensity of the fire. Some mid-elevation lodgepole pine areas would experience a mosaic of mixed-severity burned areas, as designed.
- Prescribed burn units containing invasive plant species would be aggressively treated following prescribed fire.
- Post-activity monitoring for and treatment of invasive plants would occur on all proposed treatment units. Specific emphasis would be given to areas of ground disturbance within the units, and to units with existing infestations where monitoring and treatment would occur until populations are effectively controlled.

Wildlife

- Snag retention standards and their application to this proposal are provided in table 17 that follows. Exceptions would occur in harvest units if the snags are defined a hazard to harvest operations and designated for felling by a Forest officer

Table 17. Snag standards

Forest Plan Wildlife Standard Number 3	Existing Situation	How Direction is Incorporated
Retain all snags greater than 20” d.b.h. (except hazard trees)	Snags greater than 20” d.b.h. are limited in the project area	All trees greater than 20” d.b.h. (live or dead) would be retained. Project design feature.
Do not reduce the number of snags greater than 15.0 “ d.b.h. per acre in treatment units below 8.0 snags per	Snags greater than 15” d.b.h. are limited in the project area.	Within the commercial treatment units, snags would be retained at numbers prescribed by Forest Plan standard 3,

Forest Plan Wildlife Standard Number 3	Existing Situation	How Direction is Incorporated
acre for PICO (lodgepole pine), calculated as an average for the total treatment unit acreage in a project area.		(table 12).
If there are insufficient snags in treatment units, live trees in the same size class must be retained and counted towards the snag requirement.	Expect that there are insufficient snags.	Live trees, larger than 10 inches d.b.h., would be retained for future snag recruitment at 0.9 trees per acre (calculated for the total treatment unit acreage in the project area) consistent with Forest Plan wildlife standards 3 and 4 (table 12 and 13).
These per acre requirements do not apply to the treatment units if analysis shows the levels of snags will be met for the project area as a whole.	Did not do a project area wide snag analysis.	Above requirements apply.
If, in the project area as a whole, there are insufficient live trees and/or snags greater than 15" d.b.h., the standard is deemed complied with by retention of the existing live trees and/or snags greater than 15" in the treatment units.		All live trees greater than 20" d.b.h. would be retained and all snags greater than 15" d.b.h. would be retained. Plan direction is met.

- Large woody debris, at least six pieces per acre with small-end diameter equal to or greater than 8.0 inches and at least 10 feet long, would be retained in salvage clearcut harvest units (lodgepole pine cover types). Large woody debris, at least six pieces per acre with small-end diameter equal to or greater than 12.0 inches and at least 10 feet long, would be retained in commercial thin harvest units (Douglas-fir cover types). Leave trees would be marked for retention, then cut and left following salvage harvest to meet Forest Plan requirements, where needed.
- Existing large diameter logs in various stages of decay would be retained in all treatment units where possible. Methods include placement of slash away from logs to prevent burning and avoiding the logs with equipment to prevent demolishing.

Table 18. Guidelines for protecting nesting and breeding sensitive bird species or species of interest

Species	Breeding Season Limited Operating Period	Nest Buffer
Flammulated owl	May 15 – August 15	35 acres
Black-backed woodpecker	June 1 – August 15	1 acre
Northern goshawk	April 15 – August 15	40 acres
Great gray owl	March 15 – July 15	30 acres

- Goshawks nesting activity was confirmed adjacent to units 56C, 57C, and 68S. These units would be surveyed prior to logging operations if logging and hauling was scheduled during the breeding season (April 15 - August 15).
- A great gray owl was seen in units 10C and 49S, and heard in the vicinity of units, 25C, and 27C. In addition, unidentified owls were heard in Units 55C and 59C. These units

would be surveyed prior to logging operations if logging or hauling was scheduled during the breeding season (March 15-July 15).

- Flammulated owl nest sites have been confirmed adjacent to units 20C, and within unit 23C. In addition, owls were heard or seen in units 24C, and 25C. These units would be surveyed prior to logging operations if logging or hauling was scheduled during the breeding season (May 15-August 15).
- If active nest sites for threatened, endangered, proposed candidate or sensitive birds (including species of interest, northern goshawks and great gray owls) are found, a wildlife biologist would be contacted to identify mitigation based on species needs and site-specific considerations. General guidelines are shown in table 18.
- Travel restrictions identified on the map titled Beaverhead-Deerlodge National Forest North Map 2010 and the Beaverhead-Deerlodge Forest Plan Record of Decision II Addendum to Travel Route Restrictions would be imposed as described under the Transportation section, above. In addition, access on existing or proposed roads that reduce fall secure areas would be restricted during the period of October 15 – December 2 (table 9 and table 14) (Several proposed timber haul routes cross through elk winter range; however, no units are proposed for winter logging).
- Precommercial thin units along roads open during the hunting season would retain more cover along the roads (units 13P, 14P, 16P, 17P 18P, 19P, 20P, 21P, 23P, 36P and 39P).
- In precommercial thin units, full-crowned trees with green branches down to within 12 inches of the ground would be retained to maintain winter snowshoe habitat for cover and forage (units 36P and 39P).
- Prior to implementation of prescribed burning, abandoned mine sites within prescribed burn units 3B, 4B, and 5B would be assessed by a wildlife biologist for potential Townsend's big-eared bat roosting. If the mine site is known to, or appears capable of, supporting maternity or winter roosting by Townsend's big-eared bats, mitigation measures such as management buffers or avoidance of burning during period of occupation would be applied to minimize potential impacts to roosting bats.
- During project implementation, potential bear and other wildlife attractants that include food, trash, oil products and machinery lubricants would be contained in bear-proof containers to prevent wildlife attraction to work sites.

Soils

- Ground-based yarding would not occur on slopes exceeding 35 percent that have not had a site-specific evaluation by a soil scientist determining that damage is unlikely (Forest Plan direction; Soil and Water Conservation Practice (SWCP 14.07)).
- Harvest would not occur unless soils are dry or frozen as determined by the Forest Service in order to minimize potential compaction and/or rutting (SWCP 13.06).
- Timber operations and harvest units would avoid wet areas. The Forest soil scientist, hydrologist, and fisheries biologist would work with the project implementation team to protect these areas (SWCP 13.03).
- Skid trails would be spaced an average of 75-100 feet apart (SWCP 14.08). Skid trails would be adequately drained in order to prevent overland water flow. Slash would be placed on skid trails to prevent erosion and to discourage ATV use (SWCP 14.15). Drainage structures (or slash) would be placed on temporary roads and skid trails that

would be left over the winter to reduce erosion potential during higher flows associated with the spring season (SWCP 14.15). If slash were used for overwinter protection, it would be removed before use or obliteration the following summer.

- Constructed skid trails and newly constructed temporary roads would be obliterated and revegetated with native seed mix approved by the Forest Service (SWCP 15.25).
- A range of 7 to 12 tons per acre of coarse woody debris (3 inches or greater in diameter) would be left in harvest units. This may be accomplished by felling and leaving trees where necessary (USDA Forest Service 1999).
- Landings would be revegetated with native seed and areas of compacted soil would be scarified prior to seeding (SWCP 14.11).
- Slash would be piled and burned on roads where feasible. Where this is not feasible, slash would be piled in such a way (tall and narrow) as to reduce the footprint on the soil and piles would be burned when the soil is cold or frozen and moist.
- Yarded logs would be partially or fully suspended for cable logging systems (SWCP 14.09).
- Sub-soiling would occur within specified units in order to restore portions of the units to ensure compliance with soil quality standards within these units. [21]
- Broadcast and concentration burning would be performed in the fall or spring when soil moisture levels are high (SWCP 18.02).

Hydrology and Aquatic Resources

- Harvest units, landings, temporary roads and timber operations would avoid RCAs.
- Harvest units, temporary roads, timber operations and project activities would avoid known western toad breeding sites and natal areas during breeding and juvenile rearing periods.
- Where culverts are replaced:
    - Work would be conducted during dry conditions, either naturally or via a clear water diversion to further minimize sediment impacts.
    - Streams would be dewatered during culvert removal.
    - Straw bales or other erosion control measures would be in place downstream of activities to help alleviate stream sedimentation.
    - On perennial streams, Montana Streamside Protection Act (SPA) 124 Permits would be obtained for any activity that would disturb stream channels. U.S. Army Corps of Engineers 404/401 permits would be obtained for any activities involving stream channels and/or wetlands.
    - A fish biologist or hydrologist would be notified prior to stream culvert replacements to allow them the opportunity to be present to ensure appropriate alignment and reshaping of the stream channel, bankfull width, floodplain, step-pools and grade control structures, transplants, etc.
    - Road stream crossings would have appropriately sized culverts, capable of passing a 100-year flood event.

[21] Refer to the "Soils Restoration Plan" under project design features and mitigation measures specific to each alternative.

- Temporary roads would have water bars or other appropriate drainage structures. Maximum cross drain spacing would be determined by the road grade using the following formula: 1000 feet divided by the percent grade (i.e., 1000 feet divided by 5 percent grade results in maximum 200-foot spacing).
- The hydrologist or fisheries biologist would be notified by the sale administrator that site conditions in riparian conservation areas (RCAs) warrant snow plowing for operator access and safety.
- Project-related storage of fuels and toxicants within riparian conservation areas would be prohibited. Refueling within riparian conservation areas would be prohibited except for emergencies, in which case refueling sites must have an approved spill containment plan (Forest Plan, p. 21).
- On all haul routes and reconstructed road segments, Montana Best Management Practices (BMPs) for forestry would be met at a minimum on roads used to access treatments, including provisions of the Streamside Management Zone law.
- On all reconstructed road segments:
    - All BMPs would be functional at the close of timber sale activities by subdivision, as displayed on the timber sale map. The timber sale administrator would coordinate with a Forest engineering representative and hydrologist to accomplish BMP surveys. All culverts would be marked by the Forest engineering representative before winter and cleared of debris as needed to keep them functioning. This would help prevent equipment operators from crushing the inlet and outlet of culverts.
    - Snow would not be completely removed. In general, a minimum 4 inches of snow must be left on the roadway during plowing operations to protect the surface of the road.
- Slash filter windrows or an equivalent alternative, would be placed when necessary at stream crossings and maintained to prevent measurable sediment impacts to stream and fish habitats during hauling and road maintenance related to harvest activities. Potential slash filter windrow placement sites would be identified prior to the timber sale appraisal by the forest engineer and fisheries biologist or hydrologist. The following general guidelines would be used for slash filter windrow placement:
    - Apply 100 to 200 feet of windrow to the majority of intermittent and perennial stream crossings.
    - Place where slash is available on site or with minimal haul.
    - Where slash is not immediately available, an alternative filter may be used such as silt fence or straw bales.
    - Locate at the toe of the road fill slope on both sides of the stream and road and extending over the crossing structure.
    - Place on road segments that will receive road blading and reconstruction.
    - Place on major timber haul routes where roads may be susceptible to large traffic volumes and consequent road surface erosion and rutting.
- Where system roads and unauthorized routes are reconstructed, road work would comply with all BMP standards.
- All applicable permits required by State and Federal water quality regulations would be obtained prior to project implementation. At this time it is uncertain whether this project will require a National Pollution Discharge Elimination System (NPDES)

permit for stormwater discharge from logging roads. The Forest Service will comply with any applicable NPDES permitting requirements if determined in the future that it is needed for this project.

- Following burning, landings would be reseeded within one year using native seed mix approved by the Forest Service.
- No ignition of prescribed burning is allowed within riparian conservation areas (RCAs). Burning should occur when soil moisture contents are relatively high to minimize overheating of soils, especially in riparian areas.
- Helispots would be located outside of Riparian Conservation Areas (RCA). Refueling of helicopters in RCAs would be prohibited.

Sensitive Plants

- If undocumented sensitive plant populations were found before or during the project, activities would be halted until avoidance or mitigation measures can be considered by the Forest Botanist.

Recreation

- No log hauling would occur on NFS roads on weekends and federal holidays to provide for public safety.
- The trail surface and signs would be protected from damage from treatment activities in the vicinity of Forest System Trail 8049. If trail surface damage occurs, the surface would be restructured to meet serviceable standards. Damaged signs would be replaced. Slash and burn piles would be located off the trail tread.
- All recreational trails, trailheads, and other recreation facilities (i.e., signs, gates, poster boards, etc.) would be protected during or re-established after activity.
- Dust would be abated in the vicinity of Douglas Creek Cabin if harvest or treatment activities occur while the cabin is open to occupancy during the dry season.
- Roads and trails within Unit 4B may be closed during implementation of the prescribed burns to provide for public safety.

Range

- Natural barriers removed during harvest that serve to block livestock movement between allotments would be replaced with fencing. Range betterment (RBRB) funds would be used to purchase fence materials, and fencing would be completed by the appropriate range permittee(s), or through a contract.
- Existing fences and water development would be protected from damage during project implementation. Damage to infrastructure would be repaired to Forest Service specifications.
- Gates and/or cattleguards would be installed where new roads intersect with fences.

Scenic Resources

- Visible stumps within 100 feet of Concern Level 2 routes should be cut to a maximum stump height of 6 inches. This applies would apply to units with edges that are directly adjacent to the following routes within the project area: NFS roads 707, 1544, 1557 and 636.
- Clearcut units seen from NFS roads1544 and 1557 would have form and shape that simulates natural patterns (i.e., avoiding straight lines and sharp corners). The edges of

such units would be tied into existing meadows and openings where possible, or provide feathering that allows gradual transition into the untreated adjacent forest area (as opposed to an abrupt line). Units that would be seen from NFS road 1544: 36, 45S, 69S, and 37S. Units that would be seen from NFS roads1557: 41S, 35S, 16S, 61S, 50S, 26S, 76S, and 49S.

- Final layout of units seen from the Concern Level 2 routes listed above shall be reviewed by the forest landscape architect prior to implementation.

Heritage

- Sites would be avoided or site-specific mitigation measures would be developed in consultation with the Montana State Historic Preservation Office prior to project implementation.
- Mitigation measures would ensure cultural resources are not impacted by fire in the prescribed burn units and the commercial thin and seed tree unit understory burning. If there is potential to affect a cultural site, additional mitigation measures would be developed in consultation with MT State Historic Preservation Office prior to project implementation.
- Sites with flammable components would be protected, if needed, with the use of mitigation measures prior to implementation including: Exclusion from the treatment area, handlines, blacklines (burning fuels around the site to create a fire break), wet lines, foam retardant, structural fire shelter, or removal of fuels from the site by hand.
- Non-fire sensitive sites, considered to have less risk for fire effects in low-temperature and or light fuel load condition (such as prehistoric and historic sites with deeply buried cultural deposits, prehistoric and historic artifact scatters, and prehistoric and historic sites with non-flammable surface features) that are located within prescribed burn, commercial thin and seed tree units, would be protected, if needed, with the following measures:
    - No staging, parking or use of mechanized equipment would occur within site boundaries.
    - No ignition points would occur within site boundaries.
    - Large diameter trees would be felled away from all features.
    - Thinning within site boundaries would be accomplished using hand tools only.
    - No slash piling would occur within site boundaries.
    - Thinned material would be hand carried outside site boundary.

Project Design Features and Mitigation Measures Specific to Alternative 2 (Proposed Action)

- New temporary road construction and landings would be designed to limit the need for excavation during construction and would be located on slopes less than 35 percent.
- Newly constructed temporary roads would be closed to the public through a forest order. Advance notice and appropriate signs would be used to inform the public of the closures.
- All newly constructed temporary roads would be decommissioned by obliteration upon completion of harvest operations. These roads would not remain open for post-harvest treatments including reforestation exams and pile burning. Decommissioning the temporary roads upon completion of harvest operations would reduce the chance of

unauthorized use. Obliterating temporary roads would consist of recontouring the road prism, including all cut and fill slopes. Logging slash, stumps, and woody debris would be placed on top of temporary road corridors to effectively limit vehicle travel.

Soils Restoration Plan

- For all units with proposed temporary road construction (12C, 20C, 27ST, 34S, 35S, 41S, 42C, 46S, 48C, 49S, 51S, 52S, 55C, 56C, 57C, 61S, 68C, 71C, 72S, 73S, 77S, 78S, 79S) all temporary roads (new construction) would be ripped or subsoiled, seeded with native seed, and blocked at the entrance. Roads would be re-contoured where needed.
- For three units (32ST, 40S, 41S) additional restoration may be required to comply with the regional soil quality standards. In these units existing and new skid trails would be subsoiled to reduce compaction. Restoration activities would focus on skid trails and landings and would occur on suitable acres, excluding areas that are too rocky, wet, or have other limiting factors. Restoration would be implemented on the number of acres needed to meet soil quality standards; actual acres restored may be higher or lower than what is shown in in the soils section. Treatments would occur within three years of completion of harvest.
- Actual acres to be restored would be determined by post-harvest monitoring to determine the actual percent detrimental soil disturbance, from which actual acres to be restored can be calculated. These units would need to be monitored to ensure that SQS are met within 3 years of the conclusion of the project.

Project Design Features and Mitigation Measures Specific to Alternative 3

Soils Restoration Plan

- For three units (23C, 32ST, 40S) additional restoration may be required to comply with the regional soil quality standards. In these units existing and new skid trails would be subsoiled to reduce compaction. Restoration activities would focus on skid trails and landings and would occur on suitable acres, excluding areas that are too rocky, wet, or have other limiting factors. Restoration would be implemented on the number of acres needed to meet soil quality standards; actual acres restored may be higher or lower than what is shown in table 70 in the soils section. Treatments would occur within three years of completion of harvest.
- Actual acres to be restored would be determined by post-harvest monitoring to determine the actual percent detrimental soil disturbance, from which actual acres to be restored can be calculated. These units would need to be monitored to ensure that SQS are met within 3 years of the conclusion of the project.

Monitoring

Silviculture: Monitoring of regeneration success would begin one year after all proposed actions have been implemented (generally late summer to early fall). Monitoring would continue on a schedule of first-, third- and fifth-year exams. By the third year, if exams indicate that natural regeneration is not progressing toward the desired seedling-per-acre goal, planting of seedlings would be considered.

Invasive Plants: Post activity monitoring and treatment would occur as long as necessary to ensure that existing infestations do not expand and new infestations have been controlled. It is

recommended that the units, haul routes, temporary roads, and burn piles be identified as a high priority for funding in the KV Plan to treat existing weed populations.

Soils: Units requiring subsoiling per the soils restoration plan would need to be monitored, at a minimum, to ensure compliance with Region1 SQS since they are predicted to exceed the SQS before restoration. Monitoring should follow the Forest Soil Disturbance Monitoring Protocol (USDA Forest Service, 2009b).

Heritage: A sample of cultural resources in the area of potential effect (APE) would be monitored by a Forest Service archaeologist following project work to ensure that mitigation measures were followed and sites sustained no damage. If sites are damaged, the archaeologist would determine the appropriate actions, which may include data recovery, site stabilization and reporting to insure that similar damage does not occur in the future.

A sample of sites would be re-visited by Forest Service personnel to evaluate the effectiveness of the treated. The purpose of post –treatment monitoring is to gather data that would be used to improve planning for the protection of heritage resources in future projects.

Transportation: Monitoring transportation routes to determine if soil and water conservation practices (BMPs) being implemented during project work and are they resulting in protection of water quality and beneficial uses.

Wildlife: Obliteration of temporary roads would be monitored for effectiveness of eliminating motorized use and revegetating or stabilizing the roadbed.

A portion of units would be monitored for implementation of the design features to retain snags according to Forest Plan standards, and to meet large woody debris requirements.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Alternatives not considered in detail may include, but are not limited to, those that fail to meet the purpose and need, are technologically infeasible or illegal, or would result in unreasonable environmental harm (FSH 1900.15.14.4).

Public comments submitted during scoping suggested that the number of acres proposed for treatment be increased; that the purpose and need be expanded to include restoration components; or that woodpecker conservation areas be established in areas affected by the mountain pine beetle. These alternatives either fail to meet the purpose and need, or were determined inconsistent with the Forest Plan. Therefore, four alternatives were considered by ID team and responsible official, but not analyzed in detailed pursuant to the direction cited above. The following section describes the rationale.

Provide an alternative that builds flexibility into the analysis to be able to add harvest areas at a later date. A thorough integrated analysis has been done within the project area to include all acres that are appropriate to harvest at this time and in the reasonably foreseeable future. Currently, 100 percent of the lodgepole pine stands have been affected by the mountain pine beetle. All suitable acres were looked at for harvest and presented in the updated proposed action. The number of acres proposed for commercial harvest increased by 343 acres from the June 2010 public scoping effort when 70 percent of the lodgepole pine stands were estimated to

be affected. Adding new acres would include areas that are not accessible or outside of compliance with Forest Plan standards and objectives.

Table 19 shows the comparison of the proposed commercial harvest acreages.

Table 19. Comparison of the commercial harvest acres proposed in 2010 and the current proposed action

Vegetation Treatment Type	Acres of Treatment	
	The 2010 Proposal	Current Proposal
Clearcut salvage dead + dying lodgepole pine	668	1,163
Commercial thinning ponderosa pine and Douglas-fir	1,095	1,149
Combination of clearcut lodgepole pine salvage + commercial thinning	559	0
Seed tree harvest	0	353
Total	**2,322**	**2,665**

We encourage the Forest Service to consider including a watershed or ecosystem restoration alternative for detailed evaluation, or at least to include watershed/ecosystem restoration elements in the reasonable alternatives: Watershed restoration elements would not address the purpose and need of the proposal and are not included in the range of reasonable alternatives. Road maintenance and reconstruction associated with the proposed haul routes, including implementation of Best Management Practices (BMPs) and the use of other mitigation measures would improve road surface conditions and reduce sediment delivery associated with road use and runoff.

We request the FS design a restoration/access management plan for project area streams that will achieve recovery goals. This alternative was not analyzed in detail because it does not meet the purpose and need to manage for the specific vegetation types identified in the proposed action and scoping letter.

Please include an alternative that recognizes the high value of the mountain pine beetle in creating wildlife habitat both in the short and long term, and therefore includes management conservation strategies that incorporate the value of these infestations as a resource management strategy, including woodpecker conservation areas. The no-action alternative provides for dead and dying lodgepole pine stands across the project area, providing habitat affected by the mountain pine beetle in the short and long term. Affected areas that were not included in the action alternatives due to accessibility, or retained to meet Forest Plan standards, also provide for habitat in the short and long term. The purpose and need does not include the objectives or actions suggested by the commenter; for these reasons, the suggested alternative was not analyzed in detail.

Comparison of Alternatives

Table 20. Comparison of alternatives showing how well project purpose and need is achieved and predicted preliminary effects on issues and resource concerns

Comparison Values	Alternative 1-No Action	Alternative 2 Proposed Action	Alternative 3
Purpose and Need			
1A: Manage lands suitable for timber production for the growth and yield of sawtimber, crop trees, pulpwood, and other forest products, including salvage harvest. ***1B: Forest products would be used to provide economic benefits where project objectives, forest plan objectives, and forest plan standards can be met.***			
Acres of lodgepole pine regenerated	0 acres	1,163 acres	1,022 acres
Lodgepole pine volume (salvage by clearcut harvest)	0	Sawtimber: 9,304 MBF (18,608 CCF) Non-sawtimber 2,326 MBF (4,652 CCF)	Sawtimber: 8,176 MBF (16,352 CCF) Non-sawtimber 2,044 MBF (4,088 CCF)
Acres of Douglas –fir /ponderosa pine stands commercial thinned to 40-60 basal area	0 acres	1,149 acres (including 121 acres old-growth)	666 acres (0 acres old-growth
Commercial thin volume	0	Sawtimber: 5,502 MBF (11,004 CCF) Non-sawtimber 1,376 MBF (2,751 CCF)	Sawtimber: 3,275 MBF (6,549 CCF) Non-sawtimber 819 MBF (1,637 CCF)
Acres of Douglas-fir/ponderosa pine seed tree harvest	0 acres	353 acres	353 acres
Seed tree volume	0	Sawtimber: 1,236 MBF (2,471 CCF) Non-sawtimber 309 MBF (618 CCF)	Sawtimber: 1,236 MBF (2,471 CCF) Non-sawtimber 309 MBF (618 CCF)
2A: Bring 10% of lands suitable for timber production into a managed condition			
Acres of mid- to high-elevation lodgepole pine stands treated with prescribed burning.	0	1,259	1,259
Acres of low-elevation Douglas-fir and ponderosa pine stands treated with prescribed burning.	0	731	731
Total	0	1,990	1,190
2B: Manage those stands already in a managed condition to maintain long term sustained yield.			

Comparison Values	Alternative 1-No Action	Alternative 2 Proposed Action	Alternative 3
Acres of precommercial thinning	0 acres	1,048 acres	1,048 acres
Issues			
Miles of Road Construction			
Specified Road	0 miles	1.3 miles	0 miles
Temporary road, new construction	0 miles	7.2 miles	0 miles
Acres of old-growth thinned	0 acres	121 acres	0 acres
Predicted Project Effects			
Threatened or Endangered Plant Species	No effect	No effect	
Sensitive Plant Species			
Wavy moonwort Peculiar and western moonwort Whitebark pine	No impact	May impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species	
Threatened or Endangered Wildlife Species			
Grizzly bear	No effect	No determination at this time; consulting will be conducted with USFWS	
Sensitive Wildlife Species			
Black-backed woodpecker, Bighorn sheep Fisher Gray wolf North American wolverine Townsend's big-eared bat	No impact	May impact individuals or habitat but would not likely result in a trend toward federal listing or reduced viability of the population or species	
Flammulated owl	May impact individuals or habitat but would not likely result in a trend toward federal listing or reduced viability of the population or species		
Threatened or Endangered Aquatic Species			
Bull trout	No effect	No effect	
Sensitive Aquatic Species			
Westslope cutthroat trout	No impact	May impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species.	
Western toad	No impact	May impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species.	
Invasive Plant Species			
Invasive Plants	Risk of continued spread: low	Risk of continued spread: low risk of increasing density and spread into uninfested lands; and moderate risk of spreading and establishing into areas of concern, including haul routes.	
Soils			
Projected range of detrimental disturbance for harvest units	0 – 8.7 percent	10.0 – 15.0 percent following restoration	10.0-15.0 percent following restoration

Comparison Values	Alternative 1-No Action	Alternative 2 Proposed Action	Alternative 3
and temporary roads (percentage of field plots classified as detrimentally disturbed)		(subsoiling)	(subsoiling)
Stream Sediment Delivery			
Road-stream crossings based on WEPP modeling (average pounds (lb.)/year)	2,761 lb./ year	2,145 lb./yr. during project implementation 1,459 lb./yr. post project implementation	Sediment delivery would be less than alternative 2, because new road segments would not be constructed and there would be less log haul. The greatest input of sediment from roads generally occurs during construction and active log haul during timber harvest.
Air Quality			
Air quality	No effects	Short-term impacts in project vicinity; in full compliance with MDEQ air program with coordination through the Montana/Idaho Airshed Group.	
Scenic Resources			
Scenic integrity	The high mortality of lodgepole pine would increase and have negative effects on the scenic resources. In the immediate foreground and foreground viewing distances, the amount of dead trees can often dominate the viewshed and landscape character, negatively affecting the scenic integrity.	No treatments would be seen from Concern Level 1 (CL1) platforms —Phillipsburg, Drummond, Maxville, Garrison, Grant Kohr's Ranch, Deer Lodge, Pintler Scenic Loop and I-90—areas with a High SIO management objective. Several treatment units would be visible from the Concern Level 2 platforms (NFSRs) within the project area—areas with a Moderate SIO objective. Scenic Integrity Objectives would be met at some point in the future, consist with Forest Plan scenic resource standards.	
Cultural and Heritage Resources			
Cultural and heritage resources	No effects	No effects	
Estimated Present Net Value			
Timber harvest and required design criteria	$0	$912,114	$584,513
All Activities	$0	($162,131)	($427,481)

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter describes the physical, biological, social and economic environments of the project area and the environmental consequences that would occur from implementing the alternatives. Together, these descriptions form the scientific and analytical basis for the comparison of effects in chapter 2. Additional details regarding area conditions, analysis assumptions, or methodology can be found in the individual resource reports located in the project file.

Consistency with Forest Plan Standards

See table C-1in volume 2, appendix C for a listing of all relevant Forest Plan standards and a discussion of the applicability and consistency of these standards to the Flint Foothills action alternatives.

Spatial and Temporal Context for Effects Analysis

The relative boundaries, and past, present and planned activities included in the effects analysis vary by resource both in area and time. This spatial and temporal context is described in each resource section. The cumulative effects analysis for each environmental component or resource area is guided by and consistent with FSH 1909.15, Section 15.2 "Bounding Effects".

Cumulative Effects

According to the Council on Environmental Quality (CEQ), NEPA regulations, "cumulative impact" is "…the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such actions" (40 CFR1508.7). Since past actions are already included in the affected environment, the cumulative effects analysis builds upon this existing condition assessment by considering the incremental addition of direct and indirect effects of the proposed action as well as ongoing and reasonably foreseeable actions[22].

Past Actions

The environmental analysis required under the National Environmental Policy Act is forward-looking in that it focuses on the potential impacts of the proposed action that an agency is considering. Thus, review of past actions is required to the extent that this review informs agency decisionmaking regarding the proposed action (36 CFR 220.4(f)). The resource information provided in the Affected Environment narratives includes the effects of relevant past actions that may still be contributing effects to the resource and therefore are considered as part of the existing condition.

The baseline for cumulative effects analysis is the current condition. The Forest Service National Environmental Policy Act Regulations (36 CFR 220.4(f) (July 24, 2008) state, in part:

[22] Reasonably foreseeable future action: Those Federal or non-Federal activities not yet undertaken, for which there are existing decisions, funding, or identified proposals. Identified proposals for the Forest Service are described in 36 CFR§ 220.4(a)(1) (36 CFR §220.3 definitions).

> "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effect of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simple because information about past actions may be available or obtained with reasonable effort, does not mean that it is relevant and necessary to inform decision making" (40 CFR 1508.7)

Past Vegetation and Prescribed Burning Activities

Past vegetation and prescribed burning actions considered in the affected environment and cumulative effects analysis are summarized in this section. These past activities, together with natural processes, have contributed to creating the existing condition described in this chapter. The past actions summary is not necessarily exhaustive, as records may not exist for all past activities by project. This is particularly true for those actions that predate the passage of the National Environmental Policy Act in 1970. Additional details and an associated map are provided in appendix D.

Timber was harvested in the Flint Foothills Project area to support mining, homesteading and settlement out in the valley. Timber harvest increased greatly from the 1960s through the mid-1980s and has declined in recent years. Harvest in the last decade has been post and pole thinning and roadside hazard tree removal.

Timber harvest activities included clearcut, seed tree, shelterwood, selection cut, commercial thinning (principally post and pole), sanitation (removing mistletoe infected trees) and special harvest (principally hazard tree removal). Commercial timber harvest has occurred on about 23 percent of the project area or10,265 acres (table 21).

Timber Management

Table 21 that follows displays the acres of commercial timber harvest by decade starting with 1960 and up to 2010.

Table 21. Acres of commercial timber harvest from years 1960 to 2010

Activity	1960-1969	1970-1979	1980-1989	1990-1999	2000-2010	Total acres
Stand clearcut	582	2961	125	243	0	**3,911**
Seed tree cut	51	181	88	186	0	**506**
Shelterwood cut	176	883	246	251	111	**1,667**
Selection cut	216	189	642	0	0	**1,047**
Sanitation (salvage)	0	73	331	120	0	**524**

Activity	1960-1969	1970-1979	1980-1989	1990-1999	2000-2010	Total acres
Special cut	0	74	69	129	281	**553**
Commercial thin	0	70	1,154	621	211	**2,056**
Total Acres by Decade	**1,025**	**4,432**	**2,655**	**1,550**	**603**	**10,265**

Precommercial thinning has occurred in old regeneration harvest areas, including past clearcut, seed tree and shelterwood units on about 3 percent of the project area or 1,279 acres (table 22).

Table 22. Acres of precommercial tree thinning from the years pre-1980 to 2010

Activity	Pre-1980	1980-1989	1990-1999	2000-2010	Grand Total
Total acres precommercial thinning	0	299	699	281	**1,279**

Prescribed Burning

The majority of Forest Service prescribed fire use has been disposal of logging slash, either through pile burning or jackpot burning activities. Some prescribed fire use has been for improving stand conditions for certain vegetation species (e.g. removing conifer succession in grassland-shrubland areas). Understory burns are considered low-intensity fires over the majority of the unit, whereas broadcast burning are higher-intensity fires over the majority of the unit. Minor amounts of fire woodcutter piles have also been burned. Prescribed burning has occurred on about 11 percent of the project area or 4,974 acres (table 23).

Table 23. Acres of prescribed burning from 1960 to 2010

Activity	1960-1969	1970-1979	1980-1989	1990-1999	2000-2010	Total Acres
Broadcast burning	15	132	2	79	462	**690**
Pile burning*	**27	**338	**224	***310	***203	**1,102**
Underburning	0	0	0	1,653	1,517	**3,170**
Wildlife habitat prescribed fire	0	0	0	12	0	**12**
Total Acres by decade	**42**	**470**	**226**	**2,054**	**2,182**	**4,974**

*Database records display each pile burned; above acreages are piles converted to acres using:
** 1 acre=0.10 acre dozer pile
***1 acre=0.25 acre landing pile

Present and Reasonably Foreseeable Future Actions

Table 24 displays the present and reasonably foreseeable future actions that have been identified as occurring or will occur within the project area. Each resource section identified actions from this table that are specific to that resource, and considered for the cumulative effects analysis. The activities in table 24 are displayed in figure D-2 in Volume 2, appendix D.

Table 24. Present and reasonably foreseeable future actions

Present and Reasonably Foreseeable Future Actions	
Public activities	Recreational activities such as hiking, biking, horseback riding, OHV riding, hunting, forest product gathering, camping (dispersed), snowmobiling, cross country skiing, wildlife viewing, driving for pleasure.
Activities requiring fees and or permits	(1) Douglas Cabin, recreation rental; (2) Outfitter guide services: Two Outfitters, area of operation in both Flint Foothills and Flint Uplands management areas. Activity occurs in summer and for fall big-game hunting; and (3) personal firewood and post and pole permits.
Trail maintenance	8.65 miles of trail maintenance in the project area on three trails: 8052(3.39 miles), 8054(3.89 miles), and 8049 (1.37)
Travel analysis (MVUM - motor vehicle use mapping)	The Forest has begun preliminary work on site-specific travel analyses as part of the travel planning and motor vehicle route and area designation process. The Travel Management Rule (which modified travel management regulations in 36 CFR Part 212) was published in the Federal Register on November 9, 2005. This rule requires each national forest to designate those roads, trails, and areas that are open to motor vehicle use. Following site-specific analysis, these designations will be made by class of vehicle and, if appropriate, by time of year. The travel analyses—MVUM— will be guided by the above Rule, as well as the Forest Plan, Forest Service directives, and other applicable laws, regulations, and policies. Effects from this action could change the overall mileage of roads and trail available to motorized vehicles within the project area and across the Forest. The analysis is anticipated to occur in 2014, and a Motor Vehicle Use Map (MVUM) published in 2015.
Annual road maintenance	Typical activities include surface blading, drainage cleaning and repair, roadside brushing, and sign maintenance. The annual miles of road maintenance varies; in 2011, approximately 43 miles of road maintenance was completed.
Grazing	Livestock grazing as currently permitted is expected to continue in the project area. (Five allotments, with seasons of use between 6/16 and 10/7)
Invasive plant species control	Spraying to control weeds is expected to continue in the project area. Existing invasive plant infestations within the project area are currently being treated with herbicides annually. Additional biological agents will be introduced. In 2010, the United States Forest Service Rocky Mountain Research Station released *Mecinus janthinus*, a stem mining weevil to control yellow toadflax. The Research Station will study the effects of this agent on yellow toadflax in this area and climate.
Roadside # 4 salvage hazard tree removal	Roadside tree hazard removal on 146 acres along 7.3 miles of road
Danger tree removal at developed sites	Danger tree removal within the project is being conducted in accordance with the Decision Memo for Forest-Wide Developed Site Hazard Tree Removal within the BDNF. This Decision Memo provides that dead, dying, and structurally unsound trees be removed from within developed recreation sites across the BDNF.
Winter storm damage repairs to roads. Specific descriptions provided below:	Flood damage repairs to locations on NFS roads 707 (2 sites), and 8402 are anticipated in the next 3 years. These locations experienced roadway embankment failures due to high precipitation and runoff during the spring of 2011. Funding currently being pursued for these locations include the Emergency Relief of Federally Owned Roads (ERFO) program administered through the Federal Highway Administration (FHWA).
NFS road 707 repair/ Upper Douglas	Washout repair estimated at $114,443. Regional geotechnical engineers working on design.

Present and Reasonably Foreseeable Future Actions	
Summer 2013	A spring 2011 rain on snow produced excessive flows that deposited material at the pipe inlet causing water to overflow the stream banks. The stream is running down the road for 600 feet creating a new stream channel up to 6 feet deep and up to 20 feet wide. The water has undercut the cut slope creating a small slump. This is a fish key watershed (Bull Trout and Westslope cutthroat). Repairs will include removing, cleaning and installing two pipes, excavating to the bottom of the cut created by the stream, then rebuilding the road profile with fill from a borrow source off the project. Rolling drain dips will be constructed at key points to protect the watershed and preserve the road. All unsuitable excavation will be disposed of at a site off the project. Upon reconstructing the road and replacing the culverts, the water will be directed back into the original stream channel.
NFS road 707 repair/ Lower Douglas Fall 2012	Repairs estimated at $92,914. Regional geotechnical engineers working on design. A spring 2011 rain on snow produced excessive flows that deposited debris in the stream channel, which redirected stream flow against the road fill (northern stream bank). The result is the erosion of the road fill for 200 feet. The water undermined the road shoulder creating an unstable road profile. This is a fish key watershed (Bull Trout and Western cutthroat). Road profile will be excavated to a suitable base then rebuilt using common road building practices. Large rip-rap will be placed at the stream elevation to help support the road and armor the fill slope (stream bank). Above the large rip-rap successively smaller rip-rap will be placed as the road profile/stream bank increases in elevation.
NFS road 8402 repair/ Gird Creek Fall 2012	Slump repair estimated at $78,201.50. Regional geotechnical engineers working on design. A spring 2011 rain on snow saturated the soil causing the hill to slide. The hill above the road slid onto the road and the road fill slope failed. Slope stabilization products will be keyed into the existing stable slope. Then suitable backfill will be used to rebuild the road profile. All unsuitable excavation will be disposed of at a site off the project.
Douglas Creek culvert replacements (road #s 707 and 1544)	Project replaces six culverts and re-aligns about 400 feet of stream channel, with either bridges or larger culverts, on the North Fork Douglas Creek. The Douglas Creek project is located on Forest System roads 707 and 1544 on the North Fork Douglas Creek in T9N, R12W, sections 28 and 32.
Wildland fire suppression	Wildland fire suppression actions would most likely continue in lower elevations due to proximity to private land and communities; upper elevations are available for managing wildland fires after adequate analysis determines the fire could be contained on the Forest. Time of year, fire danger, drought, weather, values at risk, firefighter and public safety are all analyzed when making this management decision
Timber harvest on private in-holdings within the project area boundary	Private land total 7,512 acres within the project area. Currently, harvest on private inholdings has occurred on approximately 80 percent (about 5,500 acres) of the forested portions. Most of the harvest on private land took place in the 1980s. Not all of the inholdings are forested; about 10 percent are nonforested, dry, grassland areas.
Emery 21 Timber Sale (Clark Fork River-Gold	Emery 21 commercial thinning (7 acres) Emery 21 Fuel Piling (hand or machine) (2 acres)

Present and Reasonably Foreseeable Future Actions	
Creek WA) On project boundary	
Forest Rose Mine and Mill CERCLA Project	This is a joint project between the Montana DEQ Mine Waste Cleanup Bureau (MDEQ - MWCB) and the Forest Service. Most of the waste (83%) is located on patented mining claims not located on National Forest System lands. This is a waste-removal project that will take place in the Dunkleberg Creek area, The project is scheduled for implementation in July 2012 and is anticipated to be finished no later than August 2013.NFS road 707 will be reconstructed and used for access to this project, from Interstate 90 (Jens exit). Repairs to the Upper Douglas Creek washout (see “NFS road 707 repair/ Upper Douglas” activity above) may be included. A site investigation will occur once snow melts on the road in Spring 2012.
Placer mining exploration	Two approved plans of operation for exploration (test holes) in a highly disturbed historic mining area T 8W, R 12 N, Section 11
Montana State Prison lands (Outside of project area)	Future timber harvest in Douglas-fir and lodgepole pine estimated to average 50-70 acres per year.
Montana DNRC lands (Outside of project area)	Potential future harvest on lands near Douglas Creek (section 36).
BLM lands (Outside of project area)	Flint Creek Integrated Project. Prescribed fire treatments on BLM and FS lands.
BLM lands (Outside of project area)	Ongoing livestock grazing

Vegetation

Introduction

The Flint Foothills Vegetation Management Project area is roughly 44,522 acres on the north end of the Flint Range, located on the Pintler Ranger District of the Beaverhead-Deerlodge National Forest (BDNF). Eighty-three percent of the area (Forest Service ownership 37,010 acres; private ownership, 7,512 acres) is managed by the BDNF. The analysis area for this Vegetation Report is the 44,522-acre project area.

This Vegetation section provides analysis of the existing condition of the major vegetation types within the project area and the effects of the proposed action on those major vegetation types. A discussion of dominant processes provides the characterization of change that has occurred over time to the vegetation types that provides the basis for the analysis.

Forest Plan Direction and Other Laws and Regulations

The regulatory framework and direction for the management of vegetative resources on the Beaverhead-Deerlodge National Forest includes the Forest Plan, the Forest and Rangeland Renewable Resources Planning Act Of 1974, National Forest Management Act of 1976, and Forest Service Handbook (FSH 2409.17). These are discussed in detail in the Vegetation report in the project file.

Overview of Issues Addressed

The relevant issue to this analysis is old growth. This issue will be analyzed in the effects discussion of this vegetation analysis.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

- Acres of lodgepole pine regenerated
- Acres of basal area reduction, growing conditions improved with thinning of Douglas-fir/ponderosa pine stands
- Acres of basal area reduction, growing conditions improved, and type change of old growth from multi-story to single story
- Acres of Douglas-fir/ponderosa pine regenerated
- Acres of basal area reduction and growing conditions improved with low-intensity prescribed burning of low-elevation Douglas-fir and ponderosa pine stands
- Acres of lodgepole pine regenerated through prescribed burning in mid- to high-elevation lodgepole pine stands
- Acres of growing conditions in young stands improved by reducing stand density in past timber harvest areas

Affected Environment

Existing Condition

A combination of site-specific scientific information in the Flint Foothills Project area as well as results of studies completed in ecosystems and landscapes of the Western United States and Northern Rocky Mountains were used to assess the processes that influenced vegetation composition and structure in the analysis area.

Dominant Processes

Composition and configuration of vegetation in the Flint Foothills Project area prior to European settlement was shaped by natural disturbances and processes and to a lesser extent, Native American land management. Natural disturbances and processes that influenced and would continue to influence vegetation in this area include climate variability, watershed processes (i.e., flooding, mass wasting, debris flows, avalanches), fire events, and insect population dynamics. Native American land management was characterized by fire ignitions for travel corridors, forage improvement, game habitat improvement, and maintenance of native plant food sources. More recently, vegetation after European settlement has been shaped by Forest Service management practices, such as timber sale activity, domestic grazing and fire suppression.

Forest Carbon Cycling and Storage

As a major disturbance on the landscape, the mountain pine beetle epidemic

with dead trees releasing carbon to the atmosphere as they decompose. Over time, these areas may shift back into a sink stage in their carbon cycle when carbon uptake by new tree regeneration exceeds the emissions from decomposing dead organic material.

Net ecosystem productivity (NEP) is a direct measure of the degree to which an ecosystem is a source (NEP less than 0) of, or a sink (NEP greater than 0) for atmospheric carbon over the time period of interest (Brown et al. 2010). Net ecosystem productivity is negative (or decreased) when carbon lost through decomposition exceeds that gained through photosynthesis. The mountain pine beetle epidemic has affected the net ecosystem productivity in these stands in several ways. First, stand photosynthesis has been dramatically reduced with the increasing severity of attack due to the death of canopy trees. This is accompanied by a corresponding decrease in stand respiration i.e., release of carbon dioxide. The decline in photosynthesis could be reduced by increased growth of tree seedlings, saplings, trees that survive the beetle attack, shrubs, grasses, and forbs (Brown et al. 2010). A substantial increase in carbon release would be expected once dead standing trees begin to fall and decompose in the next 5-15 years; these fall rates of pine trees are predicted by Mitchell and Preisler (1998).

Mountain pine beetles kill larger lodgepole pine trees preferentially, therefore, these killed trees represent proportionally larger values of carbon stocks (or sequestration) and above-ground tree carbon production within stands; more and larger trees killed results in greater decreases in carbon sequestration. Stand-level carbon can be recovered to pre-outbreak values in 25 years or less; it takes 50-160 years to recover to carbon storage values from simulations where stands were not attacked. The size distribution of surviving trees can shorten this timeframe; a greater number of smaller trees store carbon at a greater rate through an amplified growth rate when compared to larger survivors, having a greater capacity to take advantage of increased resource availability (Pfeifer et al. 2010). Successful tree regeneration is a much more critical factor in recovering carbon than stand age class distribution or tree density. As long as post-disturbance lodgepole pine stands support enough trees to have the structural characteristics of forests rather than shrublands, grasslands, or other kinds of nonforest vegetation, they would recover pre-disturbance carbon stocks quickly and the landscape would be resistant to long-term changes in carbon storage (Ryan et al. 2008).

Pregitzer and Euskirchen (2004) synthesized results from 120 separate studies of carbon pools and carbon fluxes for boreal, temperate, and tropical biomes. They found that forest age is a highly significant source of variability in net ecosystem productivity at the biome scale. In temperate forests such as those in the project area, the mean net ecosystem productivity was negative (a carbon source), but also the most variable in young stands (0-10 years). Mean NEP is positive and is highest (a carbon sink) in stands 11-30 years old, declining thereafter as stands age, but still remaining positive.

These studies also reveal a general pattern of total carbon sequestration declining after disturbance, increasing rapidly during intermediate years, and then declining over time until another significant disturbance (timber harvest or tree mortality resulting from drought, fire, insects, disease, or other natural disturbances) kills large numbers of trees and again converts the stands to a carbon source. In this situation, carbon emissions from the decay of dead biomass exceed the amount of carbon removed from the atmosphere by photosynthesis within the stand. Over the long-term (centuries) net carbon storage is often zero if stands regenerate after disturbance because re-growth of trees recovers the carbon lost in the disturbance and in decomposition of trees killed by the disturbance (Kashian et al. 2006).

Recent scientific literature confirms some general patterns of forest carbon storage and release over the period of forest stand development and natural or induced disturbances. For large-scale context, our nation's forests have and continue to sequester vast amounts of carbon, equivalent to approximately 10 percent of annual U.S. carbon dioxide emissions from burning fossil fuels, with some estimates are as high as 19 percent (Heath and Smith 2004; Birdsey et al. 2006; Ryan et al. 2010; McKinley et al. 2011). Nationally, forests are a net carbon sink, sequestering far more carbon than they release.

Climate and Climate Change

Fluctuations in temperature and precipitation that characterized historic climate likely influenced vegetation distribution and patch size in the Flint Foothills project area by affecting other processes such as germination and establishment of native species, fire regimes, insect activity, erosion, and stream morphology. Despite the uncertainty of future climate conditions at local scales, the majority of published science suggests that climate changes may strongly influence the frequency, intensity, and size of disturbances (such as fire and extensive insect outbreaks) in coming decades on areas of the BDNF. These disturbances have important consequences for community protection, timber water yield, carbon storage, timber production, invasive species, and public perception of forest management. Changes in disturbance prompted by climate change are likely as important as incremental changes in temperature and precipitation for affecting ecosystem productivity and species composition (FP FEIS, p. 1041).

Insects

Mountain pine beetle (MPB) populations have been cyclic in conifer stands of the Flint Foothills area. This species affects three species in the project area; lodgepole pine (*Pinus contorta*), ponderosa pine (*Pinus ponderosa*) and whitebark pine (*Pinus albicaulis*). Twenty to forty-year cycles of population increases lasting up to 11 years initially kill larger individual trees before successively killing smaller individuals (Cole and Amman 1980). Up to 60 percent of trees greater than 8 inches in diameter are killed when mountain pine beetle populations are epidemic.

Currently, the Flint Foothills project area is part of a larger epidemic occurring across the majority of the Beaverhead-Deerlodge National Forest and on other forests in the Northern region. Mountain pine beetle has been active in the Flint Foothills area since about 2000, reaching epidemic proportions beginning in 2007 (based on field reconnaissance of the area) and resulting in extensive areas of dead and dying[23] lodgepole pine, and the mortality of more individually scattered ponderosa pine and whitebark pine. Mountain pine beetle infestations are a regular force of natural change in forested ecosystems; however, several current outbreaks occurring simultaneously across western North America are the largest and most severe in recorded history (Bentz 2008). As trees become older than about 50 years, the proportion of trees in a given stand able to resist the beetles generally decreases. This is especially true in even-aged stands of lodgepole pine (Randell 2000). Outbreaks in even-aged stands of older trees of the same diameter class kill almost all trees, whereas mixed-aged stands lose mostly the larger trees (Amman et al. 1977).Table 25 summarizes the annual affected acreage totals and the total number of trees estimated to have been attacked over the entire Flint Foothills area,

23 For this project, dead pine trees are defined as those having red/brown or no needles. Dying trees are defined as those trees with green needles having more than five visible pitch tubes (Klein et al. 1978) on more than one face of the bole of the tree or have visible frass (the fine, sawdust-like boring dust) (Amman and Logan 1998).

including non-Federal lands for these years. Note that acreage totals can have overlap from year-to-year, as mountain pine beetle attacks can be progressive over several years within a particular acre.

Table 25. Mountain pine beetle acres and total trees affected in the Flint Foothills project area

	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mountain Pine Beetle Affected Acres & Trees	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**
	no survey	1617	104	no survey	0	745	no survey	12971	19135	3421
	Total Trees	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**
	no survey	621	174	no survey	0	1802	no survey	102423	173463	65439

Note: Acreage totals from year-to-year are not cumulative: Mountain pine beetle attacks are typically the same acre; however, the total trees attacked can be viewed as what was attacked in that individual year.

Mountain pine beetle populations have been maintained and increasing year-by-year due to the recent above average winter and spring temperatures, allowing a high over-winter success. Pine stand conditions across the BDNF are conducive for carrying epidemic populations and without a change in over-winter temperatures to colder extremes, the epidemic would continue until the host species of the appropriate diameter (about 5 inches and larger) have been exhausted. Within the Flint Foothills Project area on National Forest System lands, it is estimated that all (100 percent) of the pine stands in the project area that have trees 5 inches in diameter and larger have been affected by mountain pine beetle (19,199 acres with lodgepole, ponderosa pine or whitebark pine component; figure 8 and figure 9). Western spruce budworm (*Choristoneura occidentalis*) occurrence has been most evident at lower elevations where Douglas-fir occurs. Western spruce budworm population booms last up to 30 years and cause mortality in small, and defoliation of large, Douglas-fir trees. Increasingly, dense, late-successional stands of Douglas-fir are susceptible to western spruce budworm because these stands are often stressed by competition. Areas of higher mortality due to western spruce budworm in contiguous stands of Douglas-fir can be seen in the Gird Creek to Douglas Creek areas (figure 10).

Douglas-fir bark beetle (*Dendroctonus pseudotsugae*) numbers have generally thought to be in decline in the Northern Region as well as the Flint Foothills project area; however, an increase in individual numbers of Douglas-fir trees killed by Douglas-fir bark beetle have been noted in the Dunkleberg Ridge, Jackson Park and Blum Creek areas. An increase of mortality due to Douglas-fir bark beetle can be attributed to the heavy and repeated defoliation from western spruce budworm which may lead to increases in Douglas-fir beetle activity. Additionally, highly dense stand conditions are also contributing to the increase in mortality to Douglas-fir from Douglas-fir bark beetle activity (figure 11). Figure 12 that follows is a map displaying the USDA Forest Service Aerial Disease Survey (ADS) data showing the progression of the mountain pine beetle and Douglas-fir bark beetle infestation from 2000 through 2010.

Figure 8. A mix of dead and live lodgepole pine –Unit 26S.

Figure 9. Dead ponderosa pine killed by mountain pine beetle in the Dunkleberg Creek area.

Figure 10. Spruce budworm defoliated Douglas-fir in Dunkleberg Creek area.

Figure 11. Large Douglas-fir killed by Douglas-fir bark beetle in Dunkleberg Creek area.

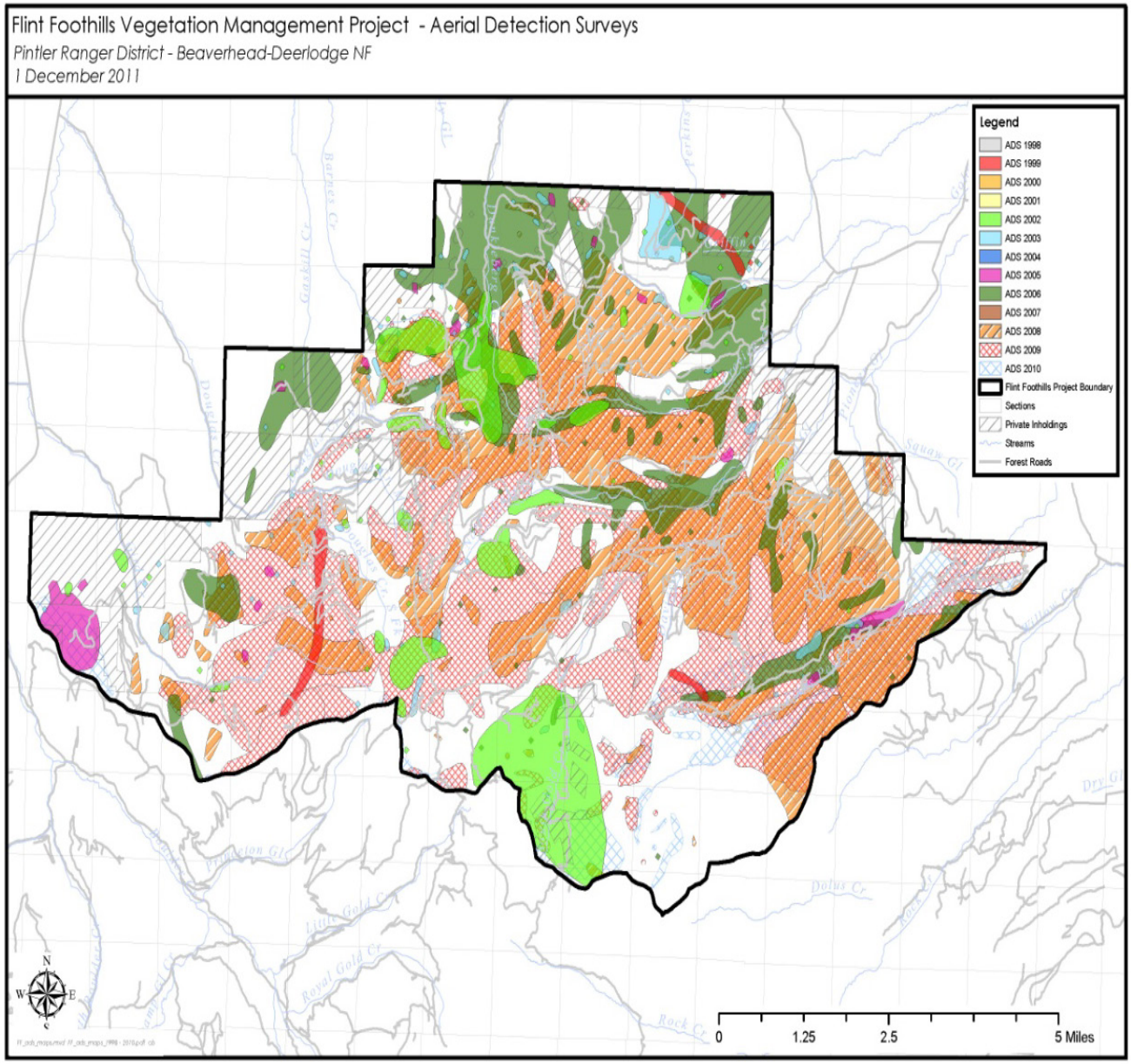


Figure 12. Mountain pine beetle and Douglas-fir bark beetle progression

USDA Forest Service Aerial Disease Survey data

Rusts, Fungi, and Microbes

The bulk of rust, fungi and microbes occurring in the Flint Foothills area are important components of ecosystem function and structure. Alternatively, white pine blister rust (*Cronartium ribicola*) is a nonnative species that has negatively affected five-needle pines in the western United States during a portion of its life cycle (McDonald and Hoff 2001). Limber and whitebark pines are the only five-needle pines on the BDNF; whitebark pine is the most common on the forest. Limber pine does not occur in the project area; whitebark pine comprises about 1.5 percent of the Flint Foothills area. In portions of the BDNF white pine blister rust has resulted in widespread mortality of whitebark pine; although a comprehensive field review of higher elevations within the Flint Foothills area has not been done, the stands

that have been reviewed show whitebark pine overstory trees moderately to severely impacted by a combination of blister rust and mountain pine beetles.

Fire

Fire was historically the predominant natural disturbance in the Flint Foothills Project area and lightning ignitions largely determined where and when fires started (Agee 1993, Baker 2002, Pyne 1982); while indigenous burning is presumed to have occurred at lower elevations within the analysis area (Kimmer and Lake 2001). Fire regimes are differentiated by the frequency, extent, severity, and timing of fire events associated with vegetation. The presence or absence of fire does play a key role in the composition and structure of vegetation that occurs in the project area (figure 13). The frequency and severity of past fires can, to a certain extent, be determined by looking at the existing condition of the different vegetation types in the project area. Although variable, natural fire intervals are a reflection of the vegetation types that occur in broad elevation, aspect and slope bands across the project area.

Plate 16a (ca. 1906-08) Fire Group 6: Moist Douglas-fir. Elevation 5,000 ft (1 524 m)
Looking northeast from point now occupied by U.S. Highway 10A, 8 miles northeast of Philipsburg, Mont. Deciduous shrubs, herbs, and young aspen are evident in foreground and midground. Conifers on benchlands include Douglas-fir, ponderosa pine, lodgepole pine, and Rocky Mountain juniper. Open slope in distance was swept by a crown fire around the turn of the century.
USGS photograph 29 by F. C. Calkins.

Plate 16b (July 21, 1981) About 73 to 75 years later
Except for the portion of clearcut visible at right midground, the landscape above highway right-of-way is now covered by a dense stand of conifers dominated by Douglas-fir. Aspen have matured along edge of conifers, while those in competition with conifers are dying out. Shrubs, including buffaloberry and snowberry, are also deteriorating.
Photograph by G. E. Gruell.

Figure 13. Effects of the absence of fire over about 75 years in the Flint Creek drainage

Upper photo from circa 1906-08, lower photo from 1981 (Gruell 1983)

High frequency, low severity fire regimes were historically typical of low elevation dry forests of Douglas-fir and mixed Douglas-fir/ponderosa pine on the BDNF. Senesced grass and herb communities fueled understory fires in these forests, allowing dominant conifer species to survive multiple low intensity fire events that killed seedlings and created low density stands (Heyerdahl et al. 2006). For the moist Douglas-fir type fire was an important agent in controlling density and species composition. Frequent low or moderate severity fires favored ponderosa pine over Douglas-fir in stands where it occurred (Fischer and Bradley 1987). In the analysis area, fire scars indicate a natural mean fire interval of 20 years in the low elevation forests until the early 1900s (USDA Forest Service 1994). The fire interval was disrupted at that time due to a combination of events: indigenous burning ended as the area was populated by European Americans; and intense grazing to support new settlements reduced available grass as a light-fuel. Additionally, fire suppression was initiated with the formation of the National Forest System.

Mixed severity fire regimes historically occurred in several forest types in the region such as early seral subalpine fir forest types dominated by lodgepole pine (Arno 1980, Arno et al. 2000). A mixed severity fire is a mixture of 'stand-replacement' (where most of the conifers die) and 'understory' (where most of the conifers live) variable intensity fire. Fuel loads increased in the mid- to high-elevation forests with the less frequent fires than those of lower elevation forests. Mixed severity fire regimes are when fire spread in mid- to high-elevation forests exhibit fire behavior that would include low severity surface fire, single or clustered tree torching, and high severity crown fire; all within a single fire perimeter. Fire intervals that produce the mixed severity fire regimes in the project area are highly variable, and are influenced by proximity to lower elevation areas of high frequency fires, climate, and fuel loading. Multiple fire scars on lodgepole trees observed in the project area suggest some lower intensity thinning fires occurred along with higher intensity stand replacement fires.

Fire frequency determines vegetation successional stage and fuel conditions and past fire shape and size play a role in fuel connectivity and landscape heterogeneity or homogeneity (Arno et al. 2000, Turner et al. 1998). Summer persistent snow pack in high elevation forests historically resulted in high fuel moisture and low potential for fire spread on an annual basis; extended time between fires then cause a buildup of high fuel loading so that when a fire does become established, fire is more readily able to spread from surface to crown with potential for canopy consumption in these forests (Romme 1982). These trends in fire and the relationship between fire and climate in the northern Rocky Mountains existed in the distant (Heyerdahl et al. 2008) and recent past (Morgan et al. 2008). The last major fires to occur in the project area were in 1847 and 1867; the entire extent of these two large fires are not known, but multiple areas from 400 to 800 acres of contiguous fuel arrangement are attributed to them, even though the fires had burned many more total acres when they occurred (USDA Forest Service1994).

The majority of Forest Service prescribed fire use has been to dispose of logging slash, either through pile burning or jackpot burning activities. Some prescribed fire use has been for improving stand conditions for certain vegetation species (e.g., removing conifer succession in grassland/brushfield areas). Understory burns are considered low intensity fires over the majority of the unit, whereas broadcast burns are higher intensity fires over the majority of the unit. Prescribed fire has occurred on about 11 percent of the project area or 4,974 acres (table 26).

Table 26. Total acres of prescribed fire by years in the Flint Foothills Project area

Activity	1960-1969	1970-1979	1980-1989	1990-1999	2000-2010	Total Acres
Broadcast burning	15	132	2	79	462	690
Pile burning*	**27	**338	**224	***310	***203	1,102
Underburning	0	0	0	1,653	1,517	3,170
Wildlife habitat prescribed fire	0	0	0	12	0	12
Total	**42**	**470**	**226**	**2,054**	**2,182**	**4,974**

** 1 acre=0.10-acre dozer pile
***1 acre=0.25-acre landing pile

Although a combination of disturbance factors contribute to size-class distribution in forest types, the dominant disturbance factor determining size is fire when an active component, or the lack of fire with fire suppression management strategies. A distribution of size classes by dominance group follows in table 27. The absence of fire, due in part to the past century of management strategies on Federal lands, has resulted in a skewing towards larger size classes. Early seral conditions have only been created through timber harvest practices.

Table 27. Size class distribution by dominance group

Dominance Group	Size Class				
	Early Seral (Seedling)	Mid Seral (Pole)	Mid to Late Seral (Sawtimber)	Late Seral (15+ inch)	Total
Subalpine fir with other shade tolerant conifers	38	4	25	-	66
Whitebark pine	8	50	110	-	167
Whitebark pine with lodgepole pine	7	161	337	-	505
Lodgepole pine	1,181	8,851	8,098	1	18,131
Lodgepole pine with whitebark pine	-	-	11	-	11
Engelmann spruce with other shade tolerant conifers	5	-	548	11	565
Ponderosa pine	37	125	-	-	162
Ponderosa pine with lodgepole pine	8	75	13	8	104
Quaking aspen	-	-	-	-	178
Douglas-fir	707	2568	14,085	82	17,442
Douglas-fir with ponderosa pine and/or lodgepole pine	22	18	66	14	119
Total	**2,011**	**11,852**	**23,294**	**116**	**44,522**

Old Growth

Old-growth stands as defined by Green et al (1992, errata corrected 2007, 2008) do occur in the Flint Foothills Project area. Stand exam surveys were completed during field season 2010 in a small portion of the project area. Stand exams were conducted in Douglas-fir/ponderosa pine (781 acres) and lodgepole pine (529 acres) stands. Old growth was identified in Douglas-fir/ponderosa pine stands (see table 28 and figure 14, figure 15 and figure 16 that follow). In addition to stand exams, informal surveys in each proposed unit were completed by a silviculturist. Informal surveys included measuring basal area and aging trees to ascertain stand characteristics. Although these surveys noted a few individual, scattered, old trees in additional stands that did not have formal stand exam surveys, the occurrence of these trees were at numbers far below old-growth standards; these old trees exist as a component in the mid- to late-seral size classes. Old-growth forests are distinguished by old trees and structural characteristics developed over time (ibid). An analysis of old growth over large landscapes as part of Forest Plan revision using FIA data was completed (Bush et al 2006). In the Clark Fork/Flints landscape, Bush et al (2006) estimate that 20.9 percent of the Forest is in old growth with a 90 percent confidence interval of 14.1 – 28.1 percent. This old-growth analysis indicates that old growth in the Clark Fork/Flints landscape is not deficient at the regional scale (ibid). Old growth was not mapped specific to Flint Foothill Project area beyond the formal stand exam surveys and informal surveys that were conducted in each proposed unit.

Table 28. Acres of inventoried old growth

Inventoried old growth stands	Acres
81104008	14
81104009	17
81104038	28
85202013	11
85202025	33
85202029	15
85301060	163
Total acres of Inventoried Old Growth	**281***

Total acres do not reflect total old growth in the project area

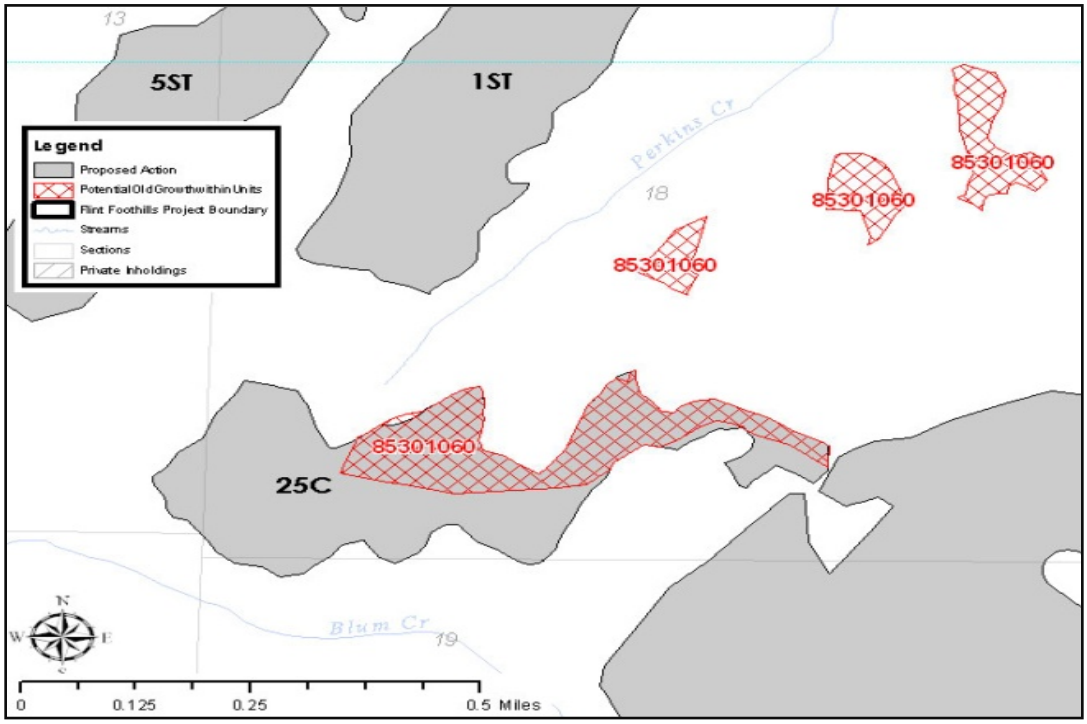


Figure 14. Old growth areas in Perkins Gulch

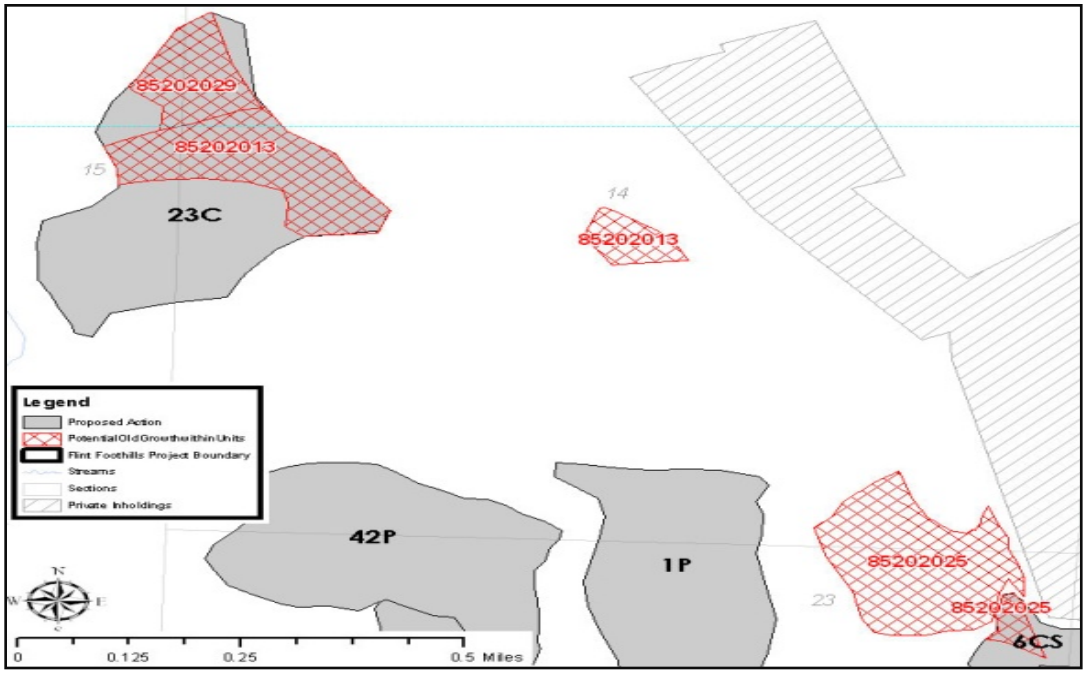


Figure 15. Old growth areas in Perkins Gulch

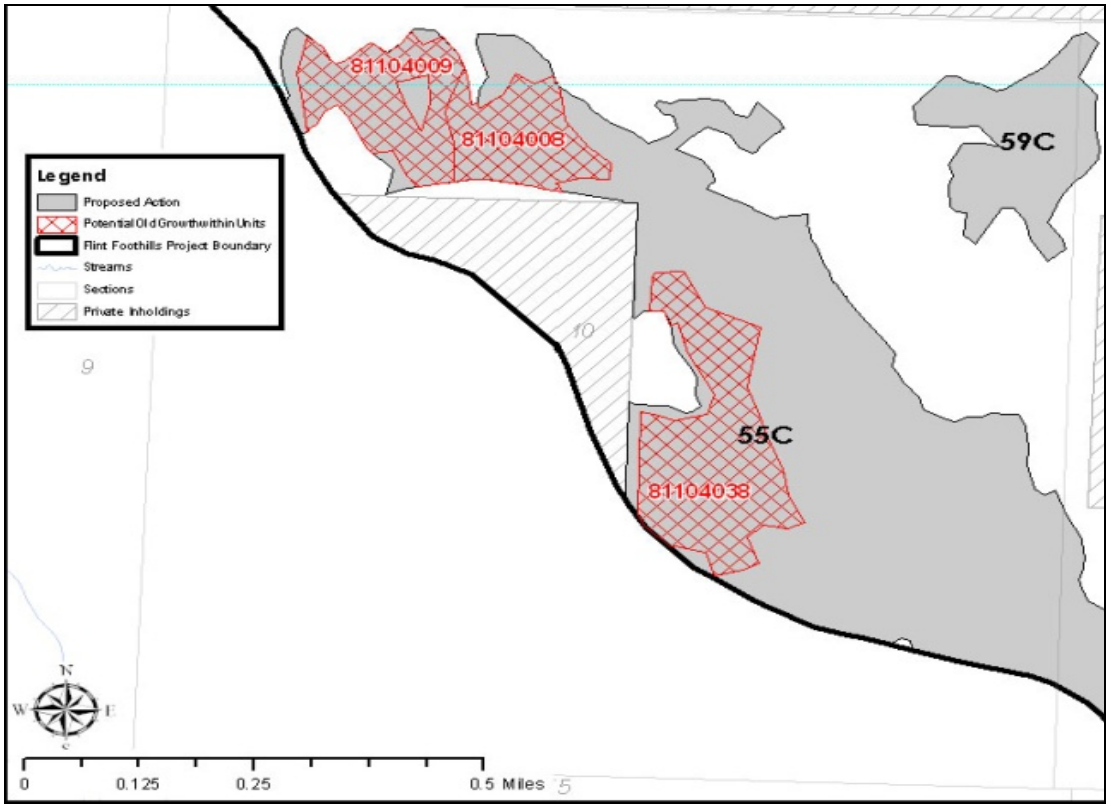


Figure 16. Old growth areas in Gird Creek

Timber Management

Timber was harvested in the Flint Foothills Project area to support mining, homesteading and settlement out in the valley. Timber harvest increased greatly from the 1960s through the mid-1980s but has declined in recent years. Harvest in the last decade has been post and pole thinning and roadside hazard tree removal.

Timber harvest activities included clearcut, seed tree, shelterwood, selection cut, commercial thinning (principally post and pole), sanitation (removing mistletoe infected trees) and special harvest (principally hazard tree removal). Commercial timber harvest has occurred on about 23 percent of the project area (10,265 acres; see table 29)

Table 29. Total acres of commercial timber harvest in the Flint Foothills Project area 1960-2010

Activity	1960-1969	1970-1979	1980-1989	1990-1999	2000-2010	Total acres
Stand clearcut	582	2961	125	243	0	3,911
Seed tree cut	51	181	88	186	0	506
Shelterwood cut	176	883	246	251	111	1,667
Selection cut	216	189	642	0	0	1,047
Sanitation (salvage)	0	73	331	120	0	524
Special cut	0	74	69	129	281	553
Commercial thinning	0	70	1,154	621	211	2,056
Total:	**1,025**	**4,432**	**2,655**	**1,550**	**603**	**10,265**

Precommercial thinning has principally occurred in old regeneration harvest areas, including past clearcut, seed tree and shelterwood units. Precommercial thinning has occurred on about 3 percent of the project area or 1,279 acres (table 30).

Table 30. Acres of precommercial thinning in the Flint Foothills project area from pre-1980-2010

Activity	Pre-1980	1980-1989	1990-1999	2000-2010	Total
Precommercial thinning	0	299	699	281	1,279

Grazing, Invasive weed treatment

Past cattle grazing in the project area has left effects of variable intensity, and may have contributed to the spread of invasive plants, such as knapweed (refer to the Noxious Weeds and Livestock Grazing analysis.) However, the majority of invasive plant introduction is from motorized routes (roads and trails). Invasive weeds have been treated and continue to be treated with herbicides; dry grassland parks are susceptible to the threat of invasive weeds, but have not been impacted due to the success of the weed spray program.

Vegetation Types

Existing Vegetation Summary

Vegetation within the Flint Foothills project area is summarized in table 31. The distribution of the vegetation cover types is displayed below in figure 12.

Table 31. Existing cover types by dominance groups

Dominance Group	Total Acres	Dominance Group	Total Acres
Dry grasslands	4,488	Lodgepole pine	18,131
Wet grasslands	100	Lodgepole pine with whitebark pine	11
Wet shrublands	178	Engelmann spruce with other shade tolerant conifers	565
Sparsely Vegetated	2,241	Ponderosa pine	162
Water	65	Ponderosa pine with lodgepole pine	104
Subalpine fir with other shade tolerant conifers	66	Quaking aspen	178
Whitebark pine	167	Douglas-fir	17,442
Whitebark pine with lodgepole pine	505	Douglas-fir with ponderosa pine and/or lodgepole pine	119
		Grand Total Acres	**44,522**

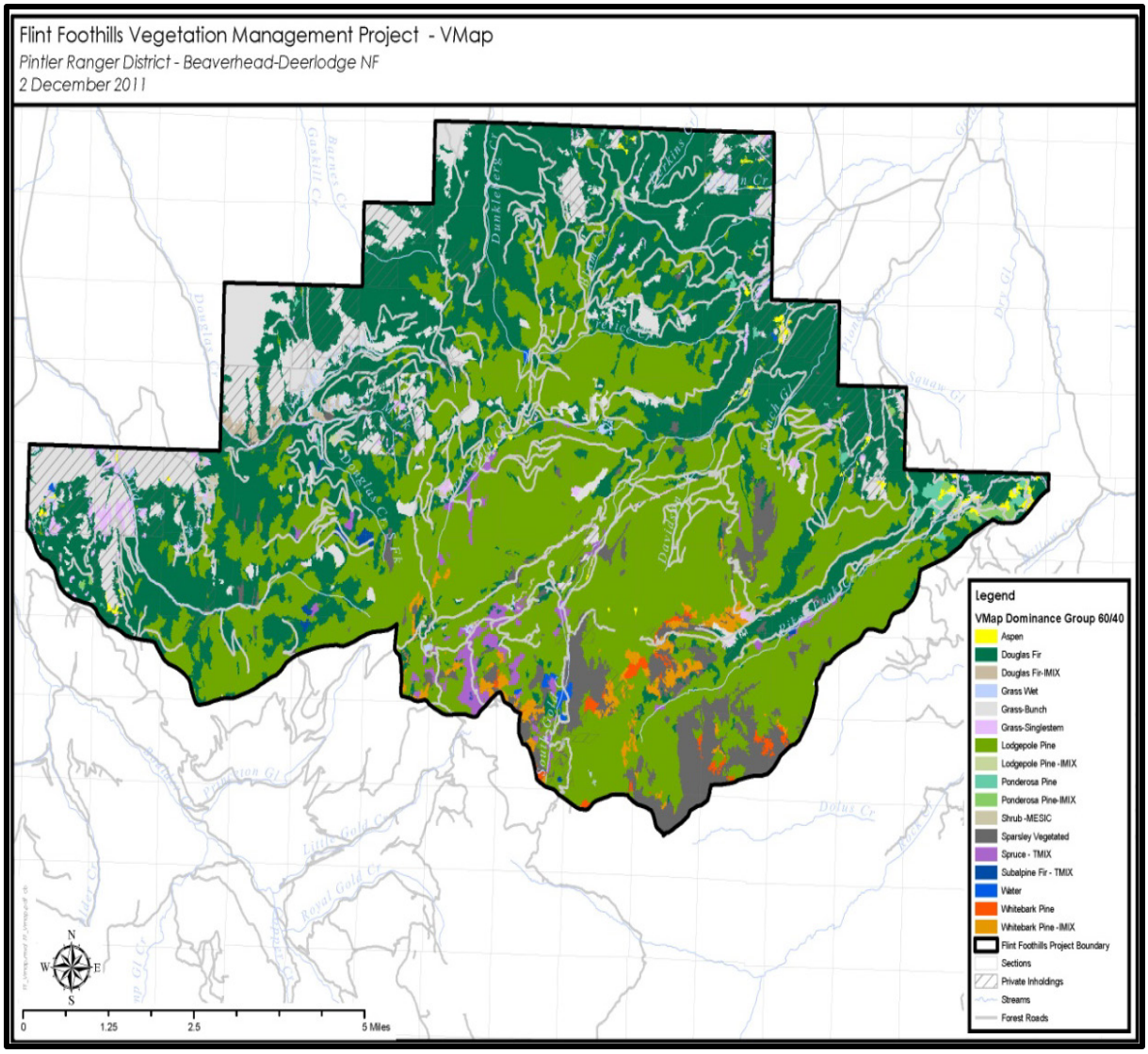


Figure 17. Distribution of cover types in the Flint Foothills Project area

Douglas-fir and ponderosa pine vegetation type

Historically, many dry coniferous forests were shaped by frequent, low-intensity fire; this included the warm, dry as well as moist Douglas-fir habitat types of the Flint Foothill Project area. This disturbance regime sustained open, large-tree dominated structures with diverse and productive understory communities (Arno 1980, Hessburg and Agee 2003). However, over the last century, fire suppression, livestock grazing, and high-grade logging, among other factors, have altered the structure and function of dry coniferous forests across much of western Montana. Forest structure and composition has been most significantly altered with the lack of fire disturbance; the disruption of the natural fire intervals of the past have resulted in higher stand densities, multi-layered stands of mostly one species, Douglas-fir. Dramatically higher stand densities and development of ladder fuels (Covington and Moore 1994a, Arno et al. 1995, Peterson et al 2005) increase the risk of uncharacteristically severe wildfire (Everett et al 2000, Friederici 2003), bark beetle infestations (Fettig et al. 2007), and in some areas such as the Flint Foothill project area, successional replacement by shade-tolerant competitors (Gruell et al. 1982, Fischer and Bradley 1987, Mutch et al. 1993, Habeck 1994, MacKenzie et al. 2004).

Along with dry grassland parks, Douglas-fir with very little ponderosa pine dominates the low to middle elevations of the Flint Foothills Project area (17,827 acres or 40 percent of the project area; see table 31). In contrast to early 1900s conditions of open-grown, larger diameter stands of Douglas-fir and ponderosa pine, current Douglas-fir stands in the project area are continuous, mid- successional and densely stocked, and establishing into dry grassland and quaking aspen communities. The increase in extent and continuity of this coniferous vegetation type has effectively reduced landscape vegetation heterogeneity and associated biodiversity and put unique habitat types of the Flint Foothills Project area (most importantly aspen and seral ponderosa pine communities) at risk of irreversible habitat conversion. Highly dense stands of Douglas-fir have been affected by western spruce budworm and an increase of individual trees killed by Douglas-fir bark beetle has been noted in the project area through field surveys. Additionally, mortality of very large ponderosa pine through bark beetles has been noted in the project area through stand exams.

Lodgepole pine vegetation type

Even-aged stands of lodgepole pine currently impacted by the mountain pine beetle epidemic make up about 41 percent of the Flint Foothill Project area; virtually all (about 100 percent) of the 18,142 acres of the lodgepole pine type greater than 5 inches in diameter has been affected by mountain pine beetle. Stand exam surveys in the project area have found tree ages of all species range from 80-120 years. Under forested canopies, intermediate and understory trees are rare (mostly suppressed lodgepole pine and Douglas-fir seedlings and saplings) and average 60-82 years old.

Cool habitats dominated by lodgepole pine are common in the Flint Foothills Project area. Two habitat types represented the broader cool habitat types dominated by lodgepole pine: habitats where lodgepole pine was the climax species and occurred as pure stands prior to climax; and mixed conifer habitats where lodgepole pine was dominant in most stands. Fire disturbances historically characterized the mosaic of age classes and stand successional stages of cool habitats dominated by lodgepole pine that characterized mid to upper elevations in the Flint Foothills area. Currently, over 17,000 acres out of the 18,142 acres of the lodgepole pine vegetation type are mid- to late seral, indicating a very homogeneous landscape in the project area. Past fire disturbances suggest a more heterogeneous landscape.

Dense lodgepole pine stands dominated cool habitats, and are one of the most common vegetation types in the Flint Foothills area. Habitat types below 7,500 feet experienced more frequent fire than those above this elevation. At lower elevations fire perpetuated lodgepole pine by eliminating shade tolerant species from stands. Fischer and Clayton (1983) indicate that lodgepole pine-dominated areas occurred in patches ranging from five to hundreds of acres. Elevations above 7,500 feet fires under natural disturbance regimes were more infrequent, lightning-caused fires that burned with mixed fire severity; the result being a patch-mosaic of lodgepole pine size classes (Fisher and Bradley 1987).

Mixed conifer vegetation type

In the project area, the mid- to high elevation forest are currently large homogeneous mature stands, lacking stand age diversity that comes from past fire disturbances that characterized a more heterogeneous project area. Blister rust has accelerated succession to subalpine fir by killing mature whitebark pine, and mountain pine beetle has killed the majority of lodgepole in the project area (table 25); this coupled with the lack of fire as a recycling agent has caused a major shift in landscape composition and structure from one of pine to fir and spruce (Keane 2000). Whitebark pine is a foundation species of high elevation ecosystems, providing snow

capture and retention, carbon storage, increasing biodiversity, and serving as a good food energy source for wildlife (Tomback et al. 2001). Throughout its range, whitebark pine is experiencing rapid mortality due to several factors including the exotic white pine blister rust (*Cronartiam ribicola*), the native mountain pine beetle (*Dendroctonus ponderosae*) infestation, and wildfire exclusion resulting in conifer encroachment, (USDA Forest Service 2010; Fish and Wildlife Service 2011). Warming temperatures are thought to further increase the rate of mortality due to favorable conditions for white pine blister rust and mountain pine beetle (Greater Yellowstone Coordinating Committee whitebark Pine subcommittee, 2011).

Within the Flint Foothill project area, many of the mature whitebark trees have been killed by mountain pine beetle over the approximately 683 acres of whitebark stands or mixed conifer (lodgepole pine, subalpine fir, Engelmann spruce and Douglas-fir) with whitebark trees. There is a strong relationship between rates of whitebark pine killed by MPB and whitebark pine regeneration density that indicates that stand-scale gap-phase[24] dynamics may be one response to mountain pine beetle outbreaks (Larson and Kipfmueller 2010). Project area-specific surveys have been completed in whitebark pine. The surveys as well as Forestwide monitoring have shown a substantial amount of whitebark regeneration established under more pure whitebark pine stands, and mature whitebark pine trees persisting in the face of both beetle and blister rust pressure (USDA Forest Service 2011). This establishment of whitebark pine seedlings underneath dead whitebark mature trees has been observed in the project area. Whitebark pine occurs most commonly at the highest elevations in the project area, with a few scattered individuals or in smaller (0.25- acre) patches down to the mid-elevations.

Ongoing successional replacement of whitebark pine with the absence of fire may actually be enhanced by blister rust and mountain pine beetle kill; this is especially true where fire exclusion reduces the opportunity for whitebark regeneration (FP FEIS, p. 453). Morgan et al. (1994) found that other conifers replace whitebark pine, in the absence of fire.

Arno (1989) reported wildfire is an important process for whitebark pine with fire return intervals from 50 to 300 years in the Northern Rockies, with fires being highly variable in severity and size. Not all ecosystems or all Rocky Mountain landscapes have experienced the impacts of fire exclusion as yet; the lack of impacts may not yet be manifested at the stand level, but are detectable at the landscape level (Keane et al. 2002). Whitebark pine survives low intensity fires but still benefits from stand replacing fire where regeneration is most successful. Arno (1986) suggests that fire is important in perpetuating an abundance of whitebark pine.

Whitebark pine was designated in 2011 as a sensitive species in the Northern Region (USDA Forest Service 2011) and is addressed in the Sensitive Plant section p. 128.

Desired Condition

Desired condition is a portrayal of the land, resource, or social and economic conditions that are expected to result in 50-100 years if objectives are achieved. It is a vision of the long-term conditions of the land (Forest Plan, p. 286). The desired condition for the project area is to maintain or improve resilient forest conditions (Forest Plan, p. 43), which is the capacity to return to prior conditions after disturbance. Resilient forests are those that not only accommodate gradual changes related to climate but tend to return toward a prior condition

[24] "Gap-phase" dynamics is defined where the patchy mortality of mountain pine beetle outbreaks create numerous forest openings and canopy gaps of varying sizes, which then allows for natural regeneration to become established (Larsen and Kipfmueller 2010).

after disturbance either naturally or with management assistance. Within the BDNF, maintaining a diversity of tree species or dominance types, age or size class diversity within dominance types, and forest density similar to what historic disturbance regimes produced, are considered underpinnings of a resilient forest (Forest Plan, p. 299). In all forest types, seedling and sapling development and management of stand densities allows for achieving resilient vegetation communities.

In Douglas-fir and ponderosa pine stands, the desired condition is to have larger diameter (up to 30 inches d.b.h.), open, grown, wide-spaced old trees (Joy and Hutton 1990) in stands averaging 60-80 square feet per acre of basal area and a range from 40-100 square feet per acre. Many of these stands would be old growth (per Green et al.), with more than 20 percent of the stands being comprised of ponderosa pine. Periodic thinning or low intensity prescribed fire would be considered in order to maintain the desired stand densities. These stands would be resilient to inherent insect and fire disturbances. Smaller trees would be scarce or occur mainly in openings (as individuals or in clumps) within the tree canopy; openings are natural and would be expected throughout these types. Shrubs and forbs would be common and would be similar to current understory vegetation. Species composition favors ponderosa pine, though the dominate species would be Douglas-fir with the potential for other species such as subalpine fir, lodgepole pine, and Engelmann spruce to be present. Aspen clones would have adequate growing space where they occur and are a healthy component of these Douglas-fir dominated stands. Ponderosa pine and Douglas-fir are long-lived which allows for stand replacement over long periods, and in most cases with partial forest canopy in place. The Forest Plan objective for the dry-forest habitat types is to reduce stand densities in the large size classes of Douglas-fir/dry forest communities to maintain or improve resilient forest conditions (Forest Plan, p. 43).

The desired forest condition for lodgepole pine is to perpetuate open to moderately dense stands averaging 80 square feet of basal area with a range of 60 to100 basal area (Schmid and Mata 1992; Schmid and Amman, 1992), at 6 to 12 inches d.b.h., and intermixed with Douglas-fir and minor representation of spruce and/or subalpine fir. Overall stand structure for lodgepole pine stands would continue to be even-aged, single-storied structure with occasional mature Douglas-fir; increase Douglas-fir component to the extent possible increasing species diversity. Stand density would be managed to perpetuate a more open and relatively evenly spaced stand of lodgepole pine to improve individual tree growth and vigor; reduce crown fire potential; promote younger age class of wind-firm, bark beetle-resistant lodgepole pine; and increase the quantity of longer-lived species such as Douglas-fir and aspen. The desired composition mix is mostly lodgepole pine, Douglas-fir and aspen, with an occasional Engelmann spruce and subalpine fir. Understory vegetation would be similar to what currently exists on site. In addition to increasing the resiliency of these stands (Forest Plan, p. 43), the Forest Plan objective for the lodgepole pine type is to increase the number of acres in the 0-5 inch d.b.h. class where insect-infested stands are dead or dying (Forest Plan, p. 44).

The desired condition for mid-elevation mixed-conifer stands is to maintain a patch mosaic of forested size classes. Forest vegetation structure provides the basis for maintaining or restoring forested ecological communities of sufficient diversity to provide for the viability of the majority of species that occur or make use of the forested types on the BDNF (FP FEIS p. 473). Creating openings suitable for early seral conifer species establishment, such as lodgepole pine and whitebark pine, is one objective with this desired condition. Although this proposal targets mid-elevation stands rather than high-elevation stands, there would be opportunities for whitebark pine establishment (which is highly desired) through Clark's nutcracker seed

caching. Fires would ensure a richer mosaic of stands in different successional stages, contributing to the long-term viability of the early seral whitebark pine (Murray et al 2000) and lodgepole pine.

Environmental Consequences

Methodology

This analysis will consider the projected trends for Douglas-fir/ponderosa pine, lodgepole pine and whitebark pine vegetative communities with the absence of treatment (no action) and the action alternatives.

The Forest Vegetation Simulator (FVS) modeling was used to estimate the 50-year-trend for these stands. FVS is one of the most widely used forest management growth models, and simulates a wide array of different forest processes, including natural disturbance process such as insects, and includes a fire and fuel extension. The fundamental disadvantage of any forest yield model is that it is not linked to the underlying causes of productivity: carbon and nutrient cycles, moisture regime, and climate (Monserud 2003).

Spatial and Temporal Context for Effects Analysis

The spatial vegetation analysis area encompasses 44,522 acres (Forest Service ownership 37,010 acres; private ownership, 7,512 acres); in essence, the project area is National Forest System lands on the entire north end of the Flint Mountain Range. The analysis area includes all proposed activities, and is within the Flint Foothills Management Area and Flint Uplands Management Area. The temporal timeframe covers the span of time in which the effects of the proposed actions were analyzed. This period takes into account the cumulative effects of all actions up to the present, and extends into the future for 50 years.

Present and Foreseeable Activities Relevant to Cumulative Effects Analysis (table 24) at the beginning of chapter 3 discloses the present and reasonably foreseeable actions within the project area that are relevant to this DEIS analysis. The actions listed that are relevant to the vegetation section are: Public activities such as recreational activities, hunting, wildlife viewing and driving for pleasure; livestock grazing; invasive plant control, and roadside hazard tree removal.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

The no-action alternative provides a means for evaluating the current ecosystem conditions as a baseline. In this alternative, proposed activities would not occur: salvage of dead and dying lodgepole pine stands by clearcut harvest, seed tree harvest, commercial thinning of Douglas-fir/ponderosa pine stands, precommercial thinning, and prescribed burning of low- and mid-elevation conifer stands. The direct, indirect, and cumulative effects of no action would be the forest stand progression trending away from the desired future condition.

Douglas-fir and Ponderosa Pine Vegetation Type

In absence of a stand-replacing fire event, Douglas-fir stands in the Flint Foothill Project area would continue to increase in density and canopy layering. Where the densest stands occur, individual trees of Douglas-fir and ponderosa pine may die (from competition or insects), continuing the current trend in the project area.

When Douglas-fir or ponderosa pine is killed by their respective beetle species, the tree attacked is usually one of larger diameter within the stand. The dead tree or groups of trees then create canopy gaps that provide opportunities for seedlings and sapling-sized trees to develop and increase in the stand; usually the size of these openings favors Douglas-fir regeneration. As stands progress over time, areas where there are gaps in the canopy would begin to fill in as Douglas-fir regeneration is established and trees grow, resulting in a decline in other species such as the early seral ponderosa pine, aspen, brush, and other herbaceous vegetation. The density of trees within the project area would increase causing a decline in individual tree vigor.

In approximately 60 to 80 years, it is possible that some of the Douglas-fir stands may attain old-growth characteristics (Koch 1996). Forest Vegetation Simulator indicates that current stands that are mature stands with 15-inch dominant trees would not attain old-growth characteristics in a 50-year period due to mortality from Douglas-fir bark beetles (appendix B of the Vegetation Report in the project file).

Existing old growth may be reduced due to mortality to large trees from beetles, with large ponderosa pine trees potentially becoming scarce due to mountain pine beetle. Fifty-year-trend modeling (with FVS) of one stand that is currently old growth estimated a reduction of ponderosa pine and the stand losing enough large trees to fall out of old growth status (appendix B of the Vegetation Report in the project file). The future trend due to beetle-caused large tree mortality is for fewer acres of low-elevation old growth in the project area.

Continued disruptions of the past mean fire interval of 20 years would affect forest structure and composition. The lack of fire coupled with insect disturbances and individual stand dynamics continue to favor increasing densities and layering of Douglas-fir, and discriminate against the early seral species ponderosa pine. Forest Vegetation Simulator modeling (appendix B of the Vegetation report in the project file) shows that with one fire disturbance, ponderosa pine increases in presence within the stand, and without fire is reduced.

Increasing Douglas-fir stand density and the multi-layering of Douglas-fir trees would allow western spruce budworm and Douglas-fir bark beetle to continue to kill large Douglas-fir trees. The heavy and repeated defoliation from western spruce budworm may lead to additional increases in Douglas-fir bark beetle activity. An increase in other bark beetles (specifically mountain pine beetle and western pine beetle) in ponderosa pine can be contributed to the sustained and increasing stand densities and associated loss in individual tree vigor due to competition from principally Douglas-fir (see Figure 13 and Figure 14).

Dramatically higher stand densities and development of ladder fuels increase the risk of wildfire, bark beetle infestations, and in some areas, successional replacement by shade-tolerant competitors (Fiedler et al 2010). It is expected that with the no-action alternative, mortality in Douglas-fir and ponderosa pine in the project area would not only continue, but increase. An increase in mortality is expected given the current trend in local climatic conditions coupled with the current dense and multi-layered stand conditions common in the Flint Foothill area for the Douglas-fir and ponderosa pine vegetation community.

Figure 18 and figure 19 that follow are photographs of stands in the project area showing loss of individual tree vigor and mortality due to understory competition.

Figure 18. A large-diameter live ponderosa pine with Douglas-fir underneath crowding the pine. Dunkleberg Creek area.

Figure 19. A large-diameter ponderosa pine tree killed by mountain pine beetle. A thicket of small Douglas-fir crowds the pine. Dunkleberg Creek area.

Lodgepole Pine Vegetation Type

Lodgepole pine stand conditions in the Flint Foothills Project area are conducive for continuing the epidemic populations of mountain pine beetle, and without a change in over-winter temperatures to colder extremes, the beetle attacks would continue until the host species of the appropriate diameter (about 5 inches and larger) have been exhausted. This trend epidemic has been seen on other locations nearer to the epicenter of the epidemic in the Butte area of the BDNF. Table 25 shows that all (about 100 percent) of the 18,142 acres of the lodgepole pine type greater than 5 inches d.b.h. has been affected by mountain pine beetle within the Flint Foothills Project area on NFS lands,

Incidental mature lodgepole pine escaping attack by mountain pine beetle would grow vigorously; other species that occur in the stand (Douglas-fir, subalpine fir, Engelmann spruce and aspen) would also see increased growth. Understory herbaceous vegetation (grasses, shrubs, and forbs) has thrived with the increased sunlight with the majority of the lodgepole pine overstory now dead. Natural regeneration has already begun in ‘canopy gap’ areas where enough warming sunlight has opened serotinous lodgepole pine cones. This natural regeneration would continue in the lodgepole pine type.

In time the dead trees would fall over (5-15 years) (Mitchell and Preisler 1998), resulting in large surface fuel accumulation. This fuel accumulation would be variable, but is estimated to be between 40 and 80 tons per acre of 5-inch and larger material, with some areas exceeding 100 tons per acre of material. Over decades, when there is a significant component of large down wood, there would be an increase in fire severity during high-intensity fire events (Jenkins et al. 2007). As the fuel load changes from standing dead to a horizontal profile, the natural regeneration would have physical barriers, and coupled with the staggering in time of canopy gaps, create a variable height and age lodgepole pine stand, with scattered older trees of the few lodgepole pine trees not affected by MPB and other species of trees. This progression with the lodgepole pine type is expected to occur on about 17,000 acres within the project area.

The extent of the bark beetle epidemic and lodgepole pine tree mortality in the Flint Foothills area would result in a profound change in the condition and arrangement of forest biomass (Kaufmann et al. 2008). Crown fires are possible both before an epidemic and while the red needles remain on the trees (ibid). Mortality due to the mountain pine beetle epidemic changes the fuel complex or characteristics in terms of fuel load and structure, microclimate and fuel moisture, and fire potential. These characteristics vary with the intensity of the beetle attack, initial stand conditions, and the time following the attack.

The 50-year-trend for lodgepole pine vegetation type, as modeled with FVS (appendix B of the Vegetation report in the project file), is for small (mean) diameter stands that would have some variability in size due to the regeneration being impeded by the horizontal profile of downed trees from the mountain pine beetle epidemic. This would result in most lodgepole pine vegetation type stands in the project area to be coming into the mid-seral pole-sized size class right at year 50.

Mixed Conifer Vegetation Type

The mountain pine beetle epidemic would continue to kill whitebark pine, especially individual trees stressed from white pine blister rust. However, with whitebark pine occurring at higher elevations, the colder climatic conditions may prevent all of the mature whitebark pine trees from being killed; this is a different potential trajectory in the project area as compared to lodgepole pine. The resulting fuel profile associated with dying pine trees within the mixed conifer vegetation type is more complex than that described in the lodgepole pine type. Accumulation of dead fuel would be in juxtaposition with live fuel, rather than the more straightforward accumulation of dead fuel loading with pure lodgepole pine stands.

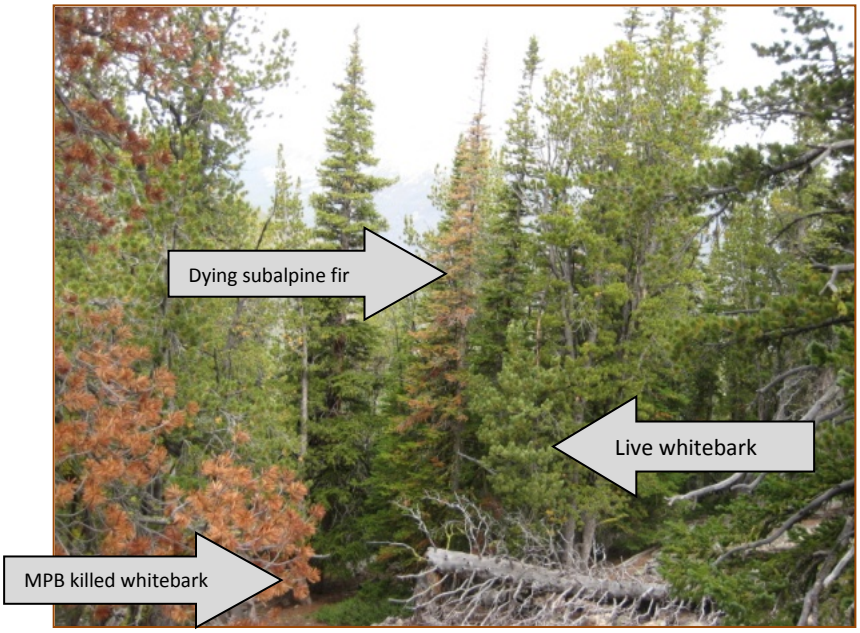


Figure 20. Mix of live and dead whitebark pine with live and dying subalpine fir; little opportunity for early seral whitebark pine establishment

Fires that burn at higher elevations are known to have beneficial effects to whitebark pine with the potential for whitebark pine natural regeneration (Arno 1986; Morgan et al 1994; Murray et al 2000; Keane 2000; Keane and Parsons 2010).

Additionally, there is a strong relationship between rates of whitebark pine killed by mountain pine beetle and whitebark pine regeneration density that indicates that stand-scale gap-phase dynamics may be one response to mountain pine beetle outbreaks (Larson and Kipfmueller 2010). Forestwide monitoring has shown a substantial amount of whitebark regeneration

established under more pure whitebark pine stands with mountain pine beetle mortality (USDA Forest Service 2011).

However, in more mixed conifer stands on the BDNF, blister rust and mountain pine beetle have accelerated succession to subalpine fir by killing mature whitebark pine, with a lack of adequate gap-size to allow whitebark pine natural regeneration to occur. It is anticipated that the dynamics in mixed-conifer stands with blister rust and mountain pine beetle mortality to whitebark pine, and mountain pine beetle mortality to lodgepole pine, coupled with the lack of fire as a recycling agent, would cause a major shift in landscape composition and structure from one of pine to fir and spruce (Keane 2000) (figure 20).

As most of the mixed conifer vegetation type includes a large component of lodgepole pine, the 50-year-trend for lodgepole pine vegetation type, as modeled with FVS (appendix B of the Vegetation report in the project file) is for small (mean) diameter stands that would have some variability in size due to the regeneration being impeded by the horizontal profile of downed trees from the mountain pine beetle epidemic. The fuel profile trajectory created from the current mountain pine beetle epidemic is projected by FVS to be relatively unchanged in 50 years. The trend is that most of the lodgepole pine in the mixed conifer type stands would be attaining mid-seral, pole, size class at year 50. Forestwide monitoring show as whitebark pine seedlings are expected to become established under more pure stands or pockets of whitebark pine, these trees would likely still be sapling size, or early seral condition. Fir and spruce are expected to become well established in the partial shade conditions of mixed-conifer vegetation types, and in 50 years are expected to be the dominant species.

Forest Carbon Cycling and Storage

The acreage of lodgepole pine forests currently affected by the mountain pine beetle epidemic is extensive throughout the Flint Foothill project area. As a major disturbance on the landscape, the mountain pine beetle epidemic and associated large-scale lodgepole pine mortality is affecting overall forest structure, development, and forest carbon storage. Due to the amount of recent dead and dying trees, it is estimated that there would be a decrease in the net ecosystem productivity (NEP) with the no-action alternative. This assumption is based on recent scientific literature on forest carbon storage, which is discussed more in this section.

These stands have been converted from a carbon sink to a carbon source to the atmosphere. Under the no-action alternative, these areas would remain that way until the carbon uptake by new tree regeneration exceeds the emissions from decomposing dead organic material. Barring a large-scale fire, these stands would likely remain a carbon source for several years or longer depending on the amount of dead biomass left on the site, the length of time before new trees become re-established, and their rate of growth once trees start to grow. As new trees become established, the amount of carbon would accumulate rapidly for several decades. The net ecosystem productivity would increase until reaching an intermediate age, then gradually begin declining but remain positive until impacted by future disturbances (Law et al. 2003).

Recent scientific literature confirms some general patterns of forest carbon storage and release over the period of forest stand development and natural or induced disturbances. For large-scale context, our nation's forests have and continue to sequester vast amounts of carbon (nationally they are a net carbon sink, sequestering far more carbon than is released), equivalent to approximately 10 percent of annual carbon dioxide emissions from burning fossil fuels (Heath and Smith 2004; Birdsey et al. 2006).

Law et al. (2003) looked at changes in carbon storage and fluxes for ponderosa pine stands in central Oregon. They evaluated the net ecosystem productivity, which is the balance between being a net carbon source and net carbon storage (referred to as carbon sink). Their evaluation concluded that net ecosystem productivity is lowest and negative (carbon source) in young stands (9 to 23 years), moderate in young stands (56 to 89 years), highest in mature stands (95 to 106 years), and low in old stands (190 to 360 years). Most mature and old stands remained a net sink of carbon.

Pregitzer and Euskirchen (2004) synthesized results from 120 separate studies of carbon pools and carbon fluxes for boreal, temperate, and tropical biomes. They found that in temperate forests, net ecosystem productivity is lowest (more towards source) and most variable in young stands (0 to 30 years), highest (more towards carbon sink) in stands 31 to 70 years, and declines thereafter as stands age. These studies also reveal a general pattern of total carbon stocks declining after disturbance, increasing rapidly during intermediate years, and then declining over time until another significant disturbance (timber harvest or tree mortality resulting from drought, fire, insects, disease or other natural disturbances) kills large numbers of trees and again converts the stands to a carbon source. In this situation, carbon emissions from the decay of dead biomass exceed the amount of carbon removed from the atmosphere by photosynthesis within the stand. Over the long-term (centuries) net carbon storage is often zero if stands regenerate after disturbance because re-growth of trees recovers the carbon lost in the disturbance and in decomposition of trees killed by the disturbance (Kashian et al. 2006).

Because mountain pine beetles kill larger lodgepole pine trees preferentially, these killed trees represented proportionally larger values of carbon stocks (sequestration) and above-ground tree carbon production in killed trees within stands; more and larger trees killed results in greater decreases in carbon sequestration. Stand-level carbon can be recovered to pre-outbreak values in 25 years or less; it takes 50 to160 years to recover to values shown in simulations where stands were not attacked. The size distribution of surviving trees can shorten this timeframe; a greater number of smaller trees store carbon at a greater rate through an amplified growth rate when compared to larger survivors, having a greater capacity to take advantage of increased resource availability (Pfeifer et al. 2010). Successful tree regeneration is a much more critical factor in recovering carbon than stand age class distribution or tree density. As long as post-disturbance lodgepole pine stands support enough trees to have the structural characteristics of forests rather than shrublands, grasslands, or other kinds of non-forest vegetation, they would recover pre-disturbance carbon stocks quickly and the landscape would be resistant to long-term changes in carbon storage (Ryan et al. 2008).

For the short term, onsite carbon stocks may remain higher under the no-action alternative than under the action alternatives. Nevertheless, caution is advised against interpreting carbon inventory maintenance or gains from deferred or foregone timber harvest in any specific forest or stand as affecting atmospheric concentrations of greenhouse gases. This only holds true if harvest does not occur elsewhere in the world to supply the same world demand for timber (Gan and McCarl 2007; Murray 2008; Wear and Murray 2004). The result can be a net carbon impact if the timber is replaced in the marketplace with higher carbon source products such as steel or concrete or is harvested in a manner that does not result in prompt reforestation (Ryan et al. 2010; McKinley et al. 2011; Harmon 2009).

The risk of some high mortality disturbance events is greater under the no-action alternative. The long-term ability of forests to persist as net carbon sinks is uncertain. Drought stress, forest fires, insect outbreaks and other disturbances may substantially reduce existing carbon stock

(Galik and Jackson 2009). Climate change threatens to amplify risks to forest carbon stocks by increasing the frequency, size, and severity of these disturbances (Dale et al. 2001; Barton 2002; Breashears and Allen 2002; Westerling and Bryant 2008; Running 2006; Littell et al. 2009; Boisvenue and Running 2010). Recent research indicates that these risks may be particularly acute for forests of the Northern Rockies (Boisvenue and Running 2010). Increases in the severity of disturbances, combined with projected climatic changes, may limit post-disturbance forest regeneration, shift forests to nonforested vegetation, and possibly convert large areas from an existing carbon sink to a carbon source (Barton 2002; Savage and Mast 2005; Allen 2007; Strom and Fulé 2007; Kurz et al. 2008a; Kurz et al. 2008b; Galik and Jackson 2009). Providing for prompt reforestation after disturbance ensures that forests become sinks again in the future and can speed carbon recovery. The no-action alternative foregoes such climate change adaptation actions.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Precommercial Thinning of Old Harvest Areas

Precommercial thinning would be used to treat naturally regenerated and planted trees in previously harvested stands in 20 units totaling 1,048 acres. Ponderosa pine, Douglas-fir and then lodgepole pine (in order of preference) would be retained to enhance species diversity, thereby improving long-term resiliency of these stands. Trees would be thinned to a 9-foot to 16-foot spacing (500 to 300 trees per acre respectively). Branches would be lopped and scattered.

The objective of the thinning in old harvest units (1960s through 1970s) is to increase growth and improve resiliency by reducing stand density with the proposed treatment (FP p. 43). Current stocking in these areas is quite variable, ranging from 300 to 1,000 trees per acre. The best trees (defined as free-growing and full crowned) would be retained. These old harvest areas are principally lodgepole pine sapling-sized stands, although some units have other conifers, specifically Douglas-fir, ponderosa pine, subalpine fir and Engelmann spruce.

The direct effect would be cutting 0 to 500 trees per acre, retaining about 300 to 500 trees per acre, with an average of about 400 trees per acre. The indirect effect would be to improve growing conditions for the remaining trees, thereby increasing resiliency. FVS modeling has indicated that in 50 years these stands would be mid- to late-seral sized (small sawtimber) stands of trees.

Commercial Thinning Douglas-fir and Ponderosa Pine Stands

The proposed prescription for the commercial thinning of Douglas-fir and ponderosa pine stands is to reduce the current stand densities that average between 90 to 220 square feet of basal area per acre (figure 21) to an initial, post-harvest density that averages between 40 to 60 square feet of basal area per acre (figure 22) over approximately 1,149 acres. Old-growth stands would have a higher basal area retained, and is discussed in more detail below. Basal area is a measurement of stand density, where a given area of trees is described by the cross-section (in square feet) of those trees. Thinning activities would cut the overstory (sawlog-sized) trees up to 20 inches in diameter. No trees greater than 20 inches would be cut. Table E-1 and E-2, in volume 2 appendix E display the attribute summaries of the stands proposed for treatment.

Additionally, the proposed prescription would remove most of the smaller trees (less than 4 inches in diameter), principally through an understory burn after the proposed thinning. Although basal area is the measure used for density in this analysis, the less than 4-inch size trees can account for a high level of tree stocking on an individual stand basis. An example of this is in Unit 59C, where 240 trees per acre with an average diameter of 1 inch account for less than 2 square feet of basal area of the total basal area for the stand.

Figure 21. Dense Douglas-fir in background with scattered large dead trees killed from bark beetles, Unit 20C

Figure 22. Desired condition; widely spaced large trees, 1990s era harvest, Blum Creek area

The proposal would convert dense (high basal area) and multi-storied stands (layering of different aged trees) into open, grown, widely spaced trees. The resultant post-treatment stand structure would be similar to what would have been created with the 20-year interval fire disturbance regime described in the existing condition of this analysis. Treatments that approximate desired conditions create relatively open, large-tree dominated structures primarily composed of seral species (Feidler et al. 2010). Poor growth, high stand densities and the amount of Douglas-fir are correlated to infestation levels of Douglas-fir bark beetle (Fettig et al. 2007). Slow growth and tree competition (with a reduction in tree vigor with increases of stand density) are also correlated to MPB levels in ponderosa pine, with thinning to reduce tree competition and increase individual tree growth potentially being critical for long term prevention of mountain pine beetle outbreaks in ponderosa pine (Fettig et al. 2007).

Post thinning conditions would find widely spaced large trees with smaller trees scarce or occurring as clumps in openings within the tree canopy. Shrubs and forbs would be common, but low growing. Surface fuels would be at 12 to 15 tons per acre. Species composition would favor ponderosa pine, although Douglas-fir is common with other species present such as aspen, lodgepole pine and Engelmann spruce. Aspen clones would be provided adequate growing space where they occur, with conifers less than 20 inches in diameter removed within and adjacent to the clone.

A total of 121 acres of old-growth stands are included in the commercial thinning treatments; these acres would meet minimum criteria for old growth after treatment, consistent with Forest Plan standards (FP p. 44). Old growth is defined using the minimum criteria required in Green

et al., errata corrected 2007 (page 12 of that document, which is Table 3: Eastern Montana Zone Old Growth Type Characteristics). Table 32 that follows discloses the pre- and post- treatment minimum criteria conditions of each proposed unit, and that the post treatment conditions would still meet the criteria of old growth.

Table 32. Inventoried old growth in proposed units with the minimum criteria pre-and post-treatment

Stand	Unit	Total Unit acres	Inventoried Old Growth Acres	Percent of Unit	Old Growth Type	Age[25]		Number of Trees/d.b.h.[26]		Basal Area per acre >5"d.b.h.[27]	
						Pre	Post	Pre	Post	Pre	Post
85202025	6C	14	2	14%	2-DF	211	211	6.7	6.7	120.0	60-80
85202013 85202029	23C	69	36	52%	2-DF 2-DF	230 210	230 210	11.1 5.7	11.1 5.7	116.7 88.0	60-80 60-80
85301060	25C	64	26	41%	1-DF	251	251	4.8	4.8	87.5	60-80
91104009 91104008 91104038	55C	175	57	33%	2-DF 2-DF 2-DF	219 224 205	219 224 205	6.2 6.7 5.6	6.2 6.7 5.6	144.0 140.0 140.0	60-80 60-80 60-80

Post thinning conditions for the old growth stands are as described above, with widely spaced large diameter trees retained at 60 to 80 square feet of basal area with small trees primarily occurring in clumps. Additional younger, mature large trees would be retained to perpetuate large trees on the site (hence, the higher basal area retained over the non-old growth commercial thin units). The old growth structural attributes would change from a multi-storied stand with layers of different sized trees to a single-storied, large-diameter stand with small pockets of seedling to sapling trees. One example of a high amount of understory is in Unit 25C where 150 trees per acre are currently under the large diameter, old growth trees. This understory would be mostly removed with this proposal, converting the multi-story canopy stand to a single-story canopy stand with small pockets of seedling-sapling sized trees.

The desired result of developing resilient old growth conditions through management techniques is to maintain composition and structure that conforms to the Green et al. old growth definition (FP FEIS p. 1052) reversing the trend described in alternative 1 where larger diameter trees succumb to bark beetles, and existing old growth stands may become non-old growth. FVS modeling of stand 85202013 within Unit 23C indicates that without treatment and continued high MPB activity, the stand would fall out of old growth status in 50 years with a reduction of ponderosa pine in the stand. The 50-year-trend (using FVS modeling) for prescribing a thin with the same old growth stand and high MPB activity indicates that the stand would still be old growth in 50 years, and the ponderosa pine component would increase.

The direct effect for the 1,149 acres of commercial thin would be the cutting down of about 50 to 160 square feet of basal area of principally Douglas-fir (with salvage of dead lodgepole in

[25] Age from Green et al for both old growth types is a minimum of 200 years old for the large trees. As the large trees would be retained, the age post treatment would remain the same.

[26] The number of trees per acre are a minimum of 4 >or= to 17"d.b.h.for OG Type 1 and 5 >or= to 19"d.b.h. for OG Type 2 (Green et al. 2007). As the large trees would be retained, the number of trees per acre above the minimum diameter would stay the same.

[27] Minimum basal area for both old growth types in this proposal is 60 square feet (Green et al. 2007).

some units) and removal of most of the smaller diameter understory. The indirect effect would be to improve growing conditions for the remaining trees, thereby increasing resiliency and promoting opportunity for quicker development of old growth stands where the minimum criteria is not met, and perpetuating old growth for the long term where currently there is old growth.

In addition, a direct effect would be the removal of conifer competition to upland aspen clones, which would indirectly improve growing conditions for aspen and creating the opportunity for seedlings to develop into large trees.

The 50-year-trend for the commercial thin non-old-growth stands would be large, open, grown ponderosa pine and Douglas-fir stands that are resilient to inherent disturbance regimes (insects and fire) as is described in the Desired Condition section of this analysis (figure 23). Widely spaced large trees with improved growing conditions for aspen, 1980s-era harvest, Blum Creek area; this is about 25 years on the 50-year desired trajectory for the proposed commercial thin units.). FVS modeling of a commercial thin and prescribed burn (appendix B in the Vegetation Report in the project file) shows that in 50 years there would be widely spaced trees (up to 30+ inches in diameter with basal area ranging from 40 to 100 square feet per acre).

Figure 23. Desired condition after commercial thinning

An increase of ponderosa pine resulting from the proposed treatments is shown with FVS modeling. If the non-old growth stands meet age requirements per Green et al. in 50 years, these stands would be classified as old growth, as FVS modeling indicates they would meet the structural definitions. Mean diameters for these stands would more than double, which means that smaller trees are not common or if present, occur in openings within the tree canopy, and that there are larger diameter trees than without treatment. Shrubs and forbs are common, but are low growing. Species composition favors ponderosa pine, although Douglas-fir is common with other species present such as aspen, lodgepole pine and Engelmann spruce. Aspen clones are provided adequate growing space where they occur, and are a healthy component of these thinned stands in 50 years. Without additional future disturbances that are similar to the natural fire intervals of the past, the stand would revert back to the stand conditions described in the no-action alternative

Forest Plan Wildlife Standard 3 (Forest Plan, p. 48) is met in the Douglas-fir commercial thinning treatments under alternative 2, as no trees (dead or alive) larger than 20 inches diameter would be removed. Forest Plan Wildlife Standard 4 (Forest Plan, p. 48) does not apply to this treatment type. Snag inventories outside of the proposed treatment units were not conducted.

Seed Tree with Reserve Trees in Douglas-fir and Ponderosa Pine Stands

The prescription for the proposed 353 acres of seed tree harvest with reserve trees is to retain ponderosa pine and Douglas-fir seed trees at about 5 to 15 trees per acre. All trees greater than 20 inches d.b.h. would be retained, with additional trees kept to maintain a distribution of seed trees across each unit; preference for retention are ponderosa pine over Douglas-fir leave trees. Ponderosa pine seedlings would be planted after the harvest has been completed. See table E-1 in volume 2 appendix E for an attribute summary of the stands proposed for seed tree harvest.

The seed tree harvest would create an early seral component of ponderosa pine leaving large diameter ponderosa pine and Douglas-fir as seed trees. The seed tree harvest would remove much of the understory; light underburning would remove the remaining ladder fuels not removed with harvest. Collectively, this would reduce stand density to between 20 and 40 square feet of basal area, which would lower the hazard for bark beetles on the remaining ponderosa pine. Not all of these stands are a pure ponderosa pine/Douglas-fir type; some stands contain a component of bark beetle-infected lodgepole pine which would be a salvage component within the seed tree harvest. The final action in these units would be planting ponderosa pine seedlings to increase the pine component over the long term of these units.

Post seed tree harvest conditions would find widely spaced large trees with about 400 ponderosa pine seedlings planted per acre. Shrubs and forbs would be common, but low growing. Surface fuels would be at 12 to 15 tons per acre. Aspen clones would be provided adequate growing space where they occur, with conifers less than 20 inches in diameter removed within and adjacent to the clone. All trees less than sawlog size would be removed and brought to a landing for disposal (either as biomass, firewood, or other product).

The direct effects from seed tree harvest would be cutting of about 0 to 200 square feet of basal area, principally Douglas-fir (with salvage of dead lodgepole pine in some units), with about 20 to 40 basal area retained (5 to 15 trees per acre). An additional direct effect would be a change in species composition to predominately ponderosa pine with some Douglas-fir after the planting has been completed. The indirect effect would be to improve growing conditions for the remaining trees to create optimal growing conditions for the planted ponderosa pine. As well as to remove conifer competition to upland aspen clones, which would indirectly improve growing conditions for aspen and create the opportunity for seedlings to develop into large trees.

The 50-year-trend for the seed tree harvest would be large, open, grown ponderosa pine and Douglas-fir stands that are resilient to inherent disturbance regimes (insects and fire) as is described in the Desired Condition section of this analysis. FVS modeling (appendix B of the Vegetation Report in the project file) shows that in 50 years there would be widely spaced large Douglas-fir and ponderosa pine trees, (over 30 inches in diameter with basal area ranging from 20 to 60 square feet per acre). The planted ponderosa pine would be over 7 inches in diameter and growing vigorously. Shrubs and forbs are common, but are low growing. Species composition in 50 years would be primarily ponderosa pine with some Douglas-fir, aspen and lodgepole pine. Aspen clones are provided adequate growing space where they occur, and are a healthy component of these thinned stands in 50 years.

Forest Plan Wildlife Standard 3 (Forest Plan, p. 48) is met in the seed tree harvest with reserve tree treatments under alternative 2, as no trees (dead or alive) larger than 20 inches diameter would be removed. Forest Plan Wildlife Standard 4 (Forest Plan, p. 48) would also be met

through the retention of the seed trees and reserve trees with this treatment type. Snag inventories outside of the proposed treatment units were not conducted.

Salvage by Clearcut Harvest of Dead and Dying Lodgepole Pine Stands

The proposed prescription for the 1,163 acres of dead and dying lodgepole is to conduct salvage by clearcut harvest of the dead and dying lodgepole pine trees, retaining all other species that occur in the units. See table E-1in volume 2 appendix E for an attribute summary of the stands proposed for salvage by clearcut harvest.

The current mortality sets the stage for the next age class of naturally regenerated lodgepole pine stands throughout the project area. This proposal changes the trajectory described in alternative 1 only for the salvage by clearcut activities on the proposed 1,163 acres, thereby removing what is now a vertical fuel structure that would fall over in 5-15 years (Mitchell and Preisler 1998), resulting in large and variable horizontal fuel accumulation that would be about 40 to 80 tons per acre of 5-inch and larger material, with some areas exceeding 100 tons per acre of material.

This proposed treatment would allow the new stands to develop without the physical barriers created by falling, jack-strawed logs, allowing future management of these stands such as thinning to improve stand health and vigor. This proposed action on 6 percent of the lodgepole pine acres increases the acres in the 0- to 5-inch d.b.h. class. The stand conditions created by salvage harvest are described in the Desired Condition section of this analysis; namely open to moderately dense stands averaging 80 square feet basal area with a range of 60 to 100 square feet basal area, intermixed with Douglas-fir and aspen, with minor amounts of spruce and/or subalpine fir. The harvested acres overtime (50 or more years) would create mid- to late- seral stands of larger diameter trees more quickly as compared to stands without harvest. The remaining 87 percent (all lodgepole pine acres except for the proposed action plus the acres of existing seedling stands) of the lodgepole pine vegetation type would continue on the projected trajectory described in the no-action alternative.

Alternative 2 has 15 units (12 with salvage by clearcut prescription, and 3 with seedtree harvest prescription) that exceed 40 acres (table 33). These units encompass past disturbance patterns, harvest, insect mortality, or fire. The compilation of these stands creates the different structural stages displayed in table 27 of this analysis. The 12 lodgepole pine units exceeding 40 acres are comprised of lodgepole pine stands created by past disturbance, rather than constrained by a certain size, i.e., the 40-acre limitation. Large patch sizes that comprise the units exceeding 40 acres provide the structure and arrangement of lodgepole pine forests that naturally occur in the Flint Foothills project area.

Standard 2 for Timber Management states that regeneration harvest operation shall not exceed 40 acres; harvest area may be larger than 40 acres after public notice, and review and approval by the officer one level above the responsible official. Alternative 2 has 15 units that exceed 40 acres in size (table 33).

The forest stands with past regeneration harvest adjacent the proposed units that exceed 40 acres are fully reforested and are no longer considered openings. The units that exceed 40 acres were designed to encompass past fire and insect disturbance patterns that created a patch mosaic of stands. Large patch sizes that comprise the units that exceed 40 acres provide the structure and arrangement of lodgepole pine forests that naturally occur within landscape that is the Flint Foothills Project area.

Table 33. Salvage by clearcut harvest and seed tree harvest units that exceed 40 acres in size

Unit #	Acres
19S	41
34S	78
35S	50
36S	61
39S	79
46S	79
49S	43
52S	94
58S	49
61S	88
73S	64
74S	74
1ST	102
5ST	47
27ST	139
Average (small, large)	73 (41,139)

This 1970s era clearcut is 53 acres in size, and surrounded by dead and dying mature lodgepole.

Figure 24. Example of an old harvest area (middle ground) in Ballard Hill area greater than 40 acres in size, surrounded by dead and dying lodgepole pine.

The direct effect is salvage by clearcut of all lodgepole pine greater than 5 inches in diameter (not to exceed 20 inches in diameter); these units would be large open areas (average size: 39 acres) with live trees consisting of Douglas-fir with occasional aspen, live lodgepole pine less than 5 inches diameter, and incidental occurrences of other conifer species. Less than 5 percent live canopy coverage would be expected to remain in the units after salvage by clearcut harvest.

The immediate increase in available light created through the salvage by clearcut treatments would stimulate understory vegetation including growth of seedling and sapling Douglas-fir, lodgepole pine, and aspen. The solar heating at ground level would open the lodgepole pine serotinous cones. By salvaging lodgepole pine rather than allowing the dead trees to fall to the forest floor, there would be an increase in the density and growth rate of the new stand thereby shortening the timeframe of establishment and subsequent growth than if these stands were not salvaged (Romme et al. 1986). FACTS[28] database queries show typical third-year stocking levels for stands in this area range from 100 to 300 trees per acre with a minimum stocking level for certification of 200 trees per acre. All stands are expected to be fully stocked within 5 years after completion of harvest units; Forest records indicate 94 percent of harvested stands reaching certification stocked with trees by natural regeneration, with the remaining 6 percent being planted trees to reach full stocking.

[28] The Forest Service Activity Tracking System (FACTS) is an activity tracking system for all levels of the Forest Service. It supports timber sales in conjunction with TIM Contracts and Permits; tracks and monitors NEPA decisions; tracks KV trust fund plans at the timber sale level, reporting at the National level; and, it generates National, Regional, Forest, and/or District Reports.

Old growth is defined using the minimum criteria required for eastern Montana old growth in Green et al. errata corrected 2007 (Forest Plan, p. 44). No proposed salvage by clearcut activities in old-growth or potential old-growth stands would occur. Because no treatment is proposed in old-growth stands, no old growth would be affected by salvage by clearcut harvest treatments.

Informal walk-through surveys were completed in the salvage by clearcut units; however, these surveys did not include snags. Snags were surveyed within 529 acres of stand exams completed in the lodgepole pine vegetation type. Table E-1, E-2 and E-3 in volume 2, appendix E display the results of those exams. Of the 18,142 acres of lodgepole pine type in the project area, an estimated 16,949 acres are pole size or larger (table 31). Virtually all of the lodgepole pine stands have been affected by mountain pine beetle; these dead trees are currently available for snags outside of the proposed treatment units. This proposal would reduce the amount available for snags by 1,163 acres (6 percent of the lodgepole pine type); however, the acres treated would meet the Forest Plan standards for snag retention. Forest Plan Wildlife Standard 3 (Forest Plan, p. 48) is met in the salvage by clearcut treatments under alternative 2, as no trees (dead or alive) larger than 20 inches diameter would be removed. Forest Plan Wildlife Standard 4 (Forest Plan, p. 48) would also be met through the retention of all live conifer trees other than lodgepole pine with this treatment type. Snag inventories outside of the proposed treatment units were not completed.

Over the next 50 years, stand density would be managed with precommercial thinning to perpetuate a more open and relatively evenly spaced stand of lodgepole pine to improve individual tree growth and vigor; reduce crown fire potential; promote younger age class of wind-firm, mountain pine beetle-resistant lodgepole pine; and increase the quantity of longer-lived species such as Douglas-fir and aspen. The 50-year-trend for the salvage by clearcut harvest of dead and dying lodgepole pine would be open to moderately dense lodgepole pine with minor amounts of other tree species in the stands that are resilient to inherent disturbance regimes (insects and fire) as described in the Desired Condition section of this analysis. FVS modeling (appendix B of the Vegetation Report in the project file) shows that in 50 years there would be fast-growing lodgepole pine at moderate densities. Shrubs and forbs would be common, but low growing. Species composition in 50 years would be primarily lodgepole pine with some Douglas-fir, aspen, subalpine fir, and Engelmann spruce.

Most of the lodgepole pine type in the project area would be in a mid-seral-pole size class due to the current mountain pine beetle activity in the project area. FVS modeling has indicated that stands that are not managed would have smaller mean diameters in 50 years than stands that are managed.

Prescribed Burn Mid-elevation Mixed Conifer and Dry Low-Elevation Forests

The proposal is to implement prescribed burning on 1,990 acres of mid-elevation mixed-conifer (lodgepole pine dominated) units and low-elevation dry-forest units. There are 1,259 acres of mid-elevation mixed conifer in three units, and 731 acres of low-elevation Douglas-fir and ponderosa pine stands in five units (table E-4, volume 2, appendix E, lodgepole pine stands.).

Prescribed burning would apply either aerial ignition (for mid-elevation burns) or hand-lighting (both mid-elevation mixed intensity and understory light intensity). Some hand-falling of trees may occur to facilitate burning objectives. Burning would occur when weather and ground conditions are suitable to maintain air quality and burning can be controlled; this timing may be in spring or fall. Ignitions may occur over multiple years.

Dead and dying pine species (lodgepole pine, ponderosa pine and whitebark pine) killed by mountain pine beetles, and ongoing defoliation by spruce budworm to Douglas-fir, set a trajectory of fuel loading (vertical and horizontal) and forest succession to fir species; this trajectory is described in the discussion for alternative 1.

Treatments in low-elevation, dry forests that approximate desired conditions (as described in the Desired Condition section) tend to create relatively open, large-tree dominated structures primarily composed of seral species; these treatments induce ponderosa pine regeneration, reduce tree density and expedite reintroduction of fire (Fiedler et al. 2010). Prescribed burning in low-elevation units with this proposal would return the fire as a disturbance process to the project area, and are designed to be low-intensity with fire ignited over the entire unit, reducing multi-layering understory trees and overall forest density. This action would allow for the ability to improve resiliency, resulting in stands more able to withstand bark beetle mortality and stand-replacing fire (Agee and Skinner 2005; Fettig et al. 2008). The Douglas-fir/ponderosa pine vegetation type in the project area historically experienced fires on frequent intervals, therefore, over time, fire disturbance as a management tool would improve long-term forest resilience; without additional future disturbances that are similar to the natural fire intervals of the past, these forest types would revert back to the conditions described in the no-action alternative.

The direct result from low-elevation prescribed fires would be burning grass, herb and shrub understory communities, along with killing seedling and sapling sized conifers in the understory. A few overstory trees (less than 5 percent) may also be killed from the understory burning. Spring burning would be more of an impact to the overstory trees, as the tree buds would be more susceptible to heat. Fall burning would be less of an impact as the tree buds would be hardened, and more able to withstand heat generated from burning. The indirect effect of low-elevation prescribed burning would be a regrowth of senesced grass, herb and shrub understory communities, increased vigor for remaining conifers, and natural regeneration of ponderosa pine. FVS modeling (appendix B of the Vegetation Report in the project file) indicates that in 50 years, understory burning would result in less-dense stands with larger mean diameters, and more ponderosa pine where it is present than compared to stands that had no burning.

Burning in spring would allow much more control over the spread of fire through ground vegetation. The fire effects from heat to conifers in a spring time burn would be greater, as conifers are more susceptible at that time due to their growing buds. Conifer buds harden in the fall, so trees would be less susceptible with a fall burn, but fire spread over the ground vegetation would be more difficult to control.

Although whitebark pine as a vegetation type is a small percentage (1.5 percent) of the project area, and is not the objective of proposed treatments, there may be an effect to whitebark pine with the mid-elevation burning. Whitebark pine is known to occur in all of the mid-elevation units (Unit 3B, 4B, and 5B). Potential effects would be to individual whitebark pine trees scattered in the proposed units, although the majority of the acres delineated are below the elevation of the more common occurrence of whitebark pine in the project area. Burning effects might include individual tree mortality. The felling of conifers prior to burning would avoid areas of units that have concentrations of whitebark pine. Additionally, ignition patterns would avoid the use of fire directly in areas of units that have concentrations of whitebark pine. Conducting the prescribed burn during spring conditions controls fire spread. The potential

effects to whitebark pine could be greater with fall burning, as fire spread with ground vegetation would be more difficult to control.

The direct effect of burning mid-elevation mixed-conifer (lodgepole dominated) stands would be killing overstory and understory conifers in a patch mosaic across the proposed unit. The fire would directly consume a portion of the existing vertical and horizontal fuel, some of which has been created by mountain pine beetles in the project area. Another direct effect would be limited burning in the grass, herb and shrub understory communities; the amount is limited due to spring burning conditions. Fall burning would directly affect more understory vegetation communities, providing more opportunity to rejuvenate these ground-cover species.

The indirect effect of mid-elevation prescribed burning in mixed conifer stands would be a regrowth of senesced grass, herb and shrub understory communities and natural regeneration of lodgepole pine and some whitebark pine.

Forest Carbon Cycling and Storage

The treatments in alternative 2 would reduce on-site carbon sources by removing the dead and dying lodgepole component that would release stored carbon during decomposition. Forested environments over time are renewable carbon sinks. Removing dead trees, allows overall carbon sequestration to increase more rapidly in the treated stands, when compared to the no-action alternative, by increasing the health and vigor of the remaining trees and understory vegetation, and by promoting regeneration of seedlings for the next stand. In general, such management actions as those proposed in the project could improve the resilience of forests to climate-induced increases in frequency and intensity of disturbances such as fire and insect and disease epidemics. Utilizing harvested trees for long-lasting forest products and renewable energy sources may help sustain the current strength of the carbon sink in U.S. Forests (Birdsey et al. 2006 and 2007).

In the short term, the proposed activities would release some of the carbon currently stored through the harvest of live and dead trees (USEPA 2010; Depro et al. 2008). Motorized equipment used during any of the proposed activities would emit greenhouse gasses. For the short term, on-site carbon stocks would be lower under the action alternatives than under the no-action alternative. Actions such as the proposed intermediate harvests may, in some cases, increase long-term carbon storage (Finkral and Evans 2008; North et al. 2009; Mitchell et al. 2009) but current research in this field shows highly variable and situational results (Mitchell et al. 2009; Reinhardt and Holsinger 2010; Ryan et al. 2010; McKinley et al. 2011). See also the discussion of forest carbon cycling and storage under the Affected Environment – Existing Conditions section.

The lodgepole pine stands recently killed by mountain pine beetle are estimated to be functioning as a net carbon source to the atmosphere. Removal of dead wood would reduce on-site carbon stores. The portion removed as wood products may partially delay carbon release relative to on-site decay rates. These stands would continue to emit more carbon than they absorb and would

Guidance on Consideration of Climate Change in Project-related NEPA

Forest Service Guidance – The Forest Service has prepared agency guidance on "Climate Change Considerations in Project Level NEPA Analysis" (http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf). In general, that guidance recognizes that while some actions may warrant qualitative or even quantitative analysis of the effects of an action on climate change, some actions are at such a minor scale that the effects would be meaningless to a reasoned decision. The 9th Circuit Court of Appeals recently agreed with that reasoning, finding that a project of similar scope as that proposed here did not warrant detailed analysis of the projects potential impacts on climate change (Hapner v. Tidwell, No. 09-35896 (9th Cir. 2010)).

Other Contextual Considerations – The top three anthropogenic (human-caused) contributors to greenhouse gas emissions (from 1970-2004) are: fossil fuel combustion, deforestation, and agriculture (IPCC 2007, p. 36). Land use change, primarily the conversion of forests to other land uses (deforestation), is the second leading source of human-caused greenhouse gas emissions globally (Denman et al. 2007, p. 512). Loss of tropical forests of South America, Africa, and Southeast Asia is the largest source of land-use change emissions (Denman et al. 2007, p. 518; Houghton 2005). This proposal does not fall within any of these primary contributors of global greenhouse gas emissions nor is it similar to the primary human activities exerting negative pressure on the carbon sink that currently exists in US forests. The affected forests will remain forests, not converted to other land uses, and long-term forest services and benefits will be maintained.

Additional discussion on considering climate change in projects is provided in the Vegetation report in the project file.

remain net carbon sources until trees that sequester additional carbon are well established. Monitored regeneration would help ensure these forest stands return to a carbon sink function as quickly as possible. As the stands continue to develop, the strength of the carbon sink would increase until peaking at an intermediate age and then gradually decline but remain positive (Pregitzer and Euskirchen 2004). Carbon stocks would continue to accumulate as the stands mature, although at a declining rate, until impacted by future disturbances.

To the extent the proposed actions reduce the risk or delay the event of future stand-replacing disturbance events, potential emissions from those events are equally reduced or forestalled. The vegetation treatments are designed to enhance forest resiliency to disturbances such as wildfire and insect outbreaks.

Sustaining forest productivity and other multiple-use goods and services requires that land managers balance multiple objectives. The long-term ability of forests to sequester carbon depends in part on their resilience to multiple stresses, including increasing probability of drought stress, high severity fires, and large scale insect outbreaks associated with projected potential climate change. Management actions (such as those proposed with this project) that maintain the vigor and long-term productivity of forests and reduce the likelihood of high severity fires and insect outbreaks can maintain the capacity of the forest to sequester carbon in the long-term. Thus, even though some management actions may in the near-term reduce total carbon stored below current levels, in the long-term they maintain the overall capacity of these stands to sequester carbon while also contributing other multiple-use goods and services (Reinhardt and Holsinger 2010).

Alternative 3

Direct and Indirect Effects

The direct and indirect effects would be the same for alternative 3 as discussed in alternative 2, with the following exceptions:

Commercial Thin Douglas-Fir and Ponderosa Pine Stands

The 483 fewer acres of commercial thinning in alternative 3 would see those acres develop on the trajectory described in alternative 1. The noteworthy difference in indirect effects is dropping old growth treatments; meaning, the 121 acres of tree density reduction where old growth is retained that would take place in alternative 2 would not take place in alternative 3. Dropping these treatment acres in alternative 3 would result in a likely conversion out of old growth status in the next 50 years. The 50-year-trend as indicated with FVS modeling of stand 85202013 within Unit 23C (in alternative 2) indicates that without treatment and continued high MPB activity, the stand would fall out of old growth status within 50 years with a reduction of ponderosa pine in the stand. The 50-year-trend (using FVS modeling) for prescribing a thin with the same old-growth stand and high MPB activity indicates that the stand would still be old growth in 50 years, and the ponderosa pine component would increase.

Salvage by Clearcut Harvest of Dead and Dying Lodgepole Pine Stands

The 141 fewer acres of salvage by clearcut harvest would see those acres develop on the trajectory described in alternative 1. The ability to manage those acres to maintain stand densities in the future, as described in the Desired Condition section of this analysis, would not take place. The potential to create mid- to late- seral stands of large diameter more quickly (as compared to stands without harvest) would not take place. The 141 acres would join the

remaining 87 percent of the lodgepole pine vegetation type on the projected trajectory described in the no-action alternative.

One of the units that exceeds 40 acres in size (36S) proposed with alternative 2 is dropped in alternative 3. Table 34 that follows displays all of the units in alternative 3 that exceed 40 acres in size. As in alternative 2, units that exceed 40 acres in alternative 3 were designed to encompass past fire and insect disturbance patterns that created a patch mosaic of stands. Large patch sizes that comprise the units that exceed 40 acres provide the structure and arrangement of lodgepole pine forests that naturally occur within the landscape that is the Flint Foothills Project area. The forest stands with past regeneration harvest adjacent to the proposed units that exceed 40 acres are fully reforested and are no longer considered openings.

Table 34. Salvage by clearcut harvest and seed tree harvest units that exceed 40 acres in size for alternative 3

Alternative 3							
Unit	**Acres**	**Unit**	**Acres**	**Unit**	**Acres**	**Unit**	**Acres**
19S	41	46S	79	61S	88	1ST	102
34S	78	49S	43	73S	64	5ST	47
35S	50	52S	94	74S	74	27ST	139
39S	79	58S	49				

Alternatives 2 and 3 Cumulative Effects

Cumulative Effects from Past, Present and Reasonably Foreseeable Future Actions

Table 24 at the beginning of chapter 3 discloses the present and reasonably foreseeable actions within the project area that are relevant to this DEIS analysis. In general, there would be no apparent cumulative effects on the project area vegetation from the sum total of past, present, and reasonably foreseeable actions when cumulatively added to either of the action alternatives. This is partly due to the small number of acres proposed for vegetative treatments (5,703 acres in alternative 2 or 13 percent of the project area; and 5,079 acres in alternative 3 or 11 percent of the project area) relative to the size of the analysis area (44,522 acres) and the type of activities proposed with known direct, indirect and cumulative effects within the project area. Over time, the types of activities that are proposed would recover the area (vegetation regrowth), which is currently observed in the project area from past harvest and prescribed burn activities.

Table 35. Measurement indicators (acres) compared by alternative for the old-growth issue

Measure	Alternative 1	Alternative 2	Alternative 3
Acres of lodgepole pine regenerated	0 acres	1,163 acres	1,022 acres
Acres of basal area reduction and growing conditions improved with thinning of Douglas –fir /ponderosa pine stand	0 acres	1,128 acres	666 acres
Acres of basal area reduction, growing conditions improved, and type change of old growth	0 acres	121 acres	0 acres

Measure	Alternative 1	Alternative 2	Alternative 3
from multi-story to single story			
Acres of Douglas-fir/ponderosa pine regenerated	0 acres	353 acres	353 acres
Acres of basal area reduction and growing conditions improved with low-intensity prescribed burning of low-elevation Douglas-fir and ponderosa pine stands	0 acres	731 acres	731 acres
Acres of lodgepole pine regenerated through prescribed burning in mid- to high-elevation lodgepole pine stands	0 acres	1,259 acres	1,259 acres
Growing conditions in young stands improved by reducing stand density in past timber harvest areas	0 acres	1,048 acres	1,048acres

Compliance with Forest Plan and other Relevant Laws, Regulations, Policies and Plans

Forest Service Guidelines

The Flint Foothill project is consistent with the Forest Service Manual and Handbook direction outlined in this analysis.

Forest Plan Consistency

The Flint Foothill project is consistent with the Forest Plan management area direction, and also is designed to meet vegetation goals and objectives within the plan

Air Quality

Introduction

Prescribed burning is subject to air quality standards by following federal and state regulations along with policies that focus on maintaining air quality standards through the management and control of emissions generated by human-caused activity. To help ensure that the Forest Plan and clean air goals are met, fire management practices that minimize emissions and impacts of smoke from prescribed burning must be considered.

Overview of Issues Addressed

Pile and under burning would occur 1) in landing areas and in the understory of commercial thin and seed tree units, and 2) in approximately 1,990 acres associated with prescribed burn units. Effects from prescribed burning in the project area may impact air quality in local Montana airsheds. Visibility in three nearby federally designated Class I areas (wilderness) could also be affected.

Affected Environment

Existing Condition

Airsheds

The Flint Foothills project area is located on the northern edge of Montana Airshed 5 (Upper Clark Fork) and adjacent to the southern edge of Montana Airshed 3B. The three nearest Class I areas are within approximately 62 miles of the project boundaries and are listed in table 36.

Table 36. Federal Class I areas within 62 miles of the Flint Foothills project area

Class I Area	Elevation (feet)	Distance (miles)	Direction
Anaconda-Pintler Wilderness	5,100 – 10,793 (avg.= 7,947)	27	S
Gates of the Mountains Wilderness	3,750 – 7,980 (avg.= 5,865)	35	NE
Scapegoat Wilderness	5,000 – 9,400 (avg.= 7,200)	41	N

The area surrounding the city of Butte is classified by MT-DEQ as a state non-attainment area[29] for PM_{10} (MT-DEQ 2008) and is the only non-attainment area for particulate matter within 100 kilometers of the Flint Foothills project area. The northern boundary of this non-attainment area is approximately 28 miles southeast from the southern-most boundary of the Flint Foothills project area.

Climate

Climate is characterized in terms of precipitation, temperature, and wind regimes. Although the action alternative would not affect the regional climate, aspects of the climate could influence timing or extent of project activities. Precipitation, temperature, or wind extremes can exacerbate the effects of past, present, and future fires. Fire is more common in the summer months where higher temperatures, higher winds, and lower relative humidity result in increased surface evaporation and drier fuels, making densely wooded areas more susceptible to wildfires or human-caused fires. Also, thunderstorm activity in the summer months increases the likelihood of lightning strikes, which can spark wildfires. Higher winds can cause fires to spread further, faster, and with increased intensity.

In Montana, the Continental Divide influences the climate of adjacent areas. West of the Divide, which is where the Flint Foothills project is location, the climate is a modified north Pacific coast type. On the west of the mountain barrier, winters are milder, precipitation is more evenly distributed throughout the year, summers are cooler, and winds are lighter than on the eastern side. The air quality report in the project file displays wind speed data for the Montana 5 airshed. In the west, there is more cloudiness in all seasons, humidity is slightly higher, and the growing season is shorter than in the eastern plains areas.

[29] A community that does not meet or attain the NAAQS may be designated as a non-attainment area by EPA for federal air quality standards or by the state for state air quality standards. The state must then develop an Emissions Control Plan as part of its SIP to improve the air quality and bring the area back into attainment. Management and restriction of prescribed fire emissions may be included in the control plan. The city of Butte has been identified as a Montana PM_{10} non-attainment area (MT-DEQ 2008).

Desired Condition

Forest Plan – Protection of Air Quality

The Forest Plan establishes guidance for all resource management activities on the forest property. The air quality in the vicinity of a fire can be severely impacted from the pollutants within the smoke which is comprised mainly of small particulates. Because smoke is readily transported by the wind, it can also impact air quality at distances downwind of a fire.

With regard to air quality, the Forest Plan has set the following goals, objectives, and standards:

- **Goals:**
  - Air Quality: Air quality is maintained within the standards set by federal and state agencies and by the Montana/Idaho Airshed Group's Memorandum of Agreement and State Implementation Plan.
  - Smoke Management: A variety of management tools (including prescribed fire and appropriate management response) are used to help manage vegetation to reduce potential smoke.
- **Standards:**
  - Standard 1: Meet smoke management requirements according to the Montana/Idaho Airshed Group Operating Guide (MIAG 2008).

Regulatory Framework – Protection of Air Quality

Clean air regulations, laws, policies, and programs that affect the action alternatives are listed below. Additional details are provided in the air quality report in the project file.

- **The Clean Air Act (CAA)** – The U.S. Congress passed the CAA in 1970 and two amendments in 1977 and 1990 (USEPA 1990). The CAA was enacted to protect and improve air quality while ensuring the protection of public health and welfare. It established National Ambient Air Quality Standards (NAAQS) as one measure to define acceptable air quality. The CAA sets the framework under which industries and government agencies, including the Forest Service, are to operate in order to maintain these standards. Each state is given primary responsibility for management of their air quality through State Implementation Plans (SIPs) defined by the entire collection of programs, policies and rules that the state's agencies use to attain and maintain the NAAQS. Through the SIPs, states develop air permitting and air pollution control programs that are as strict, if not more, than those identified in the CAA. The programs address industrial emissions, automobile emissions, outdoor burning, road dust, and similar sources of air pollution. The Montana Department of Environmental Quality (MT-DEQ) is the state agency responsibility for developing and enforcing the SIP. N
- **Non-Attainment Areas –General Conformity Provisions of the CAA** – The general conformity provisions in Section 176(c) of the CAA prohibit federal agencies from taking any action within a non-attainment area (for NAAQS) that causes or contributes to a new violation of the standards, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard. Federal agencies are also required to ensure their actions conform to applicable SIPs. Since the Flint Foothills project is not located within the city of Butte non-attainment area, it is not subject to the general conformity provisions.

In addition to the requirements established under the CAA and Montana's SIP, there are several policies, planning groups, and monitoring programs that must be considered with regard to air quality issues associated with prescribed fires, as follows:

- **Interim Air Quality Policy on Wildland and Prescribed Fires** – The EPA (1998) issued this policy to balance the use of managed wildland fires and prescribed fires with protection of public health and welfare. It has two public policy goals: (1) to allow fire to function in its natural role in maintaining healthy wildland ecosystems, and (2) to protect public health and welfare by mitigating the impacts of air pollutant emissions on air quality and visibility.
- **Montana/Idaho Airshed Group Smoke Management Program** – In 1978, federal, state, and local government agencies, and the forest products industry formed the Montana State Airshed Group for the purpose of managing and limiting the impacts of smoke generated from necessary prescribed burning. Agencies and companies from Idaho joined this group in 1990 and 1999 to collaboratively form the Montana/Idaho Airshed Group. This group operates under a smoke management program to minimize or prevent smoke impacts while using fire to accomplish land management objectives. Airshed Group members coordinate all prescribed burning activities through the Smoke Monitoring Unit (SMU) located in Missoula, Montana. The Departments of Environmental Quality for both Idaho and Montana have certified to the EPA that the Montana/Idaho Airshed Group smoke management program meets EPA's definition of a basic smoke management program. Since the Forest Service is a member of this Airshed Group, all prescribed burning within the Flint Foothills project area will comply with the smoke management program.
- **Airshed Monitoring** – As part of the smoke management program, the Montana/Idaho State Airshed Group has established a smoke monitoring system that provides air quality predictions, air dispersion forecasts, and burn recommendations and restrictions to its members. The Flint Foothills project area is located on the northern edge of Montana Airshed 5 (Upper Clark Fork) and adjacent to the southern edge of Montana Airshed 3B.
- **Smoke Impact Zones** – The MT-DEQ has further defined a number of Smoke Impact Zones around areas that are either not meeting or close to not meeting ambient air quality standards for particulate matter (MT-DEQ, 2008). These impact zones were established so that regulators may monitor open burning activities more closely in and near these areas.

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Since no prescribed burning activities would be implemented, there would be no effects.

Alternatives 2 and 3

Direct, Indirect and Cumulative Effects

The Clean Air Act and local policies require that Forest Service actions have "no adverse effect" on air resources affecting human populations by not exceeding the NAAQS and not degrading the air quality requirements for Class I areas. Smoke from prescribed fires is unlikely to impact the Butte non-attainment area because the Montana/Idaho Airshed Group would restrict burning during periods when dispersion would transport smoke toward this area.

All prescribed burning activity would be coordinated and conducted through the Montana/Idaho Airshed Group smoke management program to ensure that impacts to air quality would be minimized. This program minimizes impacts to air quality by allowing prescribed burning to occur only during favorable weather, moisture, and air quality conditions. The Montana/Idaho Airshed Group has established an air quality Monitoring Unit that provides daily air quality predictions and restrictions to its members from March 1 to November 30.The practices established by the Airshed Group are considered Best Available Control Technology by the Department of Environmental Quality. The Bureau of Land Management and the Forest Service are permitted to burn based on compliance with burning restrictions set by the Airshed Group and compliance of all other Federal and State laws and regulations.

Compliance with Forest Plan and other Relevant Laws, Regulations, Policies and Plans

All alternatives would be consistent with the Forest Plan and all clean air regulations, laws, policies, and programs identified above.

Transportation

Introduction

This section analyzes the impact of implementing the proposed activities on transportation resources. The analysis area for transportation includes all National Forest System (NFS) lands within the project area, as well as travel routes outside NFS lands that provide access to the project area.

Overview of Issues Addressed

This analysis focuses on the project engineering concerns including road treatments to accomplish proposed vegetation treatments as well as maintenance and reconstruction treatments to improve facilities and reduce negative resource impacts related to the Forest transportation system. Through the public scoping process, the potential for sediment delivery and the spread of invasive plants from temporary road construction was identified as an issue. Road engineering, including new road construction and temporary road construction will be discussed in detail in this analysis.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

- Work descriptions and mileage summaries for road treatments associated with accomplishing timber treatments, including a breakdown of proposed new road construction and temporary road actions.

Affected Environment

Existing Condition

Transportation Network

The analysis area contains a diverse network of NFS and nonsystem roads and trails. There are currently over 204 miles of existing roads inventoried within the analysis area. While the

majority is managed by the Forest Service as NFS roads, there are also county and private roads as well as unauthorized roads inventoried in the project area (figure 3). There are over 7 miles of NFS trails managed in the project area; additional information on project area trails can be found in the Recreation Resource Report. Table 37 displays the route categories and associated mileage. The current road density within the project area is 2.94 miles/square mile.

Table 37. Existing roads by category in the analysis area

Route Categories	Miles
National Forest System	166.0
County	1.3
Other federal agency	1.5
Private	5.2
Forest Service unauthorized	30.3
Total Roads	**204.3**

There is an additional 26.9 miles of roads outside the project area that provide access from Interstate 90 and Montana State Highway 1 to the Flint Foothills Project area. These routes outside the project area are under various jurisdictions, including Granite County, Powell County, and Forest Service. Figure 3 in chapter 2 displays existing roads accessing the Flint Foothills project area.

Access to the Project Area

Public road access to the southwest portion of the project area is the Finley Basin Road (Forest Road 676). This road is managed jointly by the Granite County and the Forest Service. The road starts at State Highway 1 with a paved surface (near Maxville), which then transitions to aggregate surface and then native surface before intersecting with NFS Road 1500. This Eureka Ridge Road (NFS Road 1500) climbs and accesses the SW portion of the project area.

The west side of the project area is accessed by two roads that connect with State Highway 1: the Gird Creek Road (NFS Road 8402) and the Granite County managed Douglas Creek Road. The Gird Creek Road, aggregate-surfaced from Hwy 1 and transitioning to native-surfaced after 1.6 miles, accesses the western-most project area and also connects with Forest Road 8454 (East Gird Creek). Aggregate-surfaced Forest Road 8454 passes through private land and jurisdiction for 1.7 miles before entering NFS lands and becoming native-surfaced NFS Road 8454.

The northeast portion of the project area is accessed via the Gold Creek drainage from Interstate 90. Powell County managed and aggregate-surfaced Gold Creek and Mullan Trail Roads provide access to Forest Road 636 (also Gold Creek), which is also managed by Powell County for the first 2.5 miles. Native-surfaced Forest Road 636 enters the project area and provides access to NFS Road 1557 (Jackson Park Road), which accesses a network of roads in the northern portion of the project. Forest Road 636 transitions to Forest Service jurisdiction and becomes NFS Road 636, which accesses the eastern and southern portions of the project area. Figure 3 in chapter 2 indicates the haul routes outside of the project area, and figure 5 and figure 7 in chapter 2 displays haul routes proposed by alternatives 2 and 3 respectively.

The BDNF North Visitor Map (2010) and the BDNF Addendum to Travel Route Restrictions-North Map are available through the USFS and provide additional information for roads and trails.

Flood Damage

Due to high precipitation and runoff in the winter of 2010-2011and the following spring, there are a number of flood damage sites that currently affect access to the project area. Five sites located on project roads include: Upper and Lower Douglas Creek washouts (both on NFS Road 707), lower Gird Creek (NFS Road 8402), Upper Gird Creek (NFS Road 666), and a fill failure or slump on NFS Road 1544. These sites have resulted in public road closures and blocked access to some portions of the project area. The Forest Service is currently working on repair plans to the Upper and Lower Douglas Creek washouts (NFS road 707), and lower Gird Creek (NFS road 8402), outside of the Flint Foothills project.

Desired Condition

Forest Plan

The following direction and desired condition components (forestwide desired condition, goals, objectives, and standards) come from the Beaverhead-Deerlodge Forest Plan (USDA Forest Service 2009a).

Desired forestwide conditions include:

- People and communities benefit from programs and infrastructure that support livestock grazing and an array of forest products and services. Methods for using resources to benefit people while maintaining functioning ecosystems are employed.
- Visitors benefit from a range of primitive to developed recreation settings and opportunities. Most of the BDNF continues to offer uncrowded motorized and nonmotorized backcountry opportunities, and
- Resources adversely affected by past management activities have been rehabilitated or the related public health and safety issues corrected.

Goals of the Forest Plan for infrastructure include:

- The minimum transportation system necessary is identified and managed.
- Roads and trails are identified in the transportation atlas maintained at the Forest Supervisor's Office.
- Roads and trails are constructed, managed, and maintained to meet land and resource objectives.

Goals of the Forest Plan for recreation and travel management include:

- A system of routes and areas designated for nonmotorized and motorized use are identified and available for public use.

Standards of the Forest Plan for recreation and travel management include:

- Permanent road construction is not allowed in summer nonmotorized allocations or in areas evaluated for wilderness potential.

- Motorized vehicles are not allowed in summer or winter nonmotorized allocations except for permitted or administrative use.
- Restrict year-round, wheeled motorized travel to designated routes or areas

Other Direction

The Pintler Ranger District also completed a preliminary transportation (travel) analysis in 2008, which included the Flint Foothills project area (USDA Forest Service 2008). This analysis assessed inventoried routes within the analysis area based on resource risks and values. Ultimately, changes to current travel management direction were recommended to better manage the Forest transportation system. These recommended changes were site specific, route by route, and included: Adding routes to the Forest transportation system, decommissioning unneeded routes, closing and storing roads for future use, converting roads to trails, and mitigating resource concerns through road maintenance and reconstruction. Relevant components of the 2008 analysis that affect road use for the Flint Foothills project have been incorporated into the analysis.

Last of all, road management activities in accordance with Best Management Practices (BMPs) are a preferred way to protect water quality (Logan 2001).

Environmental Consequences

Methodology

Transportation in the project area is largely road dependent. Therefore, methods to assess impacts of the alternatives on transportation resources in the project area involved analysis of impacts to these facilities. Forest Service Geographic Information System (GIS) data were used to compute indicators such as miles of existing, new and temporary roads to be used as haul routes, and miles of road decommissioning. In addition, field data from engineering road condition surveys were used to identify the conditions of roads within the project area, as well as to prescribe work items and estimate costs. The overall effect of road changes on transportation in the project area is also qualitatively discussed.

Assumptions and Limitations

The GIS data used to compute mileages generally do not correspond precisely (to the nearest hundredth of a mile) with the engineering surveys, which utilized vehicle-measured mileages for field reports. However, intersections and other landmarks were adequately noted in the field data, which allowed for confident spatial analysis involving particular route segments.

Incomplete and Unavailable Information

The best available information was used to analyze impacts to transportation resources for the effects analysis. However, some information was incomplete and unavailable due to the ongoing planning of timber activities. Approximately 80 percent of the proposed project roads received engineering surveys, and this data was used to extrapolate work and costs for the other 20 percent. In addition, within the timber treatment units, harvest activities and associated roadwork would be expected to be completed within 5 years following initiation of contracts. However, the exact dates, sequence and schedule of timber operations is unknown at this time.

Spatial and Temporal Context for Effects Analysis

The spatial scale of the impact analysis is the project area plus the inventoried travel corridors connecting the project area with Interstate 90 and State Highway 1. The short-term timeframe used for this analysis is 0 to 10 years and the long-term effects are those that last beyond 10 years. The short-term period was selected to cover harvest activities. It is anticipated that the effects of the proposed project would be visible from 1 to 40 years, depending on the extent and visibility of the proposed treatments and the details of the actual project implementation.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Historic and ongoing land use activities continue to affect the project area and have the potential to affect the cumulative effects analysis for transportation resources.

Past and Present Actions

A number of past and present actions have occurred or are occurring in the assessment area that affect transportation resources including: mining, livestock grazing, noxious weed control, use and maintenance of forest roads and trails, firewood cutting, timber harvest, wildfire and fire management and suppression activities and other land management decisions.

Timber harvest has been a relatively common occurrence within the project area. With the high mortality from the mountain pine beetle, additional danger (hazard) tree removal has been and continues to occur along roads and in developed recreation sites.

Danger tree removal within the project is being conducted in accordance with the Decision Memo for Forest-Wide Developed Site Hazard Tree Removal within the BDNF (USDA Forest Service 2009c).

Reasonably Foreseeable Future Activities

Table 24 at the beginning of chapter 3 discloses the present and reasonably foreseeable actions within the project area that are relevant to this DEIS analysis. Reasonably foreseeable future activities that have the potential for effects to transportation resources are generally the same as the past and present actions discussed above and include mining, livestock grazing, noxious weed control, wildfire, fire suppression activities, and additional road and trail use, maintenance, construction and restoration.

Continued danger tree removal along roads and at developed sites is a likely foreseeable activity as trees continue to be stressed and die.

Flood damage repairs to locations on NFS Road 707 (2 sites), and 8402 (discussed in the existing condition section) is anticipated in the next 3 years.

Stream rehabilitation is being planned for the Douglas Creek watershed, including replacement of six stream crossings as well as reconstruction of 400 feet of stream adjacent to NFS Road 707.

Another planned activity will be the Motor Vehicle Use Mapping (MVUM) effort as part of the travel planning and motor vehicle route and area designation process.

Alternative 1 – No Action

Direct and Indirect Effects

There would be no direct or indirect effects to the transportation system from the Flint Foothills Project because no project activities are proposed.

Dead and dying trees impacted from the mountain pine beetle would remain and continue to fall and break, creating potential safety issues as people travel and recreate in the area. Basic annual road maintenance would continue, although likely at a less efficient rate due to dead and dying trees that continue to fall across routes, potentially blocking access. Transportation efficiency to and through the project area would likely decrease.

Road drainage improvements associated with vegetation treatment access and product removal in compliance with BMPs would not occur in the project area.

There would be no change in the number of miles of open roads.

Cumulative Effects

Danger tree management (hazard tree removal) has occurred in the past and may continue in the future both along roads and in developed recreation sites, but comprehensive vegetation management would not occur and merchantable timber would not be salvaged. Basic annual maintenance of roads and trails would continue as funding allows. Many of these routes currently receive little maintenance, due to limited funds and backlogged maintenance. This trend would likely continue and impact future use.

Completion of the flood damage repairs for roadway failure locations on NFS Roads 1544, 666, 707 (two sites), and 8402; and the Douglas Creek stream crossing replacements and associated stream reconstruction would provide site-specific improvements to the transportation system.

Under this alternative there would be a potential threat to transportation infrastructure over time from tree blow downs, though danger tree management could occur under smaller, separate project plans and decisions.

Under this alternative, while storm damage road repairs and previously planned projects in Douglas Creek would occur, overall the project area would not move towards the desired future condition described in the Forest Plan (USDA Forest Service 2009a, pages 11-62). The anticipated Route and Area Designation Process and production of a motor vehicle use map (MVUM) for the area would still occur.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Under alternative 2 both existing roads and newly constructed roads--- temporary and permanent system roads-- would be used to transport logs and forest products from the treatment units to main arterial roads (State Highway 1 and Interstate 90) outside the USFS boundary. Figure 5 in chapter 2 shows the location of alternative 2 proposed transportation activities. A complete list of route segments and associated actions by alternative is included in appendix B of the Transportation Report in the project file.

Road maintenance and reconstruction activities on existing roads would bring the roads to a standard complying with BMPs and also allow for safe product removal. Just over 1 mile of unauthorized roads would be added to the Forest transportation system following reconstruction, and would be managed as maintenance level 2 roads (high clearance vehicles recommended). After vegetation treatments, 4.4 miles of other reconstructed existing temporary roads (unauthorized routes) would be decommissioned; these treatments are further outlined in table 6. A 0.6-mile reduction of roads open to motor vehicle use would result in the project area following treatments, and a total reduction of 3.1 miles of road would occur.

Nearly 1.3 miles of new road would be added to the Forest transportation system as NFS road, and would be put into storage (maintenance level 1) for future access following implementation of the Flint Foothills project. These maintenance level 1 roads would be closed to motor vehicle use during the time they are in storage. The 7.2 miles of newly constructed temporary road would be decommissioned by obliteration following implementation.

The new temporary roads, in particular temporary road T3 (due to proximity to an ephemeral draw in unit 55C), would be constructed away from the bottom of channels to avoid sedimentation. Where feasible, the roads would be constructed at least 50 feet from the bottom of draws, and a culvert or other means for stream crossing would be provided for areas where it is necessary to cross the draws. Natural vegetation filters or slash filter windrows, or suitable alternatives, would be utilized where the roadway drainage is directed towards the draws.

Implementing the associated transportation actions in this project would bring management of the Forest transportation system closer to the identified minimum system identified in the Pintler travel analysis. Road maintenance and reconstruction associated with timber haul, in addition to the removal of dead and dying trees, would provide for much needed maintenance and also a safer and more efficient transportation system, allowing for additional mileage to be maintained with future annual maintenance funds. NFS haul routes would be improved to comply with BMPs.

The road density within the project area after project implementation would be 2.89 miles/square mile.

Timber harvesting and associated transportation activities would be expected to occur within 5 years from the start of the timber contract(s).

Road use authorizations would need to be obtained for Forest Service, or Forest Service contractor, use of private routes. Use and maintenance should also be coordinated with the Powell and Granite County Public Works Departments for public county roads used to implement the timber and restoration treatments.

Appendix C of the Transportation Report in the project file provides a breakdown of road work items and estimated costs by alternative.

Cumulative Effects

Alternative 2 would contribute to cumulative effects to the transportation system by constructing, reconstructing, maintaining, and decommissioning roads within the project area.

Flood damage to roadway failure locations on NFS Road 707 (2 sites), and 8402 is anticipated in the next 3 years.

In the Douglas Creek Watershed, six stream crossings would be replaced, as well as reconstruction of 400 feet of stream adjacent to NFS Road 707.

The Route and Area Designation Process and production of a motor vehicle use map (MVUM) for the area would also occur. Travel management direction changes would require additional analysis and decision making prior to designation.

Collectively, the Forest transportation system within the Flint Foothills Project area would be in better condition: more resilient to storms and runoff, further maintained in accordance with Best Management Practices, and with closer resemblance to the minimum road system identified in the Pintler Ranger District travel analysis.

Alternative 3

Direct and Indirect Effects

Under alternative 3 only existing roads, including NFS and unauthorized routes would be used to transport logs and forest products from the removal treatment units to main arterial roads (State Highway 1 and Interstate 90) outside the USFS boundary. Figure 7 in chapter 2 shows the location of alternative 3 proposed transportation routes. A complete list of route segments and associated actions by alternative is included in appendix B of the Transportation Report in the project file.

Road maintenance and reconstruction activities on existing roads would bring the roads to a standard complying with BMPs and also allowing for safe product removal. Just over 1 mile of open unauthorized roads would be added to the Forest transportation system following reconstruction, and would be managed as maintenance level 2 roads (high clearance vehicles recommended). After vegetation treatments, 2.3 miles of other reconstructed existing temporary roads (unauthorized routes) would be decommissioned; these treatments are further outlined in table 6. There would be a total reduction of 2.3 miles of road (unauthorized routes) in the project area following treatments. There would be a negligible change (less than 200 feet) in mileage available for motor vehicles,

Road use authorizations would be the same as for alternative 2.

Implementing the associated transportation actions in this project would bring management of the Forest transportation system closer to the identified minimum system identified in the Pintler travel analysis. Road maintenance and reconstruction associated with timber haul, in addition to the removal of dead and dying trees, would provide for much needed maintenance and also a safer and more efficient transportation system, allowing for additional mileage to be maintained with future annual maintenance funds. NFS haul routes would be improved to comply with BMPs.

The road density within the project area after project implementation would be 2.90 miles/square mile.

Appendix C of the Transportation Report in the project file provides a breakdown of road work items and estimated costs by alternative

Cumulative Effects

Alternative 3 would contribute to cumulative effects to the transportation system by reconstructing, maintaining, and decommissioning roads within the project area.

Flood damage repairs to roadway failure locations on NFS Road 707 (2 sites), and 8402 is anticipated in the next 3 years.

In the Douglas Creek Watershed, six stream crossings would be replaced, as well as reconstruction of 400 feet of stream adjacent to NFS Road 707.

The Route and Area Designation Process and production of a MVUM for the area would also occur. Travel management direction changes subsequent to the FFVMP decision would require additional analysis and decision making prior to designation.

Collectively, the Forest transportation system within the Flint Foothills Project area would be in better condition: more resilient to storms and runoff, further maintained in accordance with Best Management Practices, and with closer resemblance to the minimum road system identified in the Pintler Ranger District travel analysis.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The no-action alternative would be consistent with the Forest Plan for infrastructure, although no action would be taken to achieve the desired conditions. Alternatives 2 and 3 would be consistent with the Forest Plan (USDA Forest Service 2009a) desired conditions, goals, objectives and standards for transportation management. Alternatives 2 and 3 activities would include implementing and managing recommendations included in the Pintler travel analysis (USDA Forest Service, 2008) and moving the Forest transportation system closer to the identified minimum system. Transportation actions in the action alternatives are also in accordance with regulations and policies regarding transportation and travel management.

The Forest Plan (USDA Forest Service 2009a) complies with the National Forest Management Act of 1976 (NFMA); the regulations for the National Forest Land and Resource Management Planning (36 CFR Part 291); and the National Environmental Policy Act (NEPA) of 1969.

Sensitive Plants

Introduction

This document serves as the biological evaluation of impacts to USDA Forest Service Northern Region sensitive plant species, including federally listed species. It is Forest Service policy to protect the habitat of federally listed threatened and endangered species (FSM 2670.31), and to avoid or minimize adverse impacts to species designated by the Forest Service as sensitive (FSM 2670.32).

In order to determine impacts, all Forest Service projects, programs, and activities are reviewed for possible effects to federally listed, threatened or endangered plant species and Forest Service designated sensitive species. No federally listed threatened or endangered plants are known to occur on the Beaverhead-Deerlodge National Forest. Therefore, the following analysis will address only the potential impacts to Forest Service designated sensitive plant species and their habitats as a result of implementing the proposed Flint Foothills Vegetation Management Project.

Overview of Issues Addressed

Sensitive plant populations and habitats can be impacted by vegetation management projects. Direct impacts can include disturbance of sensitive plant habitat from project activities and equipment, as well as direct removal or death of individual plants. Indirect impacts that may decrease sensitive plant viability can include the spread of invasive weeds and/or increased livestock grazing as a result of reduced overstory vegetation. Indirect impacts that may increase sensitive plant viability can include reduced competition from conifers or overstory species, as well as habitat creation for sensitive plant species adapted to disturbance.

Actions within the proposed activity areas may harm or destroy sensitive plants or negatively affect their habitat if present. Ground disturbing activities, prescribed fire and increased traffic related to the proposed activities may affect sensitive plants and their habitat, landscape community health, and biodiversity.

The purpose of this analysis is to:

- Determine if the alternatives will adversely affect any of the sensitive plant species that have potential to occur in the project area;
- Insure that the alternatives do not contribute to the loss of viability of any sensitive plant species or cause a trend toward federal listing;
- Comply with USDA Forest Service Region 1 policy to insure that sensitive plant species receive full consideration in the decision-making process;
- Comply with the Endangered Species Act.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

Presence of sensitive plants or potential habitat in the area of analysis would indicate that impacts from the proposed action should be considered. The threshold determination is whether the proposed action has the potential for loss of viability of sensitive plants or suitable habitat.

Affected Environment

Existing Condition

The Flint Foothills project area is experiencing extensive tree mortality in lodgepole pine, Douglas fir and ponderosa pine due to the ongoing insect and disease epidemic. Dense conifer stands do not typically present habitat for BDNF sensitive plant species. However, moist seeps, streams, ponds, bogs, open meadows, sparsely vegetated slopes, disturbed sites and some road-cut situations can present habitat for BDNF sensitive plant species.

The following nine species were identified as having potential habitat within the project area: Austin's knotweed (*Polygonum douglasii* ssp. *austiniae*), California false-hellebore (*Veratrum californicum*), Hall's rush (*Juncus hallii*), Lemhi penstemon (*Penstemon lemhiensis*), Missoula phlox (*Phlox kelseyi* var. *missoulensis*), peculiar moonwort (*Botrychium paradoxum*), Sapphire rockcress (*Arabis fecunda*) wavy moonwort (*Botrychium crenulatum*), and western moonwort (*Botrychium hesperium*). These nine species were surveyed for in the Flint Foothills project area.

In July 2011, the U.S. Fish and Wildlife Service (USFWS) declared whitebark pine (*Pinus albicaulis*) a warranted but precluded species for federal listing, giving it candidate status for the time being. The

Northern Region of the USDA Forest Service has designated whitebark pine a sensitive species based on the USFWS candidate status. Whitebark pine is known to occur within the project area at mid- and high elevations, but was not specifically surveyed during the sensitive plant surveys for the Flint Foothills Project.

Hall's rush, Lemhi penstemon and sapphire rockcress were all identified as having potential habitat within the project area. However, no populations of these species were found and none are known to occur on the Pintler Ranger District where the Flint Foothills project is occurring. Because the project area is likely outside of their range, they will not be carried forward for analysis.

Austin's knotweed, Missoula phlox and California false-hellebore all had potential habitat within the project area. Known populations occur on the Pintler Ranger District. These species will be carried forward for analysis.

Austin's knotweed – Austin's knotweed is a sparsely distributed species in Montana, occurring in open, gravelly, and sparsely vegetated slopes with shale-derived soils. There are roughly 30 known occurrences in Montana, most of which are generally not impacted by human activity due to habitat, though some do occur along roads (Austin's knotweed 2012). Populations do occur on the Pintler Ranger District, but are not known to occur within the project area, and were not found during project surveys. Steep shale slopes are present within the project area, but are not common.

California false-hellebore – California false hellebore is rare in Montana where it occurs at the periphery of its range in the southwestern corner of the state on the BDNF. Less than five occurrences are known in the state. Its habitat includes wet meadows and streambanks (Californian false-hellebore 2012). Populations occur on the Pintler and Wisdom Ranger Districts. No populations were found during project surveys, but potential habitat was present.

Missoula phlox – Missoula phlox is a state endemic, known from over two dozen occurrences in Montana. It occurs in the foothills on open, exposed slopes of limestone derived material, and in the subalpine zone on exposed ridges (Missoula phlox 2012). Several locations occur on the Pintler Ranger District. No populations were found during project surveys, but potential habitat was present.

Moonworts – One population of wavy moonwort was found during project surveys, occurring along an old, abandoned, logging road between proposed units 32ST and 33C. Aside from this population and the known whitebark pine, no other sensitive plant populations are mapped within the project area or were found during surveys.

Moonworts are difficult species to detect in the field due to their small size, sparse distribution, irregular appearance, and variation in timing of appearance. Once found the identification can be very challenging, as species differentiation is based on subtle distinctions in appearance that are only apparent in mature individuals. Even when mature, discrepancy in identification between botanists exists (Vanderhorst 1997). Potential habitat for both peculiar moonwort and western moonwort was found within the project area, and known populations occur on the Pintler Ranger District. Therefore, based on these findings, it is likely that populations of peculiar and western moonwort do occur within the project area, and were missed during project surveys. For this analysis, they will be treated as if present, but undetected.

Wavy moonwort – Wavy moonwort is a sparsely distributed sensitive plant known from over 40 populations in Montana. Additional populations occur in Arizona, California, Idaho, Oregon, Nevada, Utah, Washington, and Wyoming, as well as in Alberta and British Columbia, Canada (Wavy moonwort 2012). Previous to project surveys, there were several known locations of wavy moonwort

on the Pintler Ranger District of the BDNF, most within 5 miles of each other, as well as one unconfirmed location on the Wise River District (Salix, personal observation 2012). Within the project area, one new population of wavy moonwort was found during project surveys, occurring along an abandoned logging road bisecting proposed treatment units 32ST and 33C.

Currently, wavy moonwort has a global rank of 2 (G2), which means imperiled due to rarity or with very restricted range, i.e., vulnerable to extinction. Trend monitoring of all G1, G2, and G3 sensitive plant species is required per Forest Plan Direction (2009). Monitoring results will be reported in the 2014 BDNF Monitoring Report.

Moonworts are an interesting group of perennial plants, closely related to ferns with much of their life being spent underground as immature plants, and reproducing via spores. After germinating underground, plants may not emerge above ground for 5-10 years. When they do emerge, they produce only one leaf, and stand only 1-10 cm tall (BDNF sensitive species) making them very difficult to detect. Above ground emergence is very sporadic, where after emerging one year, they may not return above ground for several years. Yearly fluctuations in population numbers vary greatly between years because of this, likely due to environmental and demographic factors (Ahlenslager and Potash 2007). Time of year for emergence fluctuates yearly as well (Vanderhorst 1997).

Research indicates that most moonworts require habitats that have experienced some level of past disturbance, 10-30 years previously (both natural and anthropogenic), and are therefore found in early to mid-successional habitats (Ahlenslager and Potash 2007). Moonworts are heavily dependent on fungi, or mycorrhizal associations, for carbohydrates, minerals, and water uptake (ibid). Their dependence on a fungal relationship is a possible explanation for their delayed inhabitance, as fungal species composition and abundance change with succession. Successful establishment of moonwort species may be delayed until suitable mycorrhizal symbionts are present (Anderson and Cariveau 2004).

Identification of moonworts to the species level is very difficult, and many populations in Montana are simply mapped as *Botrychiums*, without identification to the species level. In addition to the difficulties in detecting them in the field and proper species identification, there are taxonomic questions that have yet to be resolved among the moonwort experts (USDA Forest Service 2000 - Marriot).

The population of wavy moonwort found along the abandoned logging road contained roughly 15 to 30 individuals within a half-acre area. The site is located on the north side of a draw, with Douglas-fir saplings encroaching into the road prism. The site was noticeably shadier than other wavy moonwort sites observed by the botanist. Wavy moonwort is commonly found occupying roadsides, meadows, wet swales, and edges of marshes or other open disturbed sites. With continued succession towards a dense, closed-canopy forest, moonwort populations are known to decline (Ahlenslager and Potash 2007). With the current site conditions, it is anticipated that continued encroachment and shading by conifers will reduce the viability of the population and will likely lead to a reduction or loss of the population over time (Mincemoyer 2012).

Peculiar moonwort – Peculiar moonwort is a sparsely distributed species, being irregularly distributed in the west in Canada, Oregon, Utah and Washington (Peculiar moonwort 2012). Over 24 populations are known in Montana. It is associated with wet meadows of spruce and lodgepole pine forests, but is also known to occur along roadsides on the BDNF. Life history and ecology is similar to that described above for wavy moonwort.

The inconspicuous nature of peculiar moonwort and moonworts in general make it very difficult to detect during project surveys, as mentioned previously. As there are known populations on the district as well as large areas of suitable habitat found within the project area, and a presence of a wavy moonwort population within the project area. This makes a strong case for there being peculiar moonwort in the project area. Therefore, peculiar moonwort will be analyzed as if known occurrences are within the project area.

Western moonwort – Western moonwort is a sparsely distributed species across its range where it occurs in eastern and western North America. In the Rocky Mountains it extends from Arizona north into Alberta and Saskatchewan. Roughly 30 populations are known in Montana (Western moonwort 2012). On the BDNF, it is only known to occur on the Pintler Ranger District. Life history and ecology is similar to that described above for wavy moonwort.

As with peculiar moonwort, the difficulty in detecting individuals, the amount of suitable habitat, and the presence of wavy moonwort all make a strong case for not discounting western moonworts occurrence in the project area. Therefore, western moonwort will be analyzed as if known occurrences are within the project area.

Whitebark pine – Whitebark pine is a common conifer of subalpine forests and can be a dominant species of treeline and Krummhotz habitats (Whitebark pine 2012). It can also occur in mid-elevation mixed-conifer stands.

Project-specific surveys were completed for whitebark pine within the Flint Foothills Project area, and identified approximately 683 acres of whitebark pine, located in whitebark pine dominated stands or mixed-conifer stands with whitebark present (Vegetation section). Many of the mature whitebark pine trees observed within the project area have been moderately to severely impact by a combination of blister rust (*Cronartiam ribicola*) and mountain pine beetles (*Dendroctonus ponderosae*). Forestwide monitoring has shown a substantial amount of whitebark pine regeneration established under more pure whitebark pine stands, and mature whitebark pine trees persisting in the face of both beetle and blister rust pressure (USDA 2011). This establishment of whitebark pine seedlings underneath dead whitebark mature trees has been observed in the project area. Whitebark pine occurs most commonly at the highest elevations in the project area, with a few scattered individuals or in smaller (0.25-acre) patches down to the mid-elevations (Vegetation section). Stand exams identified whitebark pine within three mid-elevation burn units 3B, 4B and 5B.

Whitebark pine functions as a keystone species because of its various roles in supporting community diversity, and as a foundation species for its roles in promoting community development and stability. These roles include: providing snow capture and retention; carbon storage; increasing biodiversity; and serving as a good food source for wildlife. Conifer encroachment into whitebark pine habitat, resulting from extensive mortality due to exotic white pine blister rust, the native mountain pine beetle infestation, and wildfire exclusion is occurring range wide (Vegetation section). Warming temperatures are thought to further increase the rate of mortality due to favorable conditions for white pine blister rust and mountain pine beetle (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011). Several agencies are planning and implementing protection and restoration efforts within whitebark pine stands across its range. Some of these include: protecting apparently rust-resistant trees and seed cones; planting rust-resistant trees back into the communities; reducing fuels and canopy cover around whitebark pine stands; and incorporating fire management into whitebark pine stand protection (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011).

Monitoring whitebark pine stands on the Beaverhead-Deerlodge National Forest began in 2010 and is planned to expand and continue on the Forest. Nine plots were established across the Forest and data collected included: number of seedlings, number of live trees over 4.5 feet tall, number of dead trees over 4.5 feet tall, percent live with blister rust, percent live with mountain pine beetle infection, and percent live without either blister rust or mountain pine beetle. The initial data collected showed the majority of trees at the nine monitoring plots in the seedling stage (49 percent) representing good regeneration, and 73 percent were live without mountain pine beetle or blister rust infestation (Vegetation section).

Desired Condition

The desired condition is derived from laws and FS policy. The National Forest Management Act (NFMA) of 1976 directs the FS to provide for diversity of plant and animal communities. Forest Service direction (FSM 2672.1-2672.43) requires programs or activities be reviewed for potential effects on sensitive species and outlines policy, objectives, and procedures to ensure that species do not become threatened or endangered as a result of FS actions.

The desired condition as it pertains to sensitive plants is stated in the Forest Plan, and directs the Beaverhead-Deerlodge National Forest to maintain and restore sensitive plant populations and their habitat. Large core populations or fringe-of-range populations of sensitive plants are to be conserved in research natural areas, botanical special interest areas, or protected as populations in conservation strategies or project design specifications (USDA Forest Service 2009 p, 43).

Environmental Consequences

Methodology

A pre-field review of the Beaverhead-Deerlodge NF Sensitive Plants Program files, GIS resources (USDA Forest Service 2010c), and the Montana Natural Heritage database (MNHP 2009-2011) was conducted to identify any known populations of sensitive plants within the project area, and to determine potential habitats (A list of all sensitive plants on the BDNF, which identifies presence of populations and suitable habitat, is included in appendix B of the sensitive plant report in the project file). Prior to project-specific surveys, no known sensitive plant populations or protected, managed habitats were known to occur within the project area. Proposed units containing potential habitat for sensitive plants were identified through this pre-field review and selected for field survey.

During 2010 and 2011 field seasons, a total of 55 units were surveyed, as well as ten miles of roads, covering 3,339 acres, or 59 percent of the total proposed acres and miles in the proposed action (acres of each unit and miles of each road surveyed are in appendix A of the sensitive plant report in the project file). Botanical surveys consisted of the intuitive–controlled survey method. Two survey periods were completed in 2010, one in June targeting the early-blooming species and one in August targeting the late-blooming sensitive plant species. In 2011, only August and September surveys were conducted.

As stated previously, wavy moonwort was found along an abandoned logging road intended for use during project activities, and whitebark pine is known to occur in approximately 683 acres across the project area. Peculiar moonwort and western moonwort are also likely to occur within the project area.

Incomplete and Unavailable Information

A concerted effort was made to identify potential sensitive plant habitats using GIS, satellite imagery, field visits and local knowledge. Surveys were scheduled to overlap with sensitive plant flowering windows as much as possible. However, there is always a low possibility of an individual or small population going undetected during surveys.

This Biological Evaluation was prepared based on presently available information. If the action is modified in a manner that causes effects not considered, or if new information becomes available that reveals that the action may impact sensitive plants in a manner or to an extent not previously considered, a new or revised Biological Evaluation may be required.

Spatial and Temporal Context for Effects Analysis

The spatial boundary for the sensitive plants analysis is the National Forest System lands within the project area boundary. A specific emphasis will be placed on activity areas where vegetation treatment and road construction are proposed. The spatial scale is limited to the project area since no impacts to sensitive plants are anticipated outside the project area boundary.

The temporal timeframe covers the immediate effects at the time of implementation and extends into the future 50 years. The temporal scale is based on the progression period of sensitive plant habitats being encroached by conifers, the period required for sensitive plants to colonize new disturbances (Ahlenslager and Potash 2007), and the time used by the Vegetation Report.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Table 24 at the beginning of chapter 3 discloses the present and reasonably foreseeable actions within the project area that are relevant to this DEIS analysis. Past and present actions that affect sensitive plant habitats include fire suppression, timber harvest, roadside hazard tree removal, prescribed burning, livestock grazing, invasive plants control, recreation activities, and storm and damaged road and culvert repair. These actions have contributed to the existing vegetation and habitat conditions and will likely continue into the future, and will be considered in the cumulative effects analysis.

Alternative 1 – No Action

Direct and Indirect Effects

Since no activities are proposed in alternative 1, there would be no direct effects.

The no-action alternative provides a means for evaluating the current ecosystem conditions as a baseline. The no-action alternative would result in the continued mortality of dense Douglas-fir and lodgepole pine stands as a result of insect and disease.

The lack of vegetation treatments would allow conifer and other herbaceous species to increase in density and canopy layering (Vegetation section). The impacts to sensitive plants could include fuel loading and increased fire severity, changed habitat conditions and competition. All of these forces may take decades to incur impacts to sensitive plant populations and their potential habitats.

Sensitive Moonworts - Wavy moonwort would continue to occur along the abandoned logging road for some time. Moonwort species habitats are known to be ephemeral (Zika et al. 1995). The continued trend of conifer encroachment into wavy moonworts habitat would likely reduce the viability of the current population by over-shading and lead to an eventual loss of the population

(Mincemoyer 2012), potentially within 50 years, pending the lack of a natural disturbance such as fire. This loss is unrelated to project activities, but a natural progression of the disturbed site.

Zika (1995) states that a number of moonwort habitats were historically maintained by fire; fire suppression has led to vegetative succession and fuel loading, which has reduced habitat. Zika presumes that moonworts must either withstand some degree of fire or readily recolonize burned areas from adjacent populations. Under the no-action alternative, no prescribed burning would occur, allowing vegetation conditions to exist in their current state or progress into a later- seral condition.

Western moonwort and peculiar moonwort, if present, would experience the same impacts from conifer encroachment as those described above.

Whitebark Pine - Whitebark pine would continue to be impacted by blister rust, mountain pine beetle, and fire suppression (Keane and Parsons 2010). Impacts to whitebark pine as a result of the no-action alternative would include the continued decline from these factors, as well as continued conifer competition into whitebark pine populations (Vegetation section).

Austin's knotweed, Missoula phlox and California false-hellebore - These species all prefer open habitats. Under the no-action alternative conifer encroachment could compromise the potential for Austin's knotweed, Missoula phlox and California false-hellebore to occupy these habitats. Assuming that sensitive plants would occupy these open habitats in the future is entirely speculation and cannot be known for several years or decades.

Cumulative Impacts

Under the no-action alternative, the following activities could continue to impact sensitive plant populations: Roadside #4 Hazard Tree Removal, timber harvest, livestock grazing, recreational activities (hiking, OHV, hunting, etc.), invasive plant control, wildfire suppression, prescribed burning, and the storm damaged road and culvert repairs.

Moonworts - Timber harvest occurred previously in the units where wavy moonwort was identified along the abandoned logging road. This previous disturbance likely made the habitat suitable for wavy moonwort and other moonworts to occupy. Natural and man-made disturbances, including fire, are known to create potential moonwort habitats (Zika et al. 1995). Several sensitive moonwort populations on the forest occur along roadsides. The Roadside 4 Hazard Tree Removal project occurring partially within the project area intersects with a couple of these known locations. Project activities in these known locations are being buffered to protect individuals. Additional habitat will likely be created by the Roadside 4 Hazard Tree Removal project, as it will open up the canopy creating an early successional, disturbed habitat that is favorable to moonwort species.

Livestock grazing occurs within the project area, and includes the area where wavy moonwort is present (the Hall Allotment). Livestock can impact moonwort species directly by grazing above ground structures, removing reproductive structures, and by trampling (Beatty et al. 2003). Indirectly, livestock can impact moonwort habitat by compacting soils, facilitating the spread of weeds and by changing the plant community (ibid). Currently, the population of moonwort found within the project area shows no signs of being impacted by grazing.

Recreation activities within the project area could occur within the wavy moonwort population area. With the Douglas Cabin located nearby, hiking, horseback riding and hunting within the area could occur. These activities in the area occur at low to moderate rates and should have little impact on the population.

Invasive plant species can have long-term impacts on sensitive plant species. Invasive plants can make occupied and potential habitats unsuitable for sensitive plant species. Control of invasive plants through various means can benefit sensitive plants by reducing invasive plant species from their habitats. However, control methods, such as broadcast spraying, can cause short-term harm to sensitive plants if they come into contact with the chemical (USDA Forest Service 2000-Ode). The Beaverhead-Deerlodge Weed Management Plan (2002) protects sensitive plants by employing the following mitigation measure:

> "No herbicide will be applied directly on sensitive plants during spot applications and a 100-foot buffer will be employed around known populations of sensitive plants during broadcast applications (including aerial). All aerial treatment areas will be surveyed for sensitive plants prior to initial spraying."

Invasive plants control activities do occur within the project area, but not within the immediate vicinity of the known wavy moonwort population, as no invasive plants were identified as currently present. Invasive plants control activities within the project area are not known to be impacting sensitive plants at this time.

Fire suppression can impact sensitive moonwort species by allowing conifer encroachment to alter their existing and potential habitats (Beatty et al. 2003), making it too shady for their existence.

Prescribed burning in the past, likely created potential habitat for sensitive moonwort species by reducing canopy cover.

Storm-damaged roads and culvert replacement activities proposed in the project area could impact sensitive moonwort populations if they occur along these routes or adjacent to the culvert footprint.

Overall, short-term cumulative impacts to sensitive moonwort species would be minimal. Fire suppression and the resulting conifer encroachment and successional changes over the next 50 years could have moderate impacts on existing sensitive moonwort populations within the project area.

Whitebark pine - Fire is an important component of whitebark pine ecology, as described in the Vegetation section. The continued suppression of wildfires can cause an increase in fire severity in these higher-elevation whitebark pine stands which can have mixed results for whitebark pine. A high-severity fire would likely kill all the whitebark pine individuals in the fire area, as whitebark pine cannot usually withstand such fires. In addition, high-severity fires could have the undesirable effects of burning healthy rust resistant individuals of whitebark pine. However, if seed producing individuals are somewhat nearby, it could provide opportunity for Clark's Nutcracker to cache seeds in the newly burned area for regeneration (USDI Fish and Wildlife Service 2011). At this time of whitebark pine decline, regeneration is of great importance.

Livestock grazing, recreation activities, invasive plants and their control activities within whitebark pine habitat should have little if any impact.

Overall, short-term cumulative impacts to whitebark pine should be minimal, with continued fire suppression and the resulting conifer encroachment having the potential for moderate impacts within the next 50 years.

California false hellebore - Storm damaged roads and culvert replacement activities proposed in the project area could impact California false-hellebore if it occurs along these routes or adjacent to the culvert footprint. Overall, these impacts would be short-term.

Other Sensitive Plant Species - Cumulative impacts to Austin's knotweed, Missoula phlox and California false-hellebore potential habitats should be minimal if at all.

Summary of Effects - No Action

Federally Listed Plants

Due to the lack of federally listed plant species within the Flint Foothills project area, and on the Forest in general, implementation of the no-action alternative would have no effect on listed plants.

Forest Service Sensitive Plants

Wavy Moonwort - In the short term (i.e., next 10-20 years), wavy moonwort would not be impacted by the no-action alternative. However, due to the low viability of the population, it is unlikely that the population will survive in the long term (i.e., over 50 years) due to the natural colonization of the site by conifers without a natural disturbance such as fire. This reduction in viability is unrelated to project activities. Therefore, the no-action alternative would have no impact on wavy moonwort (*Botrychium crenulatum*).

Peculiar and Western Moonworts - Though not found during project surveys, it is likely that peculiar and western moonworts occur within the project area. Impact to these species would be similar to those of wavy moonwort. Therefore the no-action alternative would have no impact to either peculiar moonwort (*Botrychium paradoxum*) or western moonwort (*Botrychium hesperium*).

Whitebark Pine - Whitebark pine is experiencing decline across the west. Under the no-action alternative this decline would naturally continue. The Flint Foothills project was not designed with whitebark pine restoration in mind, and though design features are included to protect them within treatment units, it is unlikely that the lack of treatment would be detrimental to whitebark pine. Therefore, the no-action alternative would have no impact on whitebark pine (*Pinus albicaulis*).

Austin's Knotweed – Austin's knotweed was not found within the project area, however suitable habitat was present on a few shale slopes. Encroachment into these habitats could continue under the no-action alternative regardless of project activities without a natural disturbance such as fire. The no-action alternative would have no impact to Austin's knotweed (*Polygonum douglasii* var. *austiniae*) as none are known to occur within the project area.

Missoula Phlox – Missoula phlox was not found during project surveys, but potential habitat was found in open windswept meadows. Potential habitat could be impacted by the continued encroachment of conifers into open meadows. This would occur regardless of project activities, pending no natural disturbance such as fire. The no-action alternative would have no impact on Missoula phlox populations as none are known to occur within the project area.

California False-Hellebore – California false-hellebore was not found during project surveys, but potential habitat was found in open wet meadows. Potential habitat could be impacted by the continued encroachment of conifers into open wet meadows. This would occur regardless of project activities, without a natural disturbance such as fire. The no-action alternative would have no impact on California false-hellebore populations as none are known to occur within the project area.

Alternative 2 – Proposed Action

Direct and Indirect Impacts

Sensitive moonworts - Moonworts species typically require early successional habitats with periodic disturbances. Timber harvest and road maintenance or construction can both harm moonwort populations by directly damaging individuals or their habitat, while also benefiting the species by creating future potential habitats (Beatty et al. 2003; USDA Forest Service 2000 – Marriott; Ahlenslager and Potash 2007). Under the proposed activity, the abandoned logging road where wavy moonwort occurs in unit 32ST would be re-opened and utilized during the proposed activities. By utilizing this road, most if not all of the known population would be removed or killed during implementation.

The current habitat of the known wavy moonwort population is experiencing conifer encroachment and is not expected to persist long term (i.e., beyond 50 years). Wavy moonwort is not of conservation significance because of the low viability of the population, and would not be protected. There is a chance that the population would return when conditions are favorable post disturbance because wavy moonwort already exists at the site. The disturbances created from project activities could create future habitat for sensitive moonwort species, 10 to 30 years post disturbance (Ahlenslager and Potash 2007).

Peculiar and western moonworts may experience similar impact if present within the project activity area.

Prescribed burning could directly harm moonwort individuals, or indirectly create more open habitat. Zika et al. (1995) state that a number of moonwort habitats were historically maintained by fire and fire suppression has led to vegetative succession and fuel loading, reducing habitat. Since moonworts are known to occur in post-fire habitats, it is presumed that moonworts must either withstand some degree of fire or readily recolonize burned areas from adjacent populations. Short-term impacts to moonwort species from prescribed burning could be direct removal of above ground structures. Long-term impacts could be improved habitat for the next 10-50 years.

Whitebark pine - Approximately 683 acres of whitebark pine occur within the project area, primarily in the higher elevations, but also at mid-elevations and in units 3B, 4B and 5B. The felling of conifers prior to burning activities would avoid areas within units that have concentrations of whitebark pine. Fire ignition patterns would also avoid the use of fire directly in areas of units that have concentrations of whitebark pine.

Wildfire is important for whitebark pine regeneration, as whitebark pine survives low intensity fires and can benefit from stand replacing fire where regeneration is most successful. Arno (1986) suggests that fire is important in perpetuating an abundance of whitebark pine. Morgan et al. (1994) have found that other conifer species tend to replace whitebark pine in the absence of fire. Although burning in whitebark pine stands can assist in whitebark pine regeneration, it is not an objective of the proposed treatment. Direct impacts to whitebark pine from prescribed burning can include damage or death as a result of burning individual trees. Indirect impacts to whitebark pine could include the creation of canopy openings conducive for caching whitebark seed by Clark's nutcracker birds; hence, increasing potential whitebark pine regeneration. Spring and fall burning would have the same results.

Timber projects have been shown to benefit whitebark pine by reducing competition and allowing for more rapid growth (Keane et al. 2007). Reducing high fuel loads around whitebark pine stands can

also reduce the potential for high-severity wildfires, which can be detrimental to whitebark pine if regeneration is not successful (USDI Fish and Wildlife Service 2011).

Austin's knotweed, Missoula phlox and California false-hellebore - These species all have potential habitats within the project area. These habitats could be improved by implementation of the project activities, as encroaching conifer species would be removed, providing more open areas. It cannot be known whether these species will occupy disturbance areas in the future, but reducing canopy cover coupled with soil disturbance can provide opportunity in some situations.

Cumulative Impacts for Alternatives 2 and 3

Relevant past, present, and future processes and activities have occurred and will continue to occur on Forest Service, private, and state lands within and adjacent to the proposed project area. The following activities could continue to impact sensitive plant populations: Roadside 4 Hazard Tree Removal, timber harvest, livestock grazing and recreational activities (hiking, OHV, hunting, etc.), invasive plants control, wildfire suppression, and prescribed burning and storm damaged road and culvert repairs.

Moonworts - Timber harvest has occurred previously in the units where wavy moonwort occurs along the abandoned logging road in unit 32ST. This previous disturbance likely made the habitat suitable for wavy moonwort and other moonworts to occupy. Natural and man-made disturbances, including fire, are known to create potential moonwort habitats (Zika et al. 1995). The Roadside 4 Hazard Tree Removal project occurring in a portion of the project area intersects with a couple of these known locations. Project activities in these known locations are being buffered to protect individuals. Additional habitat will likely be created by the Roadside 4 Hazard Tree Removal project, as it will open up the canopy creating an early successional, disturbed habitat that is favorable to moonwort species.

Livestock grazing occurs within the project area, and includes the area where wavy moonwort is present (the Hall Allotment). Livestock can impact moonwort species directly by grazing above ground structures, removing reproductive structures, and by trampling (Beatty et al. 2003). Indirectly, livestock can impact moonwort habitat by compacting soils, facilitating the spread of weeds and by changing the plant community (ibid). Currently, the population of moonwort found within the project area shows no signs of being impacted by grazing.

Conifer canopy removal may attract livestock to the population area and increase grazing intensity, which could reduce the chances of the wavy moonwort population returning to the site.

The Douglas Cabin is located in the project area, and recreation activities such as hiking, horseback riding and hunting could occur within the wavy moonwort population area. However, these activities take place at low to moderate levels, and should have little impact on the moonwort population.

Invasive plant species can make occupied and potential habitats unsuitable for sensitive plant species causing long-term impacts. The treatment of invasive plants through various means can benefit sensitive plants by eradication, control, or containment in their habitats. However treatment methods, such as broadcast spraying, can cause short-term harm to sensitive plants if they come into contact with the chemical (USDA Forest Service2000-Ode). The Noxious Weed Control Program Record of Decision for the Beaverhead-Deerlodge National Forest (USDA Forest Service 2002) protects sensitive plants by employing the following mitigation measure:

> "No herbicide will be applied directly on sensitive plants during spot applications and a 100' buffer will be employed around known populations of sensitive plants during broadcast applications (including aerial). All aerial treatment areas will be surveyed for sensitive plants prior to initial spraying."

Invasive plant species treatment activities do occur within the project area, but not within the immediate vicinity of the known wavy moonwort population, as no invasive plants were identified. Invasive plant treatment activities are not known to be posing impacts to sensitive plants within the project area at this time.

Fire suppression can impact sensitive moonwort species by allowing conifer encroachment to alter their existing and potential habitats (Beatty et al. 2003), making it too shady for their existence. Prescribed burning in the past, likely created potential habitat for sensitive moonwort species by reducing canopy cover.

Storm damaged roads and culvert replacement activities proposed in the project area could impact sensitive moonwort populations if they occur along these routes or adjacent to the culvert footprint.

Overall, short-term cumulative impacts to sensitive moonwort species would be minimal. Fire suppression and the resulting conifer encroachment and successional changes over the next 50 years could have moderate impacts on existing sensitive moonwort populations within the project area.

Whitebark pine - Fire is an important component of whitebark pine ecology, as described in the Vegetation section. The continued suppression of wildfires can cause an increase in fire severity in these high-elevation whitebark pine stands, which can have mixed results for whitebark pine. A high-severity fire would likely kill all the whitebark pine individuals in the fire area, as whitebark pine cannot usually withstand such fires. In addition, high-severity fires could have the undesirable effects of burning healthy rust resistant individuals of whitebark pine. However, if seed producing individuals are somewhat nearby, it could provide opportunity for Clark's Nutcracker to cache seeds in the newly burned area for regeneration (USDI Fish and Wildlife Service 2011). At this time of whitebark pine decline, regeneration is of great importance.

Livestock grazing, recreation activities, and invasive plants and treatment activities within whitebark pine habitat would have little if any impact. Overall, short-term cumulative impacts to whitebark pine would be minimal, with the continued fire suppression and the resulting conifer encroachment having the potential for moderate impacts within the next 50 years.

California false hellebore - Storm damaged roads and culvert replacement activities proposed in the project area could impact California false-hellebore if it occurs along these routes or adjacent to the culvert footprint. Overall, these impacts would be short term.

Other Sensitive Plant Species - Cumulative impacts to Austin's knotweed, Missoula phlox and California false-hellebore potential habitats should be minimal if at all.

Summary of Effects

Federally Listed Plants

Due to the lack of federally listed plant species within the Flint Foothills Project area, and on the Forest in general, implementation of the proposed action shall have no effect on listed plants.

Forest Service Sensitive Plants

As stated, direct, and indirect impacts to sensitive plants can result from implementing vegetation management projects.

Wavy Moonwort – Due to the extent of known populations of wavy moonwort in Montana and surrounding states, and the low viability of the population along the abandoned logging road in unit 32ST, implementation of the proposed action, hence removal of the known population, may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species of wavy moonwort (*Botrychium crenulatum*).

Peculiar and Western Moonworts – Due to the likelihood of peculiar and western moonworts occurring within the project area, direct and indirect impacts are possible. Therefore, implementation of the proposed action may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species of peculiar and western moonwort (*Botrychium paradoxum* and *B. hesperium*).

Whitebark Pine – Approximately 683 acres of whitebark pine occur within the project area, primarily in the higher elevations, but also at mid-elevations. Project-specific design features and mitigation measures (chapter 2) are in place to protect clusters of whitebark pine, as described above; however some individuals may be impacted. Implementation of the proposed action may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species of whitebark pine (*Pinus albicaulis*).

Austin's Knotweed – Austin's knotweed was not found within the project area. Suitable habitat was present on a few shale slopes. Potential habitat could be improved by the removal of encroaching conifers. However, the influx of Austin's knotweed into these treated areas is very speculative. As such, implementation of the proposed action alternative would have no impact on Austin's knotweed (*Polygonum douglasii* var. *austiniae*).

Missoula Phlox – Missoula phlox was not found during project surveys, but potential habitat was found in open windswept meadows. Potential habitat could be improved by the removal of encroaching conifers. However, the influx of Missoula phlox into these treated areas is very speculative. Implementation of the proposed action alternative shall have no impact on Missoula phlox (*Phlox kelseyi* var. *missoulensis)*.

California False-Hellebore – California false-hellebore was not found during project surveys, but potential habitat was found in open wet meadows. Potential habitat could be improved by the removal of encroaching conifers. However, the influx of California false-hellebore into these treated areas is very speculative. Implementation of the proposed action alternative would have no impact on California false-hellebore (*Veratrum californicum*).

Alternative 3

Direct and Indirect Impacts

Sensitive moonworts - Moonworts species typically require early successional habitats with periodic disturbances. Timber harvest and road maintenance or construction can both harm moonwort populations by directly damaging individuals or their habitat, while also benefiting the species by creating future potential habitats (Beatty et al. 2003; USDA Forest Service 2000 – Marriott; Ahlenslager and Potash 2007). Under alternative 3, the abandoned logging road in unit 32ST where

wavy moonwort occurs would be re-opened and utilized during the proposed activities. By utilizing this road, most if not all of the known population would be removed or killed during implementation.

The current habitat of the known wavy moonwort population is experiencing conifer encroachment and is not expected to persist long term, beyond 50 years. Wavy moonwort is not of conservation significance because of the low viability of the population, and will not be protected. There is a chance that the population would return when conditions are favorable post disturbance because wavy moonwort already exists at the site. The disturbances created from project activities could create future habitat for sensitive moonwort species 10 to 30 years post disturbance (Ahlenslager and Potash 2007).

Peculiar moonwort and western moonwort may experience similar impact if present within the project activity area.

Prescribed burning could directly harm moonwort individuals, or indirectly create more open habitat. Zika et al. (1995) state that a number of moonwort habitats were historically maintained by fire; therefore, fire suppression has led to vegetative succession and fuel loading reducing habitat. Since moonworts are known to occur in post-fire habitats, it is presumed that moonworts must either withstand some degree of fire or readily recolonize burned areas from adjacent populations. Short-term impacts to moonwort species from prescribed burning could be direct removal of above ground structures. Long-term impacts could be improved habitat.

Whitebark pine - Approximately 683 acres of whitebark pine occur within the project area, primarily in the higher elevations, but also at mid-elevations and in units 3B, 4B and 5B. The felling of conifers prior to burning activities would avoid areas in units that have concentrations of whitebark pine. Fire ignition patterns would also avoid the use of fire directly in areas of units that have concentrations of whitebark pine (EIS design features and mitigation measures).

Wildfire is important for whitebark pine regeneration, as whitebark pine survives low-intensity fires and can benefit from stand-replacing fire where regeneration is most successful. Arno (1986) suggests that fire is important in perpetuating an abundance of whitebark pine. Morgan et al. (1994) have found that other conifer species tend to replace whitebark pine in the absence of fire. Although burning in whitebark pine stands can assist in whitebark pine regeneration, it is not an objective of alternative 3. Direct impacts to whitebark pine from prescribed burning can include damage or death as a result of burning individual trees. Indirect impacts to whitebark pine could include the creation of canopy openings conducive for caching whitebark seed by Clark's nutcracker birds; hence, increasing potential whitebark pine regeneration. Spring and fall burning would have the same results.

Timber projects have been shown to benefit whitebark pine by reducing competition and allowing for more rapid growth (Keane et al. 2007). Reducing high fuel loads around whitebark pine stands can also reduce the potential for high-severity wildfires from occurring, which can be detrimental to whitebark pine if regeneration is not successful (USDI Fish and Wildlife Service 2011).

Austin's knotweed, Missoula phlox and California false-hellebore all have potential habitats within the project area. These habitats could be improved by implementation of alternative 3, as encroaching conifer species would be removed, providing more open habitats. It cannot be known whether these species will occupy disturbance areas in the future, but reducing canopy cover coupled with soil disturbance can provide opportunity in some situations.

Cumulative Impacts

Cumulative impacts are the same as for the proposed action alternative and are addressed previously.

Summary of Effects

Federally Listed Plants

Due to the lack of federally listed plant species within the Flint Foothills Project area, and on the Forest in general, implementation of alternative 3 shall have no effects on listed plants.

Forest Service Sensitive Plants

As stated, direct, and indirect impacts to sensitive plants can result from implementing vegetation management projects.

Wavy Moonwort – Due to the extent of known populations of wavy moonwort in Montana and surrounding states, and the low viability of the population along the abandoned logging road in unit 32ST, implementation of alternative 3, hence removal of the known population, may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species of wavy moonwort (*Botrychium crenulatum*)

Peculiar Moonwort and Western Moonwort – Due to the likelihood of peculiar moonwort and western moonwort occurring within the project area, direct and indirect impacts are possible. Therefore, implementation of alternative 3 may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species of peculiar and western moonwort (*Botrychium paradoxum* and *B. hesperium*).

Whitebark Pine – Whitebark pine is known to occur within the project area. Project design features and mitigation measures (chapter 2) are in place to protect clusters of whitebark pine, as described above; however some individuals may be impacted. Implementation of alternative 3 may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species of whitebark pine (*Pinus albicaulis*).

Austin's Knotweed – Austin's knotweed was not found within the project area. Suitable habitat was present on a few shale slopes. Potential habitat could be improved by the removal of encroaching conifers. However, the influx of Austin's knotweed into these treated areas is very speculative. As such, implementation of alternative 3 would have no impact on Austin's knotweed (*Polygonum douglasii* var. *austiniae*).

Missoula Phlox – Missoula phlox was not found during project surveys, but potential habitat was found in open windswept meadows. Potential habitat could be improved by the removal of encroaching conifers. However, the influx of Missoula phlox into these treated areas is very speculative. Implementation of alternative 3 would have no impact on Missoula phlox (*Phlox kelseyi* var. *missoulensis*).

California False-Hellebore – California false-hellebore was not found during project surveys, but potential habitat was found in open meadows. Potential habitat could be improved by the removal of encroaching conifers. However, the influx of California false-hellebore into these treated areas is very speculative. Implementation of alternative 3 would have no impact on California false-hellebore (*Veratrum californicum*).

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Beaverhead-Deerlodge Land and Resource Management Plan (Forest Plan)

This alternative complies with the Forestwide goals stated in the Forest Plan in regards to sensitive plants. The Forest Plan provides direction for management of sensitive plants to maintain and restore sensitive plant populations and their habitats. Large core populations or fringe-of-range populations of sensitive plants are conserved in research natural areas and botanical special interest areas, or protected as populations in conservation strategies, or project design specifications. Neither the whitebark pine nor the moonwort populations within the project area is considered a large core or fringe-of-range population. The loss of individuals will not lead towards a loss of viability or a trend towards federal listing.

Forest Service Manual 2600 Wildlife, Fish and Sensitive Plant Habitat Management

Forest Service Manual 2600 directs the biological evaluation process as a means to ensure that Forest Service actions do not contribute to loss of viability for any native or desired nonnative plant, or contribute to loss of viability for animal species, or trends toward Federal listing of any species. Through this process, it has been determined that implementation of either of the action alternatives identified for the Flint Foothills Project will not lead to a loss of viability or a trend towards federal listing for either moonwort species or whitebark pine

Invasive Plants

Introduction

This section analyzes the impact of proposed project activities on invasive plants and noxious weed species within the Flint Foothills Project boundary.

According to Forest Service Manual 2900 – Invasive Species Management, invasive species are defined as "…an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." The term "noxious weed" typically describes species of plants that have been determined to be undesirable or injurious in some capacity. Federal noxious weeds are regulated by USDA-Animal and Plant Health Inspection Service (APHIS) under the Plant Protection Act of 2000 (appendix A of the Invasive Plants Report in the project file).

State statues for noxious weeds vary widely but Montana is a progressive state, defining laws and regulating noxious weeds. According to the Montana Weed Management Plan (2008), a weed attains a "noxious" status by Rule as described in the Montana County Weed Control Act (revised October 2011). It further defines noxious weeds as "…plants of foreign origin that can directly or indirectly injure agriculture, navigation, fish or wildlife, or public health." Currently there are 32 weeds on the statewide noxious weed list. Each noxious weed is placed into a category based on the priority of eradication, containment, and education (more information is available in appendix B of the Invasive Plants report in the project file). Priority 1 weeds are either not present in Montana or have limited presence in Montana. Management criteria require eradication and education. Priority 2 weeds are common or abundant in Montana. Management criteria require eradication or containment and management is prioritized by local weed districts. Priority 3 weeds are not Montana listed noxious weeds but are regulated plants. The State recommends research, education and prevention to minimize the spread of the regulated plant.

To simplify terminology, all invasive plants and noxious weeds referenced in this analysis will collectively be called invasive plant species. This will include all the species listed on the Federal and Montana Noxious Weed lists as well as cheatgrass (*Bromus tectorum*) and musk thistle (*Carduus nutans*).

Overview of Issues Addressed

The establishment and spread of invasive species is considered to be one of the top threats to National Forest System ecosystem health. The threat from invasive plant species to native plant communities, especially arid rangeland plant communities, has been well documented (Zouhar 2001 and 2003).

Several comments expressed concern over the potential spread of invasive plant species caused by treatment activities. One concern was road construction and the subsequent use could create ideal conditions for weed establishment. The commenters encouraged minimizing or eliminating construction of both temporary and system roads because roads could cause establishment of weeds. To address this concern, alternative 3 was developed to exclude new road construction. The action alternatives differ by the miles of NFS road construction, and the miles of temporary road construction. Other examples of concerns received during scoping were the presence of invasive plant species on roads within burn units, the chance of invasive plant species expansion within prescribed burn units, the impacts of current invasive plant species infestations within the project area, invasive plant species overtaking native plant populations, and long-term commitment to treating invasive plant species. These concerns and more will be addressed in this section.

It is well documented that disturbed soil is highly susceptible to the establishment of invasive plant species and that invasive plant infestations can alter the composition and function of native plant communities (Prieur-Richard & Lavorel 2000). In addition, certain management actions can potentially increase the density and spread of invasive plant species. Due to these factors, the following measurement indicators will be used to help identify the risk of invasive plant species spread and establishment within the project area:

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

The following indicators are factored into the overall risk of invasive plant species becoming established and/or spreading in proposed treatment units within the project area (see Methodology)

- Acres of ground disturbance such as skid trails, log landings and burn piles susceptible to establishment by invasive plant species
- Susceptibility of an environment to the establishment of invasive species (invasibility)
- Miles of road construction
- Presence or absence of invasive plant species within proposed treatment unit
- Effectiveness of past and future invasive plant species control efforts

Affected Environment

Existing Condition

An aggressive invasive plant species management program has been in place on the Pintler Ranger District since the mid-1980s. This program has included a variety of control and management efforts including education, as well as mechanical, biological, and chemical treatments. These efforts have

been effective in reducing the total acres of invasive plant species within the Flint Foothills Project area.

In 2000, the Pintler Ranger District inventoried invasive plant species (only the species found on the Montana Noxious Weed List in 2000) for the Beaverhead-Deerlodge National Forest Noxious Weed Control Plan (USDA Forest Service 2002) and again in 2011 (all priority categories on the current Montana Noxious Weed List). These inventoried populations of invasive plant species consist mostly of point, linear, and polygon infestations within the project area. Point infestations generally consist of widely scattered individual plants. Linear infestations typically consist of widely scattered populations of invasive plant species along motorized routes. Polygon infestations consist of measurable areas of less than 0.1 acre in size to several acres.

The 2000 inventory identified 1,675 acres of invasive plant species within the Flint Foothills Project area (table 38). Invasive plant species found during that inventory included spotted knapweed (*Centaurea maculosa*), musk thistle (*Carduus nutans*) and yellow toadflax (*Linaria vulgaris*). The 2011 inventory identified 802 acres of invasive plant species within the project area, predominantly within rangeland vegetation types, along abandoned roads, old log landings and along existing roadsides (table 38). Invasive plant species identified in the 2011 inventory include musk thistle, spotted knapweed, yellow toadflax, Canada thistle (*Cirsium arvense*), houndstongue (*Cynoglossum officinale*), oxeye daisy (*Chrysanthemum leucanthemum*), common tansy (*Tanacetum vulgare*) and cheatgrass (*Bromus tectorum*).

Table 38. Acres of invasive plant species identified in the Flint Foothills project area in 2000 and 2011

Invasive plant species	2000 Inventoried Acres	2011 Inventoried Acres
Spotted knapweed	1,660	525
Yellow toadflax	6	15
Musk thistle	9	139
Houndstongue	0	73
Canada thistle	0	42
Ox-eye daisy	0	4
Common tansy	0	3
Cheatgrass	0	1
Total	**1,675**	**802**

Yellow toadflax, musk thistle, and cheatgrass were not on the Montana Noxious Weed list at the time of the 2000 inventory. The 2010 Montana Noxious Weed List has yellow toadflax listed as a Priority 2B, while musk thistle and cheatgrass are not considered noxious. However, cheatgrass is considered a regulated plant and categorized as Priority 3. Refer to the "Introduction" section for definitions of the priorities.

Spotted knapweed is the predominant invasive plant species present within the project area. It is mainly located in mountain grassland plant communities, along roads, and in the drier open-canopy forest plant communities. Musk thistle is found in low densities within mountain grassland communities. Many of these individuals were found where excessive rodent activity had disturbed the soil allowing musk thistle to establish. The increase in musk thistle is due to the difference in mapping technique. For the 2011 inventory, sporadic locations of musk thistle were lumped to make polygons rather than individual points. For example, a 15-acre mountain-grassland park may contain one musk thistle plant per acre (on a gopher mound) and be mapped as a 15-acre polygon rather than 15 individual points. This displays as an increase in acres infested with musk thistle, but it is important to note that musk thistle is not invading native plant communities, rather being

opportunistic with disturbed microsites. Musk thistle and Canada thistle were also found in isolated patches where past burn piles existed. All other invasive plant species were found in small patches or as individuals and mostly tied to motorized, wheeled, vehicle routes. Figure 25 that follows displays current locations for the invasive plant species in this analysis.

The 2011 inventory found little to no invasive plant species expansion within historic lodgepole pine and Douglas fir harvest units. The majority of invasive plant species found within those units were in burn piles and open and closed haul routes.

These inventories indicate that the Pintler Ranger District Invasive plant species Control Program has reduced invasive plant species infested acres by 48 percent over the last 10 years. Existing infestations within the project area are currently being treated with herbicides on an annual basis by Forest Service invasive plant species control crews, or by contract, and will continue to be treated into the foreseeable future. The current invasive plant species control program is operating under the 2002 Beaverhead-Deerlodge National Forest Noxious Weed Control Environmental Impact Statement and Record of Decision (USDA, 2002). The invasive plant species control program on the Pintler Ranger District has been funded through National Forest Appropriation funding, Resource Advisory Committee (RAC) grants, Rocky Mountain Elk Foundation, Sikes Act grants and Knutson-Vandenberg (KV) funds. KV funds are funds that the Forest Service is allowed to collect from harvest activities for resource enhancement, protection, and improvement work in the vicinity of the harvest area.

Several biological control agents have been introduced into invasive plant species infestations within the project area. *Urophora affins* is a fly that attacks the flower head of spotted knapweed. *Cyphocleonus achates* is a weevil that attacks the roots of spotted knapweed. In addition, *Larinus minutus* is a seed head eating weevil that is established in this area. Although none of these insects were observed during the 2011 inventory, they are believed to exist within the project area. In 2010, the United States Forest Service Rocky Mountain Research Station released *Mecinus janthinus*, a stem mining weevil to control yellow toadflax. The Research Station will study the effects of this agent on yellow toadflax in this area and local climate.

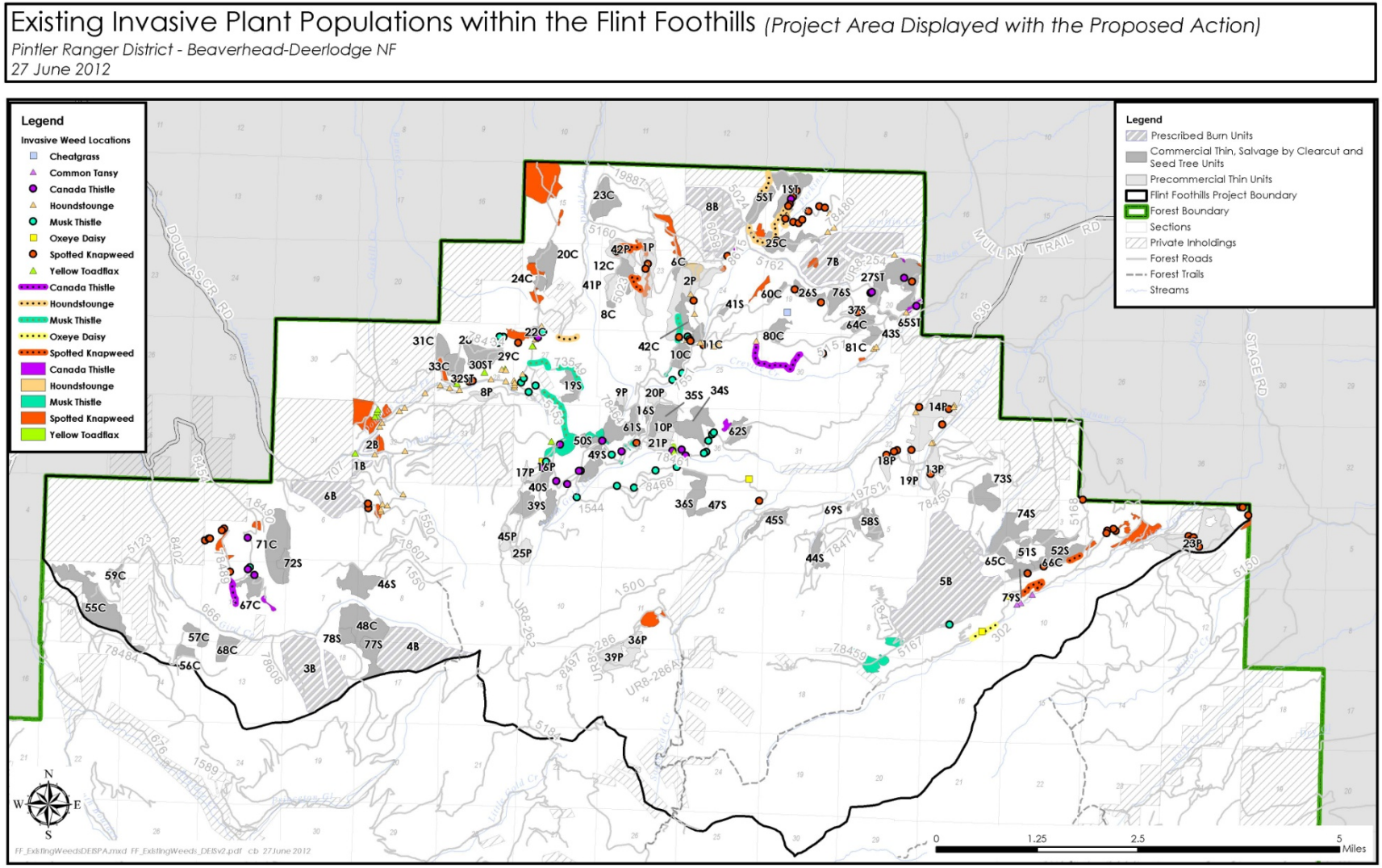


Figure 25. Existing Invasive plant species in the project area

Desired Condition

The 2009 Beaverhead-Deerlodge National Forest Land and Resource Management Plan (Forest Plan) identified the following applicable Forestwide goals for invasive plant species:

Invasive Plants/Noxious Weeds

- The influx of persistent nonnative species is minimized by using native plants, seed, and vegetative propagules for Vegetation Management work (Forest Plan, p. 43)
- Diagnosed pest problems are addressed with an integrated pest management approach, which allows monitoring, prevention, cultural, mechanical, biological, genetic and chemical techniques (Forest Plan, p. 43)
- Prevent, reduce, or eliminate infestations of nonnative or noxious weed species with emphasis on areas where there is a high likelihood of establishment and spread. Manage noxious weeds using integrated pest management techniques as described in the most current Beaverhead-Deerlodge Noxious Weed Control Record of Decision (Forest Plan p. 44).

Invasive plant species inventories completed in 2000 and 2011 within the project area indicate that infestations are still present but total acres infested has been reduced by 48 percent under the current weed control program. Suppressing invasive plant species is vital in order to protect biodiversity and enhance native vegetation. Therefore, invasive plant species monitoring and treatment needs to continue to effectively control the establishment and spread of invasive plant species as well as decrease the number of infested acres within the project area.

Environmental Consequences

Methodology

Discussions of environmental direct and indirect effects will focus on the “risk” of invasive plant species becoming established and/or spreading in proposed treatment units within the project area. In the context of this analysis, risk is defined as the probability, or potential (i.e., low, moderate, high), that (1) invasive plant species seed would be transported and then deposited into areas that are currently not infested by weeds, and (2) proposed treatment activities would increase the density and spread of invasive plant species within the project area.

Understanding the interactions among invasive plant species, native plant communities and the proposed treatments of this project requires an understanding of invasibility. Invasibilty is the susceptibility of a plant community to invasion (Smith and others 2008). This is determined by many factors including the existing vegetation, available nutrients, availability of seed from invasive plants, and amount of past human activity in the area. Generally, within this project area, the areas in the lower elevations have increased likelihood of invasion than the higher elevation areas. This is mainly due to the associated human activities in the area such as roads, livestock grazing, recreation as well as the readily available seed source from existing invasive plant species.

During the summer of 2011, the project area was surveyed and invasive plant species mapped using on-the-ground field observations (more information is available in appendix A of the Invasive Plants report in the project file). The surveys were completed by District Range Technicians whose primary job is weed treatment as well as the District’s Rangeland Management Specialist who manages the invasive plant species program. If invasive plant

species were detected, a location was recorded with a GPS unit and data was collected regarding the species, gross area, percent infested, percent canopy cover, and any associated invasive plant species present. Risk level includes the proximity of the infestations to the proposed treatment units, haul routes, unauthorized routes, and the invasibility of the land.

Incomplete and Unavailable Information

Although a thorough survey was completed within the project area for invasive plant species, it is possible that not all weed infestations were detected. Small infestations with very few plants can be extremely hard to detect and map.

Spatial and Temporal Context for Effects Analysis

To effectively describe the environmental effects of project actions on invasive plant species, the environmental consequences, including cumulative effects discussions, will focus on National Forest System (NFS) lands within the boundaries of the project area. Specific emphasis will be placed on activity areas where vegetation treatment and road construction are proposed.

This analysis will discuss both short-term (1 year or less), and long-term (greater than 1 year) project effects to invasive plants within the project area. The analysis will focus on potential establishment and spread within proposed treatment units and connected actions associated with treatment activities such as temporary road construction.

Invasive plant species can have persistent, long-lasting effects on native plant communities. The duration of these effects is highly dependent upon the severity of the infestation and the difficulty in controlling certain invasive plants. For the Flint Foothills Project, the temporal boundary for project effects would be approximately 10 years. This boundary takes into account the approximate life of the project, including potential activities such as invasive plant species control within treatment units.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Table 24 at the beginning of chapter 3 discloses the present and reasonably foreseeable actions within the project area that are relevant to this DEIS analysis. Past and present activities such as motorized vehicle access, invasive plant species control and livestock grazing have influenced the spread and establishment of invasive species within and adjacent to the project area. All three have played a role to introduce new species and expand the distribution of existing species. In addition, all three are expected to continue into the future, and will be analyzed in cumulative effects.

Alternative 1 – No Action

Direct Effects

There are no direct effects from choosing the no-action alternative.

Indirect Effects

Under this alternative, no project activities would occur. However, previously approved and ongoing activities such as livestock grazing, motor vehicle travel, and firewood cutting would continue. These activities would continue to provide potential vectors for weed spread and establishment. Even in the absence of these ongoing activities there would be potential for

weeds to invade. Invasive plant species such as spotted knapweed and cheatgrass can establish shortly after disturbance or invasion can be accelerated by disturbance. In addition, they can also invade relatively undisturbed perennial native plant communities where there is natural ground disturbance from rodents or predators digging in the soil and weed seeds can be dispersed over long distances by animals and birds (Zouhar 2001 and 2003).

Cumulative Effects

Livestock Grazing

Livestock and native ungulates can act as dispersal agents for weed seed movement. Livestock grazing activities can also result in ground disturbance that is susceptible to invasion by weeds (Frost & Launchbaugh 2003). There is low potential for livestock grazing activities to result in measureable spread of invasive plant species into uninfested lands within the project area because of existing levels of invasive plant infestations, ongoing treatment efforts, and the effectiveness of past invasive plant species control efforts.

Invasive Plant Species Control

In accordance with the Beaverhead-Deerlodge National Forest Noxious Weed Control EIS (2002), treatments of existing invasive plant species infestations would continue to occur annually. The Pintler Ranger District has an active and proven effective weed control program which would continue to benefit native plant communities within the project area by containing and reducing the coverage and density of existing and future invasive plant species infestations.

Public Actions on National Forest System Lands (Motor Vehicle Travel)

Current and future motor vehicle travel on open roads would result in a continued, long-term threat of invasive plant species being introduced and spread within the project area. Motorized vehicles have a potential for spreading invasive plants because they carry seeds and propagules in tires and underneath the vehicle. Roads are a primary source for seed dispersal because they offer disturbed ground. Although the Forest Service (FS) requires certain weed prevention practices be followed by its employees and contractors, it does not require the general public to adhere to weed prevention practices. However, the Forest Service does expend money and time educating the public on the importance of not spreading invasive plant species and proper weed prevention practices. There is low potential for continued use of open, motorized roads by the public to result in measureable weed spread into uninfested lands within the project area because of existing levels of invasive plant species infestation, ongoing treatment efforts, and the effectiveness of past invasive plant species control efforts,

Summary of Effects

Implementation of the no-action alternative would not result in any additional risk of invasive plant establishment and spread over what is currently occurring within the project area. Based on existing levels of invasive plant species infestation, ongoing treatment efforts, and the effectiveness of past invasive species control efforts, the cumulative potential of ongoing and reasonably foreseeable future activities is expected to result in a low risk of weeds being spread. Treatment of existing invasive plant species infestations would continue to occur annually in accordance with the Beaverhead-Deerlodge National Forest Noxious Weed Control EIS (2002).

Alternative 2 – Proposed Action

Direct and Indirect Effects

Table 39 displays the proposed treatment units where invasive plant species were found during the 2011 invasive plant species inventory.

Table 39. Proposed activities in units containing invasive plants species 2011

Silvicultural Prescription	Unit Number
Commercial thinning	06C, 20C, 22C, 24C, 25C, 31C, 66C
Salvage by clearcut harvest	19S, 50S, 61S, 79S
Precommercial thinning	01P, 02P, 13P, 14P, 16P, 21P, 23P, 42P
Seed tree with reserves	01ST, 05ST, 27ST
Prescribed burning	02B, 05B, 06B, 07B, 08B

In addition to the units in table 39, a small component or a few individuals of invasive plant species were found along the majority of existing NFS roads that would be used as haul routes. It was also observed during the 2011 inventory of units within the project area, that invasive plant species were along abandoned temporary routes and burn piles but were not expanding out into the moister open-canopy forest and closed-canopy forest units. The most common weeds found along the temporary routes and burn piles were Canada thistle and musk thistle. Spotted knapweed was located in random areas, mainly in dry mountain-grassland and southern aspect open-canopy forest sites.

The 2011 inventory determined that invasive plant species and seed could be dispersed within the project area by the activities in this proposal. Specifically, areas of concern for the greatest risk of establishment by invasive plant species are the newly constructed temporary roads (7.2 miles), the newly constructed NFS road (1.3 miles), skid trails, log landings, and high-severity burned areas such as burn piles. It is also expected that invasive plant species would increase along haul routes due to the increased traffic on the roads associated with the proposed treatments.

Based on the 2011 inventory and referenced literature, there is high risk for spotted knapweed, musk thistle and Canada thistle to become established in the areas of concern. This is due to increased vehicular travel and increased potential for soil disturbing activities from logging operations. This may occur during the treatment itself or indirectly by wind, wildlife, cattle, and humans following treatments. The remaining invasive plant species have a low potential to establish in the areas of concern because these species are infrequent and in low densities. In addition, there is low potential for all invasive plant species to become established outside of disturbed areas of concern within treatment areas.

This alternative also proposes approximately 1,990 acres of prescribed burn treatments as well as post-harvest underburning in the commercial thin units and seed tree with reserves units. Prescribed burning as well as post-harvest underburning typically occurs in the spring or fall. Burning during these seasons usually produces a low-severity burn. Low severity refers to fires that cause little alteration to the soil, and little mortality to underground plant parts or seed banks (Smith et al. 2008). Most literature supports the notion that invasive plant species have a lower potential of establishment and expansion following low-severity fires (Ferguson & Craig

2008). In addition, the risks of invasion increases if the pre-fire vegetation already has a significant component of invasive plant species present (Goodwin, Sheley and Clark 2002).

The mid-elevation and north facing prescribed burn units have a low invasibility rating due to the existing closed-canopy vegetation, higher elevation, shorter growing season, cooler temperatures, less human-caused disturbances and ultimately fewer existing weed infestations. However, the low elevation and south facing burn units have a higher invasibility rating because of a more open canopy, longer growing season, higher percentage of existing invasive plant species cover and more human-caused disturbances. The two main species of concern associated with prescribed fire is spotted knapweed and Canada thistle. All the other inventoried invasive plant species are of little concern because they have a very low potential of invasion or make up a small percentage of infested acres.

Research has found that spotted knapweed is not a serious threat in lodgepole/subalpine fir forest following fire (Ferguson & Craig 2010), and its abundance was not changed by early spring prescribed burning in Montana (Smith et al. 2008). The 2011 inventory showed little spotted knapweed expansion into past prescribed fire units. Therefore, spotted knapweed has a low risk to establish or expand within the burning units except for Units 2B and 7B, They are lower-elevation units and have existing infestations of spotted knapweed in or adjacent to them. Due to this fact, spotted knapweed has a moderate risk of expanding in the western portion of unit 7B and all of unit 2B.

Invasive plant species with small, wind-dispersed seed such as Canada thistle and musk thistle tend to increase 2 to 4 years after fire, after which their numbers decline (Smith et al. 2008). After a fire in Grand Teton National Park, Canada thistle cover increased to 5 percent but by 17 years post fire, had decreased to less than 1 percent. Canada thistle would have the opportunity to become established in all of the burn units but evidence from the 2011 inventory and referenced research demonstrated that it would not persist within a unit. However, it may persist within high-severity burns such as burn piles. Therefore, Canada thistle has a moderate potential to expand into burn units but should decrease with time and only persist in areas of high burn severity such as burn piles.

Therefore, based on project design features, mitigation measures, and the presence of mostly small, low-density invasive plant species infestations in 27 of the 93 proposed units, as well as effectiveness of ongoing and past control efforts, this alternative is estimated to have an overall low risk of increasing the density and spread of invasive plant species into uninfested lands, and a moderate risk of invasive plant species spreading and establishing in the areas of concern (highly disturbed). This moderate risk rating would also apply to haul routes used for project activities. The rationale for the low risk rating is:

1. Existing weed infestations within the proposed treatment units are small.
2. Monitoring and treatment of infestations within treatment units, burn piles, haul routes and temporary roads would occur as necessary focusing on the areas of concern.
3. The invasive plant species control program has been successful in reducing invasive plant species infestations despite past uses such as livestock grazing, recreation and timber harvest activities. Present and past invasive plant species treatments have been effective in reducing acres of invasive plant species infestations by 48 percent within the project area

4. Commitment to post-activity monitoring and treatment of invasive plant species infestations found within proposed units would result in a high success potential for controlling these weed occurrences within three to five years post treatment
5. Greater attention and funding to control invasive plant species in the project area would result from this alternative.

In the long term, the persistent treatment of invasive plant species infestations would continue to reduce the size and density of existing infestations.

Cumulative Effects

Livestock Grazing

Livestock and native ungulates can act as dispersal agents for seed movement. Livestock grazing activities can also result in ground disturbance that is susceptible to invasion by weeds (Frost & Launchbaugh 2003). There is low potential for livestock grazing activities to result in measureable weed spread into uninfested lands within the project area because of existing levels of invasive plant species infestation, ongoing treatment efforts, and the effectiveness of past invasive plant species control efforts.

Weed Control

In accordance with the Beaverhead-Deerlodge National Forest Noxious Weed Control EIS, treatments of existing invasive plant species infestations would continue to occur annually. The Pintler Ranger District has an active and effective weed control program that would continue to benefit native plant communities within the project area by containing and reducing the coverage and density of existing and future invasive plant species infestations.

Public Actions on Forest Service Lands (Motor Vehicle Travel)

Current and future public actions such as motor vehicle travel on open roads, forest product gathering, hunting, and recreation would result in continued, long-term threat of invasive plant species being introduced and/or spread within the project area. Motorized vehicles have a potential for spreading invasive plants because they carry seeds and propagules in tires and underneath the vehicle. Roads are a primary source for seed dispersal because they offer disturbed ground. Although the Forest Service (FS) requires certain weed prevention practices be followed by its employees and contractors, it does not require the general public to adhere to weed prevention practices. However, the FS does expend money and time educating the public on the importance of not spreading invasive plant species and proper weed prevention practices. There is low potential for continued use of open, motor vehicle routes by the public to result in measureable weed spread into uninfested lands within the project area because of existing levels of invasive plant species infestation, ongoing treatment efforts, and the effectiveness of past invasive plant species control efforts.

The cumulative potential of ongoing and reasonably foreseeable future activities as well as the implementation of the proposed action is expected to result in low risk of invasive plant species being spread and established within the treatment units, but moderate risk of invasive plant species being spread and established on the areas of concerns. Treatment of existing invasive plant species infestations as well as new infestations would continue to occur in accordance with the Beaverhead-Deerlodge National Forest Noxious Weed Control EIS (2002). A high success rate is expected because past weed control efforts have been successful in limiting the rate of spread, infested acres, and reducing plant density within the project area. Present and

past control efforts have reduced infested acres of invasive plant species by 48 percent within the project area. In addition, the identified project design features and mitigation measures (chapter 2) would lower the risk of invasive plant species spread and establishment

Summary of Effects

Implementation of the proposed action, as well as continued livestock grazing and public actions such as motorized vehicle travel would likely increase the number of small infestations of spotted knapweed, Canada thistle and musk thistle in isolated areas of concern (highly disturbed). No invasive plant species are likely to expand into the treatment units where there is little ground disturbance; however, where there is disturbance, there will be a higher probability of the three species becoming established.

The cumulative potential of ongoing and reasonably foreseeable future activities as well as the implementation of the proposed action is expected to result in low risk of invasive plant species being spread and established within the treatment units but moderate risk of being spread and established on the areas of concerns.

Monitoring Recommendations

Post activity monitoring and treatment should occur as long as necessary to ensure that existing infestations do not expand and new infestations are controlled. It is recommended that the units, haul routes, temporary roads, and burn piles be identified as high priority monitoring and treatment areas.

Alternative 3

Direct and Indirect Effects

The direct effects are similar for alternative 3 as described in the alternative 2 discussion previously, with one main exception. Alternative 3 was developed without the road component that is in alternative 2 (7.2 miles of newly constructed temporary road and 1.3 miles of newly constructed NFS road). Therefore, the areas of concern for this alternative would be limited to skid trails, log landings, and high-severity burned areas such as burn piles. This alternative would decrease the overall opportunity for invasive plant species to spread or become established, thereby reducing the number of expected new small infestations. However, this alternative is expected to increase the number of small infestations of invasive plant species within the project area compared to the no-action alternative.

Several units have been dropped in this alternative. However, none of the dropped units contained invasive plant species that were found with the 2011 inventory.

Therefore, based on project design features, mitigation measures, and the presence of mostly small, low-density invasive plant species infestations in 27 of the 83 proposed units, as well as effectiveness of ongoing and past control efforts, this alternative is estimated to have an overall low risk of increasing the density and spread of invasive plant species into uninfested lands, and moderate risk of invasive plant species spreading and establishing in the areas of concern (highly disturbed). This moderate risk rating would also apply to haul routes used for project activities. The rationale for this low risk rating is:

1. Existing weed infestations within the proposed treatment units are small.

2. Monitoring and treatment of infestations within treatment units, burn piles, and haul routes would occur as necessary, focusing on the areas of concern.
3. The invasive plant species control program has been successful in reducing invasive plant species infestations despite past uses such as livestock grazing, recreation and timber harvest activities. Present and past treatments have been effective in reducing acres of invasive plant species infestations by 48 percent within the project area.
4. Commitment to post-activity monitoring and treatment of invasive plant species infestations found within proposed units would result in high success potential for controlling these weed occurrences within 3 to 5 years post treatment.
5. Greater attention and funding to control invasive plant species in the project area would result from this alternative

In the long term, the continued treatment of invasive plant species infestations would continue to reduce the size and density of existing infestations.

Cumulative Effects

Livestock Grazing

Livestock and native ungulates can act as dispersal agents for seed movement. Livestock grazing activities can also result in ground disturbance that is susceptible to invasion by weeds (Frost & Launchbaugh 2003). There is low potential for livestock grazing activities to result in measureable weed spread into uninfested lands from the project area because of existing levels of weed infestation, ongoing treatment efforts, and the effectiveness of past weed control efforts.

Weed Control

In accordance with the Beaverhead-Deerlodge National Forest Noxious Weed Control EIS (2002), treatments of existing invasive plant species infestations would continue to occur annually. The Pintler Ranger District has an active and proven effective weed control program which would continue to benefit native plant communities within the project area by containing and reducing the coverage and density of existing and future invasive plant species infestations.

Public Actions on National Forest System Lands (Motorized Vehicle Travel)

Current and future motorized vehicle travel on open roads would result in a continued, long-term threat of invasive plant species being introduced or spread within the project area. Motorized vehicles have potential for spreading invasive plants because they carry seeds and propagules in tires and underneath the vehicle. Roads are a primary source for seed dispersal because they offer disturbed ground. Although the Forest Service requires certain weed prevention practices be followed by its employees and contractors, it does not require the general public to adhere to weed prevention practices. However, the FS does expend money and time educating the public on the importance of not spreading invasive plant species and proper weed prevention practices. There is low potential for continued use of open, motorized roads by the public to result in measureable invasive plant species spread into uninfested lands within the project area because of existing levels of invasive plant species infestation, ongoing treatment efforts, and the effectiveness of past invasive plant species control efforts.

The cumulative potential of ongoing and reasonably foreseeable future activities as well as the implementation of alternative 3 is expected to result in low risk of invasive plant species being

spread and established within the treatment units, but moderate risk of being spread and established on the areas of concerns. Treatment of existing invasive plant species infestations would continue to occur in accordance with the Beaverhead-Deerlodge National Forest Noxious Weed Control EIS (2002). A high success rate is expected because past weed control efforts have been successful in limiting the rate of spread, infested acres, and reducing plant density within the project area. Present and past control efforts have reduced infested acres of invasive plant species by 48 percent within the project area. In addition, the identified project design features and mitigation measures (chapter 2) would decrease the potential of invasive plant species spread and establishment

Summary of Effects

Implementation of the alternative 3, as well as continued livestock grazing and public actions such as motorized vehicle travel would likely increase the number of small infestations of spotted knapweed, Canada thistle and musk thistle in isolated areas of concern (highly disturbed). No invasive plant species are likely to expand into the treatment units where there is little ground disturbance; however, where there is disturbance, there will be a higher probability of the three species becoming established.

This alternative reduces the potential for invasive plant species to spread and become established compared to the proposed action because it does not include newly constructed road. However, all the other proposed activities are similar to the proposed action. Therefore, a similar outcome is expected, but with fewer small infestations in isolated areas.

The cumulative potential of ongoing and reasonably foreseeable future activities as well as the implementation of alternative 3 is expected to result in low risk of invasive plant species being spread and established within the treatment units but moderate risk of being spread and established on the areas of concerns.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Beaverhead-Deerlodge Land and Resource Management Plan (Forest Plan)

Both action alternatives comply with the Forestwide goals stated in the Forest Plan in regards to invasive plant species. The Forest Plan provides direction for management of invasive plant species in regards to prevention, reduction, or elimination of infestations of nonnative or noxious weed species with emphasis on areas where there is high likelihood for establishment and spread. The plan also directs that weeds are managed through an integrated pest management approach as described in the most current Beaverhead-Deerlodge Noxious Weed Control Record of Decision. Under the proposed action alternative, an integrated pest management approach would continue to be used to control invasive plant species within the project area.

Forest Service Manual 2900 - Invasive Plant Species Management

Forest Service manual 2900 gives direction which sets forth National Forest System policy, responsibilities, and direction for the prevention, detection, control, and restoration of effects from aquatic and terrestrial invasive plant species (including vertebrates, invertebrates, plants, and pathogens). Under the proposed action alternative, an integrated pest management approach would continue to be used to manage invasive plant species on the Pintler Ranger District.

Wildlife

Introduction

This analysis focuses on potential impacts to the wildlife resource as a result of proposed treatments and activities. This document analyzes the potential effects from the proposed action activities to any wildlife that are federally listed as threatened or endangered species, and to Forest Plan (USDA 2009) management indicator species (MIS).

Overview of Issues Addressed

Through the public scoping process, Montana Fish, Wildlife, and Parks identified the need to contain wildlife attractants at project implementation sites. Other elements identified in scoping as important to address include threatened and endangered species and habitats, sensitive species and habitats, northern goshawk habitats, snag and coarse wood retention, old growth habitat, big game habitats, and road impacts to wildlife.

Measurement Indicators

The indicators used to evaluate impacts of alternatives vary by wildlife resource addressed and consist, at least in part, of:

- Acres of habitat affected
- Open motorized road and trail densities (OMRTDs)
- Density of habitat resources such as snags and downed logs.
- Acres and proportion of secure habitat affected
- Measures for changes in habitat will be acres of treatments compared to the amount of suitable habitat available (by species).

Affected Environment

Existing Condition

Wildlife Habitats

There are several vegetation types that occur in the Flint Creek Mountains that range from subalpine and whitebark pine habitats to sagebrush and grasslands at lower elevations. Each vegetation type contributes various habitat requirements to different species. Table 40 shows acres and size classes of vegetation types on National Forest System lands within the project area.

Table 40. Size class distribution by dominance group, National Forest Systems lands within the project area

Cover Type	Acres on NFS Lands	Percentage of NFS Lands	Existing Tree Size Classes (acres)			
			Early seral (0-4.9 inches d.b.h.)	Mid-seral (5-9.9 inches d.b.h.)	Advanced seral (10-14.9 inches d.b.h.)	Late seral (15 inches+ d.b.h.)
Aspen	95	<1	unspecified			
Dry grasslands, meadow	1,930	5	-	-	-	-
Sbrubland - mesic	146	<1	-	-	-	-
Wet meadow	68	<1	-	-	-	-
Douglas-fir	13,534	37	483	1,831	11,134	86
Lodgepole pine	17,646	48	1,074	8,729	7842	1
Ponderosa pine	226	<1	31	181	6	8
Whitebark pine	625	2	15	189	421	0
Spruce/fir	615	2	43	4	557	11
Water	55	<1	-	-	-	-
Sparsely vegetated	2,065	6	-	-	-	-

Based on Vmap satellite imagery interpretation

Commercial timber harvest has occurred over approximately 23 percent of the project area since the 1960s, and precommercial thinning has occurred on approximately 3 percent of the project area since the 1980s (Vegetation section).

Mountain pine beetle activity has increased foraging habitat for woodpeckers and other birds and greatly increased the availability of snag cavity nesting habitat across the project area (table 25 and figure 12). Refer to the Vegetation section for a description of the insect activity within the project area, including the mountain pine beetle, western spruce budworm and the Douglas-fir bark beetle, as well as associated tree defoliation and mortality.

The discussions of wildlife habitat below focus on vegetation types which show the greatest change, or are rare or unique. Refer to the Vegetation section for more detail on these and the more common forest types.

Quaking aspen

Aspen are of ecological importance to many species of wildlife such as elk, deer, moose, beaver, and blue grouse. In coniferous forests in the interior west, they are a source of abundant forage for browsers. In addition, they provide cooler microsites, provide cover and nesting structure, and provide a source of snags for cavity nesters.

The amount and quality of aspen cover has been declining for many years in portions of the interior West (Bartos 2001, Di Orio 1985, Rogers 2002). Aspen is second only to riparian areas in terms of biodiversity. Aspen across the Forest (and regionwide) is considered a community at risk because it is declining in patch size and vigor (USDA Forest Service 2009b). The State Comprehensive Wildlife Plan (MFWP 2005) has identified altered fire regimes in aspen galleries with resulting conifer encroachment as a conservation concern. The Forest Plan

includes an objective to increase the aspen component within lodgepole pine and other vegetation types, over 67,000 acres. Aspen distribution within the project area consists of small scattered patches, with concentrations occurring in the eastern-most portion. Aspen size classes are unspecified in the vegetation data. As noted in table 40 and table 27in the Vegetation section, aspen is a minor component within the project area.

Whitebark pine

Whitebark pine is a high-elevation tree species that has large seeds that are an important food for many species. Whitebark pine is a critical food source not only for Clark's nutcracker, but for many wildlife species including other birds, small mammals as well as bears. In particular, their seeds have several features that make them a valuable food. They are large and therefore more energetically rewarding, the nutrients are less perishable compared to other sources, and they are a rich source of dietary fat (Whitebark pine Ecology Foundation 2010).

The higher elevations around Emery Ridge and Rose Mountain in the southern portion of the project area provide these habitats. Predominant tree size in whitebark pine stands is currently from 5-15 inches d.b.h. As noted in table 40, and table 27 in the Vegetation section, this species is a minor component within the project area.

Shrubland –Grasslands

These habitats range from solid stands of grasses or grass/forbs to a mixture of sagebrush and grasses to almost solid canopy of shrubs (mostly sagebrush). Grassland and shrubland distribution within the project area is somewhat limited, with greater availability occurring at lower elevations outside the project area boundary. Lower elevation grasslands are relatively large and continuous, whereas the upper elevation habitats are interspersed with conifers and shrubs. Fire and herbivority were historically important disturbance processes in this habitat. The absence of fire and presence of increased herbivority (including livestock grazing) have influenced the distribution and seral stages of sagebrush and grasslands available for wildlife (USDA Forest Service 2009b). At present, these habitats have increased conifer cover and nonnative vegetation than were present historically.

Snags

Bush et al. (2006) analyzed snag densities based on FIA data collected from 1996-2003 for landscapes within the BDNF, prior to the onset of widespread tree mortality generated by mountain pine beetle (MPB) activity. Results from that time period for the Clark Fork-Flints Landscape show moderate availability of snags from 10-19.9 inches d.b.h. and a lack of snags equal to or greater than 20 inches d.b.h. Since that time, mountain pine beetle epidemic has been advancing through lodgepole pine, creating a large-scale disturbance and increased snag abundance. Estimates for acres affected by mountain pine beetle activity in the Flint Foothills area has increased substantially since 2006 (table 25 Vegetation section).

In addition, mortality due to western spruce budworm and Douglas-fir bark beetle in portions of the project area has increased snag availability in Douglas-fir stands. Modeled beetle activity shows that about 55 percent of the Clark Fork-Flints landscape has been affected by insect mortality (ERG 2010, table 41).

Table 41. Modeled Beetle Activity in Clark Fork-Flints Landscape (ERG 2010)

Landscape	High	Moderate	Low	Total Beetle Activity	Total Landscape Acres
Clark Fork -Flints	48,860	55,905	98,379	203,144	369,173

Since the 1960s, commercial treatments have occurred on approximately 23 percent of the project area. These areas are expected to be very low on snags; those that were left would likely have fallen by now. Dead trees may remain standing for 5-15 years. Once they have fallen, there will be less opportunity for snag recruitment in the lodgepole dominance type.
The snag direction in the Forest Plan is based on Bollenbacher et al. (2008). That analysis looked at the density and distribution of snags by various areas, habitat types, dominance groups and seral stages. That analysis also considered the potential impacts of timber harvest and human access on snag density. The actual snag retention numbers in the Plan are based on snag densities from wilderness/roadless lands on the eastside forests. The direction focuses on retention of uncommon and rare elements; large diameter standing dead trees (smaller diameter dead trees are abundant across the forest due to the MPB epidemic).

Since that analysis, Ecosystem Research Group (ERG 2010) modeled changes in vegetation and wildlife habitat as a result of the mountain pine beetle epidemic. In the Clark Fork-Flints landscape, beetle activity was present in approximately 55 percent of the total area through 2009 (ERG 2010). Within the project area, it is currently estimated that virtually all of the lodgepole pine stands greater than 5 inches d.b.h. have been affected by mountain pine beetle. Mortality due to Douglas-fir bark beetle found in the Douglas-fir stands is also occurring (see Vegetation section).

Within the Flint Foothills Project area, stand exams conducted within proposed commercial harvest units where snag numbers were recorded, indicate that availability of snags 15 inches d.b.h. varies greatly among stands, ranging from 0 – 24 per acre, with densities averaging 2.9 per acre.

Beetle-infested trees and stands

Ecosystem Research Group (ERG 2010) evaluated how changes from mountain pine beetle, other insects, disease activity and wildfire might affect habitats for nine selected species of wildlife over the next 50 years in the BDNF. The nine selected terrestrial species analyzed include: northern goshawk, fisher, black-backed woodpecker, elk, flammulated owl, pileated woodpecker, Canada lynx, wolverine and grizzly bear. They also measured how proposed vegetation treatments would affect disturbance processes and wildlife species habitats.

ERG found that vegetation changes expected from the ongoing mountain pine beetle epidemic and future modeled wildfires will be substantial. The modeled disturbance patterns and vegetation changes start from the current insect infestation and uncharacteristic vegetation conditions, and move towards a greater mosaic of vegetation patterns with more balanced and resilient characteristics. At the forest scale, there was a small but measurable difference in modeled acres burned between the treatment and no treatment scenarios for all five decades. Results indicate that treatments are the most effective near the onset of the mountain pine beetle epidemic. Modeled mountain pine beetle acreages decrease through time because of a more balanced distribution of size classes and density in the various cover types containing pine species.

Within the Clark Fork-Flints landscape, they found that habitat for the nine species would generally remain fairly static and sustainable or increase slightly in the next 50 years, except for goshawk and flammulated owl habitats, which are projected to decrease somewhat over the same time period.. This is largely because those species evolved with and are tolerant of, or dependent upon natural disturbances. The modeled changes to potential wildlife habitats are more a function of natural disturbance and succession processes and resulting changes to vegetation through time than to treatment effects. No species will become at risk due to mountain pine beetle or wildfires. Wildlife habitat does move spatially over time. Treatments can positively affect fire occurrence and benefit wildlife habitats on a project-level scale, but pale in comparison to the effects from successional and disturbance processes at the landscape scales.

Processes by which mountain pine beetle can affect wildlife habitat include: (1) beetles as a food source; (2) defoliation of tree canopy; (3) loss of bark; (4) cessation of cone production; (5) proliferation of standing dead trees; (6) fall down of dead trees; and (7) increased production of understory vegetation (Chan-McLeod 2006).
Table 42 summarizes some of the effects of these changes.

Table 42. Changes in habitat features over time

Stage	Effects
Beetles as a food source	Several species of woodpeckers take advantage of beetle numbers. An individual tree serves as a food source for about a year. Continued foraging habitat for woodpeckers depend on spread of beetles throughout the stand.
Defoliation of tree canopy	Foliage usually changes from green to yellow to red within 3 years after attack and trees begin to lose needles 2-4 years after death. Complete defoliation occurs approximately 3-5 years after death. Loss of needles for forage (hare, grouse), loss of habitat for invertebrates (prey for foliage-gleaning birds), loss of resting and nesting habitat in canopy (small mammals, birds.
Loss of bark	Loss of cambium used by porcupines, substrate for invertebrates (prey for trunk-foraging species such as nuthatches), loss of roosting habitat for bats.
Cessation of cone production	Species such as crossbills and squirrels lose food source
Proliferation of standing dead trees	The sudden proliferation of lodgepole pine snags will not have the same value as the intermittent creation of snags due to lack of interspersion with live green canopy. In addition, there are limitations based on the small size of lodgepole pine, which will not remain standing as long as larger diameter snags.
Falling down of dead trees	The rate at which snags fall varies from area to area, but generally most snags are down within 5-15 years. Increased use as avian perches and small mammal cover.
Enhanced understory production	Increased sunlight allows increased understory grass, forb and shrub production.

These processes will be analyzed for specific species that are associated with those features. Factors affecting the nature of effects include 1) time since death; 2) residual green component; 3) ecosystem types; and 4) landscape effects. These factors are also considered in the species-specific analyses.

Old Growth

Old growth forests are distinguished by old trees and structural characteristics developed over time (Green et al. 1992, errata corrected 2007, 2008). An analysis of old growth over large landscapes was completed by Bush et al. (2006). In the Clark Fork-Flints landscape, the

analysis estimated that 20.9 percent of the Forest is in old growth with a 90 percent confidence interval of 14.1-28.1 percent. Estimates for percentage of old growth in the landscape were highest in spruce/fir associations (43.3 percent, lowest in Douglas-fir/ponderosa pine types (10 percent) and moderate in lodgepole and whitebark pine (20 percent). No old growth mapping was completed specific to Flint Foothill Project area beyond the formal stand exam surveys and informal surveys that were conducted in each proposed unit (Vegetation section). Inventoried old growth is limited to 281 acres within the project area. Treatment noted in the Vegetation Analysis indicates minimum criteria per Green at al. (2007) would still be met.

Connectivity

The Forest Plan includes a goal that the Forest would contribute to wildlife linkages between landscapes, unless isolation is determined to be beneficial. Linkage areas are those areas identified for large carnivores and ungulates through multi-agency cooperation. Options may include, but are not limited to: maintaining Forest Service ownership at highway and road crossings; consolidating ownership at approach areas to highway and road crossings substantiated by empirical data as necessary to facilitate wildlife movement; and provide secure habitat at the landscape scale to facilitate large animal movement.

Linkage areas for Canada lynx were identified for the Northern Rockies Planning Area (USDA Forest Service 2007). Linkages mapped through the Clark Fork-Flints landscape include one between Georgetown Lake and Anaconda connecting the southern and central portions of the landscape across State Highway 1, and one connecting the central portion of the landscape to portions in the John Long Mountains, across State Highway 1 (USDA Forest Service 2007). These linkages are estimates and not substantiated by empirical data on lynx movement. The Beaverhead-Deerlodge National Forest is classified as unoccupied by Canada lynx (USDA Forest Service 2007). The species absence is supported by the periodic species lists issued by the US Fish and Wildlife Service (USDI Fish and Wildlife Service 05/09/2012).

Desired Condition

The Forest Plan provides Forestwide (Forest Plan, p. 11) goals and site-specific goals, objectives and standards and guidelines for maintenance of wildlife habitat (Forest Plan, pp. 43-49).

Regulatory Framework

Applicable requirements and other direction guiding the management and protection of wildlife and habitat may be found in the Endangered Species Act (ESA), National Forest Management Act (NFMA), and USDA Forest Service manuals. The Forest Plan was developed to be consistent with ESA, NFMA, and manual direction. Details are provided in the wildlife report in the project file.

Environmental Consequences

Methodology

Pre-field reviews were conducted to determine which species are known to occur in the area or have suitable habitat present and could potentially occur. Sources reviewed include Montana Natural Heritage Program (MNHP), Forest occurrence information, Plan FEIS Appendix B (Biological Evaluation) and species distribution information.

Surveys completed in the project area (appendix F) include northern goshawk, flammulated owl, great gray owl, and woodpecker. Units were prioritized for surveys based on potential for habitat for specific species and are discussed further in species-specific analyses.

There are several types of activities proposed in this project. Not all types of activities have the potential to affect each species because each species has specific habitat requirements. This is addressed for each species.

The action alternatives propose similar treatments with variation in the amount of commercial thinning and salvage, as well as transportation components. The exception in similarity is the proposed treatment in old-growth stands under alternative 2 and lack of treatment of old growth under alternative 3. Due to the similarities, alternatives 2 and 3 are analyzed concurrently to compare and contrast effects to species. Any notable distinctions between the effects of the alternatives are identified.

Diversity Analysis

To meet the requirements of NFMA implementation regulations, the focus is for the Forest Service to assess habitat to provide for a diversity of species. NFMA direction is to"…provide for a diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple use objectives." In addition, it includes direction to consider the best available information in implementing the Plan. The Northern Region uses a principle-based approach to population viability analysis (PVA) that is widely agreed to and supported in peer-reviewed, scientific literature (summarized in Samson 2006). Samson 2006 is incorporated by reference.

Samson (2006) conducted a regionwide conservation assessment for the northern goshawk, black-backed woodpecker, pileated woodpecker, and flammulated owl, which is founded on a principle-based approach to PVA. To assess the availability of suitable habitat and ultimately assess short- and long-term viability on each Forest in the Northern Region, Samson used peer-reviewed science, all known inventory/observation data, vegetation data from Forest Inventory and Analysis (FIA), scientific information on the minimum dispersal distances for species, their home range and body sizes, and well known conservation principles for each species. In summary, based on that analysis, habitat for each of these species is abundant and widely distributed. Bush and Lundberg (2008) updated and substantiated Samson (2006) findings. The result was generally an increase in habitat for all species except pileated woodpecker.

The Biological Evaluation and Biological Assessments/Opinions for the Forest Plan revision also assessed viability for threatened, endangered and sensitive (TES) species on the BDNF (USDA Forest Service 2009b, Appendix B).

Most recently, Ecosystem Research Group (2010) analyzed vegetation changes due to mountain pine beetle across the Forest. They also looked at the effect this would have on habitat for nine selected wildlife species over the next 50 years. This new information has been incorporated into the analysis.

For this project, the above references, as well as available population status and distribution information; occurrence records from survey efforts; hunting and trapping data; and the scientific literature for information on the biological and habitat requirements for species, as well as species response to disturbance were reviewed. This analysis is tiered to the Forest Plan viability analysis.

Spatial and Temporal Context for Effects Analysis

The analysis area used for direct, indirect and cumulative effects is limited to the project area for most species. The project area boundary encompasses the affected areas where the proposed treatments would be located, and is large enough in scale to include one or more home ranges of most wildlife species in the area. Where open, motorized, road and trail densities (ORMTDs) are the basis for the effects analysis, the analysis areas to assess ORMTDs are landscapes and hunting units, consistent with Forest Plan direction (Forest Plan, Tables 13 and 14). Analysis for lynx is based on Lynx Analysis Units (LAU), which have been mapped Forestwide.

Generally, short-term effects are associated with disturbance from activities, and immediate changes to habitat after treatment. Long-term effects will consider changes to potential habitat over time, dependent on specific species habitat needs. Measures for changes in habitat will be acres of treatments compared to the amount of suitable habitat available (by species).

Part of the analysis focuses on changes in vegetation, as this proposal would result in changes to stand structure and species composition through salvage, thinning, precommercial thinning, and prescribed burning. Some species may be favored by some treatments and unaffected by others, dependent on habitat preferences. For example, flammulated owls may benefit from thinning in Douglas-fir, and be unaffected by salvage of lodgepole pine.

The analysis also includes disturbance effects due to increased traffic, human activity, and equipment use during project activities. Several species or groups of species are potentially affected by disturbance: wolves, wolverines, elk, and nesting raptors, dependent on the seasonal timing of activities. Timeframes for project activities vary by type of activity. For example, the commercial harvest units (salvage of lodgepole pine and thinning of Douglas-fir) are expected to take a maximum of 5 years, while precommercial thinning, prescribed burning, and other post-treatment activities may take up to 10 years.

Past, Present, and Foreseeable Future Activities Relevant to Cumulative Effects Analysis

Past actions that have affected vegetation include fire suppression, timber harvest, prescribed burning, livestock grazing, and firewood cutting. These past actions have contributed to the existing vegetation and habitat conditions.

Harvest increased greatly from the 1960s through the mid-1980s and has declined in recent years. Commercial timber harvest has occurred on about 23 percent of the project area, while non-commercial thinning has occurred on about 3 percent of the project area. Roadside salvage has occurred in the project area as well. Harvest has occurred on approximately 237 acres of private land within the project area boundary. Prescribed fire (burning of logging slash, understory burns, and burns to remove conifer succession in grass-shrub habitats) has occurred on about 11 percent of the project area (see the Vegetation Report in the project record).

Table 24 at the beginning of chapter 3 discloses the present and reasonably foreseeable actions within the project area that are relevant to this DEIS analysis. Present and reasonably foreseeable activities that may affect species or habitats discussed in this analysis include: public activities such as recreational activities, wildlife viewing or driving for pleasure; activities requiring fees or permits such as cabin rentals or firewood permits; trail maintenance, the Forest travel analysis to designate motorized use; livestock grazing; ongoing invasive plants control; Roadside #4 Salvage Hazard Tree Removal; wildland fire suppression; Emery 21 Timber Sale; Montana State Prison lands future timber harvest (outside of the project

boundary); Montana DNRC lands potential future timber harvest (outside of project area); BLM lands prescribed fire treatments and ongoing livestock grazing (outside of project area); and timber harvest on private inholdings.

Climate Change

Changes in climate may affect the amount, quality and distribution of broad-scale vegetation types or may impact forest structure and various successional stages associated with drought, insects, diseases or fire (see Vegetation section). As a driver of biotic systems, climate affects individual fitness; population dynamics; species abundance and distribution; and ecosystem composition, structure, and function. Wildlife can respond in three ways; they can respond in place through genetic, physiological or behavioral adaptations; they can move to a new location (distributional shifts) or they may be unable to do either and be unable to reproduce successfully and may face local extirpation or extinction.

There are numerous sources of uncertainty when trying to predict the effect of climate change. A few include variability in physical systems; uncertainty in vegetative community shifts; interactions between climate and non-climate stressors; and variation in species life history strategies, physiological tolerance and dispersal abilities (Hahn 2009). Climate change is addressed as a cumulative effect for species in this analysis where applicable.

Overview

Effects to species will be analyzed by looking at changes in habitats, as well as considering disturbance associated with the activities. Vegetation management activities may affect stand age, structure or species composition, thereby affecting habitat. Actions with potential for direct effects on habitat include salvage, commercial thinning in Douglas-fir, seed tree harvest, prescribed burning within and outside timber harvest units, and precommercial thinning. Indirect effects after project implementation include changes in vegetation structure over time.

Wildlife habitat attributes and availability of habitat components largely determine area suitability for species. Several components and attributes, including wildlife secure areas, snag retention, old growth availability, and connectivity/fragmentation, are applicable to effects analysis for a number of species addressed in this analysis. Therefore, effects to those elements are summarized in the following sections and referenced under individual species analysis.

Roads and Wildlife Security Areas

Roads are recognized as having impacts on many species of wildlife. Effects range from direct mortality, creation of edge effects, barriers to movement for some species, and disturbance and displacement (Forman and Alexander 1998; Trombulak and Frissell 2000).

Security is important for a range of mammals, including elk, bears, wolverines, and lynx. Habitat effectiveness for elk decreases as road densities increase. Increasing access and use of an area causes increasing conflicts and risks to wildlife resources that can be displayed in four broad categories: habitat alteration, disturbance, increased vulnerability to mortality, and increased invasive plant species establishment.

In the Forest Plan for wildlife secure areas and connectivity, direction is to manage density of open, motorized roads and trails by landscape year-round (except fall big game hunting season) to achieve levels at or below the levels shown in table 43. Currently, the open, motorized road and trail density (OMRTD) in the Clark Fork-Flints landscape is below the maximum level described in the Forest Plan.

Table 43. Clark Fork-Flints Landscape Goal for open, motorized road and trail densities (OMRTD

Landscape	Maximum Forest Plan OMRTD	Existing OMRTD Percent Secure Area
Clark Fork-Flints	1.9 miles/square mile	1.8 miles/square mile 40.1 % secure area

These secure areas, defined as areas greater than 10 acres regardless of vegetative components and more than 0.33 mile from an open road, are based on areas outside of the influence of open motorized roads and trails. Currently, 19 percent of National Forest System (NFS) lands within the project area provide summer wildlife-secure areas. In addition, the Forest Plan identified areas for winter nonmotorized recreation. In the Flint Foothills Project area 12 percent of the NFS lands managed by the BDNF are managed as winter nonmotorized. These areas are located within and adjacent to mapped big game winter ranges (figure 35).

Elk security is provided by secure areas (defined above) during the fall hunting season. The Forest Plan includes direction to manage OMRTD by hunting unit, to achieve levels at or below the maximum level shown in table 44 for Hunting Unit 212. Currently, Hunting Unit 212 is slightly under the OMRTD maximum level for the general hunting season (table 44). About 42 percent of NFS lands (15,415 acres) within the project area provide fall elk-secure areas. Distribution of both summer and fall wildlife security areas is shown in figure 26.

Table 44. Hunting unit 212 (fall) maximum and existing OMRTD

Hunting Unit	Maximum Forest Plan OMRTD	Existing OMRTD Percent Secure Area
212	1.4 miles/square mile	1.3 miles/square mile 49.8% secure area

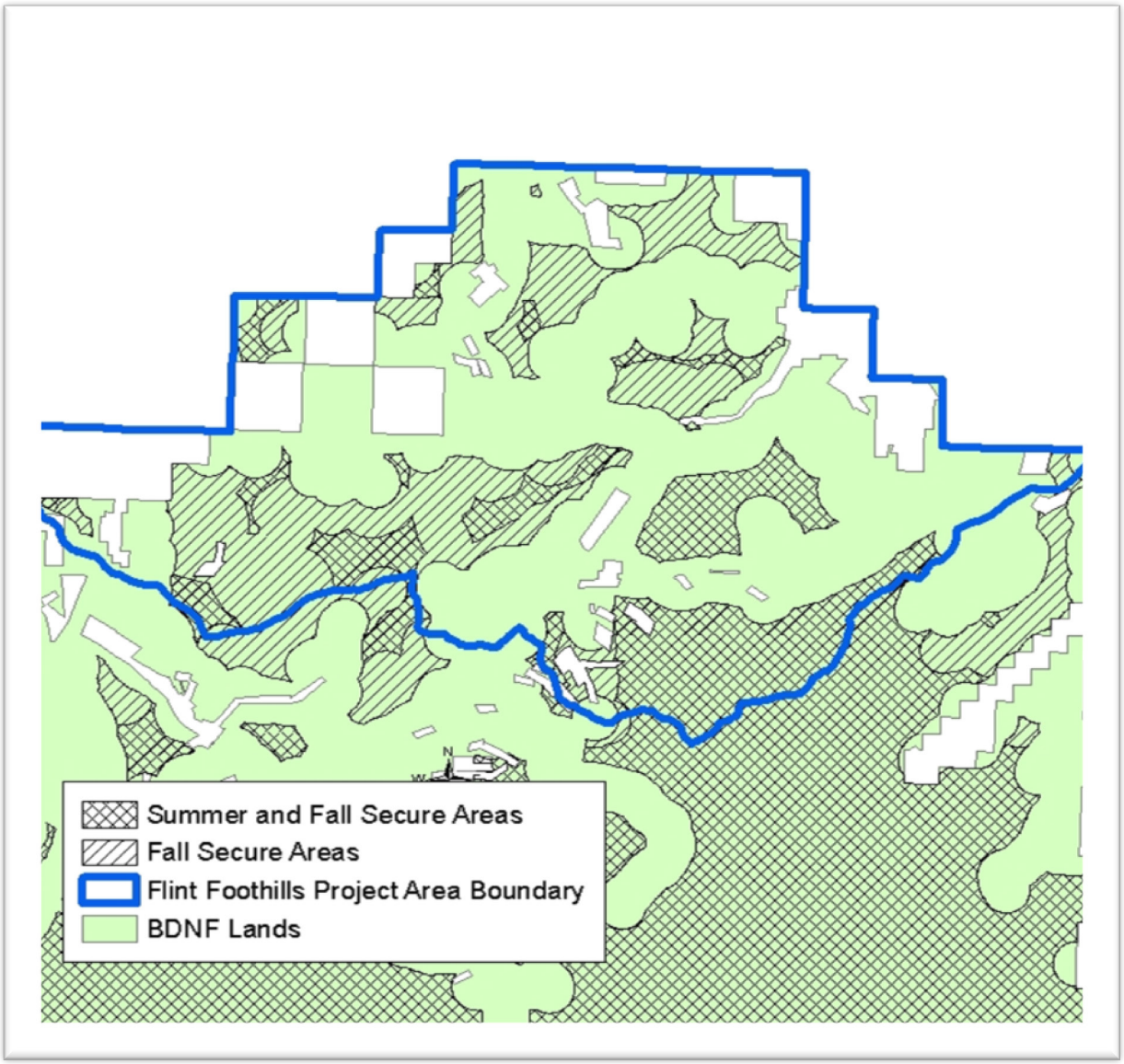


Figure 26. Summer and fall elk secure areas, BDNF lands

Alternative 1- No Action

Direct, Indirect, and Cumulative Impacts

For alternative 1, there would be no direct, indirect or cumulative effects to species analyzed for the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

Road Treatments and OMRTD

Road treatments under alternative 2 include construction of approximately 1.3 miles of new National Forest System (NFS) road that would be managed as closed to motor vehicle use after project activities are completed. Approximately 7.2 miles of new temporary road would be constructed and subsequently decommissioned by upon completion of project activities. New road NFS and temporary road construction totals 8.5 miles. On existing routes, approximately 0.6 mile of existing open unauthorized route and 0.4 mile of closed unauthorized route (about 1.0 mile total) would be reconstructed for timber haul and added to the Forest transportation system as maintenance level 2. A total of 4.4 miles of other reconstructed unauthorized roads (1.0 mile of open and 3.4 miles of closed) would be used as temporary roads for timber haul and subsequently decommissioned. Overall, alternative 2 would create a 0.6-mile reduction of roads open to motor vehicle use; a total reduction of 3.1 miles of road would occur.

Under alternative 3 only existing roads would be used for timber haul. No new or temporary road construction outside of existing routes would occur. This alternative would reconstruct 1.0 mile of existing unauthorized road for timber haul and subsequent inclusion in the Forest System, similar to alternative 2. After vegetation treatments, 2.3 miles of existing unauthorized roads would be decommissioned by obliteration. There would be no change in mileage available for motor vehicles, and a total reduction of 2.3 miles of road in the project area following treatments.

Roads within the project area are unpaved and narrow, vehicle speeds are generally low, and vegetative cover is common along travel routes. The wildlife species analyzed here are highly mobile, therefore, the potential for barriers to movement and edge effects are minimal. Road reconstruction and reconditioning associated with this proposal are not expected to increase potential for direct mortality or create barriers to movement on these existing roads for these same reasons listed above.

Table 45 summarizes road treatments and resulting OMRTDs by alternative for the summer and fall periods, respectively. During project activities, vehicle and equipment use of newly constructed roads (temporary and System road) and use of URs (existing temporary roads) for management activities would occur, thereby increasing disturbance temporarily. These roads would be closed to public motorized access during implementation. Use of all new and temporary roads for project implementation is not expected to occur simultaneously. Management activities would be distributed in space and time throughout the project area and roads would be obliterated or closed upon completion of activities associated with that road. In addition, most of the project area is in an October 15 – December 2 area restriction, where motorized use occurs only on designated routes during the hunting season. Although alternative

2 would reduce open roads by 0.6 mile, OMRTDs under both alternatives at the landscape and hunting unit scale would remain essentially unchanged after project completion.

Table 45. Pre- and post-treatments summer OMRTD in Clark Fork-Flints landscape, and fall OMRTD for Hunting Unit 212 (Alt 3 in parentheses)

Area	Existing OMRTD	Miles of New Temporary Road	Miles of Opened Road, Currently Closed	Miles of New Construction System Road	OMRTD During Project	OMRTD Post-Project
Clark Fork-Flints Landscape	1.78	7.2 (0)	3.8 (2.3)	1.3 (0)	1.80 (1.78)	1.78 (1.78)
Hunting Unit 212	1.25	7.2 (0)	3.8 (2.3)	1.3 (0)	1.3 (1.26)	1.25 (1.25)

Wildlife Security

After project implementation, 19 percent of the project area would provide summer wildlife secure areas, and 41 percent of the project area would provide fall wildlife security. This is unchanged from the existing condition.

The road work (maintenance, reconstruction, construction) and associated timber sale activities would be implemented over five years. During project implementation, existing travel restrictions would be followed with exceptions where roads are currently closed year-round. Roads closed year-round include roads 19752, 78472, and 78476 that access units 44S, 58S, and 69S under both action alternatives. Use of these roads for project implementation during the summer season would increase disturbance on 462 acres of existing summer security habitat under both action alternatives. All units accessed or located in fall secure areas would be restricted during that period under both action alternatives (Wildlife project design features and mitigation measures, chapter 2.).

Under alternative 2, new temporary roads that would access units 48C, 55C, 56C, 57C, 68C, and 71C are located inside or within 0.33 mile of existing summer security habitat. Use of these roads in the summer season during implementation would produce short-term disturbance on approximately 354 acres of summer security habitat. New NFS road construction designed to access units 36S and 47S would produce short-term disturbance on an additional 72 acres of summer secure habitat during implementation. Total area of summer security habitat affected by short-term disturbance is about 816 acres for alternative 2.

For alternative 3, no short-term disturbance would occur in summer security habitat as a result of new temporary roads or new NFS road construction. Total area of summer security habitat affected by short-term disturbance is about 462 acres for alternative 3.

Table 9 for alternative 2, and table 12 for alternative 3, display those units that are located in fall wildlife secure areas or have haul routes that are affected by the fall area restriction.

Cumulative Effects

Cumulative effects for OMRTDs and wildlife security areas are addressed where applicable under individual species analyses in this document.

Snag Availability

Alternative 1- No Action

Direct, Indirect, and Cumulative Effects

Under alternative 1, there would be no direct, indirect, or cumulative effect on snag resources because no project activities are proposed.

Alternatives 2 and 3

Direct, Indirect Effects

Within the Flint Foothills project area, stand exams that recorded snag numbers in 10 stands proposed for salvage by clearcut treatment indicated that availability of snags 15 inches d.b.h. or larger varies greatly among stands, ranging from 0 – 24 per acre, with densities averaging 2.9 per acre within lodgepole pine stands proposed for treatment. A small proportion of the project area (106 acres) is classified as stands averaging more than 15 inches d.b.h.; therefore, the vast majority of larger snags within the project area would come from larger size classes within mature stands averaging 10-14 inches d.b.h.

In medium and larger size classes (10 inches+ d.b.h.) of Douglas-fir/ponderosa pine, alternative 2 would treat 13.4 percent of existing medium and larger size classes; alternative 3 would treat 9.1 percent of existing medium and larger size classes. In lodgepole pine stands 5 inches + d.b.h., alternative 2 would treat 7 percent, while alternative 3 would treat 6.2 percent of existing medium and larger size classes. Size classes of snags removed in treatment units range from 4 to 20 inches d.b.h. Under alternatives 2 and 3, respectively, the remaining 87 – 91 percent of the Douglas-fir and 93 – 94 percent of the lodgepole pine left untreated would continue to provide snags and snag recruitment created by natural processes (drought, insect and disease, etc.).

Within the commercial treatment units, trees would be retained at numbers prescribed by the Forest Plan standard 3(table 46). Snags retained in treatment units would be clumped to reduce both the potential for windthrow and for safety reasons, as well as to increase suitability for wildlife (wildlife project design features and mitigation measures, chapter 2). Forest Plan Wildlife Standard 4 (Forest Plan, p. 48) would also be met through the retention of all live conifer trees other than lodgepole pine with the salvage treatment type (see Flint Foothills Project Vegetation Report in the project file).

Table 46. Minimum average snags per acre to be retained, calculated for the total treatment unit acreage in a project area (BDNF Forest Plan, Table 12).

Vegetation Category	Minimum average snags per acre to retain
	Snags Greater Than 15.0 inches d.b.h.
Warm	3.6
Cool	8.0
Cold	5.0
PICO	6.4

Forest Plan snag direction was based on existing snag densities in wilderness/roadless (unmanaged) areas in eastside forests which are similar to conditions under which species evolved. Currently, there are widespread snags outside of treatment areas. Snags available in untreated areas, in addition to larger snags retained within treatment units, ensure that both action alternatives would maintain habitat for cavity nesting species across the project area.

The successional stage of the surrounding plant community influences the way wildlife use snags; therefore, utilization of snags retained within treatment units will vary by wildlife species. Some species, like bluebirds, house wrens and olive-sided flycatchers will use cavities in a snag that occurs in the grass-forb stage or shrub-seedling state and will not ordinarily use the snag if it is surrounded by more advanced successional stages. Other species, such as the pileated woodpecker, hairy woodpecker, and northern three-toed woodpecker nest in a snag surrounded by trees and tend to avoid nesting in snags in earlier successional stages (Thomas 1979). While all cavity-nesting species may not use the snags that are retained in the units for nesting, existing cavities in retained trees would be used by other secondary cavity nester species that prefer snags in open areas.

Commercial thinning treatments would decrease stand densities, thereby accelerating future tree growth. This would also reduce the potential for tree mortality due to insects and disease, wildfire, and growth suppression. While total snag numbers generated in a stand that has been thinned may be less than in a stand that has not been thinned, snags in the thinned stand are more likely to be larger and therefore more functional to a wider range of species.

Cumulative Effects

Cumulative effects for snag resources are addressed where applicable under individual species analyses in this document.

Large Openings

There are 12 salvage harvest units and 3 seed tree harvest units over 40 acres proposed under alternative 2. A total of 11 salvage units and 3 seed tree units larger than 40 acres are proposed under alternative 3. The wildlife species analyzed here are mobile; therefore, these openings may alter species movements locally (i.e., at the stand level), but units are not expected to affect movements at the landscape level. In the long term, these large units would have less downed wood in the form of jackstrawed trees on the ground (as compared to unsalvaged lodgepole pine stands), thereby potentially enhancing mobility for some large species such as elk, but the lack of dense downed log accumulations within treatment units would reduce stand-level suitability for species such as fisher.

Wildlife Species Considered

Species considered in this analysis include terrestrial species listed as federally threatened, endangered, candidate or experimental/non-essential on the Beaverhead-Deerlodge National Forest, and Forest Service Northern Region's sensitive species list; listed for the BDNF and hereafter called TES. In addition, management indicator species (MIS) designated in the Forest Plan are addressed. Lastly, several other species, or groups of species are addressed as other species of interest.

Threatened and Endangered Species

Regulatory Framework

The Endangered Species Act of 1973 requires federal agencies to ensure that any agency actions (any action authorized, funded or carried out by the agency) are not likely to jeopardize the continued existence of any threatened, endangered or proposed species.

Species List

The only federally listed terrestrial wildlife species for the Beaverhead-Deerlodge is the grizzly bear (threatened). The yellow-billed cuckoo, wolverine, and greater sage grouse are classified as candidate species (USDI Fish and Wildlife Service 2012). Candidate species are not subject to any of the substantive or procedural provisions of the Endangered Species Act.

The grizzly bear is known to occur on the Madison Ranger District in the Greater Yellowstone Ecosystem. Clark Fork-Flints landscape lies outside the grizzly bear Yellowstone Distinct Population Segment (DPS). There have been recent sightings on the north end of the Forest, and grizzly bears are addressed here.

The yellow-billed cuckoo uses cottonwood-willow riparian habitats west of the Continental Divide. The species is not known to occur in Granite or Powell counties. The project area is outside of the known distribution of this species and contains no suitable habitat. There is no further analysis for this species.

The entirety of the Deerlodge portion of the BDNF, which encompasses the project area, has no sage grouse leks. The project area is located more than 60 miles north of the nearest known active sage grouse lek site and contains little or no suitable sage grouse habitat.

In December 2010, the FWS announced a 12-month finding on a petition to list the North American wolverine under the Endangered Species Act. After review, they found that wolverines occurring in the contiguous United States are a distinct population segment and listing may be warranted, but precluded, making them a candidate species. As the Forest Species list (USDI Fish and Wildlife Service 2012) states, none of the substantive or procedural provisions of the Act apply to candidate species but they encourage consideration in environmental planning. Wolverines are addressed in this analysis both as a sensitive species and as a management indicator species.

Grizzly Bears

Overall Population and Habitat Status and Distribution

The historic range of the grizzly bear (*Ursus arctos horribilis*) in the contiguous 48 States extended from the central Great Plains, west to California, and south to Texas and Mexico. Between 1800 and 1975, grizzly bear populations in the lower 48 states declined from over 50,000 to less than 1,000. As European settlement expanded westward, the grizzly was extirpated from most of its historical range.

Five areas in the lower 48 states currently support grizzly bear populations; these areas are located in Montana, Wyoming, Idaho, and Washington and include: the Yellowstone Ecosystem, Northern Continental Divide Ecosystem (NCDE), Cabinet-Yaak Ecosystem, Selkirk Ecosystem, and Northern Cascades Ecosystem. These areas represent less than two percent of the grizzly's former range (USDI Fish and Wildlife Service 1993).

Biological Information for Grizzly Bears

Grizzly bears excavate dens as early as September or prior to entry in November. Dens are usually dug on steep slopes where wind and topography cause an accumulation of deep snow and where snow is unlikely to melt during warm periods. Dens are generally found at high elevations well away from human activity and development (USDI Fish and Wildlife Service 1993).

Grizzly bears are opportunistic feeders and will prey or scavenge on almost any available food. Plants with high crude protein content and animal matter are important food items. The search for food has a prime influence on grizzly bear movements. Upon emergence from the den grizzlies move to lower elevations, drainage bottoms, avalanche chutes, and ungulate winter ranges where their food requirements can be met. Throughout spring and early summer grizzlies follow plant phenology back to higher elevations. In late summer and fall, there is a transition to fruit and nut sources, as well as herbaceous materials. This is a general pattern; however, bears will go where they can meet their food requirements (USDI Fish and Wildlife Service 1993).

Home ranges of adult bears may overlap. The home ranges of adult male grizzlies are generally two to four times larger than adult females. The home ranges of females are smaller while they have cubs, but increase when the cubs become yearlings. Mace and Roberts (2011) reported that female grizzly home ranges in the NCDE were smallest for females with cubs of the year (avg. = 40 mi^2) and largest for subadults (avg. = 93 mi^2). Home ranges vary in relation to food availability, weather conditions, and interactions with other bears.

Grizzly Bear Habitat and Use of the Analysis Area

The Flint Foothills project area lies between the Greater Yellowstone Area (GYA) and Northern Continental Divide Ecosystems (NCDE) for grizzly bears as shown in figure 27. The project area is approximately 30 miles south of the NCDE recovery zone and about 9 miles south of mapped grizzly bear distribution.

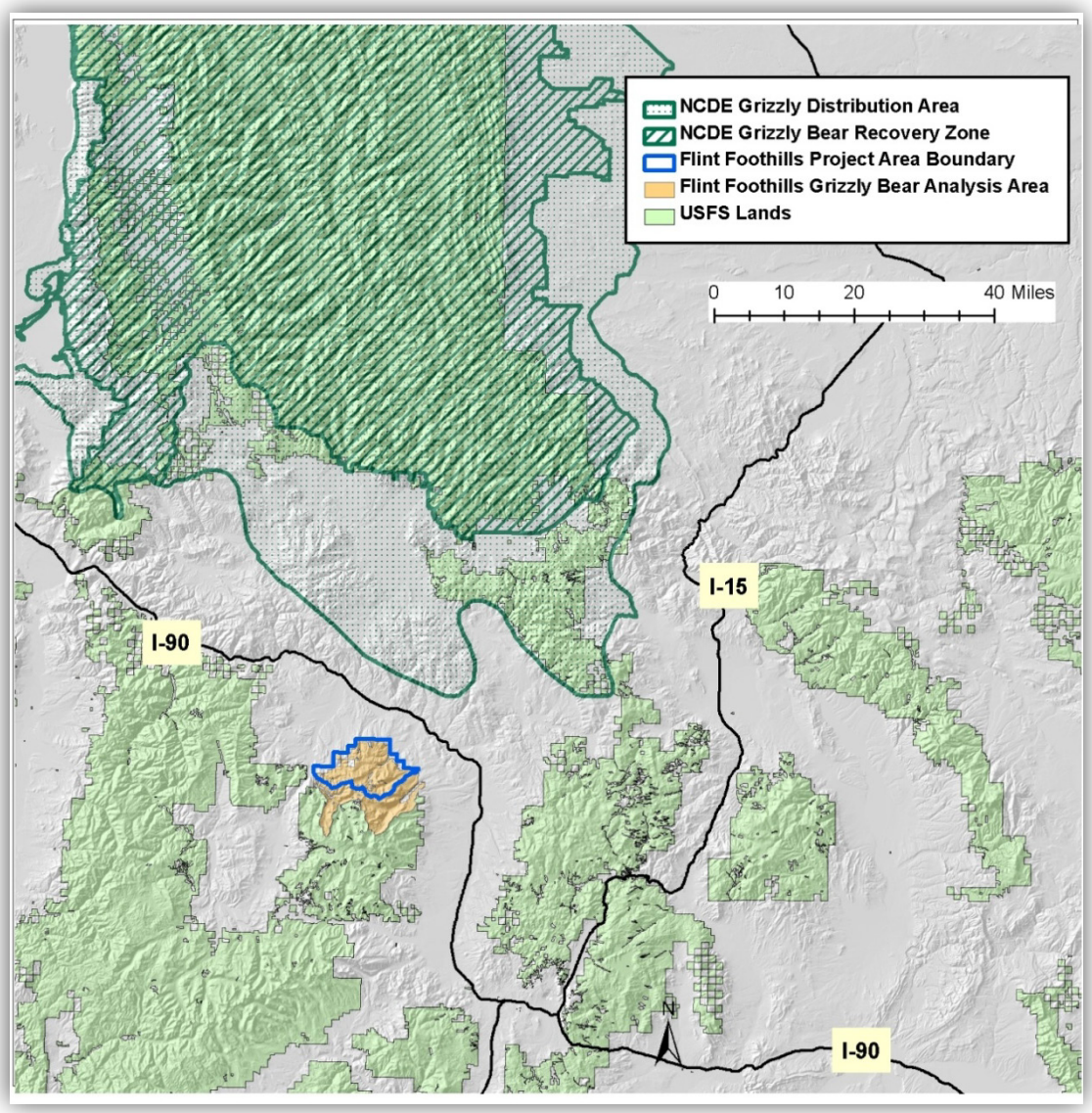


Figure 27.Grizzly bear recovery zones and distribution areas in regards to the project area

The Gravelly Landscape (on the Madison Ranger District) encompasses the only known consistently occupied area on the Forest and is located approximately 97 miles southwest of the project area. However, grizzly bears have been documented in other areas of the Forest in closer proximity to the Flint Foothills Project area. In recent years, several grizzlies have been detected in these areas. In the late 1990s, several grizzly bear tracks were documented in the Flint Creek mountain range. In 2002, a grizzly was videotaped while feeding on two moose carcasses in the John Long Mountains about 15 miles west of the project area. In 2005, an adult male grizzly was found dead on the east end of the Anaconda range, and in 2008, a young male grizzly was captured near Drummond, which is about 8.5 miles north of the project area (Jonkel and Edge 2009).

More recently, a male grizzly bear was killed on the south end of Elk Park in June 2010, (about 3.5 miles southeast of the project area), and a female with yearling were seen in the Anaconda-Pintler Wilderness in September 2010 (about 36 miles south of the project area), (Mace and Roberts 2011). In 2011, a confirmed grizzly bear track was identified on BDNF lands west of Philipsburg (more than 15 miles southwest of the project area). In April, 2012 a grizzly bear was sighted on the BDNF east of Deer Lodge (about 24 miles east of the project area). All of these sightings appear to represent transient bears with established residency yet to be corroborated by U.S. Fish and Wildlife Service updates in grizzly bear distribution. These detections indicate that bears from the NCDE are dispersing towards the northwest portions of the Pintler RD, and it would be reasonable to conclude that a grizzly bear could traverse the project during the implementation period.

The area between John Long Mountains, Flint Creek range and the Pintler range is described as having the capability of becoming a key grizzly linkage zone between the Boulder/Garnet mountain range complex and the Anaconda-Pintler Wilderness (Jonkel and Edge 2009). The Forest Plan road density goals and objectives provide secure habitat and areas of connectivity that can provide for large ungulates and forest carnivores, including the grizzly bear.

Environmental Consequences

Basis for Effects Analysis

The assessment of potential effects to grizzly bears is described in terms of those parameters that threaten grizzly bears either through human contact and conflict or through reductions in secure habitat. More specifically, parameters that address grizzly/human conflict (e.g. access management, appropriate food storage, and livestock) and vegetation management form the basis against which threats to grizzly bears are measured.

Access Management

Grizzly bear habitat across the region is best described in terms of the availability of large tracts of relatively undisturbed land that provides some level of security from human depredation and competitive use of habitat by humans (including roading, logging, grazing, and recreation) (USDI Fish and Wildlife Service 1993). To that end, secure habitat as defined in the forest plan is a useful metric to assess the extent of habitat security for grizzly bears. The definition of secure habitat as a 10-acre polygon more than 0.33 mile from an open motorized road is a slightly modified version of that used in the Yellowstone Grizzly Bear Conservation Strategy in that the 0.33-mile buffer presents a more conservative assessment of secure habitat than the 500-meter buffer used in the conservation strategy.

Many studies have found that grizzly bears will generally avoid areas with open roads. Mace and Manley (1993) found that adult grizzly bears used habitat with open road densities greater than 1 mi/mi2 less than expected. All sex and age classes of grizzly bears used habitat with total road densities greater than 2 mi/mi^2 less than expected. Grizzly bears generally adjust to disturbance associated with roads by avoiding the area that in turn results in a reduction in the amount of habitat available to the bears. Roads also provide increased access into previously remote areas that in turn encourages human settlement, recreational use, and other land uses. These activities can increase the frequency of human-bear confrontations and ultimately reduce habitat availability and grizzly populations.

Seasonal habitat use by grizzly bears is also an important consideration in access management. When bears emerge from the den, they tend to search for food in lower elevations, drainage

bottoms, avalanche chutes, and ungulate winter ranges (USDI Fish and Wildlife Service 1993). Throughout the late spring and early summer they move towards higher elevations as food becomes available. Because spring habitat tends to be at lower elevations, increased potential exists for conflict between bears and humans due to greater access into those areas by humans. Roads located in riparian zones, for example, may result in indirect habitat losses through avoidance behavior by bears. Riparian zones are heavily used by grizzlies for feeding and travel corridors (Moss and LeFrance 1987). During fall, female bears use mid- and high-elevation habitats and strongly avoid high densities of high-volume roads suggesting that seasonal road closures aimed at minimizing traffic in important seasonal habitats may benefit grizzly bears (Mace et al. 1999).

Food Storage

Availability of human-related foods can attract bears and cause changes in bear behavior leading to habituated and/or food-conditioned bears. Human food, livestock feed, and garbage all increase the opportunity for grizzly/human conflicts. Oftentimes, habituated or food-conditioned bears are removed or killed.

Livestock Grazing

Interactions between livestock and grizzly bears have historically led to the removal of grizzly bears. In several studies, livestock depredation was a leading cause for which a bear was removed and in several instances livestock depredation became a leading cause of nonhunting mortality (Thier and Sizemore 1981, Knight and Judd 1983, Knight et al. 1985, Aune and Stivers 1983). Most livestock depredations have involved sheep (Lee and Weaver 1981, Knight and Judd 1983); however, grizzly bear removals and mortality due to cattle depredation have been reported.

Grizzlies also feed on livestock carcasses (Servheen et al. 1981, Aune and Stivers 1983). Livestock carcasses may be scattered or deposited in ‘boneyards.’ Improperly situated boneyards may function like garbage dumps, attracting bears to these areas, and increasing human/bear conflicts.

Vegetation Management

Timber Management - Many studies have documented that grizzly bears avoid logged areas, while other studies indicate no changes in grizzly populations as logging pressure increased (Lyon and Basile 1980, Mace and Jonkel 1980). Despite conflicting results as to whether grizzly bear numbers are affected by logging, it appears that their behavior is modified. Timber harvest can affect the quality of grizzly bear food and cover causing bears to modify their use of that area. Timber harvest can also affect grizzly bear habitat by increasing human access into an area.

Bear flight response was stronger to ground-based human activities, such as people on foot or moving vehicles, when in the open than when in cover (McLelland and Schackleton 1989). However, the secure area definition for the Yellowstone Grizzly Bear Conservation Strategy (2003) does not include any vegetation criteria.

In the Yellowstone area, grizzly bears use of lodgepole pine forest varied widely by season, year, and structural condition (McLelland and Schackleton 1989). Recently disturbed open sites were used mainly for travel and avoided for bedding, while foraging activities in other structural types included excavation and consumption of invertebrates (mostly ants), grazing on grasses and forbs, consumption of ungulates, and consumption of whitebark pine nuts. In the

Flathead River drainage of British Columbia and Montana, regenerating forest cut-blocks (age less than 40 years since harvest) were the habitat type least-selected by bears during summer and fall seasons (McLelland and Hovey 2001).

Fire Management

Management practices that encouraged fire suppression have altered the natural succession of many forests and have resulted, in many cases, in a reduction or elimination of early successional stages. This has had a negative impact on grizzly bear food production (Martin 1983, Holland 1986). Low intensity prescribed fire in grizzly bear habitat can be beneficial to maintaining whitebark pine (USDI Fish and Wildlife Service 2011c).

Spatial and Temporal Bounds

The spatial and temporal bounds for the environmental baseline and effect analysis can be found in figure 28. This analysis area is approximately 73,931 acres (299 mi^2) on BDNF lands and includes the FS portions of the Flint Foothills project area and adjacent 6th-level watersheds (HUCs).

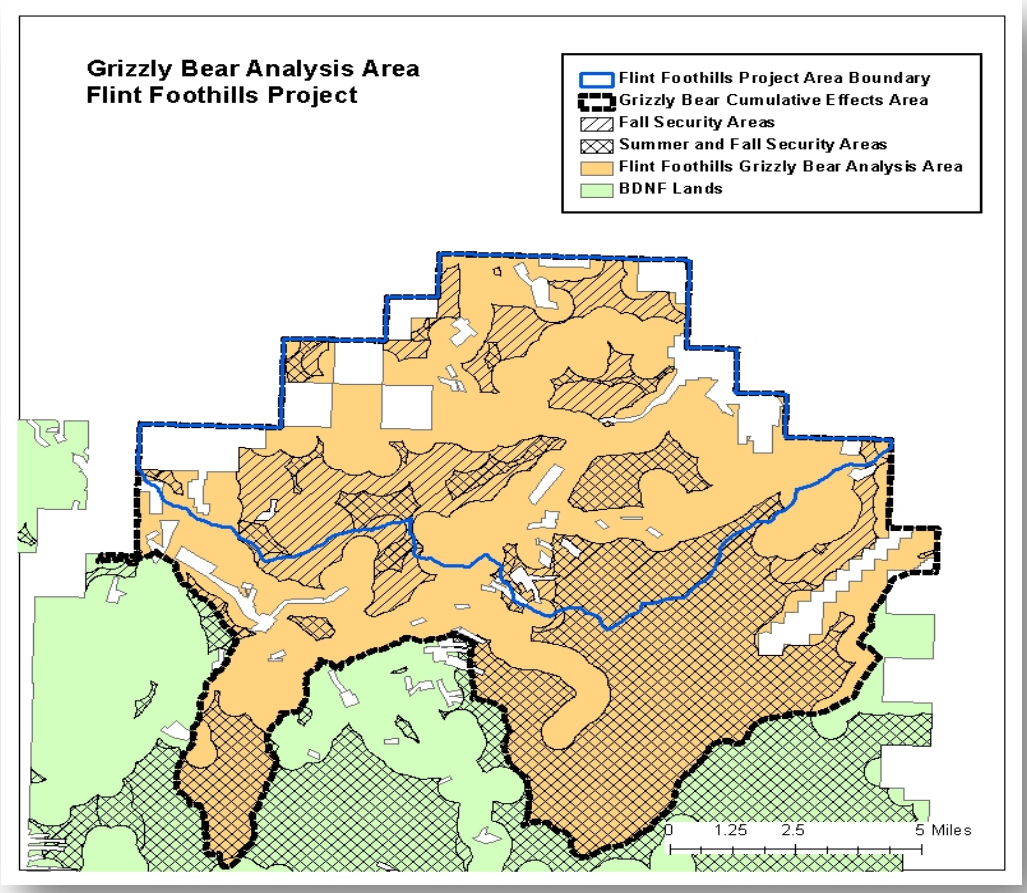


Figure 28. Existing security areas, Flint Foothills grizzly bear analysis area

It was delineated because the sufficient size to account for the average size of a female grizzly bear's home range (205-294 sq. km) more than encompasses the area of potential disturbance from the proposed activities (500 m is the approximate disturbance distance from motorized activities or roads). This will be explained in detail in the affects analysis. The length of time for effects analysis is approximately 5 years for timber units and 5-10 years for precommercial thinning, prescribed burning, and other post-treatment activities. This is based on the probable contract length for the commercial harvest units and the timeframes for other activities.

The cumulative effects area (CEA) is expanded to include all lands of other ownership within the grizzly bear analysis area as well as within the Flint Foothills Project area. The CEA encompasses a total of 83,935 acres (340 km^2) and includes all NFS lands and lands of other ownership within the BDNF administrative boundary and corresponding 6th-level HUCs (figure 28.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to grizzly bear because no project activities are proposed. There would be no change in wildlife secure areas. This would maintain existing connectivity for transitory bears that might move across the project area or mountain range.

Alternatives 2 and 3

Direct, Indirect and Cumulative Effects

This proposal would result in changes to stand structure and species composition through salvage, thinning, seed tree harvest, prescribed burning and precommercial thinning. This also includes disturbance effects due to increased traffic, human activity, and equipment use during project activities.

Vegetation Treatments

Alternatives 2 and 3 propose commercial thinning, salvage harvest, seed-tree harvest, and precommercial thinning. All vegetation treatments are expected to reduce stem densities. In salvage units, dead trees lacking green overstory would be removed, thereby increasing sight distance and reducing horizontal cover. Potential value for salvaged stands for foraging and bedding use by grizzlies would decrease, but salvage units may still be utilized for travel. The effects of reduced foraging and bedding effectiveness would last 5-15 years, which is the period where existing snags would have fallen if the stand were left untreated.

Seed tree harvest in Douglas-fir and ponderosa pine types as well as commercial thinning in Douglas-fir stands would have similar effects in that residual stand structures would be more open, thereby decreasing cover for bedding, but facilitating travel. In addition, more open canopies would stimulate understory growth of grasses and forbs. In combination with subsequent underburning, forage value of the grass-forb component would be enhanced in lower elevation stands characteristically used by grizzly bears in the spring.

Precommercial thinning units currently contain high densities of small tree boles that present an obstacle to travel and little forage value. While precommercial thinning would reduce stem densities, residual slash retained within treatment units may deter bear movement until the slash deteriorates in subsequent years.

Changes in vegetation structure may influence stand use by bears for foraging, movement, or bedding. Therefore, both commercial and precommercial treatments may affect grizzly bear habitat.

Prescribed Burning

Habitat effects resulting from prescribed burning treatments outside timber harvest varies by elevation and unit. Burning in lower elevation stands (Units 1B, 2B, 6B, 7B, and 8B) would consume the grass, herb and shrub understory communities, along with the killing of seedling and sapling sized conifers in the understory. A few overstory trees (less than 5 percent) may also be killed from the understory burning. Prescribed fire would stimulate regrowth of senesced grass, herb and shrub understory communities, and increase vigor for the remaining conifers. Treatments would reduce cover somewhat, but increase grass/forb forage value in lower elevations.

Mid-elevation stands (units 3B, 4B, and 5B) consist of lodgepole pine-dominated forest with inclusions of Douglas-fir. Prior to burning, up to 10 percent of each unit would have small-diameter (4 to 12 inches d.b.h.) conifers slashed (cut down). Burning mid elevation mixed conifer (lodgepole dominated) stands would result in mortality of overstory and understory conifers in a patch mosaic across the proposed unit. The fire would directly consume a portion of the existing vertical and horizontal fuel, some of which has been created by mountain pine beetles. Prescribed burning in mid-elevation units is expected to stimulate regrowth of senesced grass, herb and shrub understory communities and natural regeneration of lodgepole pine as well as create opportunities for whitebark pine regeneration where suitable sites are created.

Implementation of burning may include either hand ignition, helicopter ignition, or a combination of both.

Activities such as slashing and helicopter use would temporarily increase disturbance in treatment units if grizzly bears are present.

Increased human presence in addition to project activities such as helicopter use during implementation of prescribed burns may cause temporary displacement of or avoidance by, grizzly bears if they are present in proximity to project activities. Therefore, prescribed burning activities proposed under both action alternatives may affect grizzly bears.

Access Management

Existing NFS Road Maintenance and Reconstruction

Roadside and road surface maintenance proposed under both action alternatives involves maintenance and improvements within the road prism. Activities primarily include blading, brushing, culvert and drainage maintenance, and spot gravel that would occur on about 68 miles (alternative 2) and 66 miles (alternative 3) of roads currently open to public access. These activities are not expected to increase public use, nor would they occur during existing restricted travel periods.

Existing Open and Closed Unauthorized Routes

Alternative 2 would utilize 1.7 miles of existing unauthorized routes (UR) for access and timber haul. Alternative 3 would utilize less (1.0 mile) for the same purpose. Both alternatives propose to include 0.7 mile of URs in the NFS subsequent to project use. Because these routes are currently open and were included in overall road density calculations, no increased access would result from inclusion in the project.

Under alternative 2, approximately 3.8 miles of closed URs would be opened for haul of timber products; whereas alternative 3 would open 2.3 miles of the same road type for haul. Both action alternatives would subsequently manage 0.4 mile of closed UR routes as NFS roads. Closed URs would temporarily add 3.8 and 2.3 miles to overall road miles open during implementation under alternatives 2 and 3, respectively. In addition, both action alternatives would add 0.43 mile to current road mile totals in the grizzly bear analysis area if managed as open to public use after project implementation.

New NFS Road Construction
Under alternative 2, a total of 1.3 miles of new road would be constructed for timber haul and subsequently included in the NFS road inventory. After project implementation, the road would be closed to public access and managed as Level 1 for potential future use. Therefore, this would add 1.3 miles to the total miles open temporarily during project implementation under alternative 2, but would not add to the net OMRTD post-project.

No new NFS road construction would occur under alternative 3.

New Temporary Roads
A total of 7.2 miles of new temporary roads would be constructed under alternative 2. These would be managed as closed to public use during project implementation, and subsequently decommissioned upon project completion. While no public access would be allowed, management activities such as equipment use and timber haul on these routes would contribute to an increase in OMRTDs during the period of operation. Duration of increased OMRTDs would be short-term, estimated to last one season for any given route. No new temporary road construction would occur under alternative 3.

Project Effects on OMRTDs

Table 47 summarizes road treatments and resulting OMRTDs by alternative for the summer and fall periods, at the landscape level and hunting unit level, respectively. During project activities, vehicle and equipment use of new and temporary roads for management activities would occur, thereby increasing disturbance temporarily. Roads would be closed to public motorized use during implementation. Use of all new and temporary roads for project implementation is not expected to occur simultaneously. Management activities would be distributed in space and time throughout the project area and roads would be obliterated or closed upon completion of activities associated with that road. In addition, most of the project area is in an October 15 – December 2 area restriction, where motorized use occurs only on designated routes during the hunting season. Although alternative 2 would reduce open roads by 0.6 mile, OMRTDs under both alternatives at the landscape and hunting unit scales would remain essentially unchanged after project completion.

Current OMRTD for summer is 2.1 mi/mi^2 (table 47). Use of closed and new temporary roads would temporarily increase summer OMRTD to 2.19 mi/mi^2 under alternative 2 whereas summer OMRTD under alternative 3 would increase slightly to 2.11 mi/mi^2. Post-project, alternative 2 would reduce open roads by 0.6 mile, thereby decreasing net OMRTD slightly to 2.08 mi/mi^2. Summer net OMRTD under alternative 3 would be identical to the existing density.

Table 47. Alternative 2 Summer OMRTD pre- and post- project activities, Flint Foothills Grizzly Bear Analysis Area (Alternative 3 in parentheses)

Analysis Area	Existing OMRTD	Miles new temp road	Miles of opened road, currently closed	Miles of new construction system road	Miles of Existing Road Decommissioned During the Project	OMRTD Post-project
Flint Foothills grizzly bear analysis area	2.1	7.2 (0)	3.8 (2.3)	1.3 (0)	4.4 (2.3)	2.1 (2.1)

OMRTD in mi/mi^2

Fall OMRTD within the grizzly bear analysis area is currently 1.3 mi/mi^2, which is identical to OMRTD at the hunting unit scale. Project design features state that current travel restrictions would be adhered to, with the exception of several roads that are closed year-round (which would be accessed during the summer season). Therefore, no increase in fall road densities would occur under either action alternative. Increased road densities during implementation may cause temporary displacement of or avoidance by, grizzly bears if they are present in proximity to project activities.

Project Effects on Security Areas

Grizzly bear secure habitat is defined in the GYA as areas more than 0.31 mile from an open or gated motorized access route or recurring helicopter flight line, greater than or equal to 10 acres in size (USDA Forest Service 2006). As mentioned previously, secure habitat for this project was calculated using the GYA definition and was also calculated using the definition from the Forest Plan which is habitat over 0.33 mile from an open motorized road or trail and over 10 acres in size. The measurement 0.33 mile is approximately 145 feet wider than the 0.31-mile grizzly bear buffer and was adopted to accommodate mapping for quiet recreation and depicts less secure habitat than would be available under the GYA calculation (USDA Forest Service FEIS 2009). Available secure habitat is calculated for both summer and fall seasons (see below) for both 0.31-and 0.33-mile buffer distances. Summer secure habitats are generated from the maximum open road densities at any given time during the year (summer season) whereas fall secure areas are more extensive as a result of road travel restrictions during the fall season (Oct. 15 – Dec. 2).

Summer Security (0.31-mile buffer)

There are approximately 27,303 acres of secure habitat in the project area following a 0.31-mile buffer distance from open motorized roads and trails (table 48). This is approximately 37 percent of the project area and mostly occurs in the south end (figure 28).

Summer Security (0.33-mile buffer)

Proposed road treatments in relation to existing summer security areas are shown in figure 29. Approximately 26,009 acres of secure habitat is mapped in the analysis area according to the Forest Plan definition for wildlife secure habitat. As mentioned previously, the BDNF definition for secure habitat was developed as a more conservative approach to wildlife security, with recreation managers. Secure habitat consists of 21 distinct blocks, with the largest block of secure habitat (18,988 acres in size) in the south end of the analysis area. Under alternative 2, new temporary roads that would access units 48C, 55C, 56C, 57C, 68C, and 71C are located inside or within 0.33 mile of existing summer security habitat.

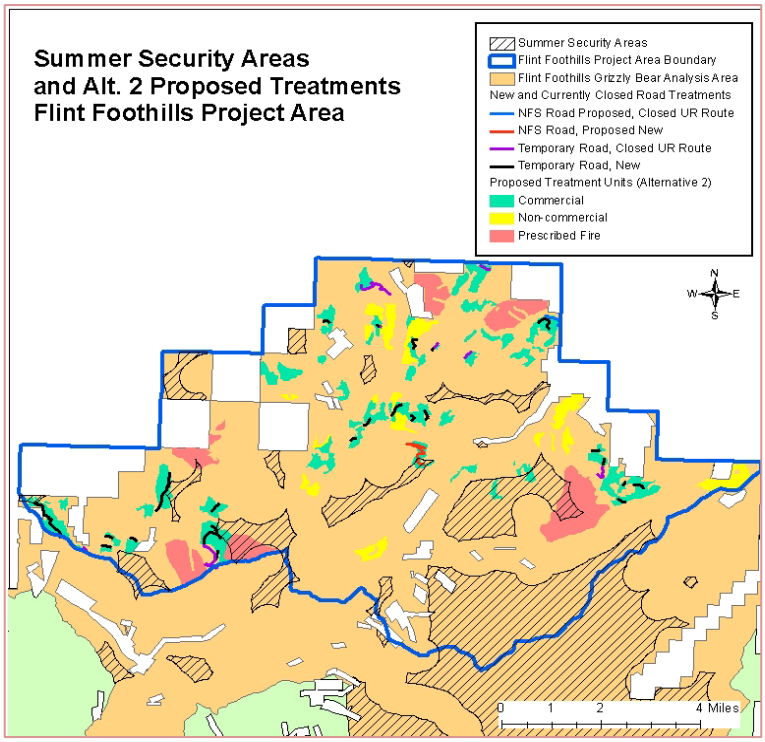


Figure 29. Grizzly bear summer security areas and proposed treatments for alternative 2

Use of these roads in the summer season during implementation would produce short-term disturbance on approximately 354 acres of summer security habitat. New NFS road construction designed to access units 36S and 47S (1.3 mi) would produce short-term disturbance on an additional 72 acres of summer secure habitat during implementation. Total area of summer security habitat affected by short-term disturbance, including 462 acres generated by use of existing closed roads, is about 816 acres for alternative 2. Summer security habitat would be reduced during project implementation from 35.2 percent to 34.1 percent (table 48).

For alternative 3, no short-term disturbance would occur in summer security habitat as a result of new temporary roads or new NFS road construction. Total area of summer security habitat affected by short-term disturbance is about 462 acres for alternative 3 due to use of existing closed roads for timber haul.

Table 48. Summer secure areas pre- and post-treatments by alternative

Buffer Distance from Open Motorized Road or Trail	Total Acres Secure Habitat		
	Existing	Unaffected by Project Disturbance	After Project Completion
Proposed Action			
0.33-mile buffer distance	26,009 (35.2%)	25,193 (34.1%)	26,011 (35.2%)
0.31-mile buffer distance	27,303 (36.9%)	26,894 (36.4%)	27,303 (36.4%)
Alternative 3			
0.33-mile buffer distance	26,009 (35.2%)	25,547 (34.6%)	26,009 (35.2%)
0.31-mile buffer distance	27,303 (36.9%)	27,291 (36.9%)	27,303 (36.9%)

Disturbance within security habitat during implementation may cause temporary displacement of or avoidance by, grizzly bears if they are present in proximity to project activities.

Post-project, summer security areas would be equal to existing amounts under both action alternatives. Therefore, the project would have no long-term effect to existing levels of summer security.

Fall Security (0.33 mile buffer)
Fall security area within the grizzly bear analysis area currently totals 37,222 acres (50.3 percent). Project design features for wildlife ensure that all units accessed or located in fall secure areas would be restricted during that period under both action alternatives. Therefore, no change in existing fall security habitat would occur during or after project implementation.

Wildlife Attractants

Human food items as well as some mechanical lubricants can attract wildlife; specifically bears. This project has incorporated a design feature that requires food storage as well as storage and cleanup of mechanical lubricants that could attract bears to work sites.

Livestock Grazing

Seasonal livestock (cattle) grazing occurs within the project area. This project does not propose changes to existing livestock numbers or distribution.

Cumulative Effects

The cumulative effects analysis area for grizzly bears is defined above and displayed in figure 28. The cumulative effects area encompasses a total of 83,935 acres (340 km2) and includes Forest Service lands (88 percent) and private lands (12 percent) within the BDNF administrative boundary. Review of the ongoing and foreseeable actions for actions that might affect prey or secure areas (areas with minimal human disturbance) on BDNF lands found that only travel analysis would have the potential to affect wildlife secure areas, but the decisions and associated effects are unknown at this time. Any update to travel management would consider wildlife secure areas and effects during that process.

On lands of other ownership within the cumulative effects analysis area, past, present, and reasonably foreseeable activities on these lands include livestock grazing and/or timber harvest. Small mining operations have occurred in the past on private lands. On lands of other

ownership, timber harvest could reduce secure areas on adjacent NFS land if additional roads are developed and accessible within 0.33 mile of BDNF lands; however, the potential for, and location of, future road developments on lands of other ownership is not identified. Because the distance of effect is only 0.33 mile, the potential impacts to grizzly bears and secure habitats at the analysis area-level would be minor.

Therefore, cumulative effects generated by vegetation modifications, temporary increases in disturbance, and temporary decreases in security areas as a result of the action alternatives, combined with other activities on National Forest System land and lands of other ownerships would not be significant.

Summary of Analysis

No observations of grizzly bears have been reported within the project area. However, recent increases in sightings on and near the northern portion of the BDNF may indicate a higher potential for grizzly bear occurrence in the future. Effects to grizzly bears and their habitats may occur as a result of temporary increase in road densities, temporary reduction in security summer security area, project-related disturbance, and vegetation modification. Consultation with USFWS concerning the effects of Flint Foothills project activities on grizzly bears will occur.

Sensitive Species

Regulatory Framework

The sensitive species analysis in this document meets the requirements for a biological evaluation as outlined in FSM 2672.42. Sensitive species are administratively designated by the Regional Forester and managed under the authority of the National Forest Management Act.

Species List

Information on sensitive species status and distribution, biological requirements, habitat and use on the BDNF was compiled in the Revised Biological Evaluation for the Forest Plan FEIS (USDA Forest Service 2009b). This document is the best available information for the species that were considered in this analysis. The Montana Natural Heritage's "Tracker" database was also consulted for species occurrence since the Forest Plan was formulated. Information for the new species was gathered from several references, as shown in the analysis. Table 49 lists the sensitive species considered in this analysis and summarizes existing habitats and species presence within the project area.

Table 49. Sensitive wildlife species list for the BDNF

Species	Habitat Preference	Habitat or Species Present in the Project Area?
Birds		
American peregrine falcon (*Falco peregrinus anatum*)	Prominent cliffs with ledges for nesting within 1 mile of water and 10 miles of hunting habitat including riparian areas, parklands and mountain valleys	No. The nearest known territory is located approximately 12 miles to the north (Rogers et al 2009).Migratory birds may pass through but no suitable cliff nesting sites.
Black-backed woodpecker (*Picoides arcticus*)	Burned or insect-killed forest	Yes. Potential habitat is increasing due to insect-caused mortality of lodgepole pine.

Species	Habitat Preference	Habitat or Species Present in the Project Area?
Bald eagle (*Haliaeetus leucocephalus*)	Nesting trees/platforms near an open water body (>80 ac) or major river system; available fish and water bird species prey near nesting habitat; forages on carrion in winter or during spring/fall migration.	Yes. No known nesting on FS lands. One breeding site is identified northwest of the project area, along Flint Creek (MFWP 2010). Suitable foraging habitat is located within one mile of the project area.
Greater sage grouse (*Centrocercus urophasianus*)	Sagebrush obligate	No. There are no sage grouse leks or State core areas anywhere on the Deerlodge NF. The entire Pintler RD and the Deerlodge Valley are outside the current and historical species' distribution range. Project area also lacks suitable sagebrush habitats
Flammulated owl (*Otus flammeolus*)	Mature (>9" d.b.h.) and old growth ponderosa pine/Douglas-fir with abundant moth prey	Yes. Dry Douglas-fir and ponderosa pine. Sightings within the project area have been recorded.
Harlequin duck (*Histrionicus histrionicus*)	Fast moving, low gradient clear mountain streams	No. Only known location on BDNF is on Middle Fork of Rock Creek on Pintler RD, more than 35 miles southwest.
Trumpeter swan (*Cygnus buccinator*)	Large water bodies with sufficient emergent vegetation and invertebrates, and appropriate nest sites	No, the project area lacks known occurrences and suitable habitat.
Mammals		
Bighorn sheep (*Ovis canadensis*)	Bighorn sheep are adapted to a wide variety of habitats but three elements are essential to quality habitat: 1) escape terrain; 2) high visibility; and 3) winter ranges are low-elevation, south-facing slopes, with escape cover in close proximity to foraging areas (MFWP 2010). WAFWA guidelines (2007, 2010), however, emphasize separation from domestic sheep as crucial to maintaining wild sheep	Yes. The Garrison herd occupies areas primarily on private lands approximately 3 miles east-northeast of the project area. Some use of higher elevation areas on BDNF lands by bighorns has been reported, and individual rams have been located to the west near Boulder Creek, and south near Powell Mine (MFWP 2010). There are no domestic sheep allotments anywhere on Deerlodge NF lands.
Fisher (*Martes pennanti*)	Moist coniferous forested types (including mature and old growth spruce/fir), riparian/forest ecotones	Yes, potential habitat is present, but no known records.
Gray wolf (*Canis lupus*)	Areas free from human disturbance, abundant prey populations	Yes. Flint Creek pack on north end of the Clark Fork-Flints landscape.
Great Basin pocket mouse (*Perognathus parvus*)	Dry grasslands with less than 40% cover	No. Known to occur in Beaverhead County and suspected in Madison County. Project area is outside species' range.
North American wolverine (*Gulo gulo luscus*)	Large areas of unroaded secure habitat; alpine/subalpine talus slopes for secure denning habitat, ungulate carrion in winter	Yes. Potential habitat is located in the southern portion of the project area. Known records generated south of the project area.
Northern bog lemming (*Synaptomys borealis*)	Wet riparian sedge meadows, bog fens	No, nearest known location at Maybee Meadows on Wisdom RD.

Species	Habitat Preference	Habitat or Species Present in the Project Area?
Pygmy rabbit (*Brachylagus idahoensis*)	Dense clumps of big sagebrush or greasewood. Forage on grasses (wheatgrass, bluegrass) in summer and sage in winter	No. The project area is located north of the known pygmy rabbit distribution, and lacks suitable sagebrush habitats.
Spotted bat (*Euderma maculatum*)	Cliffs, rock faces for roosting. Forest openings, riparian areas, wet meadows for foraging.	Foraging and roosting habitat present. Proposed treatments will have no impact on suitable habitats.
Townsend's big-eared bat (*Corinorhinys townsendii*)	Roosts in caves, mines, rocks and buildings. Forages over tree canopy, riparian areas or water.	Foraging and roosting habitat present but no known maternity colony or hibernacula.
Special Interest		
Northern goshawk (*Accipiter gentilis*)	Nests in mature conifer forest with high canopy closure (50-90%) and open understories.	Yes. Suitable habitat is present and nesting is reported for the project area.
Great grey owl (*Strix nebulosa)*	Mid- or late-successional conifer forest within 300 yards of montane meadows from 2,000 to 8,000 feet elevation.	Yes. Suitable habitat is present and observations are reported for the project area.

Species Not Carried Forward For Detailed Analysis

Based on table 49 the American peregrine falcon, greater sage grouse, harlequin duck, Great Basin pocket mouse, northern bog lemming, pygmy rabbit, trumpeter swan and spotted bat are not carried forward for further analysis because of lack of suitable habitat within the analysis area, distance from known locations, or lack of potential impact to the species or its habitats. This proposal would have "no impact" on these species. Additional information on these species is provided in the wildlife report in the project file.

Sensitive Species Carried Forward for Further Analysis

Bald Eagle

Overall Population and Habitat Status and Distribution

Bald eagles are now widely distributed across the United States. Montana has the third highest population in the lower 48 states west of the 100th meridian. In 2007 there were 325 pairs in Montana.

Biological Information for Bald Eagles

Bald eagles are associated with aquatic environments, occupying riparian or lakeside habitats almost exclusively during the breeding season. Food habits are wide-ranging including fish, waterfowl, and carrion (both wild ungulates and livestock). In Montana, nest sites are usually found within 1 mile of water, and located in larger, dominant trees, most often the tallest trees in the nest stand.

Bald eagles are a resident species in the forested, mountainous areas of Montana. Other individuals from more northerly altitudes either winter in Montana or migrate through the state to more southerly locations. Residents generally remain in the vicinity of their breeding areas

throughout the year, while some may move to areas with more temperate weather or to areas with higher concentrations of food.

Bald Eagle Habitat and Use of the Analysis Area

Flint Creek lies to the west of the project area. There is one known nest site along Flint Creek located northwest of the project area (MNHP 2011). Although no sightings have been reported, foraging may occur at Flint Creek which is located approximately 0.9 mile from proposed treatments. No winter bald eagle observations are reported in proximity to the project area (MNHP 2011). The nearest reported nonbreeding or winter occurrence is located along the Clark Fork River, approximately 5 miles from the project area boundary.

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect, or cumulative effects to bald eagles or bald eagle habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct, Indirect and Cumulative Effects

There would be no direct or indirect effects because no harvest activities would occur within 1 mile of known nesting or winter roosting areas. Project activities are proposed within 1 mile (0.9 mile) of Flint Creek where bald eagle foraging may occur. However, because proposed treatments are located east of this creek on an east-facing ridge, topographic features would prevent disturbance to eagles foraging along Flint Creek. All timber haul routes are greater than 0.50 mile from known bald eagle nesting. Haul routes within 1 mile of bald eagle nesting consist of well-traveled county roads and state highway where existing levels of vehicle use preclude additional disturbance effects due to timber haul. Bald eagle foraging within the project area may occur in late fall, winter, or early spring when carcasses from dead big game would be available. The proposed activities would not affect availability of carcasses for bald eagle foraging. In addition, no impacts to bald eagle nesting or winter activity are expected under any alternative.

There would be no direct or indirect effects, so there would be no cumulative effects. Therefore, this proposal would have no impact on this species or habitat.

Black-backed Woodpecker

Overall Population and Habitat Status and Distribution

The black-backed woodpecker breeds from central Alaska and northern Canada south to the mountainous regions of California, Wyoming, Black Hills, upper Great Lakes and New England states and into Newfoundland. The Montana Natural Heritage program has 16 confirmed breeding records in Montana as of 2008. Fifteen of the records are located in northwestern Montana counties. Unconfirmed breeding records exist that would expand their range to most counties in the western part of the State, including areas in southwestern

Montana, the Big and Little Belt Mountains and the Bridger Range (USDA Forest Service 2009b).

In 2006, the Avian Science Center, University of Montana, conducted a stratified random, grid-based survey of mountain pine beetle-killed lodgepole in northern Idaho and parts of western Montana. They detected black-backed woodpeckers in less than1 percent of the sites surveyed. The Northern Region Landbird Program has documented three detections from the Forest from 1994-2004 (USDA Forest Service 2009b). Samson (2006) lists the species as uncommon on the BDNF. The Montana Natural Heritage database has no detections anywhere in the Flint Range from 2007 to date (Database accessed 8/06/2012).

Tree mortality caused by insects, disease, and fire are ecological processes that are important for black-backed woodpeckers. These processes operate at relatively large scales both in time and space due to factors such as climate. The species itself is adapted to irruptive movements over large distances to new sources of habitat. This suggests that a viability strategy for the black-backed woodpecker should be regional in scale; that distribution of habitat is not a limiting factor; and that lack of habitat in the BDNF at some points in time would not impair the viability of the species as a whole if such habitat existed elsewhere (USDA Forest Service 2009b).

Samson (2006) reported that black-backed habitat (post-fire and insect outbreaks) has increased across the Region in the last decade. On the BDNF, he reported 48,520 acres of habitat in 1990-1993; by 2000-2003 suitable habitat had increased to 174,084 acres. Samson also found that habitat was well-distributed and would not limit black-backed woodpeckers from interacting Region wide. Updated habitat estimates in 2008 (Bush and Lundberg 2008) reported an increase to 395,155 acres of habitat on the BDNF. The Forest Plan FEIS -appendix B states "…habitat on the BDNF is approximately 13.4 times the amount needed to meet the threshold for viability across the entire Northern Region." Bush and Lundberg (2008) also show that neighboring forests have sufficient habitat above Samson's (2006) habitat threshold.

Since the time of these analyses, mountain pine beetle numbers have continued to increase across the Forest. In 2005 and 2006 the Region received normal amounts of precipitation and resulted in reductions in population levels of mountain pine beetle. However, in 2007 there was a return to drier-than-normal conditions and infested areas have been increasing since then.

Bonn et al. (2007) summarized Key Findings; (1) populations appear to be increasing in the United States; (2) habitat is abundant and well-distributed across the Region and by Forest; (3) habitat has recently increased and is expected to continue to increase as fires and outbreaks continue; (4) the level of salvage timber harvest is insignificant across the Region; and (5) the amount of habitat required for a minimum viable population compared to that available indicates that it far exceeds that needed, given the natural distribution of the species and their habitat.

Biological Information for Black-backed Woodpeckers

In Montana, preferred habitat consists of coniferous forests (spruce-fir types) especially sites that were previously burned or experienced windfall. The species nests and forages in sites that were recently disturbed (i.e., typically 5 years) and also nests in dense forest stands. They are primary cavity nesters, excavating their own cavities in April and May, often in dead or dying conifers. The young depart from the nest from early June through early July.

They are highly responsive to forest fire and other processes, such as spruce budworm or mountain pine beetle outbreaks, resulting in high concentrations of wood-boring beetles invading dead trees. Local and regional irruptions and range extensions have been observed in response to burns and wood-borer outbreaks (USDA Forest Service 2009b). One study of black-backed woodpeckers in ponderosa pine in the Black Hills found that they were strongly associated with the presence of wood-borers; mountain pine beetles create habitat for wood-borers (Bonnot 2006). However, lodgepole pine (which is present in the project area) has thinner phloem with less area for wood-borer beetles.

While Hutto (1995) described post-fire habitat as definitely preferred, he also noted the value of having large-diameter green trees available as foraging substrate after fire. Mature and old-growth coniferous forests with decadent trees, snags and fallen logs are important to provide heart-rot in trees and snags for nests, diseased trees for roosts, and beetle infested trees for foraging (USDA Forest Service 2009b). Recent infestations of mountain pine beetle would be expected to benefit black-backed woodpeckers by increases in foraging habitat.

Black-backed Woodpecker Habitat and Use of the Analysis Area

There have been no wildfires in the project area in suitable habitats within the last 10 years, and there are no preferred post-fire foraging habitats in the project area. There have been no confirmed observations of black-backed woodpeckers in the project area during field reviews. Woodpecker surveys conducted in units 10, 11, 15, 16, 27, 43, and 45 during the summer of 2010 found three-toed woodpeckers, but no black-backed woodpeckers.

Table 40 shows that there are 17,144 acres of lodgepole pine and subalpine fir stands that average greater than 5 inches d.b.h. Within the project area, it is estimated that virtually all (over 16,500 acres) of the lodgepole pine stands 5 inches or greater d.b.h. have been affected by mountain pine beetle (Vegetation section).

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to black-backed woodpeckers or habitat because no project activities are proposed. Continued infestations of mountain pine beetle (and other insects) would provide foraging and nesting habitat across the analysis area. However, after a few years, the dead trees no longer provide habitat for beetles (once the wood is dried out) and foraging habitat would decline. Dead lodgepole pine trees would eventually fall (5-15 years). While local reductions in foraging habitat may occur over time, adequate amounts of potential habitat are expected to remain available at the landscape scale in the long term (table 50).

Based on projected habitat availability, this alternative would have no impact on this species or habitat.

Alternatives 2 and 3

Direct and Indirect Effects

This proposal would result in changes to stand structure and species composition through salvage, thinning, seed tree harvest, prescribed burning and precommercial thinning. Those

project activities would include disturbance effects due to increased traffic, human activity, and equipment use during project activities.

However, disturbance has not been found to be of concern for this species (Bonn et al. 2007), and this analysis will focus on changes to habitat through commercial salvage in lodgepole pine as this vegetation type provides the most suitable foraging and nesting habitat.

The effects analysis is based on acres of potential habitat affected, and timing of activities. Direct effects to woodpeckers are unlikely but there could be effects to eggs or nestlings in those units that would be salvaged during the breeding season. Given that black-backed woodpeckers appear in low densities in unburned habitats, and none were documented during analysis area surveys or in adjacent areas, the chance of direct effects is low. If a nest is found, a timing restriction during the breeding season would be implemented; June 1 – August 31 to prevent nests, eggs, or nestlings from being destroyed (Bonnot 2006).

Salvage of lodgepole pine would occur on approximately 1,163 acres, or 6.6 percent of potential habitat (including spruce-fir) on National Forest System lands under alternative 2. Lodgepole pine salvage under alternative 3 would occur on 1,022 acres, or 6.2 percent of potential habitat. Salvage of these dead and dying trees would reduce foraging or nesting habitat within the units, as the only lodgepole pine trees to be retained would be those larger than 15 inches d.b.h. (and other species). In a study of black-backed woodpeckers in the Black Hills, Bonnot (2006) found that recent occurrence of salvage logging near a nest site did not appear to affect nest survival. Greater than 50 percent of the nests observed were in areas where logging had occurred within the last 5 years.

Under the proposed action, 12 salvage units are larger than 40 acres. This would not affect suitability for use for the black-backed woodpecker, because they are a highly mobile species and easily pass through large openings. Black-backed woodpecker habitat would be maintained across the project area because only 6.6 percent (6.2 percent for alternative 3) of suitable habitat greater than 5 inches d.b.h. would be salvaged, and the remaining 93-94 percent has been affected by mountain pine beetle.

Within the proportion that is salvaged, snags would be retained to meet Forest Plan standards (project design features and mitigation measures, chapter 2).

Prescribed burning treatments on 1,259 acres of mid-elevation conifers have the potential to increase snag presence. Crown mortality in patches up to 20 acres in size would be the objective on about 40 percent of treatment units. This equates to approximately 504 acres where suitable habitat for black-backed woodpecker could be created or already exists due to advanced levels of tree mortality.

At the landscape scale, adequate amounts of potential habitat are also expected to remain available in the long-term. ERG (2010) modeled potential habitat in the Clark Fork-Flints landscape under treatment and no-treatment scenarios. The treatment scenario was projected to maintain more acres of potential habitat than the no-treatment scenario (table 50). In the treatment scenario, projected increases in available habitat in future decades appears counterintuitive and is likely attributed to reduced fire severity in the short term that defers that mortality to future decades. Changes are more likely due to the inherent stochastic nature of the model than any substantial treatment effects. Modeling results indicate that habitat for black-backed woodpeckers will exceed historic range variables by several-fold, regardless of treatment (ERG 2010).

Table 50. Modeled acres of potential black-backed woodpecker habitat for alternatives 2 and 3 from 2010 to 2060

Clark Fork-Flints Landscape	2010	2020	2030	2060
No Treatment	225,652	320,428	275,820	348,744
Treatment	225,652	331,178	292,850	359,531

(source: ERG 2010)

Cumulative Effects

This species has a relatively small home range (average 300 acres, Dixon and Saab 2000); therefore, the cumulative effects area consists of the Flint Foothills project area.

Firewood cutting and hazard tree removal are the actions that could affect habitat within the project area. Those not having effects (availability of nesting or foraging habitat) that were not addressed include livestock grazing, weed management, road and trail maintenance, mine reclamation, and travel analysis.

Effects of past timber management actions on NFS lands have been incorporated into the existing conditions for levels of mature forest in the analysis area. Private inholdings total 7,512 acres within the project area. So far, harvest on private inholdings has occurred on approximately 80 percent (about 5,500 acres) of the forested portions. Most of the harvest on private land took place in the 1980s. Not all of the inholdings are forested; about 10 percent are nonforested (dry grassland areas). It is not known whether additional acres of private harvest would occur.

There have been no wildfires in suitable habitat in the project area within the last 10 years and there are no preferred post-fire habitats within the project area.

Hazard tree removal along roadsides would continue until the contract is completed. To date, 117 acres of roadside salvage have occurred within the project area with 29 acres remaining.

Personal use firewood gathering by the public would continue based on the forest firewood permit system. With the recent mountain pine beetle mortality, firewood cutting has increased resulting in loss of snags for wildlife habitat. As the beetle mortality spreads, more trees will be killed and available for firewood, where accessible. There are approximately 162 miles of open road. Off-road limitations to the public for firewood gathering constrain the affects to roadway corridors. Considering the amount of dead trees available near roads, it is reasonable to assume a 70-foot firewood gathering corridor, which equates to 1,375 acres[30]. However, portions of the road system cross through areas that are not habitat (grasslands/shrublands, Douglas-fir and high-elevation sites). Roads within lodgepole pine stands averaging greater than 5 inches d.b.h. total about 41 miles, thereby potentially affecting 348 acres.

Cumulatively, treatments proposed in lodgepole pine under this project (proposed action - 1,163 acres) in addition to ongoing and foreseeable hazard tree removal and firewood cutting total an estimated 1,657 acres on the BDNF. This equates to approximately 10 percent of mid- to late-

[30] The BDNF website states that,with a firewood permit, dead trees can be cut anywhere except in timber sales (marked with signs or painted trees), on private
The BDNF website states that, with a firewood permit, dead trees can be cut anywhere except in timber sales marked with signs or painted trees, on private property, in campgrounds or recreation areas, or within 150 feet of water. Exceptions include wilderness, wilderness study area, recommended wilderness, research natural area, or other areas closed to firewood cutting.

seral lodgepole pine that currently exists within the project area, leaving approximately 90 percent of the host stands for mountain pine beetle untreated under the action alternatives. Ninety percent of potential black-backed woodpecker habitat would remain in the project area, so there is adequate habitat remaining in the analysis area to support black-backed woodpeckers considering cumulative effects. Habitat for black-backed woodpeckers would remain widespread and abundant as long as mountain pine beetles (and secondary beetles such as wood borers) are present.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

There are no specific Forest Plan standards for black-backed woodpeckers. However, this project incorporates Plan standards for snags, live tree and down wood retention, all habitat components that are used by many species of woodpeckers (PDFs Chapter2).

Summary of Effects

Proposed treatments would remove up to approximately 7 percent of existing foraging habitat. Plan direction for snag, live tree and downed wood would be retained in treated areas. Unsalvaged potential habitat would continue to be widespread and abundant in the project area, as well as forestwide and regionwide; habitat for the woodpecker has increased dramatically in the last decade; and habitat would remain well-distributed. When considering all of the actions affecting potential habitat, at least 90 percent of the stands would continue to provide potential foraging and nesting habitat as long as mountain pine beetles and secondary beetles are present. Based on the above, implementation of the action alternatives may impact individuals or habitat but will not likely result in a trend toward federal listing or reduced viability of the population or species.

Flammulated owl

Overall Population and Habitat Status and Distribution

Flammulated owls are migrants that winter in Central America and breed throughout montane coniferous forests of western United States and Mexico.

Population viability modeling (Samson 2006) indicates that existing flammulated owl habitat is not limiting viability at the scale of the Forest or Region.

Biological Information for Flammulated Owls

The flammulated owl forages almost exclusively on insects, especially moths and beetles and forages in the tree canopy, between trees, and on the ground (Powers et al. 1996). They are secondary cavity nesters that often use old pileated woodpecker or northern flicker cavities as nest sites, and nest cavities may be used for several years.

In the northern Rockies, flammulated owl breeding habitat consists primarily of low- to mid-elevation montane forests with low to moderate canopy closure, a large tree component, snags and a brushy understory. “They appear to require relatively open areas, or patches of openings for foraging, in combination with dense patches of usually younger trees or dense foliage (e.g., mistletoe) for roosting. Optimal areas may be the transition between mesic and xeric sites where large snags are found near stands of Douglas-fir regeneration and small grassy openings” (Smucker et al. 2008).

Although older ponderosa pine forests and ponderosa pine/Douglas-fir forests are commonly selected for nesting, breeding has also been reported in older Douglas-fir forest types and to a

lesser extent in grand fir, western larch, spruce/fir, lodgepole pine and aspen habitats (USDA Forest Service 2009b). In a study in the Bitterroot Mountains (Wright 1996), at the broadest scale, flammulated owls occupied landscapes with a higher proportion of low to moderate canopy closure (less than 70 percent) ponderosa pine/Douglas-fir that other cover types. At the home range scale they were positively associated with non-forest openings; and the presence of snags and large trees at the micro-habitat scale. Day roosting habitat consists of thickets or stands with multilayered canopies and canopy closure greater than 50 percent in proximity to nest sites (Goggans 1986).

Flammulated Owl Habitat and Use of the Analysis Area

On the BDNF, dry forest types preferred by the flammulated owl are largely confined to the Deerlodge portion west of the Continental Divide. The Montana Natural Heritage Program (MNHP 2011) shows evidence of breeding in the northern portion of the landscape. Based on existing vegetation information, areas with the largest areas of mature Douglas-fir and ponderosa pine forest occur at mid to lower elevations within the project area. As noted in table 40, there are 11,234 acres of Douglas-fir and ponderosa pine stands averaging 10 inches or greater d.b.h. in the project area. About 4,636 acres consist of stands with less than 40 percent canopy closure.

Flammulated owl surveys were conducted during the summers of 2010 and 2011 in the project area. Detections were recorded in or adjacent to units 1ST, 20C, 23C, 24C, and 25C.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

For alternative 1, there would be no direct, indirect or cumulative effects to flammulated owl or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed. Douglas-fir and ponderosa pine stands would continue to increase in density and canopy layering, thereby reducing available flammulated owl habitat. Where the stands are densest, individual trees may die from competition or insects. Over time, canopy gaps would fill in and result in a decline of other species (aspen, shrubs, herbaceous vegetation). Higher stand densities and development of ladder fuels would increase the risk of wildfire, bark beetle infestations, and in some areas, successional replacement by shade-tolerant competitors (Fiedler et al. 2010). It is expected that under the no-action alternative, mortality in Douglas-fir and ponderosa pine would continue at an increasing rate. The increase in mortality is expected in the analysis area given the current trend in local climatic conditions coupled with the current dense and multi-layered stand conditions common in the Flint Foothill area for the Douglas-fir and ponderosa pine vegetation community (Vegetation section).

Forest Vegetation Simulation (FVS) modeling indicates that current mature stands with 15-inch dominant trees) would not attain old growth characteristics in a 50-year period due to mortality from bark beetles. Existing old growth may be reduced due to mortality to large trees from bark beetles, with large ponderosa pine trees potentially becoming scarce. Modeling of the 50 year trend (with FVS) for one stand that is currently old growth estimated a reduction of ponderosa pine and the stand losing enough large trees to fall out of old growth status. The future trend due to beetle-caused large tree mortality is for fewer acres of low elevation old growth in the project area (Vegetation section).

ERG (2010) estimated that at the Forest-scale only 4 percent of forested acres meet the criteria as suitable for this species. Modeling of the no-action alternative through time at the landscape scale predicts that habitat would continue to decline in the Clark Fork-Flints landscape in both the short-term (10 years) and long-term (past 10 years) due mainly to loss of habitat to high severity wildfires (table 51).

Table 51. Modeled acres of potential flammulated owl habitat for alternative 1 from 2010 to 2060

Clark Fork-Flints	2010	2020	2030	2060
No Treatment	60,648	36,148	19,392	28,612

(source: ERG 2010)

Cumulative Effects

Flammulated owl home range size averages from 25 to 47 acres (appendix F). Therefore, the primary cumulative effects analysis area is the project area.

Past actions consisting primarily of fire suppression, and to a lesser extent logging of mature Douglas-fir, have led to reduced amounts of open and moderately dense Douglas-fir and ponderosa pine that constitutes suitable flammulated owl habitat. Continued wildfire suppression at lower elevations containing Douglas-fir and ponderosa pine would reduce the potential for low or moderate-intensity fires that may enhance structural suitability, but would also reduce the potential for high-intensity stand replacing wildfires that would remove existing suitable flammulated owl habitat in both treated and non-treated areas. Management of wildfire at higher elevations could enhance habitats where Douglas-fir occurs if fire intensities are low to moderate. There are no other ongoing or foreseeable projects or activities that would be expected to affect mature Douglas-fir and ponderosa pine stands. Most firewood cutting occurs in lodgepole pine (abundant and easier to cut and split). Therefore, cumulative effects to the flammulated owl or owl habitat may occur but are not quantifiable.

Summary of Effects

Based on predicted trend for habitat availability, the no-action alternative may impact individuals or habitat but will not likely result in a trend toward federal listing or reduced viability of the population or species.

Alternatives 2 and 3

Direct and Indirect Effects

Both action alternatives propose treatment in Douglas-fir and ponderosa pine stands. Alternative 2 would treat a total of 1,139 acres by commercial thinning and 353 acres by seed tree harvest. Alternative 3 would treat 666 acres by commercial thinning and 353 acres by seed tree harvest. In addition, 731 acres of low-intensity underburning at lower elevations is proposed under both action alternatives.

Direct effects to flammulated owls are possible because there could be effects to eggs or nestlings in those units that would be treated during the breeding season if owls are present. Surveys documented flammulated owl presence in and adjacent to several proposed treatment units. Project design features that require flammulated owl survey prior to treatment in units 20C, 23C, 24C, and 25C have been incorporated. If a nest was found, a timing restriction during the breeding season would be implemented; no activity May 15 – August 15. The limited operating period is based on Reynolds and Linkhart (1987); territories were occupied by

the third week of May, and the mid-August date accommodates the period post-fledging when owlets can still be found in the vicinity of the nest (McCallum 1994). A nest buffer of approximately 35 acres would be applied as this is the nesting home range and the area where fledglings are found immediately after fledging (appendix F).

Proposed treatments under both action alternatives that would have the potential to indirectly affect flammulated owls consist of commercial thinning, seed tree harvest, and prescribed burning within Douglas-fir and ponderosa pine stands. In the commercial thin Douglas-fir units, stand densities would be reduced from 90-220 square feet of basal area to a density that averages between 40 to 60 square feet of basal area. Old-growth stands proposed for treatment under alternative 2would have a higher basal area retained. Commercial activities under alternative 2 would treat about 401 acres of stands with less than 40 percent canopy closure and d.b.h. 10 inches or greater, or approximately 8.6 percent of suitable stands within the project area. Treatments in stands with canopy closure greater than 40 percent total about 897 acre (19 percent). Alternative 3 would treat a total of 334 acres of existing stands with less than 40 percent canopy closure, or about 7.2 percent of existing. Under alternative 3, treatments in stands with canopy closure greater than 40 percent total about 535 acres (11.5 percent). Prescribed burning would occur in an additional 431 acres under both action alternatives, equating to 9.2 percent of existing habitat.

The 50-year-trend for the commercial thin non-old growth stands would be large, open-grown ponderosa pine and Douglas-fir stands that are resilient to inherent disturbance regimes (insects and fire). FVS modeling of a commercial thin and prescribed burn treatment shows that in 50 years there would be widely spaced trees (up to 30+ inches in diameter with basal area ranging from 40 to 100 square feet per acre). An increase of ponderosa pine resulting from the proposed treatments is also predicted. Average diameters for these stands would more than double, which means that smaller trees are not common or if present, occur in openings within the tree canopy, and that there are larger diameter trees than without treatment. Shrubs and forbs are common, but are low growing. Species composition favors ponderosa pine, although Douglas-fir is common. However, without additional future disturbances that approximate the natural fire intervals of the past (i.e. low intensity fire every 20 years on average), stands would revert back to conditions reducing available flammulated owl habitat as described in the no-action alternative.

Commercial thinning in stands classified as old growth (121 acres) under alternative 2 would result in widely-spaced large diameter trees retained at 60 to 80 square feet of basal area with small trees primarily occurring in clumps while still meeting old growth condition defined by Green et al. (2007). Additional younger, mature large trees would be retained to perpetuate large trees on the site.

Commercial thinning treatments that retain canopy closures greater than 35 percent would be expected to maintain or improve habitat for flammulated owl foraging and nesting as structural densities are reduced and large diameter trees are maintained along with pockets of seedling to sapling trees. Thinning treatments in these stands are expected to retain old growth characteristics in both the short and long terms, thereby reversing the trend described for the no-action alternative where larger diameter trees succumb to bark beetles, and existing old growth stands may become non-old growth. Forest Vegetation Simulation (FVS) modeling of one old growth stand within Unit 23C indicates that without treatment and continued high mountain pine beetle activity, the stand would fall out of old growth status in 50 years with a reduction of ponderosa pine in the stand. The 50-year-trend (using FVS modeling) for

prescribing a thin with the same old growth stand and high mountain pine beetle activity indicates that the stand would still be old growth in 50 years, with an increase in the ponderosa pine component (Vegetation section).

Due to existing variability among stands as well as treatment prescription, post-treatment canopy closure within commercial thinning units under both action alternatives is expected to range from 20-50 percent. Wildlife habitat models developed for the Northern Region FIA database and based on current science use a canopy cover range of 35-85 percent for flammulated owl habitats including nesting, foraging, and roosting (Bush and Lundberg 2008). Therefore, treated stands with residual canopy closure below 35 percent would not be suitable for flammulated owls. Over time, canopy closure would increase to the point of suitability due to tree growth in response to reduced stand density. All commercial treatments would retain all green trees greater than 20 inches d.b.h. Proposed treatments would also maintain the snag component according to Forest Plan standards. While commercial thinning treatments are expected to improve nesting and foraging habitats in stands with canopy closures exceeding 35 percent roosting habitat in the form of dense multi-storied forest patches would be removed within treatment units. Roosting habitat is expected to remain available in untreated stands adjacent to treatment units.

Seed tree treatments would result in very open stands with canopy closures below levels identified as suitable (35 percent), thereby removing suitable habitat on 171 acres (3.7 percent) under both action alternatives. Treatments would retain ponderosa pine presence in the long term and provide for development of suitable nesting and foraging habitat through time.

Prescribed burning on 436 acres (the low elevation prescribed burn units), would reduce understory densities and may reduce overstory density by causing mortality in less than 5 percent of overstory trees, but is expected to maintain stand conditions suitable for flammulated owls.

ERG (2010) modeled no treatment and treatment scenarios through time at the landscape scale. Under both scenarios, the model predicts that habitat will continue to decline in the Clark Fork-Flints landscape for over 20 years until showing an increase by year 50 (table 52). Available habitat throughout the modeling period in the treatment scenario ranged from 2 percent-22 percent more than in the no treatment scenario depending on the year modeled. Results indicate that habitat at the landscape scale would decrease, but continue to be available in the long term under both scenarios.

Table 52. ERG (2010) modeled acres of potential flammulated owl habitat, treatment and no treatment scenarios

Clark Fork-Flints	2010	2020	2030	2060
No Treatment	60,648	36,148	19,392	28,612
Treatment	60,648	36,813	24,584	32,423

(source: ERG 2010)

Cumulative Effects

Flammulated owl home range averages from 25 to 47 acres (appendix F). Therefore, the cumulative effects analysis area is the project area.

There are no ongoing or reasonably foreseeable future projects which would measurably affect mature Douglas-fir and ponderosa pine stands within the project area. Roadside hazard tree

removal and most firewood cutting occur primarily in lodgepole pine. Both spruce budworm and Douglas-fir beetle would continue to cause mortality in the mature Douglas-fir stands. Some level of snags provides habitat within these stands, but at some point the loss of live canopy cover would decrease suitability of the stand (when live canopy cover is less than 35 percent)

Continued wildfire suppression at lower elevations containing Douglas-fir and ponderosa pine would reduce the potential for low or moderate-intensity fires that may enhance structural suitability, but would also reduce the potential for high-intensity stand replacing wildfires that would remove existing suitable flammulated owl habitat in both treated and non-treated areas. Management of wildfire at higher elevations could enhance habitats where Douglas-fir occurs if fire intensities are low to moderate. Proposed thinning treatments would open stands and increase suitability, thereby counteracting the negative impacts of wildfire suppression on a relatively small portion (20 percent) of Douglas-fir stands. The cumulative effects of the thinning treatments and continued wildfire suppression on suitable habitat are not quantifiable because suppression also reduces risk of stand-replacement fires with potential to remove habitat.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

This project includes a project design feature to address the Forest Plan standard for mitigation of effects on known active nests of TES raptors. This standard would be implemented if an active nest site is found before or during implementation (project design features and mitigation measures, chapter 2). In addition, meeting the large snag standards can also provide habitat for flammulated owls per habitat requirements noted in Wright (1996) and Smucker et al. (2008).

Summary of Effects for Alternatives 2 and 3

Based on the above analysis, implementation of either action alternative may impact individuals or habitat but will not likely result in a trend toward federal listing or reduced viability of the population or species.

Bighorn sheep

Overall Population and Habitat Status and Distribution

Montana had approximately 5,700 bighorn sheep prior to the die-offs that began in 2009. It is commonly accepted that the introduction of diseases from old world sheep and goats into North America, as well as hunting, have contributed to declines in populations.

The Montana Bighorn Sheep Conservation Strategy (MFWP 2010) identified major habitat issues. Those threats that could be affected by this proposal include: 1) forest succession or woody plant encroachment into former grasslands or shrub grasslands has resulted in a loss of habitat including linkages between habitats and subpopulations; and 2) noxious weeds have resulted in decreased productivity of seasonal ranges.

The overarching threat to maintaining healthy bighorn sheep populations is disease transmission from domestic sheep (WAFWA Guidelines 2007, 2010; MFWP 2010). The Montana Strategy is quite clear that separation from domestic sheep is a crucial concern (Transplant Section - MFWP 2010). The winter 2009-2010 Montana die-offs in Rock Creek to the west and Lost Creek to the east were all disease related (WAFWA 2010 Western Die-Off Summary). While there are an estimated 1,299 domestic sheep in Granite and Powell counties (NASS 2012), there are no FS sheep allotments anywhere on the Deerlodge portion of the

BDNF. The location of domestic sheep operations in the county is not specified. A statewide status review was conducted in May, 2010 by Montana FWP precipitated by the winter 2009-2010 die offs. That review maintained bighorn sheep at Category S4-Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining (Maxell 2010).

Biological Information for Bighorn Sheep

Bighorn sheep are adapted to a wide variety of habitats but three elements are essential to quality habitat: (1) escape terrain; (2) high visibility; and (3) winter ranges are low-elevation, south-facing slopes, with escape cover in close proximity to foraging areas (MFWP 2010). Bighorn sheep forage opportunistically and utilize vegetation types that occur within their seasonal distribution. With few exceptions, bighorns utilize forbs heavily in the spring when they are readily available. As forbs desiccate during summer, diets switch to more grass and grass-like plants. Some populations make substantial use of browse species at certain times of the year (MFWP 2010).

While good habitat conditions are important for maintaining wild sheep, separation from domestic sheep is a recurring theme in the Montana Conservation Strategy and the WAFWA recommendations to Federal agencies.

Bighorn Sheep Habitat and Use of the Analysis Area

The Garrison herd utilizes a core area containing winter range and lambing habitat on private lands located about 3 miles east of the project area. The core area is separated from mountainous terrain on the BDNF by open intermountain grasslands and gradual benches descending from the Flint Creek Range (MFWP 2010). Occurrence of some ram groups and a few yews is reported for the higher mountains and rams have also been found in the western portion of the project area above Maxville and south of the project area at Powell Mine demonstrating long exploratory movements into the Flint Creek Range (figure 30).

The herd was first reported in the 1980s. As of 2008, the herd was estimated to total 65 animals (MFWP 2010). Mapped range of this herd in proximity to the project area is shown in Figure 22. This population did not experience a die-off event in the winter of 2009-2010 (WAFWA Summary 2010). About 18,283 acres of mapped bighorn sheep distribution occur within the project area.

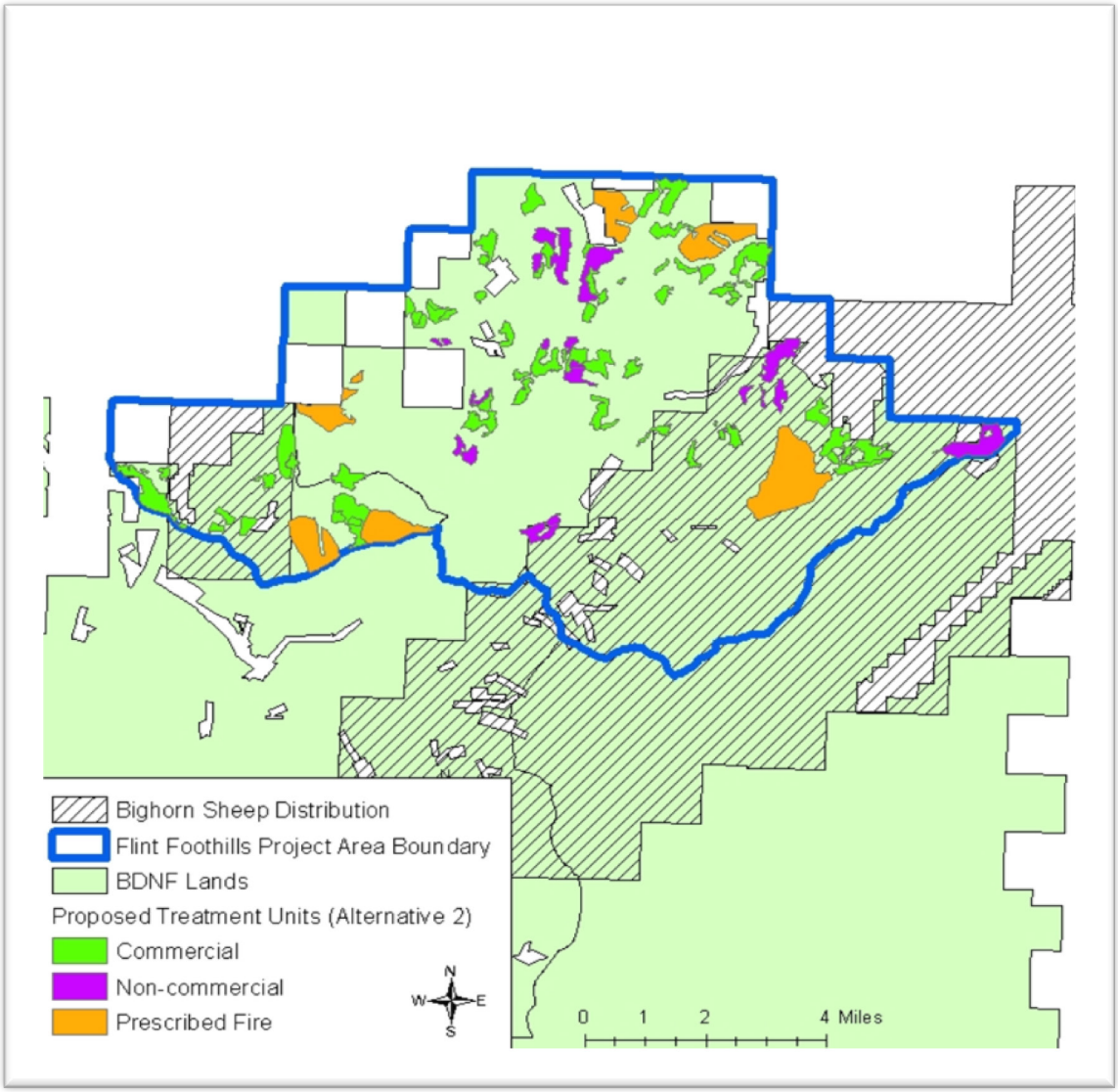


Figure 30. Bighorn sheep distribution in relation to the Flint Foothills project area

Risk factors identified for Garrison bighorn sheep herd include exposure to disease in domestic sheep and goats, forest succession or woody plant encroachment into former grasslands or shrub grasslands, development, and noxious weeds (MFWP 2010).

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to bighorn sheep or habitat because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

While proposed treatments are located within the distribution of bighorn sheep (Figure 22), treatments proposed under the action alternatives are located in forest environments, outside suitable bighorn sheep habitats. Project activities would not contribute to risk of disease transmission from domestic livestock and would not affect existing amounts or trends of forest succession into grassland or shrubland habitats.

There would be no project-related disturbance within fall secure areas. There is potential for disturbance by project activities if bighorns are utilizing areas adjacent to proposed treatment units when treatment occurs, but the potential for disturbance is low, and the duration would be short term.

Cumulative Effects

The cumulative effects area for this species is defined as the project area as well as lands within 2 miles of the project area located within mapped bighorn sheep distribution. The area encompasses 67,819 acres. Existing condition of bighorn sheep habitats in the project area are partially a function of past activities. Past road development has decreased wildlife security; wildfire suppression has allowed conifer encroachment into suitable foraging habitats.

Actions that might affect bighorn sheep and/or habitats within the project area are livestock grazing, weed control, and wildfire suppression. Livestock grazing and weed control are important actions affecting range condition. All FS allotments are under a rest-rotation grazing system; however, current range conditions within the project area are not identified. There are no domestic sheep allotments on the Deerlodge portion of the BDNF. Continued treatment of existing weed infestations with herbicides is expected to benefit habitat suitability for bighorn sheep. Wildfire suppression would reduce the potential for mortality of conifers encroaching into suitable foraging habitats.

On lands of other ownerships, timber harvest could affect secure areas on adjacent NFS land if additional roads are developed and accessible within 0.33 mile of NFS lands; however, the potential for, and location of, future road developments on non-NFS lands has not been identified. Salvage treatments on non-NFS lands would not occur in bighorn sheep suitable habitat. Livestock grazing on private lands and Montana State Prison lands outside of the BDNF and east of the project area would also continue. While there are an estimated 1,299 domestic sheep in Granite and Powell counties (NASS 2012), there are no Forest Service sheep allotments anywhere on the Deerlodge portion of the BDNF. The locations of private domestic sheep operations are unknown. The extent and location of noxious weed treatments on lands outside the BDNF is not described.

While present and reasonably foreseeable activities may affect bighorn sheep or habitats in the project area, no overlap of effects from the proposed activities is expected because activities proposed under the Flint Foothills project are located outside suitable bighorn habitats and would have minimal potential impact on wildlife security.

Summary of Effects

Based on the above analysis, implementation of either action alternative may impact individuals, but will not likely result in a trend toward federal listing or reduced viability of the population or species. Activities associated with the project may cause short-term avoidance by

individuals, but there would be no long-term changes in wildlife secure areas or habitat suitability.

Fisher

Overall Population and Habitat Status and Distribution

The present range of fishers is reduced from pre-European settlement times with most reduction occurring in the United States. Trapping and habitat loss appear to be the primary reasons. In 1959 fisher were released at Moose Lake on the Pintler RD of the BDNF (Vinkey 2003). Distribution maps of fisher in the western United States indicate that the BDNF is at the southernmost fringe of Montana's population (Montana Field Guide 2012). There is a lack of verified records for the Forest, but mature forest is widely available across the Forest that can provide habitat for fisher population expansion (USDA Forest Service 2009a). Since that time, fisher surveys have been conducted across the northern portion of the BDNF. No detections have been reported. The fisher had been petitioned for federal listing in the northern Rocky Mountains. In June 2011, the FWS released their 12-month finding that listing is not warranted at this time (USDI Fish and Wildlife Service 2011a).

Samson (2006) modeled habitat using basal area, potential vegetation type, dominance group and canopy cover. He found that habitat was well-distributed across the Northern Region and Forests. He also found that it was impossible to model large down woody debris from the existing data and that incorporation of this may or may not influence habitat estimates.

ERG (2010) reported that mesic forests are inherently rare on the BDNF and fisher detection is limited to the northwest corner of the Forest. Stands comprising potential habitat are largely within the spruce/fir cover types and are not vulnerable to mountain pine beetle. The modeling estimated a total of 135,417 acres of fisher habitat on the Forest.

Fisher hare-snare surveys according to Rocky Mountain Research Station protocol (Schwartz et al. 2006) were completed across the northern portion of the BDNF in 2007, 2008, and 2010, however to-date, no fishers have been detected.

Biological Information for Fisher

Fishers prefer dense late-successional stands with high canopy cover. Bush and Lundberg (2008) identified fisher suitable habitats as a variety of forested types with stands greater than 9 inches d.b.h. and canopy closure greater than 40 percent. High canopy cover, fallen logs, stumps, and seedlings, shrubs and herbaceous cover are important. Overall, fishers clearly avoid nonforested areas, large forest openings, recent clearcuts, and areas above timberline (Fisher survey protocol, Schwartz et al. 2006).

Riparian areas are especially important in all seasons (USDA Forest Service 2009b). Dens are found in dead or living tree cavities and in hollow logs. Fishers appear to be restricted to areas with relatively low snow accumulation. Deep fluffy snow and thin crusts restrict their movement (Ruggerio et al 1994). Where snow is deep, fishers may forage for hares on packed, snowplow drifts along roads that bisect hare habitat (in Ruggerio et al. 1994). Currently, mature forest is widely present across the Forest (USDA Forest Service 2009b). Fishers are more common where density of humans is low and human disturbance is reduced (USDA Forest Service 2009b).

Fisher Habitat and Use of the Analysis Area

Based on information in table 40, there are approximately 19,631 acres of lodgepole pine, Douglas-fir, or subalpine fir forest types averaging 10 inches d.b.h. or greater on BDNF lands within the project area. Much of the larger diameter lodgepole pine trees are dead or dying due to mountain pine beetle activity, and suitability for fisher is limited due to their preference for higher canopy cover. Stands are currently very open (low canopy cover) with little understory vegetation and are being converted to early-successional stages. Because much of the lodgepole pine forest is already converting to early-successional stages, it would be more than one hundred years before a mature, dense, high canopy cover forest reoccupies those sites. Review of the vegetation data shows that suitable stands (10 inches or greater d.b.h., greater than or equal to 40 percent canopy closure) in Douglas-fir and subalpine fir total 6,576 acres.

Due to the low number of verified records for the Forest despite surveys, the project's distance from the last relocation efforts (32 miles to the south at Moose Lake (Vinkey 2003) and lack of records for the BDNF, it is unlikely that fishers are present in the project area.

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to fisher or fisher habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

Currently, the stands likely suitable for fishers consist of Douglas-fir and subalpine fir 10 inches d.b.h. or greater with canopy closures greater than or equal to 40 percent. Review of the vegetation data shows a total of 6,576 acres of suitable habitat on NFS lands within the project area. Alternative 2 would treat 1,149 acres, or 17 percent of suitable habitat via commercial thinning in Douglas-fir stands. Alternative 3 would treat less, with a total of 666 acres of commercial thinning that amounts to about 10 percent of existing suitable. Residual canopy closures in commercially-thinned stands are expected to range from 20-50 percent in treated stands (1,028 acres under alternative 2); therefore, a portion of treated stands will contain canopy closures below those identified as suitable for fishers.

Commercial thinning treatments may also include salvage of lodgepole pine in some units. Removal of dead lodgepole pine would decrease future accumulations of downed logs that could contribute to stand suitability for fishers as described by Bull et al. (2001). Adherence to Forest Plan snag and downed log standards is expected to maintain habitat for associated species in the project area.

Prescribed burning in mid-elevation lodgepole pine stands will likely have little impact on fisher habitat due to existing levels of tree mortality.

ERG (2010) modeled fisher habitat in the northern portion of the BDNF and estimated that at the forest scale only 6 percent of forested acres meet the criteria as suitable for this species. Modeling of both nontreatment and treatment scenarios indicates that fisher habitat in the Clark

Fork-Flints landscape is predicted to increase by 4 percent and 11 percent under the no-treatment and treatment scenarios, respectively in the 50-year modeling period (table 53). Projected accelerated increases under the treatment scenarios are due to (1) a slightly negative effect from stand simplification that removes snags and coarse wood on treated acres, and (2) reduction in fire severity within the analysis area. Based on these results, fisher habitat is expected to continue to be available in the Clark Fork-Flints in both a treated and untreated landscape.

Table 53. Modeled acres of potential fisher habitat for alternatives 2 and 3 from 2010 to 2060

Clark Fork-Flints	2010	2020	2030	2060
No Treatment	135,417	143,442	149,591	140,482
Treatment	135,417	142,972	155,837	152,829

(source: ERG 2010)

Cumulative Effects

Fisher home range size for females average about 6,000 acres in the Rocky Mountains (Schwartz et al. 2006). Therefore, the primary cumulative effects analysis area is the project area. In addition, vegetation condition at the landscape scale is considered here in order to interpret habitat trends and implications over a broad area.

Past fire suppression actions have led to present day dense stands of Douglas-fir estimated to exceed historical amounts. There are no ongoing or foreseeable projects that are expected to affect availability of mature Douglas-fir stands. Most firewood cutting occurs in lodgepole pine (abundant and easier to cut and split). Wildfire suppression at lower elevations where most Douglas-fir stands occur decreases the potential for loss of dense habitat structure, but maintains uncharacteristic fire return intervals in stands where long-term sustainability of dense forest structure may not be possible. Trapping in Montana is managed by MFWP. The analysis area is located in Trapping District 2, within which the trapping quota is five fishers per year (MFWP 2012). Given the lack of known fisher occurrence, trapping is unlikely. A reduction in fisher suitable habitat within the project may slightly increase trapping effort, if occurring, in nontreated stands; however, no increased trapping access would result. Based on the above analysis, cumulative effects of the reduced canopy closure under the action alternatives combined with effects generated by trapping and wildfire suppression are expected to be minor and not quantifiable.

Summary of Effects

Given the lack of recorded fisher observations, the potential for fisher occurrence within the project area is low. Suitable habitat is available in dense Douglas-fir and subalpine fir stands. Both action alternatives would treat suitable Douglas-fir stands resulting in modest reductions (less than 20 percent) in available habitat post-treatment. Trapping within the project area is unlikely and no increased access to trapping would occur. Therefore, activities proposed under both action alternatives may affect individuals or habitat but will not likely result in a trend toward federal listing or reduced viability of the population or species.

Gray wolf

Overall Population and Habitat Status and Distribution

The gray wolf was previously listed as threatened on the northern part of the BDNF (north of I-90 and west of I-15) and experimental, nonessential over the rest of the Forest. Since that time they have been delisted (USDI Fish and Wildlife Service 2011b) and are now on the Regional sensitive species list.

Gray wolves are habitat generalists. They generally use areas that lack human disturbance (corresponding to low road densities) and have abundant prey (primarily elk). At the end of 2006, there were estimated to be 12 wolf packs found on the Forest, ranging in size from 2 to 8 wolves (USDA Forest Service 2009b). By the end of 2010, there were approximately 13 packs on or partially using the BDNF (Sime et al. 2011).

Biological Information for Gray Wolves

Packs generally consist of a socially dominant pair, their offspring of the previous year, and new pups. Pack size varies and may include as few as 3 and as many as 37. Breeding usually occurs only between the dominant pair. Young are born in late April in an underground burrow that has been abandoned by other mammals or dug by wolves. Young vacate the den when they are about 3 months old and move to a series of rendezvous sites throughout the packs territory. Pack activity is centered around the den site and nearby rendezvous sites from late April until September.

In Montana, deer, elk and moose make up the majority of wolf diets. Smaller mammals can be an important alternative to large game in the snow-free months. Wolves die from a variety of causes: malnutrition, disease, injuries, interpack aggression and human factors. Human factors accounted for 87 percent of reported wolf mortality in southwestern Montana based on carcass analysis from 2007-2010 (Sime et al. 2011).

Gray Wolf Habitat and Use of the Analysis Area

The Flint Creek wolf pack was first documented in 2007. Its territory is located at the north end of the Flint Creek Range. The pack contains at least two wolves, not identified as a breeding pair. Sightings in 2010 were reported from the prison ranch area west of Deer Lodge through Gold Creek and Douglas Creek. No depredations have been attributed to this pack (Sime et al. 2011).

Environmental Consequences

Measures for potential effects to wolves include sufficient, year round prey base (elk); suitable and somewhat secluded denning and rendezvous sites (wet meadows); and sufficient space with minimal exposure to humans. There are no known den or rendezvous sites in the project area and this measure will not be addressed further, except as provided by secure areas. This species is classified as sensitive across the entire Forest as a result of the latest final rule (USDI 2011b) delisting the Northern Rocky Mountains population. The Flint Creek pack is mapped as occurring in the project area (Sime et al. 2011).

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to grey wolves or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Big game species present across the project area include elk, mule deer and moose. This mix of species provides a good year-round prey base for wolves. See the elk analysis in the MIS section for more information on prey base.

Secure area direction in the Forest Plan was developed to provide secure habitat for all wildlife species, including elk and wolves. Currently, OMRTD direction is being met during the summer (measured by OMRTD over the landscape, and fall hunting season measured over the hunting unit (table 45).

The area would continue to provide habitat as discussed in the existing condition section. Selection of this alternative would have no impact on this species or habitat.

Alternatives 2 and 3

Direct and Indirect Effects

This proposal would result in changes to stand structure and species composition through clearcut salvage, thinning, and precommercial thinning. Wolves are not associated with particular forest stand structures, so the vegetation treatment proposals effects on vegetation will not be analyzed.

Implementation of this proposal would include disturbance effects (temporary displacement) due to increased traffic, human activity, and equipment use during project activities.

Most big game species are present across the project area, including elk, mule deer and moose. This mix of species provides a good year-round prey base for wolves. Elk are a MIS in the Forest Plan and Plan direction is being met as discussed below. In addition, there are specific mitigations that have been added to address concerns. See the elk analysis in the MIS section for more information on prey base.

Secure area direction in the Forest Plan was developed to provide secure habitat for all wildlife species, including elk and wolves. Currently, secure area direction is being met during the summer (measured by OMRTD over the landscape (table 45 and table 47). This provides secure areas during the spring and summer season and denning period. Plan direction (goal) is also being met during the fall hunting season (measured by OMRTD over the hunting unit (table 45).

Both action alternatives propose maintenance and reconstruction of existing roads, new and temporary road construction as well as reconstruction and use of existing unauthorized routes. The action alternatives would not result in increased OMRTDs post-project and open-road densities would remain consistent with Forest Plan guidance (table 45 and table 47).

During project implementation, existing travel restrictions would be followed with exceptions where roads are currently closed year-round. Roads closed year-round include NFS roads 19752, 78472, and 78476 that access units 44S, 58S, and 69S under both action alternatives.

Use of these roads for project implementation during the summer season would increase disturbance on 462 acres of existing summer security habitat under both action alternatives. All units accessed or located in fall secure areas would be restricted during that period under both action alternatives (wildlife project design features and mitigation measures, chapter 2).

Under alternative 2, new temporary roads that would access units 48C, 55C, 56C, 57C, 68C, and 71C are located in existing summer security habitat, or within 0.33 mile of summer security habitat. Use of these roads in the summer season during implementation would produce short-term disturbance on approximately 354 acres of summer security habitat. New NFS road construction designed to access units 36S and 47S would produce short-term disturbance on an additional 72 acres of summer secure habitat during implementation. Total area of summer security habitat affected by short-term disturbance is about 816 acres for alternative 2.

For alternative 3, no short-term disturbance would occur in summer security habitat as a result of new temporary roads or new NFS road construction. Total area of summer security habitat affected by short-term disturbance is about 462 acres for alternative 3.

Alternative 2 reduces the amount of open road by 0.6 mile, but has no appreciable effect on road density at the landscape and hunting unit scales. All temporary roads would be decommissioned upon completion of project activities; newly constructed temporary roads would be obliterated; existing temporary roads would be decommissioned primarily with signs and berms. Units and roads that are in fall secure areas are shown in figure 26. Mitigation has been added to comply with existing travel restrictions (Wildlife project design features and mitigation measures, chapter 2), and there would be no activities in fall secure areas during the hunting season when human disturbance activities are the greatest.

Cumulative Effects

The cumulative effects analysis area for wolves is defined as portions of Hunting Unit 212 occurring within the Boulder Creek, Lower Flint Creek, and Clark Fork-Gold Creek 5th-level HUCs, extending out 2 miles from the BDNF administrative boundary. This area totals 147,215 acres which exceeds average wolf territory size described by Sime et al. (2011). A review of the ongoing and foreseeable actions for actions that might affect prey or secure areas (areas with minimal human disturbance) on NFS lands found that only travel analysis would have the potential to affect wildlife secure areas, but the decisions and associated effects are unknown at this point in time. Travel analysis would consider wildlife secure areas and effects during that process.

Lands of other ownership within the cumulative effects analysis area include those under BLM, State of Montana, and private ownership. Past, present, and reasonably foreseeable activities on these lands include livestock grazing and/or timber harvest. On Montana DNR lands in the Douglas Creek area, and on Montana State Prison lands, timber harvest could affect secure areas on adjacent NFS land if additional roads are developed and accessible within 0.33 mile of NFS lands; however, the potential for, and location of, future road developments on lands of other ownership is not identified. Because the distance of effect is 0.33 mile, the potential impacts to wolves and secure habitats at the project-level are minor.

Therefore, temporary disturbance effects from other activities on NFS lands and on lands of other ownership, combined with effects generated by the action alternatives would have minor impacts to wolves.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The wolf Biological Opinion for the Forest Plan applied to the area of the BDNF where the wolf was listed as threatened, and does not apply here. Prior to delisting (USDI 2011b) the project area was included in the nonessential/experimental zone and not within the "threatened" zone. With the delisting of the Northern Rockies population (USDI 2011b) the terms and conditions do not apply anywhere on the BDNF.

The numerical OMRTD direction is a goal in the Forest Plan. The landscape and HU212 meet the goal. The standard that addresses this issue is Standard #1, which states "from October 15 to December 1 Hunting Units that exceed the OMTRD objective will have no net increase." Existing OMRTDs are currently below thresholds stated in the Forest Plan. This project does not result in a net increase (post-project) that exceeds the Forest Plan standard, as shown in table 45 and table 47.

Summary of Effects

Based on the above analysis, selection of either action alternative may affect individuals (temporary displacement) or habitat but will not likely result in a trend toward federal listing or reduced viability of the population or species.

North American Wolverine

Overall Population and Habitat Status and Distribution

In December 2010, the US Fish and Wildlife Service announced a 12-month finding on a petition to list the wolverine under the ESA (USDI FWS 2010b). They found that listing was warranted but precluded, making it a candidate species. They concluded that the impact of climate change constitutes a threat to the contiguous United States distinct population segment of the wolverine. Wolverine populations in the remaining U.S. range appear to be at numbers so low that their continued existence is at risk due to (1) small total population size; (2) effective population size below that needed to maintain genetic diversity and demographic stability; and (3) the fragmented nature of wolverine habitat. These risks are secondary and only rise to the level of threats to the distinct population segment as they may work in concert with climate change.

Impacts to habitat included (1) climate change; (2) human use and disturbance; (3) dispersed recreational activities; (4) infrastructure development; (5) transportation corridors; and (6) land management. The primary impact of climate change is expected to be through changes in availability and distribution of wolverine habitat (areas with persistent spring snow).

Historically in the lower 48 states the wolverine once inhabited forests from Maine to Washington and south along the Rocky Mountains into Arizona and New Mexico. Trapping in the late 1800s and early 1900s decreased numbers and distribution. Today, the last remaining stronghold in the lower 48 states is in western Montana and parts of Idaho. Wolverines occur at naturally low densities of about one wolverine per 58 square miles with a reported range from one per 25-130 square miles (Squires et al 2007). No systematic population census exists over the entire current range of wolverines in the contiguous United States, so the current population level and trends remain unknown. However, based on current knowledge, the USFWS estimates that the wolverine population in the contiguous United States numbers approximately 250 to 300 individuals (USDI Fish and Wildlife Service 2010, pg. 78031). Wolverines occur on the BDNF but total populations are unknown. While virtually all of the BDNF landscapes have

wolverine detections; the Pioneer, Anaconda-Pintler and North Flint mountains appear to have the most vigorous populations (USDA Forest Service 2009b).

Squires et al. (2006) detected a total of 22 wolverines in the 4 mountain ranges (Pioneer, Beaverhead, Flint Creek and Anaconda-Pintler) comprising the Pioneer study area from 2002-2005. A portion of one home range overlapped the Flint Foothills project area (figure 31).

The average home range for adult males and females with greater than 20 locations were 648 sq. mi. (n=4) and 211 sq. mi. (n=4), respectively. The home range of one adult male overlapped the Clark Fork-Flints landscape, and appears to overlap the project area (figure 31, Squires et al. 2006). Long distance movements of wolverines were most commonly associated with dispersal of young individuals (Squires et al. 2006).

The Wildlife Conservation Society (WCS) has ongoing wolverine research across the region. Inman et al. (2008) postulates a Central Linkage Ecosystem (CLE) for wolverines. The ecosystem is comprised of several mountain ranges located between core habitat areas and is proposed as being critical for wolverine persistence. The analysis area lies in the Anaconda deme (unit) of the CLE (Inman et al. 2008) as shown in figure 32. Dispersal through this vast CLE is yet to be documented.

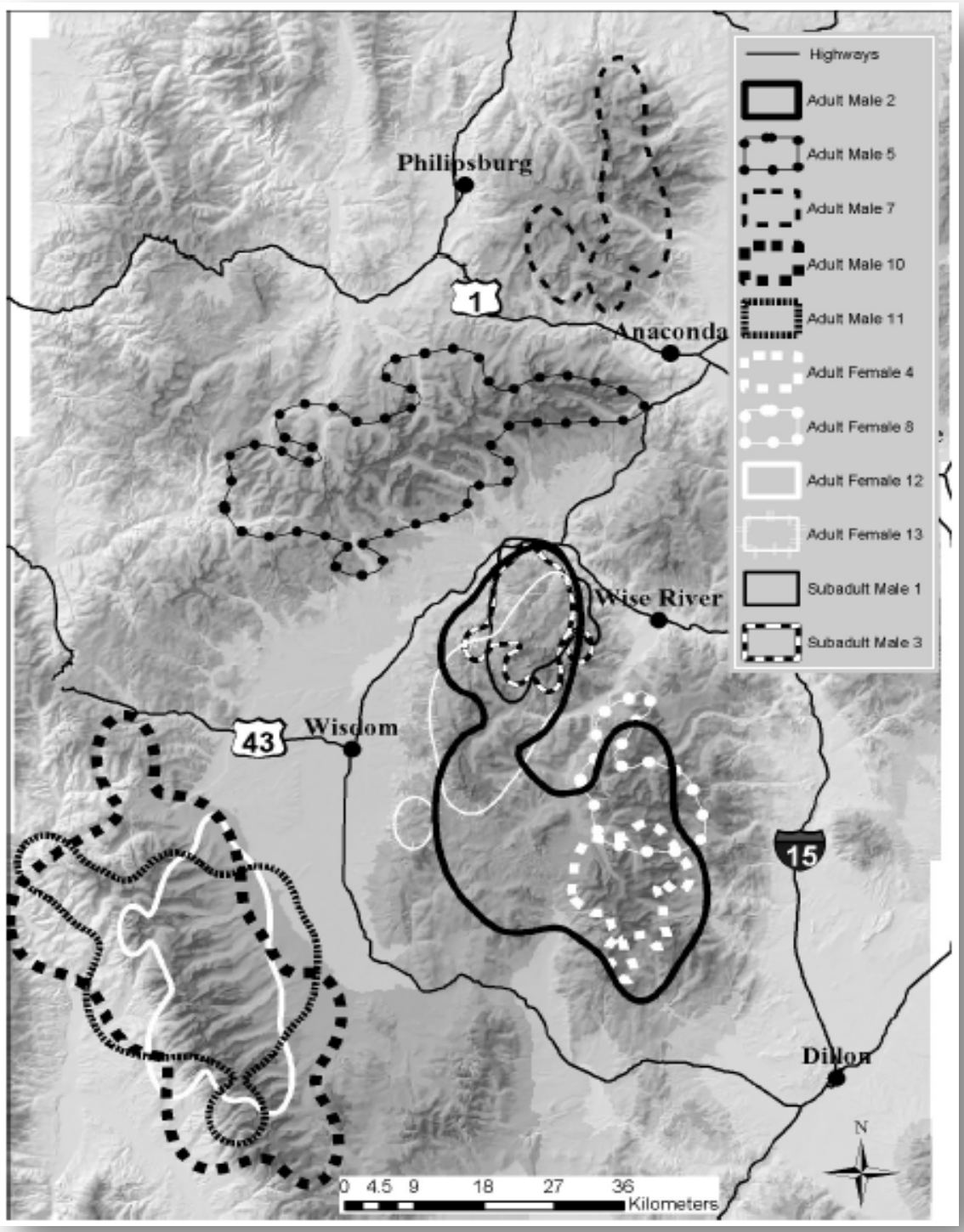


Figure 31. Spatial arrangement of wolverine home ranges in southwest Montana during 2002 and 2003 (Squires et al. 2006)

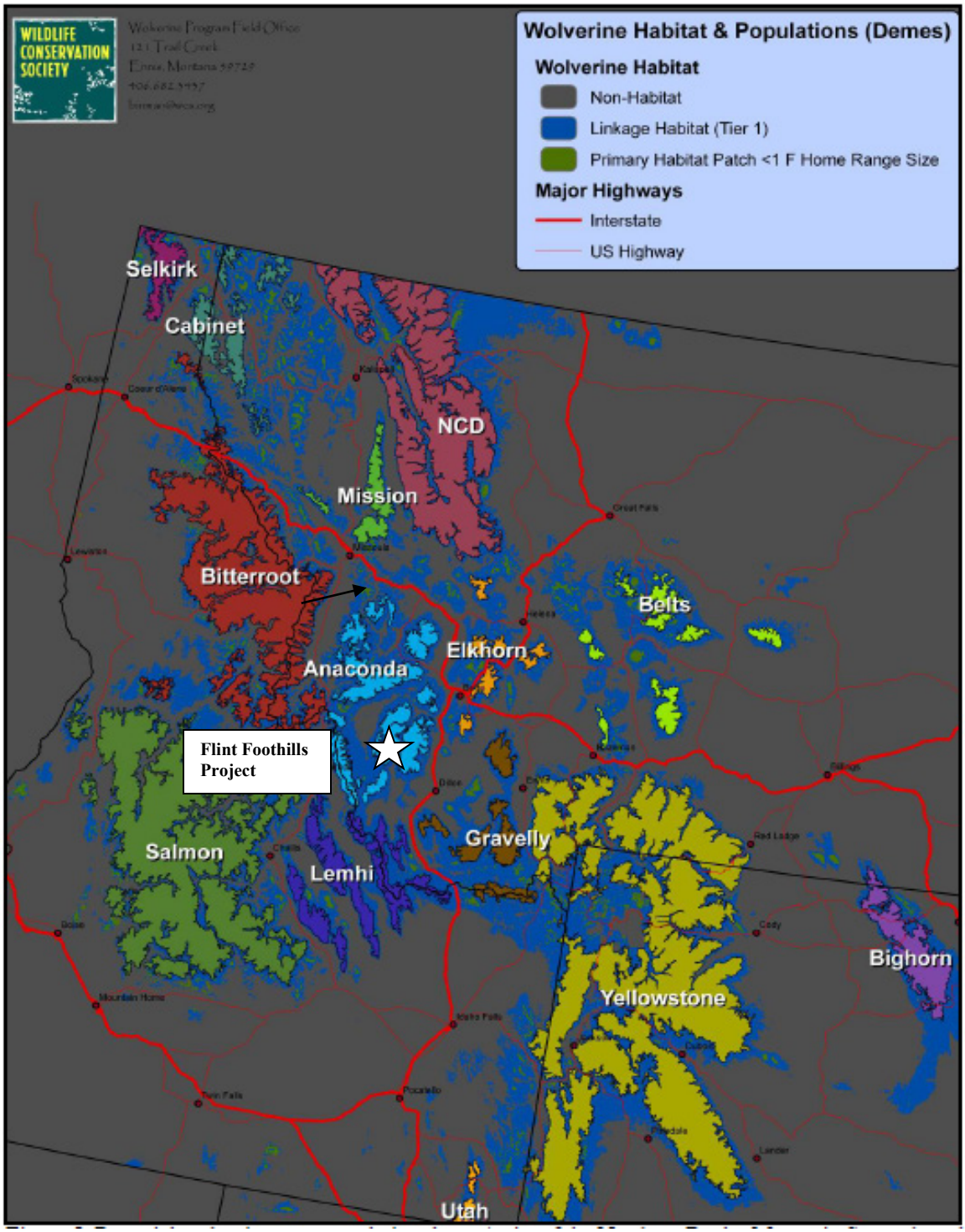


Figure 32. Wolverine Demes (Inman et al. 2008)

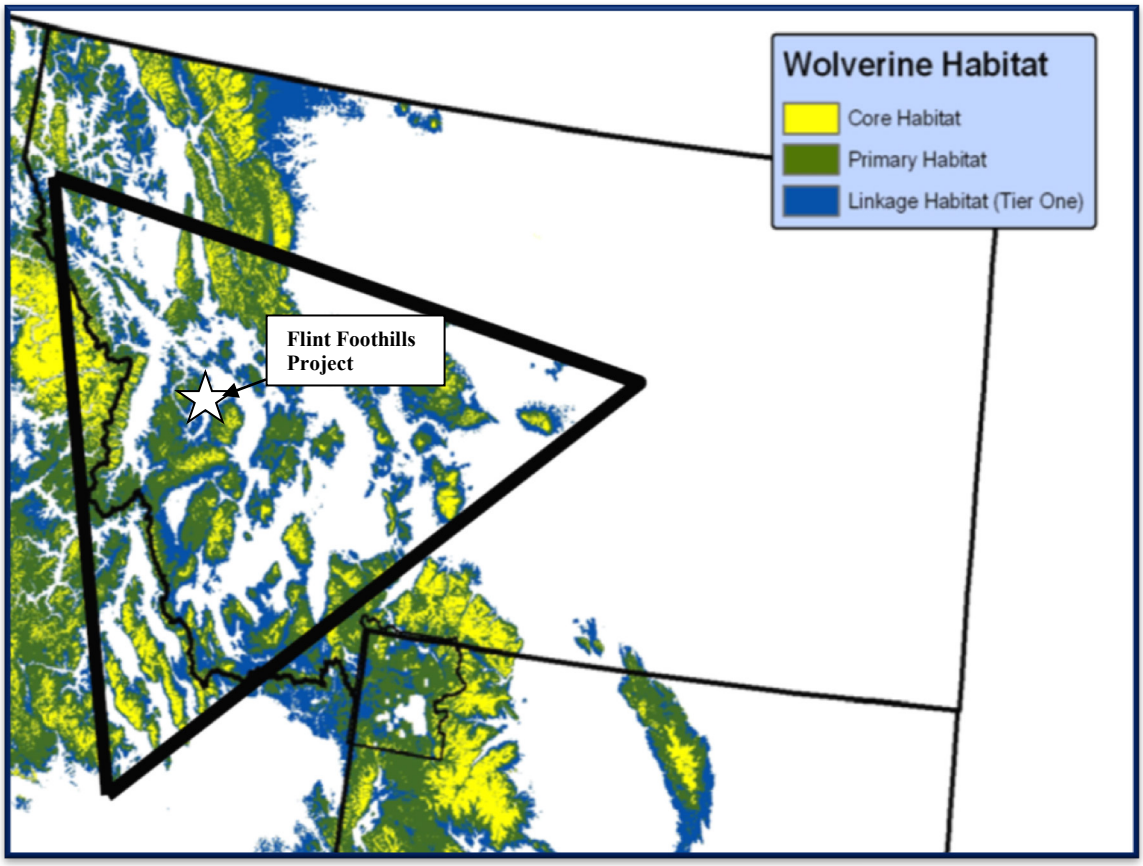


Figure 33. Wolverine Central Linkage Ecosystem (Inman et al. 2008)

As stated in the 12-month finding (USDI Fish and Wildlife Service 2010, pg. 78035) "…trapping is no longer a threat within most of the wolverine range in the contiguous U.S. Montana is the only state where wolverine trapping is still legal". MFWP changed wolverine trapping regulations in 2008. This has increased geographic control of harvest to prevent concentrated trapping in any one area and to completely stop trapping in isolated mountain ranges. No wolverine harvest was reported statewide in 2010 (Montana FWP Harvest Report). In order to achieve dispersal and gene flow among core population centers, wolverines are protected in the Central Insular Mountains, which includes the Anaconda deme (and includes the Flint Creek Mountain Range and the project area).

Biological Information for Wolverine

Wolverines are generally solitary and wide-ranging. They occur at relatively low densities; current population levels and trends are unknown. Wolverine habitat can be characterized by deep, persistent and reliable, spring snow cover (April 15 to May 14) and is the best overall predictor of wolverine occurrence in the contiguous U.S. (USDI Fish and Wildlife Service, 2010b pg. 78035). The high elevations provide deep and persistent snow cover necessary for the presence and maintenance of late-winter reproductive dens (Aubry et al. 2007, Copeland et al. 2010). Copeland et al. (2010) overlaid known den sites on the spring snow coverage and 97.9 percent of the den sites occurred in pixels that were snow-covered in at least 1 of 7 years. Ninety-five percent of summer locations and 86 percent of winter locations fell within the area of persistent spring snow. In the southern part of their range (which includes Montana), wolverines move up in elevation in summer to avoid high summer temperatures. McKelvey (R1

Regional Biologist Meeting, December 2010) stated that wolverines are 20 times more likely to stay in the area of persistent spring snow during dispersal.

In Montana, natal dens occur above 7,874 feet and are located on north aspects in avalanche debris, typically in alpine habitats near the timberline. Dens are typically used through late April or early May and after using natal dens, wolverines use rendezvous dens through early July. These sites are characterized by natural cavities formed by large boulders, downed logs (avalanche debris) and snow (USDI Fish and Wildlife Service 2010, pg. 78031). When known den sites were overlaid with areas of persistent spring snow, 69 percent of the dens were located in areas with persistent spring snow 6 to 7 years out of 7 (Copeland et al. 2010).

Protection of natal denning habitat from human disturbance may be important. The 12-month finding (USDI FWS 2010a) found that wolverine can coexist with some level of human disturbance and habitat modification. The proximity of wolverine habitats to areas heavily or moderately used for dispersed recreation needs more study, especially where the overlap is during the denning season.

A denning habitat model was developed during Forest Plan revision, based on Heinemeyer et al. 2001. This model incorporated slope, elevation, cover types and patch size. Forestwide there is good correlation between modeled denning habitat and the Copeland (2010) persistent snow model (BDNF Habitat Query 2011).

At the forest scale, summer and winter nonmotorized areas were established across the Forest. Wolverines and modeled denning habitat were one of the criteria used to select winter nonmotorized areas. These areas were selected forestwide; one area was selected in the north Flint Creek Mountain Range. The Plan restricts winter motorized use on over 70 percent of the modeled wolverine denning habitat within the BDNF (USDA Forest Service 2009b).

Because wolverine habitat in the Rocky Mountains is not contiguous, wolverines need linkage zones to move between areas of suitable habitat. Wolverines prefer to travel in habitat that is most similar to habitat they use for home range establishment. The level of development in linkage zones that wolverines can tolerate is unknown, but it appears that the current landscape does allow for wolverine dispersal (USDI Fish and Wildlife Service 2010b).

Wolverine Habitat and Use of the Analysis Area

The analysis for direct and indirect effects is the project area. This encompasses all the proposed actions that could affect potential habitat on NFS lands in the mountain range. Modeled denning habitat is located at higher elevations in the southern portion of the project area. Persistent spring snow is a main characteristic required for winter denning. Spring snow persistence (Copeland et al. 2010) and modeled denning habitats are shown in figure 34

While the project area has a generally moderate quantity of habitat based on at least 1 year with available snow, quality is lower due to having limited areas where there is persistent spring snow 6-7 years out of 7 as shown in table 54. The areas to the south (central Flint Creek Range) contain larger more contiguous habitats (figure 34). Fall secure areas would provide habitat connectivity within the mountain range and project area.

Table 54. Acres of potential wolverine habitat based on persistent spring snow (Copeland et al. 2010)

Years Out of 7 with Persistent Spring Snow	Acres in Project Area*	Percent of Project Area
1	2,702	6.1
2	5,895	13.2
3	2,530	5.7
4	2,024	4.5
5	431	<1
6	737	1.7
7	0	0

Wolverines are difficult to detect due to low densities, small population size and remote habitats (Squires et al. 2006). Specific surveys were not done for wolverines in the project area. They are known to occur in the Flint Creek Range. Winter use monitoring (2010) of nonmotorized allocations in the North Flints showed no incursions into modeled wolverine denning habitat (Wildlife Conservation Society 2010 unpublished report).

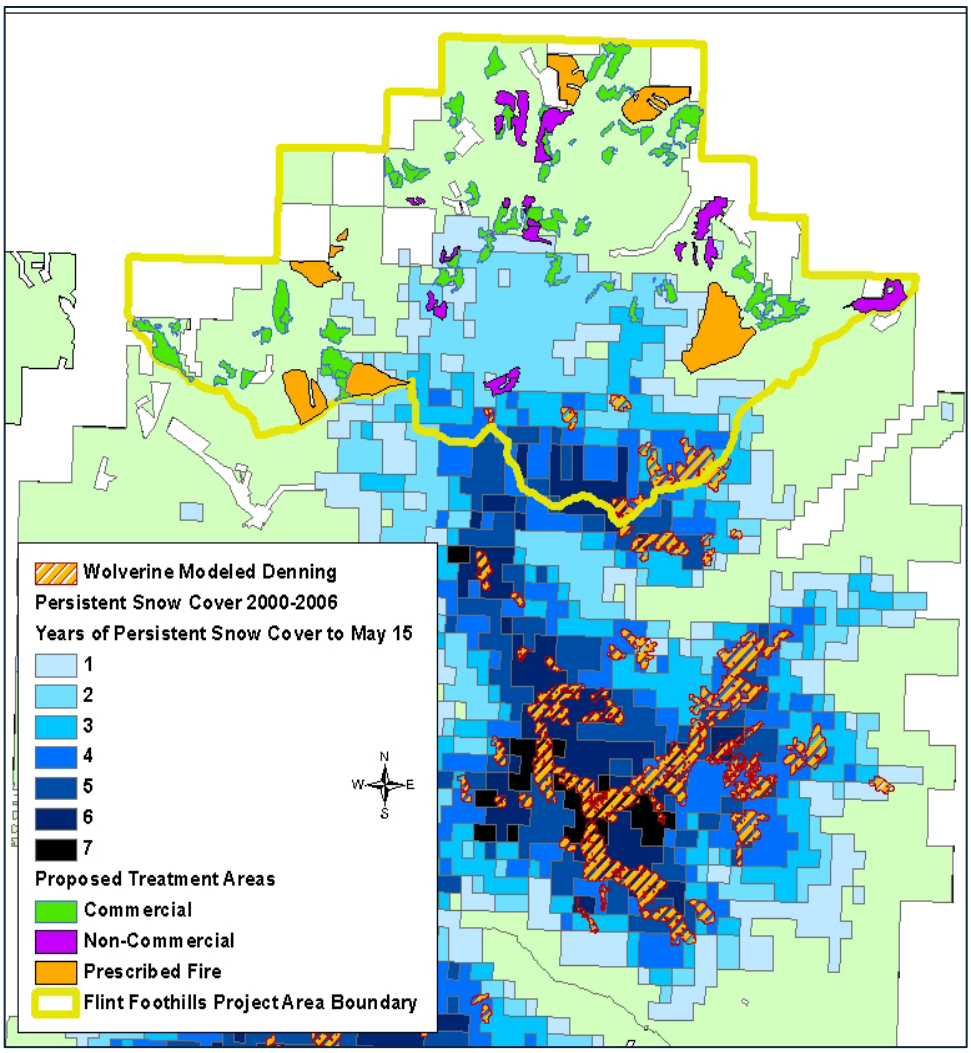


Figure 34. Wolverine modeled denning and persistent spring snow (Displays years out of 7 with spring snow cover (2000 to 2006).

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to wolverines or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

Habitat and Elevation

Availability of areas with persistent snow cover largely determines suitability for wolverine use. Copeland et al. (2007, 2010) clearly equate the association of persistent spring snow and higher elevations (greater than7800 feet) with wolverine distribution. They found that 95 percent of summer and 86 percent of winter telemetry locations were concordant with spring snow coverage. They also reported that in seven of eight North American study areas, and in southern Norway, wolverines selected for areas within the spring snow coverage during winter, summer, and when seasons were pooled, and that elevation explained use of habitat better than any other variable in both summer and winter.

Copeland et al. (2007) state elevation was the key variable for distinguishing wolverine presence. Wolverines preferred higher elevations in almost all models in which it was present. Use of high elevation was most notable during summer when all elevations greater than 7,874 feet were used more than expected and elevations less than 7,218 feet were used less than expected. During winter, use shifted to 7,872-8530 feet elevation zone with lower elevations used less than expected.

Approximately 8,865 acres (20 percent of the project area) occur at or above 7,218 feet elevation. About 2,719 acres (6 percent) are at or above 7,872 feet elevation, and 1,119 acres (3 percent) are at or above 8,530 feet. Under the proposed action, 405 acres of treatment consisting of commercial harvest, precommercial thinning, and prescribed burning would occur between 7,218 – 7,872 feet. Alternative 3 would treat slightly less (table 55). Virtually no treatments would occur above 7,872 feet elevation; therefore, there is little or no potential for disturbance to wolverines during the winter period. Activities conducted on 405 acres under alternative 2 and 394 acres under alternative 3 during the summer at elevations above 7,218 feet have the potential to overlap with wolverine occurrence and may cause short-term avoidance by the species.

Table 55. Acres of proposed treatment within upper elevation bands

Alternative	Elevation		
	7,218 feet	7,872 feet	8,530 feet
Proposed Action	405 ac	<1 ac	0
Alternative 3	394 ac	<1 ac	0

Wolverine use of the project area below 7,812 feet is unlikely. Evidence for the avoidance of low-elevation areas regardless of human presence has been reported for western North America and Norway (May et al. 2006; Copeland et al. 2007). Low-elevation, xeric habitats in the western U.S. that provide winter range for ungulates were avoided by radio- marked wolverines, even though they contained an abundant food source (Copeland et al. 2007 in Copeland et al. 2010).

Snow Persistence and Denning Habitat

Level of snow persistence within the project area is shown in table 56. Overlap of proposed treatments on snow persistence is shown in table 57. No treatments are proposed in areas with 5 or more years of snow persistence. The project area contains a moderate amount of area with snow present through the denning period at least 1 year out of 7 (figure 34); where there is persistent spring snow 6-7 years out of a 7-year occurrence is sparsely available at the highest elevations. No treatments are proposed in areas with 5 or more years of snow persistence.

Most of the units lie in areas where snow is present during the denning season for only 1-2 out of 7 years, and all treatment units, except unit 39P are more than 1 mile from modeled denning habitat (table 57). All units except 36P and 39P are more than 1 mile from areas where there is persistent snow 6 out of 7 years (where most dens occur according to Copeland et al. 2010). Both units 36P and 39P are outside existing summer secure areas. Unit 36P is within a fall secure area, but would be treated outside the fall season. Therefore, while treatment activity is proposed within 1 mile of wolverine habitat, the potential for disturbance is minimal because treatments would occur when and where there is existing human access. No winter logging is proposed.

Table 56. Acres of potential wolverine habitat based on persistent spring snow (Copeland et al. 2010) and acres of proposed treatment for those acres by alternative

Years out of 7 with persistent spring snow	Acres in project area	Percent of project area	Treatment Type/ Acres (Proposed Action)	Treatment Type/ Acres (Alternative 3)
1	2,702	6%	Commercial – 275 Precommercial – 101 Prescribed fire – 272	Commercial – 134 Precommercial – 101 Prescribed fire – 272
2	5,895	13%	Commercial – 172 Precommercial – 131 Prescribed fire - 112	Commercial – 81 Precommercial – 131 Prescribed fire - 112
3	2,530	5%	Commercial – 21 Precommercial – 6 Prescribed fire - 1	Commercial – 21 Precommercial – 6 Prescribed fire - 1
4	2,024	5%	Precommercial - <1	Precommercial – <1
5	431	<1%	0	0
6	737	2%	0	0
7	0	0	0	0
Total	**13,318**	**34%**	**1,090**	**859**

Table 57. Units and treatments within areas of persistent spring snow, grouped by proximity to habitat

Unit	Treatment	Season of Activities	Years of Persistent Spring Snow out of 7 years	Alternatives	Distance to Modeled Denning Habitat	Distance to Areas of Persistent Spring Snow 6-7 Years Out of 7
3B	Prescribed fire		1	2, 3	3.6 mi	3.0 mi
4B	Prescribed fire		1, 2, and 3	2, 3	2.3 mi	1.5 mi
13P	PCT		1	2, 3	3.5 mi	2.8 mi
14P	PCT		1	2, 3	3.9 mi	3.1 mi
16P	PCT	Outside of fall hunting season	1 and 2	2, 3	3.5 mi	2.7 mi
17P	PCT	Outside of fall hunting season	1	2, 3	3.5 mi	2.7 mi
25P	PCT	Outside of fall hunting season	1 and 2	2, 3	2.6 mi	1.8 mi
36P	PCT	Outside of fall hunting season	1 and 2	2, 3	1.1 mi	0.7 mi
36S	Salvage	Outside of fall hunting season	1, 2, 3, and 4	2	2.8 mi	2.2 mi
39P	PCT		1	2, 3	0.9 mi	0.2 mi
39S	Salvage	Outside of fall hunting season	1 and 2	2, 3	2.2 mi	2.9 mi
40S	Salvage	Outside of fall hunting season	2 and 3	2, 3	2.9 mi	2.1 mi
44S	Salvage	Outside of fall hunting season	1	2, 3	2.2 mi	1.3 mi
45P	PCT	Outside of fall hunting season	2	2, 3	2.9 mi	2.0 mi
45S	Salvage		1 and 2	2, 3	2.5 mi	1.7 mi
47S	Salvage	Outside of fall hunting season	2	2	2.8 mi	2.1 mi
48C	Comm. thin	Outside of fall hunting season	1 and 2	2	3.3 mi	2.5 mi
49S	Salvage		1 and 2	2, 3	3.3 mi	2.6 mi
50S	Salvage		1	2, 3	3.7 mi	3.0 mi
58S	Salvage	Outside of fall hunting season	1 and 2	2, 3	2.7 mi	1.9 mi

Unit	Treatment	Season of Activities	Years of Persistent Spring Snow out of 7 years	Alternatives	Distance to Modeled Denning Habitat	Distance to Areas of Persistent Spring Snow 6-7 Years Out of 7
61S	Salvage	Outside of fall hunting season	1	2, 3	3.7 mi	3.1 mi
69S	Salvage		2	2, 3	2.9 mi	2.1 mi
77S	Salvage	Outside of fall hunting season	1	2	3.4 mi	2.7 mi
78S	Salvage	Outside of fall hunting season	1	2	3.7 mi	3.0 mi

Areas to the south of the project area (central Flint Creek Range) contain larger more contiguous habitats (figure 34). Current levels of summer and fall secure areas would be maintained post-project and would continue to provide habitat connectivity within the mountain range and project area. Maintenance of secure areas would also result in no increases in levels of human use and disturbance risk factors during the fall, winter, and spring seasons. Post-project, 19 percent of the project area would provide summer wildlife secure areas, and in the fall 41 percent of the project would provide fall secure areas. This is unchanged from the existing condition. During project implementation, existing travel restrictions would be followed with exceptions where roads are currently closed year-round. Roads closed year-round include roads 19752, 78472, and 78476 that access units 44S, 58S, and 69S under both action alternatives. Use of these roads for project implementation during the summer season would increase disturbance on 462 acres of existing summer security habitat under both action alternatives. All units accessed or located in fall secure areas would be restricted during that period under both action alternatives (wildlife project design features and mitigation measures, chapter 2).

Under alternative 2, new temporary roads that would access units 48C, 55C, 56C, 57C, 68C, and 71C are located inside or within 0.33 mile of existing summer security habitat. Use of these roads in the summer season during implementation would produce short-term disturbance on approximately 354 acres of summer security habitat. New NFS road construction designed to access units 36S and 47S would produce short-term disturbance on an additional 72 acres of summer secure habitat during implementation. Total area of summer security habitat affected by short-term disturbance is about 816 acres for alternative 2.

For alternative 3, no short-term disturbance would occur in summer security habitat as a result of new temporary roads or new NFS road construction. Total area of summer security habitat affected by short-term disturbance is about 462 acres for alternative 3.

The 12-month finding determined that effects to wolverines from land management actions such as grazing, timber harvest and prescribed fire are largely unknown. Wolverines in British Columbia used recently logged areas in the summer. They concluded that land management activities do not constitute a threat to the wolverine DPS.

Effects would be similar under both action alternatives. Direct or indirect effects to wolverine denning are not anticipated. Modeled denning habitat is found outside proposed treatment units. No winter logging is currently proposed.

Cumulative Effects

Because wolverines utilize large areas as home ranges, the cumulative effects analysis area consists of portions of the hunting unit 212 within the Boulder Creek, Lower Flint Creek, and Clark Fork River-Gold Creek 5th-level watersheds, as well as extending out 2 miles from, the BDNF administrative boundary. This area totals about 230 square miles, which is somewhat larger than average home ranges reported from studies conducted in Montana (Banci 1994), but includes portions of low-elevation areas that may not be used by the species. Of all the actions listed for the project portion of the analysis area in table 56, human use on roads and motorized trails (summer and winter) has the greatest potential to affect wolverine habitat use and movements. However, these activities are subject to access determined by seasonal road restrictions already taken into consideration for delineation of wildlife security areas. Therefore, no additional disturbance impacts would occur during summer and fall seasons. Snowmobiling activity may occur during the winter season, but no overlap with proposed activities is expected because no winter activities are proposed under this project. In addition, all modeled denning habitat in the project area is located within a winter nonmotorized area, thereby reducing risk of snowmobile disturbance to wolverine denning.

Potential impacts at the larger scale include human disturbance, trapping and climate change. No additional and overlapping disturbance effects related to roads and motorized trails on National Forest System lands are expected due to the same reasons described above for the project area. Trapping is managed by the State, and annual trapping harvest in Wolverine Management Unit (WMU) 2 is restricted to one wolverine (MFWP 2012a). Project activities would not reduce wolverine habitat and no increased trapping access would result; therefore, there would be no cumulative effects to wolverine trapping generated by project activities.

Climate change is important because of the wolverine's close associations with persistent snow into May for denning. Modeled denning habitat in the cumulative effects analysis area is found around Rose Mountain, Pikes Peak, Goat Mountain, and other high-elevation peaks. Persistent spring snow has been identified as a critical component of denning habitat. Areas of persistent spring snow within northern and central portions of the Clark Fork-Flints landscape are shown in figure 34. While climate trends may impact denning, project activities are not expected to influence short- or long-term climate trends that may affect snow availability and persistence for the species.

Winter nonmotorized allocations prohibit motorized activity from December 2 to May 15. (See Forest Plan glossary). All modeled denning habitat within the project area coinciding with persistent snow (6 to 7 years of persistence) occurs within winter nonmotorized areas, thereby avoiding potential disturbance to denning by motorized use at the project scale. Outside the project area, some modeled wolverine denning habitats corresponding to persistent snow is located in areas where winter motorized use is not restricted. While motorized use in these areas may cause disturbance to denning, project-related activities would not impact denning.

Lands of other ownership within the cumulative effects analysis area include those under BLM, State of Montana, and private ownership. Past, present, and reasonably foreseeable activities on these lands include livestock grazing and/or timber harvest, mostly at lower elevations. On Montana DNR lands in the Douglas Creek area and on Montana State Prison lands, timber

harvest could affect secure areas on adjacent NFS land if additional roads are developed and accessible within 0.33 mile of BDNF lands. However, the potential for, and location of, future road developments on lands of other ownership is not identified. Because the distance of effect is 0.33 mile, the potential impacts to seasonal secure habitats at the project-level are minor.

Therefore, temporary disturbance effects from other activities on NFS lands and on lands of other ownership combined with effects generated by the action alternatives would cause minor short-term impacts to wolverines.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The FWS review of the regulatory mechanisms in place at the national and state level (USDI Fish and Wildlife Service 2010) note that the short-term, site-specific threats to wolverines from direct loss of habitat, disturbance by humans, and direct mortality from hunting and trapping are, for the most part, adequately addressed through state and federal regulatory mechanisms. They stated that federal ownership of much of the occupied wolverine habitat protects the species from direct losses of habitat and provides further protection from many other forms of disturbance. Wolverines can use habitats affected by moderate levels of human disturbance.

At the forest scale and landscape scale, winter nonmotorized areas provide secure winter habitats. This proposal would maintain secure areas and connectivity across the northern portion of the Flint Creek Mountain Range.

Summary of Effects

Potential denning habitat is unaffected by either action alternative. Activities associated with the project may cause short-term avoidance by an individual on summer habitats at elevations above 7,218 feet, but there would be no long-term changes in wildlife secure areas, connectivity areas, or areas of persistent spring snow or modeled denning habitat. Based on the above analysis, implementation of either action alternative may impact individuals or habitat but will not likely result in a trend toward federal listing or reduced viability of the population or species.

Townsend's big-eared bat

Overall Population and Habitat Status and Distribution

Townsend's big-eared bats range throughout the west, from southern British Columbia south along the Pacific Coast to central Mexico, east to the Great Plains. Elevations range from sea level to nearly 11,000 feet. General habitat associations include coniferous forest, mixed forest, deserts, prairies, riparian communities, active agricultural areas, and coastal habitat types (WBWG 2005). The species is known to occur throughout Montana, although the complete range extent within the State is unknown. Globally, the species is ranked as secure (G4), but is classified "at risk" (S2) in Montana due to rarity of occurrence and specialized habitat needs (USDA Forest Service 2009b).

Biological Information for Townsend's big-eared bat

Roosting habitats in western Montana consist primarily of caves and mines, as well as rocky outcrops. Large-diameter trees may also be used for roosting in old-growth forests. Maternity roost sites include warmer areas of caves, mines, or buildings to a lesser extent. Hibernacula (winter roost sites) consist of caves with temperatures just above freezing with moderate levels

of relative humidity. Roost sites can occur within a variety of vegetation types (USDA Forest Service 2009b). Maternity colonies form between March and June (depending upon climate) and roost site fidelity from year to year can be high (WBWG 2005). Caves and abandoned mines that can be used as hibernacula in southwestern Montana are distributed across a broad range of elevations. The long-standing maternity colony (100+ years) at Lewis and Clark Caverns State Park, more than 50 miles east of the project area, has persisted for over a century.

Microclimate at winter roost sites typically ranged from at or near freezing to the mid-40s with relative humidity from 54-100 percent (Hendrix and Kampwerth 2001). Small moths comprise the bulk of this species' diet, although prey items include a variety of nocturnal flying insects. Foraging associations include edge habitats along streams as well as areas adjacent to and within a variety of wooded habitats (WBWG 2005).

Townsend's big-eared bat Habitat and Use of the Analysis Area

The project area contains no known caves, but does include known abandoned lode mine sites. These sites have not been reviewed for species presence or suitability for roosting. Several of these sites are located within units proposed for treatment. Potential foraging habitat consisting of a wide range of forest, riparian and nonforested vegetation types is distributed throughout the project area. Larger snags (greater than 15 inches d.b.h.) are present within the project area, estimated to occur at a rate of less than 2.9 per acre.

Environmental Consequences

Alternative 1 – No Action

For alternative 1, there would be no direct, indirect or cumulative effects to Townsend's big-eared bat or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Direct and Indirect Effects

A total of seven abandoned lode mines are mapped as occurring in or within 100 feet of three commercial harvest units (22C, 23C, and 48C) and two prescribed burn units (3B and 4B). One additional mine of unknown type occurs at the perimeter of prescribed burn unit 5B. Field reconnaissance of the mine at Unit 23C shows that the structure is collapsed and would not support bat roosting use. Structure suitability and bat occurrence at the other mine sites is unknown. No impact to existing mine structure and vegetation near mine entrances would occur in commercial treatment units because known mine sites would be buffered 100 feet from timber harvest activities. In addition, within prescribed burning units, application of fire and burning would be avoided in known mining sites within prescribed burning units (Heritage project design features and mitigation measures, chapter 2). Because heavy smoke loads could impact roosting bats if they occur within proposed burn units, a project design feature has been incorporated that requires application of mitigation measures if the site appears capable of supporting Townsend's big-eared bat roosting (Wildlife project design features and mitigation measures, chapter 2).

To a lesser extent, Townsend's big-eared bat roosting may also occur in snags and large hollow trees. Direct effects to tree and snag-roosting bats by timber harvest activities would be avoided because all trees larger than 20 inches d.b.h. would be retained. Roost sites that consist of trees and snags less than 20 inches d.b.h. would be affected under both action alternatives, if they exist within proposed treatment units. The frequency of Townsend's big-eared bat use of green

trees and snags as roosting sites within the project area is unknown, but expected to be low since this species is more commonly associated with utilizing caves and abandoned mines as roost sites. Some disturbance to bats may occur due to noise during harvest activity, but the duration of disturbance would be short-term.

Cumulative Effects

Sensitive habitats for Townsend's big-eared bats consist primarily of local sites (i.e. caves and mines) while foraging can occur over a relatively broad area. Therefore, the project area encompasses the cumulative effects area for this species. Review of table 24 shows that no present or reasonably foreseeable activities are expected to impact this species. Roadside salvage and firewood cutting primarily affects dead lodgepole pine where tree diameters are likely to be less than 15 inches. Therefore, no cumulative impacts would result due to overlap between past, present, or reasonably foreseeable activities and activities proposed under alternatives 2 and 3.

Summary of Effects

No known Townsend's big-eared bat records, maternity colonies, or hibernacula occur within the project area. Several abandoned mines in addition to existing larger trees and snags may be capable of supporting seasonal roosting. However, project design features minimize the potential for adverse impacts to the species as a result of management activities. Therefore, implementation of either action alternative may impact individuals or habitat but will not likely result in a trend toward federal listing or reduced viability of the population or species.

Summary of Determinations for Federally Listed and R1 Sensitive Species

Table 58 contains a summary of effects determinations pertaining to threatened, endangered, and sensitive species.

Table 58. Northern Region sensitive species summary conclusion of effects for nonaquatic sensitive species occurring on the BDNF

Species	Scientific Name	Alternative 1 No Action	Alternatives 2 and 3
American peregrine falcon	*Falco peregrinus anatum*	NI	NI
Bald eagle	*Haliaeetus leucocephalus*	NI	NI
Black-backed woodpecker	*Picoides arcticus*	NI	MIIH
Greater sage-grouse	*Centrocircus urophasianus*	NI	NI
Flammulated owl	*Otus flammeolus*	MIIH	MIIH
Harlequin duck	*Histrionicus histrionicus*	NI	NI
Trumpeter swan	*Cygnus buccinator*	NI	NI
Bighorn sheep	*Ovis canadensis*	NI	MIIH
Fisher	*Martes pennati*	NI	MIIH
Gray wolf	*Canis lupus*	NI	MIIH
North American Wolverine	*Gulo gulo*	NI	MIIH
Northern bog lemming	*Synaptomys borealis*	NI	NI
Pygmy rabbit	*Brachylagus idahoensis*	NI	NI

Species	Scientific Name	Alternative 1 No Action	Alternatives 2 and 3
Spotted bat	*Euderma maculatum*	NI	NI
Townsend's big-eared bat	*Corynorhinus townsendii*	NI	MIIH

NE = No Effect

NI = No Impact

MIIH = May Impact Individuals or Habitat, but Will Not Likely Result in a Trend toward Federal Listing or Reduced Viability for the Population or Species

Terrestrial Management Indicator Species

Regulatory Framework

Management indicator species (MIS) are designated in the Forest Plan to represent species whose population changes are considered "indicators" for the effects of management activities on representative wildlife habitat.

Management Indicator Species

The BDNF Plan identified three terrestrial wildlife MIS shown in table 59.

Table 59. Terrestrial Management Indicator Species for the BDNF

Species	Habitat preference	Presence in analysis area
Elk	Habitat generalist. Winter range in lower elevation conifer/shrub/grassland mix. Security during hunting season is measured by open motorized road and trail densities over the hunting unit.	Yes
Wolverine	Higher elevations, rugged terrain, spring snowpack, the presence of conifer forests and edge associated with alpine habitat. Deep and persistent snow into May and areas free from human disturbance needed for reproductive dens. Summer and fall secure areas are measured by open motorized road and trail densities over the landscape.	Likely, based on modeled denning habitat and persistent snow and reports, as noted in the sensitive species section.
Mountain goat	High elevation, rugged, steep terrain. Suitable habitat is located in the extreme southern portion of the analysis area.	Yes, but species and habitats would be unaffected by proposed treatments under all alternatives.

Elk

Wisdom et al. (2004), cited in the Forest Plan FEIS (USDA Forest Service 2009b), has demonstrated threat responses of elk to motorized activity. Along with Christensen et al. (1993) references to habitat effectiveness and road density management suggest that elk are a useful MIS to monitor the effectiveness of motorized use management and secure habitat changes, especially since elk occur in every habitat type and virtually every elevation across the Forest.

The Flint Creek Range provides year-round habitat for elk. Hunting unit 212 comprises a portion of the Flint Creek Elk Management Unit, which includes the project area. At the time of the development of the State Elk Plan, the hunting unit exceeded elk population objectives (MFWP 2004). Population estimates have steadily increased since 2003. Elk numbers in

Hunting Unit 212 are currently about 2.7 times above management objective (MFWP 2012), as shown in table 60. Elk populations are widely distributed on the BDNF (appendix F).

Table 60. Elk herd objectives and population status estimates (MFWP 2012)

BDNF Hunting District	2004 FWP State Elk Plan Objective + 20%	FWP 2003 Population Estimates + 10%	FWP 2006 Population Estimates + 10%	FWP 2008 Population Estimates	FWP 2010 Population Estimates	FWP 2011 Population Estimates
212	1,000	1,100	1,074	1,825	2,504	2,693

The Forest Plan management tool for wildlife secure habitat, including elk is through management of open motorized road/trail densities (USDA 2009b).

The Forest Plan addresses wildlife secure areas through OMRTD as discussed previously (see table 44 through table 47) and much of the analysis will focus on maintenance or improvement of security during the summer season and fall hunting season. Rohrbacher (2011) provides more rationale for these measures to address elk and elk habitat (appendix F).

Summer Wildlife Security

As displayed in table 45, the Clark Fork-Flints Landscape currently meets summer OMRTDs identified in the Forest Plan. Figure 26 shows existing secure areas in the project area during the summer.

Fall Wildlife Security

Open, motorized, road and trail density is the metric by which fall secure elk habitat is managed (USDA Forest Service 2009, pp. 45-47). As shown in table 44, HU212 currently meets the Forest Plan goal. Wildlife Standard 1 in the Plan states “From October 15 to December 1 hunting units that exceed open motorized road and trail density objectives will have no net increase in designated open motorized road and trail mileage (over the hunting unit).” Figure 3 shows the current elk secure areas during the fall hunting season.

Hayes et al. (2002) and Unsworth et al. (1993) (in BDNF Elk Monitoring Report-Rohrbacher 2011, (appendix F) found that vegetation variables were not significant in relation to elk mortality from hunter harvest. Increases in open-road and hunter density were significant factors affecting elk mortality. Unsworth et al. states “Habitat is definitely important to the long-term viability of elk populations, but we believe that elk populations are more likely to be controlled by harvest than by limits in cover or forage. In most years, hunters, their efficiency modified by road density and topography, controlled elk populations.”

The importance of this discussion is that the Forest Plan emphasis on road density for secure areas for all wildlife provides for elk with an obvious metric that the Forest Service can manage—road density. This directly ties to Christensen et al. (1993) cited in the FEIS for the Forest Plan wherein they note “…where elk are one of the primary resource considerations, habitat effectiveness should be 50 percent or greater.” Tables 13 and 14 in the Forest Plan reflect this consideration.

Winter Range

Elk winter ranges are located at lower elevations that flank the northeast and northwest portions of the project area, including private and public (Forest Service, BLM and state) land. Figure 35 shows the location of winter range in and adjacent to the project area. There are no treatment units in elk winter range.

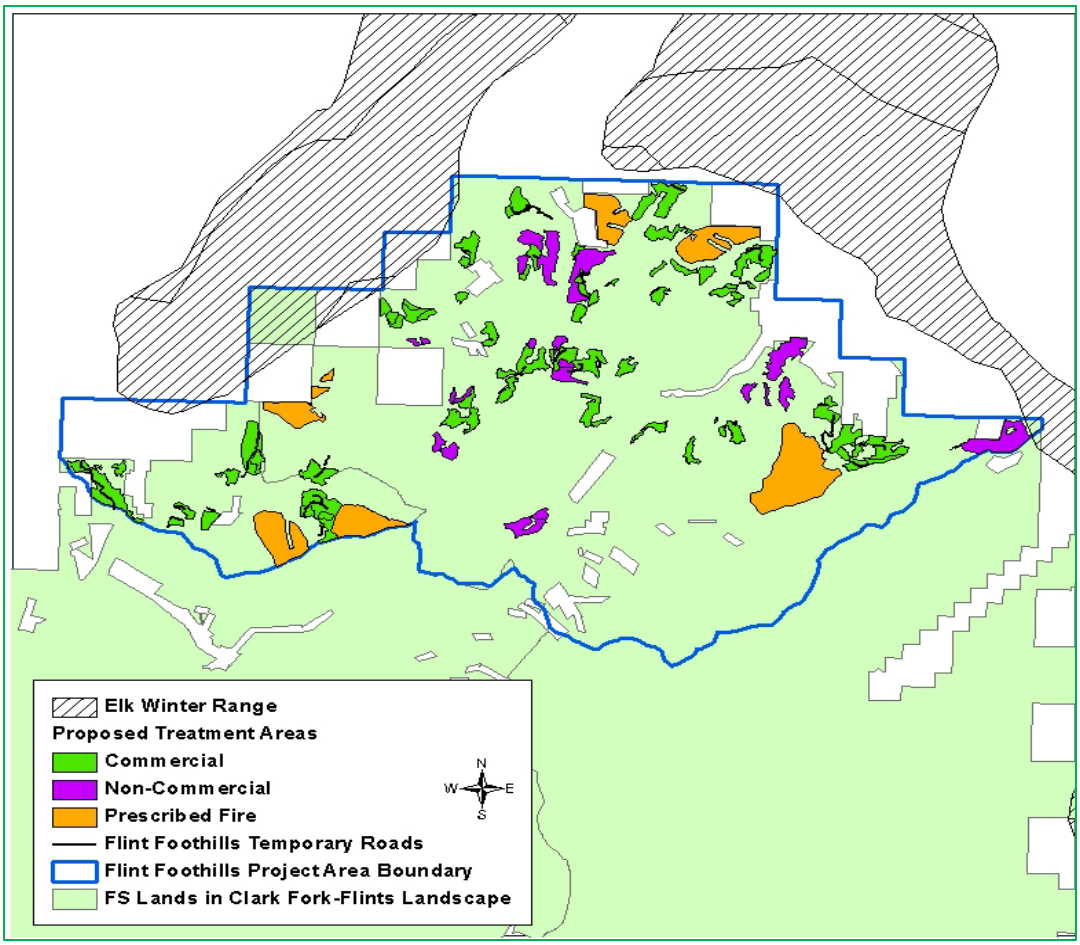


Figure 35. Elk winter range

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to elk or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

As displayed in table 44 and table 45, the Clark Fork-Flints Landscape and Hunting Unit (HU) 212 currently meet summer and fall OMRTD goals, respectively, identified in the Forest Plan. In addition, elk numbers in HU212 are currently 2.7 times higher than the management objective. The increases shown in table 60 have occurred in concert with the existing template

of multiple use activities, including road activity. As noted in table 48, despites short term implementation changes, long term secure areas would remain unchanged.

A review of the literature could find no correlation between elk densities and extensive stands with high levels of coarse woody debris (ERG 2010). Thus, it is assumed that changes in forest conditions when snags fall will (unsalvaged stands) not affect elk densities or distribution.

Wildlife standard 1 in the Forest Plan states "From October 15 to December 1 hunting units that exceed open motorized road and trail density objectives will have no net increase in designated open motorized road and trail mileage (over the hunting unit)." Figure 20 shows the current wildlife secure areas during the fall hunting season.

Alternatives 2 and 3

Direct and Indirect Effects

Effects could vary relative to timing of activities, along roads open during hunting season or in wildlife secure areas. This also includes disturbance effects due to increased traffic, human activity, and equipment use during project activities.

Effects to elk under both action alternatives are similar because existing travel restrictions would be followed under both alternatives.

Both action alternatives propose maintenance and reconstruction of existing roads, new and temporary road construction and temporary road reconstruction. Neither action alternative would result in a post-project increase in OMRTDs; open road densities would remain consistent with Forest Plan guidance. Alternative 2 reduces the amount of open road by 0.6 mile, but has no appreciable effect on road density at the landscape and hunting unit scales. Open road mileage under alternative 3 would remain identical to existing mileage post-project. All temporary roads would be decommissioned upon completion of project activities under both action alternatives. Newly constructed temporary roads would be decommissioned by obliteration, whereas existing temporary roads would be decommissioned primarily with signs and berms. Units and roads that are in fall secure areas are shown in figure 26 and table 44 and table 45. A project design feature has been added (Wildlife project design features and mitigation measures, chapter 2) to comply with existing travel restrictions and there would be no activities in fall secure areas during the hunting season when human disturbance activities are the greatest.

Winter Range

No treatments are proposed under any alternative in elk winter range; therefore, winter range habitat would not be affected. Several proposed timber haul routes cross through elk winter range. However, no units are proposed for winter logging. In addition, restricted road use due to spring breakup restrictions make it unlikely that timber haul would occur through winter range during the latter part of the winter period.

Spring (Calving Habitat)

Calving season generally runs from mid-May through mid-June. Specific areas used by elk for calving can change year to year. Typically, timber harvest and hauling activities do not occur during the calving season due to road use restrictions for spring breakup.

Summer Security
Open, motorized roads and trails are the greatest consideration on summer range relating to habitat effectiveness. As a result, the Forest Plan set secure area direction per landscape, as measured by OMRTDs. Secure areas are areas larger than 10 acres over 0.33 mile from an open route. Under the proposed action, all or portions of nine commercial units totaling 160 acres occur within summer secure areas. Alternative 3 would treat three units with a total of 58 acres in summer secure areas. OMRTDs would be maintained, below Forest Plan thresholds, as shown in table 45. During project implementation, existing travel restrictions would be followed with exceptions where roads are currently closed year-round. Roads closed year-round include roads 19752, 78472, and 78476 that access units 44S, 58S, and 69S under both action alternatives. Use of these roads for project implementation during the summer season would increase disturbance on 462 acres of existing summer security habitat under both action alternatives. All units accessed or located in fall secure areas would be restricted during that period under both action alternatives (Wildlife project design features and mitigation measures, chapter 2).

Under alternative 2, new temporary roads that would access units 48C, 55C, 56C, 57C, 68C, and 71C are located inside or within 0.33 mile of existing summer security habitat. Use of these roads in the summer season during implementation would produce short-term disturbance on approximately 354 acres of summer security habitat. New NFS road construction designed to access units 36S and 47S would produce short-term disturbance on an additional 72 acres of summer secure habitat during implementation. Total area of summer security habitat affected by short-term disturbance is about 816 acres for alternative 2.

For alternative 3, no short-term disturbance would occur in summer security habitat as a result of new temporary roads or new NFS road construction. Total area of summer security habitat affected by short-term disturbance is about 462 acres for alternative 3.

In addition, portions of three prescribed burn units (4B, 5B, and 6B) totaling 292 acres are in or partly in summer secure areas. None of these would require any temporary road or mechanized equipment and there would be no measureable effect on summer secure areas from these activities.

Fall Hunting Season Security
Wildlife standard 1 in the Forest Plan states “from October 15 to December 1 hunting units that exceed open motorized road and trail density objective will have no net increase in designated open motorized road and trail mileage (over the hunting unit).” OMRTDs in HU 212 are currently below Forest Plan thresholds. Construction of temporary roads would temporarily increase mileage but due to the low number of miles of road, there would be little measureable change over the hunting unit during project activities (table 45). These temporary roads would not be open to public use and would be decommissioned upon completion of harvest activities. There would be no net increase in road access and the Forest Plan standard is met.

Project design features include following existing travel restrictions; none of the units in fall secure areas would be harvested during the Oct 15- Dec 1 period under both action alternatives. In addition, precommercial thin units in some areas adjacent to main open roads during hunting season would maintain roadside cover. This would be effective until the lodgepole pine self-prune and lose their lower green branches.

Under alternative 2 there are 15 salvage and 3 seed tree units that are larger than 40 acres. Alternative 3 contains 14 salvage units and 3 seed tree units larger than 40 acres; of these, 11

occur in fall secure areas. As stated before, no activities would take place during the fall hunting season. Since these units are over 0.33 mile from an open route, vulnerability to hunter-related road use would not be expected to increase.

The actions proposed in both action alternatives incorporate timing restrictions for mechanized units in fall secure areas. These timing restrictions would eliminate disturbance in these areas during the season of concern, and measurable changes in elk distribution are not expected.

Cumulative Effects

The cumulative effects analysis area for elk consists of portions of HU 212 within and extending out 2 miles from the BDNF administrative boundary. Present and foreseeable actions within the project area (table 24) that might affect different seasonal habitats or secure areas (areas with minimal human disturbance) include: livestock grazing, Invasive plant species treatments, roadside hazard tree removal, and some recreational activities. Livestock grazing and invasive plant species treatments are important actions affecting winter range; however, the Montana State Elk Plan (MFWP 2004) has not identified any livestock grazing issues for winter range on HU 212. All Forest Service allotments are under a rest/rotation or deferred rotation grazing system. Each allotment management plan (AMP) contains riparian mitigation measures as well as riparian and upland use parameters (Range Resources section). On NFS lands, existing invasive plant species infestations are currently being treated with herbicides on an annual basis and will continue to be treated into the foreseeable future.

Lands of other ownerships within the cumulative effects analysis area include those under BLM, State of Montana, and private ownership. Past, present, and reasonably foreseeable activities on these lands include livestock grazing and timber harvest, mostly at lower elevations. Timber harvest could affect secure areas on adjacent NFS land if additional roads are developed and accessible within 0.33 mile of the Forest; however, the potential for, and location of, future road developments on other lands is not identified. The potential impacts to elk and secure habitats at the project level are minor because the distance of effect is 0.33 mile. Therefore, present and reasonably-foreseeable projects in combination with the action alternatives, would contribute minor cumulative impacts to elk.

Elk populations have been increasing in HU 212 within the context of existing multiple-use activities.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The Forest Plan includes direction to manage open motorized road and trail densities to provide wildlife secure areas. The Forest Plan standard states, "…from October 15 to December 1 Hunting Units that exceed the OMTRD objectives will have no net increase." This project does not result in a net increase (post-project) as shown in table 45, and meets the Plan standard.

Summary of Effects

Selection of either action alternative would not affect fall secure areas as measured by road densities at the project and forest scales. Incorporation of project design features would minimize potential impacts to elk distribution during the fall season. Increases in disturbance would occur on 816 acres of summer secure areas during project implementation under alternative 2, and 462 acres under alternative 3. However, the disturbance effects are expected to be short term. All action alternatives would retain post-treatment amounts of summer and fall security habitats equal to the existing condition. Elk populations on the BDNF would continue to be well distributed.

North American Wolverine

Wolverines were selected as a MIS to indicate changes in motorized winter recreation use levels because they use high, isolated areas for denning. Wolverines have been previously addressed as a sensitive species; see that section for the wolverine discussion for existing condition information.

Wolverines are difficult to detect due to low densities, small population size and remote habitats (Squires et al. 2006). Specific surveys were not done for wolverines in the project area. They are known to occur in the Flint Creek Range.

A denning habitat model was developed for the Forest Plan, based on Heinemeyer et al. 2001. This model incorporated slope, elevation, cover types and patch size. Forestwide modeled denning habitat correlates well (BDNF Habitat Query 2011) with Copeland et al. (2010) persistent snow.

At the forest scale, summer and winter nonmotorized areas were established across the Forest. Wolverines and modeled denning habitat were one of the criteria used to select winter nonmotorized areas. The southern end of the Flint Foothills project area contains a portion of one winter nonmotorized area. The Plan restricts winter motorized use on over 70 percent of the modeled wolverine denning habitat (USDA Forest Service 2009b). Monitoring of selected winter nonmotorized areas in 2009 found that winter nonmotorized use areas in the Flint Creek Range appears to be respected (USDA Forest Service 2009e).

Environmental Consequences

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to wolverines or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed. Wolverines are not associated with specific vegetation types and no effects due to continued mortality in lodgepole pine, declines in aspen or increased Douglas-fir densities are predicted. Acres of secure areas would be maintained and current levels of habitat connectivity within the mountain range (and project area) would be maintained.

Alternatives 2 and 3

Direct and Indirect Effects

As discussed previously, there are records of wolverines in the area, but wolverines have large home ranges, are at low densities across the Forest and are hard to detect. Effects would be similar for both action alternatives. A denning habitat model was developed for the Forest Plan based on Heinemeyer et al. 2001. This model incorporated slope, elevation, cover types and patch size. Forest-wide there appears to be good correlation with Copeland et al. (2010) persistent snow.

At the forest scale, extensive summer and winter nonmotorized areas were established. Wolverines and modeled denning habitat were one of the criteria used to select winter nonmotorized areas across the forest. One area was selected in the northern portion of the Flint Creek Range, and this area is within the southern part of the project area (volume 2, appendix

F). The Plan restricts winter motorized use on over 70 percent of the modeled wolverine denning habitat on the Forest (USDA Forest Service 2009a).

The project area holds a relatively small quantity of modeled denning habitat that coincides with areas where there is persistent spring snow 6-7 years out of 7 (based on Copeland et al. 2010). Areas to the south in the central portion of the Flint Creek Range contain larger areas of persistent snow and modeled denning structure (figure 34).

Under the action alternatives, most proposed treatment units are located in areas where snow is present through the denning period 1 out of 7 years, and all commercial units are more than 1 mile from modeled denning habitat and areas where there is persistent snow 6 out of 7 years (where most dens occur according to Copeland et al. 2010) (table 56). In addition, 96 percent of the project area occurs below elevations normally used by wolverines during the winter and no treatments are proposed within these areas during the winter season. No effects to wolverine denning are expected. While there is overlap of summer use elevations and project activities, temporary avoidance due to activities in units in potential wolverine habitat outside the denning period may occur, but are not measurable, because wolverines have large home ranges and by nature are constantly on the move.

Cumulative Effects

Wolverines utilize large areas as home ranges; therefore, the cumulative effects analysis area consists of portions of the Boulder Creek, Lower Flint Creek, and Clark Fork River-Gold Creek 5th-level watersheds within and extending out 2 miles from, the BDNF administrative boundary. This area totals about 260 square miles, which is somewhat larger than average home ranges reported from studies conducted in Montana (Banci 1994). Of all the actions listed in table 54, human use on roads and trails (summer and winter) has the greatest potential to affect wolverine habitat use and movements. However, these activities are subject to access determined by seasonal road restrictions already taken into consideration for delineation of wildlife security areas. Therefore, no additional disturbance impacts would occur during summer and fall seasons. Snowmobiling activity may occur during the winter season, but no overlap with proposed activities is expected because no winter activities are proposed under this project. In addition, all modeled denning habitat in the project area is located within a winter nonmotorized area, thereby reducing risk of snowmobile disturbance to wolverine denning.

Potential impacts at the larger scale include human disturbance, trapping and climate change. Outside the project area, some modeled wolverine denning habitats corresponding to persistent snow are located in areas where winter motorized use is not restricted. While motorized use in these areas may cause disturbance to denning, project activities would not impact denning; therefore, there is no cumulative impact. No additional and overlapping disturbance effects related to roads and motorized trails on NFS lands are expected due to the same reasons described above for the project area. Trapping is managed by the state, and annual trapping harvest in Wolverine Management Unit (WMU) 2 is restricted to one wolverine (MFWP 2012a). Project activities would not reduce wolverine habitat and no increased trapping access would result; therefore, there would be no cumulative effects to wolverine trapping generated by project activities.

Climate change is important because of wolverine's close association with persistent snow into May for denning. Modeled denning habitat in the cumulative effects analysis area is found around Rose Mountain, Pikes Peak, Goat Mountain, and other high-elevation peaks. Persistent

spring snow has been identified as a critical component of denning habitat. Areas of persistent spring snow within northern and central portions of the Clark Fork-Flints Landscape are shown in figure 34. While climate trends may impact denning, project activities are not expected to influence short- or long-term climate trends that may affect snow availability and persistence for the species.

On lands of other ownerships, timber harvest could affect secure areas on adjacent NFS land if additional roads are developed and accessible within 0.33 mile of BDNF lands. However, the potential for, and location of, future road developments on other lands is not identified. The potential impacts to seasonal secure habitats at the project-level are minor because the distance of effect is 0.33 mile. Therefore, past, present, and reasonably foreseeable projects on lands of other ownership would have an insignificant cumulative impact on availability of secure habitats.

Summary of Effects

Selection of either action alternative would not affect modeled denning habitat quantity or quality at the project and forest scale, and would maintain the existing amount of secure habitat to support the species. There is overlap of potential summer use areas and project activities, but the impacts are not measurable. Crucial denning habitat would remain unaffected by the project.

Mountain Goat

Mountain goats inhabit areas within the subalpine and arctic alpine zone of the northern Rocky Mountains and coastal ranges. The rugged terrain is comprised of cliffs, ledges, projecting pinnacles, and talus slopes. Goat range is associated with areas having well-defined glaciation at elevations between 4,500 and 10,000 feet. Grassy slide-rock slopes are major use areas in spring, summer, and fall. Alpine meadows are used most in mid-summer when vegetation on cliffs is sparse. Timbered areas are used during summer and fall by scattered single goats and by females in spring prior to parturition.

Mountain goats usually remain at or above the timberline and within reach of rocky outcrops utilized for retreat from danger. In general goats tend to make use of higher elevations during summer and lower ones in winter. They prefer to remain high on mountains and forage on windblown slopes, however, deep snows will force them to lower elevations. Water requirements for goats are generally satisfied by snow and melt water. The diets of mountain goats are quite broad and vary somewhat throughout their range; they utilize the most nutritious portions of grasses, sedges, rushes, forbs, shrubs, ferns, and mosses and lichens. During winter conifers can be a major portion of the goat diet.

Environmental Consequences

All Alternatives

General distribution of this species is shown to overlap the southern portion of the project area (MFWP 2008); however, no mountain goat occurrences are shown for the northern portion of the Flint Creek Range (Montana Heritage Tracker 2012; BDNF NRIS database). Mountain goat hunting in the northern Flint Creek Range has been closed since 2007 (MFWP 2012).

Suitable habitats are located in steep, rocky, alpine habitats outside proposed treatment units. Potential for mountain goat occurrence within treatment units is minimal. Proposed treatments

would not impact existing habitat or species distribution. Therefore, all alternatives would have no impact to population or habitat trend on the BDNF.

Other Species of Interest

A few additional species were addressed for this project because they were either detected during field surveys or were species of public interest; or are species with additional direction for analysis from a regional level (Canada lynx) or national level (migratory birds).

Northern Goshawk

The northern goshawk was removed from the Region 1 Sensitive Species list in 2007, based on a review of the best available science regarding the ecological status of the species, the estimated amounts and distribution of habitat in the Region, the results of the 2005 Inventory across the Region, and the completion of a Northern Goshawk Regional Overview 2007. The Regional Overview was revised in 2009, with new habitat estimates, a discussion of impacts of timber management and validity of activity timing restriction dates. This document is incorporated by reference. The overview found that based on recent broad-scale habitat and inventory and monitoring assessments conducted in Region 1, breeding goshawks and associated habitats appear widely distributed and relatively abundant on National Forest System lands (USDA Forest Service 2009d).

Authors of the Overview (2007 as amended) also looked at the effects of the current mountain pine beetle outbreak. They felt that the current outbreak and associated mortality poses uncertain risks to goshawk populations as a function of habitat change and loss. Data were lacking to comprehensively predict goshawk response to beetle outbreak, though some data does exist. Goshawk nest area on the Ashley National Forest in Utah experienced a mountain pine beetle outbreak of approximately 100,000 acres in lodgepole pine in the early 1980s. Goshawks continued to nest successfully in lodgepole pine forests where up to 80 percent of the overstory trees were killed (Graham et al. 1999, in Overview 2009). The number of young that fledged on these territories from 1989 until 1996 was comparable to numbers fledged over the same time period for many other populations in the western United States.

A more recent analysis that incorporates the effects of mountain pine beetle outbreak supports the contention that goshawk nesting habitat is well-distributed across the Forest. In 2010, Ecosystems Research Group (ERG) completed an evaluation of the Beaverhead-Deerlodge National Forest, using a simulation model (SIMPPLLE), to estimate how current changes from mountain pine beetle, other insect and disease, and wildfire might affect the habitats of selected wildlife species, including northern goshawk nesting habitat, for the next 50 years. The ERG analysis also examined how management treatments would affect disturbance processes and wildlife habitats. The ERG model suggests that stands providing northern goshawk potential nest habitat are currently represented on 9 percent of the Forest, or 18 percent of the forested area. SIMPPLLE modeled potential nest habitat remains at 18 percent of the forested landscape through 2020 and then increases to 20 percent by 2030 and 24 percent by 2060. In general, potential nest habitat is well distributed across the Forest in 2010, 2020, 2030 and 2060. The distribution does change from decade to decade. Northern goshawks nest in dense, multi-storied conditions, therefore, natural disturbances inevitably and periodically render any nest habitat unusable. Distribution of potential nest habitat does not appear to be a limiting factor to northern goshawk sustainability across the Forest.

In extensive landscapes of pure lodgepole pine, there may be a decline in currently suitable habitat. In the majority of the Forest, however, where lodgepole pine stands are interspersed with other cover types, the model suggests potential nesting habitat will not be limiting in future decades.

Because habitat is currently widespread and abundant, and the ERG evaluation suggests that goshawk nesting habitat will continue to be widespread and abundant over the next 50 years, despite the current MPB outbreak, this analysis focuses on the Forest Plan standard for protection of known active nest sites (this Plan standard also applies to great gray owls). Goshawks were added to the Forest Plan nesting standard as they have been identified as a species of interest through public comments, appeals or litigation (USDA Forest Service 2009a).

Goshawk surveys in 2010 and 2011 concentrated effort to determine status of historic nest sites. A total of nine historic sites were surveyed, none of which showed active nesting. Surveys were also conducted in units 27 and 43 with negative results. One new site with active nesting was discovered along Gird Creek in 2011 adjacent to units 56C, 57C, and 68C.

Environmental Consequences

Clough (2000) investigated habitat parameters associated with goshawks nesting in the northern portion of the Clark-Flints landscape area that includes the Flint Foothills project area. Results showed that, in general, goshawks nested in multi-storied stands with higher densities of large trees (greater than 15 inches d.b.h.) dominated by either Douglas-fir (57.9 percent) or lodgepole pine (42.1 percent). Only 3 of 19 occupied stands exhibited characteristics indicative of old-growth. Nests in lodgepole pine cover types were located at the lower extent of lodgepole pine distribution, whereas nests in Douglas-fir were found throughout the elevation range of this cover type. Nest sites were located primarily on northerly aspects (82.6 percent). Nest stand canopy closures ranged from 48-82 percent. Goshawk diets consist of a variety of bird and mammal species. As determined by total biomass, primary goshawk prey species in the northern Flint Creek Range described by Clough (2000) include snowshoe hare (53 percent), red squirrel (14 percent), Columbian ground squirrel (9 percent) and blue grouse (12 percent).

Analysis for northern goshawks has suggested that there is a 30,147-acre minimum viable population habitat threshold for the entirety of the Northern Region (Samson 2006). Updates to Samson (2006) by Bush and Lundberg (2008) indicate 363,593 acres of goshawk post-fledging habitat on the BDNF alone, greatly exceeding the Regional threshold.

Seasonal movements of goshawks within the project area are not well known. Samson (2006) describes goshawks in Region 1 as partial migrants. Squires and Ruggiero (1995) reported that goshawks in south central Wyoming migrated out of summer nesting habitats.

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to northern goshawks or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

The action alternatives would result in changes to stand structure and species composition through salvage, thinning, seed tree harvest, and prescribed burning. This also includes disturbance effects due to increased traffic, human activity, and equipment use during project activities. Goshawk nesting use of lodgepole pine stands with high levels of mortality is uncertain (USDA Forest Service 2009d). Because goshawk nesting has been documented in such stands, this analysis assumes that existing older lodgepole pine stands (stands 10 inches or greater d.b.h.) proposed for salvage harvest may constitute suitable nesting at least in the short-term until needle-drop occurs thereby removing overstory canopy in the stand. Once needle-drop occurs, these stands may be used as foraging habitat by goshawks, but the extent of use is unknown.

Salvage by clearcut harvest, commercial thinning treatments and seed tree harvest have the potential to remove nesting habitat, as goshawks use denser stands for nesting. Vmap vegetation data shows that about 1,487 acres in the project area consist of stands 10 inches or greater d.b.h. with high canopy closure (60 percent or greater). Approximately 36 acres of harvest would occur in those stands, which equates to approximately 2.4 percent of suitable nesting habitat within the project area. Alternative 3 would treat slightly less, totaling 31 acres of suitable nesting habitat, or 2.1 percent of available habitat within the project area.

Post-treatment condition of thinned stands is projected to contain the larger trees at densities from 40-60 square feet of basal area with canopy closures ranging from 20-50 percent. Residual canopy closure within some thinned stands is expected to fall below 40 percent. Bush and Lundberg (2008) identified stands above 40 percent canopy closure as functional foraging habitat for goshawks. Therefore, commercial thinning treatments may remove foraging habitat in the short term until stand densities increase to suitable levels.

Effects to goshawk prey species would vary by species and treatment type. Snowshoe hares prefer stands with overhead cover and dense understories (Fisher and Wilkinson 2005, Litvaitis et al. 1985). Standard precommercial thinning prescriptions have the potential to reduce snowshoe abundance and habitat by reducing overhead density (Griffin and Mills 2007, Hoymack et al. 2007). Precommercial thinning units proposed for treatments under this project consist of older stands not currently expected to provide snowshoe hare habitat (see Snowshoe Hare analysis that follows). Proposed salvage treatment units currently lack dense understories. In addition, overhead canopy density is lacking due to recent MPB mortality. Therefore, stands proposed for salvage harvest generally lack snowshoe hare habitat characteristics. Douglas-fir stands proposed for commercial thinning in this project generally contain dense overstories, and consequently, contain sparse shrub and tree understories that provide little habitat for snowshoe hares.

Red squirrels comprise another main diet component for goshawks. Stone (1995) found that red squirrels were abundant in lodgepole pine stands with low (26-50 percent) mortality during a mountain pine beetle epidemic, but squirrel abundance decreased in stands with higher tree mortality due mainly to reductions in canopy foliage. High tree mortality also reduces availability of conifer cones as a food source. Lodgepole pine salvage harvest under this project may decrease red squirrel abundance within treatment units, but the degree of impact is reduced by the advanced level of existing tree mortality in stands proposed for treatment.

Treatments in Douglas-fir stands have the potential to impact red squirrel densities. In dry Douglas-fir stands, Herbers and Klenner (2007) reported that partial timber harvest reduced red squirrel abundance by approximately 40 percent from 2-4 years after 50 percent of timber volume was removed. Thinning treatments in Douglas-fir stands are proposed on 1,149 acres under alternative 2, thereby potentially affecting red squirrel abundance on 10 percent of existing Douglas-fir 10 inches or greater d.b.h. on BDNF within the project area. Alternative 3 proposes commercial thinning on 666 acres, which equates to about 6 percent of existing Douglas-fir 10 inches or greater d.b.h. Untreated Douglas-fir stands would continue to support red squirrel at existing levels within 90 percent and 94 percent of existing habitat under alternatives 2 and 3, respectively.

Low-intensity underburning in lower-elevation stands may reduce stand understory density, but is expected to maintain overall nesting suitability where it occurs within treatment units. Prescribed burning at mid-elevations in lodgepole pine has the potential to reduce available nesting habitat on an estimated 504 acres under both action alternatives. However, these stands consist predominately of lodgepole pine where abundant tree mortality is expected to exist, therefore, the current suitability of these stands for goshawk nesting is unknown.

At a larger scale, ERG (2010) modeled suitable goshawk amounts for a 50-year period comparing treatment and no-treatment scenarios within the Clark Fork-Flints landscape. Habitat under both scenarios is expected to remain fairly stable through 2020, with slight increases shown in 2030 (table 61). In 50 years, slight decreases are projected under both scenarios. Modeling results indicate that suitable goshawk habitats would be available through time at the landscape scale regardless of treatment or no treatment.

Table 61. Modeled acres of potential goshawk nest habitat from 2010 to 2060

Clark Fork-Flints	2010	2020	2030	2060
No Treatment	185,345	185,423	188,041	174,001
Treatment	185,345	187,479	199,048	189,705

(source: ERG 2010)

Goshawks were removed from the Northern Region Sensitive Species list in 2007. Direction from the Regional Office states "…although the goshawk is no longer a sensitive species, analysis of goshawks and their habitat should continue on Forests that use them as MIS" (letter dated 17 July, 2007). The goshawk is not a MIS on the BDNF. Because of this, most of the analysis for goshawks is based on Forest Plan direction. Forest Plan vegetation management direction is designed to restore, maintain and retain a range of landscape conditions under which species evolved. The Forest Plan includes a standard to mitigate management actions around known active nest sites of TES birds, including goshawks.

The 2009 Northern Region Northern Goshawk Overview reviewed timing restrictions. Clough found a random sampling of breeding goshawks (on the BDNF) began incubating eggs on May 5 (+/- 1 day) and fledged by July 12 (+/- 1 day) (USDA Forest Service 2009c). The prohibited operating period used for this project is April 15 to August 15 and is more than adequate to protect active nest sites. This project includes a 40-acre nest buffer. Studies have found a range of nest area sizes (30 acres by Reynolds in the southwest, 1-32 acres by Squires and Reynolds (1996) in Wyoming, and 40 acres reported by Clough in west central Montana on the BDNF (as

discussed in the Overview) and this project used nest area size reported from this part of the goshawks range.

There is a known goshawk nest site in proximity to proposed treatment units 56C, 57C and 68C. A mitigation measure (Wildlife project design features and mitigation measures, chapter 2) has been added to do pre-implementation surveys in areas with potential goshawk sightings and nests if specific units are harvested during the breeding season. Because the Forest Plan standard addresses reducing disturbance during the nesting period, nest stands could be harvested outside the nesting season. But, because habitat is widespread and abundant within the Forest and landscape, there would be minimal effect on goshawks or goshawk habitat at these scales.

Cumulative Effects

The cumulative effects analysis area for goshawks is the project area. Past wildfire suppression has led to denser Douglas-fir stands that may have increased available goshawk nesting habitat. Review of ongoing and foreseeable activities in table 24 shows no ongoing or foreseeable projects that are expected to affect mature Douglas-fir, ponderosa pine stands or live mature lodgepole pine stands. Roadside salvage and most firewood cutting occur in dead lodgepole pine. In addition, other actions that could affect raptor nest sites are subject to the Forest Plan standard to mitigate around known active nests. Continued wildfire suppression activities at lower elevations where most Douglas-fir/ponderosa pine stands are located would favor retention of denser stand conditions for nesting. No measurable cumulative effects to goshawks are expected.

Great Gray Owls

Great gray owls were also added to the Forest plan bird nesting standard. They have been identified as a species of interest through public comments, appeals or litigation (USDA Forest Service 2009a). Great gray owl populations are secure globally, which means that they are considered “common, widespread and abundant”. In Montana, they are ranked S3 which means they are vulnerable due to a restricted range, relatively few populations, recent and widespread declines, or other factors making them vulnerable. They are considered a Species of Concern by the state of Montana. No statewide population estimates are available for Montana and no long-term, rigorous or standardized data on regional or local breeding populations are available (USDA Forest Service 2009b). The great gray owl appears to be widely distributed and relatively well represented on NFS lands in the western half of Montana based on broad-scale data in MNHP Tracker (MNHP 2011) database.

The Biological Evaluation for the Forest Plan found that direction to increase vegetation resiliency, maintain old growth, and retain large snags in managed units similar to those found in unmanaged areas, along with timber harvest (largely in beetle-killed lodgepole pine stands that do not provide good quality habitat) would not cause a loss of viability of the great gray owl or cause a trend toward federal listing (USDA Forest Service 2009b).

Great gray owls nest early, beginning nesting in March or April. Nests are placed on large, broken-topped snags, old stick nests of other birds or in debris platforms from dwarf mistletoe. They prefer mature, dense (greater than 60 percent canopy closure) forest near natural meadows or open forest for hunting. Preferred foraging habitat in northeastern Oregon consists of forested stands with canopy closures ranging from 11-59 percent (Bull and Henjum 1990), while others reported preference for nonforested openings (Duncan and Hayward 1994). The species is known to use spruce-fir, lodgepole pine and Douglas-fir cover types on the BDNF.

Approximately 50 percent of these cover types on the Forest are in the large size classes that would provide nesting habitat for the owl (USDA Forest Service 2009b).

Environmental Consequences

Alternative I - No Action

Direct, Indirect, and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to great gray owl or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Units were prioritized for surveys based on proximity to meadows or parks. Great gray owl surveys were conducted in 2011 in units 1ST, 5ST, 20C, 24C, and 59C with no positive response. In late August and early September, 2011 (after the nesting season) great gray owls were observed in units 10S and 49S. One great gray owl was heard from unit 25C during flammulated owl surveys.

A mitigation measure has been added to do pre-implementation surveys in these units if they would be harvested during the breeding season (March 15 – July 15). If the pre-implementation surveys are not conducted, a limited operating period prohibiting logging operations would be required and no harvest activities would occur during the breeding season. No surveys would be required if logging operations occur outside of the breeding season.

Great gray owl timing and nest buffers were established based on the best available information, largely from other parts of their range (appendix F). The 30-acre nest buffer includes the area where nestlings are found immediately after fledging while they are flightless and vulnerable. The limited operating period begins in mid-march which is consistent with the majority of studies; and the mid-July date accommodates the period post-fledging when owlets are still found in the vicinity of the nest.

Some units are larger than 40 acres, but would not affect suitability of the larger area for use by these raptor species as they are highly mobile and cross openings.

The Biological Evaluation for the Forest Plan found that Plan direction to increase vegetation resiliency, maintain old growth, and to retain large snags in managed units similar to those found in unmanaged areas along with timber harvest (largely in beetle-killed stands that typically do not have enough large diameter snags to provide good quality habitat) would not cause a loss of viability of the great gray owl or cause a trend toward federal listing (USDA Forest Service 2009b). Plan direction has been incorporated into this project. While the nest standard would protect know nests during the breeding season, nest stands could be treated outside of the breeding season.

Both action alternatives would result in changes to stand structure and species composition through commercial thinning, seed tree harvest and prescribed burning. Salvage treatments are not expected to affect available nesting habitat because this species is not known to utilize stands of dead lodgepole pine for nesting. Effects to the species also include disturbance due to increased traffic, human activity, and equipment use during project activities.

Because great gray owls use denser stands for nesting, commercial thinning treatments and seed tree harvest have the potential to remove nesting habitat. A review of Vmap vegetation data for the project area shows a total of 501acres in non-lodgepole pine stands contain canopy closures greater than 60 percent and trees 10 inches or greater d.b.h. Of these, a total of 32 acres (6.4 percent) occur within commercial thinning and seed tree harvest units. While some great gray owl use may be occurring in available green lodgepole pine stands, this analysis does not include lodgepole pine due to unknown levels of tree mortality and existing canopy closures in stands outside those identified for salvage treatment. Alternative 3 would treat fewer acres, resulting in impacts to 28 acres, or about 5.6 percent of larger-diameter Douglas-fir and spruce/fir stands.

Post-treatment condition of thinned stands is projected to contain the larger trees at densities from 40-60 square feet of basal area with canopy closures ranging from 20-50 percent, which approximates a portion of the range of suitable canopy closure for foraging described by Bull and Henjum (1990).

Prescribed burning at mid elevations has the potential to reduce available nesting habitat on approximately 15 acres (3 percent) in suitable habitat outside lodgepole pine stands under both action alternatives. However, these stands consist predominately of lodgepole pine where abundant tree mortality is expected to exist.

Cumulative Effects

The cumulative effects analysis area for great gray owls is the project area. Past wildfire suppression has led to denser Douglas-fir stands that may have increased available goshawk nesting habitat. Review of ongoing and foreseeable activities in table 24 shows no ongoing or foreseeable projects that are expected to affect mature Douglas-fir, ponderosa pine stands or live mature lodgepole pine stands. Roadside salvage and most firewood cutting occur in dead lodgepole pine. In addition, other actions that could affect raptor nest sites are subject to the Forest Plan standard to mitigate around known active nests. Continued wildfire suppression activities at lower elevations where most Douglas-fir/ponderosa pine stands are located would favor retention of denser stand conditions for nesting, but decrease the occurrence of open-structured conifer and forest openings that serve as foraging habitat. No measurable cumulative effects to great gray owls are expected.

Canada Lynx

The Northern Rockies Lynx Management Direction Record of Decision (USDA Forest Service 2007) classifies the Beaverhead-Deerlodge National Forest as unoccupied by Canada lynx (USDA Forest Service 2009b).

Prior to the decision declaring the Forest to be unoccupied, lynx surveys were done across the Region. In the late 1990s a noninvasive hair snag pad DNA survey was conducted on grids across the Region. Lynx detection surveys were conducted on the BDNF from 1999-2001; no lynx were detected. Sample identification results from lynx detection surveys are shown in table 62. Figure 36 and figure 37show locations of lynx survey points on the BDNF, some of which occur in the Clark Fork-Flints Landscape.

Table 62. National Lynx Survey BDNF, Summary DNA results, 1999- 2001

Species	1999	2000	2001
Coyote	5	3	2
Black bear	8	2	24
Bobcat	7	0	4
Wolf/dog	1	1	0
Cougar	0	2	0
Domestic cat	0	0	1
Ungulate	0	0	3
Other*	12	0	2

*Other species is defined as a species that was not a cat (domestic or wild), bear, canid, or ungulate.

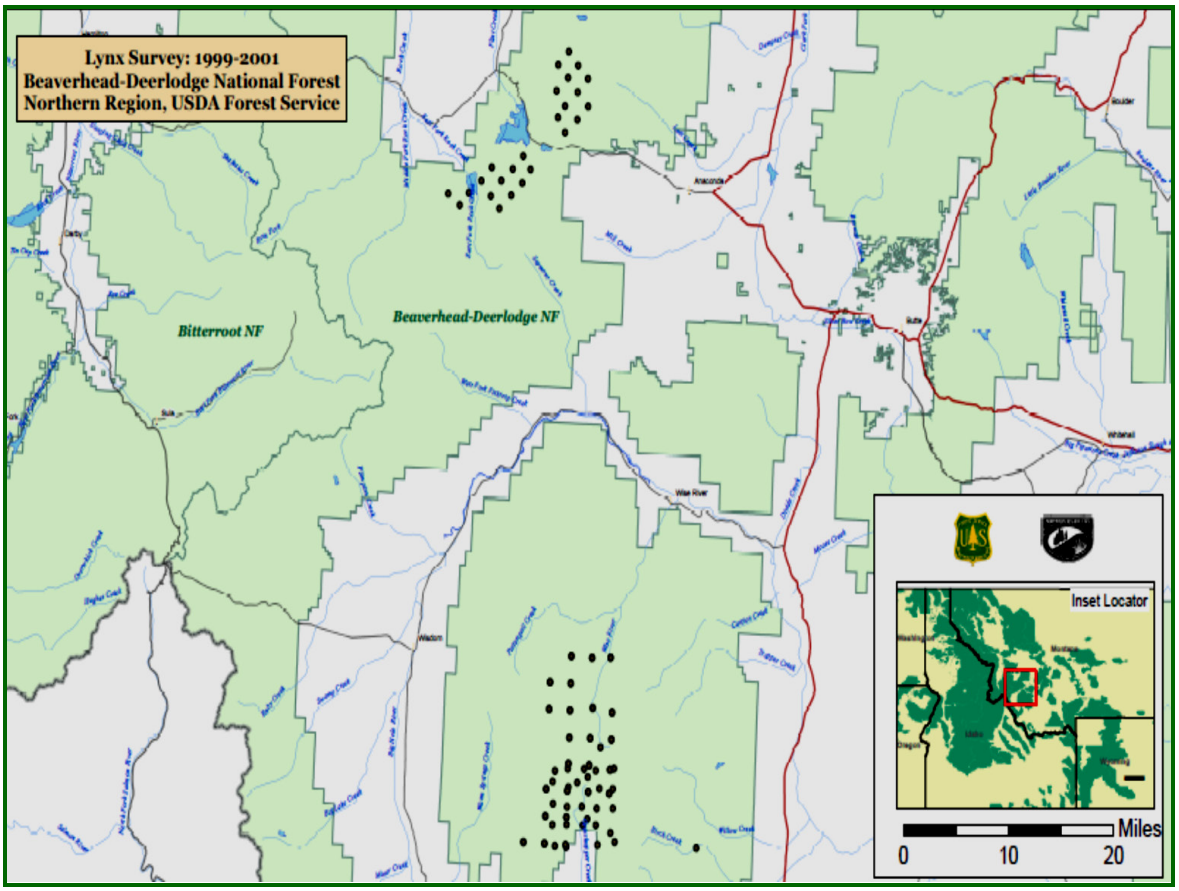


Figure 36. Vicinity Map, 1999-2001 BDNF Lynx Survey Locations

Squires et al. (2003) began what was to be a lynx survey in the Pioneer, Anaconda-Pintler and Flint Creek mountain ranges in 2001 (to the south, west, and north of the project area). Rigorous winter snow track surveys were conducted as a first step to determine the presence and distribution of lynx. They only found a single lynx track throughout the three mountain ranges. Although data show that lynx were historically present in the area, the area did not support a resident population at the time of their survey. Because lynx were at such low densities, and they detected numerous wolverines, that study shifted to wolverines.

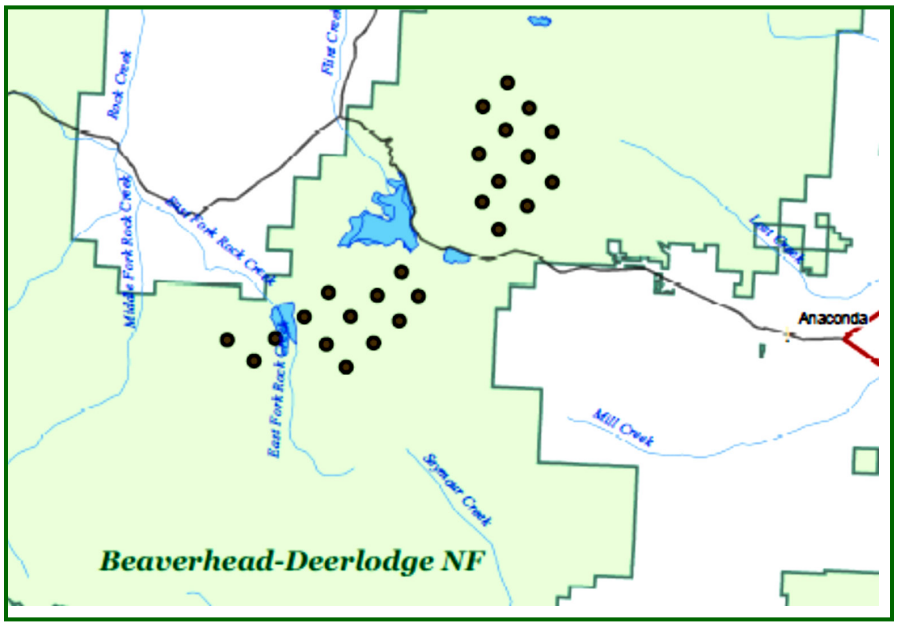


Figure 37. Lynx Survey Locations

Subsequently, in the spring of 2009, two different groups did lynx surveys on the Forest. Nate Berg (Greater Yellowstone Lynx Study) identified and surveyed a few areas of lynx habitat using track surveys. Two routes were run in the Flint Creek mountain range, two routes in the Sapphire/Anaconda-Pintler, one route in the Boulder Mountains, two routes in the Pioneers and one route on the Mt Haggin WMA (Berg 2009). One possible set of lynx tracks were found on the West Fork Rock Creek (Sapphire Mountains), but poor snow conditions precluded positive identification. Another group, Wild Things Unlimited, conducted hair snare and remote camera system surveys in the Flint Creek, Pioneer and Boulder mountains in 2009 (Porco 2009). None of the surveys resulted in confirmation of lynx presence.

In 2000, lynx habitat was mapped across the Forest, based on Regionwide protocol. This mapping included dry site Douglas-fir and lodgepole pine that has lower suitability for lynx. Based on that mapping, the project area includes Lynx Analysis Unit (LAU) numbers 18, 28, 30, and 36 and very small portions of 55 as shown in figure 38.

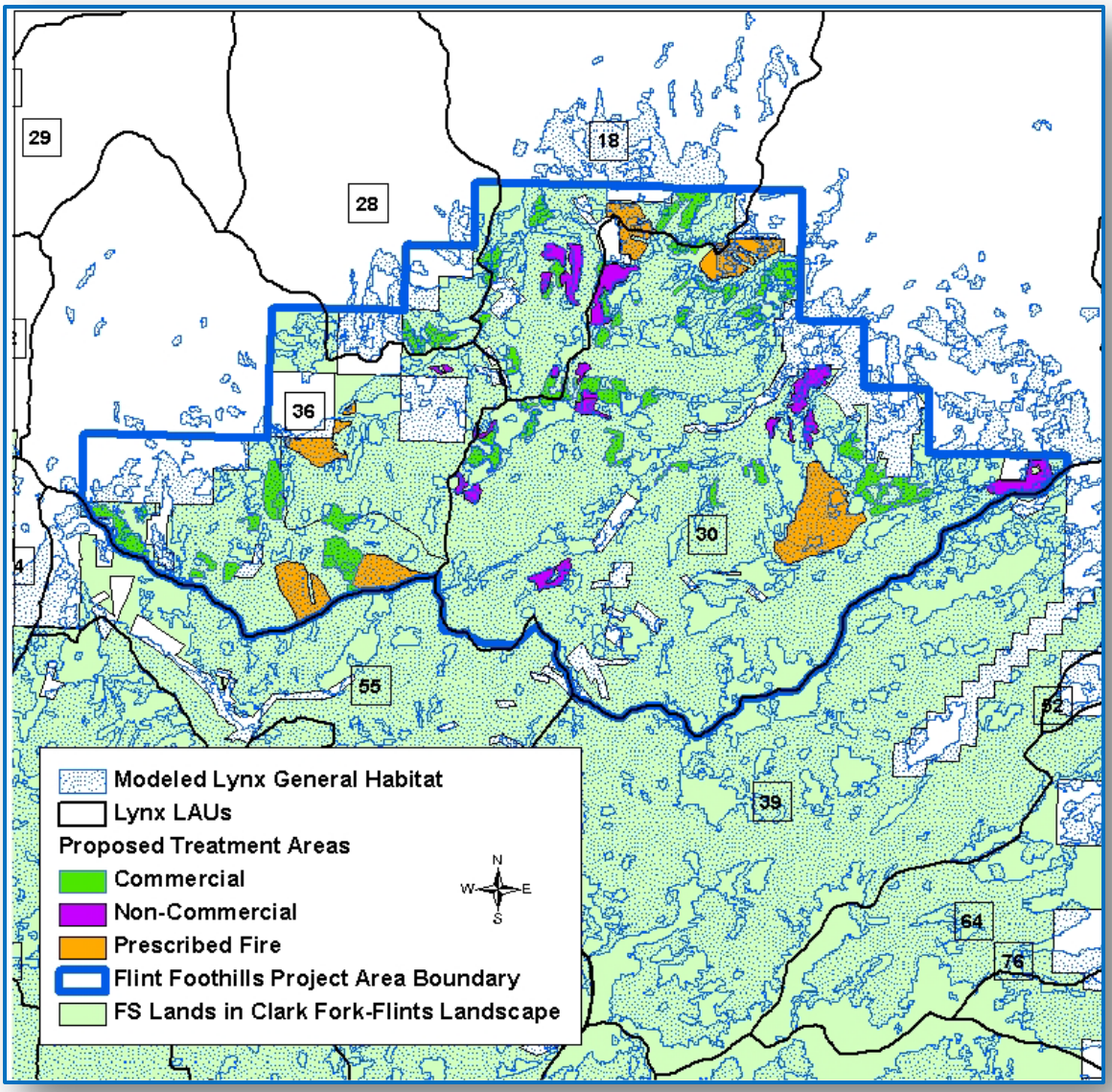


Figure 38. LAUs and mapped lynx habitat

ERG (2010) found that currently only 0.1 percent of the forested landscape on the BDNF provides multi-storied potential habitat for lynx (spruce-fir-lodgepole pine stands greater than5 inches d.b.h./two-storied or multi-storied stands. This is due to (1) eastside lodgepole pine (BDNFs predominant cover type) seldom having multi-storied stands; and (2) mesic spruce/fir stands are a minor type on the BDNF.

Devineau et al. (2010) published a paper with a map showing lynx satellite locations following reintroductions of lynx in Colorado. While the map does show numerous locations in Montana, including southwest Montana, interpreting Devineau et al. (2010) as supporting lynx occupancy of the Beaverhead-Deerlodge NF is incorrect. The Devineau et al. locations, as substantiated by Jake Ivan-Colorado Division of Wildlife, are clearly transient animals that did not stay in Montana. According to Ivan (2011), “Eight of 218 reintroduced lynx in Colorado made 10

forays into Montana lasting between 1 and 217 days (no Colorado-born kittens went to Montana). One individual localized for about 2 weeks in the Madison Range, but other than that these animals were most definitely traveling." The Madison Range is approximately 75 miles southeast of the Flint Foothills project. None of the locations were in the project area and cannot be construed as establishing occupancy for the BDNF. The definition from the USDA/USDI Amendment (2006) defines occupancy as:

1. There are at least 2 verified lynx observations or records since 1999 on the national forest unless they are verified to be transient individuals; or
2. There is evidence of lynx reproduction on the national forest.

The 2009 Forest Plan, Appendix G, pg. 29 (Record of Decision – Northern Rockies Lynx Management Direction) notes: "… as noted in the Biological Opinion, the FWS said, and we agree that lynx detection is needed to assess whether further management direction is warranted. Therefore, we agree to work with the FWS to develop and complete an acceptable protocol to survey currently unoccupied lynx habitat in secondary areas as described in the Biological Opinion, Terms and Conditions #4."

The Forest is establishing lynx-hair snare survey points on the Forest in 2012, as per terms and conditions in the Biological Opinion and ROD for the Lynx Amendment. At this time, the points are being established per hair snare protocols developed by McDaniel et al. (2000). Results will be documented in subsequent monitoring reports.

Direction on occupied and unoccupied lynx habitat was provided in a letter from the Regional Forester in 2009 (USDA Forest Service 2009c). This letter directs unoccupied forests to "…consider lynx management direction using the Northern Rockies Lynx Management Direction Standards and Guidelines Consistency Evaluation Table for Project Specific Activities." This has been done and is found in appendix F. There are four vegetation standards that apply directly to this project (Veg S1, Veg S2, Veg S5 and VegS6) and they are discussed in the lynx and snowshoe hare analyses that follow.

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect, and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to Canada lynx habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

This proposal would result in changes to stand structure and species composition through salvage, thinning, seed tree harvest, and precommercial thinning. This also includes disturbance effects due to increased traffic, human activity, and equipment use during project implementation.

Subalpine fir and spruce provide the most suitable structure and composition to provide habitat for lynx. This proposal would salvage dead and dying lodgepole pine and would not affect the

most suitable habitat. Dead and dying lodgepole pine on dry sites do not provide cover for primary prey species, and do not intercept snow or moderate weather. The units currently have little downed wood for cover. As a result, there would be no change in the amount of available habitat for lynx, should the BDNF become occupied in the future. Snags and downed wood would be retained in the salvage units at levels prescribed under the Forest Plan. This would maintain these habitat components in the units in the future. See appendix F for complete Lynx Evaluation Table.

Veg S1
Veg S1 states "… unless a broad-scale assessment has been completed, if more than 30 percent of the lynx habitat is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation projects. Table 63 shows that this standard is being met (no LAUs are above 14 percent).

Table 63. Habitat and past regeneration treatments within lynx analysis units

LAU Number	Total NFS Acres	Acres Lynx Habitat	Percent Habitat	Acres Past Regeneration Activities*	Past Stand Initiation Percent of Total Acres (VEG S1)
18	3,868	2,930	76	142	5
28	1,001	638	64	54	8
30	23,698	18,491	78	2,652	14
36	8,400	6,782	81	838	12

Veg S2
Standard VEG S2 applies to all vegetation management[48] projects that regenerate timber, except for fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to the following limitation:

- Fuel treatment projects within the WUI[49] that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 may occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest).
- For fuel treatment projects within the WUI[49] see guideline VEG G10.
- Veg S2 states, "Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands in an LAU in a ten-year period".

Table 64 shows that this standard is met by alternative 2: none of the LAUs are over 9 percent. Alternative 3, which has less acres of salvage and precommercial thinning would also meet Veg S2.

Veg S5 and Veg S6
A discussion of Veg S5 and Veg S6 for snowshoe hare follows in the next section.

Table 64. Acres of lynx habitat affected – Alternative 2

LAU Number	Acres of Lynx Habitat (NFS Lands)	Acres of Lynx Habitat Proposed Salvage	Acres Seed Tree Harvest	Acres Regen Last 10 Years*	Percent of Habitat VEG S2	Acres Commercial Thin DF	Acres Prescribed Burn	Acres PCT
18	2,930	90	150	5	8%	232	139	209
28	638	0	57	0	9%	86	0	0
30	18491	925	147	477	8%	240	710	813
36	6782	184	0	226	6%	590	749	26

*includes ongoing roadside salvage project

Snowshoe Hare

Veg S5

The snowshoe hare occurs in overstocked stands of lodgepole pine (and other stands with dense vegetative cover) and is an important prey species for many predators, including the Canada lynx. Winter was determined to be a critical time for lynx, and as a result the Northern Rockies Lynx Management Direction includes a standard for precommercial thinning limits to maintain snowshoe hare habitat (Veg S5). The standard reads: "…precommercial thinning projects that reduce snowshoe hare habitat, may occur from the stand initiation stage (harvest) until the stands no longer provide winter snowshoe hare habitat only within…" and then lists exceptions.

Occurrence and distribution of snowshoe hares was not determined in the field, rather the focus was on suitability of stands proposed for precommercial thinning for winter snowshoe hare habitat. Hamann (USDA Forest Service 2011) described methodology and results for assessing suitability of stands proposed for precommercial thinning for winter snowshoe hare habitat in the Fleecer Mountains. To determine whether stands proposed for precommercial thinning still provided winter snowshoe hare habitat, a representative sample of units where harvest varied were sampled in March and September 2010. Data collected in the Fleecer Mountains during the winter included snow depth and distance from snow surface to lowest green branches of overstory trees. This data was gathered in transects within the units, and then also in mature forest outside but adjacent to units. Summer surveys were walk-through surveys to get general information on stand conditions. Results from the Fleecer Project area showed that conifer regeneration in timber stands harvested in the 1980s and 1990s currently provided suitable conditions for snowshoe hare foraging due to lack of self-pruning and green branches accessible given the measured snow depths (table 65). Conifer regeneration in stands harvested prior to the 1980s had self-pruned and green branches (snowshoe hare forage) out of reach and well above snow depth.

Table 65. Results of precommercial thinning review, Fleecer Mountains (USDA Forest Service 2011)

Year of original harvest	Current stand condition
1960s	Average stand height is 30 ft. and average height to lowest green branches ranged from 2 ft. to 12 ft. Fairly high mortality (80% in trees >6" d.b.h., 30% in trees <6" d.b.h.) was noted. The majority of trees in these units have self-pruned and there are few to no green branches that would be available for snowshoe hare in winter.
1970s	Average trees are 4" d.b.h. and 20-22 ft. in height. Trees adjacent to openings have not self-pruned and have green branches that would be available. However, where stand densities are higher (where thinning would occur), they have self-pruned and lowest green branches are approximately 10 ft. up. This is well above snow depth and would not provide winter snowshoe hare habitat.
1980s	Average trees are 2" d.b.h. and 8 -10 ft. in height, with low mortality. Green branches are present at snow surface. Surveys in summer again found that trees had not self-pruned and would be suitable for snowshoe hare winter habitat.
1990s	Suitable winter snowshoe hare habitat.

Based on FS field surveys March and September 2010

For the Flint Foothills Project, proposed precommercial thinning units were reviewed for year of stand initiation. Consistent with methods described for the Fleecer Mountains Project (USDA Forest Service 2011), proposed units where stand growth was initiated after 1979 are expected to be providing suitable snowshoe hare habitat, and were removed from treatment consideration. Advanced growth and self-pruning of lower branches in stands initiated prior to 1980 precludes use by snowshoe hare. However, field reviews conducted in 2012 showed that two proposed units, 36P and 39P that originated from treatment in 1978, contain suitable snowshoe hare habitat.

Veg S6

Veg S6 states, "Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late-successional forests may occur only:

1. Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements, including infrastructure within permitted ski area boundaries; or
2. For research studies or genetic tree tests evaluating genetically improved reforestation stock; or
3. For incidental removal during salvage harvest (e.g. removal due to location of skid trails).

Preliminary review of conditions within proposed treatment units suggested that multi-storied structure providing suitable snowshoe hare habitat exists in four units 27ST, 30ST, 32ST, and 33C proposed for commercial treatment as well as Unit 5B, proposed for prescribed burning.

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect, and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to snowshoe hare habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

Veg S5

Units from the 1980s and 1990s are still providing winter snowshoe hare habitat. Precommercial thinning in these units was dropped from consideration during the initial planning phase of the project. Field reviews conducted in 2012 showed that two proposed units, 36P and 39P, contained suitable snowshoe hare habitat. Therefore, precommercial thinning in units 36P and 39P would remove suitable snowshoe hare habitat. All other precommercial thin units in the action alternatives would meet Veg S5.

Because portions of some units may contain some winter snowshoe hare habitat due to differential tree spacing and density within a given stand, a project design feature has been added to retain full-crowned trees (ones with green branches down to within one foot of the ground) during thinning. This would retain those trees that are providing winter cover and forage for snowshoe hares.

VegS6

Preliminary review of conditions within proposed treatment units suggested that multi-storied structure providing suitable snowshoe hare habitat exists in four units, 27ST, 30ST, 32ST and 33C, proposed for commercial treatment, and also Unit 5B, proposed for prescribed burning. Additional field review in Unit 5B will be required to verify suitability for snowshoe hares. Burn treatments are projected to result in more open stand densities with reductions in understory tree density, thereby removing snowshoe hare habitat if verified as present within Unit 5B.

Summary of Cumulative Effects for Lynx and Snowshoe Hare Habitat

The Northern Rockies Lynx Management Direction Standards and Guidelines Consistency Evaluation Table for Project-Specific Activities provide a means of measuring potential impacts to lynx habitat, including past, present, and ongoing effects in conjunction with activities proposed under this project. Habitat availability and habitat treated indices are within thresholds identified in the Lynx Management Direction for VegS1 and VegS2; therefore, cumulative effects generated by this project in combination with other activities are expected to be minor. Foreseeable projects with the potential to impact lynx habitat would be subject to the lynx management direction standards, and therefore are not expected to contribute cumulative impacts to lynx habitats at the LAU scale.

Migratory Birds

A Memorandum of Understanding (MOU) between the USFS and USFWS was signed in December 2008 (USDA Forest Service and USDI Fish and Wildlife Service 2008). This MOU

meets the requirements of Executive Order 131866, and outlines a collaborative approach to promote the conservation and reduce the take of migratory birds. The purpose of the MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds. Within the National Forests, conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple scales and ensuring that bird conservation is addressed when planning for land management activities.

Forest Service responsibilities relative to project-level planning outlined in the MOU are as follows:

> Within the NEPA process, evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitat and key risk factors. To the extent practical: evaluate and balance long-term benefits of projects against any short-term or long-term adverse effects; pursue opportunities to restore or enhance the composition, structure, and juxtaposition of migratory bird habitats in the project area; consider approaches for identifying and minimizing incidental take (altering season of activities; retaining snags where underrepresented; retaining integrity of known breeding sites); and coordinate with FWS when a project is likely to have a negative effect on migratory bird populations.

Birds of conservation concern have been identified by the USFWS (2008). Their report identifies criteria for selection, as well as their rationale for selection of Bird Conservation Regions (BCRs) as the smallest geographic scale. The project area lies in BCR 10. The birds of conservation concern for BCR 10 are shown in table 66.

Three of these species have already been addressed as sensitive species (bald eagle, peregrine falcon and flammulated owl). Of the remaining species, Swainson's hawk, calliope hummingbird, Williamson's sapsucker, olive-sided flycatcher, willow flycatcher, black rosy finch, and Cassin's finch may be found in the analysis area, based on known distribution and habitats present in the analysis area (table 67).

Table 66. Birds of conservation concern

Species	Habitat or Structural Component	Species or Habitat Likely Present in Project Area	Forest Service Sensitive Yes/No
Bald eagle	River or lake habitat	Not likely. Addressed as sensitive species	Yes
Swainson's hawk	Shrubsteppe, prairies, open woodlands	Yes, R1 landbird detection 2004.	No
Ferruginous hawk	Dry open country including native prairie, but also shrubsteppe, plains	Not likely in project area due to habitat used.	No
Peregrine falcon	Nests on cliffs	No detections on NFS lands. No MNHP point detections.	Yes
Upland sandpiper	Prairie grasslands, but also wet and dry meadows, hayfields	Not likely. No MNHP point detections.	No
Long-billed curlew	Shortgrass and grazed mixed-grass prairies	Not likely in project area due to habitat used.	No

Species	Habitat or Structural Component	Species or Habitat Likely Present in Project Area	Forest Service Sensitive Yes/No
Yellow-billed cuckoo	Found west of Continental Divide; uses cottonwood willow riparian bottoms	Not likely No MNHP point detections.	No
Flammulated owl	Mature ponderosa pine but also PP/Douglas-fir	Yes, addressed as sensitive species	Yes
Black swift	Steep cliffs, canyons, nest on rock behind waterfalls	Not likely. No MNHP point detections.	No
Calliope hummingbird	Montane shrubland, meadows, burned areas	Potential. No MNHP point detections.	No
Lewis' woodpecker	Open forest and woodland, primarily PP as well as riparian cottonwood	Not likely in project area based on habitat used.	No
Williamson's sapsucker	Montane conifer forest as well as aspen woodland	Yes. R1 landbird survey detections in 2002 and 2004.	No
White-headed woodpecker	Open coniferous and deciduous forest	Not likely. No MNHP point detections.	No
Olive-sided flycatcher	Montane conifer forest, especially burned areas with snags	Yes, R1 landbird survey detections in 1995, 1998, 2002.	No
Willow flycatcher	Dense willow thickets; low, dense, riparian woodland	Yes, habitat likely. R1 landbird survey detections in 2000.	No
Loggerhead shrike	Open areas	Not likely. No MNHP point detections.	No
Sage thrasher	Lower elevation shrubsteppe, sagebrush communities	Not likely. No MNHP point detections.	No
Brewer's sparrow	Shrubsteppe, shortgrass prairie with scattered shrubs	Not likely. No MNHP point detections.	No
Sage sparrow	Shrubsteppe, especially sagebrush dominated	Not likely. No MNHP point detections.	No
McCown's longspur	Shortgrass prairie, heavily grazed mixed-grass prairie	Not likely. No MNHP point detections.	No
Black rosy finch	Alpine tundra in summer, lower on mountain slopes in winter	Possible., In alpine habitats, southern portion of project area	No
Cassin's finch	Open stands of drier montane coniferous forests and woodlands	Yes, R1 landbird survey detections in 1994, 2002	No

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect, and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to migratory birds or habitat from the Flint Foothills Vegetation Management Project because no project activities are proposed.

Alternatives 2 and 3

Direct and Indirect Effects

This proposal would result in changes to stand structure and species composition through salvage, thinning, prescribed burning, and precommercial thinning. This also includes disturbance effects due to increased traffic, human activity, and equipment use during project activities. Species that may be in the project area were carried forward from table 66 and are shown in the following table 67 along with how project activities would affect habitat components.

Table 67. Birds of conservation concern that may be in the project area, and effects to habitat or components from project activities

Species	Project Activities That Could Affect Habitat	How This Project Affects Habitat and Components
Swainson's hawk	No treatments proposed in suitable habitats.	No effect to suitable habitats.
Calliope hummingbird	No treatments proposed in suitable habitats.	No effect to suitable habitats.
Williamson's sapsucker	LPP salvage, DF/PP commercial	Retention of large diameter trees and snags for nesting. Salvage of dead lodgepole pine may affect habitat availability within treatment units by removing snags up to 20 inches d.b.h. Snag retention within treatment units according to Forest Plan standards, as well as snags available in untreated areas are expected to contribute to suitable habitat.
Olive-sided flycatcher	LPP salvage, DF/PP commercial; Prescribed burn	Snags available across project area, All treatments retain all trees (live and dead) greater than 20" d.b.h. Treatments that remove snags greater than 15 inches d.b.h. may affect habitat availability within treatment units. Snag retention within treatment units according to Forest Plan standards, as well as snags available in untreated areas are expected to contribute to suitable habitat. Treatments increase openings/edge habitat.
Willow flycatcher	No treatments proposed in suitable habitats.	No effect to suitable habitats.
Black rosy finch	No treatments proposed in suitable habitats.	No effect to suitable habitats.
Cassin's finch	DF/PP commercial; Prescribed burn	Treatments in Douglas-fir would maintain open stand structure in dry conifer nesting and foraging habitats.

Several factors influence the richness and diversity of bird species in a stand, including the structure and composition of living and dead vegetation. In western dry coniferous forests, bird community composition depends on the heterogeneity of habitats available, proximity to water, fire history and silvicultural legacy (Pilliod et al. 2006). The species most likely to be affected by vegetation treatments are those with nesting and foraging habitats associated with the vegetation being affected, and species that either prefer or avoid disturbed areas. There is the potential for short-term direct effects to some individuals during breeding season, depending on timing of harvest or treatment.

Hejl et al. (1995) reviewed species abundance following silvicultural treatments. Each species responded uniquely to the harvesting treatments. Of the forest-associated species listed above that they considered, calliope hummingbirds showed a positive response to partial cuts (no data on clearcuts); olive-sided flycatchers showed a positive response to low-shrub and tall-shrub clearcuts and partial cuts (no data on pole-sapling clearcuts); and Cassin's finch showed no change in low-shrub clearcuts, a decrease in tall-shrub clearcuts and positive responses in pole-sapling clearcuts and partial cuts.

Openings created by lodgepole pine salvage and stand density reductions in Douglas-fir/ponderosa pine thinning units, and seed tree harvest are expected to improve habitats for olive-sided flycatchers. Large conifer and snag retention in thinning units would retain suitable nest sites for Williamson's sapsuckers. In addition, aspen improvements associated with Douglas-fir thinning and seed tree harvest would increase future nesting opportunities in aspen for this species. Stand density reductions generated by thinning, seed tree harvest, and prescribed burning in Douglas-fir and ponderosa pine stands would increase suitable habitats for Cassin's finch.

Cumulative Effects

The cumulative effects analysis area for migratory birds is the project area. Past activities such as timber harvest, road construction, livestock grazing, mining, and wildfire suppression have contributed to the existing condition. Present and foreseeable activities that may impact migratory birds consist of roadside salvage and woodcutting. Because acreage affected by both activities is minor at the project scale, cumulative effects resulting from ongoing and foreseeable activities in combination with activities from alternatives 2 and 3 are not expected to impact migratory bird populations.

Summary of Effects

Forest Plan vegetation management direction is designed to restore, maintain and retain a range of landscape conditions under which species evolved. See table 27 for the percentage of habitats that would be affected on BDNF lands. Potential impacts of activities would be minimized by adherence to Forest Plan standards for habitat components including snags, large woody debris and buffers from mechanized equipment in riparian areas. Overall, both action alternatives would maintain or improve habitats for these species and would not negatively impact migratory landbird populations or their habitats.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The Plan includes a standard that states "…the Northern Region Lynx Management Direction (2007) is included in Appendix G and will apply to the BDNF as described in the Northern Rockies Lynx Management Direction". Direction on occupied and unoccupied lynx habitat was

provided in a letter from the Regional Forester in 2009. This letter directs unoccupied forests to consider lynx management direction using the Northern Rockies Lynx Management Direction Standards and Guidelines Consistency Evaluation Table for Project Specific Activities. This has been done and is found in Attachment A to the Wildlife Report and in the preceding analysis. There are four vegetation standards that apply directly to this project (Veg S1, Veg S2, Veg S5 and VegS6). As discussed in this analysis, alternatives 2 and 3 would both meet Veg S1 and Veg S2. However, implementation of the project would be inconsistent with Northern Region direction pertaining to standard Veg S5 due to proposed precommercial thinning in units 36P and 39P. The project may also be inconsistent with standard Veg S6 if pending verification of suitable snowshoe hare habitat is verified within treatment units.

Soil Resources

Introduction

This section describes the geology, landforms, and soil present in the Flint Foothills Project area, and analyzes the impact to the soil resource from implementation of the proposed actions. The main issues concerning the soil resource include existing soil disturbance from previous activities within the project area, and the potential direct, indirect, and cumulative effects of the commercial timber harvest and prescribed burn components of the proposed action to the soil resource.

The precommercial thin component of the proposed action is not discussed in detail because no effects to the soil resource are expected. All work would be done by hand (i.e., hand felling of trees and hand piling); no mechanical treatments would occur.

Overview of Issues Addressed

Issues associated with soil productivity and quality include evaluation of existing detrimental soil disturbances from past and present activities, as well as potential effects to the soil resource from new disturbances related to implementation of proposed commercial harvest and prescribed burning activities. Potential soil productivity effects from the commercial timber harvest component of the proposed action are soil erosion, compaction, rutting, and displacement from machinery during felling, bunching, yarding, loading logs and temporary road construction, as well as soil heating from slash burning, and reduction in site nutrient capital due to the removal of woody material from the site. Potential soil productivity effects from the prescribed burning component of the proposed action are soil heating and potential accelerated erosion as a result of loss of surface cover due to burning.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

As defined by the Region 1 Soil Quality Standards (1999), detrimental soil disturbance (DSD) includes the effects of compaction, rutting, displacement, severe burning, surface erosion, loss of surface organic matter, and soil mass movement. At least 85 percent of an activity area must have soil that is in satisfactory condition. An activity area is defined as: “A land area affected by a management activity to which soil quality standards are applied. Activity areas must be feasible to monitor and include harvest units within timber sale areas, prescribed burn areas, grazing areas or pastures within range allotments, riparian areas, recreation areas, and alpine

areas. All temporary roads, skid trails and landings are considered part of an activity area" (USDA Forest Service 1999).

Detrimental soil conditions include:

- **Compaction:** Detrimental compaction is a 15 percent increase in natural bulk density. The cumulative effects of multiple site entries on compaction should also be considered since compacted soils often recover slowly.
- **Rutting:** Wheel ruts at least 2 inches deep in wet soils are detrimental.

  Displacement: Detrimental displacement is the removal of 1 or more inches (depth) of any surface horizon, usually the A horizon, from a continuous area greater than 100 square feet.
- **Severely-burned soils:** Physical and biological changes to soil resulting from high intensity burns of long duration are detrimental. This standard is used when evaluating prescribed fire. Guidelines for assessing fire intensity are contained in the Burned-Area Emergency Rehabilitation Handbook FSH 2509.13 (USDA Forest Service 1995).
- **Surface Erosion:** Rills, gullies, pedestals, and soil deposition are all indicators of detrimental surface erosion. Minimum amounts of ground cover necessary to keep soil loss to within tolerable limits (generally less than 1 to 2 tons per acre per year) should be established locally depending on site characteristics.
- **Soil Mass Movement:** Any soil mass movement caused by management activities is detrimental.

The R1 SQS refers to the Burned-Area Emergency Rehabilitation Handbook FSH 2509.13 (USDA Forest Service 1995) for assessing fire intensity. However, more currently, fire effects to the soil are defined in terms of soil burn severity in order to differentiate between post-fire soil properties from fire effects on vegetation (Parsons et al. 2010). This distinction is important as fire intensity and soil burn severity do not necessarily correlate directly. High soil burn severity would be considered detrimental soil disturbance. The following definitions from Parsons et al. 2010 will be used in the effects analysis.

- **Soil burn severity:** The effect of a fire on ground surface characteristics, including char, depth, organic matter loss, altered color and structure, and reduced infiltration (Lentile and others 2006; Debano and others 1998; Ryan and Noste 1985). The classification of post-fire soil condition is based on fire-induced changes in physical and biological soil properties.
- **Low soil burn severity:** Surface organic layers are not completely consumed and are still recognizable. Structural aggregate stability is not changed from its unburned condition, and roots are generally unchanged because the heat pulse below the soil surface was not great enough to consume or char any underlying organics. The ground surface, including any exposed mineral soil, may appear brown or black (lightly charred), and the canopy and understory vegetation will likely appear "green."
- **Moderate soil burn severity:** Up to 80 percent of the pre-fire ground cover (litter and ground fuels) may be consumed but generally not all of it. Fine roots (~0.1 inch or 0.25 cm diameter) may be scorched but are rarely completely consumed over much of the area. The color of the ash on the surface is generally blackened with possible gray patches. There may be potential for recruitment of effective ground cover from scorched needles or leaves remaining in the canopy that will soon fall to the ground. The prevailing color of the site is often "brown" due to canopy needle and other vegetation scorch. Soil structure is generally unchanged.

- **High soil burn severity:** All or nearly all of the pre-fire ground cover and surface organic matter (litter, duff, and fine roots) is generally consumed, and charring may be visible on larger roots. The prevailing color of the site is often "black" due to extensive charring. Bare soil or ash is exposed and susceptible to erosion, and aggregate structure may be less stable. White or gray ash (up to several centimeters in depth) indicates that considerable ground cover or fuels were consumed. Sometimes very large tree roots (>3 inches or 8 cm diameter) are entirely burned extending from a charred stump hole. Soil is often gray, orange, or reddish at the ground surface where large fuels were concentrated and consumed.

Existing and Predicted Soil Disturbance

Soil disturbance is an indicator of departure from natural conditions and may negatively affect soil productivity when detrimental. Soil productivity is defined as "the inherent capacity of the soil resource to support appropriate site-specific biological resource management objectives, which includes the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses" (USDA Forest Service 2010). The Region 1 Soil Quality Standards (USDA Forest Service 1999) defines the degree and aerial extent of soil disturbance to maintain soil productivity, thus meeting the intent of NFMA. The Forest Soil Disturbance Monitoring Protocol (FSDMP) was used to assess existing, management-caused soil disturbance in the proposed harvest units (USDA Forest Service, 2009b). Existing soil disturbance is displayed as a percentage of each proposed harvest unit.

Soil disturbance resulting from implementation of the proposed action was predicted for each proposed harvest unit using assumptions based on local monitoring data, literature, and risk ratings from the landtype inventory soil map. Predicted soil disturbance is displayed as a percentage of each proposed harvest unit.

Coarse Woody Debris

Coarse woody debris (CWD) is one soil quality indicator which influences soil hydrology, biology, nutrient cycling, and soil stability and support functions which are indicators of soil productivity (USDA Forest Service 2010). The removal of woody material from the site is common due to whole tree harvesting practices. The R1 supplement to FSM 2550 recommends following the guidelines set forth in Graham et al. 1994 in determining the amount of coarse woody debris to be left onsite. Coarse woody debris is defined as pieces 3 inches or greater in diameter. Baseline coarse woody debris measurements (in tons/acre) were taken in the proposed harvest units to address coarse woody debris recommendations.

Affected Environment

Existing Condition

Soils, Landforms, and Geology

Soil development is affected by climate, parent material, topography, living organisms, and the amount of time the soil has developed. Local climate near the project area in Deer Lodge, MT is cold and relatively dry, with an annual average maximum temperature of 55.6 degrees, an annual average minimum temperature of 26.0 degrees, and an annual average of 10.78 inches of precipitation (Western Regional Climate Center, accessed 1/23/12). In general, the combination of a cold, moderately dry climate, and a relatively short time for development have resulted in somewhat moderately developed soils. The majority of the soils in the proposed

harvest units have formed in undifferentiated parent material (mostly consisting of calcareous and noncalcareous sedimentary and metasedimentary materials) on mountain slopes and moraines. The most common soil type found within the commercial harvest units is Loamy-skeletal, mixed, superactive Typic Eutropcryepts.

Table 1 in the Soils Report in the project file displays the landtypes, geology, landforms and dominant soils types found in the commercial timber harvest units.

No commercial harvest units, precommercial thin units, or prescribed burn units fall within landtypes with a major wet soil component (USDA Forest Service 2007a). Eight landtypes list wet soils as a minor component comprising 15 percent or less of the map. These map units have limited areas of wet soils and the casual observer would not be aware that wet soils were a component of the landtype. Furthermore, the vegetative components associated with the minor wet components (subalpine-fir/bluejoint and meadows) do not correspond to the vegetation where treatments will occur.

Landtype Inventory Soil Map and Interpretations

The landtype inventory soil map is an appropriate scale to display soil interpretations for management. Soil survey data are interpreted to estimate the risk that management activities will affect soils. These risk estimates, or risk ratings, are called soil interpretations (USDA Forest Service 2007a, USDA Forest Service 2011a).

Soil Hazard Ratings: Erosion, Rutting, Compaction, and Mass Movement

Soils were rated for their susceptibility to erosion, rutting, compaction, and mass movement (USDA Forest Service 2007a, USDA Forest Service 2011a). These ratings, or interpretations, for the landtype inventory are qualitative ratings based on field observations of past activities, the inherent characteristics of each landtype (such as texture or rock content), and assumptions about the general modifications that would occur in the landtype as a result of management activities. Field observations of soil impacts on various landtypes formed the core of data used to develop the interpretive ratings. The landtypes with the field observations were rated first. The remaining landtypes were rated relative to those with field observations. Landtype characteristics were used as criteria for comparison and evaluation in the rating process.

The landtype inventory soil map was used to determine risk ratings for each commercial timber harvest unit associated with the proposed action for both alternative 2 and alternative 3 (table 68). Many of the proposed commercial timber harvest units contain more than one landtype, often resulting in multiple risk ratings for one unit. Each unique risk rating representing at least 0.50 acre is displayed. Risk ratings are defined in appendix A of the Soils report in the project file.

Table 68. Risk rating for erosion, rutting, compaction, and mass movement by unit

Soils Risk Ratings for the Flint Foothills Project Area				
Unit	**Erosion Hazard**	**Rutting Hazard**	**Compaction Hazard**	**Mass Movement Hazard**
1ST	High-Moderate	Slight	Slight	Slight
1ST	High-Moderate	Slight	Moderate	Slight
1ST	High	Slight	Moderate	Slight
5ST	High-Moderate	Slight	Moderate	Slight
5ST	High-Moderate	Slight	Slight	Slight
6C	Slight-Moderate	Slight	Slight	Slight
6C	Moderate	Slight	Slight	Slight
6C	High	Slight	Slight	Slight
8C	Moderate	Slight	Slight	Slight
8C	High-Moderate	Slight	Slight	Slight
10C	Slight-Moderate	Slight	Slight	Slight
11C	Slight-Moderate	Slight	Slight	Slight
12C	Moderate	Slight	Slight	Slight
12C	High-Moderate	Slight	Slight	Slight
16S	Slight-Moderate	Slight	Slight	Slight
19S	High-Moderate	Slight	Slight	Slight
20C	Slight-Moderate	Slight	Slight	Slight
20C	Moderate	Slight	Slight	Slight
20C	High-Moderate	Slight	Slight	Slight
20C	High	Slight	Slight	Slight
20C	High	Slight	Moderate	Slight
22C	High-Moderate	Slight	Slight	Slight
23C	Moderate	Slight	Slight	Slight
23C	High-Moderate	Slight	Slight	Slight
23C	High	Slight	Slight	Slight
24C	Moderate	Slight	Slight	Slight
24C	High-Moderate	slight	Slight	Slight
25C	High-Moderate	Slight	Slight	Slight
25C	High-Moderate	Slight	Moderate	Slight
25C	High	Slight	Moderate	Slight
26S	High-Moderate	Slight	Slight	Slight
27ST	Slight-Moderate	Slight	Slight	Slight
27ST	Moderate	Moderate	Moderate	High
27ST	Moderate	Slight	Slight	Slight
27ST	Moderate	Slight	Moderate	Slight
28C	High-Moderate	Slight	Slight	Slight

Soils Risk Ratings for the Flint Foothills Project Area				
Unit	**Erosion Hazard**	**Rutting Hazard**	**Compaction Hazard**	**Mass Movement Hazard**
29C	High-Moderate	Slight	Slight	Slight
30ST	High-Moderate	Slight	Slight	Slight
31C	High-Moderate	Slight	Slight	Slight
32ST	High-Moderate	Slight	Slight	Slight
33C	High-Moderate	Slight	Slight	Slight
34S	Slight-Moderate	Slight	Slight	Slight
35S	Slight-Moderate	Slight	Slight	Slight
36S[a]	Slight-Moderate	Slight	Slight	Slight
36S[a]	Moderate	Slight	Slight	Slight
37S	Slight-Moderate	Slight	Slight	Slight
37S	Moderate	Moderate	Moderate	High
39S	Slight-Moderate	Slight	Slight	Slight
40S	Slight-Moderate	Slight	Slight	Slight
40S	Moderate	Slight	Slight	Slight
41S	Slight-Moderate	Slight	Slight	Slight
42C	Slight-Moderate	Slight	Slight	Slight
43S	Slight-Moderate	Slight	Slight	Slight
43S	High-Moderate	Slight	Slight	Slight
44S	Slight-Moderate	Slight	Slight	Slight
44S	Moderate	Slight	Slight	Slight
45S	Slight-Moderate	Slight	Slight	Slight
45S	Slight-Moderate	Moderate	Moderate	Slight
46S	Slight-Moderate	Slight	Slight	Slight
46S	Moderate	Slight	Slight	Slight
46S	High-Moderate	Slight	Slight	Slight
47S[a]	Moderate	Slight	Slight	Slight
48C[a]	Moderate	Slight	Slight	Slight
48C[a]	High-Moderate	Slight	Slight	Slight
49S	Slight-Moderate	Slight	Slight	Slight
50S	Slight-Moderate	Slight	Slight	Slight
50S	Moderate	Slight	Slight	Slight
51S	Slight-Moderate	Slight	Slight	Slight
51S	High-Moderate	Slight	Slight	Slight
52S	Moderate	Slight	Slight	Slight
52S	Slight-Moderate	Slight	Slight	Slight
52S	High-Moderate	Slight	Slight	Slight
55C	High-Moderate	Slight	Moderate	Slight

Soils Risk Ratings for the Flint Foothills Project Area				
Unit	**Erosion Hazard**	**Rutting Hazard**	**Compaction Hazard**	**Mass Movement Hazard**
55C	High	Slight	Moderate	Slight
56C[a]	Moderate	Slight	Slight	Slight
57C[a]	Moderate	Slight	Slight	Slight
57C[a]	High	Slight	Slight	Slight
58S	Slight-Moderate	Slight	Slight	Slight
58S	Moderate	Slight	Slight	Slight
59C	High	Slight	Moderate	Slight
60C	High-Moderate	Slight	Slight	Slight
61S	Slight-Moderate	Slight	Slight	Slight
61S	Moderate	Slight	Slight	Slight
61S	High-Moderate	Slight	Slight	Slight
62S	Slight-Moderate	Slight	Slight	Slight
62S	High-Moderate	Slight	Slight	Slight
64C	Slight-Moderate	Slight	Slight	Slight
64C	High-Moderate	Slight	Slight	Slight
65C	Slight-Moderate	Slight	Slight	Slight
65ST	Slight-Moderate	Slight	Slight	Slight
65ST	Moderate	Moderate	Moderate	High
66C	Slight-Moderate	Slight	Slight	Slight
67C	Moderate	slight	Slight	Slight
68C[a]	High-Moderate	Slight	Slight	Slight
69S	Slight-Moderate	Slight	Slight	Slight
71C[a]	Moderate	slight	Slight	Slight
71C[a]	High-Moderate	Slight	Slight	Slight
72S[a]	High-Moderate	Slight	Slight	Slight
73S	High	Slight	Moderate	Slight
73S	High-Moderate	Slight	Slight	Slight
74S	High-Moderate	Slight	Moderate	Slight
74S	Slight-Moderate	Slight	Slight	Slight
74S	High-Moderate	Slight	Slight	Slight
76S	High-Moderate	Slight	Slight	Slight
77S[a]	Moderate	Slight	Slight	Slight
78S[a]	Moderate	Slight	Slight	Slight
78S[a]	High-Moderate	Slight	Slight	Slight
79S	Slight-Moderate	Slight	Slight	Slight
80C	Slight-Moderate	Slight	Slight	Slight
80C	High-Moderate	Slight	Slight	Slight

Soils Risk Ratings for the Flint Foothills Project Area				
Unit	**Erosion Hazard**	**Rutting Hazard**	**Compaction Hazard**	**Mass Movement Hazard**
81C	Slight-Moderate	Slight	Slight	Slight
81C	High-Moderate	Slight	Slight	Slight

[a] Units only pertain to alternative 2.

Existing Soil Disturbance

Detrimental soil disturbance in the form of compaction, rutting, or displacement exists in 5 units out of 65 in alternative 2 and 3 combined (table 69). Field data for five units was not collected, therefore, the DSD is assumed to be zero until the data is in. Soil disturbance was noted as compaction, rutting, and displacement. The disturbance was caused by former harvest as well as livestock.

Table 69. Percent existing detrimental soil disturbance by commercial harvest unit

Commercial Harvest Unit	Percent Compaction	Percent Rutting	Percent Displacement	Percent Total DSD
25C	3.3	0.0	0.0	3.3
27ST[a]	0.0	0.0	0.0	0.0
28C[a]	0.0	0.0	0.0	0.0
31C[a]	0.0	0.0	0.0	0.0
32ST	8.7	0.0	0.0	8.7
40S	6.7	0.0	0.0	6.7
64C	0.0	0.0	3.3	3.3
65ST	0.0	3.3	0.0	3.3
68C[ab]	0.0	0.0	0.0	0.0
74S[a]	0.0	0.0	0.0	0.0

[a]No field data available for unit. DSD assumed to be zero until field data collected. [b]Units only pertain to alternative 2.

Coarse Woody Debris

Baseline coarse woody debris measurements (in tons/acre) were collected in each proposed harvest unit to address coarse woody debris recommendations in the R1 supplement to FSM 2550 (Graham et al. 1994; Brown 1974). Coarse woody debris measurements within the proposed harvest units ranged from 1 to 17 tons/acre, with an average of 6 tons/acre (table 70).

Table 70. Existing coarse woody debris (ton/ac) by commercial harvest unit

Unit	Coarse Woody Debris (ton/ac)	Unit	Coarse Woody Debris (ton/ac)	Unit	Coarse Woody Debris (ton/ac)
1ST	2	35S	6	59C	1
5ST	4	36S[a]	15	60C	3
6C	1	37S	6	61S	3
8C	4	39S	3	62S	5

Unit	Coarse Woody Debris (ton/ac)	Unit	Coarse Woody Debris (ton/ac)	Unit	Coarse Woody Debris (ton/ac)
10C	3	40S	10	64C	3
11C	4	41S	7	65ST	5
12C	5	42C	3	65C	17
16S	11	43S	1	67C	5
19S	8	44S	7	69S	7
20C	2	45S	9	71C	6
22C	4	46S	8	72S[a]	4
23C	5	47S[a]	6	73S	3
24C	2	48C[a]	6	76S	4
25C	1	49S	6	77S[a]	6
26S	3	50S	1	78S[a]	6
29C	2	51S	16	79S	17
30ST	3	56C[a]	5	80C	7
32ST	5	57C[a]	14	81C	1
34S	4	58S	5		

[a] Units only pertain to alternative 2

Desired Condition

The desired condition for the soil resource is the maintenance of soil productivity. Under NFMA, the Forest Service may harvest timber from national forests only where "soil, slope, or other watershed conditions will not be irreversibly damaged." 16 U.S.C. § 1604(g)(3)(E)(i).

The Beaverhead-Deerlodge Forest Plan states that ground based yarding shall not be allowed on slopes exceeding 35 percent without site-specific environmental analysis that shows damage is unlikely and soil goals and objectives can be met (USDA Forest Service 2009c). The plan also states that the most current Region 1 Soil Quality Standards (SQS) are adopted as Forest Plan soil standards.

Region 1 SQS address NFMA by requiring that new activities do not create detrimental soil conditions on more than 15 percent of an activity area following project implementation and restoration activities (USDA Forest Service 1999). Restoration is defined as treatments that restore vital soil functions to their inherent range of variability. Restoration treatments could include, but are not limited to, tillage, ripping, subsoiling, seeding, mulching, recontouring of temporary roads, and water barring. Activity areas are defined as the proposed harvest units, including landings, skid trails, and temporary road construction, and the proposed prescribed burning units. As defined by the Region 1 Soil Quality Standards, detrimental soil disturbance includes the effects of compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement.

According to the R1 supplement to FSM 2550, coarse woody debris objectives should follow research guidelines such as those contained in Graham et al. 1994. Leaving 7-25 tons/acre of pieces with a diameter of 3 inches or greater meets recommendations set forth in Graham et al. for habitat types present in the project area. For practical purposes, a range of 7-12 tons/acre should be left in each unit (project design features and mitigation measures, chapter 2).

Environmental Consequences

Methodology

Existing Detrimental Soil Disturbance

Existing detrimental soil disturbance (DSD) was determined by Forest Service soil scientists with onsite visits to timber harvest units occurring August 2010 and August through October 2011. The Forest Soil Disturbance Monitoring Protocol (FSDMP) was used to assess existing, management-caused soil disturbance in the proposed harvest units (USDA Forest Service, 2009b). The FSDMP is applied to areas disturbed by management activities, and is a presence/absence (1 = present, 0 = absent) method of collecting visual attribute data in order to assess soil disturbance. Attributes evaluated include forest floor impacts, surface soil displacement, mixed surface soil/subsoil, rutting, burning (only management prescribed burning is assessed), compaction, and platy or massive structure.

If previous management activities or disturbance were evident, 30 sample plots were spaced across the unit to obtain an estimate of the amount and extent of soil disturbance. A sample plot consisted of a 6-inch diameter circular area. Determinations of detrimental soil disturbance were based on the Region 1 Soil Quality Standards (USDA Forest Service 1999). If no evidence of past management or disturbance was present, then a walk-through of the unit was conducted and documented.

Coarse Woody Debris

Baseline coarse woody debris measurements (in tons/acre) were taken in most of the proposed harvest units following Brown 1974. Random azimuth transects were run at plots 5, 10, 15, 20, and 25 for those units with 30 sample plots. Five random azimuth transects spaced throughout the unit were run in walk-through units.

Predicted Detrimental Soil Disturbance

To predict the amount of detrimental soil disturbance (DSD) associated with the proposed action, the following assumptions were made:

- Projected DSD associated with the proposed action is assumed to be 10 percent for each activity area (commercial harvest unit) harvested under dry conditions in the summer. This assumption is based on local data, which shows that DSD is typically less than 10 percent in the summer (USDA Forest Service 2004; USDA Forest Service 2008; USDA Forest Service 2009a; USDA Forest Service 2009d). The estimate above includes landings, skid trails, and temporary road construction associated with the activity areas. Detrimental soil disturbance associated with burning slash piles is also included with these figures since landings were included in the post-implementation monitoring. Projected DSD associated with broadcast burning in the commercial thin and seed trees units is assumed to be 0 percent. This assumption is based on local data which has shown low soil burn severity (not detrimental) is typical of broadcast and concentration prescribed burning (Fletcher 2011b).
- In addition to the baseline 10 percent (summer harvest) assumed for each activity area, DSD due to temporary road construction associated with each harvest unit was calculated. Acres of disturbance were calculated by multiplying a width of 14 feet by the length of proposed road. This may result in an overestimation of DSD, but aids in displaying the effects of temporary road construction needed for some of the harvest units. All temporary road construction is considered DSD. Existing roads that would be maintained or

reconstructed are not counted towards DSD, since they are already removed from the productive soil base. Existing unauthorized routes to be used as haul roads that would not be added as System roads are counted towards DSD. Newly constructed temporary roads would be obliterated, and hence restored to some degree (assuming 50 percent effectiveness—see Effectiveness to Restore DSD that follows) after harvest is completed. Existing unauthorized routes would be decommissioned by use of signs and berms; therefore 0 percent of these temporary roads would be restored after harvest is completed.

- Net DSD reflects cumulative DSD as a result of project implementation. Net DSD is predicted by adding existing DSD, projected DSD, and DSD associated with haul routes on nonsystem roads (includes temporary roads), and then crediting the restoration (50 percent) of haul routes. It is important to note that these figures are likely an overestimation of cumulative DSD at the end of project implementation. In units with existing skid trails and landings, DSD is essentially double-counted. The existing skid trails and landings are likely to be reused rather than disturbing new areas; however, the existing disturbances are counted under existing DSD and projected DSD.
- Projected DSD associated with the proposed action is assumed to be 0 percent for each prescribed burn unit. This assumption is based on local data, which shows low soil burn severity (not detrimental) is typical of broadcast and concentration prescribed burning (Fletcher 2011b).

Soils Restoration Plan

- For all units with newly constructed temporary roads (12C, 20C, 27ST, 34S, 35S, 41S, 42C, 46S, 48C, 49S, 51S, 52S, 55C, 56C, 57C, 61S, 68C, 71C, 72S, 73S, 77S,78S,79S) all temporary roads (new construction) would be ripped or subsoiled, seeded with native seed, and blocked at the entrance. Roads would be recontoured where needed.
- For three units (32ST, 40S, and 41S) additional restoration may be required to comply with the regional soil quality standards. In these units existing and/or new skid trails would be subsoiled to reduce compaction. Restoration activities would focus on skid trails and landings and would occur on suitable acres, excluding areas that are too rocky, wet, or have other limiting factors. Restoration would be implemented on the number of acres needed to meet soil quality standards; actual acres restored may be higher or lower than what is shown (table 72). Treatments would occur within 3 years of completion of harvest.
- Actual acres to be restored would be determined by post-harvest monitoring to determine the actual percent detrimental soil disturbance from which actual acres to be restored can be calculated. These units would need to be monitored to ensure that SQS are met within 3 years of the conclusion of the project.

Predicted Soil Erosion Using Disturbed WEPP

The Disturbed WEPP model (Elliot and Hall 2010) was run to generate predicted erosion rates for the existing condition and following implementation of the proposed harvest. The following assumptions were made:

- Units with the greatest erosion hazard (high) were used to represent the worst case scenario for the proposed actions (table 68); only these units were modeled.
- The Deerlodge, MT local climate was modified to reflect elevation within the project area. All runs were based on 50 years of climate.
- Proposed commercial harvest units were assigned a vegetation/treatment category of thin or young forest, which reflects an area that has been harvested (Elliott et al. 2000).

- Eighty-five percent ground cover was assumed for harvest units to reflect no more than 15 percent DSD in each unit modeled (ground cover is likely disturbed or removed if the soil is detrimentally disturbed).

Design Feature and Mitigation Measure

Effectiveness of Preventing Detrimental Soil Disturbance

Monitoring conducted on previous vegetation management projects has proven soil and water conservation practices (SWCPs) to be effective in controlling the amount of DSD in activity areas. For example, the FY 2004 Monitoring Report (USDA Forest Service 2004) documents monitoring of BMP effectiveness on the West Face Timber Sale (p.30). Harvesting began on the West Face Timber Sale in winter 2001. The project area is in the Pioneer Mountains and soils are generally derived from the Pioneer Batholith, which is broadly quartz-monzonite composition. Quantitative monitoring of the West Face Sale showed that "detrimental disturbance was estimated at less than 10 percent overall" (FY 2004 Monitoring Report, p.30). The report attributes reductions in DSD found in recent projects, compared to 'historic' timber projects, to logging in the driest times of the summer and over snow, excluding harvest during the wetter spring months. Logging when the soil is dry or frozen is listed above in "Design Features and Mitigation Measures" for the proposed action, and is captured under SWCP 13.06.

The FY 2004 Monitoring Report also included monitoring in the Joe/Fox Sale (p. 93). Soils in the Joe/Fox sale are more uniformly susceptible to compaction than the soils found in the Flint Foothills project area, because they have surface layers of volcanic ash mixed in where soils in the Flint Foothills project area do not. Soils in the Joe/Fox sale also had a soil water content of 18 to 20 percent on the date sampled, moisture levels which increase susceptibility to compaction. Monitoring results demonstrated that 15 passes of normal machinery on moist soil caused a 6.2 percent and 9.4 percent increase in surface and subsurface bulk density, respectively. These values are considerably lower than the 15 percent threshold for detrimental compaction (USDA Forest Service 1999). The percentage change is expected to be even less on frozen or drier soils. Allowing soils to dry before using heavy equipment, (Soil Resources project design features and mitigation measures chapter 2) has been shown to be effective in minimizing soil compaction both locally as described above, and in the literature as well (Han et al. 2006). Designating skid trails (SWCP 14.08) has been shown to reduce soil compaction to 10 percent or less of an activity area from 25-30 percent of an area if skid trails are not designated (Adams and Froehlich, 1981). Monitoring of the Butte South Salvage Sale demonstrated the effectiveness of designating skid trails, allowing soils to dry prior to harvest activities, and placing slash on skid trails (USDA Forest Service 2007b). Ground cover in the units ranged from 87-93 percent after slash was placed on skid trails.

Burning slash piles when the soil is frozen or moist has been shown to protect the soil. Two landings in the West Face Timber Sale were monitored for detrimental burning. The piles were moist and were burned in the fall with frozen soil and 6 inches of snow. No severely burned soils were noted and vegetation is already returning (USDA Forest Service 2006, p.37). Burning slash piles when soils are approaching saturation near the surface reduces the heat load to the soil. A fuel pile burned on a wet mineral soil had 20 percent heat load compared with the heat load of a fuel pile burned on a dry mineral soil (Frandsen and Ryan 1986).

Effectiveness to Restore Detrimental Soil Disturbance

Compaction reduces infiltration rate of water into the soil, potentially reducing plant available water and affecting soil productivity. Compaction is the major detrimental soil condition

associated with temporary roads, landings and skid trails. Restoration activities that reduce compaction will restore infiltration and available water, thereby reducing the potential effects on productivity.

Subsoiling has been shown to be an effective tool in treating compacted soils over many soils and site conditions (Andrus and Froehlich 1983). Carr (1989) found that subsoiling successfully reduced the soil density of compacted soils on landings. Davis (1990) found that subsoiling areas compacted by brush piling reduced bulk density values to undisturbed levels. McNabb (1994) had only "moderate" success decompacting temporary roads and landings, and attributed the results to soil moisture levels being too high during subsoiling, which reduced the effectiveness of the treatment. Kolka and Smidt (2004) found that subsoiling roads as a method of decommissioning resulted in significantly greater white pine diameter growth and yellow-poplar height and diameter growth than the control treatment (planting cover crops) after two years. Much of the published research on the effectiveness of subsoiling comes from the Pacific Northwest; however, it is likely to work well on soils in the project area, as the technique has been proven successful on a variety of soil textures (Andrus and Froehlich 1983). Further, the Bitterroot NF has been successfully using subsoiling to treat their compacted soils for a few years (Mayn 2008). The Bitterroot National Forest Soil Scientist visited the BDNF to assess local soils in 2008; he predicted that subsoiling would be successful as long as the water content of the soils during treatment was optimal (not too dry or too wet).

Temporary road obliteration and subsequent reseeding has been shown to be an effective means of soil compaction restoration on the Beaverhead-Deerlodge National Forest. In order to evaluate the effectiveness of temporary road obliteration, temporary roads from the Butte South Salvage Sale were monitored 1 year after obliteration. Obliteration occurred in 2009 and included recontouring where necessary, seeding with native seed, and blocking the entrance of the road to prevent use. One year after obliteration, cover in the form of slash and native grasses was adequate (Fletcher 2011a). Areas of road that were recontoured did not have compacted soil within the top 12 inches of the surface. Where recontouring was not necessary, the top 4-6 inches of soil were not compacted, allowing vegetation to take hold (Fletcher 2011a).

The planned obliteration of constructed skid trails, temporary roads, and landings in the proposed action would re-establish slope hydrology and deter surface erosion that hinders natural recovery (Switalski et al. 2004). Using infiltration as a proxy for the recovery of compaction, road rehabilitation led to roughly 40 percent of the natural soil infiltration rate (Luce 1997, Foltz and Maillard 2003). Unreclaimed surfaces typically have almost no infiltration.

Restoration techniques improve the recovery trajectory. Standard timber sale contract/stewardship contract provisions for erosion control are proposed for constructed skid trails, temporary roads, and landings. Leaving slash on skid trails ensures hydrological and biological soil processes have been set up for recovery. For these road restoration treatments, 50 percent effectiveness is assumed for calculation of the DSD.

Incomplete and Unavailable Information

The following units were not field reviewed during 2010 and 2011: 27ST, 28C, 31C, 68C, and 74S. No information in regards to existing detrimental soil disturbance is available. For the Draft EIS, existing DSD will be assumed to be zero. Field data will be collected in 2012, between the Draft and Final EIS.

Spatial and Temporal Context for Effects Analysis

This analysis is largely focused on the commercial timber harvest component of the proposed action, as the activities associated with these treatments have greater potential to affect soil productivity than precommercial thin treatments and prescribed burn treatments.

The spatial context for the discussion of direct, indirect, and cumulative effects of the proposed action are the harvest units (activity areas), including skid trails, landings, and temporary roads associated with the proposed units. Effects to soils are generally confined to the site-specific location of activities (e.g., a harvest unit, a landing, etc.). With few exceptions, soil cumulative effects occur only when management activities occur on the same site.

Analyzing effects to soil at a landscape scale (i.e., by watershed) is inappropriate as it does not analyze soil disturbance using a site-specific activity area approach as considered under the Region 1 Soil Quality Standards (USDA Forest Service 1999). Additionally, due to the inherent variability of soil properties such as texture, organic matter and surface cover, and the variable soil response to previous management activities, it is not feasible to analyze past management effects on the soil at the landscape scale in a meaningful way.

The temporal context considered for soil effects analysis is 3 years. As described previously, the Region 1 Soil Quality Standards (USDA Forest Service 1999) address the National Forest Management Act (NFMA) by ensuring that soils will not be irreversibly damaged. Since soil quality standards are required to be met within 3 years of the close of the project (USDA Forest Service 2011b), soil productivity would be maintained over the short term. Additionally, soil recovery would occur in the years following implementation as vegetation reestablishes. For example, in comparing detrimental soil disturbance after post-fire salvage logging, a location that had a few years to recover before monitoring had less detrimental disturbance (4 percent) compared to a site that was monitored 1 year after the project was completed (28 percent) (Dumroese et al. 2006a). The study cited vegetative recovery as a reason for the difference between the locations. However, not all soils recover at the same rate. Recovery is largely dependent on the type of disturbance and the inherent characteristics of the soil in question. After 5 years, the surface 10 cm of severely compacted coarse-textured soils experienced some recovery while fine-textured soils showed little recovery in the same timeframe (Dumroese et al. 2006b). Similarly, after 16 years, a loamy soil showed no improvement in detrimental compaction found in skid trails (Rawinski and Dumroese 2008).

To assess the potential longer-term effects of post-fire salvage logging on soil quality, and to gauge soil recovery, a 7.5-acre unit less than 1 mile from Homestake Pass that burned in 1988 and was logged in 1989 was assessed in October, 2008 (internal monitoring). The unit currently meets lodgepole pine stocking levels. Thirty-four plots were taken across the unit; no detrimental disturbance was found. Soils in the unit are poorly developed sandy loams. The average litter depth was 1.58 cm; the average litter depth of a nearby unburned control was 2.5 cm. Live plants and fine woody debris were present in 94 percent of the plots. Bare mineral soil was present at 14.7 percent of the plots, but was not detrimental. Interestingly, 73.5 percent of the plots had some sort of biological soil crust present (e.g., moss and/or lichen species). Usually the crust was present along with grasses or other plants. Common and important in arid environments, biological soil crusts can take years to recolonize a site after fire (DeBano et al. 1998). The site appears to have mostly recovered since the fire and subsequent harvest. The harvest activities took place during the time when soil quality standards were in the beginning stages of development. At this time, awareness of the importance of reducing soil disturbance was increasing, but the current Region 1 numerical standards did not exist. The fact that no

detrimental soil disturbance was noted when this unit was monitored in 2008 speaks to the effectiveness of minimizing soil disturbance to protect long-term soil productivity, thus meeting the intent of NFMA.

Soils in the Homestake area were probably more detrimentally disturbed after salvage harvest (due to the combination of effects from wildfire and harvest) than soils found in the project area are projected to be after project implementation. Given these factors, and complying with the soil quality standards, and soil and water conservation practices (see Design Features and Mitigation Measures previously in this section), it is likely that the soil will have recovered to a large degree within 20 years of project implementation.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Past management activities such as thinning and clearcutting have occurred throughout the project area; several units had existing detrimental soil compaction from past harvest activities. The effects from past timber management activities have been captured during onsite visits and are reflected in the existing detrimental soil disturbance.

Grazing is an ongoing activity within the project area; at least one the proposed harvest units have existing detrimental soil rutting attributed to livestock activity. The effects from ongoing grazing activities have been captured during onsite visits and are reflected in the existing detrimental soil disturbance.

Recreational activities such as fire wood retrieval and dispersed camping are also ongoing activities within the project area. The effects from recreational activities have been captured during onsite visits and are reflected in the existing detrimental soil disturbance.

The Roadside #4 Salvage Hazard Tree Removal project is currently ongoing within the project area. While Roadside #4 units do not overlap with proposed action units, skid trails to access the proposed units may cross the roadside harvest units.

Alternative 1 – No Action

Direct and Indirect Effects

Since no activities are proposed, there would be no direct or indirect effects to the soil resource. Natural processes would continue. Ongoing activities including recreational activities, grazing, and invasive plant species control would continue. Recreational activities such as firewood retrieval and dispersed camping may result in minor, localized ground disturbance. Cattle activity would generally be limited to cattle trails and comprise a very small amount of disturbance. The Invasive Plant section describes a low risk of spread and effective treatment of invasive plant species; therefore, the potential impact on soil productivity would be expected to be minimal (Rasor 2012).

Cumulative Effects

Soil cumulative effects generally occur only when management activities occur on the same site. Under the no-action alternative, there are no direct or indirect effects to the soil resource from project activities, and therefore no cumulative effects.

Alternative 2 – Proposed Action

Direct Effects

Commercial Timber Harvest

Potential direct environmental effects of the commercial timber harvest component of the proposed action on soil productivity include compaction, displacement, and rutting from machinery use during felling, bunching, skidding, processing and loading logs, as well as soil heating from slash and understory burning. All soils affected by commercial harvest are resistant to compaction and rutting when dry or frozen. Projected detrimental disturbance for each proposed harvest unit in alternative 2 was determined as described in the methodology section previously. Results for each unit are presented in table 71 that follows.

Haul routes on nonsystem roads include proposed newly constructed temporary roads and existing open and closed unauthorized routes. Proposed temporary roads (7.2 miles) would be obliterated, and hence restored to some degree (assuming 50 percent effectiveness, see Effectiveness to Restore DSD previously) after harvest is completed. Existing open and closed unauthorized routes (4.4 miles) would be decommissioned (table 6).

Table 71. Alternative 2 - Projected detrimental soil disturbance by harvest unit

A	B	C	D	E	F	G
Unit	**Existing Percent Detrimental Disturbance**	**Projected Percent Detrimental Disturbance with Proposed Action[b]**	**Percent Detrimental Disturbance Associated with Haul Routes on Non-System Roads**	**Total Percent Projected Detrimental Disturbance**	**Percent of Unit Restored Due to Temporary Road Obliteration and Subsoiling[c,d]**	**Net Percent DSD After Proposed Action and Restoration**
1ST	0.0	10.0	0.4	10.4	0.0	10.4
5ST	0.0	10.0	0.0	10.0	0.0	10.0
6C	0.0	10.0	0.0	10.0	0.0	10.0
8C	0.0	10.0	0.0	10.0	0.0	10.0
10C	0.0	10.0	0.0	10.0	0.0	10.0
11C	0.0	10.0	0.0	10.0	0.0	10.0
12C	0.0	10.0	0.6	10.6	0.2	10.4
16S	0.0	10.0	0.0	10.0	0.0	10.0
19S	0.0	10.0	0.0	10.0	0.0	10.0
20C	0.0	10.0	0.4	10.4	0.2	10.2
22C	0.0	10.0	0.0	10.0	0.0	10.0
23C	0.0	10.0	2.6	12.6	0.0	12.6
24C	0.0	10.0	0.0	10.0	0.0	10.0
25C	3.3	10.0	0.0	13.3	0.0	13.3
26S	0.0	10.0	0.0	10.0	0.0	10.0
27ST[a]	0.0	10.0	0.6	10.6	0.3	10.3

A	B	C	D	E	F	G
Unit	**Existing Percent Detrimental Disturbance**	**Projected Percent Detrimental Disturbance with Proposed Action[b]**	**Percent Detrimental Disturbance Associated with Haul Routes on Non-System Roads**	**Total Percent Projected Detrimental Disturbance**	**Percent of Unit Restored Due to Temporary Road Obliteration and Subsoiling[c,d]**	**Net Percent DSD After Proposed Action and Restoration**
28C[a]	0.0	10.0	0.0	10.0	0.0	10.0
29C	0.0	10.0	0.0	10.0	0.0	10.0
30ST	0.0	10.0	0.0	10.0	0.0	10.0
31C[a]	0.0	10.0	0.0	10.0	0.0	10.0
32ST	8.7	10.0	0.0	18.7	3.7	15.0
33C	0.0	10.0	0.0	10.0	0.0	10.0
34S	0.0	10.0	0.9	10.9	0.5	10.5
35S	0.0	10.0	1.2	11.2	0.6	10.6
36S	0.0	10.0	0.0	10.0	0.0	10.0
37S	0.0	10.0	0.0	10.0	0.0	10.0
39S	0.0	10.0	0.0	10.0	0.0	10.0
40S	6.7	10.0	0.0	16.7	1.7	15.0
41S	0.0	10.0	10.7	20.7	5.7	15.0
42C	0.0	10.0	2.0	12.0	1.0	11.0
43S	0.0	10.0	0.0	10.0	0.0	10.0
44S	0.0	10.0	0.0	10.0	0.0	10.0
45S	0.0	10.0	0.0	10.0	0.0	10.0
46S	0.0	10.0	1.0	11.0	0.3	10.7
47S	0.0	10.0	0.0	10.0	0.0	10.0
48C	0.0	10.0	1.8	11.8	0.5	11.3
49S	0.0	10.0	0.6	10.6	0.3	10.3
50S	0.0	10.0	0.0	10.0	0.0	10.0
51S	0.0	10.0	0.9	10.9	0.5	10.5
52S	0.0	10.0	0.9	10.9	0.2	10.7
55C	0.0	10.0	1.1	11.1	0.5	10.5
56C	0.0	10.0	5.1	15.1	1.0	14.1
57C	0.0	10.0	4.3	14.3	0.6	13.7
58S	0.0	10.0	0.0	10.0	0.0	10.0
59C	0.0	10.0	0.0	10.0	0.0	10.0
60C	0.0	10.0	0.0	10.0	0.0	10.0
61S	0.0	10.0	0.5	10.5	0.2	10.2
62S	0.0	10.0	0.0	10.0	0.0	10.0
64C	3.3	10.0	0.0	13.3	0.0	13.3

A	B	C	D	E	F	G
Unit	**Existing Percent Detrimental Disturbance**	**Projected Percent Detrimental Disturbance with Proposed Action[b]**	**Percent Detrimental Disturbance Associated with Haul Routes on Non-System Roads**	**Total Percent Projected Detrimental Disturbance**	**Percent of Unit Restored Due to Temporary Road Obliteration and Subsoiling[c,d]**	**Net Percent DSD After Proposed Action and Restoration**
65C	0.0	10.0	0.0	10.0	0.0	10.0
65ST	3.3	10.0	0.0	13.3	0.0	13.3
66C	0.0	10.0	0.4	10.4	0.0	10.4
67C	0.0	10.0	0.0	10.0	0.0	10.0
68C[a]	0.0	10.0	0.8	10.8	0.4	10.4
69S	0.0	10.0	0.0	10.0	0.0	10.0
71C	0.0	10.0	1.0	11.0	0.5	10.5
72S	0.0	10.0	1.0	11.0	0.5	10.5
73S	0.0	10.0	1.9	11.9	1.0	10.9
74S[a]	0.0	10.0	0.0	10.0	0.0	10.0
76S	0.0	10.0	0.0	10.0	0.0	10.0
77S	0.0	10.0	1.6	11.6	0.8	10.8
78S	0.0	10.0	1.4	11.4	0.7	10.7
79S	0.0	10.0	1.6	11.6	0.8	10.8
80C	0.0	10.0	1.2	11.2	0.0	11.2
81C	0.0	10.0	0.0	10.0	0.0	10.0

[a] No field data available for unit. Existing DSD assumed to be zero until field data collected.
[b] Assumes summer harvest for all units.
[c] Assumes 50 percent effectiveness from temporary road obliteration.
[d] Assumes 50 percent effectiveness from subsoiling.

Implementation of the proposed action creates the potential for three harvest units (51 acres or 2 percent of the proposed harvest acres) to exceed R1 Soil Quality Standards of 15 percent detrimental soil disturbance per activity area (table 71).

Subsoiling would occur on the following units to ensure compliance with the soil quality standards: 32ST (18.6% DSD), 40S (16.7 percent DSD), and 41S (20.7 percent DSD). The number of acres to be treated would vary by unit depending on unit size and projected DSD (table 72).

Table 72. Alternative 2 - Harvest units requiring restoration activities to ensure compliance of SQS

A	B	C	D	E	F	G
Unit	**Acres**	**Existing DSD (Acres)**	**Potential Acres To Restore (From New Disturbance)**	**Acres Requiring Restoration Treatment(S)[a]**	**Percent of Unit Restored Due to Subsoiling**	**Suitable Acres Available to Meet SQS Post Restoration [B]**
32ST	18	1.6	1.8	1.3	3.7	YES
40S	29	1.9	2.9	1.0	1.7	YES
41S	4	0.0	0.4	0.3	3.6	YES
		Total acres requiring restoration		**2.6**		

[a] Assumes 50 percent effectiveness for restoration treatments (acres requiring treatment have been doubled).
[b] Suitable acres available when Column D > Column E.

Units 32ST, 40S, and 41S would contain enough potential suitable acres for restoration treatments to ensure that R1 SQS would be met post restoration. Unsuitable acres would include areas of existing disturbance with impacts from livestock or mining, and inoperable ground such as rock outcrops and wet areas.

Prescribed Burning

Potential direct environmental effects of the prescribed burn component of the proposed action (eight prescribed burn units and post-harvest burning in commercial thin and seed tree units) are soil heating and loss of surface cover due to burning. The potential for detrimental soil heating is low given that the burning would occur in the spring or fall when soil moisture content is high. Spring burning is preferable when the potential for long duration, high intensity burns is lower due to higher fuel moisture levels. However, fall burning is also acceptable and the potential for soil heating is minimal if the prescribed burn is implemented within proper prescription parameters and mitigation measures are followed. Monitoring of the McVey and Doolittle prescribed burns on the Beaverhead-Deerlodge National Forest indicates that prescribed burning implemented in the spring resulted in an overall low soil burn severity (Fletcher 2011b). The surface organic layers are not completely consumed and are still recognizable in areas of low soil burn severity; therefore, the potential for detrimental soil disturbance due to loss of surface cover (i.e. organic matter) is low. Detrimental soil disturbance due to soil heating or loss of surface cover is not expected in any of the prescribed burn units.

Indirect Effects

Commercial Timber Harvest

Ground disturbing activities associated with the commercial timber harvest component of the proposed action have the potential to expose mineral soil to overland flow and subsequent erosion. Probability of erosion and estimated erosion rates was modeled for alternative 2 using Disturbed WEPP (assumptions listed above in the methodology section). The probability of erosion reflects the occurrence of erosion only for the year following harvest. Generally, for all harvest units, the probability of erosion would decline every year following harvest due to natural vegetative regeneration.

The probability of erosion increases in one unit, 73S, from 0 percent to 2 percent. However, model results for the proposed action - alternative 2 indicate an average annual erosion rate of 0 tons/acre/year for each modeled harvest unit.

The Region 1 SQS state that the tolerable soil loss rate (average annual) is generally less than 1 to 2 tons per acre per year (USDA Forest Service 1999). Based on the WEPP modeling, SQS for surface erosion would continue to be met in all units under the proposed activities for alternative 2. Additionally, the WEPP results do not take into account SWCPs listed in the Soil Resources project design features and mitigation measures, chapter 2; in particular, providing drainage control and slash placement on skid trails. These SWCPs will ameliorate disturbance associated with harvest, reduce erosion potential, and hasten soil recovery.

Ground disturbing activities associated with the commercial timber harvest component of the proposed action have the potential to spread invasive plant species into new, previously uninfested areas. The potential areas of invasive plant species spread would be on soils disturbed by temporary road and skid trail construction and landings. Based on a 2011 inventory, Canada thistle, common tansy, houndstongue, musk thistle, oxeye daisy, spotted knapweed, and yellow toadflax are present in the Flint Foothills project area mostly in rangeland and along roads; however, occurrences were noted in harvest units 1ST, 5ST, 6C, 19S, 20C, 22C, 24C, 25C, 27ST, 31C, 66C, 50S, 61S, and 79S (Rasor 2012). These weed species have the potential to affect soil productivity through competition for resources such as space, light, water, and nutrients; and also through allelopathy. Allelopathy is defined as "chemical interactions among and between plants that do not include positive effects" (Foy and Inderjit 2001). Allelopathic invasive plant species exude chemicals that can have a negative effect on native plant species. Canada thistle and spotted knapweed are known to be allelopathic (Foy and Inderjit 2001).

While the potential for impacts to soil productivity exists as a result of invasive plant species infestation, the actual impact to long term soil productivity is likely minimal, due to the following:

- The Invasive Plant Species section describes a low risk of noxious weeds becoming established and/or spreading in proposed treatment units within the project area.
- The mitigation measures listed in chapter 2 include monitoring and treatment for invasive plant species within units and along roads.
- Treatment of invasive plant species with herbicides on the Beaverhead-Deerlodge NF has been effective (infested acres reduced by 48 percent over the last 10 years on the Pintler Ranger District) (Rasor 2012).

Prescribed Burn

Potential indirect environmental effects of the prescribed burn component from the proposed action are potential accelerated erosion as a result of loss of surface cover due to burning, and loss of soil productivity due to invasive plant species spread. Surface cover is an important attribute in determining susceptibility to erosion. Work in burned forest soils by Noble (1965) and Orr (1970), as cited in Robichaud and others (2000), found that 30 percent cover reduces erosion by half compared to bare soil and 60 percent cover reduced sediment movement to negligible amounts. Monitoring of the McVey and Doolittle prescribed burns on the Beaverhead-Deerlodge indicate post burn surface cover ranging from 96-100 percent. The potential for accelerated erosion as a result of loss of surface cover due to implementation of the proposed action is low as surface cover post burn is expected to be more than adequate.

The potential for increasing the density and spread of invasive plant species, and in turn negatively affecting soil productivity is low. Project design features and mitigation measures for invasive plants (chapter 2) would lead to low risk of increasing the spread and density of invasive plant species.

Cumulative Effects

The cumulative impact of past disturbance in addition to proposed harvest activities and prescribed burn treatments under alternative 2 would not likely lead to long-term impairment of soil productivity, since the Region 1 SQS would be met. Cumulative impacts may be greatest where ground vegetation and ground cover is disturbed. Cumulative effects due to the proposed action activities and continued grazing are possible; however, additional cumulative effects from cattle activity following harvest are not expected because (1) no increases in cattle numbers or lengthening of the season of use would occur with implementation of the proposed action, (2) trailing through the unit would likely use existing cattle/game trails, and (3) allotments will be monitored for compliance with established grazing standards. Any cumulative effects due to cattle activity and proposed harvest that may occur in units would generally be limited to cattle trails and comprise a very small amount of disturbance.

Cumulative effects due to the proposed commercial timber harvest under alternative 2 and previous harvest activity was projected to exceed SQS in three harvest units (32ST, 40Sand 41S). These figures do not take into account the fact that some of the existing disturbance in the harvest units due to old skid trails and landings would probably be reused instead of creating additional DSD by constructing new skid trails and landings. These units would need to be monitored to ensure that SQS are met at the conclusion of the project. After project implementation, any harvest unit that does not meet standards would be restored to ensure that 85 percent of the harvest unit is in satisfactory soil condition; this would assure that productivity effects are reduced in the near term and eliminated over the long term.

Cumulative effects due to recreation would be limited to areas where proposed harvest units are also used for recreational activities. Effects from firewood gathering are generally limited to a 50 to 100-foot corridor from existing roads where firewood cutting activity has occurred. These effects are localized and generally minor. No dispersed camping sites were noted within the proposed harvest units, and obliteration of temporary roads would prevent unauthorized motorized access. Therefore, no cumulative effects from recreational activities would be expected.

Roadside Hazard Removal #4 is currently ongoing. This project involves removing dead and dying lodgepole pine along main roads within the project area. The corridor of tree removal varies, depending on the slope and height of the trees, from 0 to about 150 feet along both sides of the roadways. Trees will be whole-tree yarded to landing areas. Slash will either be burned on site, or chipped and removed. Some of the areas harvested under Roadside Hazard Removal #4 are adjacent to harvest units under the Flint Foothills proposed action. Cumulative effects, if they occur, would be limited to any skid trails used for the Flint Foothills units that also pass through the Roadside Salvage Units.

The cumulative effects of the proposed harvest and temporary road construction in addition to existing effects from previous harvest and grazing are shown in table 72, column E. This column displays the effects before restoration measures are applied. In three harvest units a restoration plan has been developed to assure compliance with the soil quality standards. The cumulative effects of existing detrimental soil disturbance, DSD created by this project, and

restoration of DSD is shown in table 72, column G. All units would meet the regional SQS. Monitoring would occur to ensure SQS are met.

Summary of Effects

Three harvest units (out of 65) are projected to exceed Region 1 SQS due to indirect, direct, and cumulative effects from the proposed action. However, with the identified project design features and mitigation measures, specifically restoration activities, all harvest units would meet the Region 1 SQS requiring that new activities do not create detrimental soil conditions on more than 15 percent of an activity area following project implementation and restoration activities, or in areas where more than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 2 would meet the standards to protect soil productivity set forth in the Region 1 Soil Quality Standards (USDA Forest Service 1999) and referenced in the Beaverhead-Deerlodge Forest Plan (USDA Forest Service 2009c).

- No ground based yarding would occur on slopes greater than 35 percent that have not had a site-specific analysis showing that damage is unlikely.
- Alternative 2 would result in at least 85 percent of each activity area having soil that is in satisfactory condition after any needed restoration measures are applied.
- Mitigation measures used are shown to be effective

Alternative 3

Direct Effects

Commercial Timber Harvest

Table 73 displays the potential direct environmental effects of the commercial timber harvest component of the proposed action on soil productivity including compaction, displacement, and rutting from machinery use during felling, bunching, skidding, processing and loading logs, and soil heating from slash and understory burning. These soils are resistant to compaction and rutting when soils are dry or frozen. Projected detrimental disturbance for each proposed harvest unit was determined as described in the methodology section above.

Haul routes include 2.3 miles of existing open and closed unauthorized routes. No proposed temporary roads would be constructed in alternative 3 (new construction). Temporary roads on existing open or closed unauthorized routes would be decommissioned (table 6)

Table 73. Alternative 3 - Projected detrimental soil disturbance by harvest unit

A	B	C	D	E	F	G
Unit	Existing Percent Detrimental Disturbance	Projected Percent Detrimental Disturbance with Proposed Action[b]	Percent Detrimental Disturbance Associated with Haul Routes on Non-System Roads	Total Percent Projected Detrimental Disturbance	Percent of Unit Restored due to Subsoiling[c]	Net Percent DSD after Proposed Action and Restoration
1ST	0.0	10.0	0.4	10.4	0.0	10.4
5ST	0.0	10.0	0.0	10.0	0.0	10.0
6C	0.0	10.0	0.0	10.0	0.0	10.0
8C	0.0	10.0	0.0	10.0	0.0	10.0
10C	0.0	10.0	0.0	10.0	0.0	10.0
11C	0.0	10.0	0.0	10.0	0.0	10.0
12C	0.0	10.0	0.2	10.2	0.0	10.2
16S	0.0	10.0	0.0	10.0	0.0	10.0
19S	0.0	10.0	0.0	10.0	0.0	10.0
20C	0.0	10.0	0.0	10.0	0.0	10.0
22C	0.0	10.0	0.0	10.0	0.0	10.0
23C	0.0	10.0	5.4	15.4	0.4	15.0
24C	0.0	10.0	0.0	10.0	0.0	10.0
25C	3.3	10.0	0.0	13.3	0.0	13.3
26S	0.0	10.0	0.0	10.0	0.0	10.0
27ST[a]	0.0	10.0	0.0	10.0	0.0	10.0
28C[a]	0.0	10.0	0.0	10.0	0.0	10.0
29C	0.0	10.0	0.0	10.0	0.0	10.0
30ST	0.0	10.0	0.0	10.0	0.0	10.0
31C[a]	0.0	10.0	0.0	10.0	0.0	10.0
32ST	8.7	10.0	0.0	18.7	3.7	15.0
33C	0.0	10.0	0.0	10.0	0.0	10.0
34S	0.0	10.0	0.0	10.0	0.0	10.0
35S	0.0	10.0	0.0	10.0	0.0	10.0
37S	0.0	10.0	0.0	10.0	0.0	10.0
39S	0.0	10.0	0.0	10.0	0.0	10.0
40S	6.7	10.0	0.0	16.7	1.7	15.0
41S	0.0	10.0	0.0	10.0	0.0	10.0
42C	0.0	10.0	0.0	10.0	0.0	10.0
43S	0.0	10.0	0.0	10.0	0.0	10.0
44S	0.0	10.0	0.0	10.0	0.0	10.0
45S	0.0	10.0	0.0	10.0	0.0	10.0
46S	0.0	10.0	0.0	10.0	0.0	10.0

A	B	C	D	E	F	G
Unit	Existing Percent Detrimental Disturbance	Projected Percent Detrimental Disturbance with Proposed Action[b]	Percent Detrimental Disturbance Associated with Haul Routes on Non-System Roads	Total Percent Projected Detrimental Disturbance	Percent of Unit Restored due to Subsoiling[c]	Net Percent DSD after Proposed Action and Restoration
49S	0.0	10.0	0.0	10.0	0.0	10.0
50S	0.0	10.0	0.0	10.0	0.0	10.0
51S	0.0	10.0	0.0	10.0	0.0	10.0
52S	0.0	10.0	0.4	10.4	0.0	10.4
55C	0.0	10.0	0.0	10.0	0.0	10.0
58S	0.0	10.0	0.0	10.0	0.0	10.0
59C	0.0	10.0	0.0	10.0	0.0	10.0
60C	0.0	10.0	0.0	10.0	0.0	10.0
61S	0.0	10.0	0.0	10.0	0.0	10.0
62S	0.0	10.0	0.0	10.0	0.0	10.0
64C	3.3	10.0	0.0	13.3	0.0	13.3
65C	0.0	10.0	0.0	10.0	0.0	10.0
65ST	3.3	10.0	0.0	13.3	0.0	13.3
66C	0.0	10.0	0.4	10.4	0.0	10.4
67C	0.0	10.0	0.0	10.0	0.0	10.0
69S	0.0	10.0	0.0	10.0	0.0	10.0
71C	0.0	10.0	1.0	11.0	0.0	11.0
73S	0.0	10.0	0.0	10.0	0.0	10.0
74S[a]	0.0	10.0	0.0	10.0	0.0	10.0
76S	0.0	10.0	0.4	10.4	0.0	10.4
79S	0.0	10.0	1.2	11.2	0.0	11.2
80C	0.0	10.0	0.0	10.0	0.0	10.0
81C	0.0	10.0	0.0	10.0	0.0	10.0

[a] No field data available for unit. Existing DSD assumed to be zero until field data collected.
[b] Assumes summer harvest for all units [c] Assumes 50 percent effectiveness from temporary road obliteration
[d] Assumes 50 percent effectiveness from subsoiling

Implementation of alternative 3 would create the potential for three harvest units (80 acres or 4 percent of the proposed harvest acres) to exceed R1 Soil Quality Standards of 15 percent detrimental soil disturbance per activity area (table 73). Sub-soiling would occur on the following units to ensure compliance with the soil quality standards: 23C (15.4 percent DSD), 32ST (18.7 percent DSD) and 40S (16.7 percent DSD). The number of acres to be treated would vary by unit depending on unit size and projected DSD (table 74).

Table 74. Alternative 3 - Harvest units requiring restoration activities to ensure compliance of SQS

A	B	C	D	E	F	G
Unit	**Acres**	**Existing DSD (Acres)**	**Potential Acres to restore (From New Disturbance)**	**Acres Requiring Restoration Treatment(S)[a]**	**Percent of Unit Restored Due to Subsoiling**	**Suitable Acres Available to Meet SQS Post Restoration [b]**
23C	33	0	3.3	0.3	0.4	YES
32ST	18	1.6	1.8	1.3	3.7	YES
40S	29	1.9	2.9	1.0	1.7	YES
		Total acres requiring treatment		**2.6**		

[a] Assumes 50 percent effectiveness for restoration treatments (acres requiring treatment have been doubled)
[b] Suitable acres available when Column D > Column E

Units 23C, 32ST and 40S would contain enough potential suitable acres for restoration treatments to ensure that R1 SQS would be met post restoration. Unsuitable acres would include areas of existing disturbance with impacts from livestock or mining, and inoperable ground such as rock outcrops and wet areas.

Prescribed Burning

Potential direct environmental effects of the prescribed burn component of the proposed action (eight prescribed burn units and post-harvest burning in commercial thin and seed tree units) are soil heating and loss of surface cover due to burning. The potential for detrimental soil heating is low given that the burning would occur in the spring or fall when soil moisture content is high. Spring burning is preferable when the potential for long-duration, high-intensity burns is lower due to higher fuel moisture levels. However, fall burning is also acceptable and the potential for soil heating is minimal if the prescribed burn is implemented within proper prescription parameters and mitigation measures are followed. Monitoring of the McVey and Doolittle prescribed burns on the Beaverhead-Deerlodge National Forest indicates that prescribed burning implemented in the spring resulted in an overall low soil burn severity (Fletcher 2011). The surface organic layers are not completely consumed and are still recognizable in areas of low soil burn severity; therefore, the potential for detrimental soil disturbance due to loss of surface cover (i.e. organic matter) would be low. Detrimental soil disturbance due to soil heating and/or loss of surface cover is not expected in any of the prescribed burn units.

Indirect Effects

Commercial Timber Harvest

Ground disturbing activities associated with the commercial timber harvest component of the proposed action would have the potential to expose mineral soil to overland flow and subsequent erosion. Probability of erosion and estimated erosion rates because of alternative 3 activities was modeled using Disturbed WEPP (assumptions listed above in the methodology section). The probability of erosion reflects the occurrence of erosion only for the year following harvest. Generally, for all harvest units, the probability of erosion would decline every year following harvest due to natural vegetative regeneration.

The probability of erosion increases in one unit, 73S, from 0 percent to 2 percent from the existing condition. However, model results for alternative 3 indicate an average annual erosion rate of 0 tons/acre/year for each modeled harvest unit.

The Region 1 SQS state that the tolerable soil loss rate (average annual) is generally less than 1 to 2 tons per acre per year (USDA Forest Service 1999). Based on the WEPP modeling, SQS for surface erosion would continue to be met in all units under the proposed action for alternative 3. Additionally, the WEPP results do not take into account SWCPs listed in the Soil Resources project design features and mitigation measures, chapter 2, in particular, providing drainage control and slash placement on skid trails. These SWCPs will ameliorate disturbance associated with harvest, reduce erosion potential, and hasten soil recovery.

Ground disturbing activities associated with the commercial timber harvest component of the proposed action have the potential to spread invasive plant species into new, previously uninfested areas. The potential areas of invasive plant species spread would be on soils disturbed by skid trail construction and landings. Based on a 2011 inventory, Canada thistle, common Tansy houndstongue, musk thistle, oxeye daisy, spotted knapweed, and yellow toadflax are present in the Flint Foothills project area mostly in rangeland and along roads; however, occurrences were noted in harvest units 1ST, 5ST, 6C, 19S, 20C, 22C, 24C, 25C, 27ST, 31C, 66C, 50S, 61S, and 79S (Rasor 2012). These weed species have the potential to affect soil productivity through competition for resources such as space, light, water, and nutrients; and also through allelopathy. Allelopathic weed species exude chemicals that can have a negative effect on native plant species. Canada thistle and spotted knapweed are known to be allelopathic (Foy and Inderjit 2001).

While the potential for impacts to soil productivity exists as a result of noxious weed infestation, the actual impact to long term soil productivity is likely minimal, due to the following:

- The Invasive Plant section describes low risk of invasive plant species becoming established and/or spreading in proposed treatment units within the analysis area.
- The mitigation measures listed in the DEIS include monitoring and treatment of invasive plant species within units and along roads.
- Treatment of invasive plant species with herbicides on the Beaverhead-Deerlodge NF has been effective (infested acres reduced by 49 percent on the Pintler Ranger District) (Rasor 2012).

Prescribed Burn

Potential indirect environmental effects of the prescribed burn component of the proposed action are potential accelerated erosion as a result of loss of surface cover due to burning and loss of soil productivity due to noxious weed spread. Surface cover is an important attribute in determining susceptibility to erosion. Work in burned forest soils by Noble (1965) and Orr (1970), as cited in Robichaud and others (2000), found that 30 percent cover reduces erosion by half compared to bare soil, and 60 percent cover reduced sediment movement to negligible amounts. Monitoring of the McVey and Doolittle prescribed burns on the Beaverhead-Deerlodge NF indicate post-burn surface cover ranging from 96 to100 percent. The potential for accelerated erosion as a result of loss of surface cover due to implementation of the proposed action is low as surface cover post burn is expected to be more than adequate.

The potential for increasing the density and spread of invasive plant species and in turn negatively affecting soil productivity is low. Project design features and mitigation measures described for invasive plant species (Chapter 2) lead to a low risk of increasing the spread and density of noxious weeds.

Cumulative Effects

The cumulative impact of past disturbance in addition to proposed harvest activities and prescribed burn treatments under alternative 3 would not likely lead to long-term impairment of soil productivity, since the Region 1 SQS would be met. Cumulative impacts may be greatest where ground vegetation and ground cover is disturbed. Cumulative effects due to the proposed action and continued grazing are possible. However, additional cumulative effects from cattle activity following harvest are not expected because (1) no increases in cattle numbers or lengthening of the season of use would occur with implementation of the proposed action, (2) trailing through the unit would likely use existing cattle/game trails, and (3) allotments will be monitored for compliance with established grazing standards. Any cumulative effects due to cattle activity and proposed harvest that may occur in units would generally be limited to cattle trails and comprise a very small amount of disturbance.

Cumulative effects due to the proposed commercial timber harvest under alternative 3 and previous harvest activity was projected to exceed SQS in three harvest units (23C, 32ST and 40S). These figures do not take into account the fact that some of the existing disturbance in the harvest units, due to old skid trails and landings, will probably be reused instead of creating additional DSD by constructing new skid trails and landings. These units will need to be monitored to ensure that SQS are met at the conclusion of the project. After project implementation, any harvest unit that does not meet standards will be restored to ensure that 85 percent of the harvest unit is in satisfactory condition; this will assure that productivity effects are reduced in the near term and eliminated over the long term.

Cumulative effects due to recreation would be limited to areas where proposed harvest units are also used for recreational activities. Effects from firewood gathering are generally limited to a 50 to100-foot corridor from existing roads where firewood cutting activity has occurred. These effects are localized and generally minor. No dispersed camping sites were noted within the proposed harvest units. Therefore, no cumulative effects from recreational activities would be expected.

Roadside Hazard Removal #4 is currently ongoing. This project involves removing dead and dying lodgepole pine along main roads within the project area. The corridor of tree removal varies, depending on the slope and height of the trees, from 0 to about 150 feet along both sides of the roadways. Trees will be whole-tree yarded to landing areas. Slash will either be burned on site, or chipped and removed. Some of the areas harvested under Roadside Hazard Removal #4 are adjacent to harvest units under the Flint Foothills proposed action. Cumulative effects, if they occur, would be limited to any skid trails used for the Flint Foothills units that also pass through the roadside salvage units.

The cumulative effects of the proposed harvest and temporary road construction in addition to existing effects from previous harvest and grazing are shown in table 73, column E. This column displays the effects before restoration measures are applied. In three harvest units a restoration plan has been developed to assure compliance with soil quality standards. The cumulative effects of existing detrimental soil disturbance, DSD created by this project, and

restoration of DSD is shown in table 73, column G. All units would meet regional SQS. Monitoring would occur to ensure SQS are met.

Summary of Effects

Three harvest units (out of 55) are projected to exceed Region 1 SQS due to indirect, direct, and cumulative effects from the proposed action. However, with the identified project design features and mitigation measures, specifically restoration activities, all harvest units would meet the Region 1 SQS requiring that new activities do not create detrimental soil conditions on more than 15 percent of an activity area following project implementation and restoration activities, or in areas where more than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 3 would meet the standards to protect soil productivity set forth in the Region 1 Soil Quality Standards (USDA Forest Service 1999) and referenced in the Beaverhead-Deerlodge Forest Plan (USDA Forest Service 2009c).

- No ground based yarding would occur on slopes greater than 35 percent that have not had a site-specific analysis showing that damage is unlikely.
- Alternative 3 would result in at least 85 percent of each activity area having soil that is in satisfactory condition after any needed restoration measures are applied.
- Mitigation measures used are shown to be effective

Hydrology

Introduction

This report documents existing conditions and the analysis of potential environmental effects to hydrologic resources from the proposed Flint Foothills Project. Potential effects addressed consist of impacts to water quality, water quantity, channel stability, and wetlands and floodplains.

Overview of Issues Addressed

The public expressed concerns during scoping that permanent and temporary road construction could affect water quality. Alternative 3 was developed to exclude all new road construction. Specific issues relevant to the analysis and associated indicators and measures are discussed below.

Issues and Measurement Indicators

Issue - Water Quality

- Indicator - Change in sediment delivery
    - Measure - Consistency of the project with total maximum daily loads (TMDLs)
    - Measure - Changes in sediment delivery to streams based on WEPP Road model, and sedimentation risk from haul routes
    - Measure - Changes in sediment from harvest units from Disturbed WEPP

    - Measure - Miles of new National Forest System (NFS) or temporary road construction
    - Measure - Miles of new National Forest System or temporary roads within 300 feet of streams
    - Measure - New haul route stream crossings and sediment delivery at stream crossings
- Indicator - Change in stream temperatures
    - Measure - Roads and openings in Riparian Conservation Areas (RCAs)

Issue - Water Quantity and Channel Stability

- Indicator - Changes in water yield and peak flows resulting in channel changes
    - Measure - Harvested area by 6th field HUC
    - Measure - Water yield increase greater than 10 percent

Issue - Wetlands and floodplains

- Indicator - Changes in floodplain and wetland function
    - Measure - New stream crossings in floodplains
    - Measure - Protection of wetlands provided by RCAs and other project design features

Affected Environment

Existing Condition

This section discusses those resources that may potentially be affected by the proposed project. Also included are background data to provide context for later discussions of effects.

Watershed Description and Conditions

The project area totals 44,493 acres and is located within portions of the Barnes Creek, Clark Fork River-Dunkleberg Creek, Clark Fork River-Perkins Creek, Douglas Creek, Gold Creek, Lower Flint Creek-Gird Creek and Pikes Peak Gulch 6th level watersheds, or HUC(Hydrologic Unit Code). The Hydrologic Unit system is a standardized watershed classification system developed by U.S. Geological Survey (USGS) in the mid-1970s. Hydrologic units are watershed boundaries organized in a nested hierarchy by size. They range in size from regions to the smaller cataloging units (HUCs), which are roughly equivalent to local watersheds.

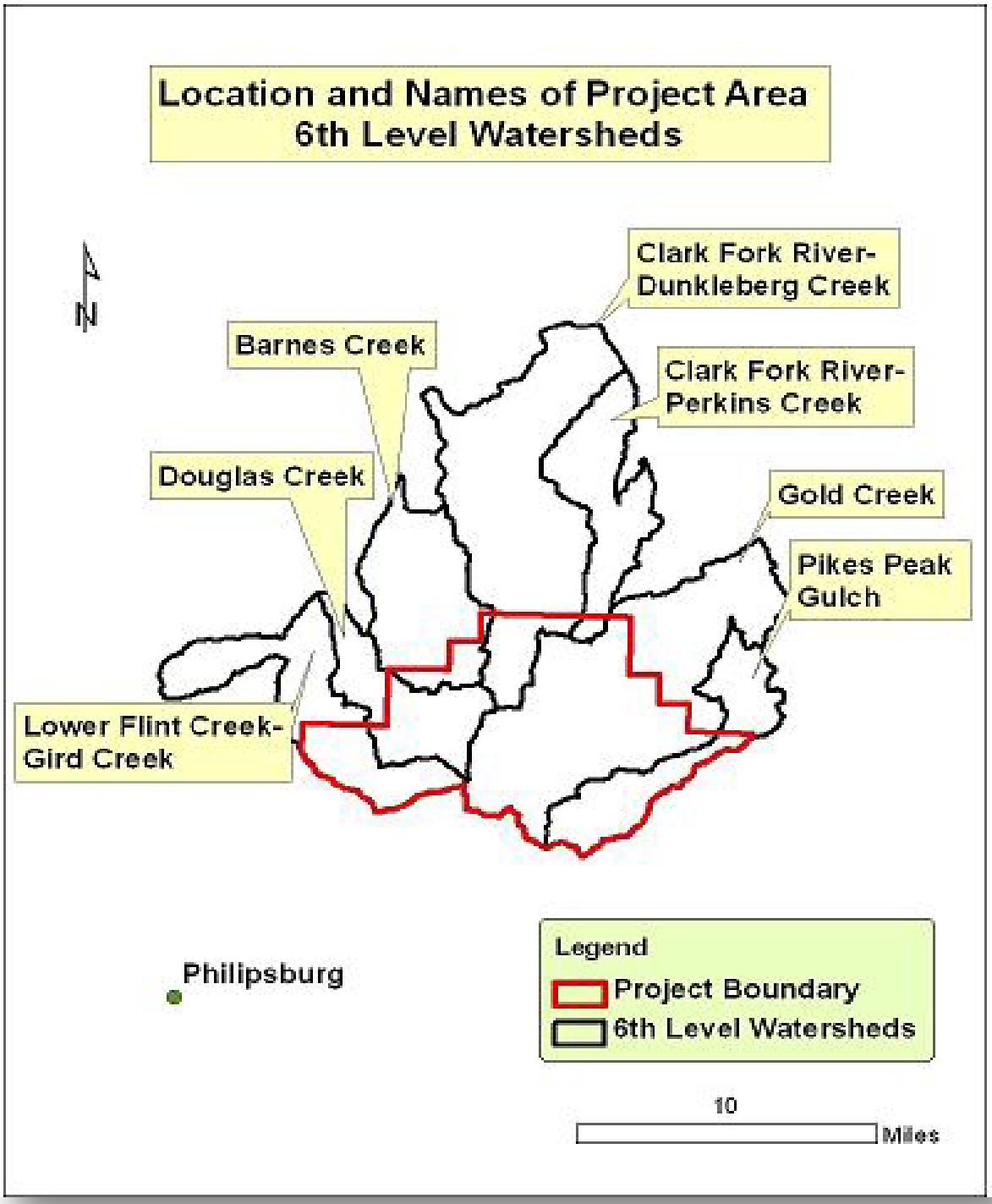


Figure 39. Location and names of 6th level watersheds in the Flint Foothills area

Past management activities with the project area that have affected watershed conditions include placer and lode mining, livestock grazing, timber harvest, prescribed fire treatments, and road construction and maintenance. Mining has had detrimental effects on channels in some areas, with excessive sedimentation leading to over-widened channels, such as seen in lower Douglas Creek. Ongoing impacts from existing and past impacts from abandoned mines could include ground disturbance, sediment from access roads, and minor forest clearing. Past impacts to water quality in mining areas in the project area have been documented in several drainages and include heavy metal contamination in streams. Abandoned mine sites may continue to be a source of water quality impairment.

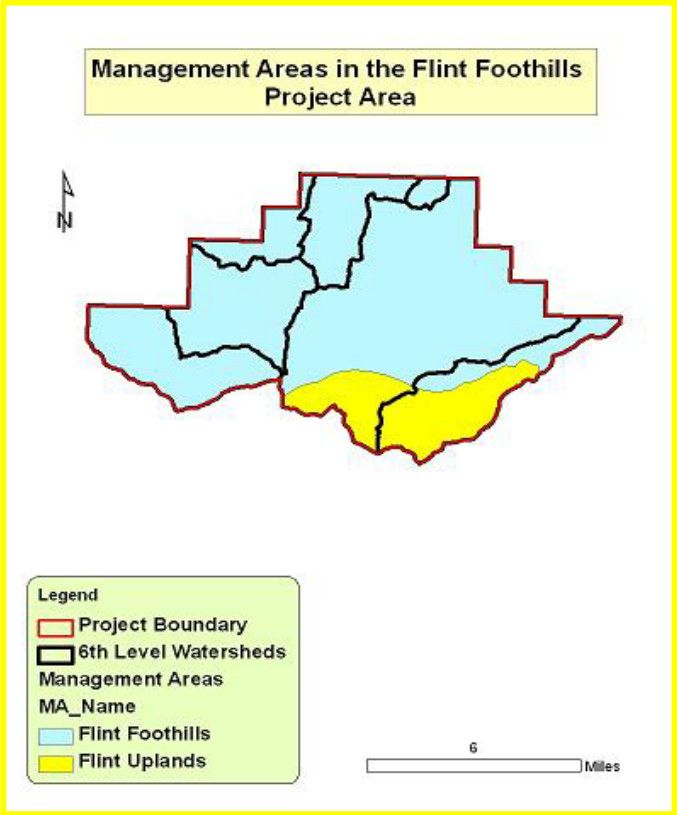


Figure 40. Management areas and 6th level watersheds in the Flint Foothills project area

Grazing can also impact streams, because cattle often congregate along streams and within riparian areas. Watershed conditions were surveyed as part of this project, and within these grazing allotments conditions appeared to be generally good. Although none were observed, there are likely localized areas where riparian areas are somewhat degraded or stream banks are modified by trampling and compaction.

Past vegetation and prescribed burning treatments were numerous within the project area. The list of past treatments associated with ground disturbance is displayed in appendix D. The earliest recorded harvest treatments were completed between 1950 and 1959, with the most recent occurring in 2011. Douglas Creek watershed has the highest percentage of area involved in past vegetation treatments at 8.2 percent. Gold Creek, Lower Flint Creek-Gird Creek and Pikes Peak Gulch watersheds have 2.5, 4.1 and 1.5 percent of areas involved in past treatments, respectively. Barnes Creek, Clark Fork River-Dunkleberg Creek and Clark Fork River-Perkins Creek all have less than 1 percent of watershed areas involved with past vegetative treatments.

Currently, tree mortality in watersheds affected by mountain pine beetle ranges from 6 trees per acre at Gold Creek watershed, to up to 310 trees per acre for Lower Flint Creek-Gird Creek watershed. This has led to scattered mortality of overstory trees in some areas (Gump 2011). Currently, 100 percent of the lodgepole pine stands with trees greater than 5 inches diameter at breast height (d.b.h.) in the Flint Foothills watersheds have been affected by the mountain pine beetle, causing extensive tree mortality (Vegetation section).

Water Quality (Issue)

Total Maximum Daily Loads (TMDLs)

Water quality is defined by the level of impairment of designated beneficial uses for a given stream drainage. Designated beneficial uses are defined under Title 17, Chapter 30, and Subchapter 6: “Surface Water Quality Standards” in the Administrative Rules of Montana (ARM) (State of Montana, 2010a).

The waters within the proposed project boundary are classified as B-1 waters (State of Montana 2010a). Water classified B-1 is suitable for drinking, culinary and food processing purposes, and after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

For all streams, the State of Montana requires that "land management activities refrain from generating pollutants in excess of those that are naturally occurring. Naturally occurring' is defined by the Administrative Rules of Montana as that water quality condition resulting from runoff or percolation over which man has no control or from developed lands where all 'reasonable' land, soil and water conservation practices have been applied." Compliance with Montana water quality law requires: (1) BMPs or project design features are applied, (2) Beneficial uses are not impaired, and (3) Monitoring takes place to test whether BMPs are protecting beneficial uses.

Streams found to be impaired—not fully meeting water quality standards or threatened—likely to violate standards in the near future—are compiled with the State’s water quality standards, which are listed every two years in the report required by Section 305(b) of the Clean Water Act. Impaired waters are often referred to as “water quality limited” (WQL) and are identified in the “303(d) list”.

The 2011 GIS layer for 303(d) streams in Montana indicates that there are 16.2 miles of water quality limited (WQL) streams within the project boundary including Barnes Creek, Dunkleberg Creek, North Fork Douglas and Douglas Creeks and Gold Creek. Table 75 describes what is limiting water quality for these streams. Note that impairments in Dunkelberg, NF Douglas and Gold Creeks are associated with heavy metals from mining or nutrients. Metals concentrations or nutrients in project streams will not be affected by this project and will not be addressed in the subsequent analysis.

Table 75. Summary of 303(d) listed streams in project area and beneficial uses not met by streams

303(d) Listed Stream	Reason Stream is Listed	Beneficial Use Not Met
Barnes Creek (headwaters to mouth (Flint Creek))	Sediment, Nutrients, Iron	Drinking Water Aquatic Life-Cold Water Fishery Primary Contact Recreation Industrial Agricultural
Dunkleberg Creek (Headwaters to T9N,R21W, S2 SW)	Heavy Metals, Nutrients	Drinking Water Aquatic Life-Cold Water Fishery Primary Contact Recreation
Douglas Creek (Confluence of Middle and South	Nutrients, Stream Substrate	Aquatic Life-Coldwater Fishery

303(d) Listed Stream	Reason Stream is Listed	Beneficial Use Not Met
Forks to mouth-Flint Creek/T9N,R13W, S10)		
North Fork Douglas Creek (Headwaters to mouth of Middle Fork Douglas Creek)	Heavy Metals	Drinking Water Aquatic Life- Cold Water Fishery Primary Contact Recreation Agricultural
Gold Creek (Headwaters to National Forest Boundary)	Heavy Metals, Nutrients, Low Flow Alterations	Drinking Water Aquatic Life-Coldwater Fishery

303(d) listed streams must be scheduled for development of water quality improvement strategies. These strategies are in the form of total maximum daily loads, or TMDLs intended to define the quantity of pollutants that may be delivered to a water body without violating water quality standards. In practice, they are plans to improve water quality in a listed water body until water quality standards are met (i.e., until designated uses are fully supported).

Currently there is a draft TMDL in place for the Flint Creek drainage. The Draft Flint Creek Planning Area Sediment and Metals TMDLs and Framework Water Quality Improvement Plan (Montana 2012) include target pollutant allocations for streams in the project area. Barnes Creek, a tributary to Flint Creek, is the only stream in the project area impaired for sediment (table 76). The sediment load allocation for Barnes Creek under the draft TMDL totals 461 tons/year, and allows for 1 ton of sediment to be delivered to the channel from all roads (table 76). This represents an estimate of the sediment expected to be delivered under all reasonable land, soil, and water conservation practices and natural conditions.

Table 76. Sediment TMDL load allocations for Barnes Creek

Barnes Creek Sediment TMDL Load Allocations			
Sediment Sources	**Current Estimated Load (Tons/Year)**	**Sediment Load Allocation (Tons/Year)**	**Sediment Load Allocation – Expressed as Percent Reduction**
Bank erosion	409	186	55%
Roads	3	1	79%
Upland load	635	275	57%
Total sediment load	**1,047**	**461**	**56%**

The road sediment allocation in the TMDL represents a gross estimate of the sediment load once road BMPs are applied. The TMDL assumes sedimentation from road treads, cutslopes, and fillslopes will be reduced to 100 feet on each side of a crossing, once BMPs are applied. This distance is not a formal goal at every crossing. For example, many roads may easily allow for a smaller contributing length, while others may not be able to meet a 100-foot goal. Achieving this reduction in sediment loading from roads may occur through a combination of methods.

Project Area Roads (Haul Routes) and Sediment

Existing roads within the analysis area provide the benefit of access for management activities

and public use including recreation, but can also have adverse impacts to the function of the watershed. Existing water quality concerns relevant to the Flint Foothills analysis are primarily the result from sediment delivered from roadways. Factors such as the condition of the road bed and its surface, its proximity to the stream, and the interconnectedness of the road drainage with the stream system can influence sediment delivery from area streams. Roads located along streams in RCAs can pose a higher risk of delivering sediment to streams because there is less travel distance to infiltrate drainage leaving the road or cut- and fill slope surface. Undersized culverts on roads in the project area, while not affecting current water quality, are also a concern in that culvert failure during a large flow event would likely result in the entrainment and deposition of large volumes of sediment within stream channels.

By intercepting subsurface water and routing it to the surface of the road, and through erosion of the road surface and ditch networks, roads can alter physical processes in streams, leading to changes in flow regimes, the movement and storage of sediment, bank stability and substrate composition. These changes can have important biological consequences, affecting all stream ecosystem components (Furniss et al. 1991). The changes also can range from subtle to dramatic, depending on a variety of factors, including the resilience of the watershed to disturbance, weather, traffic patterns, road surfacing material, condition of the road surfacing, condition of the road profile (maintenance), and the interconnectedness of the road drainage with the fluvial system.

Major fish bearing streams in the project area that may have been affected by existing road networks include Dunkleberg Creek, Douglas Creek, SF Douglas Creek, MF Douglas Creek, NF Douglas Creek, Gold Creek, NF Gold Creek, SF Gold Creek, Blum Creek, Crevice Creek, Pikes Peak Creek, and Gird Creek. Refer to figure 41 in the aquatics section for a map of these streams. Roads within each of the watersheds have to some degree contributed sediment to stream channels, and altered hillslope drainage patterns.

Field work in summer 2011 revealed a range of existing road conditions for potential haul routes. Roads in valley bottoms, roads paralleling streams and within 300 feet of a stream, and roads with live stream crossings generally pose the highest risk of contributing road-derived sediment. A road sediment survey was conducted for the project area watersheds to evaluate existing rates of sedimentation. The survey identified existing road segments that were hydrologically linked to stream channels, with a focus on areas where roads crossed streams, and thus had the potential to deliver sediment to channels during runoff events. These areas are summarized in detail in table 77. Observed problems with roads usually involved poor drainage and erosion of the road surface.

Road maintenance activities would include surface blading, vegetation removal, minor slump repair (5 cubic yards or less) and drainage structure cleaning, and installation. Reconstruction activities would include the previous items as well as more significant roadway realignment, embankment and slump repair over 5 cubic yards, curve widening, subgrade boulder or cobble excavation and removal, and upgrades to accommodate safe timber haul. Refer to figure 5 in chapter 2 for a map of the road system in the project area. Specific road maintenance and reconstruction activities for each road used as a haul route are identified in appendix A of the transportation report in the project file.

Existing Sedimentation from Roads: WEPP Roads

Road segments that are hydrologically linked to stream channels and thus have the potential to deliver sediment to channels during runoff events were identified in the sediment source survey. Existing road segments identified in the survey were modeled using the WEPP Roads model

(Elliot et al.1999). The model's output consists of predicted annual average sediment yield from the road prism, in terms of pounds per year, based on site-specific climate data and road characteristics. The model estimated an annual average sediment delivery to project streams under existing, current conditions. Results of modeling are presented in table 77.

The concept of an existing, current average annual sediment load is somewhat misleading in that sediment delivery varies widely from year to year based mainly on runoff variability. In WEPP, the average annual sediment load value is calculated based on a 2-year-return-interval runoff event—there is an equal probability that the sedimentation could be greater or less than this value.

Comprehensive sediment management begins by identifying the existing primary sources of sediment and developing a strategy that preferably minimizes or eliminates sources of sediment or the erosive action in the first place. This can be accomplished by first reviewing all existing road segments posing sediment delivery risk to the stream system, planning preventive measures that reduce or eliminate road-derived sediment, and then implementing those measures. Identification of major sediment delivery sources to streams on many roads in the Flint Foothills Project area have been identified in table 77.

Table 77. Summary of existing current road conditions and problem areas, with existing sediment yield estimated with Road WEPP at road/stream crossings

Road Number	Comments	Sediment (lbs./year)
5167	Pike Peak Ck drainage Rutted in spots, needs improved drainage to route water onto hillside, and needs surfacing all along steeper uphill section. **Not considered a sediment source to nearby streams**	-
636	Gold Ck Drainage Parallels an intermittent drainage Possible sediment source at stream crossings	117
636	Davidson Ck- Crossing to hillcrest. Gullies were observed in road surface. Road parallels Davidson Ck in places, sediment source at stream crossings	543
78473	Mostly good condition**, Not considered a sediment source.**	-
78472	78472 road adjacent to unit 16P had poor drainage. This is a naturally wet area and streamflow and sediment source area.	538
636 Rd South Fork Gold Creek Crossing near unit 45S	North side of channel has drainage problems, rutting down road.	186
NFS road 8615 into unit 8B	Intermittent drainage through unit is a sediment source to stream	26
Access road to units 40S, 39S off NFS road 636	Wet area along road needs drainage improvement- potential sediment source. Currently not a sediment source.	–
1557	Along Gold Creek, stable, no sediment source at stream crossing	-

Road Number	Comments	Sediment (lbs./year)
636	North Gold Creek Sediment source at stream crossing	123
1557	Crevice Ck- Possible undersized culvert and sediment source	387
1557 Rd, spur to Unit 16S, 64S, (8464 road)	Dunkleberg Creek- Very wet area and stream flow source areas- Road is overgrown, and culverts have been pulled- needs total re-build. Currently not a sediment source	-
1557 road Blum Ck area	Road through unit 11p has rutting problems from poor drainage. Crossing over an intermittent drainage within unit 11P needs surfacing. Currently not a sediment source.	-
NFS road 5151 into unit 64C	Needs surface blading in spots, especially within unit 64C. Roads are currently overgrown with grasses. Currently not a sediment source	-
NFS road 1557 near unit 10P	Rills in road, potential sediment source	403
Stream crossing nr. Rd 78461/636 Intersection Intermittent drainage	Potential sediment source, recommend slash windrows along fill downstream side, potential sed. source	438

*From WEPP Modeling

Sediment from Past Harvest

Vegetation has recovered in past harvest areas; outside of access roads, these areas were not observed to be active sediment sources.

Stream Temperatures

Stream temperatures have the potential to be affected from removal of trees adjacent to stream channels. Currently there are no documented concerns with stream temperatures for streams within the project area.

Water Quantity and Channel Stability (Issue)

Stream flows, or water quantity as it relates to effects on channels, is an important variable in the project area. Increased streamflows can change channel morphology, leading to channel and bank instability, stream sedimentation and water quality impairments. A review of the U.S. Geological Survey Water Information System Mapper indicates that there are no U.S. Geological Survey (U.S.G.S) stream gaging stations within the project area.

In the Pintler Range, flows generally peak in the spring due to snow melt and rain on snow events. Low base flows typically occur in the summer as temperatures increase and continue on into winter when temperatures decrease, and precipitation tends to occur as snowfall. Smaller peak flows may be observed in streams during the summer if convective thunderstorms occur and are associated with higher amounts of rainfall.

Past forest harvest in the project watersheds has not likely lead to measureable changes in stream flow amounts and total water yield in the project area because it was limited in extent to under 20 percent of each watershed**.** Peer-reviewed research has suggested that in areas such as the project area, roughly 20 to 30 percent of a watershed must be treated in order to begin to attain a statistically significant increase in streamflow (MacDonald and Stednick 2003). Hydrologic recovery is the process that takes place mainly as a result of vegetative re-growth where the flow or runoff patterns from watersheds return to pre-disturbance conditions after a disturbance such as forest harvest or beetle kill.

Past forest harvest in the project watersheds was limited to less than 10 percent of each watershed on National Forest System lands. Harvest has also occurred on private lands within the project area; when added to the percent watershed harvested amounts shown in table 6 the past harvest would not appreciably increase changes in percent watershed harvested values. Private lands total 7,512 acres within the project area. Currently, harvest on private inholdings has occurred on approximately 80 percent (about 5,500 acres) of the forested portions. Most of the harvest on private land took place in the 1980s. Not all of the inholdings are forested; about 10 percent are nonforested, dry grassland areas. Private land harvest would have to be extensively recently clearcut in order to increase percent harvest values to amounts needed to begin to see flow increases as a result of the project, and this level of harvest was not observed on private lands adjacent to the project area within the project watersheds.

Table 78 summarizes the percent of acres treated in the past for each of the 6th field watersheds. The highest value is Douglas Creek at 8.2 percent. Full vegetation recovery from re-growth of vegetation treatments is assumed at 30 years for stand clearcuts (Gump 2011). For the project area, past clearcut treatments are assumed to be fully recovered or almost fully recovered since many of these treatments took place in the 1980s and 1990s. Recent clearcuts, within the last ten years, have taken place in the project area, but they represent small acreage percentages, and do not appreciably affect watershed percent harvest. Some broadcast and underburning has occurred as part of past projects. Vegetative recovery for broadcast and underburning is considered 1 to 2 years (Gump 2011) and past impacts are considered to be recovered.

Table 78. Percent of each of 6th level watershed treated, 1959-2011, National Forest System lands.

6th level Watershed	Total Percent of Watershed Treated
Douglas Creek	8.2 percent
Lower Flint Creek-Gird Creek	4.1 percent
Gold Creek	2.5 percent
Pike Peaks Gulch	1.5 percent
Barnes Creek	Less than 1 percent
Clark-Fork Dunkelberg Creek	Less than 1 percent
Clark Fork River-Perkins Creek	Less than 1 percent

According to the Draft Flint Creek Planning Area Sediment and Metals TMDLs and Framework Water Quality Improvement Plan (Montana 2012) timber harvest should not increase the peak water yield by more than 10 percent of historic conditions. If a natural disturbance, such as a forest fire or beetle kill, increases peak water yield, the increase should be accounted for as part of timber harvest management.

Numerous studies have been done on water yield and streamflow changes after forest harvest. In a review and summary of the short-term effects of forest harvest in the United States and other countries, Hibbert (1967) concluded that a "reduction of forest cover increased water yield," but the "response to treatment is highly variable, and for the most part, unpredictable." He also found that, in general, the increases in streamflow and water yield decreased over time as vegetation re-grew. In a later review, Bosch and Hewlett (1982) analyzed an additional 55 studies and concluded that increased streamflow is caused by a decrease in forest cover, and that the decrease correlated with the amount of the forest overstory canopy removed. Streamflow increases were highest in areas with greater amounts of mean annual precipitation, and were generally short-lived as vegetation re-grew.

Observed changes in the water yield after forest removal in snowmelt-dominated areas in the intermountain west are due to both a decrease in winter interception and a reduction in growing season soil moisture depletion (Potts 1984; Troendle 1987). In the upper part of project subwatersheds, precipitation accumulates over the winter as snow pack, with minimal melt over this accumulation period. When the snowpack begins to melt in spring, the melt water first recharges the soil by replacing the water depleted during the previous growing season. Once soil moisture storage is filled, the excess meltwater is available to become streamflow. Paired watershed studies have shown that approximately 30 percent of the increase in water yield can be attributed to the decrease in interception and resultant increased amount of water contained in the snowpack. The reduced evapotranspiration during the previous summer also reduces the amount of meltwater needed for soil moisture recharge. This process accounts for approximately 50 percent of the increase in water yield. The remaining 20 percent of the observed increase in water yield results from the reduction in evapotranspiration losses during April and May (Troendle and King 1985).

Total water yield increase from project watersheds is not expected due to beetle killed trees. Beetle killed tree mortality in lodgepole pine and other species may have led to the reduction of overstory trees This may have led to slight increases in snowpack accumulation (up to 15 percent greater) in some areas, with slightly earlier snowmelt runoff (Pugh and Small 2011) by up to a week. Younger lodgepole pine trees less than 5 inches d.b.h. largely remain unaffected by insect mortality. As trees lose their needles, slight increases in water availability may occur due to lower amounts of evapotranspiration compared to a fully forested condition. These increases may be offset, however, by existing understory vegetation that is released by overstory mortality.

Riparian Areas and Riparian Conservation Areas

GIS data on riparian areas within the project area and the forest is limited. There is a "modeled" riparian GIS layer. In this layer the presence of riparian vegetation is projected based on slope, aspect, and the use of Digital Elevation Model (DEMs) and a portion of the National Wetlands Inventory (NWI) wetlands layer.

Riparian Conservation Areas (RCAs) are the portions of watersheds where riparian-dependent resources receive primary emphasis. RCA definitions, goals, objectives and standards are defined in the Forest Plan. In RCAs, management activities are subject to specific standards and guidelines. The Forest Plan (p. 300) defines RCAs as, "300 feet from perennial streams and 50 feet from intermittent streams" (USDA Forest Service 2009). There are many acres of intermittent and perennial RCAs in the project watersheds. These areas act as filters to appreciably reduce the risk of sediment delivery to streams, provide a source of large woody debris for channels, and help maintain cooler stream temperatures.

Wetlands and Floodplains (Issue)

Wetlands

No wetlands or springs were observed within proposed project units. Springs and seeps were observed throughout the project area. Usually springs and seeps are associated with headwater areas of streams. National Forest System road 636 between South and North Gold creeks has a high density of springs. This is a north aspect slope. These springs are an issue because of the need to maintain the NFS 636 Road as a haul road for the project. The National Wetlands Inventory (NWI) database helped to determine the presence of wetlands within the project area. This data is summarized in the hydrology report in the project file.

Floodplains

A floodplain is flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but do not experience a strong current (http://en.wikipedia.org/wiki/Floodplain). Narrow floodplains exist along stream channels in the project area.

Desired Condition

Forest Plan

Forest Plan direction for hydrologic resources that are applicable to this project are listed below.

Forestwide Goals for Aquatic Resources

Watersheds: Watersheds are maintained to ensure water quality, timing of runoff, and water yields necessary for functioning riparian, aquatic ecosystems, wetlands, and to support native aquatic species reproduction and survival. Watershed restoration projects promote long-term ecological integrity of ecosystems, conserve genetic integrity of native species, and contribute to attainment of desired stream function and support beneficial uses (IN 1).

Total Maximum Daily Loads (TMDLs): Management actions are consistent with TMDLs. Where waters are listed as impaired and TMDLs and Water Quality Restoration Plans are not yet established, management actions do not further degrade waters. Water quality restoration supports beneficial uses.

Stream Channels: Stream channel attributes and processes are maintained and restored to sustain natural desired riparian, wetland, and aquatic habitats and keep sediment regimes as close as possible to those with which riparian and aquatic ecosystems developed (IN 2).

Instream Flows: Instream flows are secured to support functioning riparian and aquatic habitats, stable and effective stream function, and ability to route flood discharges (IN 3).

Floodplains: The condition of floodplains, channels and water tables are maintained and restored to dissipate floods and sustain the natural timing and variability of water levels in riparian, wetland, meadow and aquatic habitats (IN 4).

Riparian Areas: Riparian habitat, species composition, and structural diversity of native and desired nonnative riparian plant communities are maintained or restored to (IN 5-6):

- Provide an amount and distribution of woody debris characteristic of functioning aquatic and riparian ecosystems
- Provide adequate summer and winter thermal regulation for streams to support beneficial uses
- Provide bank stability to maintain rates of surface erosion, bank erosion, and channel migration which are characteristic of functioning aquatic and riparian ecosystems
- Effectively trap and store sediment, build stream banks and floodplains, and promote recovery after watershed disturbance

Riparian Habitat: Habitat to support viable, well-distributed populations of native and desired nonnative plant, invertebrate, and vertebrate aquatic- and riparian-dependent species are maintained or restored. Movement corridors within and between watersheds, where desired, are maintained or restored to provide aquatic-dependent species' habitat needs and maintenance of metapopulations (IN 8).

Riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region are maintained or restored (IN 7).

Channel Integrity: Stream channel function and water quality are maintained or restored to support designated beneficial uses on all reaches through management decisions, restoration projects or best management practices as outlined in the Soil & Water Conservation Practices Handbook(1988).

Roads: Roads are designed, constructed, and maintained to meet desired stream function and avoid adverse effects to native fish and sensitive aquatic species (RF 2).

Stream Crossings: Culverts, bridges, and other stream crossings can accommodate a 100-year flood, including associated bedload and debris (RF 4).

Forestwide Objectives

TMDLs: Cooperate with the state, tribal, and other agencies and organizations to develop and implement total maximum daily loads (TMDLs) and their implementation plans for 303(d) impaired water bodies influenced by National Forest System lands.

Road Drainage: Reconstruct road and drainage features that do not meet design criteria or operation and maintenance standards, or are proven less effective for controlling sediment delivery, or retard attainment of desired stream function, or increase sedimentation in Fish or Restoration Key Watersheds (RF 3a).

Roads: Close and stabilize or obliterate and stabilize roads not needed for future management activities (RF 3c).

Forestwide Standards

Standard 1: Riparian Conservation Area (RCA) -1 Any activity in RCAs shall be designed to enhance, restore, or maintain the physical and biological characteristics of the RCA by implementing the following requirements.

> Activities in RCAs, that meet or exceed RMOs, must be designed to maintain existing stream function.

Activities in RCAs that are not meeting RMOs shall include a restoration component, commensurate with the scope of the activity affecting the fishery, which trends towards accomplishing desired stream function, as part of the project.

Activities in RCAs shall not result in long-term degradation to aquatic conditions. Limited short-term effects from activities in the RCA may be acceptable when outweighed by the long-term benefits to the RCA and aquatic resources.

Standard 25: Project related storage of fuels and toxicants within Riparian Conservation Areas is prohibited. Refueling within Riparian Conservation Areas is prohibited except for emergency situations, in which case refueling sites must have an approved spill containment plan (RA-4).

Existing Laws, Regulations, Executive Orders and Memorandum of Understanding

Federal Laws and Executive Orders Relating to Water Quality

Federal laws that govern federal actions with potential to affect water quality and quantity include the Clean Water Act, the Organic Act of 1897, the Multiple Use-Sustained Yield Act, the National Environmental Policy Act, the Forest and Rangeland Renewable Resources Act and the National Forest Management Act.

Executive Order 11988, Floodplain Management

This Executive Order requires that agencies avoid, to the extent possible, adverse impacts associated with occupancy and modification of floodplains. It applies to all floodplain locations, as a minimum to areas in the 100-year, or base, floodplain.

Executive Order 11990, Protection of Wetlands

This Executive Order states that agencies shall minimize destruction, loss, or degradation of wetlands and shall preserve and enhance their natural and beneficial values. Agencies are to avoid construction in wetlands unless it is determined that there is no practicable alternative and that all practicable measures are taken to minimize harm to wetlands

Montana Laws and MOU Relating to Water Quality and Quantity

The following Montana Code Title 75: Environmental Protection, Chapter Five: Water Quality (http://data.opi.mt.gov/bills/mca_toc/75_5_1.htm) and Montana Administrative Rules of the State of Montana (ARM).

Memorandum of Understanding

Montana ARM 16.20.603 states that there is a Memorandum of Understanding (MOU) between the State of Montana and the Forest Service, which states that the Forest Service will use best management practices, or BMPs, to deal with preventing or mitigating non-point source pollution

Details from the Clean Water Act, the National Forest Management Act, and applicable State of Montana regulations are provided in the hydrology report in the project record.

Forest Service Manuals and Handbooks

Forest Service Manual, Water Resources Management, sections 2532.02, 2532.03

Sections 2532.02 and 2532.03 of the Manual describe the objectives and policies relevant to protection (and, where needed, improvement) of water quality on National Forest System lands so that designated beneficial uses are protected. Guidelines for data collection activities (inventory and monitoring) are also described.

Forest Service Handbook 2500

This handbook states policy and direction regarding watershed management.

Forest Service Handbook 2509.22 Soil and Water Conservation Handbook

Provides a non-point source management strategy to develop site-specific conservation practices for activities on national Forest System lands to minimize effects on soil and water resources and protect water-related beneficial uses.

Environmental Consequences

Methodology

Field work was conducted to assess stream channel flow characteristics (perennial, intermittent, or ephemeral), presence or absence of wetlands and overall watershed condition, and to examine these characteristics relative to the location of the proposed action. In addition to field data, best available science, literature reviews, Forest monitoring reports, geographical information system (GIS) data, and professional judgment were also used to support report conclusions.

Field reconnaissance for hydrologic resources was conducted in August 2011 to evaluate existing watershed conditions and the potential effects to these resources related to the proposed action. Proper functioning condition data was noted for several of the stream drainages that were visited. This information is provided in hydrology report in the project file.

The WEPP Road model was used to predict sediment transport from roads to stream channels. The Disturbed land WEPP model was also used to evaluate hillslope erosion (Soils section). Input data used to run these models were collected in the field during sediment surveys. The physical basis and performance of the WEPP models is discussed in the model documentation (Elliot et al. 1999, 2000) as well as several peer-reviewed papers (e.g. Larsen and MacDonald 2007; Laflen et al. 2004; Elliott 2004). In general, erosion prediction models have limited precision predicting sediment from a road, hillslope, or watershed at time scales useful to land managers. This is due mainly to a high degree of variability in site characteristics and in climatic variables. An average erosion/sediment delivery rate prediction can encompass this variability to some degree, although this value becomes much more useful when combined with a predicted probability that erosion will occur. The WEPP models incorporate climate data tailored to the individual site using PRISM data (Daly et al. 2001) and simulates daily events for a number of years specified by the user (30 years in this analysis) to determine the probability of sediment leaving the unit. The model incorporates individual precipitation event characteristics and antecedent conditions as well as site characteristics into its prediction of average annual runoff, erosion, and sediment yield values.

Spatial and Temporal Context for Effects Analysis

The spatial boundary for cumulative, direct and indirect effects is delineated by the 6th-level watersheds within the project boundary. The project boundary is an appropriate scale for determining potential effects. If larger scales were used for either direct, indirect or cumulative

effects, the amount of area involved would be too large compared to the project scale and effects would appear diminished.

Two levels of temporal context are discussed in the effects analysis. The time frame for short-term effects unless defined otherwise is assumed to be less than 3 years and long term is defined as greater than 3 years. These time frames are based on best professional judgment.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

A watershed cumulative impact can be defined as the total impact, on runoff, erosion, sediment or water yield, riparian areas and/or water quality that result from the incremental impact of a proposed action, when added to other past, present and reasonably foreseeable future actions occurring within the same natural drainage basin, or watershed (CEQ 1997).

Past activities or disturbance within the watersheds include beetle killed trees, grazing, mining, road construction and maintenance, and vegetation treatments. Past, present and reasonably foreseeable vegetation treatments are summarized in table 23 in the DEIS.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Since no activities are proposed in alternative 1, there would be no direct effects to water quality, water quantity and channel stability, or wetlands and floodplains from this alternative. No indirect impacts to floodplains or wetlands would occur; and wetlands and streams would continue to be protected by RCAs under this alternative. Vegetation recovery in areas harvested in the past would continue to recover leading to hydrologic recovery within project watersheds.

The effects of the no-action alternative would be consistent with the goals and objectives of TMDL water quality planning efforts in the project area; however, would do nothing to reduce sediment and improve water quality in the project area.

Present conditions and trends for water quality, water quantity, riparian areas, floodplain and flood-prone areas, and stream channels would continue. Roads with poor drainage may continue to be a source of sediment and runoff to streams, adding to sedimentation from past, future and other existing sources in project watersheds, including recreation, livestock grazing and mining.

Flood repairs after the 2011 spring runoff would occur with a focus on the Douglas Creek watershed in 2012 or 2013. This work would consist of bridge and culvert repair, and road surfacing. This effort would be a beneficial effect in the long run to stream water quality because of reduced risk of crossing failure. Ongoing scheduled maintenance would also reduce sediment and contribute to increased water quality.

The storm-damage road repairs scheduled for reclamation and mine-waste removal at the Forest Rose Mine and Mill CERCLA Project, scheduled for July 2012 would improve water quality in Dunkleberg Creek.

Beetle killed tree mortality in lodgepole pine and other species may lead to the reduction of overstory trees, though overall a recovery of hydrologic flow regimes due to continued vegetative recover would be expected.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Measurement Indicators

Issue - Water Quality

Indicator- Changes in sediment delivery.

Measure- Consistency of the project with total maximum daily loads (TMDLs)

The effects of this project would be consistent with the goals and objectives of TMDL water quality planning efforts in the project area. Water quality impaired TMDL and 303(d)-listed streams would be protected because best management practices, project design features, and required RCA stream buffers would be implemented. Target values for road and upland sediment sources for Barnes Creek specified in the Draft Flint Creek Planning Area Sediment and Metals TMDLs and Framework Water Quality Improvement Plan (Montana 2012, table 2) would not be exceeded because 1.1 percent of the lands within the Barnes Creek watershed would be harvested under this alternative (table 81). There are no haul route stream crossings proposed in this watershed that could act to deliver sediment to Barnes Creek. Effective water quality project design feature such as BMPs (available in the project file) would be in place to address sediment generated from project activities and haul roads. Long-term indirect effects to water quality would not be expected. Water quality beneficial uses would not be impaired.

Measure- Changes in sediment delivery to streams and sedimentation rates based on WEPP Road model and sedimentation risk from haul routes

WEPP Road Model

For haul routes, the Road WEPP model (an erosion prediction program) was used to estimate potential annual sediment generation at sediment source areas for nine stream crossings on project haul routes within the Gold Creek watershed. Active sediment source areas were not identified at stream crossings in other watersheds within the project area. Additional sediment source areas may exist at stream crossings at areas that were not accessible during field surveys. With the application of BMPs and road improvements planned for this project all sediment source areas associated with stream crossings should see a reduction similar to those observed for stream crossings shown in table 79 for sites in the Gold Creek watershed.

Modeled stream crossings are located on the National Forest System road (NFSR) network used to access treatment areas for both action alternatives. In alternative 2, 68 miles of NFS roads would be used to access treatments areas. In modeling, three scenarios were evaluated: current traffic levels, high traffic levels which would occur during project implementation and high traffic levels with a gravel or native surface. Road measurement data collected during field surveys in the summer of 2011 were incorporated into the Road WEPP model. Modeled road segments included up to several hundred feet of road leading to channel crossings. Using guidelines suggested by Elliott et al. (1999), current traffic levels are considered low and traffic levels during project implementation would be considered high. A graveled or native surface with a soil texture of silt loam was mostly used during modeling for the existing condition and for the high traffic levels. Road WEPP modeling results are displayed in table 79.

Table 79. Road WEPP modeling results for alternatives 2 for project major haul routes stream crossings within the Gold Creek watershed

Site	Existing Average annual sediment (lb.)	Average annual sediment during project (lb.) BMPs in place*	Post-Project Average annual sediment (lb.) BMPs in place*
NFSR 636 @ Gold Creek	117	117	96
NFSR 636 uphill of Davidson Ck stream crossing	543	565	441
NFSR 78472 adjacent to unit 16P(un-named trib. to Gold Creek))	538	286	97
NFSR 636 S. Fork Gold Ck crossing nr unit 45S	186	186	145
NFSR 8615 into unit 8B (un-named trib. to Blum Ck)	26	32	15
NFSR 636 @ N. Gold Ck crossing	123	123	123
NFSR 1557 @ Crevice Creek crossing	387	316	137
NFSR 1557 near unit 10P (un-named trib. to N. Gold Ck)	403	316	316
NFSRs 78461/636 jct. Intermittent stream crossing	438	204	89
Total Sediment Delivered to Streams (pounds)	**2,761**	**2,145**	**1,459**

* BMPs consist of a variety of road maintenance improvements and reconstruction actions based on local conditions and include project design features. The proposed actions are identified in appendix a of the Transportation report in the project file.

WEPP modeling shows that sediment erosion and delivery is possible from roads used for the project, as shown for segments leading to stream crossings. Road WEPP analysis indicates that under current traffic conditions sediment production ranged from 26 pounds to 543 pounds for project road-stream crossings. Results of model runs for sediment produced during the project range from 32 pounds for the NFS 8615 road accessing unit 8B, to 565 pounds for the NFS 636 road upstream of Davidson Creek (table 79). Comparison of before, during and after project sediment values indicates that there would likely be an overall decrease in sediment during and after the project from roads. This is a result of implementation of road sediment reduction BMP upgrades or road reconstruction for improved drainage. Sediment reduction methods at road crossings would also include placing slash windrow, or equivalent methods, at runoff points at stream crossings. This was not modeled, but would further reduce sediment both during and after the project. Monitoring on National Forest System lands has shown up to 85 percent reduction in sediment delivery to streams from the use of slash windrows (Seyedbagheri 1996).

The results from WEPP modeling are comparable to measurements of road sediment in field studies and the level of sedimentation is positively correlated to higher traffic volume (Bilby et al. 1989; Luce and Black 1999; Forsyth et al. 2005). These same studies all show that the largest proportion, up to 80 percent of sediment from roads is very fine-grain, suspendable material (0.005-0.02 mm); (Bilby et al. 1989; Luce and Black 1999; Forsyth et al. 2005), probably created

by the action of tires grinding on road particles. Particles in this size class would be suspended in running water and probably only filtered out through infiltration into soil (Bilby et al. 1989).

Increases in traffic levels from project activities would most likely occur during the dry season, when the precipitation is low. Western Montana is characterized by a semi-arid climate with dry summers, which limits erosion potential during the dry season (Sugden and Woods 2007). Several studies (Bilby et al. 1989; Forsyth et al. 2005 Sheridan et al. 2006) document that sediment production is greatest early in the wet season following high traffic dry season, or from any storm with measureable runoff following a substantial period of dryness.

Roads that were modeled for sediment production are summarized with specific project design features for maintenance or to address sediment concerns. This information is provided in the hydrology report in the project record (table 6). In addition, slash filter windrows or equivalent methods are recommended for all stream crossings, and are included in the project design features.

All roads in the forest are a significant source of sediment that can be successfully mitigated through the use of best management practices (Burroughs and King 1989). Best management practices and project design features would be employed to reduce sediment from all roads used for this project. The effectiveness of BMPs in controlling sediment on National Forest System land has been documented (Burroughs and King 1989, Montana 2008). The State of Montana's 2008 Forestry Best Management Practices Monitoring BMP Audit Report conducted BMP monitoring on seven Forest Service sites and one Bureau of Land Management site. These sites are referred to in the report as "Federal" sites. Overall, 96 percent of the BMPs were rated as "meets or exceeds", meaning that they were implemented correctly for Federal sites. The overall rating for effectiveness of BMPs on Federal sites was 96 percent, which meant that adequate protection was provided. BMPs that were applied where there was a great risk of impacting water quality were also evaluated separately and were labeled "high risk BMPs". For Federal sites, these BMPs were applied and 89 percent of the practices rated "meets or exceeds" for implementation. For effectiveness of these BMPs, 91 percent of the applied BMPs were rated as providing adequate protection. The effectiveness of streamside management zones, which function in part as buffer strips, was rated as 97 percent effective (Montana 2008).

Sedimentation Risk from Haul Routes

Road maintenance and reconstruction on haul routes, including 10.6 miles within RCAs for perennial and intermittent streams, would be completed, improving the function of water and sediment control measures such as road crowning, condition of ditches, ditch blocks and rolling dips, and culvert function. This action would further reduce the amount of sediment being introduced into streams, as well as the amount of water from road-surface runoff. Reconstruction includes existing 4.4 miles of existing open and closed unauthorized routes. Some of these existing routes are in poor condition as a result of no maintenance or BMP implementation, and could be an on-going sediment source to streams, while other unauthorized routes are overgrown or stable and not considered sediment sources. Reconstruction of these routes would lead to an overall reduction in potential sedimentation, because as a result, many of these roads would show improved drainage. After vegetation treatments, unauthorized routes would be decommissioned. Specific decommissioning treatments are specified table 5 in chapter 2, and range from closure with a sign or berm and natural revegetation to blocking access and recontouring drainages.

Road maintenance-related upgraded BMPs would help to reduce the amount of generated sediment, but not completely eliminate the risk of sediment delivery. Although some short-term

water quality indirect effects such as local erosion and sedimentation may occur immediately after road maintenance, with the implementation of BMPs the amount of sediment would be minimal and not be expected to modify water quality, stream channel morphology or stability.

Miles of proposed haul routes were determined in select drainages of major project streams. Stream crossings, proposed new temporary and proposed National Forest Systems roads within 300 feet of streams were also calculated (table 80).

The highest risk of sediment delivery under alternative 2 to these streams would be from new road construction within RCAs, including proposed temporary and NFS road construction, followed by drainages with the highest number of stream crossings. New road construction exposes soil and may increase erosion and sediment delivery to streams, especially when located in RCAs. Existing haul road mileages were highest in the Gold Creek drainage, and within that drainage were highest in the North Fork sub-drainage. North Fork Gold creek under alternative 2 would have three major haul route stream crossings, and 0.3 miles of new road construction within 300 feet of streams. Gold Creek drainage is probably the highest risk area for potential sediment delivery to streams overall from haul roads within the project area.

The highest risk of sedimentation from new road construction in RCAs would occur in North Fork Gold Creek. The highest number of haul-route stream crossings would occur in Dunkleberg Creek, Blum Creek and the Douglas Creek drainages. For drainages with stream crossings, highly effective BMPs such as slash windrows would be used to reduce the potential for sediment delivery to streams. Where construction of new roads within 300 feet of streams will occur, BMPs designed to help avoid impacts to water quality including sediment delivery to streams will be used to reduce short- and long-term impacts. Short-term risks and impacts for new road construction would be ground-disturbance and soil compaction that could lead to indirect effects such as soil erosion. Long-term impacts once roads are constructed would be potential road drainage problems.

Table 80. Alternative 2-miles of haul routes, temporary roads, and proposed temporary or new NFS roads, and number of stream crossings within 300 feet of selected streams

Streams	Haul Routes (miles)	Haul Routes in RCAs (miles)	Temporary Roads Including newly constructed and unauthorized routes (miles)	Haul Route Major Stream Crossings	Proposed Temporary or new NFS roads within 300 ft. of streams (miles)	Notes
Dunkleberg Creek	7.9	0.6	0.9	6	0.1	Temporary road has two major stream crossings in trib. to Dunkleberg Ck.
Douglas Creek Mainstem	4.8	0.0	0.7	0	0.0	Sediment deposits observed from 2011 flooding from road washout in N. Fk. Douglas Creek.
South Fk Douglas Creek	1.1	0.6	0.0	1	0.0	

Streams	Haul Routes (miles)	Haul Routes in RCAs (miles)	Temporary Roads Including newly constructed and unauthorized routes (miles)	Haul Route Major Stream Crossings	Proposed Temporary or new NFS roads within 300 ft. of streams (miles)	Notes
Middle Fk. Douglas Creek	0.8	0.8	0.0	1	0.0	
North Fk. Douglas Creek	5.6	2.3	1.8	2	0.0	High sediment from road washout in upper watershed in 2011. Sediment deposits evident downstream.
Gold Creek Mainstem	11.6	1.4	0.0	1	0.0	Gold Creek mainstem is located on private lands.
N. Fk. Gold Creek	14.4	1.0	1.3	3	0.3	This drainage has the highest amount of new road constructed in RCAs.
S. Fk. Gold Creek	1.1	0.3	0.0	1	0.0	
Blum Creek	9.6	0.6	1.4	4	0.0	High numbers of stream crossings, but most are not sediment sources.
Crevice Creek	3.7	1.1	0.2	3	0.0	
Pikes Peak Creek	0.0	0.0	0.0	0	0.0	
Flint Creek Tributary/Gird Creek	5.0	1.9	2.0	2	0.2	Haul road parallels Gird Creek within RCA for 2.3 miles. Temporary road parallels a tributary to Flint Creek for 0.2 miles.

Note- information obtained from estimates based on Proposed Action map

Measure- Changes in sediment from harvest units from Disturbed WEPP

Projected estimates of erosion, based on Disturbed WEPP modeling for each proposed unit, showed no measurable erosion delivered to streams from project units after harvest (Soils section). Probabilities for runoff and sediment delivery range from 0 to 2 percent for each proposed unit (Soils section).

When conducting Disturbed WEPP modeling, the required widths for RCA buffers were included in the modeling. BMP monitoring demonstrates that these buffers are effective in preventing or mitigating the amount of sediment entering a stream (Montana 2008, Schuler and Briggs 2000, Rashin et al. 2006, USDA Forest Service 1999 and 2006).

Measure- Miles of new NFS or temporary road construction

Alternative 2 would construct 7.2 miles of new temporary road and 1.3 mile of new NFS roads. For the Gold Creek watershed, 3.4 miles of new temporary road construction is proposed, 2.9 miles in Lower Flint Creek-Gird Creek watershed, 0.9 miles in Douglas Creek watershed, and 0.3 miles in the Dunkleberg watershed. Proposed NFS and temporary roads outside of RCAs in upland areas would be low-risk for delivering sediment to streams. Miles of new construction in RCAs is discussed in the next section of this report. All newly constructed temporary roads would be decommissioned by obliteration following project implementation. BMPs and project design features for temporary roads should be effective at reducing sediment amounts generated from construction of new temporary roads.

Construction of logging roads exposes soil and increases the susceptibility to erosion and transport of sediment to streams (Kochenderfer et al. 1997; Swift 1985, 1988). The greatest input of sediment from roads generally occurs during construction and active log haul during timber harvest. Sediment erosion and delivery is possible within 1 or 2 years after construction, in areas immediately adjacent to where road construction or road reconstruction activities occurred (Luce and Black 1999, 2001), and during log haul. Longer-term effects (over 3 years after disturbance) such as erosion and delivery of sediment would not be expected for this alternative due to improvements in road drainage and implementation of BMPs during activities and once activities are completed.

Construction of forest roads can be a considerable source of sediment that can be successfully mitigated through the use of best management practices (Burroughs and King 1989) and project design features. Road BMPs would be applied during construction that would reduce, but not completely eliminate the risk of generating sediment. Increases in sediment would be expected to be limited to 1 year or less (Sugden and Woods 2007). Although some short-term water quality indirect effects such as local erosion and sedimentation may occur immediately after temporary road construction and during use, with the implementation of BMPs, the amount of sediment would be minimal and not expected to modify water quality, stream channel morphology or stability.

Measure- Miles of new system or temporary roads within 300 feet of streams

New temporary road construction would take place on 0.2 miles within RCAs in the Lower Flint Creek-Gird Creek watershed, 0.1 miles within RCAs in the Clark Fork Dunkelberg Creek watershed, and 0.3 miles within RCAs in Gold Creek. New temporary road construction near stream channels has the highest risk of delivering sediment to streams because of soil disturbance and displacement. The temporary road segments T3 in unit 55C (Lower Flint Creek-Gird Creek) and T17 leading into unit 23C would have the highest risk of sediment delivery to channels of proposed project temporary roads due to proximity to stream channels.

Temporary roads in RCAs generally pose one of the highest risks of contributing road-derived sediment. BMPs such as waterbars spaced at intervals to divert surface flows on temporary roads would be implemented that would substantially reduce the risk of sediment erosion and delivery to channels.

Although some short-term water quality indirect effects such as local erosion and sedimentation may occur immediately after temporary road construction and during use, with the implementation of BMPs the amount of sediment would be minimal, and not be expected to modify water quality, stream channel morphology or stability.

Measure- New haul route stream crossings and sediment delivery at stream crossings

One new stream crossing would be constructed on a temporary haul route (T3) in Lower Flint Creek-Gird Creek under this alternative. Stream crossings, wetland crossings, and the approaches of roads to these areas are sources of the majority of sediment contribution to streams and wetlands (Swift 1988) especially where BMPs have not been properly applied (Stuart and Edwards 2006). There are numerous existing road stream crossings on proposed log haul routes. WEPP Road modeling results document sediment production from road segments leading to stream crossings. With the implementation of BMPs the amount of sediment would be minimal, and not be expected to modify water quality, stream channel morphology or stability.

Indicator: Stream temperature changes.

Measure – Roads and openings in Riparian Conservation Areas

As stated above, new temporary road construction would take place on 0.2 miles within perennial stream RCAs for Lower Flint Creek-Gird Creek watershed, 0.1 miles within intermittent stream RCAs in the Clark-Fork Dunkelberg Creek watershed, and 0.3 miles within both intermittent and perennial RCAs in Gold Creek. This would lead to a reduction in shade within RCAs. The RCA for perennial streams extends 300 feet on either side of the stream, whereas on intermittent streams the RCA extends 50 feet on either side of the drainage. Proposed RCAs would be sufficient to protect streams from direct beam solar radiation that could lead to stream temperature increases under this alternative. Roads can open streams to direct-beam solar radiation leading to warmer stream temperatures. However, because roads would occupy a small area within the RCA, measurable project road-related impacts to stream temperature from new project haul routes would not be expected from this project.

Issue - Water Quantity and Channel Stability

Indicator- Change in water yield and peak flows resulting in channel changes

In summary, a stream system's channel morphology, including streambed and streambank stability, reflects the existing balance between stream flow, sediment input, and substrate/bank composition. If one of these components varies, there is a corresponding change with the other two. When peak flow is increased, there is an increase in the amount of energy available to transport sediment and erode streambanks. These changes in turn can potentially result in modifications to water quality and aquatic habitat.

For alternative 2, no notable changes in flow volume, or alteration to timing of peak flows would be expected resulting from treating proposed units. As a result, no impacts are expected to occur to channels within the project area.

Measure- Harvested area by 6th field HUC

Potential direct and indirect effects associated with vegetation treatments include a decrease in tree canopy and an associated increase in water available for stream flow. Areas of prescribed fire were not considered to be a significant factor affecting water yield because it will have a limited

effect on overstory vegetation density, and effects of prescribed fire are not included in the calculations.

The amount of harvested ground- or cable-based units have been determined for each watershed for National Forest System lands within the project boundary for this alternative in order to provide information on the percent watershed proposed to be harvested within each watershed (table 81). Harvest has also occurred on private lands adjacent to the National Forest, and mostly occurred in the 1980s, so currently it has a negligible effect on streamflows. Percent harvest information is used to estimate the amount of flow increases in project watersheds as a result of forest clearing, provided in the following "measure" discussion. The largest amount of harvest would occur in Gold Creek with 1317 acres of treatment, and 4.1 percent of the watershed followed by lower Flint Creek-Gird Creek watershed with 550 acres of commercial harvest, or 3.8 percent of the watershed. Other project watershed percent treatments range from 0-2 percent of the watershed areas.

Table 81. Total percent past harvest of project watersheds and proposed harvest for the proposed action

Watershed	Proposed Action Percent Harvest, All Treatment Types	Percent Watershed Involved in Past Vegetative Treatments*	Total Percent Harvested
Barnes Creek	1.1%	<1 %	1.1%
Clark Fork River-Dunkleberg Creek	1.3%	<1 %	1.3%
Clark Fork River-Perkins Creek	0.9%	<1 %	1.0%
Douglas Creek	2.0%	8.2%	10.2%
Gold Creek	4.1%	2.5%	6.6%
Lower Boulder Creek	0.0%	0.0%	0.0%
Lower Flint Creek-Gird Creek	3.8%	4.1%	7.9%
Pikes Peak Gulch	0.0%	1.5%	1.5%

*Most of the past treatments in the watersheds have recovered hydrologically,

Measure- Water yield increase greater than 10 percent

Timber harvest should not increase the peak water yield by more than 10 percent of historic conditions (State of Montana, 2012). Potential direct and indirect effects associated with vegetation treatments include a decrease in tree canopy and an associated increase in water available for stream flow. Timber harvest units are not expected to lead to sedimentation (Rice et al. 1971), but can lead to increased runoff and water yield (Troendle and King 1985), which can affect channel stability and stream function. The potential increase in water available for stream flow is due to decreases in interception and transpiration. In wet climates, this can increase annual water yield. Stednick (1996) noted that changes in annual water yield resulting from forest cover reduction in a watershed by forest harvest of less than 20 percent could not be determined through hydrometric or stream-flow measurement methods. Other research indicates that up to 25 percent of a watershed must be harvested before changes are detected. Grant et al. (2008) documented that although any disturbance that reduces the density of live vegetation cover will locally increase runoff from forested watersheds; flow increases are generally not measurable until about 25 percent of the basal area of a forested watershed has been harvested.

The existing canopy percent in proposed units range on average from about 10-70 percent (Gump 2012) depending on tree species. Canopy may be less than this amount in beetle killed dead lodgepole stands. After treatment, canopy would be estimated to be 0-30 percent depending on the treatment type. Watershed scale changes in canopy would not be expected to result in a measurable change to flow for several reasons. Table 81 shows the watershed percent that would be harvested, compared to existing harvest percentages from past harvest. Past harvest was mostly done in the 1980s and 1990s, and past harvest areas are mostly recovered hydrologically. Recent beetle killed trees may have contributed to canopy loss through mortality of overstory trees typically greater than 5 inches d.b.h. This does not likely translate into canopy loss in beetle killed stands however, because smaller trees not affected by insect mortality may still occupy sites. These smaller trees often will function to maintain evapotranspiration and moderate increases in water yield. Further, the distribution of dead and dying trees resulting from insect mortality was observed to be often not continuous and varies with difference in soil moisture and other factors.

The highest proposed harvest (4.1 percent) is in Gold Creek watershed, followed by 3.8 percent in Lower Flint Creek-Gird Creek watershed. Except in Gold Creek watershed, most of the proposed harvest in project watersheds would be treated by commercial thinning, with large, dominant trees left after treatment. Thinning would focus on taking suppressed intermediate sized trees (7-20 inches d.b.h.). As a result, substantial gaps in the canopy would not be generated and measurable increases in water quantity would not be expected in commercially thinned areas (Bosch and Hewlett 1982, Grant et al. 2008). Historical harvest on private lands, when added to percent watershed harvested amounts in alternative 2, is not expected to appreciably change percent watershed harvested values. Private and other agency lands would have to be extensively clearcut in order to increase percent harvest values to amounts needed to begin to see flow increases in project watersheds. For instance, the Gold Creek watershed has 20,624 acres in the project area; 18 percent or 3,712 acres would need to be recently harvested (within the last few years) to exceed 25 percent watershed harvest.

Salvage by clearcut areas or seed tree harvest areas make up a smaller percentage of harvest in most watersheds except Gold Creek, where over 500 acres of salvage by clearcut is proposed. Twelve salvage units, across the project area, would be over 40 acres in size in alternative 2, and these are factored in percent watershed harvested calculations. When harvest exceeds about 25 percent of watershed area measurable runoff increases may begin to occur. The overall percent of trees to be harvested, combined with past harvest is well under the threshold of about 25 percent for all watershed (table 81). Because watershed percent harvest is low compared to amounts required to start seeing increased water yields, no change in timing and magnitude of peak flows or annual water yield due to forest harvest is expected. Estimated project flow increases would be below 10 percent for the project. Overall, total water availability increases after initial harvest would be small and essentially not measureable. As trees grow back in harvested areas, evapotranspiration would increase, and more incoming precipitation would be taken up by vegetation or evaporated. In turn, less water would be available to re-supply shallow and deep groundwater, and less will be available for runoff.

Issue - Floodplains and Wetlands

Indicator- Changes in floodplain and wetland function

Measure- New stream crossings in floodplains

Floodplain development is not proposed for the project. No direct or indirect effects to floodplains, their morphology or function would be expected due to the implementation of BMPs

and project design features for units and roads, and implementation of RCA buffers. No adverse effects are expected to floodplains from new temporary road stream crossings on perennial Gird Creek, and stream crossing construction on the temporary road crossings on the intermittent tributary to Dunkleberg Creek.

Measure- Protection of wetlands provided by RCAs, and other project design features

Wetlands would be protected by RCAs under this alternative. BMPs and project design features and mitigation measures were also designed to prevent, or limit, upland sediment introduction into wetlands and streams (appendix B of the Hydrology report in the project file). Included in these protection measures is the mandatory use of RCAs. Stream buffer effectiveness is documented in Montana (2008), Schuler and Briggs (2000), Rashin et al. (2006), and USDA Forest Service (1999 and 2006). Other studies have documented effectiveness of stream buffers in reducing sediment transport to wetlands or streams. No wetlands or springs have been identified in project units, but if they are discovered during layout these areas would be protected during logging operations by establishing RCAs or buffers around wetland features. Springs that were observed along roads such as NFS road 636 would be protected through improved road drainage that would route spring drainage off road surfaces. As a result of the presence of RCAs and the use of other project design features no direct or indirect effects resulting from the project would be anticipated.

No commercial thinning, salvage by clearcut, or seed trees harvest would be conducted within RCAs. No direct ignition would occur within RCAs. Fire would be allowed to creep (back burn) into RCAs from the point of ignition. Short-term direct effects of back burning may consist of partial groundcover removal. Indirect effects such as erosion and transport of sediment would be considered unlikely due to implementation of BMPs, prohibition of ignition within RCAs, maintenance of groundcover throughout the majority of the RCAs, and burning only when soils are moist and cool.

Cumulative Effects

In summary, no cumulative effects from this project are expected from sediment generation from roads and other activities.

No measureable cumulative increases in stream temperatures are expected from this project. No measureable cumulative effects to channels are expected from water yield increases. Positive impacts from mining-related activities such as the Forest Rose Mine reclamation would lead to water quality improvements and a reduction of cumulative effects on Dunkleberg Creek. Other ongoing and future expected impacts such as livestock grazing or recreation are not expected to generate cumulative effects when combined with the effects of this project. When combined with other past, present and expected future activities in project watersheds, no measurable changes to water quantity, stream channel conditions, wetlands, springs or floodplains would be expected from this project. No measurable negative effects to water quality is expected.

Sedimentation from past activities has occurred, is ongoing or may occur in the future in the project area. Cumulative effects from sedimentation can include channel widening and bank instability, changes in channel substrates from fine sediment, or longer term increases in stream turbidity. Any sediment generated by roads used for this project would add to existing amounts of sediment in project watersheds. However, with the implementation of BMPs and other project design features and mitigation measures, sediment generation would be expected to be reduced overall in project watersheds compared to existing conditions. Sedimentation from the activities proposed for alternative 2 would not be expected to increase, including haul route road

maintenance or construction activities, road drainage at stream crossings, and increased traffic levels. Any effects to sedimentation from this project would be of short duration, usually occurring within the same year the activity takes place, and would not add sediment in amounts where cumulative effects of sedimentation would be expected to occur. After the project is complete, improvements in road drainage leading to sediment reduction as a result of road maintenance and road mile reduction would be expected to reduce sediment delivered to waterways.

Flood repairs after the 2011 spring runoff would occur with a focus on the Douglas Creek watershed in 2012 or 2013. This work will consist of bridge and culvert repair, and road surfacing. This effort would be a beneficial effect in the long run to stream water quality because of reduced risk of crossing failure. Positive impacts from mining-related activities such as the Forest Rose Mine reclamation would lead to water quality improvements and a reduction of effects in Dunkleberg Creek. Ongoing scheduled maintenance would also reduce sediment and contribute to increased water quality.

No measureable cumulative increases in stream temperatures are expected from this project. No measureable cumulative effects to channels are expected from water yield increases. Other ongoing and future activities such as livestock grazing or recreation are not expected to generate cumulative effects to the RCAs or water quality when combined with the effects of this project. When combined with other past, present and expected future activities in project watersheds, no measurable changes to water quality, quantity, stream channel conditions, wetlands, springs, or floodplains would be expected from this project.

Potential direct and indirect effects associated with vegetation treatments include a decrease in tree canopy and an associated increase in moisture availability that can lead to more water available for stream flow. The potential cumulative increase in water available for stream flow after harvest is due to changes in interception and transpiration. However, for this project, when combined with other activities that affect vegetation in project watersheds, measureable cumulative increases in stream flow are not expected. As trees grow back in harvested areas, evapotranspiration would increase, and more incoming precipitation would be taken up by vegetation or evaporated.

Summary of Effects

Activities under this alternative include ground disturbance resulting from vegetation treatments, prescribed and pile burning, use of skid trails, hauling logs, and road construction reconstruction and maintenance.

Sediment delivery to streams from roads poses the greatest risk to water quality. BMPs and project design features would be employed for all roads used for this project, and are demonstrated to be effective at reducing sediment delivery to waterways. RCA buffers would prevent sediment from reaching channels, and as a result, minimal amounts of sediment would be expected to pass through these buffers and enter stream channels. Sediment-related water quality changes would be expected to be minimal. Increases in sediment, if it occurs, would be expected to be limited to 1 year or less. No measurable change to channels would be expected from harvest activities.

Potential direct and indirect effects associated with vegetation treatments include a decrease in tree canopy and an associated increase in water available for runoff. Because watershed percent

harvest is low compared to amounts required to realize increased water yields, no change in timing and magnitude of peak flows or annual water yield due to forest harvest is expected.

Target values for road and upland sediment sources for Barnes Creek specified in the Draft Flint Creek Planning Area Sediment and Metals TMDLs and Framework Water Quality Improvement Plan (Montana 2012, table 2) would not be exceeded. No additional degradation to 303(d)-listed streams would be expected with the implementation of soil and water quality BMPs, implementation of the required RCAs and improvements to road drainage. Any changes to stream water quality would probably not be measurable relative to natural variation.

With no or minimal sediment introduction to any of the stream drainages as a result of the project, no cumulative changes to stream channel morphology, substrates or turbidity would be expected. After the project is complete, improvements in road drainage leading to sediment reduction as a result of road maintenance and road mile reduction would be expected to reduce sediment delivered to waterways.

Minimal changes to water quantity, stream channel conditions, riparian areas, wetlands springs or floodplains would be expected due to the implementation of BMPs and project design features for units and roads. As a result, no notable cumulative effects for these resources would be expected.

Overall, watershed conditions would be expected to improve with the implementation of the proposed action, due to road maintenance and implementation of BMPs along the project road system.

Alternative 3

Under alternative no new road construction would occur. Only existing NFS or existing open or closed unauthorized routes would be used as haul routes.

Direct and Indirect Effects

Indicators and Effects Measures

Issue - Water Quality-

Indicator- Change in sediment delivery

Measure- Consistency of the project with total maximum daily loads (TMDLs)

The effects of this project would be consistent with the goals and objectives of TMDL water quality planning efforts in the project area. Target values for road and upland sediment sources for Barnes Creek specified in the Draft Flint Creek Planning Area Sediment and Metals TMDLs and Framework Water Quality Improvement Plan (Montana 2012, table 2) would not be exceeded, since only 1.1 percent of the lands within the Barnes Creek watershed would be harvested under this alternative (table 83). Effective water quality project design features such as BMPs would be in place to address sediment. Long-term indirect effects to water quality would not be expected. Water quality beneficial uses would not be impaired.

Measure- Changes in sediment delivery to streams and sedimentation rates based on WEPP Road model and sedimentation risk from haul routes

WEPP Road Model

Road WEPP modeling that was done for major haul routes for alternative 2 is used for this alternative (table 79). The major haul routes where sediment source assessments were done are the same for both alternatives.

Road WEPP analysis indicates that under current traffic conditions sediment production ranged from 26 pounds to 543 pounds for project road-stream crossings. Results of model runs for sediment produced during the project range from 32 pounds for the NFS 8615 road accessing unit 8B, to 565 pounds for the NFS 636 road upstream of Davidson Creek (table 79). Comparison of before, during and after project sediment values indicates that there would likely be an overall decrease in sediment during and after the project from roads. This is a result of implementation of road sediment reduction BMP upgrades or road reconstruction for improved drainage. Sediment reduction methods at road crossings would also include placing slash windrows, or equivalent methods, at runoff points at stream crossings. This was not modeled, but would further reduce sediment both during and after the project. Monitoring on National Forest System lands has shown up to 85 percent reduction in sediment delivery to streams from the use of slash windrows (Seyedbagheri 1996).

Roads that were modeled for sediment production are summarized with recommended specific project design features for maintenance or design features to address sediment concerns. This information is provided in the hydrology report in the project record. As in alternative 2, BMPs will be employed to reduce sediment from all roads used in this alternative. The effectiveness of BMPs in controlling sediment on National Forest System land has been documented (Burroughs and King, 1989, Montana 2008). In addition, slash filter windrows or equivalent methods are recommended for all stream crossings, and are included in the project design features.

Sedimentation Risk from Haul Routes

The potential amount of sediment delivery risk to streams from the project road system is less from this alternative than alternative 2 because no new road segments or crossings would be constructed. New temporary road construction near stream channels has the highest risk of delivering sediment to streams because of soil disturbance and displacement. Sediment delivery and erosion occurring because of road maintenance and reconstruction would be less in this alternative than in alternative 2, because there would be about 12 fewer miles of haul routes (including unauthorized routes).

Road maintenance and reconstruction (9.5 miles) would occur within RCAs along perennial and intermittent streams improving water function and sediment control measures such as road crowning, condition of ditches, ditch blocks and rolling dips, and culvert passage. This would further reduce the long term amount of sediment being introduced into streams, as well as the amount of water from road-surface runoff. The reconstruction includes 2.3 miles of existing open and closed unauthorized routes. Some of these existing roads are in poor condition as a result of no maintenance or BMP implementation, and could be an on-going sediment source to streams, while other unauthorized routes are overgrown or stable and not considered sediment sources. Reconstruction of these routes would lead to an overall reduction in potential sedimentation, because as a result, many of these roads would show improved drainage. After vegetation treatments, unauthorized routes would be decommissioned. Specific decommissioning treatments

are specified table 5 in chapter 2, and range from closure with a sign or berm and natural revegetation to blocking access and recontouring drainages.

Comparisons of haul road miles and other factors were made to determine effects in drainages of major streams. Highest road miles for existing proposed haul routes are in N. Fork Gold Creek, Gold Creek Mainstem and Blum Creek. Major proposed haul route stream crossings were highest for Blum and Dunkleberg Creeks (table 82).

Table 82. Alternative 3-miles of haul routes, temporary roads, and proposed temporary or new NFS roads, and number of stream crossings within 300 feet of select streams

Streams	Haul Routes (miles)	Haul Routes in RCAs (miles)	Unauthorized Routes, (miles)	Haul Route Major Stream Crossings	Temporary or New NFS Roads within 300 ft. of Streams (miles)	Notes
Dunkleberg Creek	6.9	0.6	0.9	4	0.0	
Douglas Creek Mainstem	4.1	0.0	0.0	0	0.0	Sediment deposits observed from 2011 flooding from road washout in N. Fk. Douglas Creek.
South Fk Douglas Creek	1.1	0.6	0.0	1	0.0	
Middle Fk. Douglas Creek	0.8	0.8	0.0	1	0.0	
North Fk. Douglas Creek	3.8	2.3	0.0	2	0.0	High sediment from road washout in upper watershed in 2011. Sediment deposits evident downstream.
Gold Creek Mainstem	11.6	1.4	0.0	1	0.0	Gold Creek mainstem is located on private lands.
N. Fk. Gold Creek	12.2	1.0	0.0	3	0.0	
S. Fk. Gold Creek	1.1	0.3	0.0	1	0.0	
Blum Creek	8.2	0.6	0.8	4	0.0	High numbers of stream

Streams	Haul Routes (miles)	Haul Routes in RCAs (miles)	Unauthorized Routes, (miles)	Haul Route Major Stream Crossings	Temporary or New NFS Roads within 300 ft. of Streams (miles)	Notes
						crossings, but most are not sediment sources.
Crevice Creek	3.1	1.1	0.0	3	0.0	
Pikes Peak Creek	0.0	0.0	0.0	0	0.0	
Flint Creek Tributary/ Gird Creek	3.0	0.9	0.0	2	0.0	

(Note- information obtained from estimates based on alternative 3 map)

Measure- Changes in sediment from harvest units from Disturbed WEPP

Projected estimates of erosion, based on Disturbed WEPP modeling for each proposed unit, showed no erosion delivered to streams from project units after harvest (Soils section), and were similar to alternative 2. Probabilities for runoff and sediment delivery range from 0 to 2 percent for each proposed unit (Soils section). Based on these factors indirect effects including erosion and sediment generation and delivery to streams would not be expected as a result of unit harvest treatment.

When conducting Disturbed WEPP modeling, the required widths for RCA buffers were included in the modeling. BMP monitoring demonstrates that these buffers are effective in preventing or mitigating the amount of sediment entering a stream (Montana 2008, Schuler and Briggs 2000, Rashin et al. 2006, USDA Forest Service 1999 and 2006).

Measure- Miles of new NFS or temporary road construction

In this alternative, because no new roads are proposed, there would be no potential increased sedimentation from new road construction. Because there will be no new construction of roads, the risk of sediment reaching stream channels would be lower than alternative 3, especially where new road construction would have taken place within RCAs. Although the precise amount of sediment reduction under this alternative is unknown, from WEPP modeling of known haul route sites sediment production from road segments leading to channel crossings ranged up to over 500 pounds/crossing. Fewer miles of temporary or other roads are likely to lead to less risk of sediment production from roads. This alternative would likely result in a notable reduction in potential sediment from the construction of temporary or other roads.

Measure- Miles of new system or temporary roads within 300 feet of streams

Road construction disturbs soils and increases the potential for erosion during and after construction. Because there will be no new construction of roads, the short-term risk of sediment

reaching stream channels would be lower than alternative 2 where the 0.6 miles of new road construction would take place within RCAs.

Measure- New haul route stream crossings and sediment delivery at stream crossings

No new stream crossings are required under this alternative. This would decrease the short-term risk of sediment reaching channels compared to alternative 2.

Indicator: Stream Temperature changes

Measure- Roads and openings in RCAs

Proposed RCAs would be sufficient to protect streams from direct beam solar radiation that could lead to stream temperature increases under this alternative. The RCA for perennial streams extends 300 feet on either side of the stream, whereas on intermittent streams the RCA extends 50 feet on either side of the drainage. Existing roads can open streams to direct-beam solar radiation leading to warmer stream temperatures. Under this alternative no new roads will be constructed in RCAs so no additional project road-related impacts to stream temperature from project haul routes would be expected (MacDonald et al.1991).

Issue - Water Quantity and Channel Stability

Indicator- Changes in water yield and peak flows resulting in channel changes

In summary, potential impacts to stream channels will be similar to alternative 2, and not be expected to modify stream channel morphology or stability. No significant changes in flow volume, or alteration to timing of peak flows would be expected resulting from treating proposed units. As a result, no impacts are expected to occur to channels within the project area.

Measure- Harvested area by 6th field HUC

Approximately 600 fewer acres of mechanically harvested, ground- or cable-based harvest units are proposed under this alternative, across all watersheds, compared with alternative 2. When acres of historical logging are added to acres of proposed logging under this alternative, percent watershed harvested areas is less under this alternative than alternative 2.

Table 83. Total percent past harvest of project watersheds and proposed harvest for alternative 3

Watershed	Alternative 3 Percent Harvest, All Treatment Types	Percent Watershed Involved in Past Vegetative Treatments*	Total Percent Harvested
Barnes Creek	1.1%	<1 %	1.0%
Clark Fork River-Dunkleberg Creek	1.1%	<1 %	1.0%
Clark Fork River-Perkins Creek	0.7%	<1 %	1.0%
Douglas Creek	0.5%	8.2%	8.7%
Gold Creek	3.8%	2.5%	6.3%
Lower Boulder Creek	0.0%	0.0%	0.0%
Lower Flint Creek-Gird Creek	1.5%	4.1%	5.6%
Pikes Peak Gulch	0.0%	1.5%	1.5%

Measure- Water yield increase greater than 10 percent

Similar to alternative 2, water yield increases greater than 10 percent as a result of the project are not expected.

Issue - Wetlands or Floodplains

Indicator-Changes in floodplain or wetland function

Measure- New stream crossings in floodplains

Floodplain development is not proposed for the project. No direct or indirect effects to floodplains, their morphology or function would be expected due to the implementation of BMPs and project design features for units and roads, and implementation of RCA buffers. No adverse effects are expected to flood plains from new temporary road stream crossings on the intermittent tributary to Dunkleberg Creek.

Measure- Protection of wetlands provided by RCAs and other project design features

Wetlands would continue to be protected by RCAs under this alternative. BMPs and resource protection measures were also selected and designed to prevent, or limit, upland sediment introduction into wetlands and streams (appendix B of the Hydrology report in the project file). As in alternative 2, no wetlands have been identified in project units, but if they are discovered these areas will be protected during logging operations by establishing RCAs or buffers around wetland features. Improved drainage along haul roads such as the NFS road 636 would route seeps and spring off the road surface and would reduce the risk of sedimentation in these areas. As a result the other presence of RCAs and use project design features no direct or indirect effects resulting from the project would be anticipated.

As in alternative 2, no commercial thinning, salvage by clearcutting, or seed tree harvest would be conducted within RCAs. No direct ignition would occur within RCAs or within riparian areas. In RCAs, only back burning would be allowed when soils are moist and temperatures cool. Short-term direct effects of back burning may consist of partial groundcover removal. Indirect effects such as erosion and transportation of sediment would be considered unlikely due to implementation of BMPs, prohibition of ignition within RCAs, maintenance of groundcover throughout the majority of the RCAs, and burning only when soils are moist and cool.

Cumulative Effects

Similar to alternative 2, no cumulative effects from this project are expected from sediment generation from roads and other activities.

Sedimentation from past activities has occurred, is ongoing or may occur in the future in the project area. Cumulative effects from sedimentation include effects such as channel widening and bank instability, changes in channel substrates from fine sediment, or longer term increases in stream turbidity. Any sediment generated by roads used for this project would add to existing amounts of sediment in project watersheds. However, with the implementation of BMPs and other project design features and mitigation measures, sediment generation would be expected to be reduced overall in project watersheds compared to existing conditions. Sedimentation from alternative 3 is not expected to increase as a result of project activities including haul route road maintenance or reconstruction activities, road drainage at stream crossings, and increased traffic levels, and overall be less than alternative 2. Any effects to sedimentation from this project would be of short duration, usually occurring within the same year the activity takes place, and would not add sediment in amounts to where cumulative effects of sedimentation would be expected to

occur. After the project is completed, improvements in road drainage leading to sediment reduction as a result of road maintenance and road mile reduction would be expected to reduce sediment delivered to waterways.

As in alternative 2, flood repairs after the 2011 spring runoff will occur with a focus on the Douglas Creek watershed. This work will consist of bridge and culvert repair, and road surfacing. This effort would be beneficial in the long run to stream water quality as vegetation grows back, and because of reduced risk of crossing failure. Positive impacts from mining-related activities such as the Forest Rose Mine reclamation will lead to water quality improvements and a reduction of effects in Dunkleberg Creek. Scheduled road maintenance would also reduce sediment and contribute to increased water quality.

No measureable cumulative increases in stream temperatures are expected from this project. No measureable cumulative effects to channels are expected from water yield increases. Other ongoing and future potential impacts such as recreation are not expected to generate cumulative effects when combined with the effects of this project. When combined with other past and anticipated future activities in project watersheds, no measurable changes to water quantity, stream channel conditions, wetlands, springs, or floodplains would be expected from this project.

Potential direct and indirect effects associated with vegetation treatments include a decrease in tree canopy and an associated increase in moisture availability that can lead to more water available for stream flow. The potential cumulative increase in water available for stream flow after harvest is due to changes in interception and transpiration. However, for this project, when combined with other activities that affect vegetation in project watersheds, measureable cumulative increases in stream flow are not expected. As discussed under direct and indirect effects, cumulative overall total water availability increases after initial harvest would be small and essentially unmeasurable. As trees grow back in harvested areas, evapotranspiration would increase, and more incoming precipitation would be taken up by vegetation or evaporated.

Summary of Effects

Activities under this alternative include ground disturbance resulting from vegetation treatments, prescribed and pile burning, use of skid trails, hauling logs, and road reconstruction and maintenance. Potential indirect effects include increased sediment introduction or delivery into streams, altering water quality or water quantity.

This alternative includes no new road construction, compared to the proposed action which proposes 1.3 miles of new NFS road construction, and no new miles of temporary road construction. 2.3 miles of existing temporary roads would reconstructed, which would be 2.1 miles less than alternative 2. As a result there would be no ground disturbance from new road construction under alternative 3 compared to alternative 2, and subsequently substantially less risk of sedimentation. Also, the risk in sediment delivery would be less for alternative 3 because of fewer haul route miles and no road construction in RCAs.

Sediment delivery to streams from roads poses the greatest risk to water quality. As in alternative 2 BMPs and project design features would be employed for all roads used for this project, and are demonstrated to be effective at reducing sediment delivery to waterways. RCA buffers would prevent sediment from reaching channels, and as a result, minimal amounts of sediment would be expected to pass through these buffers and enter stream channels. Sediment related water quality changes would be expected to be minimal. Increases in sediment, if they occur would be expected

to be limited to 1 year or less. No measurable change to channels would be expected from harvest activities.

Potential direct and indirect effects associated with vegetation treatments include a decrease in tree canopy and an associated increase in water available for runoff. Because watershed percent harvest is low compared to amounts required to realize increased water yields, no change in timing and magnitude of peak flows or annual water yield due to forest harvest is expected.

Target values for road and upland sediment sources for Barnes Creek specified in the Draft Flint Creek Planning Area Sediment and Metals TMDLs and Framework Water Quality Improvement Plan (Montana 2012, table 2) would not be exceeded. No additional degradation to 303(d) listed streams would be expected with the implementation of soil and water quality BMPs, implementation of the required RCAs and improvements to road drainage. Any changes to stream water quality would probably not be measurable relative to natural variation.

With no or minimal sediment introduction to any of the stream drainages as a result of the project, no cumulative changes to stream channel morphology, substrates or turbidity would be expected. After the project is complete, improvements in road drainage leading to sediment reduction as a result of road maintenance and road mile reduction would be expected to reduce sediment delivered to waterways.

Minimal changes to water quantity, stream channel conditions, riparian areas, wetlands, springs, or floodplains would be expected due to the implementation of BMPs and project design features for units and roads. As a result, no notable cumulative effects for these resources would be expected.

As a result of this alternative and due to the implementation of BMPs and project design features for units and roads, minimal changes to water quantity, stream channel conditions, riparian areas, wetlands springs or bogs, or floodplains would be expected. As a result, no notable cumulative effects for these resources would be expected.

Overall, watershed condition would be expected to improve with the implementation of alternative 3, due to road maintenance and reconstruction, and implementation of BMPs on the project road system.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives comply with the Beaverhead-Deerlodge Forest plan, and other State and local laws, regulations, policies and plans.

At this time it is uncertain whether this project will require a National Pollution Discharge Elimination System (NPDES) permit for stormwater discharge from logging roads. The Forest Service will comply with any applicable NPDES permitting requirements if determined in the future that it is needed for this project

Fish and Aquatic Resources

Introduction

This section documents existing condition and environmental consequences to aquatic resources from the proposed Flint Foothills Vegetation Management Project. The analysis include the

potential effects to Forest Service sensitive and management indicator species (MIS), as well as aquatic species listed according to the endangered species act (ESA). These species include westslope cutthroat trout (*Oncorhynchus clarki lewsi*), western toad (*Bufo boreas*), arctic grayling (*Thymallus arcticus*) and bull trout (*Salvelinus confluentus*), western pearlshell mussel *(Margaritifera falcata),* and the mayfly*, (Drunella doddsi).*

Overview of Issues Addressed

All fisheries habitat within the analysis area is confined to streams. Amphibians are present in streams, ponds, wetlands and their riparian areas, so all of these represent habitats that could be affected. Finally, direction in the Forest Plan requires that we analyze the potential for new projects to increase the risk of aquatic nuisance species introduction. Aquatic nuisance species introduction would result in mortality or displacement of individual trout and amphibians.

Issues and Measurement Indicators

Issue - Change in Stream Habitat Conditions for *Drunella doddsi* (MIS) and other Aquatic Species

- Indicator - Change in stream function:
    - Measure - Change in sediment delivery to streams
    - Measure - Changes in miles of motorized routes in RCAs

Issue - Change in Pond and Wetland Habitat Conditions for Aquatic Species

- Indicator - Change in sediment delivery to streams, ponds and wetlands
    - Measure - Change in miles of motorized routes in RCAs
    - Measure - Change in sediment delivery to ponds and wetlands

Issue - Persistence of Sensitive WCT populations within the Analysis Area

- Indicator - Habitat conditions for WCT occupied streams
    - Measure - Change in sediment delivery to occupied WCT streams in the analysis area
    - Measure - Changes in miles of motorized routes in RCAs

Issue - Persistence of Sensitive Western Toad Populations within the Analysis Area

- Indicator - Expected change in direct mortality to toads from motorized vehicles:
    - Measure - Change in miles of motorized routes in RCAs
    - Measure - Miles of haul routes in RCAs.

Issue - Change in distribution of Aquatic Nuisance Species (ANS)

- Indicator - Expected change in vectors of transport and introduction of ANS

Affected Environment

Existing Condition

The following sections describe the existing condition of the affected environment for aquatic resources in the Flint Foothills Project area and include the following: general watershed characteristics, overview of analysis areas, watershed descriptions, fish distribution, special status fishes, and special status amphibians. The existing condition of issue indicators is also described.

Watershed Description and Conditions

The analysis area totals 44, 493 acres and is located within portions of the Barnes Creek, Clark Fork River-Dunkleberg Creek, Clark Fork River-Perkins Creek, Douglas Creek, Gold Creek, Lower Flint Creek-Gird Creek and Pikes Peak Gulch 6th level watersheds (See figure 39 in the hydrology section for location of 6th level watersheds found in the Flint Foothills project area). Although the project boundary includes the upper portion of Barnes Creek, no vegetation or fuel management activities are planned in the Barnes Creek watershed, therefore it will not be discussed further.

Overview of Stream and Watershed Characteristics

The existing condition of project area streams and fish populations reflect the influences of both natural (climatic and geologic) conditions and human activities. Past management activities affecting aquatic resources include road construction and maintenance, timber harvest, livestock grazing, water diversion for irrigation, dispersed recreation, and historic mining.

The existing condition of riparian areas and wetlands are variable. Well-vegetated riparian areas filter pollutants from overland flow; provide habitat for wildlife, and stabilize and shade stream channels, which provide high quality habitat and minimize extreme variations in water temperature. Typically, linear wetlands are found along the low-gradient stream reaches. These wetlands serve as habitat for amphibians and other aquatic species, as well as storage for water during spring runoff. Wetlands release cool, clean water to the channel during the later parts of summer.

Sub-watersheds/6th Field HUC Descriptions

Clark Fork River – Dunkleberg Creek 6th Field Watershed

Dunkleberg Creek

Dunkleberg Creek is a tributary to the Clark Fork River and enters the drainage at approximately river mile 427.3. Land ownership in the drainage is primarily NFS lands in the upper portion of the drainage, while the lower portion of the drainage is primarily private lands along with some State of Montana school trust lands. The primary land use in the drainage is cattle grazing although some historic logging was also observed.

A riparian assessment was conducted at RM 6.2 of Dunkleberg Creek (Lindstrom et al. 2008). The creek was classified as a C channel type, and the habitat was in relatively good condition with some minor degradation observed. The degradation that was observed was primarily due to reduced densities of woody riparian vegetation throughout the reach and the absence of willows from the reach. Large woody debris was also absent from the reach and deep pools were observed infrequently. This site appeared to have been grazed heavily in the past, but was currently recovering from this disturbance. Signs of historic logging in this reach were also observed that may have impacted fish habitat at this site.

Dunkleberg Creek supports brown trout as well as a genetically pure population of westslope cutthroat trout. The Forest has previously invested in watershed improvements in Dunkleberg Creek. These improvements include riparian fencing to exclude livestock access to the stream and willow planting to enhance stream channel stability.

Clark Fork River-Perkins Creek 6th Field Watershed

Perkins Creek

Perkins Creek is a tributary to the Clark Fork River near river mile (RM) 285.3. This very small stream drains for approximately 4.7 miles out of the Flint Range before reaching its terminus near Jens. Present surface connection to the Clark Fork River is unlikely as the stream appears to be captured by an irrigation ditch (originating on the Clark Fork River) prior to reaching the river. Land ownership along Perkins Creek is comprised primarily of privately owned lands, with limited NFS land ownership in the upper extent of the watershed. Most of Perkins Creek is accessible only through private land. The primary land uses in the drainage are livestock grazing and timber harvest. Additionally, several residences/farmsteads are located along the stream close to its mouth. Electrofishing surveys conducted in Perkins Creek did not capture any fish (MFISH 2009).

Douglas Creek 6th Field Watershed

Douglas Creek

Douglas Creek is a tributary to Flint Creek and enters the drainage at approximately river mile 10.0. Mainstem Douglas Creek begins with the confluence of the North and Middle Forks of Douglas Creek, and flows for approximately 6.6 miles to its confluence with Flint Creek. Land ownership on Douglas Creek is predominately private with the exception of a small parcel of land owned by the State of Montana. The primary land use is cattle grazing, but historic mining and logging are also present in the drainage. Below the project boundary, an old reservoir existed at approximately river mile 3.0, but it appears that a new channel of Douglas Creek was constructed to flow around this old reservoir, apparently as part of the past mining reclamation that has occurred in the drainage. It is speculated this work was completed to prevent Douglas Creek from using its historic channel and floodplain, presumably due to the polluted nature of these soils. A steep culvert was placed on Douglas Creek at the end of the constructed reach to direct flow back into the historic channel below the dam and this structure is currently functioning as a fish passage barrier limiting fish in the upper stream channel on NFS lands. (Lindstrom et al 2008). Douglas Creek contains brook trout, brown trout and a population of genetically pure westslope trout.

Middle Fork Douglas Creek

Middle Fork Douglas Creek is a tributary to Douglas Creek and enters the drainage at approximately river mile 6.3. The confluence of Middle Fork Douglas Creek with North Fork Douglas Creek forms mainstem Douglas Creek. Land ownership in the Middle Fork drainage is comprised of both National Forest and private lands. Land use in the drainage is primarily cattle grazing with historic mines present throughout the drainage.

One section was electrofished on Middle Fork Douglas Creek in August 2008 (RM 0.5) (Lindstrom et al. 2008). This section was located on National Forest System land just upstream from the confluence of the South Fork Douglas Creek (RM 0.5). Westslope cutthroat trout were the only fish species sampled on this creek and suspected genetically pure as there is no record of stocking.

A riparian assessment was also completed on the Middle Fork Douglas Creek in 2008. Middle Fork Douglas Creek at this site was classified as a B channel type, and the woody riparian vegetation at this site consisted of Douglas-fir, alder, and lodgepole pine. Primary land use at this site was cattle grazing via a Forest Service grazing allotment. The stream was well-vegetated in most spots, however some cattle hoof shear and bank erosion was observed. Fine sediment was relatively abundant in the reach and is likely due to both upstream impacts and bank erosion

within the sampled reach. Overall, the width to depth ratio in this reach was low and pools were relatively abundant (Lindstrom et al. 2008).

South Fork Douglas Creek
South Fork Douglas Creek is a tributary to Middle Fork Douglas Creek and enters the drainage at approximate RM 0.3. South Fork Douglas Creek flows entirely through National Forest System lands. A grazing allotment exists on South Fork Douglas Creek, and cattle grazing was the primary land use observed in the drainage.

One section was electrofished on the South Fork Douglas Creek in August 2008. This section was located approximately 0.3 miles upstream from the confluence with Middle Fork Douglas Creek. No fish were captured at this site. It is unknown why no fish were captured as no potential migration barriers were observed downstream of this section and westslope cutthroat trout were captured in Middle Fork Douglas Creek (Lindstrom et al 2008).

A riparian assessment was also completed on the South Fork Douglas Creek in 2008. At this site, South Fork Douglas Creek was classified as a B channel type and the woody riparian vegetation consisted of Douglas-fir and alder. Bank erosion was high due to cattle hoof-shear and woody riparian vegetation was sparse due to poor recruitment and heavy browse on young woody species. However, the creek was a boulder dominated B-channel, and fish habitat remained good due to numerous boulder formed pools. Many springs feed the creek in this reach which likely keeps water temperatures low in the summer.

Gold Creek 6th Field Watershed

Gold Creek
Gold Creek is a tributary to the Clark Fork River that drains for approximately 15 miles before reaching the upper portion of the Clark Fork basin at RM 291.6. Land ownership along Gold Creek is comprised largely of private lands with some NFS lands in the upper portion of the watershed. The primary land uses in the Gold Creek drainage are hay production, cattle grazing, and timber harvest. There is also evidence of extensive historic mining activity in the watershed.

Fish surveys were completed in Gold Creek in September of 2007. The sites were located at river mile (RM) 11.1, and 13.8. At RM 11.1, the fish community was comprised entirely of westslope cutthroat trout. Like at RM 11.1, westslope cutthroat trout were the only species present at RM 13.8. However, these fish tended to be notably smaller (Lindstrom et al 2008).

A riparian assessment was completed at each site electrofished on Gold Creek in 2007. At RM 11.1 Gold Creek was classified as a Rosgen B channel type. The riparian area was dominated by a conifer overstory, with spruce and Douglas fir being most common. Alder and willows were also present, but the willows appeared to be made up of older, decadent plants with little recruitment observed. It was noted that browse pressure was evident on many of the willows that were present in the reach. Fish habitat was good in this part of Gold Creek, but lack of deep pool habitat was thought to be a somewhat limiting factor. Flow in this segment of the stream was noted as being relatively low (Lindstrom et al. 2008).

At the most upstream site sampled in Gold Creek in 2007 (RM 13.8), the channel type at the survey site was typical of a Rosgen B stream type. Riparian vegetation was dominated by a spruce and Douglas fir overstory, and a dense sedge and grass understory. Willows were in the area but very limited in abundance, and those present showed considerable browse. Additional notes from the assessment indicate the presence of nearby berms and old ditches likely associated

with historic mining activity. Fish habitat was rated as fair and was not felt to be at its potential. This was primarily due to low flow and a complete lack of large pools and deeper pocket water.

North Gold Creek
North Fork Gold Creek is a tributary to Gold Creek that drains for approximately 4 miles before entering upper Gold Creek at RM 10.1. Land ownership along North Fork Gold Creek is comprised almost exclusively of lands administered by the Forest Service. However, approximately 0.2 mile of channel at the mouth of the stream is located within a mining claim and is under private ownership. The primary land uses in the North Fork Gold Creek drainage are cattle grazing and timber harvest.

Fish surveys were completed at two sites on North Fork Gold Creek in October 2007 (Lindstrom et al. 2008) at RM 1.6 and 3.7. At RM 1.6 the fish community was comprised entirely of westslope cutthroat trout. No fish were found at RM 3.7. The upstream distribution of fish in North Fork Gold Creek was not determined.

Riparian assessments were completed at both sites electrofished on North Fork Gold Creek in 2007 (Lindstrom et al. 2008). At RM 1.6, North Fork Gold Creek exhibited characteristics of both Rosgen B and C channel types. While the riparian health within the reach was generally good, factors affecting the overall score were site-specific grazing impacts, as well as the presence of an old road crossing that left a segment of channel wide and shallow allowing mid-channel sediment delivery. Riparian vegetation was dominated by a conifer overstory with lodgepole pine and spruce most abundant. Alder was also present, but younger age-classes were lacking. Fish habitat was rated as good, but was lacking in large woody debris and deeper pools. A diversion was noted approximately 1 mile upstream of the survey reach.

At RM 3.7, North Fork Gold Creek was confined in a narrow valley, and the gradient of the stream was beginning to increase. For these reasons, the channel was classified as a Rosgen Ba stream type. No fish were captured or observed at this site. Riparian vegetation was dominated by a conifer overstory with lodgepole pine and spruce most abundant.

South Fork Gold Creek
South Fork Gold Creek is a tributary to Gold Creek that drains for approximately 3 miles before entering upper Gold Creek at RM 12.0. Land ownership along South Fork Gold Creek is a mixture of NFS administered lands and a number of private mining claims. Several lakes exist within the drainage including Gold Creek Lakes, which occur at approximately RM 1.9 on South Fork Gold Creek, and Rainbow Lake, which is located off of South Fork Gold Creek. All have historically been stocked with fish (both rainbow trout and westslope cutthroat trout); however, the most recent plant was in Rainbow Lake in 2001 (westslope cutthroat trout). The primary land uses in the South Fork Gold Creek drainage are historic mining and timber harvest, and recreation.

A fish survey was completed at one site on South Fork Gold Creek in October 2007 (Lindstrom et al. 2008). This site was located on NFS lands at RM 0.8. The fish community at this site was comprised entirely of westslope cutthroat trout. The stream at the survey site was classified as a Rosgen B channel type. Riparian vegetation was dominated by a conifer overstory, with spruce and Douglas fir the dominant species present. Alder and snowberry were also common in the understory. Fish habitat was rated as good, and was thought to be near its potential. Large woody debris, root wads and overhanging vegetation were all abundant throughout the reach. Pools however, tended to be smaller and lacked depth. Fine sediment accumulation was notable. A culvert located upstream of the section did not appear to be a fish passage concern.

Blum Creek
Blum Creek is a small (average wetted width 4 feet), first order tributary to Gold Creek with the confluence located downstream of the Forest boundary. The stream flows perennially for approximately 2.3 miles on the Forest. The average gradient for the stream is 4-6 percent. Instream habitat throughout Blum Creek is poor. Although this stream does support low numbers of cutthroat trout, no estimate of the population size was possible due to the very low numbers of adult fish. Preliminary results indicate this population of westslope cutthroat trout may be slightly hybridized with Yellowstone cutthroat trout.

Crevice Creek
Crevice Creek is a tributary to Gold Creek that drains for approximately 4.5 miles before entering middle Gold Creek at RM 6.6. Land ownership along Crevice Creek is comprised mostly of lands administered by the Beaverhead-Deerlodge NF, with the lower mile of the channel flowing through private lands at the site of a low-density subdivision. Goldberg Reservoir is a small 8-acre impoundment at the head of the drainage. However, the primary direction of flow out of this reservoir is into the Dunkelberg Creek watershed. Only a marginal connection to Crevice Creek appears to be present, and is related to high water level elevations. The primary land uses in the Crevice Creek drainage are cattle grazing and timber harvest.

Fish surveys were completed at two sites on Crevice Creek in September of 2007 (Lindstrom et al. 2008) at RM 1.8 and 4.4. The fish community at both sites was comprised entirely of westslope cutthroat trout. Fish were also observed to be present in Goldberg Reservoir.

Riparian assessments were completed for both sites electrofished on Crevice Creek in 2007 (Lindstrom et al. 2008). At RM 1.8, Crevice Creek was classified as a Rosgen B channel type. Woody vegetation at RM 1.8 was dominated by alder and spruce, with dogwood and Douglas fir also present. However, it was noted that dogwood and woody shrubs showed notable browse pressure. Cattle hoof shear was evident along the streambanks and throughout the riparian area, and noxious weeds were also fairly abundant. Fish habitat at RM 1.8 was rated as good, but was not at its potential. This was primarily because of a lack of large woody debris in the channel, as well as the absence of deep pools. Fine sediment accumulation was notable throughout the reach.

At RM 4.4, Crevice Creek continued to display characteristics of a Rosgen B channel type. Conifers, with spruce and lodgepole pine most abundant, dominated the riparian overstory. Snowberry and alder plants were also present. Grazing impacts were observed throughout the reach with hoof shear along the streambanks and low stubble height on available grasses being most notable. Fish habitat at RM 4.4 was rated as only fair and was not at its full potential. This was primarily due to the lack of deep pools, large woody debris, and grazed grasses on the stream bank that offered little overhead cover. Fine sediment accumulation was also notable at this site (Lindstrom et al. 2008).

Pikes Peak Creek 6th Field Watershed

Pikes Peak Creek
Pikes Peak Creek is a tributary to Gold Creek that drains for over 12 miles before entering lower Gold Creek at RM 2.9. Land ownership along the lower 6 miles of Pikes Peak Creek is comprised largely of private lands with some limited State of Montana ownership where it flows through lands administered by the Montana State Prison. The upper 6 miles of the stream flows exclusively though NFS administered lands. The primary land uses in the Pikes Peak Creek drainage are cattle grazing and timber harvest. There is also evidence of historic mining activity in the watershed.

A fish survey was completed at one site on Pikes Peak Creek in October 2007 (Lindstrom et al. 2008). The site was located on NFS land at RM 6.7. The fish community at this site was comprised entirely of westslope cutthroat trout.

A riparian assessment was also completed at the site electrofished on Pikes Peak Creek in 2007 (Lindstrom et al. 2008). Riparian vegetation was dominated by a conifer overstory of spruce and Douglas fir, with alder, willow and cottonwood also present. It was noted that younger age-classes of willow, alder and cottonwood were largely absent, and what was present showed evidence of heavy browse pressure. Although the channel was a relatively stable Rosgen B stream type, cattle impacts to the streambanks were also noted. Fish habitat in the reach was rated only fair due to lack of quality cover components such as deep pools and overhanging vegetation, as well as very low flow in the channel. The stream was observed to be dewatered and dry for most of its length downstream of the sample site. Larger cobbles and boulders dominated the substrate at RM 6.7, and appeared to be a possible result of historic placer mining activity in the stream channel.

Lower Flint Creek - Gird Creek 6th Field Watershed

Gird Creek

Gird Creek and its tributaries support an isolated population of genetically pure westslope cutthroat trout. They are the only fish species present in this drainage, as the stream dewaters near the lower end of the stream on private land, these barriers effectively block invasion of nonnative species. Habitat survey data was not available for Gird Creek.

Sensitive Aquatic Species

Westslope Cutthroat Trout

Sub-species Range

Westslope cutthroat trout, (WCT) inhabit streams on both sides of the continental divide. Its eastside distribution is largely in Montana in the Missouri River drainage. Historically, within the Missouri basin, the downstream distribution extended to Great Falls and included headwaters of the Judith, Milk, and Marias rivers. On the west side, the subspecies occurs in the upper Kootenai, Clark Fork, Clearwater, and Salmon rivers. It also inhabits the Spokane River above Spokane Falls and the Coeur d'Alene and St. Joe drainages.

Westslope cutthroat distribution and abundance has declined substantially. Describing current WCT distribution is complicated by an abundance of populations with varied levels of genetic purity. Shepard et al. (2002) used specific criteria to designate conservation populations. Basically they are genetically unaltered; or those which are hybridized or the genetic status is unknown, but have ecological, genetic and behavioral attributes of significance. Populations that occupy habitat likely to become part of a WCT conservation focus were also included.

Total stream-miles occupied by conservation populations are nearly even east and west of the Continental Divide, 646 on the west side and 635 on the east side. However there are 29 conservation populations west of the divide, while there are 144 populations east of the divide. Data points to notable differences between populations separated by this geographic boundary. The average stream length occupied on the west side is 22.3 miles, while it is only 4.4 miles on the east side.

Influences from nonnative trout and other factors have resulted in severely disjointed WCT distribution patterns east of the divide. While WCT conservation populations are present in a

reasonable number of sub-watersheds/6th HUCs, they have been eliminated from most mid-sized and larger streams and rivers. This leaves harsh, less productive headwater streams as their most common refuge. Even in headwaters, they are often restricted to relatively short, stream segments where fish passage barriers protect them against upstream invasion by nonnative trout.

Individual WCT are exposed to invasion by nonnative trout and unnatural competition and hybridization risks when they move below barriers, and are essentially lost to the population. Consequently, selective pressures result in the strong tendency for east-side populations to be isolated, non-migratory residents lacking the characteristics and benefits of a metapopulation. While nonnative trout have influenced WCT populations west of the continental divide in the same manner described above, the extent and magnitude of effects are greater on the east side. The percentage of sub-watersheds containing conservation populations in the Upper Clark Fork River are notably higher than those east of the divide. Further, conservation populations persist in 36 percent of the historically occupied stream-miles west of the divide and in only 8 percent of historic habitats east of the divide.

Westslope cutthroat was petitioned for listing throughout its historic range in 1997. In 2000, the USFWS found WCT "Not Warranted for Listing". A recent lawsuit resulted in the determination being remanded to the USFWS for reevaluation. Following a new status assessment, the August 2003 finding issued in response to the amended petition, again found WCT "Not Warranted for Listing."

Forestwide Distribution
Based on the most thorough evaluation to date, WCT historically occupied about 33,000 miles of stream in Montana. This represented about 59 percent of the range-wide distribution (Shepard et al. 2002). About 9,300 of those miles (28 percent of the statewide distribution) are in the BDNF area. WCT were broadly distributed across the Beaverhead, Big Hole, Red Rock, Madison, Ruby, Boulder, Jefferson, and Upper Clark Fork rivers and Rock Creek drainages. Our best information suggests only 10 of 433 sub-watersheds (6th field HUCs) did not historically host westslope cutthroat trout. Eastern brook trout is the most influential nonnative competitor for WCT forestwide. While the nature of the competitive advantage is not fully understood, the magnitude of the effects on WCT distribution is well known. Fish biologists are documenting that brook trout continue to invade new areas and displace cutthroat many decades after the original introduction.

Project Area Distribution
Westslope cutthroat trout occupy most of the named streams in the project area. They are the only trout species present in the Dunkleberg, Middle Fork, South Fork and North Fork of Douglas Creeks, North and South forks of Gold Creek, Blum Creek, Crevice Creek, Pikes Peak Creek and Gird Creeks. See figure 41 followed by table 84 in this section for WCT distribution in the project area.

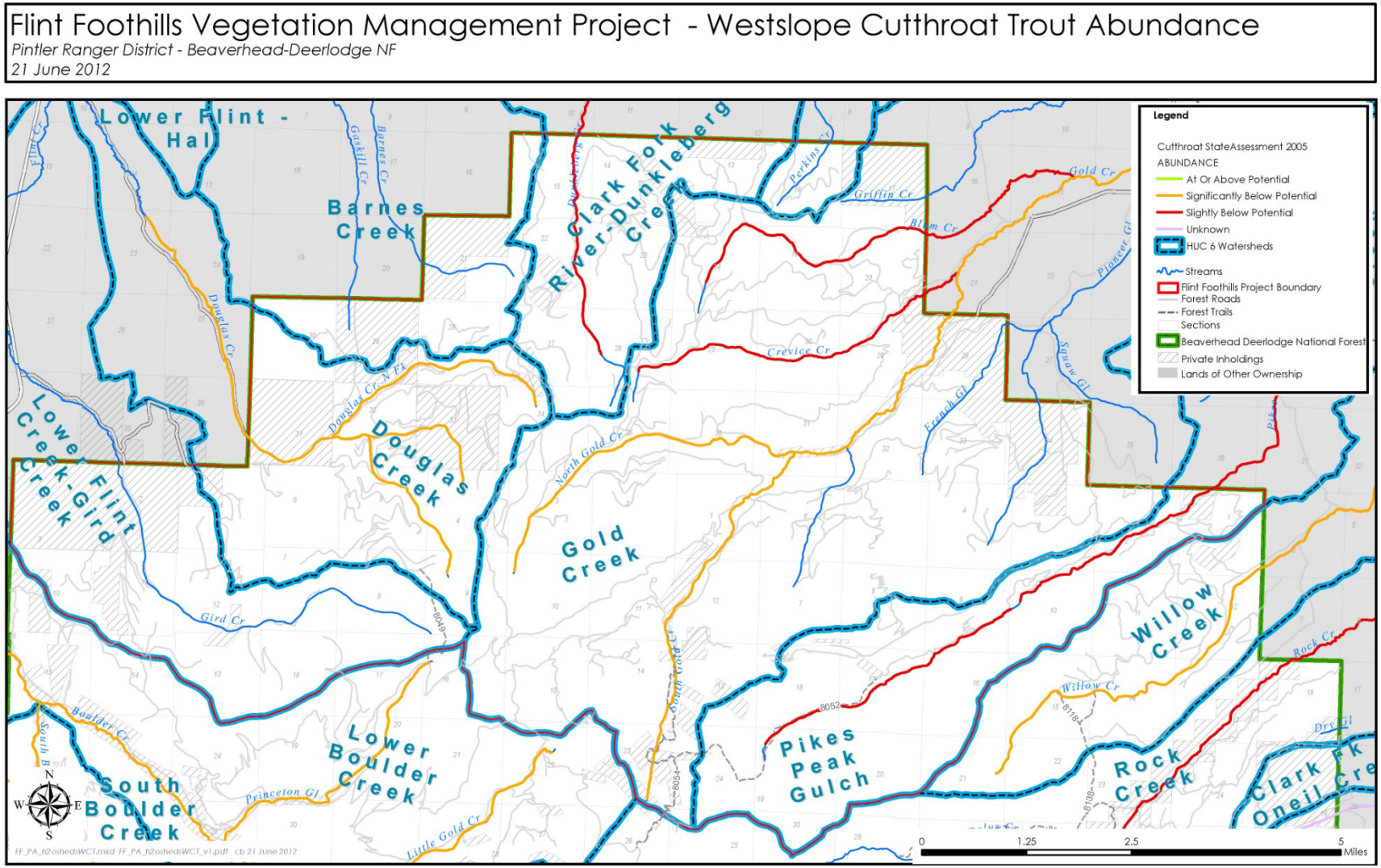


Figure 41. Westslope cutthroat trout distribution in the project area

Table 84. Fish distribution in the project area streams

Stream	River Miles	Species	Abundance
Dunkleberg Creek	6.2-11.8	westslope cutthroat trout	common
Perkins Creek	0-4.7	No fish	
Douglas Creek	0-0.6	westslope cutthroat trout	unknown
	0-1.5	brown trout	abundant
	2.4-6.4	brook trout	abundant
MF Douglas Creek	0-2.2	westslope cutthroat trout	common
SF Douglas Creek	0-2.2	westslope cutthroat trout	rare
NF Douglas Creek	0-3.1	westslope cutthroat trout	rare
Gold Creek	0-12.1	brown trout westslope cutthroat trout slimy sculpin	common
NF Gold Creek	0-4.4	westslope cutthroat trout	common
SF Gold Creek	0-1.9	westslope cutthroat trout	common
Blum Creek	0-5.5	westslope cutthroat trout	unknown
Crevice Creek	0-4.5	westslope cutthroat trout	common
Pikes Peak Creek	0-13.2	westslope cutthroat trout	common
Gird Creek	0-1.5	westslope cutthroat trout	unknown

Western Toad

The western toad is largely terrestrial and found in a variety of habitats from valley bottoms to high elevations. They breed in lakes, ponds and occasionally in slow-flowing streams. They prefer shallow areas with muddy bottoms. Breeding typically occurs from May to July, and tadpoles will metamorphose when 2 to 3 months old (Reichel and Flath 1995). Juveniles can be found in dense aggregations adjacent to breeding grounds. They are susceptible to high mortality rates if measurable disturbance occurs shortly after metamorphosis.

Adult and juvenile toads are freeze intolerant and over-winter and shelter in underground caverns, or rodent burrows (Maxell 2000). Adults feed on a variety of ground dwelling invertebrates and are known to eat smaller individuals of their own species.

Within the last 25 years, western toads have undergone population crashes in Colorado, Utah, southeast Wyoming and New Mexico (Ross et al. 1995; Corn 1998). In the northern Rocky Mountains they have also undergone declines. Surveys in the late 1990s revealed they were absent from a number of areas historically occupied. While they remain widespread across the

landscape, they appear to be occupying only 5 –10 percent, or less, of the suitable habitat (Maxell 2000).

Forestwide Distribution
A systematic inventory of standing water bodies in 50 randomly chosen sub-watersheds, on and off Forest demonstrated similar findings (Maxell 2004). Data indicates western toads are widespread across the Forest but relatively rare in occurrence (Maxell 2004). Toads were detected and breeding in only 7 percent of the suitable habitats within watersheds. What this represents with regard to historic distribution and abundance in this area is not known, since there is no baseline data to compare against. However, based on declines in other western states, it seems reasonable they are depressed and a primary cause is believed to be disease. The Montana Natural Heritage Tracker Database is the primary source for this information (MNHP 2010b).

Project Area Distribution
Surveys conducted by Maxell 2004 included the Flint Creek watershed in the project area, did not locate any western toads although suitable habitat may be present. For this reason, it is assumed they may occur in or along any of the perennial streams (or their tributaries) within the project area.

Western pearlshell mussels
Margaritifera falcata may be one of the longest living freshwater invertebrates and animals. Specimens have been aged at greater than 90 years (Vannote and Minshall 1982). The western pearlshell mussel has an elongate shell typically 2.5-4 inches long with a concave ventral edge. The interior shell has a purple to pink hue as the outside shell is dark brown to black. These mussels are found in cool, stable running, generally low to moderate gradient streams and rivers. Swift stream velocities can limit where mussels occur in streams. They are most commonly found in stable gravel and pebble benthic substrate, but can occur in sand or gravel among cobble and boulders in moderate to higher gradient larger rivers. They usually occupy reaches of stream where the riparian zone is dominated by willows or alders.

The life history of this mussel consists of four basic life stages, reproductive, larval or parasitic, juvenile and adult. The larval stage (glochidia) briefly parasitizes a host fish, most commonly westslope cutthroat trout by attaching to the gills. They fall off the host as a juvenile mussel. The larval parasitism on fish enables upstream transport to habitats otherwise difficult to reach by relatively immobile adult mussels. Western pearlshell glochidia are considered highly host specific (Bauer 1987) as they are typically restricted to salmonid fishes.

The western pearlshell mussel has experienced significant reductions in distribution over the last 100 years. A primary cause is believed to be stream habitat deterioration from high levels of fine sediment. Excess fine sediment degrades mussel habitats by decreasing substrate permeability. This has a smothering effect on juvenile mussels and limits successful recruitment (Stagliano 2010).

Because they have not been observed during past stream surveys, the Montana Natural Heritage database contains no record of occurrence for this species in the project area and because the streams tend not to provide the types of habitats they prefer it appears western Pearlshell mussels are not present, and so will not be addressed further in this analysis.

Drunella Doddsi - Management Indicator Species

Background

The mayfly, *Drunella doddsi* (DD), is an aquatic management indicator species (MIS) for the Beaverhead Deerlodge NF. It was selected because it commonly occurs in streams across the Forest; and because it is influenced by changes in water quality, including sedimentation. The analysis for the Forest Plan recognized sedimentation as an impact common to aquatic systems from land management actions, including various types of vegetation management, road construction, vehicular use of roads and trails, livestock grazing, and various types of restoration actions. High levels of fine sediment in aquatic systems are commonly synonymous with degraded habitat conditions and poor stream function. The reverse is so when fine sediment levels are low.

There are specific habitats with greater potential for hosting DD than others. Its preference is commonly for higher stream gradients with larger substrate size. It is often present in lower gradient reaches, where we commonly survey to evaluate aquatic impacts from management; but commonly in lower densities. We expect to see abundances of DD decline in moderate to low gradient reaches if fine sediment is deposition is increasing, leaving the population centralized in higher gradient areas where sediment is transported through to downstream reaches. Thus, DD is probably more quickly influenced (and changes in abundance more observable) in lower gradient reaches than in its steeper more preferred habitats.

Based on its ecology, abundances of DD should decline or increase depending on the influence land management is having on sediment introduction. As such, its abundances should indicate whether management activities are effectively maintaining and/or improving conditions for desired aquatic species.

Abundances of DD naturally vary in four ways:

- Between stream segments within the same stream depending on the quality and abundance of preferred habitats
- Between streams, depending on differences in thermal regimes and the abundance of preferred habitats
- Between different periods within the year, depending on when adult emergence occurs and when newly deposited eggs hatch and become large enough to be captured during sampling
- Between years, depending on favorability of weather and stream flow conditions for reproduction and recruitment

Thus, sampling times, locations and equipment can influence comparability of data between years. Because DD was only identified as an aquatic MIS upon completion of the Forest Plan (2009), adjustments to sampling procedures remain a possibility as we learn more about distribution and emergence patterns in streams we monitor. Any adjustments will be done with the intention to produce the most comparable data possible.

Because DD was relatively recently identified as an aquatic MIS, reliable trend information is not currently available. We have sampled and counted DD in 111 samples from 75 streams across the Forest. Densities ranged from 1 to 714 (per square meter); however it is common for them to occur in relatively low densities. In 30 percent of the samples they occurred in densities of 10 or less. Fifty-two percent of the samples had densities of 25 or less and 79 percent of the samples had densities of 100 or less.

Data on abundance is available for the North Fork Gold and the South Fork Douglas Creeks within the analysis area. We have 1 year of information for each stream. For this reason comparison of the data to determine trends in abundance is not practical at this time. Results are provided in table 85 that follows.

Table 85. *Drunella doddsi* sample results by stream

Stream	Date	Density/m^2
NF Gold Creek	7/13/07	8
SF Douglas Creek	6/13/09	12

Drunella doddsi occurs in relatively low abundances in the two streams sampled in the project area. However, inferring management effects from single samples is less than desirable and can be misleading. Interpretation of this MIS data will be more reliable when results from additional samples are available. There will be an opportunity to correlate MIS data with management actions and habitat condition trends in the future.

Our monitoring is designed to measure changes in abundance of DD over time as an indication of changing sediment levels. Effects of proposed management on this species will be assessed based on expected change in stream function. As conditions improve in streams that are not in properly functioning condition, sediment levels will decline and DD densities should increase (Brammer 2012).

Aquatic Nuisance Species

Currently, there are no aquatic nuisance species documented within or adjacent to the Flint Foothills Project area.

Species Not Carried Forward For Detailed Analysis

Bull trout (threatened), and arctic grayling and western pearshell mussel (sensitive) are not carried forward for further analysis because of lack of suitable habitat within the analysis area, distance from known locations, or lack of potential impact to the species or its habitats. Activities from the Flint Foothills Project would not have an impact on these species.

Desired Condition

Regulatory Framework

Three government agencies share responsibility for managing aquatic resources. The U.S. Fish and Wildlife Service is a regulatory agency for federally listed species that seeks to recover these species in conjunction with other agencies. The Montana Department of Fish, Wildlife and Parks (MDFWP) has primary responsibility for managing fish populations. Management of fish and amphibian habitat on National Forest System lands is largely a Forest Service responsibility. All three agencies cooperate in research and monitoring efforts.

The Beaverhead-Deerlodge National Forest must comply with several regulations regarding management of aquatic species. Both action alternatives fully comply with all regulations. The mayfly, *Drunella doddsi*, is a management indicator species for the Beaverhead Deerlodge National Forest. It was selected because it commonly occurs in streams across the Forest and because it is influenced by changes in water quality, including sedimentation.

The sensitive species analysis in this document meets the requirements for a biological evaluation as outlined in FSM 2672.42. Sensitive species are administratively designated by the Regional Forester and managed under the authority of the National Forest Management Act.

The Regional Forester has determined that westslope cutthroat trout, arctic grayling, western toad and western pearlshell mussel are sensitive species on the Beaverhead-Deerlodge National Forest. The Forest Service is required to protect their habitat and prevent population declines that would lead to listing under the Endangered Species Act (FSM 2670).

In 1999, the Regional Forester signed the "Conservation Agreement and Management Plan for Westslope Cutthroat Trout in Montana." This conservation agreement has five objectives, of which the first three are relevant to National Forest System lands. The memorandum of understanding was updated in 2007 and the Forest is still committed to the objectives described. The first objective is to protect all genetically pure populations. The second objective is to protect all populations that are only slightly introgressed (90 percent pure). The third objective is to recover cutthroat trout in several large watersheds (at least 50 miles of habitat) across the state.

The U.S. Fish and Wildlife Service listed bull trout (*Salvelinus confluentus*) as a threatened species, under the Endangered Species Act in 1998.Bull trout are not present in the analysis area and will not be addressed further in this analysis. Critical habitat was designated in 2010. Forest-wide, they are present in upper Clark Fork River. Water quality conditions have largely eliminated upper Clark Fork River as suitable habitat or as a migratory corridor and bull trout are currently rare to incidental in the river upstream of river mile 9.4, and absent from all the project area tributary streams (Montana FWP 2009).

The National Forest Management Act of 1976 - Prevents watershed conditions from being irreversibly damaged and protects streams and wetlands from detrimental impacts. Land productivity must be preserved. Fish habitat must support a minimum number of reproductive individuals and be well distributed to allow interaction between populations.

Executive Order 11988 - Directs federal agencies to provide leadership and take action on federal lands to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to avoid the direct or indirect support of development on floodplains whenever there are reasonable alternatives and evaluate the potential effects of any proposed action on floodplains.

Executive Order 11990*, as amended* - Requires federal agencies exercising statutory authority and leadership over federal lands to avoid to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Where practicable, direct or indirect impacts of new construction in wetlands must be avoided. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands. Other laws pertinent to watershed management of NFS lands can be found in Forest Service Manual (FSM) 2501.1.

Executive Order 13112 - Directs federal agencies whose actions may affect the status of invasive species to (1) prevent the introduction of invasive species, (2) detect and respond rapidly to and control populations of such species in a cost effective and environmentally sound manner, as appropriations allow.

Beaverhead-Deerlodge Forest Plan – This project follows direction from the Beaverhead-Deerlodge National Forest Land and Resource Management Plan (Forest Plan, USDA Forest Service (2009) including goals, standards and guides, and desired condition.

The 2009 Forest Plan includes the following desired conditions that are applicable to the project area fisheries, water quality, and riparian and aquatic ecosystems.

- Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of forest, shrub land, grassland, riparian, and aquatic communities
- Conditions for self-sustaining or viable populations of native and desired nonnative plant and animal species are supported within the natural capability of the ecosystem
- Resources adversely affected by past management activities have been rehabilitated or the related public health and safety issues corrected

The 2009 Forest Plan also contains goals specific to managing aquatic resources that are applicable to the project

Stream Channels: Stream channel attributes and processes are maintained and restored to sustain natural desired riparian, wetland, and aquatic habitats and keep sediment regimes as close as possible to those with which riparian and aquatic ecosystems developed (IN 2) (USDA 2009a, pg. 13).

Floodplains: The condition of floodplains, channels and water tables are maintained and restored to dissipate floods and sustain the natural timing and variability of water levels in riparian, wetland, meadow and aquatic habitats (IN 4) (USDA 2009a, pg. 14).

Riparian Areas: Riparian habitat, species composition, and structural diversity of native and desired nonnative riparian plant communities are maintained or restored to (IN 5-6) (USDA 2009a, pg. 14):

- Provide an amount and distribution of woody debris characteristic of functioning aquatic and riparian ecosystems
- Provide adequate summer and winter thermal regulation for streams to support beneficial uses
- Provide bank stability to maintain rates of surface erosion, bank erosion, and channel migration which are characteristic of functioning aquatic and riparian ecosystems;
- Effectively trap and store sediment, build stream banks and floodplains, and promote recovery after watershed disturbance

Riparian Habitat: Habitat to support viable, well distributed populations of native and desired nonnative plant, invertebrate, and vertebrate aquatic- and riparian-dependent species are maintained or restored. Movement corridors within and between watersheds, where desired, are maintained or restored to provide aquatic-dependent species' habitat needs and maintenance of metapopulations (IN 8) (USDA 2009a, pg. 14).

Channel Integrity: Stream channel function and water quality are maintained or restored to support designated beneficial uses on all reaches through management decisions, restoration projects or Best Management Practices as outlined in the Soil & Water Conservation Practices Handbook.

Aquatic Nuisance Species: Introductions of aquatic nuisance species in riparian and aquatic habitats are prevented. Forest biologists work cooperatively with appropriate state and federal agencies, or other stakeholders to reduce or eliminate impacts, where aquatic nuisance species are adversely affecting the viability of desired aquatic species.

Roads: Roads are designed, constructed, and maintained to meet desired stream function and avoid adverse effects to native fish and sensitive aquatic species (RF 2**)** (USDA 2009a, pg. 15)**.**

Stream Crossings: Culverts, bridges, and other stream crossings can accommodate a 100-year flood, including associated bedload and debris (RF 4) (USDA 2009a, pg. 16).

Standards

Standard 2: Evaluate the risks of aquatic nuisance /exotic species introduction as part of project analysis (Scale – Project area) (USDA 2009a, pg. 18).

Standard 5: New activities within known sensitive amphibian breeding sites and natal areas during breeding and juvenile rearing periods will not cause a threat to viability or a trend toward federal listing (Scale - Breeding sites and natal areas identified at the project level) (USDA 2009a, pg. 18).

Standard 21: Provide and maintain fish passage at new, replacement, and reconstructed road crossings of existing and potential fish-bearing streams, unless barriers are determined beneficial for native fish and sensitive aquatic species conservation (RF 5**)** (USDA 2009a, pg. 20)**.**

Standard 27: Vegetation and/or fuel management prescriptions in RCAs will be for the purpose of restoring, enhancing, or protecting the physical and biological characteristics of the RCA including Riparian Management Objectives. Vegetation and/or fuel treatments, for the purpose of protecting urban interface, private property and other investment, and public safety in RCA's shall be designed so as not to prevent the attainment of desired stream function (TM 1) (USDA 2009a, pg. 21).

Environmental Consequences

Methodology

This analysis addresses effects on populations that result from:

- Effects on aquatic habitat
- Effects on individual aquatic species

Effects on species present in the Flint Foothills Project area, but not specifically addressed in this analysis, should not vary substantially from those presented below. The extent of impacts to individuals within populations should also be within the range described. This is because their behavioral tendencies and sensitivity to influence from the causative factors are not substantially different from those species analyzed.

Sediment Delivery

Roads

Estimated sediment delivered to streams from proposed road closures and culvert replacement/removals were evaluated using the Forest Service WEPP Road Erosion Predictor

model. The Hydrology section provides a discussion on p. 277 of WEPP Roads model used in the modeling process.

For the purposes of this analysis, only roads within 300 feet of perennial streams are considered to be hydrologically connected (i.e., have the potential to deliver sediment). Beyond 300 feet, any sediment that might be produced would typically be immobilized by vegetation and other ground barriers, before it reaches water. However, not all roads within 300 feet are connected.

The extent of sedimentation that occurs from roads is dependent on many factors. The potential for sediment delivery from any route is first dependent on its proximity to a stream course. As the length of road near a stream increases or as the distance between them decreases; impacts to the stream generally increase. Increased sedimentation also occurs as the number of stream crossings increase. Failure of culverts is another factor, and can occur if they have not been designed to handle high-water events. These events are not necessarily typical, but are predictable as 10- to 100-year events. A more common occurrence is "incomplete" failure, where water pools against the road prism or flows over the top of the road for an abbreviated period, causing substantial erosion and the need for repair. This is typically caused by partial or complete debris blockages at the upstream end of the culvert; or water passage limitations during common high water events.

Beyond stream proximity and the number of crossing structures, the physical characteristics of each route define the intensity, extent and location of sediment related impacts. The physical characteristics include: width, slope, drainage features, geology, soils, adjacent topography, and the capacity of crossing structures. All of these characteristics vary substantially between routes and are primary determinants of the extent of sedimentation that occurs. The aquatics report in the project record provides more detail on the factors that affect sediment delivery. This analysis expects that all newly constructed temporary roads would be obliterated and would be hydrologically disconnected within a reasonable timeframe.

Temporary Roads

Haul Routes and Road-Stream Crossings

The erosion and sediment delivery potential associated with RCA road segments and road-stream crossings on the proposed log haul routes was modeled with the Forest Service WEPP Road Erosion Predictor model (Elliot et al. 2002). The estimated sediment contributions from roads and road-stream crossings are reported in pounds per year.

Ground-based Timber Harvest

The Disturbed WEPP model was run for all timber harvest units within the Flint Foothills project area that have a moderate, high-moderate, or high risk of erosion, and included those units that have sensitive soil types and boundaries close to the RCA buffers. No sediment delivery is expected from proposed timber units (See hydrology section).

Spatial and Temporal Context for Effects Analysis

The spatial context for effects vary by issue, and range from individual streams, multiple streams occupied by the same populations, and sub-watersheds (6th -field HUCs).

The spatial context for cumulative effects consists of the analysis area boundary and includes portions of the following six 6th field HUCs: Clark Fork-Dunkleberg, Gold Creek, Douglas Creek, Pikes Peak Gulch, Clark Fork River-Perkins Creek and Lower Flint Creek-Gird Creek

HUCs (figure 39 in the Hydrology section). Perennial streams in these HUCs are numerous and listed in table 84. Small ponds and wetlands are also present within these HUCs.

The time period that direct and indirect effects from sedimentation are projected to last, is through the first major flushing flow following the cessation of the action. Across the project area, this is expected to be no more than 5 years from the time the harvest commences, and often one year from the initiation of specific treatments.

New sedimentation sources and their impacts can last a relatively short period of time if they are moderate to low in intensity and soon to be removed. Excessive sediment deposited over longer periods may take longer to pass through the system. Sediment impacts expected to be measurable in the stream beyond 3 years are considered to be long term. Those expected to be measurable less than 3 years are considered short term.

Alternative 1 – No Action

Direct and Indirect Effects

There would be no direct, indirect or cumulative effects to aquatic resources because no project activities are proposed. A description of the on-going processes is provided below for each aquatic issue, by addressing their indicators.

Issue: Change in Stream Habitat Conditions for Drunella doddsi (MIS) and other Aquatic Species

Change in stream function

Change in sediment delivery to streams: Because there would be no project activities, there would be no new road or ground-based timber harvest change in the level of sediment delivered to streams. Sedimentation levels may change due to ongoing management. Taking “no action” to address motorized roads in managed watersheds (like those in the project area) almost always results in the same or increased levels of sedimentation over time.

Changes in Miles of motorized routes in RCAs: Because there would be no project activities, there would be no change in the miles of motorized routes in RCAs.

Measure Summary: Because there would be no project activities, there would be no change in sediment delivery to streams or change in miles of motorized routes in RCAs. Thus, a change in function for any stream within the project area is not expected.

Issue Summary: Alternative 1 would fail to promote improvement in stream habitat conditions for *Drunella doddsi* (MIS) or for other aquatic populations that exist in streams. Thus, certain aquatic populations would remain at lower densities than those in streams that are functioning properly and where habitat quality and quantity are nearer potential.

Issue: Change in Pond and Wetland Habitat Conditions for Aquatic Species

Change in miles of motorized routes in RCAs: Because there would be no project activities, there would be no change in the miles of motorized routes in RCAs.

Change in sediment delivery to ponds and wetlands: Because there would be no project activities, there would be no new road or ground-based timber harvest change in the level of sediment delivered to streams. Sedimentation levels may change due to ongoing management actions. Taking “no action” to address motorized roads in managed watersheds (like those in the project area) almost always results in the same or increased levels of sedimentation over time.

Issue Summary: Alternative 1 would not result in any change in pond and wetland habitat conditions for aquatic species.

Issue: Persistence of Sensitive WCT populations within the Analysis Area

Habitat conditions for WCT occupied streams:

Change in sediment delivery to occupied WCT streams in the analysis area: Because there would be no project activities, there would be no new road related or ground-based timber harvest change in the level of sediment delivered to streams occupied by WCT. Sedimentation levels may change due to ongoing management actions. Taking "no action" to address motorized roads in managed watersheds (like those in the project area) almost always results in the same or increased levels of sedimentation over time.

Changes in Miles of motorized routes in RCAs: Because there would be no project activities, there would be no change in the miles of motorized routes in RCAs.

Measure Summary: Because there would be "no action" there would be no measure/s taken to promote change in function or sediment delivered for any WCT occupied stream within the project area that is not currently at desired conditions.

Issue Summary: Alternative 1 would not result in any change of the persistence of WCT populations within the project area.

Issue: Persistence of Sensitive Western Toad Populations within the Analysis Area

Change in sediment delivery to streams, ponds and wetlands: Because there would be no project activities, there would be no change in road related or ground-based timber harvest sediment delivery to streams ponds and wetlands. Sedimentation levels may change due to ongoing management actions. Taking "no action" to address motorized roads in managed watersheds (like those in the project area) almost always results in the same or increased levels of sedimentation over time.

Expected change in direct mortality to toads from motorized vehicles:

Change in miles of motorized routes in RCAs: Because there would be no project activities, there would be no change in the miles of motorized routes in RCAs.

Miles of Haul routes in RCAs: Because there would be no project activities, there would be no change in the miles of haul routes in RCAs.

Measure Summary: Because there would be "no action" there would be no expected change in direct mortality to toads from motorized vehicles.

Issue summary: Alternative 1 would not result in any change in the in the likelihood of western toad population persistence within the project area.

Issue: Change in distribution of Aquatic Nuisance Species (ANS) within the Analysis Area

Expected change in vectors of transport and introduction of ANS: Because there would be no project activities, there would be no expected change in vectors of transport and introduction of ANS within the project area.

Issue Summary: Alternative 1 would not result in a change in distribution of aquatic nuisance species in the analysis area.

Alternative 2 – Proposed Action

Table 86 provides measures that are used in the subsequent analysis. It displays haul route and temporary road lengths, stream crossings and proposed temporary or NFS roads in RCAs for alternative 2 for drainages with streams occupied by westslope cutthroat trout.

Table 86. Alternative 2-miles of haul routes, temporary roads, and proposed temporary or new NFS roads, and number of stream crossings within 300 feet of selected streams

Stream	Watershed (6th Field HUC)	Haul Routes (miles)	Haul Routes in RCAs (miles)	Temporary Roads Including Newly Constructed and Unauthorized Routes (miles)	Haul Route Major Stream Crossings	Proposed Temporary or New NFS Roads within 300 ft. of Streams	Notes
Dunkleberg Creek	Clark Fork River – Dunkleberg Creek	7.9	0.6	0.9	6	0.1	Temporary road has two major stream crossings in trib. to Dunkleberg Ck.
Douglas Creek Mainstem	Douglas Creek	4.8	0.0	0.7	0	0	Sediment deposits observed from 2011 flooding from road washout in N. Fk. Douglas Creek.
South Fk Douglas Creek	Douglas Creek	1.1	0.6	0.0	1	0	
Middle Fk. Douglas Creek	Douglas Creek	0.8	0.8	0.0	1	0	
North Fk. Douglas Creek	Douglas Creek	5.6	2.3	1.8	2	0	High sediment from road washout in upper watershed in 2011. Sediment deposits evident downstream.
Gold Creek Mainstem	Gold Creek	11.6	1.4	0.0	1	0	Gold Creek mainstem is located on private lands.
N. Fk. Gold Creek	Gold Creek	14.4	1.0	1.3	3	0.3	This drainage has the highest amount of new road constructed in

Stream	Watershed (6th Field HUC)	Haul Routes (miles)	Haul Routes in RCAs (miles)	Temporary Roads Including Newly Constructed and Unauthorized Routes (miles)	Haul Route Major Stream Crossings	Proposed Temporary or New NFS Roads within 300 ft. of Streams	Notes
							RCAs.
S. Fk. Gold Creek	Gold Creek	1.1	0.3	0.0	1	0	
Blum Creek	Gold Creek	9.6	0.6	1.4	4	0	High number of stream crossings, but most are not sediment sources.
Crevice Creek	Gold Creek	3.7	1.1	0.2	3	0	
Pikes Peak Creek	Pikes Peak Creek	0.0	0.0	0.0	0	0	
Gird Creek	Lower Flint Creek - Gird Creek	5.0	1.9	2.0	2	0.2	Haul road parallels Gird Creek within RCA for 1.9 miles. Temporary road parallels a tributary to Flint Creek for 0.2 miles.
Total		65.6	10.6	8.3	24	0.5	

Note- information obtained from estimates based on proposed action map

Direct and Indirect Effects

A description of the direct and indirect effects of alternative 2 is provided below for each aquatic issue, by addressing their indicators.

Issue: Change in Stream Habitat Conditions for (MIS) *Drunella doddsi* (DD) and other Aquatic Species

Changes in the quality and quantity of stream habitat conditions, is directly related to how well a stream functions. Stream function in the analysis area is primarily affected by sediment delivery and physical alterations to stream banks and floodplains. If the amount of sediment delivered to a stream increases beyond the stream's capacity to transport it, it is deposited on the stream bottom blanketing it and changes characteristics important to aquatic species. Fine sediment clogs interstitial spaces in stream substrate, restricting sub-surface water movement.

Oxygen delivery to fish eggs and removal of metabolic wastes is reduced and increased mortality to eggs results. When eggs survive, they hatch, and fry absorb their yolk-sacs. Sediment laden stream substrate also restricts movement of fry to the substrate surface, where they must begin active feeding. Entombment often occurs and mortality increases.

Substantial increases in sediment can also prevent juvenile trout from using spaces between larger, cobble sized rocks in the substrate. As pools fill, their depth and complexity decreases. The combined result is a reduction in a stream's ability to support a healthy fishery.

Amphibians also use streams, but are probably more substantially affected by changes to small lakes, ponds and wetlands. Because they typically lay eggs on submergent vegetation or on top of the substrate, sediment effects on reproductive success is less immediate than with trout. Concerns are more closely related to sediment deposition causing lakes ponds and wetlands to fill in; reducing their size and/or suitability as breeding, juvenile or adult habitats.

Mussels similarly can be negatively impacted by excess sedimentation. As a result of decreased substrate permeability, juvenile mussels can be subject to the smothering effect of silt added to stream habitats. Also, as sediment decreases the spawning success and recruitment of the mussels' salmonid hosts, can limit mussel recruitment as well.

Change in stream function

Change in sediment delivery to streams: Sediment delivery to streams occurs primarily from roads in riparian conservation areas (RCAs). WEPP models allow us to estimate sediment that may be delivered from roads. The Hydrology section provides modeled estimates of current sediment delivery from existing roads and stream crossings that would be used as haul routes, and roads that would be closed under action alternatives. It also provides modeled estimates of sediment delivery during and post implementation of alternative 2. Under existing conditions, the total WEPP modeling estimate of sediment delivered from those roads is 2,761 pounds per year. It also indicated this would decrease to 2,145 pounds per year during implementation of alternative 2, then drop to 1,459 pounds per year post implementation.

Road WEPP analysis indicates that under current traffic conditions sediment production ranged from 26 pounds per acre to 543 pounds per crossing for project road-stream crossings in the Gold Creek watershed. Comparison of before, during and after project sediment values indicates that there would be an overall decrease in sediment during and after the project from roads. This is a result of implementing sediment reducing BMP upgrades and road reconstruction for improved drainage. Placing slash windrows, or equivalent methods, at runoff points at stream crossings, this was not modeled, but would further reduce sediment both during and after the project.

Alternative 2 would construct 0.5 miles of new temporary road in RCAs, of which 0.33 miles are needed to access Unit 55c, and 0.17 to access Unit 68c. Proposed temporary roads outside of RCAs would be low-risk for delivering sediment to streams. All newly constructed temporary roads would be decommissioned by obliteration following project implementation. BMPs and project design features for temporary roads should be effective at reducing sediment amounts generated from construction of new temporary roads.

The greatest input of sediment from roads generally occurs during construction and active log haul during timber harvest. Sediment erosion and delivery is possible within 1 or 2 years after construction occurs in areas immediately adjacent to where road construction or road reconstruction activities have occurred (Luce and Black 1999, 2001), and during log haul.

Longer-term effects (over 1 year after disturbance) such as erosion and delivery of sediment would not be expected for this alternative due to improvements in road drainage and implementation of BMPs during activities and once activities are completed.

Temporary roads in RCAs generally pose one of the highest risks of contributing road-derived sediment. BMPs such as waterbars spaced at intervals to divert surface flows on temporary roads would be implemented that would substantially reduce the risk of sediment erosion and delivery to channels. Road maintenance for temporary roads would be conducted for this project. These activities would include road surface blading, dust abatement, ditch cleaning, and work on minor drainage structures.

Changes in Miles of motorized routes in RCAs: New temporary road construction would take place on 0.2 miles within RCAs for Lower Flint Creek-Gird Creek watershed, and 0.3 miles of new construction within RCAs in Gold Creek. All newly constructed temporary roads would be decommissioned by obliteration immediately following project activities. The transportation section describes actions associated with obliteration.

Measure Summary: Although some short-term water quality effects such as local erosion and sedimentation may occur immediately after temporary road construction or road maintenance, with the implementation of BMPs the amount of sediment would be reduced during and after project activities, and not be expected to modify water quality or stream function. Under alternative 2 there would be measurable long-term reductions in sedimentation (as inferred through risks associated with WEPP modeled estimates) from road related actions, realized within a few years after implementation in streams modeled. All newly constructed temporary roads would be decommissioned by obliteration immediately following project activities; therefore the increase of 0.5 miles of motorized routes in RCAs would be temporary.

Issue Summary: Although there would likely be small increases in sedimentation to some streams from temporary road construction, road maintenance and log hauling in RCAs there would be substantially greater reductions from road maintenance and BMP related improvements. In total, alternative 2 should result in notable long-term improvements in stream habitat conditions for DD and other aquatic species in the analysis area due to the overall reductions in road generated sediment. Increases in population densities of DD and other aquatic populations would be expected as instream sediment levels decrease. Although some short-term water quality effects such as local erosion and sedimentation may occur immediately after temporary road construction or road maintenance, with the implementation of BMPs the amount of sediment would be minimal, and not be expected to modify water quality or stream channel function.

Issue: Change in Pond and Wetland Habitat Conditions for Amphibian Species

Amphibian species mostly depend on pond and wetland habitats. Some also depend on streams to meet their habitat needs. Within the analysis area, ponds are limited in abundance, mostly occurring as beaver ponds. Most wetlands are narrow, linear features associated with streams and their floodplains. For this reason, stream RCAs are focus areas where there is the greatest likely-hood of effect and where the greatest changes could occur.

The types of effects to ponds relative to sediment introduction and physical alterations are similar to wetlands. Vehicle impacts along with sedimentation would mostly occur around the margins of ponds where habitat characteristics are similar to—or actually representative of—wetland conditions; with shallow water depths and emergent vegetation. With this in mind, this

analysis will focus on effects to wetlands, understanding that effects to ponds would be similar in nature.

Wetlands have the greatest potential to be impacted physically by motorized vehicles traveling through them and by sediment delivery that makes them smaller or shallower. For these reasons, the indicators chose for changes in pond and wetland habitat conditions are; the change in miles of motorized routes in RCAs and the change in sediment delivery to ponds and wetlands.

Change in miles of motorized routes in RCAs: New temporary road construction would take place on 0.2 miles of within RCAs for Lower Flint Creek-Gird Creek watershed, and 0.3 miles within RCAs in Gold Creek. All newly constructed temporary roads would be decommissioned by obliteration immediately following project activities. *Change in sediment delivery to ponds and wetlands:* For this analysis, we assume there is a direct correlation between reduction in road miles in RCAs and the potential for improvement in ponds and wetlands. No wetlands have been identified in project units, but if they are discovered these areas would be protected during logging operations by establishing RCAs or buffers around wetland features. As a result, no direct or indirect effects resulting from the project would be anticipated. Considering sediment delivery occurs at points along roads and is not continuous, the occurrence of sedimentation to ponds and wetlands is probably limited to a few occurrences in the project area. WEPP modeling **(**Hydrology section) indicates there would be some short-term water quality effects such as local erosion, and sedimentation may occur immediately after temporary road construction or road maintenance. With the implementation of BMPs there would be measurable long-term reductions in sedimentation (as inferred through risks associated with WEPP modeled estimates) from road related actions realized within a few years after implementation in streams modeled.
Measure Summary: Although some short-term water quality effects such as local erosion and sedimentation may occur immediately after temporary road construction or road maintenance, with the implementation of BMPs the amount of sediment would be reduced during and after project activities, and not be expected to modify water quality or stream function. Under alternative 2 there would be measurable long-term reductions in sedimentation (as inferred through risks associated with WEPP modeled estimates) from road related actions, realized within a few years after implementation in streams modeled. All newly constructed temporary roads would be decommissioned by obliteration immediately following project activities;; therefore the increase of 0.5 miles of motorized routes in RCAs would be temporary,

Issue Summary: For ponds or wetlands to lose their ability to function properly, they have to be severely, physically altered they lose their water table (substantial portion dries up); or have so much sediment delivered to them that they largely fill in; Across the Forest, there are numerous instances of motorized road and trail crossings in wetlands and specific sites where sediment delivery is occurring. , However, there are few if any where road or management related sediment impacts are severe enough to cause that level of alteration. Within the analysis area, there are no known ponds or wetlands that are at risk of losing their suitability as amphibian habitat.

WEPP modeling for Alternative 2 indicates there would be reductions in sedimentation during and after the project. As a result, there should not be measurable negative changes to suitable amphibian habitats.

Issue: Persistence of Sensitive WCT populations within the Analysis Area

The persistence of sensitive westslope cutthroat trout in the project area requires suitable protections against hybridization and competition from nonnative species, an adequate distribution to prevent them from being threatened by intense, isolated environmental events (flood, fire and drought), and an adequate quantity and quality of stream habitats to support abundant numbers of fish in all life stages.

The Forest Service does not manage nonnative fisheries and so cannot remove them from streams where they pose a threat to WCT. This is the responsibility of Montana Fish, Wildlife and Parks. We can influence the level of function in streams. As mentioned above, with changes in function, there is a corresponding change in habitat conditions. We can also influence fish distribution, through the removal or placement of fish passage barriers (if it will not pose a threat from nonnative trout).

Indicators used to evaluate the likely-hood of WCT populations persisting within the analysis area are:

Habitat conditions for WCT occupied Streams:

Change in sediment delivery to occupied WCT streams in the Analysis Area: WCT occupied streams include:

- Dunkleberg Creek
- Douglas Creek
- SF Douglas Creek
- MF Douglas Creek
- NF Douglas Creek
- Gold Creek
- NF Gold Creek
- SF Gold Creek
- Blum Creek
- Crevice Creek
- Pikes Peak Creek
- Gird Creek

The Hydrology report provides modeled estimates of current sediment delivery from existing roads and stream crossings that would be used as haul routes, and roads that would be closed under both action alternatives. It also provides modeled estimates of sediment delivery during and post implementation of alternative 2. Under existing conditions, the total WEPP modeling estimate of sediment delivered from those roads is 2,761 pounds per year. It also indicated this would decrease to 2145 lbs. /year during implementation of alternative 2, then drop to 1,459 pounds per year post implementation.

Project road information displayed previously in table 86 shows there are 24 major stream crossings located on haul routes. Road WEPP analysis indicates that under current traffic conditions sediment production ranged from 26 pounds per acre to 543 pounds per crossing for project road-stream crossings. Comparison of before, during and after project sediment values indicates that there would likely be an overall decrease in sediment from roads during and after the project. This is a result of implementation of road sediment reduction BMP upgrades or

road reconstruction for improved drainage. BMP effectiveness is discussed later in this document. Sediment reduction methods at road crossings would also include placing slash windrows at runoff points at stream crossings. This was not modeled, but would further reduce sediment both during and after the project.

Further reductions in long-term effects to water quality from roads under this alternative would be expected because of reductions in the length of open roads. This alternative includes closure of 3.1 miles of roads in the project area following treatments. Because closed roads generate less sediment than open roads, this reduction would reduce the amount of sediment generated and available for delivery to streams after the project is completed.

The highest risk of delivery of sediment under alternative 2 to streams would be from new road construction within RCAs, including both proposed temporary and NFS road construction, followed by drainages with the highest number of stream crossings. New road construction exposes soil and may increase erosion and sediment delivery to streams, especially when located in RCAs.

Existing haul road mileages were highest in the Gold Creek drainage, and within that drainage were highest in the North Fork Gold Creek. North Fork Gold Creek would have three major haul route-stream crossings, and 0.3 miles of new road construction within 300 feet of streams. Gold Creek drainage is probably the highest risk area for potential sediment delivery to streams overall from haul roads within the project area. Surveys in the Gold Creek 6th field noted fair habitat with notable fine sediment.

In the Gird Creek 6th field HUC alternative 2 proposes 0.2 miles of new temporary road construction that would parallel a tributary to Flint Creek for 0.2 miles; the haul road parallels Gird Creek within RCA for 1.9 miles with 2 major stream crossings.

Douglas Creek shows high sediment loads from erosion caused by flooding in 2011. Haul route mileage proposed in the Doulas 6th field is approximately 12.3 miles of which 3.7 occurs in the RCA. No new temporary roads are proposed in Douglas Creek. Surveys in Gird Creek and Douglas Creek and its forks indicate fair to good habitat for WCT.

The WEPP modeling estimate of sediment delivered from roads is the Gold Creek drainage for the existing condition is 2,761 pounds per year. It also indicated this would decrease to 2,145 lbs. /year during implementation of alternative 2, then drop to 1,459 pounds per year post implementation. This decrease in sediment input to Gold Creek from BMP maintenance to roads should show measurable decrease in sediment in the Gold Creek 6th field watershed, and therefore improvements in WCT habitat. Other watersheds in the analysis area that were not modeled should show similar decreases during and after project implementation.

Measure Summary: For drainages with stream crossings highly effective BMPs such as slash windrows, or equivalent methods, would be used to reduce the potential for sediment delivery to streams. Where construction of new roads within 300 feet of streams would occur, BMPs designed to help avoid impacts to water quality including sediment delivery to streams would be used to reduce short- and long-term impacts. Short-term risks and impacts for new road construction would be ground-disturbance and soil compaction that could lead to indirect effects such as soil erosion. Long-term impacts once roads are constructed would be potential road drainage problems.

After considering road maintenance and road improvements that would occur prior to hauling, and road closures, along with the WEPP models tendency to overestimate sediment delivery, measurable reductions in sediment delivery to streams would result in habitat improvements in the WCT occupied streams within a couple of years after implementation of alternative 2. Reducing sediment delivery would lead to improved spawning substrate and habitat conditions, WCT population density should also improve.

Changes in Miles of motorized routes in RCAs: New temporary road construction would take place on 0.2 miles of within RCAs for Lower Flint Creek-Gird Creek watershed, and 0.3 miles of new construction with RCAs in Gold Creek. All temporary roads constructed would be decommissioned by obliteration immediately following project activities.
Measure Summary: All newly constructed temporary roads would be decommissioned by obliteration immediately following project activities; therefore the increase of 0.5 miles of motorized routes in RCAs would be temporary.

Issue Summary: Alternative 2 should result in long-term improvements in stream habitat conditions for all WCT occupied streams in the analysis area. Increases in population densities of WCT would be expected. Although some short-term water quality effects such as local erosion and sedimentation may occur immediately after temporary road construction or road maintenance, with the implementation of BMPs would result in measurable long-term reductions in sediment delivery – and measurable stream habitat conditions in streams in the analysis area.

Issue: Persistence of Sensitive Western Toad Populations within the Analysis Area

Data indicates western toads are widespread across the Forest but relatively rare in occurrence. Although they have not been documented in the project area, suitable habitat is present throughout. For this reason it is assumed they may occur in or along any of the perennial streams (or their tributaries) within the project area.

Western toads commonly use stream, pond and wetland habitats. Within the analysis area, ponds are limited in abundance, mostly occurring as beaver ponds. Most wetlands are narrow, linear features associated with streams and their floodplains. For this reason, stream RCAs are focus areas where there is the greatest chance of effect and where the greatest changes could occur.

The types of effects to ponds relative to sediment introduction and physical alterations are similar to wetlands. Vehicle impacts along with sedimentation would mostly occur around the margins of ponds where habitat characteristics are similar to – or actually representative of – wetland conditions; with shallow water depths and emergent vegetation. With this in mind, this analysis will focus on effects to wetlands, assuming that effects to ponds would be similar in type and extent.

Wetlands have the greatest potential to be impacted physically by motorized vehicles traveling through them and by sediment delivery that makes them smaller or shallower. For these reasons, the indicators chosen for changes in pond and wetland habitat conditions are changes in sediment delivered to streams and wetlands; changes in direct mortality to individuals from motorized vehicles.

Change in sediment delivery to streams and wetlands: With implementation of alternative 2, WEPP modeling data in the Hydrology section provides modeled estimates of current sediment delivery from existing roads and stream crossings that would be used as haul routes, and roads

that would be closed under action alternatives. It also provides modeled estimates of sediment delivery during and post implementation of alternative 2. Under existing conditions, the total WEPP modeling estimate of sediment delivered from those roads is 2,761 pounds per year. It also indicated this would decrease to 2145 pounds per year during implementation of alternative 2, then drop to 1459 pounds per year post implementation.

Road WEPP analysis indicates that under current traffic conditions sediment production ranged from 26 pounds per acre to 543 pounds per acre for project road-stream crossings. Comparison of before, during and after project sediment values indicates that there would likely be an overall decrease in sediment during and after the project from roads. This is a result of implementation of road sediment reduction BMP upgrades or road reconstruction for improved drainage. Sediment reduction methods at road crossings would also include placing slash windrows at runoff points at stream crossings. This was not modeled, but would further reduce sediment both during and after the project.

Further reductions in long-term indirect effects to water quality from roads under this alternative would be expected because of reductions in the length of open roads. This alternative includes closure of 3.1 miles of roads in the project area following treatments. Because closed roads generate less sediment than open roads, this reduction would reduce the amount of sediment generated and available for delivery to streams after the project is completed.

Existing haul road mileages were highest in the Gold Creek drainage, and within that drainage were highest in the North Fork Gold Creek. North Fork Gold Creek would have three major haul route-stream crossings, and 0.3 miles of new road construction within 300 feet of streams. Gold Creek drainage is probably the highest risk area for potential sediment delivery to streams overall from haul roads within the project area. Surveys in the Gold Creek 6th field noted fair habitat with notable fine sediment.

In the Gird Creek 6th field HUC alternative 2 proposes 0.2 miles of new temporary road construction that would parallel a tributary to Flint Creek for 0.2 miles; the haul road parallels Gird Creek within RCA for 1.9 miles with 2 major stream crossings.

Douglas Creek shows high sediment loads from erosion caused by flooding in 2011. Haul route mileage proposed in the Doulas 6th field is approximately 12.3 miles of which 3.7 occurs in the RCA. No new temporary roads are proposed in Douglas Creek. Surveys in Gird Creek and Douglas Creek and its forks indicate fair to good instream habitat with good riparian vegetation.

The WEPP modeling estimate of sediment delivered from roads is the Gold Creek drainage for the existing condition is 2,761 pounds per year. It also indicated this would decrease to 2,145 lbs. /year during implementation of alternative 2, then drop to 1,459 pounds per year post implementation. This decrease in sediment input to Gold Creek from BMP maintenance to roads should show measurable decrease in sediment in the Gold Creek 6th field and therefore improvements in Western toad habitat. Other watersheds in the analysis area that were not modeled should show similar decreases in sediment generated by roads both during and after project implementation.

Measure Summary: For drainages with stream crossings highly effective BMPs such as slash windrows would be used to reduce the potential for sediment delivery to streams. Where construction of new roads within 300 feet of streams would occur, BMPs designed to help avoid impacts to water quality including sediment delivery to streams would be used to reduce short- and long-term impacts. Short-term risks and impacts for new road construction would be

ground-disturbance and soil compaction that could lead to indirect effects such as soil erosion. Long-term impacts once roads are constructed would be potential road drainage problems.

After considering road maintenance and road improvements that would occur prior to hauling, and road closures, along with the WEPP models tendency to overestimate sediment delivery, measurable reductions in sediment delivery to streams would result in habitat improvements in the streams within a couple of years after implementation of alternative 2. Reducing sediment delivery would lead to improved substrate and habitat conditions, Western toad population density should also improve.

Expected change in direct mortality to individuals from motorized vehicles: Notable changes in direct mortality from motorized vehicles would be related to changes in the intensity and speed of traffic near concentration areas.

Change in miles of motorized routes in RCAs: New temporary road construction would take place on 0.2 miles of within RCAs for Lower Flint Creek-Gird Creek watershed, and 0.3 miles of new construction with RCAs in Gold Creek. All newly constructed temporary roads would be decommissioned by obliteration immediately following project activities.

Miles of Haul routes in RCAs: It is possible there could be increases in the speed of vehicles traveling routes within the project area. This could result from some of the road improvements that would occur. However, it is unlikely the increases would be more than a few miles-per-hour. With the relatively low vehicle speeds common to Forest roads, we expect the change in speed to have little to no effect on the risk of vehicle related mortality. Situations that have been noted for causing mortality levels that are a concern are often associated with pavement and vehicles traveling at much higher speeds than we would see as a result of this project.

There would be increases in vehicle traffic with workers traveling to the project area and with log hauling. The time of travel would be concentrated during daylight hours, a period when vehicle mortalities to toads are much less common. Based on this, there is a small increase in the possibility of mortalities due to higher traffic levels, but the change in risk is small.

Documentation of locations and the number of individual toads killed on Forest roads for more than 5 years have noted relatively few occurrences; none of which resulted in a high number of, or even multiple mortalities. Also, we are not aware of any breeding sites that are adjacent to roads; a situation where densities of toads would be concentrated, increasing the risk of high mortalities when small toadlets are migrating away from the area.

Aquatic standard5 in the Forest Plan (Forest Plan p. 18) requires that new management activities within known sensitive amphibian breeding sites and natal areas during breeding and juvenile rearing periods will not cause a threat to population viability or a trend toward federal listing. This standard directs us to modify management actions around a newly identified breeding and/or natal area if they are causing mortalities to, or pose a threat to, high numbers of individuals. Given this direction, along with the fact that there would be little to no change in risk, and we know of no areas where mortalities are beyond incidental, we expect there would be no measurable change in the incidence of vehicle related mortality to toads. Thus, for alternative 2, vehicle related mortality to amphibians should remain at low levels and would not occur at levels that should create negative trends in populations or place populations at risk

Issue Summary: We expect there should be little to no change in the persistence of Western toad from increases in vehicle speed or vehicle traffic levels if implementing alternative 2.

There would be small short-term increases in the total miles of roads in RCAs. Vehicle related mortality to amphibians may not even occur because there are no known breeding sites along current or proposed haul routes. If mortality does occur to individuals, it would not be common enough to create negative trends in populations or place populations at risk.

There would be small increases in sedimentation on project area streams as described above, due to road construction and maintenance. During and following project implementation sedimentation would be reduced at all sites. The initial increase would not be substantial enough to cause measurable change in suitable habitat for western toads.

Thus, proposed activities in alternative 2 would not threaten the persistence of western toad within the analysis area.

Issue: Change in the Distribution of Aquatic Nuisance Species (ANS)

The actions proposed under alternative 2 are to conduct treatments to improve vegetation communities clearcut salvage, commercial thinning, seed tree harvest and precommercial thinning The proposed action treatments would be done with mechanized ground-based equipment on slopes less than 35 percent, or with cable-based logging systems on steeper slopes. Aquatic Nuisance Species (ANS) are nonindigenous plant or animal species that threaten the diversity or abundance of native and desired nonnative species and the ecological stability of the infested water. For the purposes of this analysis, the ANS are Western Milfoil, the New Zealand mud snail (NZMS), and the parasite *Myxobolus cerebralis,* which causes whirling disease. Zebra mussels are nonindigenous and can wreak havoc on native mussel populations, but have yet to be found in Montana.

Currently whirling disease has been found in over 95 bodies of water in Montana with severe infections in the Madison River; middle Missouri River near Helena, Rock Creek near Missoula, Big Blackfoot River and many smaller wild trout streams, but has not been identified in or adjacent to the project area.

The NZMS is native to New Zealand but long established in Australia and Europe. Population levels can exceed 100,000 snails per square meter. New Zealand mud snails have become established in every major river drainage in Yellowstone National Park and in the Madison River Drainage in Montana. Modes of transportation may include hitchhiking on recreational equipment and other equipment used in water, in the guts of harvested or illegally transported fish, or via transport on waterfowl and other aquatic birds. NZMS degrade habitat due to their high reproductive capacity and the subsequent impacts on invertebrate food sources. Fish receive little, if any, nutritive value from eating the snail. The snail has an operculum that it closes when threatened, which prevents digestive juices from reaching the soft tissue of the snail's body when ingested by fish.

Expected change in vectors of transport and introduction of ANS: The risk of introducing ANS into the analysis area depends on changing the likelihood for transport from infected water to unoccupied water in the analysis area. The nearest locations for 3 ANS of concern are Canyon Ferry (western milfoil), the Beaverhead River (New Zealand mudsnail) and the Clark-Fork River (whirling disease). There is nothing proposed as part of Alternative 2 that would increase the risk of transporting these species from their current locations to the project area.

There would be no change in recreational uses that would increase the potential for transporting these species from their current locations to the project area.

Issue Summary: Because there are currently no known ANS near to – or within the analysis area and this project is not expected to cause a change in pattern or type of recreational activities that could add vectors of transport and/or increase risk of introduction; There should be no change in the occurrence and/or introduction of ANS within the analysis area by implementing Alternative 2.

Alternative 3

Table 87 provides measures that are used in the subsequent analysis. It displays haul routes and temporary road lengths, stream crossings and proposed temporary or NFS roads in RCAs for alternative 3 for drainages with streams occupied by westslope cutthroat trout.

Table 87. Alternative 3-miles of haul routes, temporary roads, and proposed temporary or new NFS roads, and number of stream crossings within 300 feet of select streams

Stream	Watershed (6th Field HUC)	Haul Routes (miles)	Haul Routes in RCAs (miles)	Unauthorized Routes (miles)	Haul Route Major Stream Crossings	NFS roads within 300 ft. of streams (miles)	Notes
Dunkleberg Creek	Clark Fork River – Dunkleberg Creek	6.9	0.6	0.9	4	0	
Douglas Creek Mainstem	Douglas Creek	4.1	0.0	0.0	0	0	Sediment deposits observed from 2011 flooding from road washout in N. Fk. Douglas Creek.
South Fk Douglas Creek	Douglas Creek	1.1	0.6	0.0	1	0	
Middle Fk. Douglas Creek	Douglas Creek	0.8	0.8	0.0	1	0	
North Fk. Douglas Creek	Douglas Creek	3.8	2.3	0.0	2	0	High sediment from road washout in upper watershed in 2011. Sediment deposits evident downstream.
Gold Creek Mainstem	Gold Creek	11.6	1.4	0.0	1	0	Gold Creek mainstem is located on private lands.

Stream	Watershed (6th Field HUC)	Haul Routes (miles)	Haul Routes in RCAs (miles)	Unauthorized Routes (miles)	Haul Route Major Stream Crossings	NFS roads within 300 ft. of streams (miles)	Notes
N. Fk. Gold Creek	Gold Creek	12.2	1.0	0.0	3	0	
S. Fk. Gold Creek	Gold Creek	1.1	0.3	0.0	1	0	
Blum Creek	Gold Creek	8.2	0.6	0.8	4	0	High number of stream crossings, but most are not sediment sources.
Crevice Creek	Gold Creek	3.1	1.1	0.0	3	0	
Pikes Peak Creek	Pikes Peak Creek	0.0	0.0	0.0	0	0	
Gird Creek	Lower Flint Creek - Gird Creek	3.0	0.9	0.0	2	0	Haul road parallels Gird Creek within RCA for 0.9 miles
Total		55.9	9.6	1.7	22	0	

Direct and Indirect Effects

A description of the direct and indirect effects of alternative 3 is provided below for each aquatic issue, by addressing their indicators.

Issue: Change in Stream Habitat Conditions for *Drunella doddsi* (MIS) and other Aquatic Species

Changes in the quality and quantity of stream habitat conditions, is directly related to how well a stream functions. Stream function in the analysis area is primarily affected by sediment delivery and physical alterations to stream banks and floodplains.

Change in stream function:

Change in sediment delivery to streams: Road WEPP modeling that was done for major haul routes for alternative 2 is used for this alternative (see hydrology report). The major haul routes where sediment source assessments were done are the same for both alternatives. The potential amount of sediment delivery risk to streams from the project road system is less from this alternative than alternative 2. Sediment delivery and erosion occurring because of road maintenance and reconstruction would be less in this alternative than in alternative 2, because

there would be about 12 fewer miles of haul routes, including unauthorized routes, and no new NFS or temporary road construction.

Approximately 55.9 miles of roads within drainages occupied by westslope cutthroat trout would be utilized as haul route, of these 10.7 miles are located in RCAs with 22 road-stream crossings (table 87). However, considering BMPs would be implemented, and their demonstrated high effectiveness rates, road related sediment is expected to be reduced during and after project implementation, so sediment related water quality changes would be expected to be minimal.

Sediment delivery to streams occurs primarily from roads in riparian conservation areas (RCAs). WEPP models allow us to estimate sediment that may be delivered from roads. The Hydrology section provides modeled estimates of current sediment delivery from existing roads and stream crossings that would be used as haul routes, and roads that would be closed under action alternatives. It also provides modeled estimates of sediment delivery during and post implementation of alternative 2. Under existing conditions, the total WEPP modeling estimate of sediment delivered from those roads is 2,761 pounds per year. It also indicated this would decrease to 2,145 pounds per year during implementation of alternative 2, then drop to 1,459 pounds per year post implementation.

Road WEPP analysis indicates that under current traffic conditions sediment production ranged from 26 pounds per acre to 543 pounds per crossing for project road-stream crossings in the Gold Creek watershed. Comparison of before, during and after project sediment values indicates that there would be an overall decrease in sediment during and after the project from roads. This is a result of implementing sediment reducing BMP upgrades and road reconstruction for improved drainage. Placing slash windrows, or equivalent methods at runoff points at stream crossings was not modeled, but would further reduce sediment both during and after the project.

Long-term indirect effects to water quality from roads would be expected to be reduced compared to alternative 2 because there would be no new roads constructed and fewer miles of haul routes. Road maintenance within the RCAs for perennial and intermittent streams would be completed on 10.7 miles, improving the function of water and sediment control measures such as road crowning, condition of ditches, ditch blocks and rolling dips, and culvert function. This action would further reduce the amount of sediment being introduced into streams, as well as the amount of water from road-surface runoff.

Changes in Miles of motorized routes in RCAs: In this alternative, because no new roads are proposed, there would be no increases in the miles of motorized routes in the RCAs.

Measure Summary: Although some short-term water quality effects such as local erosion and sedimentation may occur immediately after road maintenance, with the implementation of BMPs the amount of sediment would be reduced during and after project activities, and not be expected to modify water quality or stream function. Under alternative 3 there would be measurable long-term reductions in sedimentation (as inferred through risks associated with WEPP modeled estimates) from road related actions, realized within a few years after implementation in streams modeled.

Issue Summary: Alternative 3 should result in long term improvements in stream habitat conditions for DD and other aquatic species in the analysis area due to the reductions in road generated sediment. Although some short-term water quality effects such as local erosion and sedimentation may occur immediately after road maintenance, with the implementation of BMPs the amount of sediment would be minimal, and not be expected to modify water quality

or stream channel function, so DD and other aquatic population densities should increase as instream sediment levels decrease.

Issue: Change in Pond and Wetland Habitat Conditions for Amphibian Species

Amphibian species mostly depend on pond and wetland habitats. Some also depend on streams to meet their habitat needs. Within the analysis area, ponds are limited in abundance, mostly occurring as beaver ponds. Most wetlands are narrow, linear features associated with streams and their floodplains. For this reason, stream RCAs are focus areas where there is the greatest likely-hood of effect and where the greatest changes could occur.

The types of effects to ponds relative to sediment introduction and physical alterations are similar to wetlands. Livestock and vehicle impacts along with sedimentation would mostly occur around the margins of ponds where habitat characteristics are similar to – or actually representative of – wetland conditions; with shallow water depths and emergent vegetation. With this in mind, this analysis will focus on effects to wetlands, understanding that effects to ponds would be similar in nature.

Wetlands have the greatest potential to be impacted physically by motorized vehicles traveling through them and by sediment delivery that makes them smaller or shallower. For these reasons, the indicators chose for changes in pond and wetland habitat conditions are; the change in miles of motorized routes in RCAs and the change in sediment delivery to ponds and wetlands.

Change in miles of motorized routes in RCAs: In this alternative, because no new roads are proposed, there would be no increases in the miles of motorized routes in the RCAs.

Change in sediment delivery to ponds and wetlands: Wetlands would continue to be protected by RCAs under this alternative. BMPs and resource protection measures were also selected and designed to prevent, or limit, upland sediment introduction into wetlands and streams. As in alternative 2, no wetlands have been identified in project units, but if they are discovered these areas would be protected during logging operations by establishing RCAs or buffers around wetland features. As a result no direct or indirect effects resulting from the project would be anticipated.

As in alternative 2, no commercial thinning or salvage would be conducted within RCAs. No commercial thin, seed tree harvest or salvage by clearcut harvest would be conducted within RCAs. No direct ignition would occur within RCAs or within riparian areas. In RCAs, only back burning would be allowed when soils are moist and temperatures cool. Short-term direct effects of back burning may consist of partial groundcover removal. Indirect effects such as erosion and transportation of sediment would be considered unlikely due to implementation of BMPs, prohibition of ignition within RCAs, maintenance of groundcover throughout the majority of the RCAs, and burning only when soils are moist and cool. The greatest potential for sediment reduction is associated with road maintenance and improvements that would occur prior to log hauling.

Measure Summary: Although some short-term water quality effects such as local erosion and sedimentation may occur immediately after road maintenance, with the implementation of BMPs the amount of sediment would be reduced during and after project activities, and not be expected to modify water quality or stream function. Under alternative 3 there would be measurable long-term reductions in sedimentation (as inferred through risks associated with

WEPP modeled estimates) from road related actions, realized within a few years after implementation in streams modeled.

Issue Summary: We expect there should be little to no change in the persistence of western toad from increases in vehicle speed or vehicle traffic levels if implementing alternative 3. There would not be increases in the total miles of roads in RCAs. Vehicle related mortality to amphibians may not even occur because there are no known breeding sites along current or proposed haul routes. If mortality does occur to individuals, it would not be common enough to create negative trends in populations or place populations at risk.

There would be small increases in sedimentation on project area streams as described above, due to road construction and maintenance. During and following project implementation sedimentation would be reduced at all sites. The initial increase would not be substantial enough to cause measurable change in suitable habitat for western toads.

Thus, proposed actions in alternative 3 would not threaten the persistence of western toad within the analysis area.

Issue: Persistence of Sensitive WCT populations within the Analysis Area

The persistence of sensitive westslope cutthroat trout in the project area requires suitable protections against hybridization and competition from nonnative species, an adequate distribution to prevent them from being threatened by intense, isolated environmental events (flood, fire and drought), and an adequate quantity and quality of stream habitats to support abundant numbers of fish in all life stages.

The Forest Service does not manage nonnative fisheries and so cannot remove them from streams where they pose a threat to WCT. This is the responsibility of Montana Fish, Wildlife and Parks. We can influence the level of function in streams. As mentioned above, with changes in function, there is a corresponding change in habitat conditions. We can also influence fish distribution, through the removal or placement of fish passage barriers (if it will not pose a threat from nonnative trout).

Habitat conditions for WCT occupied streams

Change in sediment delivery to occupied WCT streams in the Analysis Area: WCT occupied streams include:

- Dunkleberg Creek
- Douglas Creek
- SF Douglas Creek
- MF Douglas Creek
- NF Douglas Creek
- Gold Creek
- NF Gold Creek
- SF Gold Creek
- Blum Creek
- Crevice Creek
- Pikes Peak Creek
- Gird Creek

Road WEPP modeling that was done for major haul routes for alternative 2 is used for this alternative (see hydrology report). The major haul routes where sediment source assessments were done are the same for both alternatives. The potential amount of sediment delivery risk to streams from the project road system is less from this alternative than alternative 2. Sediment delivery and erosion occurring because of road maintenance and reconstruction would be less in this alternative than in alternative 2, because there would be about 12 fewer miles of haul routes, including unauthorized routes, and no new NFS or temporary road construction. Approximately 55.9 miles of roads would be utilized as haul routes, including 10.7 miles within the RCA along perennial and intermittent streams.

Short-term increases in turbidity and suspended sediment may occur from roads during project implementation and road maintenance. However, considering BMPs would be implemented, and their demonstrated high effectiveness rates, not all eroded sediment would be delivered to stream drainages, so sediment related water quality changes would be expected to be minimal.

Existing haul road mileages were highest in the Gold Creek drainage, and within that drainage were highest in the North Fork Gold Creek. North Fork Gold Creek would have three major haul route-stream crossings. Gold Creek drainage is probably the highest risk area for potential sediment delivery to streams overall from haul roads within the project area. Surveys in the Gold Creek 6th field noted fair habitat with notable fine sediment.

In the Gird Creek 6th field HUC alternative 3 the haul road parallels Gird Creek within RCA for 0.9 miles with 2 major stream crossings.

Douglas Creek shows high sediment loads from erosion caused by flooding in 2011. Haul route mileage proposed in the Doulas 6th field is approximately 12.3 miles of which 3.7 occurs in the RCA. Surveys in Gird Creek and Douglas Creek and its forks indicate fair to good habitat for WCT.

The WEPP modeling estimate of sediment delivered from roads is the Gold Creek drainage for the existing condition is 2,761 pounds per year. It also indicated this would decrease to 2,145 lbs./year during implementation of alternative 2, then drop to 1,459 pounds per year post implementation. This decrease in sediment input to Gold Creek from BMP maintenance to roads should show measurable decrease in sediment in the Gold Creek 6th field watershed, and therefore improvements in WCT habitat. Other watersheds in the analysis area that were not modeled should show similar decreases in sediment generated by roads, both during and after project implementation.

Measure Summary: After considering road maintenance and road improvements that would occur prior to hauling, and road closures, along with the WEPP models tendency to overestimate sediment delivery, measurable reductions in sediment delivery to streams would result in habitat improvements in the WCT occupied streams within a couple of years after implementation of alternative 2. Reducing sediment delivery would lead to improved spawning substrate and habitat conditions, WCT population density should also improve.

Long-term indirect effects to water quality from roads would be expected to be reduced compared to alternative 2 because there would be no new roads added and fewer miles of haul routes. Road maintenance within the RCAs for perennial and intermittent streams would be completed on 10.7 miles, improving the function of water and sediment control measures such as road crowning, condition of ditches, ditch blocks and rolling dips, and culvert function. This

action would further reduce the amount of sediment being introduced into streams, as well as the amount of water from road-surface runoff.

Changes in Miles of motorized routes in RCAs: In this alternative, because no new roads are proposed, there would be no increases in the miles of motorized routes in the RCAs.

Measure Summary: On existing roads, effects of maintenance would be less than alternative 2, because there would be about 12.4 fewer miles of haul routes, and no temporary road construction. BMPs would be employed to reduce sediment from all roads used in this alternative. The potential amount of sediment delivery risk to streams is less from this alternative. Reducing sediment delivery would lead to improved spawning substrate and habitat conditions, therefore WCT population density should also improve.

Issue Summary: Alternative 3 should result in long-term improvements in stream habitat conditions for WCT in the analysis area due to the decreases in road generated sediment. Increases in population densities of WCT would be expected. Although some short-term water quality effects such as local erosion and sedimentation may occur immediately road decommissioning or road maintenance, with the implementation of BMPs the amount of sediment would be reduced during and after project implementation, and not be expected to modify water quality or stream channel function.

Issue: Persistence of Sensitive Western Toad Populations within the Analysis Area

Wetlands have the greatest potential to be impacted physically by motorized vehicles traveling through them, by livestock trampling and by sediment delivery that makes them smaller or shallower. For these reasons, the indicators chosen for changes in pond and wetland habitat conditions are changes in sediment delivered to streams and wetlands; changes in direct mortality to individuals from motorized vehicles; and a change in the level of non-sediment related impacts to streams and wetlands.

Change in sediment delivery to streams, ponds and wetlands: Wetlands would continue to be protected by RCAs under this alternative. BMPs and resource protection measures were also selected and designed to prevent, or limit, upland sediment introduction into wetlands and streams. As in alternative 2, no wetlands have been identified in project units, but if they are discovered these areas would be protected during logging operations by establishing RCAs or buffers around wetland features. As a result no direct or indirect effects resulting from the project would be anticipated.

As in alternative 2, no commercial thinning or salvage would be conducted within RCAs. No commercial thin, seed tree harvest or salvage by clearcut harvest would be conducted within RCAs. No direct ignition would occur within RCAs or within riparian areas. In RCAs, only back burning would be allowed when soils are moist and temperatures cool. Short-term direct effects of back burning may consist of partial groundcover removal. Indirect effects such as erosion and transportation of sediment would be considered unlikely due to implementation of BMPs, prohibition of ignition within RCAs, maintenance of groundcover throughout the majority of the RCAs, and burning only when soils are moist and cool. The greatest potential for sediment reduction is probably associated with road maintenance and improvements that would occur prior to log hauling.

Ponds and wetlands represent only a fraction of area instream RCAs in the project area. Considering sediment delivery occurs at points along roads and is not continuous, the occurrence of sedimentation to ponds and wetlands is probably limited to a few occurrences in

the project area. There is also potential for sediment reduction associated with road maintenance and improvements that would occur prior to log hauling. For this analysis, we assume there would probably be a small change in sediment delivery to ponds and wetlands. However, it is doubtful the change would substantially change wetland conditions to any measurable extent.

Existing haul road mileages were highest in the Gold Creek drainage, and within that drainage were highest in the North Fork Gold Creek. North Fork Gold Creek would have three major haul route-stream crossings. Gold Creek drainage is probably the highest risk area for potential sediment delivery to streams overall from haul roads within the project area. Surveys in the Gold Creek 6th field indicate fair habitat with notable fine sediment.

In the Gird Creek 6th field HUC alternative 3 proposes the haul road parallels Gird Creek within RCA for 0.9 miles with 2 major stream crossings.

Douglas Creek shows high sediment loads from erosion caused by flooding in 2011. Haul route mileage proposed in the Doulas 6th field is approximately 12.3 miles of which 3.7 occurs in the RCA. Surveys in Gird Creek and Douglas Creek and its forks indicate fair to good instream habitat with good riparian vegetation.

The WEPP modeling estimate of sediment delivered from roads is the Gold Creek drainage for the existing condition is 2,761 pounds per year. It also indicated this would decrease to 2,145 lbs. /year during implementation of alternative 2, then drop to 1,459 pounds per year post implementation. This decrease in sediment input to Gold Creek from BMP maintenance to roads should show measurable decrease in sediment in the Gold Creek 6th field watershed, and therefore improvements in Western toad habitat. Other watersheds in the analysis area that were not modeled should show similar decreases in sediment generated by roads both during and after project implementation.

Measure Summary: For wetlands to lose their ability to function properly, they have to be severely, physically altered or have so much sediment delivered to them that they largely fill in. Modeling indicates there would be overall decrease in sediment from roads both during and after project implementation.

Expected change in direct mortality to toads from motorized vehicles: Notable changes in direct mortality from motorized vehicles would be related to changes in the intensity and speed of traffic near concentration areas.

Change in miles of motorized routes in RCAs: In this alternative, because no new roads are proposed, there would be no increases in the miles of motorized routes in the RCAs. No new stream crossings are required under this alternative.

Miles of Haul routes in RCAs: It is possible there could be increases in the speed of vehicles traveling routes within the project area. This could result from some of the road improvements that would occur. However, it is unlikely the increases would be more than a few miles-per-hour. With the relatively low vehicle speeds common to Forest roads, we expect the change in speed to have little to no effect on the risk of vehicle related mortality. Situations that have been noted for causing mortality levels that are a concern are often associated with pavement and vehicles traveling at much higher speeds than we would see as a result of this project.

There would be increases in vehicle traffic with workers traveling to the project area and with log hauling. The time of travel would be concentrated during daylight hours, a period when

vehicle mortalities to toads are much less common. Based on this, there is a small increase in the possibility of mortalities due to higher traffic levels, but the change in risk is small.

There are no known breeding sites near existing roads. The estimated increase in daytime traffic from logging trucks is relatively insubstantial and it should not coincide with night-time hours or wet periods when toads are more likely to migrate. Thus, for alternative 3, vehicle related mortality to amphibians should remain at low levels and would not occur at levels that should create negative trends in populations or place populations at risk.

Aquatic standard 5 in the Forest Plan (Forest Plan, p. 18) requires that new management activities within known sensitive amphibian breeding sites and natal areas during breeding and juvenile rearing periods will not cause a threat to population viability or a trend toward federal listing. This standard directs us to modify management actions around a newly identified breeding and/or natal area if they are causing mortalities to, or pose a threat to, high numbers of individuals. Given this direction, along with the fact that there would be little to no change in risk, and we know of no areas where mortalities are beyond incidental, we expect there would be no measurable change in the incidence of vehicle related mortality to toads.

Issue Summary: We expect there should be little to no change in the persistence of Western toad from increases in vehicle speed or vehicle traffic levels if implementing alternative 3. There would not be increases in the total miles of roads in RCAs. Vehicle related mortality to amphibians may not even occur because there are no known breeding sites along current or proposed haul routes. If mortality does occur to individuals, it would not be common enough to create negative trends in populations or place populations at risk.

There would be small increases in sedimentation on project area streams as described above, due to road construction and maintenance. During and following project implementation sedimentation would be reduced at all sites. The initial increase would not be substantial enough to cause measurable change in suitable habitat for western toads.

Thus, proposed actions in Alternative 3 would not threaten the persistence of western toad within the analysis area.

Issue: Change in distribution of Aquatic Nuisance Species (ANS)

The actions proposed under alternative 3 are to conduct treatments to improve vegetation communities clearcut salvage, commercial thinning, seed tree harvest and pre-commercial thinning The proposed action treatments would be done with mechanized ground-based equipment on slopes less than 35 percent, or with cable-based logging systems on steeper slopes. Aquatic Nuisance Species (ANS) are nonindigenous plant or animal species that threaten the diversity or abundance of native and desired nonnative species and the ecological stability of the infested water. For the purposes of this analysis, the ANS that will be considered are the New Zealand mud snail (NZMS) and the parasite *Myxobolus cerebralis*, which causes whirling disease. Zebra mussels are nonindigenous and can wreak havoc on native mussel populations, but have yet to be found in Montana.

Currently whirling disease has been found in over 95 bodies of water in Montana with severe infections in the Madison River; middle Missouri River near Helena, Rock Creek near Missoula, Big Blackfoot River and many smaller wild trout streams, but has not been identified in or adjacent to the project area.

The NZMS is native to New Zealand but long established in Australia and Europe. Population levels can exceed 100,000 snails per square meter. New Zealand mud snails have become established in every major river drainage in Yellowstone National Park and in the Madison River Drainage in Montana. Modes of transportation may include hitchhiking on recreational equipment and other equipment used in water, in the guts of harvested or illegally transported fish, or via transport on waterfowl and other aquatic birds. NZMS degrade habitat due to their high reproductive capacity and the subsequent impacts on invertebrate food sources. Fish receive little, if any, nutritive value from eating the snail. The snail has an operculum that it closes when threatened, which prevents digestive juices from reaching the soft tissue of the snail's body when ingested by fish.

Expected change in vectors of transport and introduction of ANS: The risk of introducing ANS into the analysis area depends on changing the likelihood for transport from infected water to unoccupied water in the analysis area. The nearest locations for 3 ANS of concern are Canyon Ferry (western milfoil), the Beaverhead River (New Zealand mudsnail) and the Clark-Fork River (whirling disease). There is nothing proposed as part of alternative 2 that would increase the risk of transporting these species from their current locations to the project area.

There would be no change in recreational uses that would increase the potential for transporting these species from their current locations to the project area.

Issue Summary: Because there are currently no known ANS near to – or within the analysis area and this project is not expected to cause a change in pattern or type of recreational activities that could add vectors of transport and/or increase risk of introduction; There should be no change in the occurrence and/or introduction of ANS within the analysis area by implementing Alternative 3.

Cumulative Effects for All Alternatives

The table that follows summarizes those actions with the greatest potential for measurable effects to *Drunella doddsi* (DD) and other aquatic species. The effects of past actions are reflected in the existing conditions described above.

Table 88. List of past present and reasonably foreseeable actions likely to currently, or in the future, affect *Drunella doddsi* and other aquatic populations, with a rating of influence on those populations

Activity	Past	Present	Reasonably Foreseeable in Future	Currently Measurable Effect	Positive	Negative
Livestock grazing	x	x	x	Substantial		x
Irrigation diversion	x	x	x	Moderate		x
Invasive plant species treatment	x	x	x	Little	x	
Mining	x			Minor		x
Dispersed recreation	x	x	x	Little		x
Roads and trails	x	x	x	Moderate-Substantial		x
Hazard tree removal		x		Little-None		x

- **Livestock grazing:** This affects DD and other aquatic populations because it alters stream morphology and vegetative conditions in the uplands and riparian areas. This causes increases in sedimentation and ultimately increased levels of fine sediment in the stream substrates where DD lives.
- **Irrigation diversion:** Irrigation diversion effects on DD and other aquatic populations occur through the loss of instream flows and possibly temperature increases. The effects are probably low to moderate because most extensive and dramatic diversions occurs downstream of Forest lands.
- I**nvasive plant species treatment**: Beneficial effects are expected from reversing trends in vegetative conditions. These are potential negative effects if herbicides contact individuals directly. The risk is low for this; the BDNF Noxious Weed EIS provides mitigations to reduce risks of introduction of herbicide into streams and other water bodies. We expect the balance of effects related to this management to be beneficial.
- **Mining:** Historic mining has had minor effects on water quality and stream function in the project area, but there is no known water quality or stream channel conditions caused by historic mining that would be affected by the proposed activities. Placer operations have altered the physical function of some stream channels through the removal of stream gravels.
- **Dispersed recreation:** This is common across the analysis area and will continue – and probably increase – in the future. Effects to DD and other aquatic populations are likely minor. Even though most dispersed camping and other activities occur in close proximity to water, the length of streams disturbed is relatively small. Sediment delivery from dispersed recreation can occur but it is limited enough in scope in most cases to keep it from being a notable concern relative to DD populations.
- **Road construction and maintenance:** alternative 2 proposes approximately 8.5 miles of new temporary roads would be constructed for haul of which 0.5 is located in RCA. No roads are proposed under alternative 3; only existing roads would be used to transport logs and forest products from the removal treatment units to main arterial roads. Required maintenance on roads for the project would reduce sources of sedimentation that are negatively affecting DD.
- **Hazard tree removal:** This is limited to certain road and trail corridors and recreation sites. Effects to DD and other aquatic populations are likely minor

Alternative 1 (no action) would not promote any change in existing conditions within the analysis area. Because many streams are currently nonfunctioning or functioning at risk, alternative 1, when considered with other current, past and reasonably foreseeable actions would result in DD and other aquatic populations persisting at depressed levels.

Alternatives 2 and 3 would promote improvement in road conditions and therefore positive trends in stream function across the analysis area. The effects of Flint Foothills proposed actions when considered cumulatively with other past, present and reasonably foreseeable actions should promote the attainment of properly functioning conditions (PFC) in aquatic habitats. Decreases in abundance or distribution of DD and other populations should not occur. As stream conditions to move toward PFC fine sediment levels in stream bottoms will decrease and DD and other populations should expand; provided other natural climatic inhibitors allow it. The table below summarizes those actions with the greatest potential for measurable effects to WCT populations. The effects of past actions are reflected in the existing conditions described above.

Table 89. List of past present and reasonably foreseeable actions that are most likely to currently, or in the future, influence WCT abundance, distribution and possibly persistence of populations

Activity	Past	Present	Reasonably Foreseeable in Future	Currently Measurable Effect	Positive	Negative
Livestock grazing	x	x	x	substantial		x
Irrigation diversion	x	x	x	Minor	x	
Invasive plant species treatment	x	x	x	little	x	
Mining	x			Minor		x
Dispersed recreation	x	x	x	little		x
Prescribed burning	x	x		minor - none	x	
Range improvements		x	x	minor	x	
Roads and trails	x	x	x	Mod - Subst		x
Hazard tree removal	x	x		little – none		x

- **Livestock grazing:** This affects WCT because it alters stream morphology and vegetative conditions in the uplands and riparian areas. This changes the capabilities of hydrologic processes and stream morphology changes, reducing stream function. The result is a reduction and simplification in habitats needed by cutthroat trout.
- **Irrigation diversions:** The effects on WCT occur through the loss of instream flows and possibly temperature increases and loss of individuals in irrigation ditches. The effects on WCT are low because most streams with conservation populations of cutthroat are diverted below the populations' distribution. In some cases, diversion is benefiting WCT because it is limiting upstream movement of nonnative species that would hybridize and/or compete with them.
- **Invasive plant species treatment:** Beneficial effects are expected from reversing trends in vegetative conditions. Potential negative effects if herbicides contact individuals directly. Risk is low for this; the BDNF Noxious Weed EIS provides mitigations to reduce risks of introduction of herbicide into streams and other water bodies. We expect the balance of effects related to this management to be beneficial.
- **Mining:** Historic mining has had minor effects to water quality and stream function in the project area, but there are no known water quality or stream channel conditions caused by historic mining that would be affected by the proposed activities. Placer operations have altered the physical function of some stream channels through the removal of stream gravels. No mining operations are proposed or ongoing at this time.
- **Dispersed recreation:** This is common across the analysis area and will continue – and probably increase – in the future. Effects to WCT are likely minor. Even though most dispersed camping and other activities occur in close proximity to water, the length of streams disturbed is relatively small. Sediment delivery from dispersed recreation can occur but it is limited enough in scope in most cases to keep it from being a notable concern relative to WCT populations. Angling probably results in a limited amount of mortality, even though state regulations prohibit anglers from keeping WCT from streams in the analysis area.
- **Prescribed burning:** This has some risk of increasing short term sediment delivery because of the temporary loss of vegetative cover that occurs. This, however, is effectively mitigated in most situations through the application of treatment buffers around streams and

other water bodies. Benefits occur through longer-term improved vegetation cover in riparian and uplands, which would reduce sediment delivery.

- **Range improvements:** These are expected to help with livestock distribution, decreasing impacts to streams, and so limiting negative effects on stream channel morphology and stream function.
- **Road construction and maintenance:** No new road construction is proposed under alternative 3; only existing roads would be used to transport logs and forest products from the removal treatment units to main arterial roads. Required maintenance on roads for the project would reduce sources of sedimentation that are negatively affecting WCT.
- **Hazard tree removal:** This is limited to certain road and trail corridors and recreation sites. Effects to DD and other aquatic populations are likely minor.

Alternative 1 (no action) would not promote any change in existing conditions within the analysis area. While this alternative meets the Forest Plan direction of "no measurable effect", it does nothing to help ensure movement toward desired conditions. Because many streams are currently nonfunctioning or functioning at risk, alternative 1, when considered with other current, past and reasonably foreseeable actions could work cumulatively with the management activities/natural events discussed above to limit the potential to achieve healthy population densities in certain populations.

Alternatives 2 and 3 would promote improvement in stream conditions through long term reductions in sediment delivery and physical impacts to stream channels. They would promote positive shifts in stream function across the analysis area and promote increases in distribution of WCT. In this light, the effects of the Flint Foothills proposed actions when considered cumulatively with other past, present and reasonably foreseeable actions should promote the attainment better habitat conditions, and more abundant and resilient WCT populations.

Table 90 that follows summarizes those actions with the greatest potential for measurable effects on western toads and other amphibians. The effects of past actions are reflected in the existing conditions described above.

Table 90. List of past present and reasonably foreseeable actions that are most likely to currently – or in the future – affect western toads and other amphibians

Activity	Past	Present	Reasonably Foreseeable in Future	Currently Measurable Effect	Positive	Negative
Livestock grazing	x	x	x	minor	x	x
Irrigation diversion	x	x	x	minor - mod		x
Invasive plant species treatment	x	x	x	minor - none	x	
Mining	x			minor		x
Dispersed recreation	x	x	x	moderate		x
Prescribed burning	x	x		minor - none	x	
Range improvements		x	x	minor	x	
Roads and trails	x	x	x	moderate		x

- **Livestock grazing:** This affects toads and other amphibians, because it alters stream morphology and vegetative conditions in the uplands and riparian areas. Changes related to grazing tend to be inherently negative. Maxell (2000), however, indicated that toads tend to prefer areas with some level of disturbance; and livestock alteration, if not excessive, may function as a benefit for this species.
- **Irrigation diversion:** The effects on toads and other amphibians occur through the loss of instream flows. The effects on toads is probably low to moderate because they are mobile and can select where they want to become established and the most extensive and dramatic diversions occurs downstream of national forest lands.
- **Invasive plant species treatment:** This provides beneficial effects from reversing trends in vegetative conditions. Potential negative effects can occur if herbicides contact individuals directly. Risk is low for this; the BDNF Noxious Weed EIS provides mitigations to reduce risks of this to an acceptable level. We expect the balance of effects related to this management to be beneficial.
- **Mining:** Historic mining has had minor effects to water quality and stream function in the project area, but there are no known water quality or stream channel conditions caused by historic mining that would be affected by the proposed activities. Placer operations have altered the physical function of some stream channels through the removal of stream gravels. No mining operations are proposed or on-going at this time.
- **Dispersed recreation:** This is common across the analysis area and will continue – and probably increase – in the future. Effects to toads and other amphibians is likely moderate, because of the attraction of water for recreationists and the opportunity for them to find and capture individuals and disturb riparian habitats.
- **Prescribed burning:** This has some risk of influencing individuals directly during the action, however we expect toads would move during implementation. Benefits occur through improved vegetation cover in riparian areas and uplands.
- **Range improvements:** These are expected to help with livestock distribution, decreasing impacts to streams, ponds and wetlands.
- **Roads:** No road construction is proposed under alternative 3; only existing roads would be used to transport logs and forest products from the removal treatment units to main arterial roads. Required maintenance on roads for the project would reduce sources of sedimentation that are negatively affecting amphibians.

Our data indicate that western toads are limited in their distribution within the analysis area. Their occurrence is not substantially different than other places on the Forest and the belief is that disease, not habitat, is limiting them. Constraints unrelated to habitat quality and availability and their spotty occurrence helps limit their exposure to the management actions proposed. Non-the-less all of the alternatives should allow recovery of stream, wetland and riparian areas.

Summary of Effects

Alternative 1 (no action) would not promote any change in existing conditions within the analysis area. Because many streams are currently nonfunctioning or functioning at risk, alternative 1, when considered with other current, past and reasonably foreseeable actions could limit the occurrence of some improvements in wetland conditions.

Alternatives 2 and 3 would promote improvement in stream conditions and positive shifts in stream function across the analysis area. The effects of proposed actions when considered cumulatively with other past, present and reasonably foreseeable actions should promote the

attainment of properly functioning conditions in stream habitats. Some improvements in wetland conditions could occur. Benefits of these changes to toad and amphibian populations may not be observable. Decreases in abundance or distribution toads and other amphibian populations should not occur. Rather, we expect populations to remain stable provided climate and other environmental conditions allow it.

Table 91. Summary of how each alternative meets or influences the aquatic issues/concerns used for this analysis.

Aquatic Issues/Concerns	Alternative 1 Effects	Alternative 2 Effects	Alternative 3 Effects
Change in habitat for *Drunella doddsi* (MIS) and other aquatic species	No Change	Positive change	Greatest positive change
Change in pond and wetland conditions for amphibian species	No Change	Limited positive change	Limited positive change
Effect on WCT persistence	No Change	Positive	Greatest positive change
Effect on sensitive western toad persistence	No Change	No measurable change	No measurable change
Effect on aquatic nuisance species distribution in analysis area	No Change	No change	No change

Table 92. Analysis area species and summary of effects

Species	Species Status	Present In Action Area: Habitat or Detections	Effects Determination	Rationale for Determination
Fishes				
westslope cutthroat trout (*Oncorhynchus clarki lewsi*),	USFS Sensitive	Yes, Habitat and Detections	May impact, not likely to result in trend toward federal listing	Minor effects possible (e.g., short term fine sediment increase)
Amphibians				
western toad (*Bufo boreas*)	USFS Sensitive	Yes, Habitat and Detections	May impact, not likely to result in trend toward federal listing	Individual animals may be affected on haul routes.
Invertebrates				

Sensitive Species Determinations

Threatened species bull trout, sensitive species arctic grayling and western pearlshell mussels are absent from the analysis area. Thus the determination for these species is: No Impact.

The Biological Effects Determination for westslope cutthroat trout and western toad, if implementing alternatives 2 or 3 is: May Impact Individuals or Habitat, but will not likely contribute to a trend toward Federal Listing or Loss of Viability to the Population or Species.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternatives 2 and 3 meet the aquatic requirements of the Forest Plan and promote attainment of desired aquatic conditions the Plan encourages. The aquatics report in the project file describes how the action alternatives meet the relevant aquatic standards. These alternatives are consistent with viability requirements in the 1982 Forest Planning regulations, and with other relevant laws, regulations, policies and plans.

Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout

In 2007, the *Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout* was co-signed by numerous partners, including the Regional Forester (MCTSC 2007). The agreement includes the following goals.

- Ensure the long-term, self-sustaining persistence of each subspecies distributed across their historical ranges as identified in recent status reviews;
- Maintain the genetic integrity and diversity of non-introgressed populations, as well as the diversity of life histories, represented by remaining cutthroat trout populations; and
- Protect the ecological, recreational, and economic values associated with each subspecies.

A primary objective of the Montana cutthroat trout conservation agreement is to maintain, secure, and/or enhance all cutthroat trout populations designated as conservation populations, especially the genetically pure core conservation populations. The proposed project Alternatives 2 and 3 would not alter any instream channel or population connectivity therefore it is in compliance with the MOU.

Range Resources

Introduction

This section analyzes the impact of implementing the project on livestock grazing resources within the project area. The analysis will focus on National Forest System (NFS) lands within the boundaries of the project area. A specific emphasis will be placed on activity areas where vegetation treatment and road construction are being proposed.

Overview of Issues Addressed

Treatment activities can damage range allotment infrastructure, such as stock water systems and allotment boundary or pasture fences. Treatment activities may also remove natural barriers between allotments or pastures, allowing unrestricted livestock movement.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

- Proposed treatment units that could potentially damage existing infrastructure.
- Proposed treatment units with the potential to remove natural barriers.

Affected Environment

Existing Condition

The history of grazing use throughout the project area is typical of most grazing areas in southwest Montana. Livestock grazing began in the mid-1800s, prior to the creation of the National Forest Reserves. Present allotments in the analysis area include Boulder Creek, Gird Creek, Hall, Blum Gold, and Willow Creek. These five allotments are managed by the Pintler Ranger District. Each allotment contains range improvements such as fences and water developments (figure 42). A brief description of each allotment within the project area follows.

Boulder Creek Allotment

The Boulder Creek Allotment consists of approximately 14,166 acres, and 129 cow/calf pairs are currently permitted on this allotment from June 21 through September 30. An allotment management plan (AMP) was prepared and approved for this allotment in January 2000. The AMP contains riparian mitigation measures as well as riparian and upland use parameters (e.g., stubble height, bank disturbance, browse utilization, grass/forb utilization). A modified four-pasture (Princeton, Cow Camp, Maywood, and Pickett Gulch) rest-rotation grazing system is used to guide livestock management (described in the annual operating plan).

Gird Creek Allotment

The Gird Creek Allotment consists of approximately 3,438 acres, and 27 cow/calf pairs are currently permitted on this allotment from June 21 through September 30. An allotment management plan (AMP) was prepared and approved for this allotment in October 1999. The AMP contains riparian mitigation measures as well as riparian and upland use parameters (e.g., stubble height, bank disturbance, browse utilization, grass/forb utilization). A two-pasture (Morrison's and Boomer's) deferred-rotation grazing system is used to guide livestock management (described in the annual operating plan). However, pasture containment is sometimes difficult due to the lack of fencing within the allotment. Therefore, riding and salting is used to improve livestock management.

Hall Allotment

The Hall Allotment consists of approximately 10,858 acres and 172 cow/calf pairs are currently permitted on this allotment from June 23 through October 7. An analysis was completed for this allotment in 1996. The AMP contains riparian mitigation measures as well as riparian and upland use parameters (e.g., stubble height, bank disturbance, browse utilization, grass/forb utilization). A three-pasture (Douglas Mountain, Dunkleberg, and South Fork) deferred-rotation grazing system is used to guide livestock management (described in the annual operating plan).

Blum Gold Allotment

The Blum Gold Allotment consists of approximately 7,379 acres and 124 cow/calf pairs are currently permitted on this allotment from July 1 through September 30. An analysis for this allotment was completed in November 2001. The AMP contains riparian mitigation measures as well as riparian and upland use parameters (e.g., stubble height, bank disturbance, browse utilization, grass/forb utilization). A four-pasture (Crevice Creek, North Blum, South Blum, and North Gold) rest-rotation grazing system is used to guide livestock management and described in the annual operating plan.

Willow Creek Allotment

The Willow Creek Allotment consists of approximately 8,491 acres and 260 cow/calf pairs are currently permitted on this allotment from June 16 through September 30; however, full nonuse was authorized for the 2011 grazing season. An analysis for this allotment was completed in November 2001. The AMP contains riparian mitigation measures as well as riparian and upland use parameters (e.g., stubble height, bank disturbance, browse utilization, grass/forb utilization). A three-pasture (Doney Lake, Ballard Hill, and North Willow) deferred-rotation grazing system is used to guide livestock management (described in the annual operating plan). A mix of sagebrush/grasslands, grasslands, mountain meadows, riparian areas, and forested rangelands provide the grazing capacity at all elevation zones within these allotments. All of these allotments are currently active and are grazed annually in accordance with direction found in the current Allotment Management Plan (AMP) for each allotment.

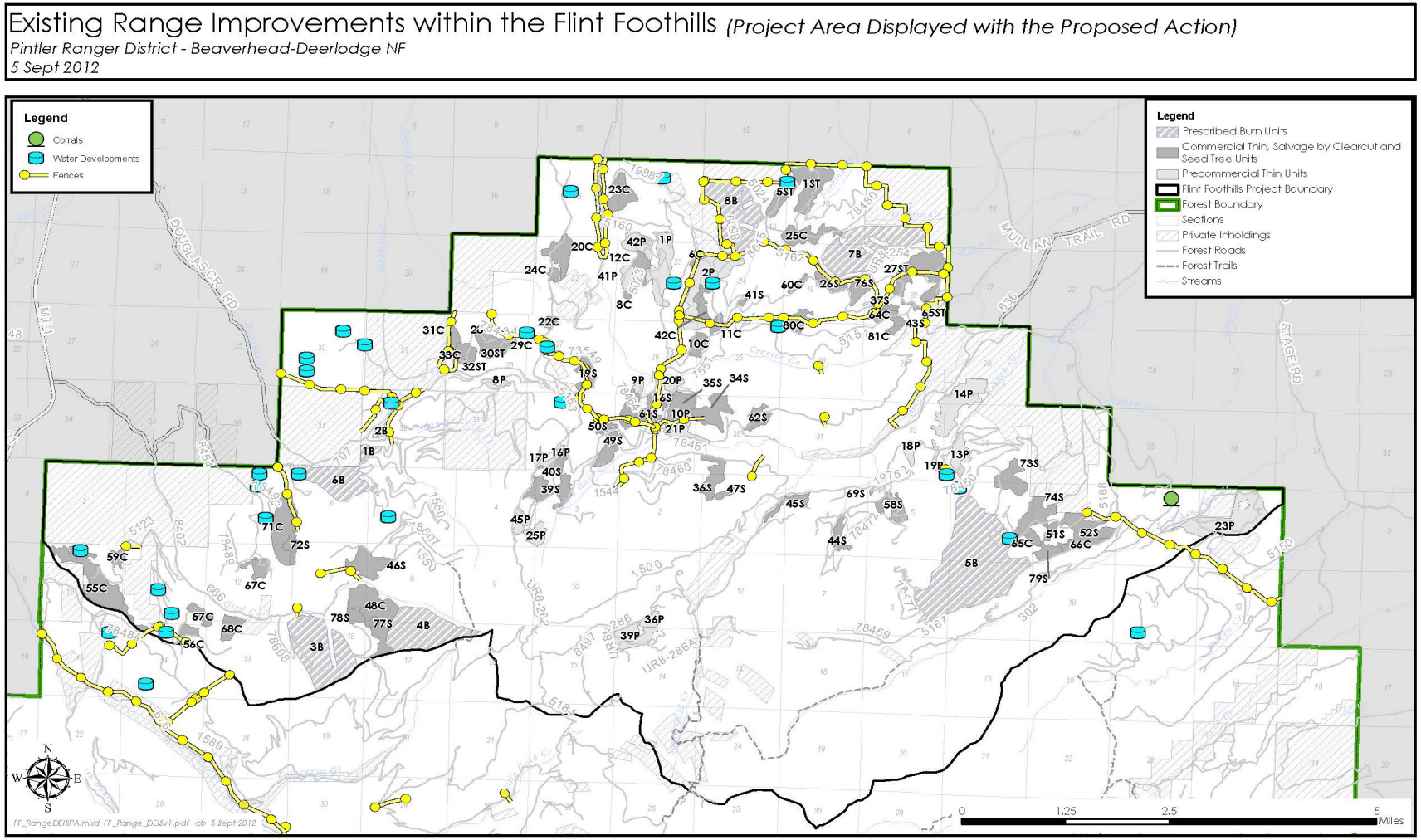


Figure 42. Existing Range Improvements within Flint Foothills, shown with the proposed action

Desired Condition

According to the 2009 Beaverhead-Deerlodge National Forest Land and Resource Management Plan (LRMP) or Forest Plan, the following applicable Forestwide goals have been identified for livestock grazing:

- Sustainable grazing opportunities are provided for domestic livestock from lands suitable for forage production (Forest Plan, p. 25); and
- Use of forage by domestic livestock will maintain or enhance the desired structure and diversity of plant communities on grasslands, shrub lands, and forests. Use will be managed to maintain or restore riparian function as defined in the allotment management plan (Forest Plan, p. 25).

The Forest Service provides standards and guidelines for rangeland use by livestock grazing operations in the Forest Plan (USDA Forest Service 2009). These stipulations apply unless or until specific long-term objectives, prescriptions, or allowable use levels have been designed through individual resource management plans or site-specific NEPA decisions (e.g., revised AMPs). All of the allotments associated with the project area have current management plans.

Environmental Consequences

Methodology

Grazing allotment boundaries and improvements within the analysis area have been mapped and potential effects within the allotments are based on their association and proximity to treatment units. Effects to grazing are primarily the potential of proposed activities to damage existing infrastructure within the allotments. Infrastructure includes existing interior and exterior pasture and allotment boundary fences, existing stocktanks, and the potential to remove natural barriers to livestock movement. Allotment maps displaying existing range improvements, such as fences and water developments, were compared to maps displaying the proposed treatment units. Potential effects to the existing allotment infrastructure were based on the proximity of the existing improvements to the proposed treatment units. Since several of the allotments utilize short drift fences and natural barriers to control livestock movement, potential areas where natural barriers may be removed were also identified.

Spatial and Temporal Context for Effects Analysis

This analysis will discuss both short-term (one year or less), and long-term (greater than one year) project effects to livestock grazing activities, within the project area.

Present and Reasonably Foreseeable Actions Relevant to Cumulative Effects Analysis

Invasive plant control is an ongoing action in the project area that can affect livestock grazing. Spraying to control invasive plant species is expected to continue, and additional biological agents will be introduced.

See table 24 at the beginning of chapter 3 for a full list of present and reasonably foreseeable actions for the project area.

Alternative 1 – No Action

Direct, Indirect Effects and Cumulative Effects

For alternative 1, there would be no direct, indirect or cumulative effects to existing grazing activities or allotment infrastructure for the Flint Foothills Project because no project activities are proposed.

The continued treatment of noxious weeds would improve range conditions throughout the allotments within the project area through continued reduction in infested acres (see the Invasive Plant Species section).

Alternative 2 – Proposed Action

Direct and Indirect Effects

There would be no increase in livestock numbers or increase in season of use resulting from implementation of alternative 2. The effects of proposed vegetation management activities on livestock grazing activities within the analysis area would be mostly beneficial. Specifically, the salvage logging and thinning operations would indirectly increase short-term forage production through removal of conifers, and "daylighting" of forested stands so that sunlight is able to reach the forest floor to stimulate herbaceous plant growth. This short term flush of herbaceous growth would diminish as conifers recolonize the harvest units.

This alternative has the potential to directly affect existing allotment infrastructure. Infrastructure includes existing interior and exterior pasture and allotment boundary fences, existing stocktanks, and the potential to remove natural barriers to livestock movement. Damage to existing fences, water developments, or breaching natural barriers, could affect livestock distribution and movement. This could disrupt scheduled grazing rotations within allotments, and allow cattle in unauthorized areas.

In regards to grazing management, all range allotments within the analysis area are being managed under rest-rotation or deferred-grazing systems, and these systems are flexible enough that they can be adjusted to accommodate proposed vegetation management activities.

Removing timber during harvest activities along existing natural barriers, which are often used as pasture barriers or barriers between allotments, would open the area for livestock to freely breach the barrier, resulting in unauthorized drift into adjacent pastures or allotments. Timber Unit Standard 4 within the Forest Plan (USDA Forest Service 2009) requires "replacement of natural barriers to livestock movement removed by harvest activities with some other barrier." Existing fences and water developments would be protected during project implementation.

Cumulative Effects

The cumulative effects of improved range conditions through short-term forage production and continued treatment of invasive plant species would be beneficial to forage species.

Summary of Effects

Implementation of the proposed alternative would have short-term benefits to livestock grazing assuming all allotment infrastructures are protected and any natural barriers removed are replaced with new barriers in a timely manner. Forage production should increase through the removal of conifers, which would stimulate herbaceous plant growth. This short-term flush of

herbaceous growth would diminish as conifers recolonize the harvest units. There should be no disruption to cattle grazing from the Flint Foothills Project. All allotment infrastructures would be protected, and barriers removed would be replaced in a timely manner.

Alternative 3

Direct, Indirect Effects and Cumulative Effects

The direct, indirect effects are the same for alternative 3 as described in the alternative 2 discussion.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Beaverhead-Deerlodge Land and Resource Management Plan (LRMP)

For all alternatives, livestock grazing activities would continue to be managed in compliance with grazing direction identified in the Forest Plan as well as the allotment management plans.

Recreation

Introduction

This section analyzes the effects the proposed activities would have on the recreation resources within the project area.

Overview of Issues Addressed

No issues were identified that relate to recreation. One outfitter guide provided a scoping comment that stated the proposal may impact some of their hunting in the Gird Creek drainage, but noted that adjustments could be made due to the large size of the area.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

- Effects to developed and dispersed recreation activities, sites, and facilities
- Analyzes how the proposed actions affect the use, availability, and quality of the recreation experience within the project area.
- Consistency with Recreation Opportunity Spectrum - Analyzes the consistency of the proposed action with established recreation opportunity spectrum (ROS) objectives for the project area (Forest Plan allocations: summer road-based, and winter motorized, pp. 54-55; and 112).

Affected Environment

The Flint Foothills MA portion of the project area (85 percent) provides a roaded setting for dispersed recreation. The Flint Uplands MA (15 percent) provides a mix of semi-primitive motorized and nonmotorized recreation settings (table 93). There are no specially designated areas within the project area boundary (i.e., wilderness, wilderness study, or recommended wilderness areas). A small portion of the Dolus Lake Inventoried Roadless Area (I-439) is

within the project area's south boundary, while a larger portion is adjacent to the project area, and can be viewed from within the project area (see figure 43B).

Existing Condition

The Flint Foothills form a scenic backdrop for Interstate 90 between Drummond and Butte. A portion of Montana Highway 1, outside of the project area, is designated the "Pintler Scenic Loop" (Helena 2011). Evidence of timber harvest and vegetation management activities are common sights within the Flint Foothills MA portion of the project area. The history of use and management is reflected in the developed road systems, mining sites, and scenery (USDA Forest Service 2009). Evidence of beetle-killed trees is a typical sight (USDA Forest Service 2009).

The area within the Flint Uplands MA in the higher elevations provides a mix of semi-primitive motorized and nonmotorized recreation opportunities. The setting appears as a mix of managed and naturally appearing landscape. High mountain scenic vistas and backcountry opportunities are key attractions to the forest visitor traveling through this area. Roads within the management area are primarily historic roads built for harvesting and vegetation management, mining, and dam maintenance (USDA Forest Service 2009).

Figure 43 A and B depicts two popular attractions in the project area—the Douglas Cabin and the Dolus Lakes Inventoried Roadless Area (IRA). A small portion of the IRA is within project area; the majority is adjacent to the project area and part of the scenic vista.

Figure 43A. Douglas Cabin is within the project area boundary. 43B. North aspect of Dolus Lakes Inventoried Roadless Areas (I-439) adjacent to the project area and part of the scenic vista

Recreation Activities

Recreation activities are mostly dispersed and commonly occur on or along roads. Gathering firewood, weekend camping, fishing and hunting are popular pursuits for local and regional visitors (USDA 2009). Visitors can expect to encounter other users with motor vehicles, those travelling by foot, stock, and mountain bikes in the summer, or skis and snowmobiles during winter months.

Two outfitter and guide special use permit holders who operate within the project area:

> Royal Outfitters – Their area of operation extends into the southwest end of the project area with Gold Creek Lake and NFS Road1550 as the general limit of extent. Area of operation occurs in both Flint Foothills and Flint Uplands management areas. This outfitter and guide's focus is summer use and fall big game hunting.

Bartlett Creek Outfitter – Their area of operation extends approximately one mile into the southeastern corner of the project area. Area of operation occurs in both Flint Foothills and Flint Uplands management areas. This outfitter and guide's focus is fall big game hunting.

Recreation Sites

The Douglas Cabin is the only developed recreation site in the project area. It is a recreation rental facility and a favorite of hunters during rifle and bow seasons and is popular among snowmobilers during winter months. The Recreation Opportunity Spectrum (ROS) map (figure 44) in the Desired Condition section that follows displays the location of the cabin.

Recreation Roads and Trails

There are approximately 204 miles of roads and 7.5 miles of trails available for public access and use within the project area boundary. Approximately 30 miles of these roads are considered unauthorized. The access from the road system for recreational purposes is currently affected by storm repair damage, which is resulting in road closures and detours. These roads include sections of National Forest System (NFS) roads 707, and 8402 (see the Transportation section).

Trails are in the southern portion of the project area and include National Forest System trails 8054 (3.9 miles, motorized), 8049 (1.37 miles, nonmotorized) and 8052 (3.39 miles, nonmotorized). The trails are displayed on the alternative maps, Figure 4 and figure 6, in chapter 2. Motorized users of NFS Trail 8054 currently experience periods of limited availability. National Forest System Road 1550, which accesses the north end of trail 8054, is closed to motorized use from October 15 – December 1. National Forest System Road 1500, which accesses the south end of trail 8054, is closed to motorized use from September 1 – June 15.

Recreation Streams and Lakes

Streams and lakes are features that people use for various forms of recreation including fishing and boating. There are approximately 55 miles of streams within the project area, but none are rated as class one (i.e., considered larger or major rivers). There are four lakes (used for recreation activities) within the project area: Goldberg Reservoir, Big Gold Creek Lake, Little Gold Creek Lake, and Rainbow Lake. Goldberg Reservoir is the only popular recreational lake within the project area that is connected to a National Forest System road associated with the proposed action. None are listed among the lake and pond fishing areas on the Beaverhead-Deerlodge National Forest's webpage. Gold Creek Lake(s) and Goldberg Reservoir are on the Trout Nation website (Montana 2011). See the ROS map (figure 44) presented in the Desired Condition section that follows for location and distribution. No designated wild and scenic rivers or other water bodies of national importance are located in the project area.

Desired Condition

The Forest Plan lists elements of the desired condition on page 11. The one that relates most closely to recreation and scenery states, "Visitors benefit from a range of primitive to developed recreation settings and opportunities. Most of the BDNF continues to offer uncrowded motorized and nonmotorized backcountry opportunities (USDA Forest Service 2009)." The Forest uses the agencies Recreation Opportunity Spectrum concepts and definitions to establish allocations for recreation use. Table 93 lists the adopted summer-based allocations within the project area that are applicable to this proposal, followed by a map that displays the distribution.

Table 93. Forest Plan Recreation Allocation – Summer and Road-based ROS descriptions (USDA Forest Service 1986)

Forest Plan Allocation	Equivalent ROS Class	Description
Summer Motorized Backcountry	Semi-primitive Motorized	Offers opportunities for varied types of travel and recreation activities
Road Based*	Roaded Natural Rural	Offers opportunities for varied types of travel and recreation activities
Summer Nonmotorized	Roaded Natural Rural	Offers opportunities for mountain biking, horse and stock travel, hiking and dispersed camping etc.

*All proposed activities occur in this allocation

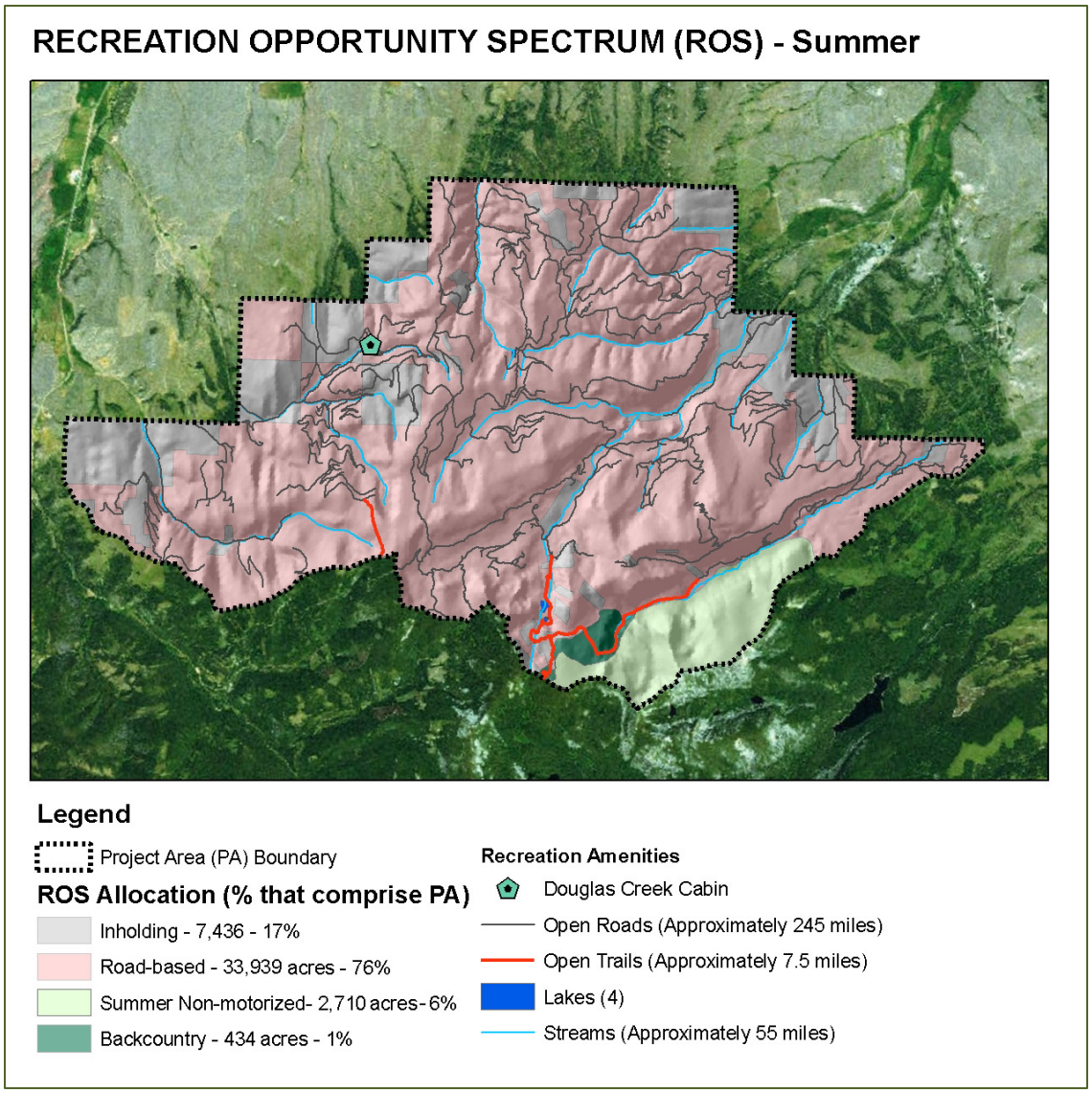


Figure 44. Summer ROS allocations and location of recreation features

Winter allocations are also assigned to this area in the Forest Plan, but there are no activities proposed for implementation in the winter, so they are not included in this discussion. The Recreation report in the project file displays the winter ROS map and descriptions.

Environmental Consequences

Methodology

The proposed vegetation and road treatments are dispersed throughout the project area. Potential effects to forest visitor's recreation experience are based on the indicators identified in the Overview section.

Spatial and Temporal Context for Cumulative Effects Analysis

Spatial Boundary: Project Area

Rationale - Consistency with ROS settings outside the project area boundary do not apply.

Temporal boundary: Short-term timeframe: 1-5 years (period of project implementation)

Rationale - The timber sale contract may last up to 5 years, and disruptions would be intermittent over that timeframe during the normal operating period. This assumes that the prescribed burning would also occur during this timeframe.

Long-term timeframe: 5 years and beyond (i.e., after project completion)

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Activities that have occurred or may occur in the assessment area that have an effect on recreation resources are: livestock grazing, mining, noxious weed control, use and maintenance of forest roads and trails, firewood cutting, timber harvest, wildfire and fire management and suppression activities. Fire management and suppression has occurred throughout the project area. Hazard tree removal has occurred and continues to occur along roads and near developed recreation sites (i.e., the area around the Douglas cabin). Motor vehicle use mapping (MVUM) as part of the travel planning process is a reasonably foreseeable future activity that may affect the recreation resource. Effects from this action could change the overall mileage of trails open or closed to motorized vehicles within the project area and across the forest.

See table 24 at the beginning of chapter 3 for a full list of present and reasonably foreseeable activities that affect the Flint Foothills Project area.

Alternative 1

Under alternative 1, there would be no direct, indirect, or cumulative effects on recreation resources because no project activities are proposed.

Use and opportunities available regarding the recreation amenities identified in the Existing Conditions section would remain, and are consistent with the ROS classification within the project area boundary.

Cumulative Effects

Since there are no activities proposed, this alternative would not contribute to past, present or reasonably foreseeable effects on developed and dispersed recreation activities, sites and facilities, or cause any inconsistencies with the ROS settings.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Dispersed Activities

No permanent direct or indirect adverse effects to dispersed recreation opportunities from vegetation treatments proposed in alternative 2 are anticipated. All of the newly constructed temporary roads would be obliterated; the majority of the unauthorized routes would be decommissioned; and the newly constructed NFS road would be put into "storage" following project implementation.

Currently open segments of UR8-246 (0.4 mile), UR8-271 (0.5miles), and UT8-110 (0.2 mile) would be decommissioned. The effect of this action is a 1.1 mile reduction in opportunity for various dispersed road-based activities (i.e. roadside camping, parking for hunting, etc.). Currently closed UR-253 (0.4 mile) would be added to the Forest's transportation system, and available for the type of road based activities and uses described above. These actions would result in a net reduction of 0.6 mile of open road.

Forest visitors (e.g., hunters, outfitter guide /special use permit holders, and others who participate in dispersed recreation activities) would likely experience occasional, intermittent delays and reduced access to forest areas while operations (logging and prescribed burn treatments) are under way. A timber sale contract typically has a 5-year term. The prescribed burning activities in units 2b, 3b, 4b, 5b, 6b, 7b, and 8b would likely take place over several years, and could occur in either the spring or fall. Forest visitors (described above) in the vicinity of implementation activities may experience indirect effects from sounds and sights such as timber falling, log hauling, noise, and dust. A project design feature is in place to mitigate roadway interference and provide for greater safety during weekends and federal holidays (Recreation project design features and mitigation measures, chapter 2).

In the short term, stumps, slash and logging activities may affect recreation experiences: Tree stumps and harvest slash would be apparent to users traveling through treatment areas until vegetation becomes established or until slash is eliminated. In the long term, as openings created by logging are replaced with healthier stands that offer more diversity in terms of scenery, canopy and ground cover, those seeking camping and other dispersed forms of recreation would benefit.

Recreation Sites

The only developed recreation site managed by the Forest Service within the project area boundary is Douglas Cabin. Commercial thinning and seed tree units are proposed approximately 800 feet behind it. The access road to the cabin is NFS Road 707, which is also a haul route, and has the potential to create dusty conditions that could disturb users of the cabin. NFS Road 707 services 14 units and would require an estimated 453 haul truck trips to complete the treatment activity. Project design features would help to control dust during cabin

use periods, mitigate roadway interference and provide for greater safety during weekends and federal holidays (Recreation project design features and mitigation measures, chapter 2).

Recreation Use of Roads and Trails

Prescribed burn unit 4b is proposed where Forest System Trail U8049 meets the project area boundary and unit 29P (a precommercial thinning prescription) is located at the trails terminus. In the shorter term, opportunity to access portions of this trail is expected to be reduced during periods of prescribed burning implementation. Forest System trails 8054 and 8052 would not be affected.

A 450-foot section of NFS Trail 8049 is bisected by burn unit 4b. During periods of implementation, opportunity to access portions of this trail would be limited as short-term closures could be expected. Users of NFS Trail 8049 could be exposed to smoke while this unit is treated as well. The public accessing and using Trails 8054 and 8052 would not notice any effects. No permanent addition or reduction of trails miles would result from the proposed action.

Approximately 70 miles (30 percent) of NFS roads within the project area boundary would be used as haul roads. National Forest System roads 1544 and 1557 access many salvage treatment units and are expected to be the most heavily used. Staging equipment and loading haul vehicles would likely occur directly from the roadside of units adjacent to these roads. There is the potential for temporary closures that could affect recreation access and availability (including hunting) but types of closures would vary. The following photos were taken in the project area and exhibit temporary closures that could be anticipated.

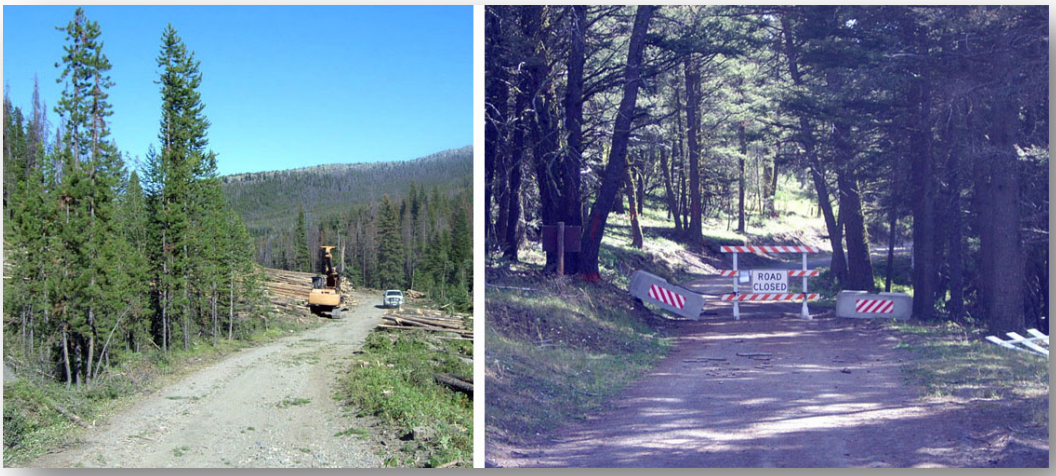


Figure 45. Images reflecting typical but short-term closures that may limit or restrict access within the project area during periods of project activity

A project design feature is in place to mitigate roadway interference and provide for greater safety during weekends and federal holidays.

Recreation Use of Streams and Lakes

Goldberg Reservoir is the only popular recreational lake in the project area that is connected to a NFS road associated with the proposed action. Delays or limits to access for this reservoir

would be expected during implementations. Access or limits to use because of proposed management activities are not expected for stream sections within the Flint Uplands Management Area of the project area.

Sections of Dunkelberg Creek may be affected since the stream is in proximity to unit 61S and follows NFS Road 1544 (a haul route) for approximately 1.5 miles. Effects would be short term, intermittent delays to accessing the creek at various places while proposed maintenance activities (to bring road to standard) and eventual hauling occurs. Similar effects can be anticipated (under the same rationale) for sections of Douglas Creek that follow NFS roads 1544 for approximately 2.5 miles and 707 (also a haul route) for approximately 1 mile.

Consistency with ROS

Approximately 1.3 miles of new road constructed under this alternative would be put into storage when the project is completed and not available for future use. All activity is proposed in summer road based settings. The Douglas Cabin where units 30ST, 28CS, 33C and 31C are proposed is also allocated as a winter nonmotorized setting. However, no project activities are proposed during winter. All activities would remain consistent with the current ROS setting as a result of proposed actions.

Cumulative Effects

The types of projects that could impact recreation are current roadside salvage harvest, ongoing travel management and trail and road maintenance. Trail maintenance is a recreation-related project expected to occur in the future; however, no such projects are currently scheduled or planned. Trail maintenance would be neutral or beneficial to the user.

The current Roadside #4 Hazardous Tree Removal Project and salvage activities discussed in the proposed action would cumulatively reduce the abundance of hazardous snags and future downfalls from Forest System roads and the general area. The two projects would not overlap in time, so there would be no cumulative effects to recreation due to combined operations (access closures, traffic delays, etc.).

Short-term effects to the recreation experience are associated with operations during implementation, as tree stumps and harvest slash would be apparent to users traveling through treatment areas until vegetation becomes established or slash eliminated. Combined with the ongoing declining recreation setting because of dead and dying beetle-affected trees, the quality of the recreation experience would be reduced. In the long term, these projects benefit recreation use by moving the land toward the desired condition and meeting standards set for recreation in the Forest Plan.

Road maintenance projects (replacing culverts, etc.) benefit most recreation users by ensuring safe access to the forest continues. Removing hazardous trees, ongoing road maintenance, and maintenance and reconstruction associated with the haul routes under the proposed action could cumulatively provide better driving and forest experiences for the forest visitor.

Travel management can affect recreation users who rely on motorized vehicles as a form of recreation or as access to recreation areas. Future travel management decisions may reduce or increase the available miles but those decisions are forthcoming so there can be no certain determination of their cumulative effects in regards to recreation at this time.

Alternative 3

Direct and Indirect Effects

Dispersed Activities

Effects to activities would be similar as described under alternative 2.With alternative 3, UR8-246 (0.4 mile) would be decommissioned; and currently closed UR-253 (0.4 mile) would be added to the Forest's transportation system , and available for road based activities and uses. These actions would result in a negligible increase (about 200 feet) in miles of open road.

No new system or temporary roads would be constructed; fewer treatment units are proposed overall under alternative 3. Under this alternative, hunters, special use permit holders, and others who participate in dispersed recreation activities would encounter fewer short-term delays to access the general forested area than under alternative 2. Other recreation activities within the affected environment would be expected to have the same effects as described under alternative 2.

Recreation Sites

Effects to recreation sites as described under alternative 2 are the same for alternative 3. Both alternatives offer the same actions within the vicinity of Douglas Cabin and the same project design features apply, so effects would be expected to be the same.

Recreation Use of Road and Trails

Effects to road and trail use would be similar as discussed previously under alternative 2 with respect to temporary closure and delays. Haul roads identified under alternative 3 are the same as under alternative 2. However, alternative 3 anticipates approximately 118 fewer loads hauled along NFS Road 8402. Any perceived difference to the public in terms of closures or delays as a result is anticipated to be minimal.

Recreation Use of Streams and Lakes

The activities proposed under alternative 3 are the same as alternative 2 with respect to affected steams or lakes within the project area boundary, and the effects are described under alternative 2 previously.

Effects to ROS

The activities proposed under alternative 3 are the same as for alternative 2 with respect to effects on ROS classification within the project area boundary.

Cumulative Effects

In terms of the recreation resource, proposed activities for alternatives 2 and 3 are similar enough that the cumulative effects discussed previously in alternative 2 apply to both alternatives.

Summary of Effects for Alternatives 2 and 3

The majority of effects to recreation resources are short term. Temporary delays and closures create limited access while treatments occur within the project area boundary. Limited access would affect various recreation activities, sites, roads, and trails. Upon completion of treatment activities, access and opportunities would primarily revert as they currently exist – no new or

different activities, trails, facilities, or other opportunities would result from any of the proposed actions. There would be a net reduction of 0.61 miles of open road in alternative 2; and a negligible increase (200 feet) in alternative 3. There are no irreversible or irretrievable commitments related to recreation resources from the proposed action.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives would be consistent with the Forest Plan. Alternatives 2 and 3 would address recreation goals and objectives outlined in the 2009 Beaverhead-Deerlodge National Forest Revised Land and Resource Management Plan

Roadless Areas

Introduction

This section describes the roadless and unroaded resources in the planning area and analyzes the impact of the project's alternatives on those resources. The Dolus Lakes IRA (I-429) is a 9,365-acre IRA (inventoried roadless area) that overlaps the Flint Foothills project area; 3,158 acres of the Dolus Lakes IRA are in the project area. Unroaded resources are National Forest System (NFS) lands that are outside a designated Wilderness or IRA, but may yet retain some wilderness attributes or roadless characteristics. Collectively, IRAs and unroaded areas can be referred to and analyzed together as a roadless expanse, which would describe a contiguous land area comprised of unroaded areas adjacent to an inventoried roadless area.

The section discloses potential effects to wilderness attributes in the project area roadless expanse to determine if, or to what extent, future consideration for wilderness recommendations would be affected. This analysis focuses on the potential effects of the proposed action on wilderness characteristics as defined in the Forest Service Handbook (FSH) 1909.12 (72.1).

Forest Plan and Regulatory Framework

The Beaverhead-Deerlodge Forest Plan established forestwide multiple use goals, objectives, and management area direction. The analysis of inventoried roadless areas (IRA) is documented in appendix C of the FEIS for the Plan—inventoried and evaluated areas with wilderness potential— using a methodology consistent with Forest Service policy direction. Appendix C of the FEIS for the BDNF Forest Plan (2009) provides additional detail on the methodology used for this evaluation. As a result of this Forestwide analysis, some roadless areas were recommended for inclusion in the National Wilderness Preservation System and others were not. The Dolus Lakes IRA (1-429), which overlaps the project area, was not recommended for inclusion in the National Wilderness Preservation System. The vast majority of the IRA was assigned to the Flint Uplands management area (MA), which is managed for a mix of semi-primitive motorized and nonmotorized recreation, as well as secure high-elevation wildlife habitat. Approximately 80 acres were assigned to the Flint Foothills MA and managed for timber production, livestock grazing and dispersed recreation.

No Forestwide or management area standards specific to inventoried roadless areas or areas evaluated for wilderness potential that were not recommended for designation as wilderness were prescribed in the 2009 Forest Plan. The Forest Plan does, however, prescribe more general management direction which overlaps with Inventory Roadless Areas (IRAs) and other areas considered for wilderness potential in this analysis. This management direction takes the form

of place-based management area goals, objectives, or standards; recreation allocations and specific standards for resources across the Forest. Forest Plan standards exist to ensure that specific management direction is followed.

Methodology

The principal attributes of wilderness listed below, as described in Forest Service Handbook (FSH) 1909.12, are generally, but not necessarily listed in order of importance or desirability (USDA 2007). The FS Handbook directs managers to consider these five characteristics when analyzing the quality of the wilderness resource of potential wilderness areas.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

- **Natural:** Ecological systems are substantially free from the effects of modern civilization and generally appear affected primarily by forces of nature. Effects of modern civilization include:
    a. The presence of nonnative species that alter the composition of natural plant and animal communities (such as nonnative plants, animals, fish, livestock, invertebrates, and pathogens).
    b. Developments that degrade the free-flowing condition of rivers and streams (such as dams or other water diversions and impoundments).
    c. The presence of light pollution that degrades night sky quality and night sky quality related values.
    d. The presence of pollutants that degrade water quality.
    e. The health of ecosystems, plant communities, and plant species that are rare or at risk.
- **Undeveloped:** The degree to which the area is without permanent improvements or human habitation. A measure of undeveloped is the level of human occupation and modification including evidence of structures, construction, habitations, or other forms of human presence, use and occupation.
- **Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation:** The area provides solitude or primitive and unconfined types of recreation including a wide range of experiential opportunities such as: physical and mental challenge, adventure and self-reliance, feelings of solitude, isolation, self-awareness and inspiration. Solitude is the opportunity to experience isolation from sights, sounds, and the presence of others from the developments and evidence of humans. The opportunity to experience isolation from the evidence of humans, to feel a part of nature, to have a vastness of scale, and a degree of challenge and risk while using outdoor skills are measures of primitive and unconfined recreation.
- **Special Features and Values:** The area provides other values such as those with ecologic, geologic, scientific, educational, scenic, historical, or cultural significance. Examples include unique fish and wildlife species, unique plants or plant communities, connectivity, potential or existing research natural areas, outstanding landscape features and significant cultural resource sites.
- **Manageability:** In determining capability, consider the ability to manage an area as wilderness as required by the Wilderness Act. Section 2(c) of the Wilderness Act defines wilderness as an area that, "…(3) has at least 5,000 acres of land or is of sufficient size to

make practicable its preservation and use in an unimpaired condition." The Forest Service's ability to manage an area as an enduring resource of wilderness, untrammeled by humans, retaining its primeval character, and to protect and manage its natural character are all factors to consider. Consider such factors as size, shape, and juxtaposition to external influences. Evaluate how boundaries affect manageability of an area. In the most desirable situations:

a. Boundary locations avoid conflict with existing or potential public uses outside the boundary that might result in demands to allow nonconforming structures and activities in the wilderness.
b. It is possible to readily and accurately describe, establish, and recognize boundaries on the ground.
c. Boundaries, where possible, conform with terrain or other features that constitute a barrier to prohibited use.
d. Boundaries provide adequate opportunity for access and traveler transfer facilities.

Table 94 shows how these wilderness attributes from FSH 1909.12 correspond to the characteristics of roadless areas listed in the 2001 Roadless Rule.

Table 94. Crosswalk between wilderness attributes and roadless area characteristics

Wilderness Attributes	Roadless Area Characteristics
Natural (ecological systems are substantially free from the effects of modern civilization and generally appear to have been affected primarily by forces of nature)	High quality or undisturbed soil, water, and air; Sources of public drinking water: Diversity of plant and animal communities; Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; Reference landscapes
Undeveloped (degree to which the area is without permanent improvements or human habitation)	Natural appearing landscapes with high scenic quality
Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation Solitude: opportunity to experience isolation from the sights, sounds, and presence of others from the developments and evidence of humans Primitive and unconfined recreation: opportunity to experience isolation from the evidence of humans, to feel a part of nature, to have a vastness of scale, and a degree of challenge and risk while using outdoor skills.	Primitive, semi-primitive nonmotorized and semi-primitive motorized classes of dispersed recreation
Special Features and Values (capability of the area to provide other values such as those with geologic, scientific, educational, scenic, historic, or cultural significance)	Traditional cultural properties and sacred sites; and Other locally identified unique characteristics.
Manageability (the ability of the Forest Service to manage an area to meet size criteria and the elements of wilderness)	No criteria

The analysis that follows focuses on wilderness attributes and examines whether the actions proposed would potentially affect the future wilderness value of the roadless expanse in the project area. In addition, projects on lands contiguous to, or within Inventoried Roadless Areas must also analyze the environmental consequences of the proposed actions, including the irreversible and irretrievable commitment of potential wilderness attributes.

Affected Environment – Existing Condition

The Dolus Lakes Inventoried Roadless Area (IRA) (I-429) is a 9,365-acre IRA that overlaps the southeastern section of the project area; 3,158 acres of Dolus Lakes IRA are in the project area. Unroaded resources are National Forest System (NFS) lands that are outside a designated Wilderness or IRA, but may yet retain some wilderness attributes or roadless characteristics.

Collectively, IRAs and unroaded areas can be referred to and analyzed together as a "roadless expanse," which describes a contiguous land area comprised of unroaded areas adjacent to an inventoried roadless area. The analysis of the roadless expanse for the Flint Foothills Project describes the roadless and unroaded resources in the planning area, and analyzes the impact of the project's alternatives on those resources.

The roadless expanse is defined as the entire Dolus Lakes IRA including the portion of the IRA that extends south of the project area. It also includes all unroaded polygons that are adjacent to the Dolus Lakes IRA and not separated by a road. The unroaded polygons adjacent to Dolus Lakes IRA were identified through a GIS analysis. The Flint Range IRA, which is located outside the project area to the south, is also considered an adjacent unroaded polygon and is included in the roadless expanse. The size of the roadless expanse is 163,327 acres. This roadless expanse boundary is appropriate because it includes the entirety of the IRA overlapping the project area boundary, adjacent to areas where treatment units are proposed, and includes all unroaded lands contiguous to the IRA.

Figure 46 provides a depiction of roadless expanse boundaries, existing roads and trails, proposed treatment units[31] and temporary roads within the roadless expanse. No treatments are proposed within the IRAs.

The Dolus Lakes IRA and its contiguous unroaded areas are located in the Flint Uplands and Flint Foothills management areas. There are no roads or trails in the part of the Dolus Lakes IRA that is in the project area. There are two National Forest System Trails (8052 and 8054) in the unroaded section of the roadless expanse within the project area, to the northwest of the IRA boundary. National Forest System Trail 8052, running along the northern boundary of the IRA, is nonmotorized. National Forest System Trail 8054 is a motorized trail running north/south in the western half of the roadless expanse. The recreation allocations in the roadless expanse are summer and winter nonmotorized recreation for most of the IRA itself, with motorized recreation permitted in the rest of the unroaded expanse (figure 46). There are approximately 25 miles of National Forest System road in the Dolus roadless expanse. Most of these roads stretch into the roadless expanse from its edges and dead-end in the roadless expanse. Figure 55 in the Scenic Resources section shows a view of the Dolus Lake IRA.

None of the Dolus roadless expanse has been identified as potential wilderness or recommended for federal wilderness designation.

[31] Treatment units shown on figure 42 are units from the proposed action.

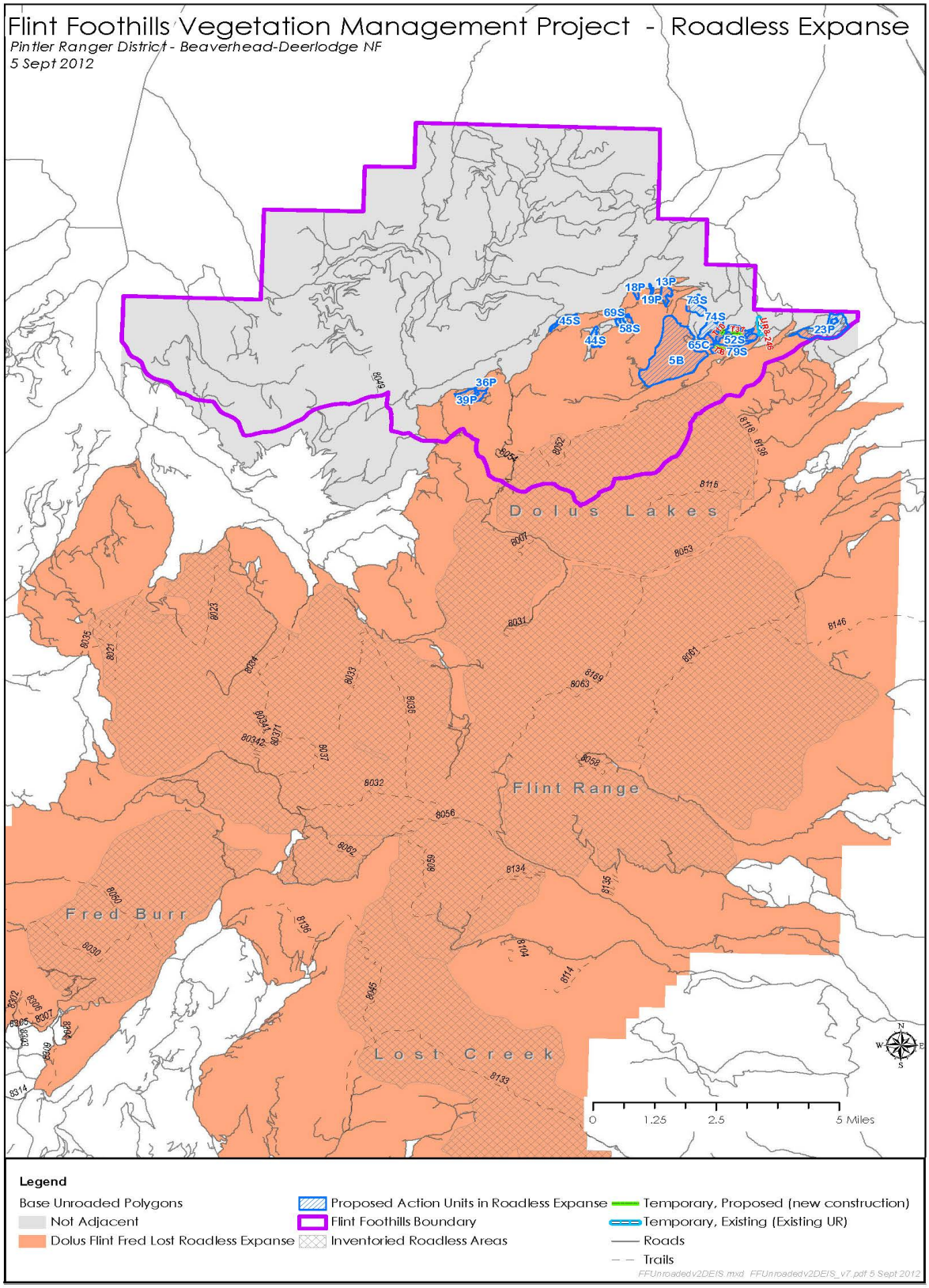


Figure 46. Flint Foothills Project roadless expanse

Existing Wilderness Attributes

In 2003, the BDNF undertook an assessment process whereby the wilderness potential of each IRA was quantitatively assessed. These worksheets, the Inventoried Roadless Area Capability Assessment (USDA Forest Service 2003) graded each IRA according to five main elements to help determine the wilderness potential of inventoried roadless areas. A summary of these worksheet scores is reflected in appendix C of the BDNF Forest Plan FEIS (USDA Forest Service 2009), and the actual worksheets are in the Forest Plan record. The ratings scale used to grade the IRA performance in these elements is: High = 10, Moderate =5, Low = 1. The Dolus Lakes IRA[32] received the following scores:

- Environment (i.e. natural integrity and apparent naturalness) – Moderate (7.5)
- Recreation Opportunities (solitude, challenge and adventure, diversity) – High (9)
- Special Features (scientific, educational, historic, scenic, variety and abundance of wildlife) Moderate (5.8)
- Manageability – Moderate (4.3)

The capability worksheets also ask six yes or no questions that pertain to the area's availability for wilderness consideration. The answers to these questions suggest that, overall; this area has moderate availability for wilderness consideration. The six yes or no questions are: (1) Is the area vitally needed for increased water protection or storage? (2) Would wilderness management seriously restrict important wildlife management? (3) Does the area have high strategic mineral development or potential? (4) Are there unique or outstanding natural phenomenon that requires public access and development be inconsistent with wilderness designation? (5) Is the land needed to clearly document resource demands such as timber, minerals, or recreation sites including winter sports? (6) Are there existing contractual or other significant obligations on the area not in concert with wilderness designation?

To further describe the analysis area's existing condition, the roadless expanse was evaluated from the perspective of the five wilderness attributes described in the analysis methods section and summarized in table 94. These descriptions can be found in the Individual Roadless Area Evaluations section in appendix C of the BDNF Forest Plan FEIS (USDA Forest Service 2009).

Natural and Undeveloped Attributes

The Dolus Lakes and Flint Range IRAs, within the roadless expanse, are described in the corrected FEIS for the Forest Plan,(USDA Forest Service 2009 pp. C 58-59), as mostly natural appearing, with moderately high scenic integrity. Exceptions to this include scattered historic mining, drill sites, exploration pits, low standard roads, and trails. There are also many roads within and around the edges of the roadless expanse, which impact the naturalness of the area. Past management activities are also evident. The natural integrity has also been slightly reduced by livestock grazing and fluctuating water levels. Grazing allotments in the analysis area support a very limited number of cattle. Streams maintain their biological values, channel structure, and riparian function, and are used for downstream irrigation.

The IRA portion of the roadless expanse also provides secure habitat for wildlife, enhancing linkages and connectivity across the landscape in between the Greater Yellowstone Area (GYA) and forests to the west and north. There is mapped Canada lynx habitat and wolverine denning habitat. In addition, westslope cutthroat and bull trout inhabit some stream segments.

[32] The Capability assessment for the Dolus Lakes IRA also includes the Flint Range IRA.

Some of the Dolus roadless expanse is favorable for mining deposits, including gold-silver veins and associated base metals. The area is considered a high value known locatable mineral deposit area. Oil and gas potential for the area is low.

The unroaded polygons in the northern portions of the roadless expanse, further away from the IRA, are already influenced by human development and are less natural appearing. There is evidence of past harvest activity in the northern end of the roadless expanse, as well as a much more roaded landscape. Vegetation treatments have occurred from 1960 to the present on approximately 2,700 acres. Forty-nine miles of road, at a density of approximately 1.2 miles of road per square mile, currently exist in this section of the roadless expanse.

Solitude and Primitive Recreation Attributes

The Dolus IRA provides many opportunities for solitude, primitive recreation, and challenging hiking or climbing. Numerous small lakes are surrounded by cool moist forests, and enhance opportunities for solitude. Some of the lakes are popular for family outings, however; this influx of people would reduce the opportunity for solitude. Fall hunting season also brings visitors to the backcountry of the roadless expanse. Snowmobiling is popular on motorized trails of the expanse in winter, reducing the solitude and primitive recreation potential of those areas.

There are not opportunities for solitude or primitive recreation in the entire roadless expanse however; because the northern half of the roadless expanse—away from the Dolus IRA—is a more roaded landscape with a motorized recreation setting. Primitive recreation opportunities and solitude would be more difficult to find in this portion of the roadless expanse.

Special Features

A limited amount of survey work has been done within the IRA portion of the roadless expanse, producing some heritage sites. More would likely be found with additional survey work. There are no other known special features in the Dolus roadless expanse.

Manageability Attributes

The boundaries of the Dolus IRA generally follow topographic features, and are therefore favorable towards manageability as a wilderness. In the larger roadless expanse however, there are several different blocks of private inholdings, which would make manageability more difficult.

Environmental Consequences

Spatial and Temporal Boundaries

The spatial boundary for the Flint Foothills roadless analysis is the “roadless expanse” as described in the previous section.

The temporal boundaries of the effects analysis s are determined by how long the effects of project activities will last. Direct and indirect effects to unroaded areas can be either short term or long term. Short term or temporary effects are the human-induced impacts to the land surface and vegetation that the land would recover from within ten years after initiation of the activity. Long-term effects are human-caused disturbances that would be evident on the landscape for more than 10 years.

Alternative 1 – No Action

Direct and Indirect Effects

For alternative 1, there would be no direct, indirect or cumulative effects to the roadless expanse because no project activities are proposed. Therefore, there would be no effect on the existing naturalness of the area from the project.

The roadless expanse spans a wide range of degree of naturalness, from the more natural, undisturbed landscape of the IRA in the south, to the more actively-managed landscape in the north. This range of naturalness would not change in the no- action alternative. As no activities would occur in the roadless expanse, the ability to find solitude would remain as it currently exists. There is more ability to find solitude in the less-roaded southern roadless expanse landscape and less solitude potential in the more roaded north. This would not change with implementation of the no- action alternative.

Current manageability of the roadless expanse also would not change. A summary based on the current conditions assessment finds the IRA portion of the Dolus roadless expanse to have moderate wilderness suitability for inclusion into the Wilderness Preservation System. This would not change under the no- action alternative. Natural processes would continue to dominate in the IRA part of the roadless expanse, and the lands to the north of the IRA would continue to be more managed.

Alternative 2 –Proposed Action

Direct and Indirect Effects

The following table lists all alternative 2 vegetative treatments and acres proposed in the roadless expanse. These treatments are also depicted on figure 47, which focuses on alternative 2 treatment units and their distance from features in the roadless expanse

Table 95. Acres of vegetation treatments by unit in the Dolus roadless expanse for alternative 2

Vegetation Treatments in the Dolus Roadless Expanse for Alternative 2		
Treatment Type	**Unit**	**Acres**
Salvage by clearcut harvest	44S	31
	45S	31
	51S	19
	52S	94
	58S	49
	69S	2
	73S	64
	74S	74
	79S	31
Subtotal salvage by clearcut harvest		***395***
Commercial thinning treatment	65C	18
	66C	24
Subtotal commercial thinning		***42***
Precommercial thinning treatment	13P	50

Vegetation Treatments in the Dolus Roadless Expanse for Alternative 2		
Treatment Type	**Unit**	**Acres**
	18P	23
	19P	12
	23P	187
	36P	21
	39P	73
Subtotal precommercial thinning		***366***
Prescribed burning treatment	5B	710
Total Prescribed burning treatment		***710***
Total vegetative treatments in roadless expanse		***1,513***

Alternative 2 also proposes 0.59 mile of new temporary road construction, and would reconstruct 0.39 mile of existing unauthorized routes in the roadless expanse area to access the treatment units. All of the proposed temporary roads are on the eastern boundary of the roadless expanse analysis area. Table 96 lists these roads by type for the proposed action.

Table 96. Temporary roads and existing unauthorized roads in roadless expanse by type in alternative 2

New Temporary Roads and Existing Unauthorized Roads in the Dolus Roadless Expanse for Alternative 2	
Road type	**Miles**
New temporary road construction	0.59
Temporary road construction on existing unauthorized routes	0.39
Total temporary roads in the roadless expanse	**0.98**

The vegetation and road treatments listed above are proposed in the roadless expanse, outside the Dolus Lakes IRA boundary. The largest treatment proposed is in Unit 5B, a 710-acre prescribed burn unit. This unit proposes mixed-severity prescribed burning in lodgepole pine stands. It is located approximately 0.50 mile northeast of the Dolus Lakes IRA boundary, and proposes ignitions on approximately 40 percent of the unit. This would result in a mosaic of burned and unburned areas, with an objective of 50 percent mortality in unit overstory trees. The unburned portions of the unit would primarily include riparian areas. Control lines would primarily be natural features such as rock slopes and natural fuel breaks of different fuel types.

Units 51S, 52S, 65C, 66C, and 79S propose a total of 186 acres of a variety of salvage cutting and thinning actions in the northeast section of the roadless expanse, approximately 0.50 mile away from the Dolus IRA boundary. Units 73S and 74S straddle the eastern boundary of the roadless expanse, but are near enough to potentially impact the wilderness attributes of the roadless expanse. Units, 13P, 18P, and 19P propose precommercial thinning in the northeastern section of the roadless expanse. Just to the southwest of the precommercial units, there are salvage logging units (44S 45S, 58S, and 69S). Two more precommercial thinning units (36P and 39P) are located in the northwestern region of the roadless expanse analysis area. The analysis that follows considers whether, under alternative 2, any of the units described previously could have an impact on the potential wilderness attributes of roadless expanse.

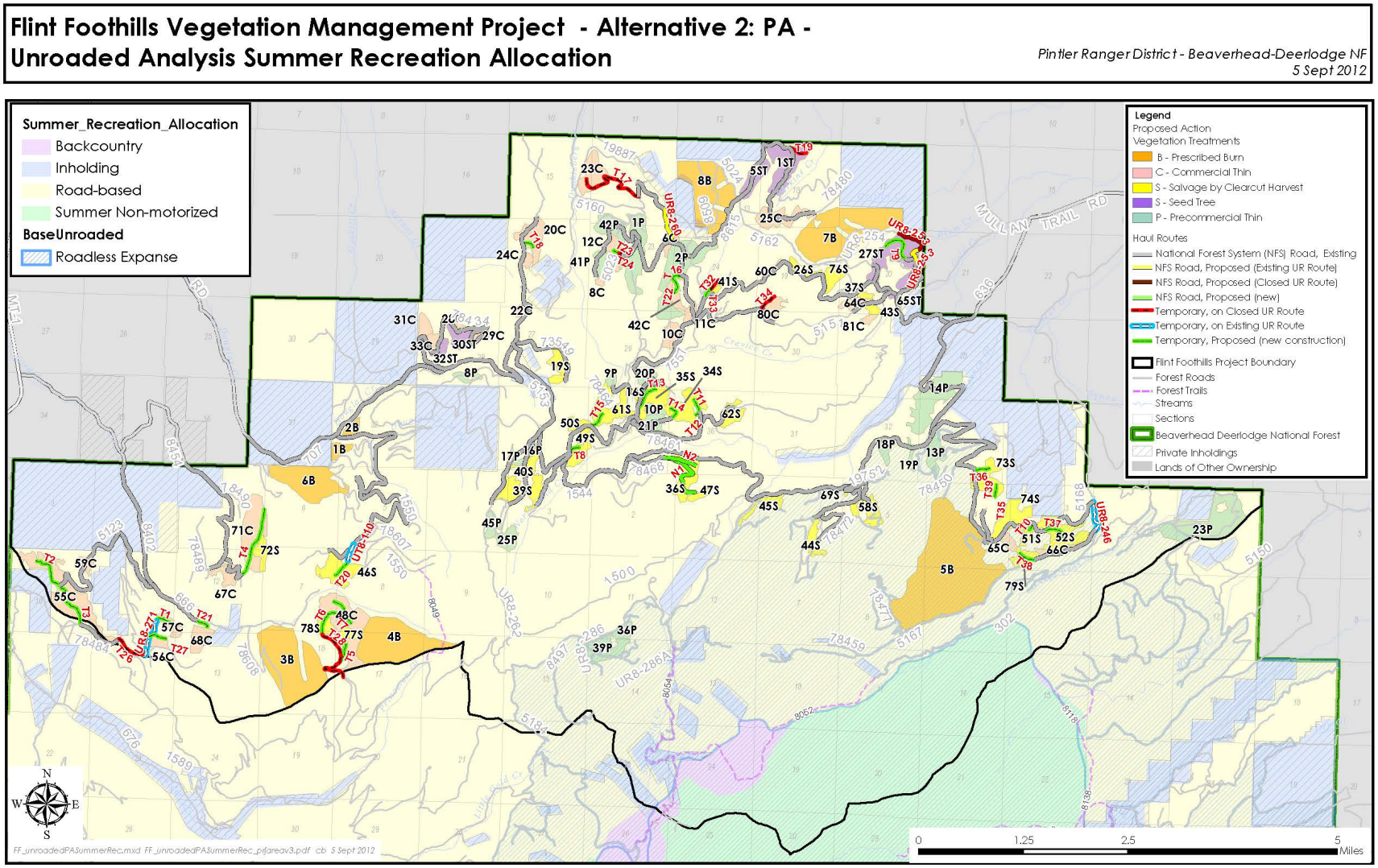


Figure 47. Flint Foothills Roadless Analysis, Alternative 2

Natural

Determine whether the area's ecological systems are substantially free from the effects of modern civilization and generally appear to have been affected primarily by forces of nature.

There may be a temporary, short-term effect on air resources across the roadless expanse in the short term. Prescribed burning can affect air quality at the time of the burning. The effects, however, are expected to be minimal and of short duration. The proposed burn unit is located in the roadless expanse, approximately 0.50 mile north of NFS Trail 8052. There would be no long-term effects to air quality in the IRA or unroaded areas because project design features and mitigation measures (chapter 2) for prescribed burning would be implemented.

The effects of the vegetation treatments on the naturalness of the unroaded expanse vary by treatment. Effects of vegetation treatments are discussed in further detail in the Vegetation section of this EIS. For the prescribed burn units, the killing of overstory and understory conifers would result in a patch mosaic which may appear similar to a small wildland fire, In the short and long term it would not be evident as to whether the fire was caused by a natural event (i.e., lightning) or was a human-caused disturbance. There would be some initial recovery of understory native vegetation that would occur shortly after the prescribed fire treatments.

Burning would also have some mixed effects on sensitive plants. For example, the moonwort species' above-ground structures could be removed by prescribed burning, reintroduction of fire would have a beneficial effect on the species in the long term. Burning is also expected to have a positive impact on the treated areas' resiliency, resulting in stands more able to withstand insect or fire mortality (Vegetation Specialist Report), which would in turn, create a more natural landscape.

The cutting units would have varied effect on the naturalness of the unroaded expanse. The precommercial thin units would not have a notable short or long term impact on the natural appearance of the unroaded expanse because they are located in a more disturbed part of the roadless expanse. The 395 acres of salvage treatments, however, would have more notable short- and long-term effect on the naturalness of the unroaded expanse. The treatments in these areas would create openings that would be obvious to the casual observer in the short and long term; these may mimic natural disturbance patterns, but the openings themselves would impact the naturalness of the area.

During implementation of vegetation treatments—salvage, precommercial thin, and prescribed burn—there would also be an impact on the natural potential wilderness characteristics of the area. This implementation impact would primarily affect southern portions of the analysis area that have more naturalness potential, particularly the IRA. These impacts would include the sights and sounds of crews working, such as running chainsaws and other logging related activities, and burning activities such as ignition with helitorches. These effects to natural character would occur during the implementation of the project only and would be short term.

Although there will be effects from the proposed vegetation treatments, there would not be an irretrievable loss of wilderness attributes.

Undeveloped

Determine the degree to which the area is without permanent improvements or human habitation. A measure of undeveloped is the level of human occupation and modification of the

area including evidence of structures, construction, habitations, or other forms of human presence, use, and occupation.

There is evidence of human manipulation already existing in parts of the roadless expanse such as roads, mining and grazing evidence (fences, stock tanks). These existing human modifications would continue to exist unchanged with the implementation of the proposed action. No additional permanent management developments are proposed for the area, so there would be no new evidence of structures, construction, habitations, or other forms of human presence, use and occupation added as a result of alternative 2. The actions proposed in alternative 2 would not affect the undeveloped component of the roadless expanse's wilderness potential in the long term.

In the short term, new temporary roads built in the roadless expanse would impact the undeveloped attribute of the expanse. On the eastern edge of the roadless expanse, the 1 mile of temporary access road (0.59 mile is new), would alter the area's undeveloped character while the roads are being built or reconstructed and used. All of the temporary roads would be decommissioned after use; the newly constructed temporary roads would be obliterated; the existing unauthorized routes would be decommissioned by sign, berms and other closure methods, as shown in table 6.

In summary, the proposed treatments would only have short-term effects on the undeveloped attributes of the roadless expanse, and the majority of those effects would occur in an area already influenced by human development. There would be no long-term impact on the area's undeveloped character. As such, the short-term effects to the undeveloped character of the area are not permanent and thus not considered an irreversible or irretrievable loss of wilderness attributes.

Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

Determine an area's capability of providing solitude or primitive and unconfined types of recreation. This includes providing a wide range of experiential opportunities such as: physical and mental challenge, adventure and self-reliance, feelings of solitude, isolation, self-awareness, and inspiration.

Outstanding opportunities for solitude or primitive and unconfined recreation are a direct reflection of distance from and ability to detect disturbances associated with existing and/or proposed human development within the area. The actions proposed in alternative 2 would not have long-term effects on solitude or primitive and unconfined recreation attributes of the roadless expanse's wilderness potential. As described in the Affected Environment section, not all of the analysis area has opportunities for solitude and primitive recreation. Opportunities for solitude are most likely to be found in the southern portion of the analysis area, closest to the Dolus IRA. Therefore, treatment units proposed in the northern section of the analysis will not impact this attribute. The treatment unit activities in alternative 2 would have no long-term impact on the area's solitude or primitive recreation value, as most of the vegetation treatment units occur within close proximity to existing motorized roads and trails with an already low opportunity for solitude or unconfined and primitive recreation experiences (figure 47).

Alternative 2 may have a minor short-term effect on semi-primitive recreation opportunities in the roadless expanse area. The Dolus Lakes IRA and adjacent unroaded polygons within the unroaded expanse provide nonmotorized as well as some motorized recreation opportunities for visitors year-round. Semi-primitive recreation in the Dolus roadless expanse is primarily

limited to foot traffic on trails such as NFS Road 8052, which borders the IRA, as well as camping or hunting activities (figure 47). Any hunting or camping recreation is likely to be on or near roads and trails in the roadless expanse. Burn activities in Unit 5B, which is 0.30 miles from 8052, may produce short-term, localized impacts on these road and trail-based recreationists, primarily with smoke and haze. Although these activities may impact recreation in the roadless expanse in the short term, the effects are not anticipated to last beyond project implementation.

In addition, cutting units 39P and 36P may impact semi-primitive recreation in the short term by creating possible sights and sounds of treatment activities, such as chainsaw use. These units are each approximately 0.50 miles away from motorized trail 8054. Therefore, while these units would not be visible from the trail; sounds of implementation may be heard, and the trail user's viewscape may be impacted. Impacts on the recreationist's viewscape would be short term.

This alternative would produce short term effects, particularly during project implementation; however, would not cause long-term effects to the solitude attribute. As such, the proposed vegetation activities are not considered an irreversible or irretrievable loss of wilderness attributes even though they occur within the confines of the Dolus roadless expanse.

Special Features and Values

Determine the area's capability to provide other values such as those with ecologic, geologic, scientific, educational, scenic, historical, or cultural significance. Examples include unique fish and wildlife species, unique plants or plant communities, connectivity, potential or existing research natural areas, outstanding landscape features, and significant cultural resource sites. Identify and describe any such values and their contribution to Wilderness character.

The actions proposed in alternative 2 would not affect the special features attribute of the roadless expanse's wilderness potential, as there are no known special features in the roadless expanse.

Manageability

In determining capability, consider the ability to manage an area as Wilderness as required by the Wilderness Act. Section 2(c) of the Wilderness Act defines Wilderness as an area that ". (3) has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unimpaired condition. . ." Forest Service ability to manage an area as an enduring resource of Wilderness, untrammeled by humans, retaining its primeval character, and to protect and manage its natural character are all factors to consider. Consider such factors as size, shape, and juxtaposition to external influences.

None of the treatments identified for the proposed action would have long-term effects on the boundary of, size or shape of, or access to the Dolus roadless expanse. None of the vegetation treatments proposed in this alternative would change any of the existing conditions regarding these factors, as all existing motorized routes would remain the same and access routes added (on the eastern edge of the roadless expanse) are temporary. Therefore, the proposed action would not have long-term effects on the wilderness manageability attribute of the Dolus roadless expanse.

Alternative 3

Direct, Indirect, and Cumulative Effects

Although the project treatment units proposed in alternative 3 vary from those in the proposed action, the vegetative units proposed in alternatives 2 and 3 are identical within the roadless expanse (table 95).

The road treatments proposed in the roadless expanse in alternative 3 vary from those in the proposed action. For alternative 3, in the roadless expanse, no new temporary road construction would occur to access to the vegetative treatment units; existing unauthorized routes would be reconstructed to access the units. Table 97 lists this road mileage for alternative 3.

Table 97. Temporary roads in roadless expanse by type in Alternative 3

Temporary Roads in the Dolus Roadless Expanse for Alternative 3	
Road type	**Miles**
New temporary road construction	0.00
Temporary roads reconstructed on existing unauthorized routes	0.39
Total temporary roads in roadless expanse	**0.39**

The effects of alternative 3 on the roadless expanse are therefore the same as described in alternative 2, with the exception of the short-term impact on the “undeveloped” attribute in alternative 2. Alternative 3 uses only existing unauthorized routes in the roadless expanse, so would therefore have no impact on the “undeveloped” value.

Cumulative Effects of Alternative 2 and Alternative 3

When considering the cumulative effects of the alternatives on the potential wilderness value of the roadless expanse, incremental impacts from past, present and reasonably foreseeable actions must be considered. Present and reasonably foreseeable actions are listed in chapter 3 (table 24). These actions were considered in combination with direct and indirect effects of proposed alternative actions, to arrive at the cumulative effects determination on the wilderness/roadless character of the roadless expanse.

Past, present, and future management activities in the project area that could impact the roadless expanse include roadside and danger tree hazard tree removal, wildland fire suppression activities, invasive plant species control, and continued livestock grazing. The cumulative effect of these activities, combined with activities proposed for alternatives 2 and 3, may affect the naturalness, undeveloped value, and feelings of solitude in the roadless expanse. These activities would take place primarily in the northern parts of the roadless expanse, away from the IRA, where the existing level of wilderness potential is already lower. Most of this area with past, present and future management activity is in a road-based recreation allocation, where these types of activities would be expected.

Management decisions such as the Beaverhead-Deerlodge Forest Plan (USDA Forest Service 2009) and travel management planning- Motor Vehicle Use Mapping (MVUM) will change the miles of roads and trails open to motorized use. This could result in a positive cumulative effect within the roadless expanse by increasing opportunities for solitude and primitive unconfined recreation.

Another management activity that has occurred in the past and will continue in the future is trail maintenance work. Trail work continues on both motorized and nonmotorized trails in the roadless expanse. Maintenance work on NFS Trail 8052, which borders the IRA, will help maintain nonmotorized trail opportunities in the southern part of the roadless expanse. This maintenance activity will likely have effects on primitive and unconfined recreation, as well as feelings of solitude. Trail maintenance is also ongoing on motorized NFS Trail 8054, which is located 0.50 miles from proposed project units for alternatives 2 and 3. This activity, when combined with project objectives, may have a positive long-term effect on the Forest's recreation resource, but as it is a motorized trail, will not add to the solitude value of the roadless expanse.

In summary, cumulative effects of past, present and reasonably foreseeable activities may affect the roadless expanse, primarily in the area in and immediately adjacent to the IRA, where there is a higher starting value for potential wilderness attributes. These effects will likely be positive and negative to the natural and undeveloped character. There would be minimal cumulative effects on wilderness/roadless attributes in the contiguous unroaded area part of the roadless expanse, due to a lower existing wilderness value condition. Cumulative effects associated with future travel management decisions may also have either positive or negative impacts on the wilderness character of this roadless expanse, as the status of additional roads or trails may change.

Summary of Effects of Alternative2 and Alternative 3

In summary, project activities would have some short- and long-term effects on the wilderness attributes for the roadless expanse from salvage by clearcut treatments and prescribed burning. The primary effects on the Dolus roadless expanse from implementing alternatives 2 or 3 would come from impacts to the IRA's naturalness value from the cutting and burning activity located near the Dolus IRA. For example, following salvage by clearcut harvest, less than 5 percent live canopy coverage would be expected to remain in the units. However, within 5 years of harvest completion, 94 percent of stands would be expected to be fully-stocked (Vegetation Specialist Report). This creates a short-term impact on naturalness, but minor long-term impact. And in the burn units, although evidence of burning would look natural, it may stand out to the observer, as it would look different from the surrounding vegetation. There would also be some short-term implementation effects from the alternatives, caused by the sights and sounds of chainsaws, other logging-related activities; and prescribed burn ignitions by hand crews or use of helitorches. Other project activities located in the northern part of the roadless expanse would produce little to no impacts on potential wilderness value, because they are located in an area with more past and ongoing management activities, where few wilderness attributes currently exist. There would also be some beneficial effects from implementing alternatives 2 or 3, including increased forest resiliency in the vegetative communities targeted for treatment. These beneficial effects are particularly applicable to the natural attribute. There would be no irreversible and irretrievable commitment of potential wilderness attributes.

Scenic Resources

Introduction

This section analyzes the scenery resource for the Flint Foothills Vegetation Project. The analysis examines the effects of the proposed treatments on the visual resources within the affected environment of the project area.

Terminology used in this analysis is defined in Agriculture Handbook #701, Landscape Aesthetics: A Handbook for Scenery Management (USDA Forest Service 1995). In addition to terminology, this handbook provides more information regarding scenery management.

Overview of Issues Addressed

None of the numerous concerns identified by the public during scoping were directed towards the scenery resources specifically. However, visual effects associated with implementation activities and how areas might appear after treatments could be considered concerns to some members of the public regardless.

Measurement Indicators

The measurement indicators used to evaluate impacts of alternatives:

- Compliance with Scenic Integrity Objectives associated with the Clark Fork Flint Landscape (Forest Plan p. 33; and Appendix A, A-1, A-4 through A-7).

Affected Environment

There are no specially designated areas within the project area boundary such as Wilderness, Wilderness Study, or Recommended Wilderness areas. A portion of the Dolus Lake Inventoried Roadless Area (I-439) is within the project area's south boundary.

Existing Condition

Effects from human activity are visible on the landscape from the transportation system network while traveling through the project area. These activities include timber harvest, mineral extraction, fire suppression, and grazing, road construction, facility construction (including buildings, communication sites, and transmission lines), developed, and dispersed recreation sites and trails. Of these, timber harvest activities have had the greatest impact on scenery because of their quantity, scale, proximity to the road system and time usually required for visual recovery.

The affected environment of the project area can be characterized as a mix of managed and naturally appearing landscapes. High mountain scenic vistas and backcountry opportunities are key attractions. Roads within the management area are primarily historic roads built to facilitate timber harvest and vegetation management activities, mining, and dam maintenance. The Flint Foothills form a scenic backdrop for Interstate 90 between Drummond and Butte, and a portion of Montana Highway 1 designated the "Pintler Scenic Loop" from Drummond south of Philipsburg (Helena 2011).

Figure 48. Typical view of Flint Foothills Management Area from Interstate 90 looking south towards project area, which is in the background distance zone (4 miles or more from viewpoint)

Figure 49. Typical view of Flint Foothills Management Area from Highway 1. The view is east towards the project area, which is in the background distance zone (4 miles or more from viewpoint).

Evidence of timber harvest and vegetation management activities are common sights within the project area, as the majority of the area has been managed for timber production, livestock grazing and dispersed recreation. Landscape settings with evidence of beetle kill are a typical sight as well (USDA 2009). As mentioned in the Vegetation section, it is estimated that 100 percent of the lodgepole pine stands with trees 5 inches d.b.h. or larger within the Flint Foothills MA on the Beaverhead-Deerlodge National Forest lands have been affected by the mountain pine beetle, causing extensive tree mortality. The following figure depicts how beetle killed trees typically appear on the high visibility landscape setting in the immediate foreground from a forest road. Note the discoloration of dead trees in contrast to those that are living. The visual effect is lowered scenic integrity.

Figure 50. Typical view of beetle-killed trees in the project area from a viewpoint along NFS Road 1544. Contrast between affected stands and those unaffected results in low scenic integrity.

Figure 51. The project area depicts a diverse landscape with a mix of natural and human impacts

The history of use and management is reflected in the developed road systems, mining sites, and scenery. Figure 51 depicts a typical view within the project area that ranges from naturally appearing to modified or managed. Note the power line running through the center of the scene and second growth clear-cut regeneration to the left. The lowland grass coverage serves as area for cattle to graze.

Foreground views in many places are of dense stands of even-aged immature trees. The effect is reduced visual penetration into the stands that can reveal positive landscape attributes and provide an open park-like condition that is preferable to viewers (Ryan 2005). The following image depicts such a condition within the Flint Foothills project area.

Figure 52. A view of dense tree stands adjacent to roadways within the project area boundary

Landscape Character

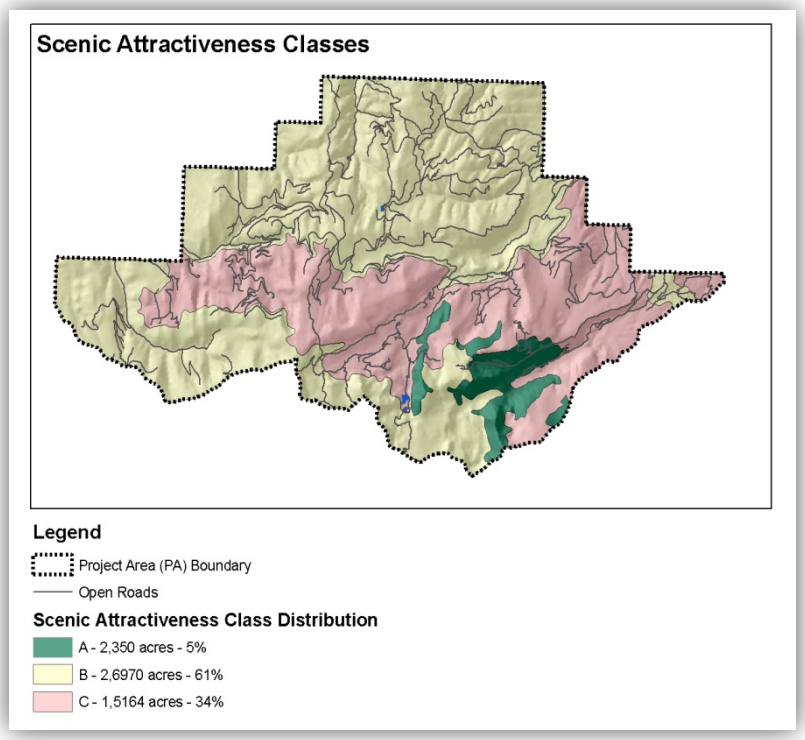
Landscape Character is defined as an overall visual and cultural impression of the landscape attributes – the physical appearance and cultural context of a landscape that gives it an identity and "sense of place "(USDA Forest Service 1995).

The overall setting provides a scenic backdrop of rugged mountains above what is known as the Southern Flint Creek Valley, where traditional ranching contributes a pastoral element to the overall character of the landscape. Lodgepole pine is the most common species on the Forest here, though all local conifers are represented.

Scenic Attractiveness

Scenic Attractiveness is the "primary indicator of the intrinsic scenic beauty of a landscape and of the positive responses it evokes in people. It helps determine landscapes that are important for scenic beauty, based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, and land use patterns and cultural features" (ibid). Scenic Attractiveness is measured as Class A (Distinctive), B (Typical), or C (Indistinctive). It is important to note that the frame of reference for scenic attractiveness is the landscape character description (ibid).

Class A includes areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide unusual, unique, or outstanding scenic quality within the landscape character. Class A landscapes comprise approximately 5 percent of the project area.



Class B (Typical) contains areas in which the natural and cultural features combine to create ordinary or common scenic quality. Class B landscapes comprise approximately 61 percent of the project area.

Class C (Indistinctive) contains those areas where natural and cultural features (or the lack thereof) combine to provide low scenic quality. Class C landscapes comprise approximately 34 percent of the project area.

Figure 53. Scenic attractiveness class distribution in the Flint Foothills Project area

Landscape Visibility

Landscape visibility addresses the relative importance and sensitivity of what is seen and perceived on the landscape (ibid). Landscape visibility is affected by a number of factors including context of viewers; duration of view; degree of discernible detail; and number of viewers – all which are subjective and can vary. In general, the greater the number of people likely to view a landscape and the longer the duration, the more sensitive the landscape is to modification. Landscape visibility consists of three elements – how far the viewer is from the viewing object (distance zone), travelways and use areas, and the level of concern amongst viewers of the area or object being viewed (as defined by concern level 1 and 2 routes and sites) (ibid).).

Distance Zones

The proximity of the viewer to the particular landscape affects the visibility and sensitivity; viewing distances for this analysis are:

- Immediate foreground (0 feet to 300 feet) – Built structures or facilities that serve the public offer vantage points from which scenery can be experienced from. The scenery management system regards such elements as “viewing platforms”. Roads and trails are

considered viewing platforms, and are normally (as expected) visible in this immediate foreground.

- Foreground (FG) - Views from 300 feet to one-half mile as seen from viewing platform.
- Middleground (MG) - Views from one-half mile to 4 miles from viewing platform.
- Background (BG) - Views 4 miles and greater from viewing platform (ibid)

Concern Level 1 and 2 Routes and Sites

Of particular concern to landscape visibility are travel ways such as primary highways and trails, as well as primary use areas such as campgrounds. The Scenery Management System identifies such features as Concern Level (CL) 1 and 2 viewing platforms. The Forest Plan identifies these CL 1 and 2 viewing platforms for the BDNF (Appendix A).

- Concern Level 1 - Generally includes all seen areas from primary travel routes, use areas, and water bodies where the forest visitors have a high interest in scenic qualities.

Phillipsburg, Drummond, Maxville, Garrison, Grant Kohrs Ranch, and Deerlodge are Concern Level 1 areas that surround the project area boundary; however, there are no CL 1 routes, areas, or sites within the project area. The Forest Plan identifies Montana Highway 1 (The Pintler Scenic Loop) that runs north to south along the west aspect (but outside) of the project area boundary, and Interstate Highway 90 that runs northwest to southeast along the north and west aspect (but outside) of the project area boundary as CL 1 routes. Views into the project area from either of these routes are seen as background distance zone views (i.e., 4 or more miles from view point). Refer to figure 48 and figure 49 for images of views looking towards the project area from these two routes.

- Concern Level 2 (CL 2) - Generally includes all seen areas from primary travel routes, use areas, and water bodies where the forest visitors have a moderate interest in scenic qualities or low interest in scenic qualities if the area receives moderate to high use.

There are approximately 37 miles of CL 2 routes (identified in the Forest Plan) within the project area boundary. Segments of these specific routes include National Forest System (NFS) roads 707, 302, 78615, 1557, 636 and 1544. The Douglas cabin, located within the project area boundary, is considered a CL2 site.

Figure 54 that follows depicts the concern routes and sites listed previously that are near the project area boundary.

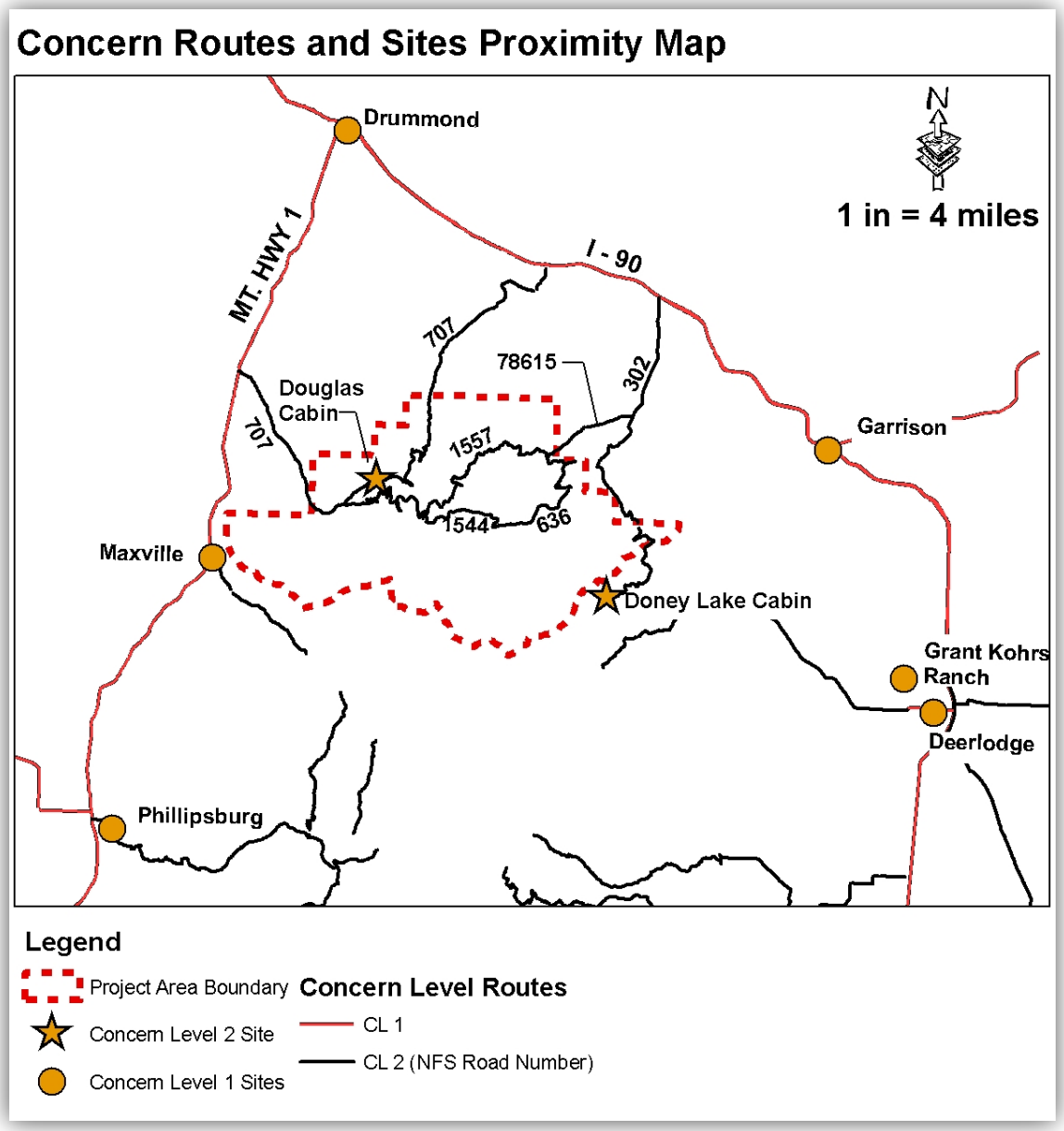


Figure 54. Concern routes and sites in the project area

Existing Scenic Integrity

Existing Scenic Integrity (ESI) is the measure of the degree to which a landscape is visually perceived to be complete. The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal. Scenic integrity is used to describe an existing situation (as with ESI), or can be applied as a standard for management. When used as a standard for management, it is a Scenic Integrity Objective (SIO). Existing scenic integrity within the project area ranges from Low to High. The following list and images help describe these ranges.

High – Human activities are not visually evident. Activities may only repeat attributes of form, line, color, and texture found in the existing attributes, qualities or traits of a landscape that give it an image and make it identifiable or unique.

A portion of the Dolus Lakes IRA as seen in figure 55 offers the only consistent High ESI setting within the project area boundary. Scenes of unmanaged landscape settings such as this are not typical within the project area.

Figure 55. Example of High ESI - View along southeastern portion of the project area boundary looking south towards a portion of the Dolus Lakes IRA.

Moderate – Human activities are evident but are visually subordinate to the attributes of the existing landscape character. They may repeat form, line, color or texture common to these characters but changes in quality, size, number, intensity, etc. must remain visually subordinate to the attributes, qualities or traits of a landscape that give it an image and make it identifiable or unique. The following figure 56 serves as an example of Moderate ESI from within the project area.

Note that the past harvest activity in the upper right aspect of the landscape is evident. However, its physical qualities closely match those of the natural openings within its surroundings, and the size of the effect is subordinate to the overall landscape setting. This view is typical of the landscape settings within the project area.

Figure 56. Example of Moderate ESI - View from within the project area along NFS Road 707 (concern level 2 route).

Low – Human activities of vegetative and landform alterations may dominate the original, natural landscape character, but should appear as natural occurrences when viewed at background distances.

Note the utility line and its corridor as it cuts through the hillside. Though this human activity his highly evident and dominates this foreground distance zone view, it would likely be unnoticeable to the casual observer when viewed as a background distance zone feature (i.e., four or more miles away from observer). Occurrences of such views are common within the project area.

Figure 57. Example of Low ESI - Photo taken from within the project area along NFS Road 1544 (concern level 2 route).

Desired Condition

The 2009 Beaverhead-Deerlodge National Forest Land and Resource Management Plan (Forest Plan) lists elements of its desired condition on page 11. The one that relates most closely to recreation and scenery states, "Visitors benefit from a range of primitive to developed recreation settings and opportunities. Most of the BDNF continues to offer uncrowded motorized and nonmotorized backcountry opportunities."

Environmental Consequences

Methodology

This analysis was completed using ArcMap and relevant Geographic Information System (GIS) data layers from the Forest. Global positioning system (GPS) tools were used to collect point data in 2011. A photo record to support existing conditions analysis is included as digital files in the project record. GIS data and tools, and field records were used in combination to determine visibility of proposed treatment activities.

The potential impacts to scenery resources from the proposed project were determined based on the site visits to the CL 1 and 2 routes and sites within and outside of the project area, review of photos of the project area, use of GIS and GPS data, and review of similar projects.

Standards

The Forest manages the scenery of its lands using concepts described under the Scenery Management System. Standards from the Forest Plan give a strict or specific set of expectations to ensure a properly managed resource.

Scenic Standards

Standards for scenic resources are found on page 33 of the Forest Plan. A summary of these standards as they pertain to the proposed action follows.

- *Standard 1: Where no minimum SIO's are identified by landscape or management area – prior to the completion of a forestwide scenic integrity map – the objectives for scenery shall be determined by procedures outlined in the Landscape Aesthetics Handbook, Agricultural Handbook No. 701. The analysis shall use the Scenic Concern Level List in Appendix A, Scenic Attractiveness GIS layer, and the Scenery Integrity Level Matrix below.*

The forest has completed the forestwide SIO map, and this layer is included in the GIS library and presented in figure 58 that follows.

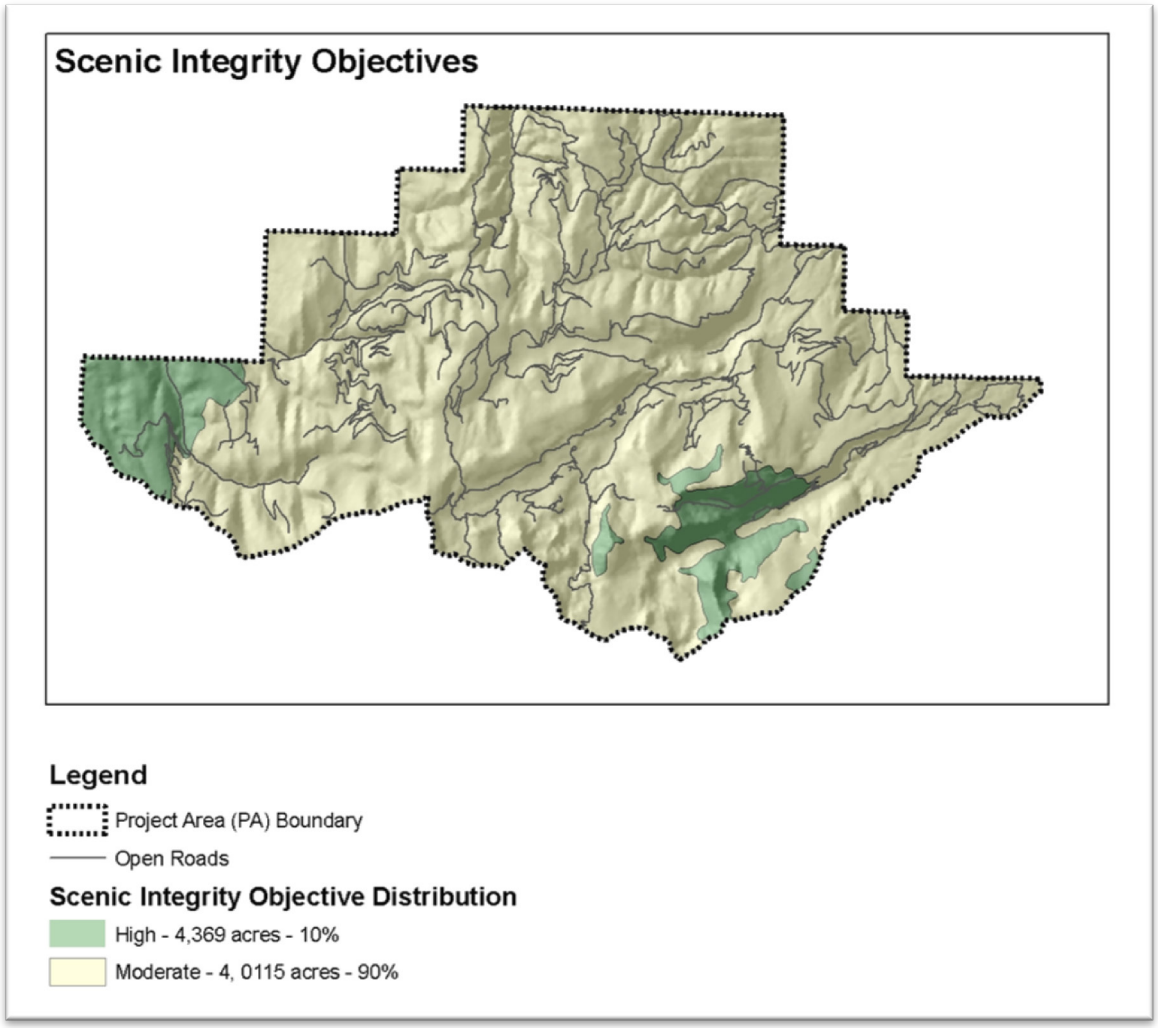


Figure 58. Scenic integrity objective distribution within the Flint Foothill Project area

- For both the Flint Foothills and Flint Uplands MAs, the appropriate SIO is High for areas visible from CL 1 viewing platforms in the foreground and middleground viewing distances, and Moderate in the background viewing distance. For areas visible from CL 2 viewing platforms within the Flint Foothills MA, the SIO is Moderate in the foreground and middleground viewing distances. For areas visible from CL 2 viewing platforms within the Flint Uplands MA, the SIO in all viewing distances is Moderate.

Moderate and High SIOs are described in the Glossary of the Forest Plan as:

- Moderate – Human activities must remain visually subordinate to the attributes of the existing landscape character. They may repeat form, line, color, texture common to these characteristics but changes in quality, size, number intensity, etc. must remain visually subordinate to the attributes, quality or traits of a landscape that give it an image and make it identifiable or unique.
- High- Human activities are not evident. Activities may only repeat attributes of form, line, color and texture found in the existing attributes, qualities or traits of landscape that give it an image and make it identifiable or unique.

Assumptions

- Analysis assumes all best management practices, project design features, or mitigation measures identified under each alterative area applied.
- All geospatial data provided by the Forest and District was accurate and the best available.

Spatial and Temporal Context for Effects Analysis

Scenery effects occur where evidence of activity can be seen. The spatial context for this analysis consists of the project area as viewed from the identified CL1 and CL2 routes and sites.

With regard to temporal context for effects to scenic resources, short term refers to the first 5-year period, beginning when all harvesting, slash treatment activities, temporary road decommissioning/obliteration, and all other project activities in an area are complete. Long term refers to time that exceeds 5 years.

Figure 59. Example of short-term effects that are within the treatment timeframe - Photos from current activity within the project area boundary

After 5 years, projects are usually complete and “green up” is beginning to occur. That is, vegetative recovery starts to mask visual signs associated with activity disturbances such as stumps left from cut trees, track and tire imprints embedded in the soil, blackened ground caused by burning, and imprint of closed and re-vegetated temporary roads. Some areas may meet adopted SIOs upon project completion; others may need time for vegetative recovery before the management objective is reached.

Figure 60. Example of long-term effects - These trees reflect visual recovery associated with a 15-year (approximate) green-up period - Photos from past activity within the project area boundary

Cumulative Effects, Past, Present, and Reasonably Foreseeable Activities in the Project Area

The existing condition of the visual resource is a result of past and current activity and is discussed in the Affected Environment section. Evidence of past activities is most noticeably powerline corridors, road alignments, infrastructure, and past harvest. The current Roadside #4 Salvage Hazard Tree Removal could produce long-term effects on a scale that could influence the current visual condition or scenic integrity objective.

For a full list of, present and reasonably foreseeable activities in the Flint Foothills Project area see table 24 at the beginning of chapter 3.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Under alternative 1, there would be no direct, indirect, or cumulative effects on scenic resources from the Flint Foothills Vegetation Management Project because no project activities are proposed.

The existing condition would prevail, and current trends would likely continue. The mountain pine beetle is affecting the vegetation of the project area and the surrounding area. This activity would continue to affect the scenery into the future, resulting in additional dead and dying trees, demonstrated by red needles and bare, dead stems.

The high mortality of lodgepole pine and the resulting presence of trees with an obvious reddish color, seen in small pockets and large swaths throughout the landscape, would increase and have negative effects on the scenic resources within the project area. The landscape character ranges from appearing intact to slightly altered, depending on the number of dead

trees visible. In the immediate foreground and foreground viewing distances, however, the amount of dead trees can often dominate the viewshed and landscape character, negatively affecting the scenic integrity.

Visual impacts due to past harvests and road construction are noticeable throughout the project area. The no-action alternative does not worsen or improve the current visual condition for now or in the foreseeable future; so no cumulative effects are expected.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The direct and indirect effects of the proposed action are measured as appropriate from identified viewing platforms (i.e. Concern Level 1 and 2 viewing platforms) that exist within and outside of the project area boundary. As mentioned in the Affected Environment section, viewing platforms within the project area boundary are comprised of the Concern Level 2 routes identified in the Forest Plan and in the Affected Environment section. These are routes where the forest visitors have a moderate interest in scenic qualities or low interest in scenic qualities if the area receives moderate to high use.

Phillipsburg, Drummond, Maxville, Garrison, Grant Kohrs Ranch, Deerlodge are Concern Level 1 areas that surround the project area boundary but the project area cannot be seen from these locations. There are no CL 1 routes, other areas, or sites within the project area boundary. The portions of the project area where treatment is proposed are not visible from the CL 1 areas due to distance and topography.

Montana Highway 1 (The Pintler Scenic Loop) is a CL 1 route that runs north to south along the west aspect (but outside) of the project area boundary, and Interstate Hwy 90 which runs northwest to southeast along the north and west aspect (but outside) of the project area boundary. Views into the project area from either of these routes are seen as background distance zone views (i.e., four or more miles from view point). No affects from these CL1 routes are anticipated because the distance, topography and sights of landscape patterns associated with the existing visual condition would obscure activity from view.

Sections of the following Concern Level 2 routes that were determined to be directly affected by the proposed actions (where the visible result of project activities would be noticed from them) are listed as follows: NFS Road 707, FR1544, FR636, and NFS Road 1557. No proposed actions (treatments) are expected to be seen from NFS Road 302 and NFS Road 78615, the remaining CL 2 routes within the vicinity of the project area. Therefore, no direct, indirect, or cumulative effects are associated with them. Proposed actions (treatments) not identified in the following analysis are not expected to be seen from any Concern Level 2 routes due to factors such as distance and obstruction or screening by terrain features and vegetation.

The direct and indirect effects of the proposed action are those related to the specific activities proposed. The following lists the actions proposed (treatment type), the units proposed, the concern level routes affected, and their anticipated effect on the existing scenic integrity for the landscape setting in which they are located.

Lodgepole Pine Salvage by Clearcut Harvest

This treatment would result in created openings in each of the units, with few trees remaining[33]. This would be perceived as a change from the current forested appearance (in spite of nearly all of the trees in these units being dead). Clearcut prescriptions have greater potential to contrast with the form, texture, line, and color from their natural, unaffected surroundings. These characteristics are consistent with lower scenic integrity. Project design features were developed to ensure that moderate scenic integrity is met by clearcut salvage treatments seen from Concern Level 2 routes within the affected environment.

Proposed salvage clearcuts (including those 40 acres or more in size) are planned for areas in a current state of lower scenic integrity or quality due to the beetle infestation. The salvage activity would not change the existing scenic integrity of these areas in the short term. The overall scenic integrity of treated areas would improve in the long term as healthy stands replace those that were dead, dying, and removed under the proposed action.

There are several units proposed for this treatment that would be visible from the identified Concern Level 2 viewing platforms. Units seen from NFS Road 1544 include: 36S, 37S, 45S, and 69S. Units seen from NFS Road 1557 include 16S, 26S, 35S, 41S, 49S, 50S, 61S, and 76S. Effects of these units are described below.

Portions of these units would be partially seen from the Concern Level 2 route section they are adjacent to. Some places along these road sections are likely to have visual screening (where stands of green trees are) between the road and unit; others would not (where stands of trees to be salvaged are located). Temporary roads are planned from NFS Road 1557, a Concern Level 2 route that would provide access to units 49S, 61S, 35S, and 41S.

Short-term effects created by activity associated with treatments (such as tractor harvest, and the people and other equipment needed to accomplish the work) would be visible directly from these associated Concern Level 2 route sections until treatment is complete. Evidence of the temporary road footprint would be difficult to see in the long-term, as the road would be obliterated upon project completion. The created openings as a result of this treatment have the potential to create visual effects that dominate the setting, but project design features would help to mitigate this. In the long term, after adequate vegetative regeneration occurs, the resulting visual condition would be consistent with that expected within the management area and meet the adopted SIO of moderate.

The following provides an estimate for the extent of foreground effects for each unit as seen from the adjacent Concern Level 2 route as well as other details that may pertain to a specific unit.

Unit 36S - The portion of this unit adjacent to NFS Road 1544 is approximately 0.36 mile in length and would be partially seen from this road section.

Unit 45S - The portion of this unit adjacent to NFS Road 1544 is approximately 0.36 mile in length and would be partially seen from this road section.

[33] In salvage units, lodgepole pine (from 4 inches up to 20 inches d.b.h.) would be salvage clearcut harvested using mechanized ground-based equipment. All other species that occur in the units (Douglas-fir, spruce, subalpine fir, and aspen) would be retained. All trees (live or dead) greater than 20 inches d.b.h. would be retained in all units. An exception would occur in harvest units if they are defined a hazard to harvest operations and designated for felling by a Forest officer.

Unit 40S – The portion of this unit adjacent to NFS Road 1544 is approximately 0.20 mile in length and flat terrain, combined with vegetation buffer between unit and road, is likely to obscure visibility into the treatment area; so this unit would be relatively unnoticed. Only haul vehicles are expected to be seen since treatment is accomplished from other Forest roads that are not identified as having visual concerns. Scenes of activity from this section of NFS Road 1544 might be noticeable in the background while treatment occurs.

Unit 69S - The portion of this unit adjacent to NFS Road 1544 is approximately 0.36 mile in length and would be partially seen from this road section.

Unit 37S - The portion of this unit adjacent to NFS Road 1557 is approximately 500 feet in length and would be partially seen from this road section.

Unit 41S - The portion of this unit adjacent to NFS Road 1557 is approximately 400 feet in length and would be partially seen from this road section since it is offset from the roadside by approximately 200 ft.

Units 35S, 16S, 61S, 50S, and 49S – These units are in close proximity to one another and the combined portion of these units adjacent to NFS Road 1557 is approximately 1.22 miles in length. Portions of all these units are expected to be visible.

Units 26S and 76S - These units are in close proximity to one another and the combined portion of these units adjacent to NFS Road1557 is approximately 0.73 mile in length. Most of the direct effects associated with this treatment method would be unseen, as these units are located on the side of the slope below NFS Road 1557. An indirect effect is that the quality of the scenic experience is improved along this road section. Trees in the immediate foreground along this road section currently screen views of the pastoral landscape setting to the north. Dead and dying trees removed here would reveal these views more, but Burn unit 7B would be more visible as a result as well. The appearance of Unit 7B would reflect a landscape setting that has been subjected to fire events of mixed severity.

Commercial Thin

This treatment would result in open stands with increased visual penetration into the stand, and emphasis on maintaining larger diameter trees. In the long term, larger trees would dominate views in the foreground, and provide for a coarse-textured tree canopy in middle- and background viewing distances. By their nature, thinning prescriptions have a lower potential for producing negative scenery effects. Thinning treatments can be designed to blend in well with their natural, unaffected surroundings as their forms are obscure, texture and color match the nature surroundings well enough to appear natural, and lines are difficult to define. These characteristics are consistent with high scenic integrity, and no mitigations are required.

Units 64C, 60C, 10C and 11C are visible from NFS Road 1557, and unit 22C is seen from NFS Road 707 (both are Concern Level 2 viewing platforms).

Unit 64C spans for approximately 300 feet directly adjacent to NFS Road 1557 where scenery is of moderate to low concern.

Unit 60C - This unit would be seen along a 0.50-mile (approximate) section of NFS Road 1557 where scenery is of moderate to low concern. An indirect effect is that the quality of the scenic experience is improved along this road section. Trees in the immediate foreground along this road section currently screen views of the pastoral landscape setting to the north. Dead and

dying trees removed here would reveal these views more. Burn unit 8B would be partially visible through the thinned stands as well, but any resulting evidence of fire treatment would be vague (i.e., darker color contrast than surrounding landscape).

Units 10C and 11C – These units are located close to one another, and would be seen along a 0.50-mile (approximate) section of NFS Road 1557 where scenery is of moderate to low concern.

Unit 22C - This unit would be seen along a 0.35-mile (approximate) section of NFS Road 707where scenery is of moderate to low concern.

This treatment would result in landscape settings with more open, park-like conditions comprised of larger stands of trees. No temporary roads are planned from this travel route, and activity associated with treatments (people, and other equipment needed to accomplish the work) would be visible directly from this section of NFS Road 1557 until treatment is complete. The resulting visual condition would be consistent with that expected within the management area and meet the adopted SIO of moderate after project completion and into the long term.

Precommercial Thin

Similar to commercial thinning, the effect of this treatment would be a reduced number of stems per acre, resulting in increased spacing between trees and increased viewing distance into these stands from the adjacent areas. This increase in visual penetration would be slight, due to the form and foliage of the trees, which still have low-growing branches.

There are several units proposed for this treatment that would be visible from the identified Concern Level 2 viewing platforms. Units seen from NFS Road 636 include 13P, 14P, 18P and 19P. Units seen from NFS Road 1557 include 20P and 43P.

These treatments would result in landscape settings with more open, park like conditions comprised of larger stands of trees. No temporary roads are planned from any of the Concern Level routes for these treatments, and activity associated with treatments (people, and other equipment needed to accomplish the work) would be visible directly from these road sections until treatment is complete. The resulting visual condition would be consistent with that expected within the management area and meet the adopted SIO of moderate upon project completion and into the long term.

The following provides an estimate for the extent of foreground effects for each unit as seen from the Concern Level Route they are adjacent to, and other details that may pertain to a specific unit not covered in the paragraph above.

Units 18P, 19P, 13P and 14P - These units are in the direct vicinity of one another, are located directly adjacent to NFS Road 636, and affect an approximate one-mile section of this road.

Unit 20P - This unit is located directly adjacent to NFS Road 1557, and totals approximately 0.40 mile of affected road section.

Seed Tree Harvest

Visual characteristics of this prescription are described in the vegetation resource report for this project as having widely spaced large-diameter ponderosa pine and Douglas-fir trees (5-15 trees

per acre) with about 400 ponderosa pine seedlings planted per acre. Shrubs and forbs would be common, but low growing.

Units 65ST and 27ST would be visible from the identified Concern Level 2 viewing platform NFS Road 1557. These units would be seen along a 0.50-mile (approximate) section of NFS Road 1557 where scenery is of moderate to low concern. The existing condition is already open and park like, with larger diameter trees dominating the foreground views. The effect of this treatment would not appear much different from what already exists, with the exception of larger openings or spacing between trees within the stands. No temporary roads are planned from this travel route, and activity associated with treatments (such as tractor harvest, the people, and other equipment needed to accomplish the work) would be visible directly from this section of NFS Road 1557 until treatment is complete. The resulting visual condition would be consistent with that expected within the management area and meet the adopted SIO of moderate upon project completion and into the long term.

Prescribed Burn

Prescribed fire is the skillful application of fire to fuels in a definite area under precisely defined conditions including wind-speed, fuel moisture, soil moisture, and other factors, in order to produce the intensity of heat and rate of spread required to accomplish specific results (Bacon 1985). Prescribed and wildfires have the power to change a landscape in ways that cause people to enjoy, dislike, or feel ambivalent about nature, depending on their personal tastes and cultural background. Aesthetics has the potential to influence fire management. Public perceptions affect land management plans and influence national regulations, so it is necessary for managers to consider the visual quality of the landscape (Fowler 2008).

There are several units proposed for this treatment that would be visible from one Concern Level 2 viewing platform - NFS Road 707. Effects to these units are described below.

Units 1B, 2B, and 6B – These units are in the same vicinity and have an approximate 200-foot buffer between NFS Road 707 and the burn unit boundary. The height and density of the vegetative buffer between the units and road would allow the lower part of these units to be relatively unnoticed by the public using the road system. However, aspects of treatment along hillsides would be noticeable. Under this alternative, treated sections within the project area boundary would be restored closer to or within their natural historic fire regimes—and serve both visually and functionally as a fire adapted ecosystem. The appearance of the landscape under this alternative would be one that reflects a forest that has been subjected to fire events of mixed severity. Evidence of crown fires may be apparent but such occurrences are expected to be infrequent since treatment would occur when weather conditions keep fire severity in check and closer to the ground. “Green up” or vegetation regeneration that would occur within a natural timeframe would enhance scenic quality.

No temporary roads are proposed for these units. This activity is consistent with practices for management or use within the management area, and both short- and long-term effects would result in meeting the adopted scenic integrity objective of moderate.

Cumulative Effects

Visual impacts due to past harvests are noticeable throughout the project area. Extensive harvest activity has occurred where allowed. This visual condition is expected in a management area that is suitable for timber harvest, and results in a moderate SIO.

Along with the proposed activities, the type of projects that could affect scenery is the current Roadside #4 Salvage Hazard Tree Removal Project. This project would benefit scenery in the short and long term by changing the low scenic integrity resulting from the uniform appearance created by acres of dead stands of trees to a scenic integrity level that is higher by offering landscape scenery that appears with more diversity and life.

The proposed activity, in conjunction with past, current, and future activities may change existing landscape conditions as seen from specific sections of CL2 routes identified in the analysis, but not in a manner that exceed Scenic Integrity Objectives in the long term. That is, areas that are of moderate SIO would remain moderate.

Summary of Effects

The visual condition would result in landscape settings that directly, indirectly, and cumulatively, remain consistent with the Scenic Integrity Objectives prescribed to the project area by the Forest Plan (2009). All pertinent standards for scenery would be followed.

Alternative 3

Direct and Indirect Effects

The direct and indirect effects to scenery as stated under the proposed action are the same for alternative 3. For units seen from CL 2 routes within the affected environment, alternative 3 proposes the same treatment prescriptions, at the same places, and employs the same harvest methods. There is one difference in what is proposed in terms of effects to scenery, and that is clear-cut salvage unit 41S. Under alternative 3, no temporary road is proposed to access the unit; therefore, no short-term effects from temporary road obliteration are anticipated.

Cumulative Effects

For units seen from CL 2 routes within the affected environment, alternative 3 proposes the same treatment prescriptions, at the same places, and employs the same harvest methods. The cumulative effects to scenery as stated under the proposed action are the same as stated for alternative 2. Collectively, actions in alternative 3, in conjunction with past, current, and future activities may change existing landscape conditions as seen from specific sections of CL2 routes identified in the analysis, but not in a manner that exceed Scenic Integrity Objectives in the long term, so there would be no cumulative effects to the moderate SIO .

Summary of Effects

The visual condition would result in landscape settings that directly, indirectly, and cumulatively, remain consistent with the Scenic Integrity Objectives prescribed to the project area by the Beaverhead-Deerlodge National Forest Land and Resource Management Plan (2009). All pertinent standards for scenery would be followed.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives meet the goals and objectives, outlined in the 2009 Beaverhead-Deerlodge National Forest Revised Land and Resource Management Plan.

Alternatives 2 and 3 also meet the relevant Forest Plan standard. They would meet their scenic integrity objectives, if not upon project completion, in the future as described in the effects

analysis. For these action alternatives, all proposed activities seen from CL 2 platforms, are in a Moderate SIO management objective. No activity would be seen from CL 1 platforms, or in areas that have a High SIO management objective.

In some cases, Scenic Integrity Objectives would not be met immediately after management activities have been completed, but would be met at some point in the future. It is important to note that the Forest Plan (per direction provided by the Scenery Management System) does not attach timeframes to meeting Scenic Integrity Objectives. Instead, timeframes for meeting Scenic Integrity Objectives are disclosed in the project scenic resources analysis. Since all Scenic Integrity Objectives would be met, the project is consistent with the Forest Plan scenic resources standards (Forest Plan p. 33).

Heritage Resources

Introduction

This analysis examines the Heritage/Cultural Resources within the project area and discusses how these resources may be affected by the proposed activities. Cultural Resources are the physical remains of past human activities (e.g., artifacts, burials, pictographs, Native American ceremonial sites, and the remains of mining, logging, ranching and other historic activities) having scientific, prehistoric, or social values.

Affected Environment

Existing Condition

As a result of past cultural resources inventory within the Flint Foothills analysis area, 25 cultural properties were identified and recorded and three site leads were noted. One prehistoric site and 24 historic sites are recorded within the analysis area. The one prehistoric site is a pictograph. The other sites in the analysis area are historic. Seventeen historic sites are associated with historic mining activity, five log cabins, one logging activity sites, one historic Forest Service administration site, and one historic mining district. Most importantly, sixteen historic sites have cabin remains and/ wooden structural remains present. Twenty-five sites were formally recorded but only two were formally evaluated for significance in consultation with the Montana State Historic Preservation Office.

A list of documentary references that were consulted for information on the prehistoric and historic human use of the project area is provided in the Methodology section, below. The Heritage report in the project file provides more detail on past surveys in the project area.

Desired Condition

Heritage/Cultural Resource Laws and Statutes

In addition to Forest Plan direction, the following laws are the major statutes that guide and define the management of prehistoric and historic heritage sites on the National Forest System.

- The National Historic Preservation Act and its implementing regulations, particularly 36 CFR 800, Sections 106 and 110.
- The Antiquities Act
- The Archaeological Resources Protection Act

- The Native American Graves Protection and Repatriation Act
- The American Indian Religious Freedom Act
- Religious Freedom Restoration Act
- Executive Order 3175 (Indian Trust Responsibilities)
- Executive Order 13007 (Indian Sacred Sites)
- Executive Order 13175 (Coordination with Indian Tribal Governments)
- National Register Bulletin #38 (Traditional Cultural Properties)
- USFS Manual Guidance FSM 2300 (Chapter 2360)

Forest Plan Standards for Heritage Resources

The Forest Plan provides forest wide objectives (pp. 22-23) and standards (p.23) for heritage resources.

Standards relating most directly to this project:

- Standard 1: Heritage resources determined eligible for listing in the National Register of Historic Places will be preserved in place, or a consensus determination of "no adverse effect" will be reached with the Montana SHPO, the Advisory Council on Historic Preservation, and appropriate Indian tribes.
- Standard 2: Unplanned discoveries of heritage resources during project implementation shall cause project operations in the area of the discovery to cease until analysis and evaluation of the heritage resources are completed, including consultation with the Montana SHPO and appropriate Indian tribes.
- Standard 3: Heritage protection measures will be added to all appropriate contracts, sales documents, and special use permits.

Environmental Consequences

Methodology

Heritage personnel use three types of inventory strategies for this project: existing data review, sample survey, and intensive survey. Existing data review includes a basic literature review to identify previous archaeological and historic research done in the area and to determine what information previous work may have revealed. A wide array of standard references were reviewed, including the National Record of Historic Places, the Montana State Historic Preservation Plan, General Land Office Plats, Homestead Entry Surveys, Mineral Surveys, land status maps, historic Forest Service maps and professional reports, and historic monographs directly related to the archaeology and history of the Flint Foothills area.

The following documentary references were consulted for information bearing on the prehistoric and historic human use of the project area.

- The National Register of Historic Places
- The Montana State Historic Preservation Plan
- The Beaverhead Unit and Deerlodge Unit cultural site atlases, cultural site files and records of previous archaeological surveys
- General Land Office (GLO) Plats
- Homestead Entry Surveys

- Mineral Surveys
- Relevant books, articles, professional monographs on the history and prehistory of southwestern Montana and historic maps.

An examination of the existing Beaverhead-Deerlodge Heritage Program records provided information on the number and type of previously recorded cultural resource inventories and cultural sites within the analysis area. All inventories were primarily project compliance related in advance of a number of proposed federal undertakings including: timber sales, small range improvements (fences, water developments), and mining exploration and development.

Sample survey is based on the Site Identification Strategy (SIS) found in the Region I Programmatic Agreement (PA) and within the SIS is the Stratified Survey Standards (SSS). For "analysis level" (Code of Federal Regulations 800.4.b(1)) undertakings, such as the Flint Foothills project, phased Section 106 of the National Historic Preservation Act (NHPA) compliance may be completed using a sampling (as defined from Secretary of Interior Standards and Guidelines) and monitoring strategies in High-Probability areas. At the Section 106 compliance level Heritage Resource personnel will implement the SSS model for their survey methodology for specific Areas of Potential Effect (APE). The Intensive survey is a complete pedestrian examination of an entire project area of potential effect to locate and record all cultural resources. Heritage personnel would walk a compass or GPS oriented transects spaced every 20 meters for the intensive survey.

Stratification Standards and Guidelines

Archaeologists may employ a stratified sample survey for all forest undertakings where the project Area of Potential Effect is in excess of 100 acres. The stratification will include 100 percent survey of all High Probability areas, 30 percent coverage of all Moderate Probability areas, and 10 percent of all Low Probability areas. Probability areas are based on qualified intuitive assumptions. Therefore, the stratification of those probability areas is not firmly fixed and adjustments are easily made in the field.

During the 2011 field season Heritage personnel completed an existing data review, sample survey and intensive field inventory to complete the salvage, commercial thin and seed tree units except for four timber units and the prescribed burn units. Units not covered during the 2011 field season include units 55C, 59C, 68C, and 71C and all eight prescribe burn units (1B, 2B, 3B, 4B, 5B, 6B, 7B and 8B). These remaining unsurveyed timber and prescribed burn units would be field inventoried in summer 2012 using the Sample and Intensive survey strategies. The precommercial thinning units would not be surveyed by Heritage personnel. Based on the SIS, Heritage personnel determined the precommercial thinning would have no potential to cause effects on historic properties (CFR 800.3(a)(1) and CFR 800.16(y). There is no ground disturbing activity proposed and the felling of small diameter trees would not affect cultural resources.

Sites identified in the project area will be avoided and/or site specific mitigation measures would be developed in consultation with the Montana State Historic Preservation Office prior to project implementation.

Incomplete and Unavailable Information

Additional survey is needed, in 2012 for all prescribed fire units (1B, 2B, 3B, 4B, 5B, 6B, 7B and 8B) and four timber salvage and commercial thin units (55C, 59C, 68C and 71C).

Spatial and Temporal Context for Effects Analysis

The spatial context used for direct and indirect effects is limited to the areas of potential effect which are all salvage, commercial thin, seed tree, and prescribed burn treatment units, landings, new road construction, temporary road construction, and existing road reconstruction.

Cultural sites will be avoided or site-specific mitigation will be developed in consultation with the MT State Historic Preservation Office, therefore, the various proposed project activity timeframes will not affect cultural resources. There are no temporal effects identified.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

No past or reasonably foreseeable activities would affect cultural resources. For a full list of, present and reasonably foreseeable activities in the project area, see table 24 at the beginning of chapter 3.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Under alternative 1, there would be no direct or indirect effects to heritage resources from the Flint Foothills Vegetation Management Project because no project activities are proposed.

There are no known reasonably foreseeable actions that would reduce the heritage resource database. Other management activities that would occur in this area would need cultural resource field inventory.

Alternative 2 and Alternative 3

Direct and Indirect Effects

Under both alternative 2 and 3 there would be no direct effects to cultural resources because the area of potential effect which is the proposed activity areas including timber units (salvage, commercial thin, and seed tree), prescribed burn units, landings, temporary road construction, new road construction, and existing road reconstruction would be surveyed and sites identified prior to project implementation. The prescribed burn units would have additional survey beyond the specific delineated burn boundaries to ensure there would be no direct effects to cultural resources.

Sites would be avoided and/or mitigation measures would be developed in consultation with the Montana State Historic Preservation Office as stipulated by the Region 1 Programmatic Agreement and in accordance with Section 106 of the National Historic Preservation Act. Mitigation measures are provided in chapter 2. These mitigation measures have proven effective in the past on wildfires, managed fires and prescribed fires on the Beaverhead-Deerlodge National Forest. Over the past 20 years, no heritage resources or cultural sites have been affected where these measures have been implemented (personal communication, Joe Sampson 02/28/2012).

There would be no direct effect associated with the spring or fall prescribed burning in the commercial thin and seed tree units because heritage personnel would field-inventory the entire unit, and the trees would be whole tree yarded to a landing reducing the fuel component within the units. Fire intensity would be less and the method of burning would be ground based so

sites would be more visible, and sites would be avoided and/or mitigation measures would be developed in consultation with the MT State Historic Preservation Office prior to project implementation.

There would be no indirect effects for all the timber harvest units (salvage, commercial thin, and seed tree), prescribe burn units, and the prescribed burning of the commercial thin and seed tree units for the action alternatives because sites would be avoided and mitigation measures would be developed in consultation with the MT State Historic Preservation Office.

Cumulative Effects

Because cultural sites would be avoided and/or mitigation measures would be developed in consultation with the MT State Historic Preservation Office prior to project implementation there would be no cumulative effects for either alternative.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All of the alternatives are compliant with the 2009 Forest Plan (USDA 2009) and compliant with relevant federal laws and regulations. Alternative 1 is compliant with the above mentioned regulations because there are no proposed project activities that would affect cultural resources, Sites with project activities for the action alternatives have been or would be surveyed, and sites would be avoided or mitigation measures would be developed in consultation with the Montana State Historic Preservation Office

Economics and Social Science

Introduction

The management of the natural resources on the Beaverhead-Deerlodge National Forest (BDNF) has the potential to affect local economies. People and economies are an important part of the ecosystem. Use of resources and recreational visitation to the national forests generate employment and income in the surrounding communities and counties. They also generate revenues returned to the Federal treasury or used to fund additional on-the-ground activities to accomplish resource management objectives.

This section presents concepts used to delineate an affected area and describes the methods and results of analyzing the economic effects of the project, including project feasibility, financial efficiency, and economic impacts. Project feasibility and financial efficiency relate to the costs and revenues of doing the action. Economic impacts relate to how the action affects the local economy in the surrounding area.

The project area is located within portions of both Granite and Powell Counties, Montana. Since these are the two counties that would be most affected by the project in terms of social and economic effects, the Affected Environment section focuses on these two counties.

The combination of small towns and rural settings, along with people from a wide variety of backgrounds, provides a diverse social environment for the geographical region around the BDNF, including the Pintler Ranger District. Local residents pursue a wide variety of life styles but many share a common theme—an orientation to the outdoors and natural resources. This is reflected in both vocational and recreational pursuits including employment in logging and

milling operations, outfitter and guide businesses, hiking, hunting, fishing, camping, and many other recreational activities.

Timber, tourism, and agricultural industries are important to the economy of local areas. Despite the common concern for, and dependence on, natural resources within the local communities, social attitudes vary widely with respect to their management. Local residents hold a broad spectrum of perspectives and preferences ranging from complete preservation to maximum development and utilization of natural resources.

Timber management activities within the project area have the potential to impact the economic conditions of local communities and counties.

Overview of Issues Addressed

Three measurement indicators and their analysis methods were selected to compare how well the alternatives are expected to meet the purpose and need.

Table 98. Economic measures of success and analysis methods

Measures of Success for Economics	Analysis Method
Available revenue	Region 1 sale feasibility spreadsheet tool – residual value analysis
Present net value	Financial efficiency analysis
Employment and labor income	IMPLAN economic impacts analysis

The preparation of NEPA documents is guided by CEQ regulations for implementing NEPA [40 CFR 1500-1508]. NEPA requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during scoping. NEPA does not require a monetary benefit-cost analysis. If an agency prepares an economic efficiency analysis, then one must be prepared and displayed for all alternatives [40 CFR 1502.23].

OMB Circular A-94 promotes efficient resource use through well-informed decision making by the Federal Government. It suggests agencies prepare an efficiency analysis as part of project decision making and prescribes “present net value” as the criterion for the efficiency analysis.

The development of timber sale programs and individual timber sales is guided by agency direction found in Forest Service Manual (FSM) 2430. Forest Service Handbook (FSH) 2409.18 guides the financial and, if applicable, economic efficiency analysis for timber sales.

Many of the costs and benefits associated with a project are not quantifiable in financial terms. For example, the benefit to wildlife from habitat improvement from a project designed to maintain forests in a mosaic of diverse species and age classes resilient to insects and disease is not quantifiable in financial terms. These costs and benefits are described qualitatively in the indicated resource sections of this document. Title 40, Code of Federal Regulations for NEPA (40 CFR 1502.23) indicates:

> For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are qualitative considerations.

Affected Environment

Methodology

Socioeconomic measures used to describe the affected environment were obtained from the Headwater Economics' Economic Profile System – Human Dimensions Toolkit (EPS-HDT 2011), which compiles and summarizes primary population and economic data from a variety of government sources into county, multi-county or state reports. Key measures used in this analysis include land ownership, population, employment and income. Relevant excerpts from the recent Social Assessment of the Beaverhead Deerlodge National Forest written by Northern Economics (2002) are also provided to describe social conditions and preferences. Because one commenter (scoping) requested consideration of national and state level polls revealing attitudes towards logging national forests, several pertinent polls are also presented. Abundant additional information is available in the Eastern Montana National Forest Economic Assessment written by Stockmann and Stewart (2002). All of these documents are located in the project file or through the publically available EPS-HDT at http://headwaterseconomics.org/tools/eps-hdt.

Existing Condition

Project Area

The Flint Foothills Vegetation Management project area is on the Pintler Ranger District of the BDNF and is located approximately 6 miles southeast from Drummond and 28 miles northwest of Deerlodge, straddling the Granite and Powell county line. To estimate the potential effect on jobs and income, a zone of influence (or economic impact area) was delineated. The impact area was chosen using suggested USDA Forest Service protocols for delineating economic impact areas (Meti Corp 2010), which bases the selection of the impact area on commuting data and where the timber is likely to be processed (log flows). This analysis suggested that Granite and Powell Counties, Montana were the appropriate counties to include in the economic impact analysis area.

Land Ownership

More than half of the land area encompassed by the two-county impact area is managed by various public agencies, with 55 percent of the 2.6 million acres being federally owned and an additional 5 percent is owned by the state. The Forest Service manages around 1.3 million acres, or 50 percent of the land area within the impact area. Granite County has the larger share of Federal public lands (63.2 percent), and Powell County has the smaller amount (49.7 percent). By comparison, only 20.6 percent of the land area of the United States is publicly owned (figure 61).

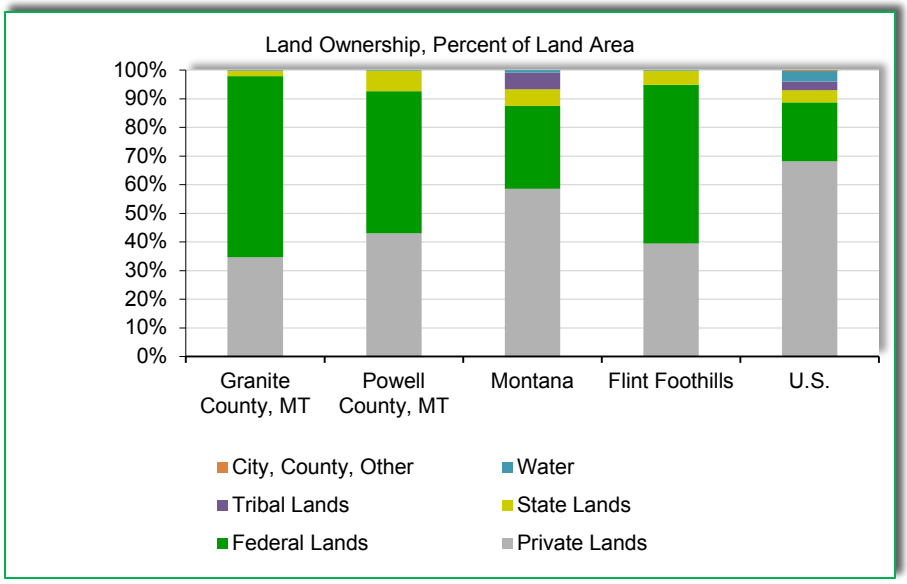


Figure 61. Land ownership by percent of land area

Source: Land Ownership 2008, Montana Natural Heritage Program

Payments from federal lands were responsible for 8.0 percent of Granite County's government revenues during 2007. This was roughly half the dependence that Powell County had on federal land payments that year, when about 15.6 percent of all their revenues came from Secure Rural Schools and Community Self Determination Funding, PILT and a few other programs.

Population and Demographic Change

According to the U.S. Census Bureau, the population of Granite County grew 13.9 percent between 1990 and 2009, while the population of Powell County grew by 6.8 percent over the same time period (table 99). Population growth in both the state and the nation outpaced the change observed in these two counties (USDC 2008).

Sources of population growth in both counties were relatively similar from 2000-2009, where both counties saw roughly two-thirds of new residents from natural growth (births-deaths) and one third from migration.

Table 99. Estimated population change 1990 to 2009

Community	1990	2000	2009	Total Percent Change
Granite County population	2,528	2,843	2,879	13.9 Increase
Powell County population	6,640	7,178	7,089	6.8 Increase
State of Montana population	800,204	903,293	974,989	21.8 Increase

Source: U.S. Census Bureau, 2009 Population Estimates, 2000 Census, 1990 Census

The racial composition of the population in the State of Montana and the analysis area in 2000 is shown in table 100. The overwhelming majority of the population across the state and within Granite and Powell Counties is white. The total population of all races other than white was less than 10 percent at both the county and state level.

Table 100. Racial composition of 2000 population

Location	White	Black or African American	American Indian, Alaskan Native	Asian, Native Hawaiian, other Pacific Islander	Other race or two or more races	Hispanic or Latino (of any race)
Montana	90.6%	0.3%	6.2%	0.6%	2.3%	2.0%
Granite County	96.3%	0.0%	1.3%	0.1%	2.3%	1.3%
Powell County	92.5%	0.5%	3.5%	0.4%	3.0%	1.9%

Source: U.S. Census Bureau, 2000 Census,

Employment

From 1970 to 2009,when the Standard Industrial Classification System was used to describe the economy, total employment for full- and part-time jobs increased by 61 percent in Granite County (from 1,139 to 1,835) and increased by 42 percent in Powell County (from 2,576 to 3,666). The State of Montana saw an increase in total employment of 107.8 percent averaging roughly 2.8 percent annually, over this same period (USDC 2011). State employment growth was largely due to increases in service and professional sector employment (including retail trade, health and social services, transportation, utilities, finance, education, etc.). Employment in the two-county impact area has consistently increased since 1970. The higher increase in employment was in Granite County, which experienced a 1.6 percent average annual rise in employment from 1970 to 2009. The lower increase was in Powell County with 1.1 percent average annual growth.

Table 101. Total employment 1970-2009

Location	Total Employment			Total Percent Increase (1970-2009)	Average Annual Percent Increase (1970-2009)
	1970	2000	2009		
Granite County	1,139	1,798	1,835	61	1.6
Powell County	2,576	3,603	3,666	42	1.1
Flint Foothills economic impact area	3,715	5,401	5,501	48.1	1.2
Montana	301,051	560,432	625,516	107.8	2.8
United States	91,277,600	165,510,200	173,809,200	90.4	2.3

(BEA 2011b)

National and regional trends in industry sectors influence the ability of communities to adapt to changing circumstances (Northern Economics 2002). Employment in extractive industries such as timber and mining, as well as in ranching and agriculture, is declining in western Montana. Projections indicate continued declines in employment in these areas. Although the differences between today's national forest timber sale program and the program that was in place a decade or so ago have changed, the role that timber production from NFS lands plays in national and regional economies through logging and related activities has existed for a considerable time period and is integral to local communities and individuals directly employed by them.

During 2009, both counties had roughly 9 percent of employment in agriculture, which were twice the Montana proportion and roughly five times the national proportion. Granite County had more than 28 percent and Powell County has just fewer than 23 percent of their 2009 jobs in sectors associated with travel and tourism. In addition, service jobs composed a larger portion of private employment in Granite County, with contrasts with Powell County where government jobs (34.2 percent many associated with the Montana State Prison) represented a larger share of employment than in Granite County, where on 14.9 percent of jobs were attributed to government. For Montana in general, the earnings from jobs in services at $32,145/year are lower than those in government, which average $41,221/year. For comparison, forestry and logging jobs paid an average of $31,239/year and wood products manufacturing jobs averaged $31,090/year for the two-counties.

The BDNF is a major employer and landholder in southwestern Montana. Consequently, Forest Service budget reductions and policies impact employment opportunities throughout the region. Jobs in the government sector decreased between 1990 and 2000 by 7.8 percent (from 34.2 to 26.4 percent in Powell County but only by 0.3 percent (from 30 to 29.7 percent in Granite County. There have been changes in the forest timber sale program over the past 15 years as objectives have changed and timber harvest levels have declined. Although the timber output amounts to only 1 percent of industry outputs in Powell County, the community of Deer Lodge (i.e., Sun Mountain Lumber) still relies heavily on timber processing for employment. While 27 percent of the industry output for Granite County came from the timber industry, the county relies heavily on private sources of timber products. The Forest Plan EIS (USDA Forest Service 2009b, p. 196) contains information about forest resource related industries and services and the declining trends in extractive industries such as timber.

Although the portion of all timber-related jobs was down from 22.4 percent during 1998 to 17.0 percent by 2009, the portion of the economy this represents was still far greater in the Flint Foothills economic impact area that the Montana state average. Of the 4,123 jobs in the state, representing 1.2 percent of the total jobs during 2009, 247 of these were located in Granite (45 or 9.5 percent of all private employment) and Powell (202 or 20.7 percent of all private employment). For Granite County the majority of these jobs were in harvesting (35) whereas in Powell County although harvesting accounted for 88 jobs, sawmills contributed more with 112 jobs in 2009. Roughly 4 jobs, 2 in each county, were attributed to other wood products manufacturing.

Despite overall growth in jobs, finding work in Granite County has been harder lately than in the past two decades. Average annual unemployment declined from 8.2 percent during 1991 to 6.5 percent during 1994. It spiked during 1995 at 7.0 percent before dropping to 5.7 percent during 1996. Then it climbed the next three years to 8.9 percent during 1999, before dropping every year until the recent low of 4.2 percent during 2006. From 2007 it climbed at an accelerating rate until 9.5 percent by 2009 before slowing its growth rate, but still climbing in 2010, reaching 10.4 percent. More recent monthly data for the early months of 2011 indicate it continued climbing.

Although recent average annual and monthly unemployment rates are at or near their highest levels in 20 years in Powell County, there is a different history for those attempting to find work there than in Granite County. Average annual unemployment increased from 5.9 percent during 1991 to 8.9 percent during 1993. After this short spike it fell until 1999 at 5.1 percent then rolled along roughly stable until 2002 at 6.2 percent dropped to its low for the period 4.7 percent during 2006. It climbed rapidly from 5.0 percent during 2007 to 8.9 percent in 2010.

More recent monthly data for the early months of 2011 indicate it continued climbing until October when monthly rates finally were lower than October 2010.

Income

Since 1970, total personal income in Granite County grew at nearly double the rate it did in Powell County. Granite County total personal income increased roughly 105 percent from 1970 to $93.742 billion by 2009, whereas in Powell County growth was 59 percent for the same period, reaching 183.063 billion by 2009. The 2009 Per capita personal income, or total personal income divided by total population was higher in Granite County ($32,561) than in Powell County ($25,823) that year. However, the 2009 average earning per job was higher in Powell County ($32,264) than in Granite County ($22,929). Part of the explanation for this inconsistency lies in the proportion of total income derived from non-labor income. Non-labor income consists of dividends, interest and rent (collectively often referred to as money earned from investments), and transfer payments (payments from governments to individuals, age-related payments, including Medicare, disability insurance payments, and retirement payments). In Granite County, 53.4 percent of all 2009 income was from non-labor sources, which was substantially higher than 46.8 percent in Powell County.

Each year the US Census Bureau releases a report on Poverty. The interactive mapping tool located at http://www.census.gov/did/www/saipe/data/maps/index.html?reload indicates that during 2010, the most recent year available, the poverty rate in Granite County, was 14.8 percent down from 17.4 percent during 2009. This is similar to the entire State of Montana, which had an estimated rate of 15.0 percent during 2009, up slightly to 15.2 percent during 2010. In Powell County it higher than the state average, at 20.5 percent during 2010, up slightly from 20.3 percent during 2009. It is worth noting that the prisoner population in Powell County partially explains the low income. It is also noteworthy that earlier in 2000, the American Indian population had a very high level of poverty in both Granite County (62.5 percent) and Powell County (30.5 percent).

Social Environment

The Forest Plan FEIS (USDA Forest Service 2009b, p. 203) includes information about the social environment of the analysis area (i.e., the lifestyles and attitudes toward forest resources and the way these resources are used). Information from the Social Assessment of BDNF (Northern Economics 2002), which identified contemporary trends affecting lifestyle, attitudes, and values, is incorporated into that discussion. Maintaining traditional uses like grazing, timber harvest, and recreational activities and maintaining the condition of forest resources for the health of the community (e.g., clean water, fish, wildlife, fuel hazards, and roadless management) were identified by the public as concerns related to lifestyle, attitudes, and values.

Excerpts from the 2002 social assessment describe some local thoughts on BDNF timber management: Section 3.2.2.1 Timber and Logging Lifestyles

> "The buckers, riggers, "cat" operators, road builders, and log truck drivers each have their own place in the logging hierarchy. Collectively they have a fierce pride in their work and describe it as a way of life that is, in part, made meaningful because of the opportunity to "work in the woods." Furthermore, the level of skills required often takes an extended period of time to learn. One of the current concerns in communities such as Clancy, Dillon, and Deer Lodge is the ongoing loss of "infrastructure" and the skill loss that accompanies that loss."

As one mill operator noted:

> "You are not just going to replace those people overnight. We are losing that infrastructure and we will not be able to replace it in a short space of time. We need to do something to keep the skills up or we will not be able to do anything with the timber if it does become available. "

These workers often describe themselves as people who care about forests and their health. As one small mill operator observed:

> "I am not an environmentalist, but I am a conservationist and I care about what happens out there. The health of the forest is important for my business and for my family's future. If we don't take care of it, then it isn't going to be there. I know I want my kids to have the same opportunity I have had to enjoy the woods and to get to know it. You learn from being close to it and it isn't something you get from a book."

The mills are now much fewer in number in project count communities than fifteen years ago. The Stoltze Mill in Dillon closed in 1990. This was among the first of many mill closures in western Montana during the 1990s. Today, there are only a few mills operating in the seven project counties (Anaconda-Deerlodge, Beaverhead, Butte-Silver Bow, Granite, Jefferson, Madison, and Powell Counties, MT). There are three general types of mills in the project area:

- The mill at Deer Lodge, typical of medium to large size mills that use spruce, fir, and pine to produce fingerjoint products, dimensional lumber and studs or plywood
- Post and pole mills that use primarily lodge pole pine to make fence posts, garden stakes, and similar products suited to small diameter timber
- Specialty mills that serve niche markets. An example of this type is the mill in Clancy that saws rough-hewn timber from fir and pine often sold to builders making "western style" homes.

Today, most of the timber processed in these mills is bought from private lands. Timber from public lands constitutes a relatively small part of the overall log supply.

Indeed, the limited amount of federal timber and its economic effects is a topic of ongoing controversy between the timber industry and those who argue that the decrease in federal timber has had negligible economic effects for western Montana communities (e.g. Power and Barrett 2001).

Although timber jobs are concentrated in only a few areas among the project counties, feelings are intense about the role of federal timber in supporting what has traditionally been an important way of life in western Montana. Although the number of persons living this lifestyle has declined, sentiments about its importance remain strong. These sentiments persist for reasons beyond our ability to explain them, but clearly they are rooted in the connection of lifestyle and place; they are connected to a wider set of concerns in western Montana about changing lifestyles resulting from in-migration and other sources of change beyond local influence (Northern Economics 2002).

Section 3.2.2.2 Resource Management Issues from the assessment specifically notes,

> "There is frustration about not being allowed to salvage dead trees.

> "If they are not going to let us go in and salvage dead trees they are not going to let us go in and cut green ones.
>
> People see the wasted wood and they are very frustrated."

Section 12.3.5 Timber Issues further presents residents feelings during 2002.

Timber cutting emerged primarily in discussion with timber and logging interests as well as some community members in towns that have or previously had lumber mills. However, timber sentiments are strongly held and rooted in the history of natural resource use in these communities. What may appear to be economic issues are also cultural issues related to the preservation of timber-related lifestyles. The themes below express the link between timber harvesting, community economies, and lifestyle values:

It is a renewable resource.

Loggers and others who visit the woods perceive an abundance of "timber supply" on public lands and advocate for "sustainable harvests. Timber is perceived as a renewable resource that can be cut and it will grow again for future generations to use. There is a sentiment that,

> "If we (the timber industry) don't take care of the resource, then it will not be there for the future."

It is a way of life.

The timber industry has been part of the history of southwest Montana since gold was discovered in the 1860s. Mills, large and small, have existed in all project counties and the timber industry has been part of the mix of the region's resource-dependent lifestyles. There is sentiment that the BDNF should be:

> "A good neighbor and support the local communities. That used to be true here. The forest supported the community. Now they have taken on an elitist attitude and they don't support us. Why did that change? There is a sentiment that good forest management creates jobs in the community."

This sentiment links forest management, lifestyles, and community support.

They need a timber program.

Timber interests perceive a need for a timber program to promote forest health and keep an infrastructure that is disappearing. Forest health is perceived to benefit by thinning and cutting dead or dying timber that can create fire danger. Overall, forest health is perceived as declining because beetle infested timber and burned trees from past fires are not being cut. For example:

> "A healthy forest is a growing forest, one that is producing fiber and creating oxygen and not building up this great biomass that is just going to burn. No one is going to get any benefit from it. Timber is one of our greatest wastes here. I feel that the BDNF is really neglecting its forests. The past ten years especially, forest health has really gone down. In the 60s and 70s maybe there was too much cutting, but now people are looking at the forests differently. Montanans are looking at forests differently. I would like to see a well-managed forest. Take out some of the diseased trees and open the forest up so there is no multi story timber canopy. Then if a fire comes through it wouldn't be catastrophic. You can't do it everywhere, but in some locations you can do that. With new logging techniques and machinery it is very low impact. It would

> improve the forest and they need to get their heads out and get a timber program going to do something about the overall health of the forest."

Forest health: periodic disturbance.

The resource user perspective on forest health deserves brief attention, since this topic emerged as a theme about forest management. This perspective may differ from that of other interest groups, but this is a thought model held by some interests group about the process for maintaining forest health. This perspective includes the idea that forest health depends on "periodic disturbance". This perspective is succinctly summarized in the following statement:

> "Forest health is a mixture of timber, brush, and grass. It is a mosaic of landscape and animals. It is diverse. It is not all green trees or all of any one thing. Some of the trees are burnt, some are snags, and there is a diversity of age classes. What you need to create this mosaic is periodic disturbance and some of that comes from timber harvesting. I think timber harvesting promotes forest health because it creates that mosaic in the landscape."

In this perspective, periodic disturbance through timber harvesting or grazing creates forest health. Forest health is expressed in a diversity or "mosaic" of species and conditions. This is a different construction of forest health than some environmental interests that perceive forest health is created by non-intervention and non-disturbance, other than "natural" disturbance.

Burned timber needs to be harvested.

Another theme that emerged in several counties is related to the salvage of burned timber. Residents, members of the forest products industry, and local government officials expressed frustration about the perceived inability of the Forest Service to salvage burned areas (Northern Economics 2002).

Relevant Montana Surveys

Comments received during scoping for this project asked that we incorporate national polls and polls from other states. While the social assessment above is useful in understanding how local people think the BDNF should be managed, looking at residents living near neighboring forests, line officers across the country, and results from randomized surveys of US citizens can help readers understand the broader interests in management of this landscape. Although this is useful information for the responsible official, it is not the intent to direct their decisions with this information alone. Responsible officials weigh all the information presented in the environmental assessment to reach their decision.

The Bureau of Business and Economic Research (BBER), at the University of Montana asked residents of two neighboring forests about this topic prior to the mountain pine beetle epidemic.

Although the cause of mortality differed, during 2001 BBER asked the following question of Bitterroot Valley residents, the national forest that adjoins the BDNF to the west and southwest of the project area:

> "In all the public lands that burned this summer, can you tell me which of the following management actions you would like the Bitterroot National Forest to take? Please rate the following choices on a scale from one to five, where one is not at all important and five is very important."

In that study, 13.2 percent of residents replied that salvaging timber, in this case killed by the large fires in the summer of 2000, was somewhat important, and 76.3 percent of residents replied that salvaging timber was very important.

During their 2002 study for the Helena NF, BBER asked residents the following:

> "The year 2000 fire season and last summer's fire season brought to attention steps that the Helena National Forest could take to manage the National Forest. Please tell me to what extent you support or oppose each of the following possible management actions in the Helena National Forest."

Results show that 72.3 percent of respondents indicated they strongly supported salvaging burned, insect infested or diseased timber, and 11.9 percent indicated they support it somewhat. On the other hand, 3.4 percent were somewhat opposed and 5.1 percent were strongly opposed. Respondents were sorted into visitors, non-visitors. In general, visitors identified as urban showed the least support, non-visitors showed more support and visitors identified as rural showed the highest amount of strong support. Respondents who did not support salvage were asked if there were conditions where they would or would not support salvage. Of those who were somewhat opposed or strongly opposed, 52 percent of them indicated no conditions exist where they could be supportive, but 38 percent said there were conditions where they would support salvaging burned or diseased timber. Roughly half of those respondents who were supportive of salvage listed, noted there were some conditions when they would be opposed. These included ill effects to ecosystem (52 percent), when activities were planned in a roadless area (20 percent) and if it involved green trees (5 percent). In addition, far more respondents to this study supported using prescribed burning than those who opposed it (Sylvester et al. 2002).

In another question from the 2002 Helena NF survey, residents were asked:

> "Recreation fees, grazing fees, timber sales and other fees on the Helena National Forest generate income for local governments and for the Federal Government. To what extent do you support or oppose generating income by selling timber from Helena National Forest?"

For all respondents, More than 35 percent somewhat support selling timber, more than 35 percent strongly supported selling timber. This contrasts more than 8 percent that somewhat oppose it and more than 9 percent that strongly oppose selling timber to from the Helena National Forest. Respondents were again sorted into visitors, non-visitors. In general, rural visitors showed the greatest support, while urban visitors and non-visitors showed similar support, and non-visitors showed the highest level of opposition. (Sylvester et al 2002).

Relevant National Polls

It is important to consider not only the local, and neighboring residents, but also the national picture. Several national level studies indicate less support for timber management on National Forests than the more local Helena and Bitterroot BBER studies presented above. For example, in an interesting repeat of a 1981 study, Brown and Harris (1992) from the University of Idaho, conducted a 1990 randomized poll of USFS District Rangers and Forest Supervisors, results show averages from numerical responses suggesting that line officers in the agency in 1990 were generally neutral to slightly unfavorable in response to the statement: Increased production of wood from National forest System lands. Using a 1-5 scale, where 1 represents favorable and 5 represents unfavorable, the mean score for District Rangers and Forest Supervisors had increased from 2.35 during 1981 to 3.91 by 1990 and from 2.21 to 3.99,

respectively. While tallies or medians from each category would have also been helpful information (a histogram of tallies gives the most information about responses and the median is not influenced as much as the mean by outliers, so comparing it to the mean helps share information about the distribution of responses), this is an interesting snapshot of the agency 31 and 22 years ago.

Eight years later or roughly 14 years ago, in June of 1998, Market Strategies, Inc. asked 800 randomly selected registered voters across the country:

> "There has been a national debate about whether the U.S. Forest Service should continue to sell timber from our national forests. Do you favor or oppose continuing to allow timber companies to log in our national forests?

The following are the 1990 results:

Strongly favor logging in our national forests:	7 percent
Somewhat favor logging in our national forests:	17 percent
Neither:	2 percent
Somewhat oppose logging in our national forests:	19 percent
Strongly oppose logging in our national forests:	50 percent
Don't know	5 percent

This study noted that even voters in the West, by a two-to-one margin (62 percent - 31 percent), oppose continuing to allow timber companies to log in national forests (Market Strategies, Inc. 1990).

Several statewide polls taken from 1996 to 2002 and two more recent national polls in 1999-2000 (American Viewpoint 2000) and 2000 (Shields et al 2002) also show low support for logging, but high support for protecting ecosystem health.

American Viewpoint who was called "a leading Republican pollster," according to a news release from the Heritage Forests Campaign and the National Environmental Trust polled 1,000 western registered voters in 6 days in late 1999 and early 2000, asking:

> "National forest lands in the United States total 192 million acres. Fifty-one percent of this land has already been logged, mined or has roads, and remains open to commercial development. Eighteen percent is permanently protected. The remaining 31 percent are wild but unprotected roadless areas. The Clinton administration has proposed to protect nearly all of these remaining wild but unprotected areas. This means it could be used for most types of recreation, but that logging, new roads, mining, oil drilling and off-road vehicles would be prohibited. Do you favor or oppose this proposal?"

The poll, focused on roadless management revealed that, by a margin of 60 to 31 percent,

> "Americans oppose allowing logging, mining and other industrial activities on national forest lands" (American Viewpoint 2000).

Shields et al. (2002) found wide support for the first goal described in the 2000 Revision of the USDA Forest Service Strategic Plan, as the public sees the promotion of ecosystem health as an important objective for public lands and such protection as an important role for the USDA Forest Service. Mixed results were found for the goal of providing multiple benefits to people. The public supports multiple uses but does not support all uses equally. Finally it should be noted that there is only moderate support for the provision of resources to dependent communities and traditional cultural uses.

Desired Condition

The Forest Plan includes the following forestwide goals and standards affecting the economics of the area:

- Contribute to the social and economic well-being of local communities by promoting sustainable use of renewable natural resources. Provide timber for commercial harvest, forage for livestock grazing, exploration and development opportunities for mineral resources, and recreation settings consistent with other resource goals (Forest Plan, p. 21).
- Forest products would be used to provide economic benefits where project objectives, forest plan objectives, and forest plan standards can be met (Forest Plan, p. 38).

Environmental Consequences

Methodology

The economic measures used for this analysis are project feasibility, financial efficiency, economic impacts, and environmental justice. These measures, including methodologies, are described below.

Project Feasibility

Project feasibility is used to determine if a project is feasible, that is, will the timber sell, given current market conditions. The determination of feasibility relies on a residual value (stumpage = revenues - costs) feasibility analysis that uses local delivered log prices and stump to mill costs to determine if a project is feasible. The appraised stumpage rate from this analysis is compared to the base rate (revenues considered essential to cover regeneration plus minimum return to the Federal treasury). The project is considered to be feasible if the appraised stumpage rate exceeds the base rates. If the feasibility analysis indicates that the project is not feasible, the project may need to be modified. Infeasibility indicates an increased risk that the project may not attract bids and may not be implemented.

Financial Efficiency

Based on comments received during scoping, all costs and revenues included in the efficiency analysis are presented in tables in this section of the analysis. The financial efficiency analysis is specific to the timber harvest and restoration activities associated with the alternatives (as directed in Forest Service Manual 2400-Timber Management and guidance found in the Forest Service Handbook 2409.18). Costs for sale preparation, sale administration, regeneration, and restoration activities are included. Costs for restoration activities are based on recent experienced costs and professional estimates. Non-harvest related costs are not included in appraised timber value but they are included in the financial efficiency analysis. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team. If exact costs were not known, the maximum of the cost range was used to produce the most conservative present net value (PNV) result. The PNV is the net value when expected future

costs and benefits are discounted into a single year and combined. The expected revenue for each alternative is the corresponding predicted high bid from the sale feasibility analysis. The predicted high bid is used for the expected revenue (rather than the appraised stumpage rate) since the predicted high bid is the best estimate of the high bid resulting from the timber sale auction. The PNV was calculated using a 4 percent real discount rate over the ten-year project lifespan (2013-2022). For more information on the values or costs, see the project file.

Financial efficiency provides information relevant to the future financial position of the Federal government if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. PNV is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decision-making process. PNV combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive PNV indicates that the alternative is financially efficient. Because all planning costs are incurred prior to the line officer selecting any alternative, these are considered sunk costs and are not included in the forward looking financial efficiency analysis.

This analysis is not intended to be a comprehensive benefit-cost or PNV analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. **Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework.** These values such as improved mosaic of species and age classes desired for enhanced resilience to future insect and disease are discussed throughout this document, for each resource area.

Economic Impacts (Jobs and Labor Income)

Economic impacts are used to evaluate potential direct, indirect, and cumulative effects on the economy. Economic impacts are estimated using input-output analysis. Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical representation allows one to examine the effect of a change in one or several economic activities on an entire economy, all else constant. This examination is called impact analysis. The IMPLAN modeling system (MIG 2003) allows the user to build regional economic models of one or more counties for a particular year. The model for this analysis used the 2010 IMPLAN data from Granite and Powell Counties, Montana.

IMPLAN translates changes in final demand for goods and services into resulting changes in economic effects, such as labor income and employment of the affected area's economy.

The economic impact effects are measured by estimating the direct jobs and labor income generated by (1) the harvesting and processing of the timber volume from the project, and (2) Forest Service expenditures for contracted restoration activities included as part of the proposed treatments. Government work is not included in impact estimates since the work involved in this project is part of an ongoing government Agency's vegetation management program. Data used to estimate the direct effects from the timber harvest and processing were provided by the University of Montana's Bureau of Business and Economic Research (Morgan et al. 2007). This national data is broken into multi-state regions and is considered more accurate than that which is available from IMPLAN. The Northern Rockies BBER Region (Montana and Idaho)

is used for this analysis. The BBER data represents the results of mill censuses that correlate production, employment, and labor income.

The direct employment and labor income benefit employees and their families and, therefore, directly affect the local economy. Additional indirect and induced multiplier effects (ripple effects) are generated by the direct activities. Indirect effects are felt by the producers of materials used by the directly affected industries. Induced effects occur when employees of the directly and indirectly affected industries spend the wages they receive. Together the direct and multiplier effects comprise the total economic impacts to the local economy.

Potential limitations of these estimates are the time lag in IMPLAN data and the data intensive nature of the input-output model.

Environmental Justice

As stated in Executive Order 12898, it is required that all federal actions consider the potential of disproportionate effects on minority and low-income populations in the local region. The principles of environmental justice require agencies to address the equity and fairness implications associated with Federal land management actions. The Council on Environmental Quality (CEQ) (1997) provides the following definitions in order to provide guidance with the compliance of environmental justice requirements:

Minority population

- "Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis..."

Low-income population

- "Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."

Spatial and Temporal Context for Effects Analysis

The analysis area for the efficiency analysis is the project area. It includes portions of both Granite and Powell Counties. The temporal scope of the analysis is the duration of the proposed activities. The project is expected to be accomplished over a ten-year period with the harvest activity occurring primarily in the first five years.

Timber management activities within the project area have the potential to impact the economic conditions of local communities and counties. To estimate the potential effect on jobs and income, a zone of influence (or economic impact area) was delineated. The impact area was chosen based on commuting data suggesting a functioning economy and where the timber is likely to be processed. This analysis suggested that Granite and Powell Counties were the appropriate counties to include in the economic impact analysis area.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The financial efficiency of the project would not be affected by the past, present, or reasonable foreseeable future actions in the project area. Other projects occurring in the economic impact area have the potential to contribute cumulatively to jobs and labor income provided by implementing this project. A full list of present and reasonably foreseeable activities for the project area is available in table 24 at the beginning of chapter 3.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Under alternative 1, there would be no direct, indirect or cumulative effects to the economic resource from the Flint Foothills Vegetation Management Project because no project activities are proposed. The no-action alternative has neither future costs nor revenues associated with it, and thus would have a PNV of $0. The no-action alternative contributes/maintains no jobs nor income because there are no activities associated with this alternative.

Alternatives 2 and 3

The action alternatives utilize the same vegetation treatments and units to meet the purpose and need for action. The alternatives differ by the number of units and total acreages of units for salvage by clear-cut harvest, and commercial thin of ponderosa pine and Douglas-fir stands. There is no difference in treatment acres between the alternatives for the seed tree harvest, prescribed burn and precommercial thin treatments.

Direct Effects

The estimation of project feasibility was based on the Northern Region residual value appraisal approach, which took into account logging system, timber species and quality, volume removed per acre, lumber market trends, costs for slash treatment, and the cost of specified roads, temporary roads and road maintenance. The estimated predicted high bids and minimum rates for the action alternative are displayed in table 102.

For alternative 2, the appraised stumpage of $60.43/CCF and the predicted high bid, $66.08/CCF were compared to $3/CCF minimum rates (revenues considered essential to cover the legal minimum return to the federal treasury). The predicted high bid for alternatives 2 indicates that the 40,104 CCF timber sale portion of the Flint Foothills Project would be feasible. The predicted high bid from the feasibility analysis is used in the financial efficiency analysis for each alternative discussed below. Alternative 2 could also produce 8,021 CCF of small-diameter non sawlog material which would likely be sold for $1/CCF, the minimum rate for that material. Since this would not be a mandatory element of the sale, the revenue associated with this sale is not included in the financial efficiency analysis; however a non-saw[34] adjustment was made to develop the saw log stumpage appraisal above.

For alternative 3, the appraised stumpage value of $56.61/CCF and the predicted high bid, $62.26/CCF were compared to $3/CCF minimum rates (revenues considered essential to cover the legal minimum return to the federal treasury). The estimated predicted high bids and minimum rates for the action alternative are displayed in table 102. The predicted high bid for

[34] Non-saw log or non-saw timber is less than 7 inches d.b.h. in R1 ($1/CCF); this varies in other locations. See the website where the adjustment tool is available: http://fsweb.r1.fs.fed.us/forest/sales/appraisal1/index.htm

alternatives 3 indicates that the 31,615 CCF timber sale portion of the Flint Foothills Project would be feasible. The predicted high bid from the feasibility analysis is used in the financial efficiency analysis for each alternative discussed below. Alternative 3 could also produce 6,343 CCF of small-diameter non sawlog material which would likely be sold for $1/CCF, the minimum rate for that material. Since this would not be a mandatory element of the sale, the revenue associated with this sale is not included in the financial efficiency analysis; however a non-saw adjustment was made to develop the saw log stumpage appraisal above.

Table 102. Project feasibility and financial efficiency summary (2010 dollars)

Category	Measure	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3
Timber harvest information	Acres harvested	0	2,602	2,041
	Volume harvested (CCF)	0	40,104	31,615
	Base rates ($/CCF)	$0	$3.00	$3.00
	Appraised stumpage rate ($/CCF)	$0	$60.43	$56.61
	Predicted high bid ($/CCF)	$0	$66.08	$62.26
	Total revenue (thousands of $)	$0	$2,650	$1,968
Timber harvest and required design features	PNV (thousands of $)	$0	$912	$585
Timber harvest and all other planned non-timber activities	PNV (thousands of $)	$0	-$162	-$427

Financial Efficiency

Table 102 summarizes the project feasibility and financial efficiency, including the base rates, appraised stumpage rate, predicted high bid, total revenue, and PNV for each alternative. Because all costs of the project are not related to the timber sale, two PNVs were calculated. One PNV indicates the financial efficiency for the timber sale, including all costs and revenues associated with the timber harvest and required design features. The required design features as used here include:

1. Sale preparation costs
2. Sale administration costs
3. Excavator piling and burning of activity fuel
4. Slashing damaged residuals
5. Erosion control
6. Landing rehabilitation

7. Haul route road reconstruction
8. New temporary road construction/obliteration
9. Road decommissioning
10. Road storage
11. Regeneration exams
12. Weed spraying connected with harvest
13. Weed monitoring.

A second PNV includes all costs for each alternative, including all activities listed in table 103. The costs used in the PNV calculations can be found in table 103. Table 103does not include sale preparation costs of $13.50/CCF, sale administration costs of $4.50 per CCF because they have been funded with regularly appropriated money; however these costs are used in both PNV calculations. The cost of sale preparation and sale administration for alternative 2 is $721,872. The cost of sale preparation and sale administration for alternative 3 is $570,870. These costs are captured in the efficiency analysis but not shown in the budget picture in table 7 because they would be funded with regularly appropriated dollars. Planning costs are not included in efficiency analysis since they are sunk costs at the time of decision.

Table 102 indicates that both action alternatives are financially efficient (positive PNVs) when analyzing timber sale and required design features but both become financially inefficient when the analysis includes all activities. Alternative 2 has the highest PNV for the timber sale, $912,114 and -$162,131 for all activities. For alternative 3, the PNV for the timber sale and required design features is $584,513 and -$427,481 for all activities.

A reduction of financial PNV in any alternative as compared to the most efficient solution is a component of the economic trade-off, or opportunity cost, of achieving that alternative. The no-action alternative would not harvest or take other restorative actions and, therefore, incur no costs. As indicated earlier, many of the values associated with natural resource management are non-market benefits. These benefits should be considered in conjunction with the financial efficiency information presented here. These non-market values are discussed in the various resource sections found in this environmental assessment.

Mandatory and Other Appropriated Dollar Activities

Table 103 displays the mandatory activities, their costs, and the potential available revenue for paying for those activities. The starting point for the available revenue is the estimated stumpage value from the sale feasibility analysis minus an allowance for essential regeneration costs. This stumpage value estimate is used since it is a conservative value of the timber sale.

Considering all of the mandatory activities embedded in the appraisals (First set of activities in table 103) the estimated available revenue ranges from approximately $2,423,485 for alternative 2 to $1,789,725 for alternative 3. However, not all mandatory activity costs were captured in the appraisals. For example, appraisals don’t include some direct outlays included in the project such as; 12. weed spraying connected with harvest, and 13. weed monitoring. When we add these costs, alternatives 2 and 3 are expected to produce enough revenue to pay for all of the mandatory activities. For alternative 2, once the mandatory activities are funded, there would be approximately $2,093,485 of available funds left to put towards the other activities. For alternative 3, once the mandatory activities are funded, there would be approximately $1,456,725 of available funds left to put towards the other activities.

Table 103. Activity Expenditures by Alternative (2011 dollars)

	No Action	Alternative 2	Alternative 3
Mandatory Activities Already Included in Appraisals			
3) excavator piling and burning of activity fuel	$0	$17,044	$13,171
4) slashing damaged residuals	$0	$9,022	$6,915
5) erosion control	$0	$13,075	$10,067
6) landing rehabilitation	$0	$8,981	$6,888
7) haul route road reconstruction	$0	$174,677	$138,223
8) temp road construction / obliteration	$0	$66,517	$15,105
9) road decommissioning	$0	$7,000	$4,001
10) road storage	$0	$1,200	$1,000
11) regeneration exams	$0	$45,305	$34,697
Available Revenues Based on Appraisal			
Estimated stumpage value (appraised stumpage * volume)	$0	$2,423,485	$1,789,725
Mandatory Activities Expenses Not Included in Appraisal			
12) Weed spraying	$0	$255,000	$255,000
13) Weed monitoring	$0	$75,000	$75,000
Total for Mandatory Expenses Not Included in Appraisal		**330,000**	**$330,000**
Revenue Remaining after All Mandatory Activities	**$0**	**$2,093,485**	**$1,456,725**
Other Project-Associated Activities			
14) Road maintenance BMPs	$0	$91,503	$86,783
15) Weed spraying not connected to harvest	$0	$170,000	$170,000
16) Precommercial thinning	$0	$430,728	$430,728
17) Piling and burning of non-activity fuels	$0	$150,200	$101,900
18) Manual fire line construction	$0	$1,500	$1,500
19) Lop and scatter natural fuels	$0	$30,040	$20,380
20) Prescribed fire in non-commercial areas	$0	$199,000	$199,000
21) Spot slashing for burn only treatments	$0	$15,920	$15,920
22) Interplanting	$0	$183,560	$183,560
23) Natural regeneration exams year 1 and 3	$0	$18,608	$16,352
24) Certification of natural regeneration exams year 5	$0	$13,956	$12,264
Total other project-associated activities	**$0**	**$1,305,045**	**$1,238,387**

The lower portion of table 103 displays the other activities not tied to commercial harvest and required design features. These activities would occur as funding becomes available from the timber sale revenue and other appropriated funds. The costs associated with these activities range from about $1.305 million for alternative 2 to $1.238 million for alternative 3.

Table 104indicates that conservatively estimated expected timber revenue would cover all costs for alternative 2 alternative 3. However, for conventional timber sales, a minimum of $0.25/CCF must be returned to the treasury.

Economic Impact Effects

The analysis calculated the jobs and labor income associated with the harvesting and processing of the timber products harvested as well as all contracting needed to conduct mandatory and optional stewardship activities. Timber products harvested from the proposed project and the non-timber activities would have direct, indirect, and induced effects on local jobs and labor income. In order to estimate jobs and labor income associated with timber harvest, the timber harvest levels were proportionally broken out by product type (table 104). In order to estimate jobs and labor income associated with reforestation and restoration activities, expenditures and timing for these activities were developed by the resource specialists.

Table 104. Proportion of timber harvest by product type

Product Type	Proposed Action
Sawmills	60
Log Homes	10
Post & Poles	10
Pulp	20

Table 105 displays the direct, indirect and induced, and total estimates for employment (part and full-time) and labor income that may be attributed to each alternative. Since the expenditures occur over time, the estimated impacts of jobs and labor income would be spread out over the life of the project. It is important to note that these may or may not be new jobs or income, in either case they are jobs and income that are supported by this project. These impacts are shown both in total (over the life of the project) and on an annual basis. It is anticipated that the timber harvest would occur over a five-year period, with the restoration activities spread out over ten years. Therefore, total implementation could take up to 10 years.

Table 105. Economic impacts - employment and labor income, total and annual ($2010)

Jobs and Income	**Alternatives**					
	Alternative 1		**Alternative 2**		**Alternative 3**	
Non-timber activities						
Part and full time jobs contributed	Total	Annual	Total	Annual	Total	Annual
Direct	0	0	13	1	12	1
Indirect and induced	0	0	2	0	2	0
Total	**0**	**0**	**15**	**2**	**15**	**1**
Labor income contributed ($M2010)						
Direct	$0	$0	$594	$59	$583	$58
Indirect and induced	$0	$0	$51	$5	$49	$5
Total	**$0**	**$0**	**$645**	**$65**	**$632**	**$63**
Timber harvest						
Part and full time jobs contributed	Total	Annual	Total	Annual	Total	Annual
Direct	0	0	115	23	91	18

Jobs and Income	Alternatives					
	Alternative 1		Alternative 2		Alternative 3	
Indirect and Induced	0	0	78	16	61	12
Total	**0**	**0**	**193**	**39**	**152**	**30**
Labor income contributed ($M2010)						
Direct	$0	$0	$5,316	$1,063	$4,204	$841
Indirect and induced	$0	$0	$2,933	$587	$2,320	$464
Total	**$0**	**$0**	**$8,249**	**$1,650**	**$6,524**	**$1,305**
All activities						
Part and full time jobs contributed	Total	Annual	Total	Annual	Total	Annual
Direct	0	0	128	24	103	19
Indirect and induced	0	0	80	16	64	13
Total	**0**	**0**	**208**	**40**	**167**	**32**
Labor income contributed ($M2010)						
Direct	$0	$0	$5,910	$1,123	$4,787	$899
Indirect and induced	$0	$0	$2,984	$592	$2,369	$469
Total	**$0**	**$0**	**$8,895**	**$1,714**	**$7,156**	**$1,368**

* Employment is the total full- and part-time wage, salaried, and self-employed jobs in the region.

**Labor income includes the wages, salaries and benefits of workers who are paid by employers and income paid to proprietors.

Alternative 2 would result in 128 direct and 208 total (direct, indirect and induced) part and full-time jobs and $5.910 million direct and $8.895 million in total labor income over the life of the project.

Of this amount, timber harvest and processing in alternative 2 would contribute 115 direct and 193 total jobs during the five years, with $5.316 million direct and $8.249 million in total labor income. Annually this means a contribution of 23 direct and 39 total jobs and $1.06 direct and $1.65 million in total labor income. If the implementation takes longer than anticipated, the total impacts would remain the same, but the annual contributions would be reduced.

The precommercial thin, prescribed burn and other project-related resource activities proposed in alternative 2 would contribute approximately 13 direct and 15 total part and full-time jobs during the ten years. This contribution would entail $594,000 direct and $645,000 in total labor income. Annually, this would mean a contribution of roughly 1 direct and 2 total jobs and $59,000 direct and $65,000 total labor income performing restoration activities.

Alternative 3 would result in 103 direct and 167 total (direct, indirect and induced) part and full-time jobs and $4.787 million direct and $7.156 million in total labor income over the life of the project.

Of this amount, timber harvest and processing in alternative 3 would contribute 91 direct and 152 total jobs during the five years, with $4.204 million direct and $6.524 million in total labor income. Annually this means a contribution of 18 direct and 30 total jobs and $841,000 direct

and $1.305 million in total labor income. If the implementation takes longer than anticipated, the total impacts would remain the same, but the annual contributions would be reduced.

The precommercial thin, prescribed burn and other project-related resource activities proposed in alternative 3 would contribute approximately 12 direct and 15 total part and full-time jobs during the ten years. This contribution would entail $583,000 direct and $632,000 in total labor income. Annually, this would mean a contribution of roughly 1 direct / total jobs and $58,000 direct and $63,000 total labor income performing restoration activities.

Environmental Justice

Environmental Justice is discussed in the Forest Plan EIS (USDA Forest Service 2009b, p. 206). According to the CEQ's Environmental Justice Guidelines for NEPA (1997), "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." Table 100 shows that the total share of all minority populations represented less than 10 percent of the population in the state and the analysis area in 2000. Thus, the U.S. Census data suggest minority populations within the analysis area do not meet the CEQ's Environmental Justice criterion.

CEQ guidance on identifying low-income populations states that "…agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (e.g., migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect." Low-income populations are defined, based on the 2000 Census standard, as persons living below the poverty level (based on total income of $13,359 for a family household of four). Persistent poverty status requires a county to have experienced an individual poverty rate in excess of 20 percent for several Census years. In 2010, 14.8 percent of the population in Granite County and 20.3 percent of the population in Powell County were living below the poverty level. In the case of Granite County this was down from 2009, whereas for Powell County it was slightly higher than 2009. Based on these data, the characteristic of persistent poverty may be present in Powell County, part of the analysis area. As noted above, the State of Montana prisoner population in Powell County partially explains the low income.

Summary of Effects

The decision maker takes many factors into account to facilitate the decision. The use of efficiency measures is one tool used when evaluating trade-offs. Many things cannot be easily quantified with dollars, such as effects on the vegetation. Table 106 indicates how well each of the alternatives makes progress towards the purpose and need established for the Flint Foothills Vegetation Management Project.

Table 106. Summary Trade-off Analysis Table

Objective	Performance Measures	Alternative 1	Alternative 2	Alternative 3
A	Stands already in a managed condition managed to maintain long term sustained yield (acres)	0	1,048	1,048
A	Volume of timber harvested (CCF)	0	32,083-40,014	25,372-31,715
B	Increases in the 0 to 5 inch d.b.h.	0	2,775	2,634

Objective	Performance Measures	Alternative 1	Alternative 2	Alternative 3
	class (acres)			
B	Reduction in forest density in large size classes of dry forest communities (acres)	0	1,880	1,397
	Economic measures	**Alternative 1**	**Alternative 2**	**Alternative 3**
	Revenue generated*	$0	$2,423,485	$1,789,725
	Purchaser costs		$331,425	$ 331,425
	Estimated program costs**		$721,872	584,513
	Present net value (Timber harvest and required design features, Forest Service perspective)	$0	$912,114	$584,513
	FS Costs***		$1,634,953	$1,573,045
	Present net value (All activities, Forest Service perspective)	$0	($162,131)	($427,481)

*Revenues are conservatively estimated by multiplying stumpage value, after reducing stumpage to residual value accounting for several costs.

**Includes sale preparation and sale administration, covered with regular appropriations.

***Cost not included in appraisal as detailed provided in Table 7, called "mandatory expenses not included in the appraisal" and "other" costs.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives comply with applicable Forest Plan, as well as other relevant laws, regulations, policies and plans.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). The resource sections in chapter 3 disclose the short-term and long-term environmental impacts. Implementation of the alternatives would involve tradeoffs between long-term productivity and short-term uses of the environment including the short-term disturbances of soils that could cause sedimentation to area streams, or biological resource impacts from habitat disturbance. Conversely, the treatments would have a positive benefit to the long-term productivity of the treatment stands. Impacts would be mitigated by project design features and mitigation measures (chapter 2) including BMPs. No significant losses in long-term productivity have been identified as a result of this project.

Unavoidable Adverse Effects

The resource sections of chapter 3 disclose the environmental consequences, including unavoidable adverse effects related to implementation of the alternatives. The analysis in this document used the best available information to estimate environmental impacts; conservative assumptions were made to estimate effects where information was unavailable. The severity of the effects would be minimized by the project design features and mitigation measures (chapter 2).

Irreversible and Irretrievable Commitments of Resources

NEPA requires a discussion of "any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented" (40 CFR 1502.16).

An irreversible commitment of resources refers to the loss of non-renewable resources that cannot be regained over time, such as the removal of mined ore or extinction of a species. An irretrievable commitment applies to the loss of production or use of renewable resources for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or a road.

The impacts described in chapter 3 involve irretrievable commitments of resources, including short-term loss of productivity in areas cleared for road and landings; and detrimental soil disturbance on areas compacted by logging operations. Growth of forest vegetation would be affected during the time the roads and landings are used for logging operations, up to 5 years (length of the timber contract); the new temporary roads would be obliterated after completion of the logging activities. The 1.3 miles of NFS road construction in the proposed action would affect productivity long term on approximately 6 acres. The compacted soil areas would be rehabilitated after logging by subsoiling, so there would be a nominal lag in growth of forest vegetation in these areas. The action alternatives would not jeopardize the continued existence of any species.

Chapter 4. List of Preparers

List of Preparers

Beaverhead-Deerlodge National Forest

Joe Brabender	Air Quality
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Consultation

The Forest Service consulted the following federal and state agencies and tribes during the development of this environmental impact statement.

Federal, State, and Local Agencies:

USDI Bureau of Land Management, Missoula, MT
USDI Fish and Wildlife Service, Helena, MT
Montana Department of Natural Resources, Anaconda, MT

Tribes

Confederated Salish & Kootenai Tribes Tribal Historic Preservation Office
Shoshone-Bannock Tribe Cultural Program

Distribution of the Environmental Impact Statement

This environmental impact statement has been distributed to individuals who commented during the first and second rounds of scoping and those requesting to be on the mailing list. In addition, copies have been sent to the following federal agencies or other agencies notified of availability; federally recognized tribes, state and local governments and organizations.

United States Environmental Protection Agency

United States Environmental Protection Agency, Region 8, Montana Office

Fish, Wildlife and Parks Region 2 Office

Montana Department of Environmental Quality

Montana Historical Society, SHPO

Shoshone-Bannock Tribes

Granite County Board of Commissioners

Powell County Board of Commissioners

Alliance for Western Rockies

Native Ecosystem Council

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Glossary

Active Crown Fire ~ A fire that moves into and through the tree crowns, generally due to a combination of fire intensity and ladder fuels

Activity Fuels ~ Fuels created by management actions

Allelopathy ~ The inhibition of growth in one plant species by chemicals produced by another. For example, other plants will often not grow underneath black walnut trees, since these trees produce juglone, a chemical inhibiting plant respiration.

Anadromous Fish ~ Species of fish that are born in freshwater, move to the ocean to mature, and return to freshwater to reproduce

Aquatic ~ Living or growing in water

Aquatic Conservation Strategy (ACS) ~ A strategy "developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands"

(USDA Forest Service and USDI Bureau of Land Management 1994b, B-9)

Aquatic Conservation Strategy Objectives ~ Objectives that "define the context for the agency review and implementation of management activities. Complying with the Aquatic Conservation

Strategy objectives means that an agency must manage the riparian-dependent resources to maintain the existing condition or implement actions to restore conditions. The baseline from which to assess maintaining or restoring the condition is developed through a watershed analysis. Improvement relates to restoring biological and physical processes within their ranges of natural variability." (USDA Forest Service and USDI Bureau of Land Management 1994b, B-10)

Beneficial Uses ~ "Beneficial uses" of the waters of the state that may be protected against water quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves (from Section 13050(f) of California's Porter-Cologne Water Quality Control Act)

Best Management Practices (BMPs) ~ Measures certified by the State Water Quality Control Board and approved by the Environmental Protection Agency as effective means of reducing water quality impacts from non-point sources of pollution

Board Foot ~ A unit of measurement equal to an unfinished board one-foot square by one-inch thick

Burn Severity ~ Effects of fire on the soil surface; related to fire intensity and duration

Canopy: Tree crowns in a stand

Canopy Base Height ~ The distance from the ground to the base of the tree crowns (usually an average value for a stand)

Channel Morphology ~ the study of the form (shape) and physical characteristics of a stream channel.

Classified Road ~ Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned road, National Forest System roads, and other roads authorized by the Forest Service

Coarse Woody Debris (CWD) ~ Woody material at least 20-inches in diameter from whatever source that is dead and lying on the forest floor. Term used for terrestrial species habitat. See Large Woody Debris for aquatic species habitat

Compacted Soils ~ Soils with reduced porosity

Critical Habitat ~ Defined in the ESA as (1) the specific areas within the geographical area occupied by the species, at the time it is federally listed, on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed, when it is determined by the Secretary of the Interior that such areas are essential for the conservation of the species

Crowning ~ Situation where fire rises to the tree tops and begins advancing from tree top to tree top, or where fire intermittently ignites tree crowns as a surface fire advances.

Cumulative Effects ~ Those effects resulting from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions

Cumulative Watershed Effects Model ~ A model for Cumulative Watershed Effects with three components: Equivalent Roaded Acres (ERA), sediment delivery from surface erosion, and sediment delivery from mass wasting. The model quantifies disturbances and land sensitivity at the 7th field watershed scale and can calculate them at larger scales. The estimated results fall on a continuum. As disturbances increase over time and space, at some point the risk of initiating or contributing to existing adverse cumulative watershed impacts becomes a cause for concern. Concern thresholds have been identified for each component based on field observations in the Forest

Diameter Breast Height (d.b.h.) ~ The diameter of a standing tree at a point 4½ feet above ground level, measured from the uphill side.

Direct Effects ~ Those effects occurring at the same time and place as the initial cause or action.

Dispersal ~ The relatively permanent movement of individual animals from one location to another. Usually dispersal is the movement of young animals from where they were born to a site where they eventually settle to breed

Ecosystem ~ A dynamic community of biological organisms, including humans, and the physical environment with which they interact

Effects ~ Impacts; physical, biological, economic, and social results (or expected results) from implementing an activity

Embeddedness ~ Degree to which large streambed materials such as cobbles and gravel are surrounded or covered by fine sediment

Endangered Species ~ Designated by the United States Fish and Wildlife Service or NOAA Fisheries, an animal or plant that has been given Federal protection status because it is in danger of extinction throughout all or a significant portion of its natural range.

Environmental Justice: Executive Order 12898 requires an assessment of whether minorities or low-income populations would be disproportionately affected by proposed actions

Equivalent Road Acres (ERA) ~ An index of average watershed disturbance expressed in road equivalent acres relative to a “threshold of concern” assigned for the watershed.

Erosion: A general term for movement of soil particles on the surface of the land initiated by rainfall and running water. This includes surface erosion and channel erosion, as opposed to landsliding

Filtering Capacity ~ Ability of a riparian reserve to trap sediment and prevent it from reaching a stream.

Fine Fuels ~ Fuels less than 3 inches in diameter that is easy to ignite

Fire Behavior ~ The manner in which a fire reacts to fuels, weather, and topography

Fire Intensity ~ A general term relating to the heat energy released in a fire

Fire Regime ~ The combination of fire frequency, predictability, intensity, seasonality, and distinctive characteristics of fire in an ecosystem; Agee (1993) defines three broad categories of fire severity "based on the physical characters of fire and the fire adaptations of vegetation"

Fishery ~ the total population of fish in a stream or body of water and the physical, chemical and biological factors affecting that population.

Global Rank ~ global rank of 2 (G2), which means imperiled due to rarity or with very restricted range, i.e., vulnerable to extinction. Trend monitoring of all G1, G2, and G3

Imminent Mortality ~ Mortality is imminent when the majority of the root system is destroyed and the remaining roots can no longer support the remaining live portions of the tree (Thies and Sturrock 1995). We define "imminent" as likely to occur in several months to, possibly, a few years (up to five). Similarly, mortality is imminent in trees with destroyed portions of crowns and thus with greatly diminished ability to supply adequate quantities of carbohydrates to the bole and roots. Imminent mortality occurs when the carbohydrate budget is in deficit; respiration exceeds photosynthesis, and stored carbohydrate reserves become exhausted (Waring 1987).

Key Watersheds ~ Fish Key Watersheds are watersheds selected for focusing federal funds and personnel for the purpose of protecting, restoring, or maintaining viability of Threatened, Endangered and Sensitive aquatic species. Restoration Key Watersheds are watersheds selected for focusing federal funds and personnel for the purpose of accelerating improvements in water quality and watershed conditions.

Low Severity Fire Regime ~ Effect of typical fire is benign; fires are frequent (often < 20 years), of low intensity, and the ecosystems have dominant vegetation well-adapted to survive fire

Mixed Severity Fire Regime ~ Fires are of intermediate frequency (25-100 years), range from low to high intensity, and have vegetation with a wide range of adaptation

High Severity Fire Regime ~ Fires are usually infrequent (often >100 years) but may be of high intensity, most vegetation is at least top-killed

Fire Return Interval ~ Number of years between two successive fire events in a given area.

Fire Risk ~ The statistical probability of a fire start occurring over a ten-year period for a given thousand-acre area

Fire Severity ~ The degree to which a site has been altered or disrupted by fire; severity is affected by fire intensity and how long the fire remains at the site. In this document, fire severity is defined as tree mortality

Fire Suppression ~ All work and activities associated with extinguishing a fire

Force Account ~ Term used to refer to Forest Service personnel and equipment

Forest Plan (LRMP) ~ The Klamath National Forest Land and Resource Management Plan, approved in 1995. The Forest Plan provides land allocations, Standards and Guidelines, and direction for management of the Klamath National Forest.

Fuel Loading ~ The quantity of fuel per acre in a given area

Fuel Treatment ~ The process of removing and/or modifying natural or human created fuels to reduce fire hazard and achieve other resource objectives

Fuels ~ Anything within the forest that will burn; usually live and dead woody vegetation

Full-Bench Skid Trails ~ For ground-based equipment skid trails, the entire road surface is cut into the hill slope

Geographical Information System Coverage ~ Data layer in a Geographical Information System.

Grapple System ~ A mechanical method of piling fuels using an articulating arm on a low ground pressure vehicle that picks up the material and places it on the pile

Green Tree Retention ~ A regeneration cut in an even-aged silvicultural system that maintains a portion of the existing stand, creating a two-storied structure with two or more age classes present

Ground-based Equipment ~ Equipment that runs on the ground, like tractors, rubbertired skidders, and masticators

Group Selection ~ Harvest treatment in an uneven-aged silvicultural system that removes small groups of trees, resulting in different age classes in the stand

Habitat ~ The place where a plant or animal lives and grows under natural conditions

Head of Fire ~ Advancing edge

Hydrologic ~ Dealing with the movement and properties of liquid water in environmental systems. Includes the circulation patterns of water in the biosphere from condensation and precipitation to movement both on and under the ground surface to evaporation back into the atmosphere

Hydrologic Recovery ~ Harvested timber stand with sufficient canopy closure that snow accumulation, melt rates, and soil protection from raindrop impact are comparable to pre-harvest levels; this typically is achieved when the average tree size is 8” diameter breast height or 35 feet tall. Recovery is complete by around 30 years after harvest on the westside of the Forest

Hydrologic Unit Code (HUC) ~ A coding system developed by the U.S. Geological Service to map geographic boundaries of watersheds by size.

Impacts ~ Physical, biological, economic, and social results (or expected results) from implementing an activity

Incorporation by Reference ~ A technique used to cut down on the bulk in environmental documents without impeding agency and public review of the action. The material included as part of the document must be cited in the document and its content briefly described

Indirect Effects ~ Those effects occurring later in time or that are spatially removed from the activity

Inference Point ~ The midpoint of a zone where disturbances become great enough to cause concern about initiating or contributing to adverse cumulative watershed effects

Infiltration (soil) ~ The movement of water through the soil surface into the soil

Interdisciplinary ~ The utilization of individuals representing two or more areas of knowledge and skills focusing on the same subject

Irretrievable ~ An irretrievable commitment of resources entails a loss of production, harvest, or use of natural resources. Such decisions are reversible, but the production opportunities foregone are irretrievable (50 Federal Register 26082)

Irreversible ~ An irreversible commitment of resources entails a loss of future options. This applies primarily to the effects of use of non-renewable resources such as minerals or cultural resources, or to those factors, such as soil productivity, that are renewable only over a long period of time (50 Federal Register 26082)

Issue ~ Point of discussion, debate, or dispute about the environmental effects of the proposed action

Ladder Fuels ~ Small trees and brush in the understory that allow fire to move from the ground into the tree crowns

Land Allocation ~ The assignment in the LRMP of a management emphasis to particular land areas with the purpose of achieving goals and objectives

Late-successional characteristics ~ Characteristics of a stand of trees indicative of maturity, including mature and overmature trees in the overstory; multi-layered canopy with trees of several age classes; and standing dead trees and down material

Late-successional habitat ~ Older forested stands with moderate to high canopy closure; often containing a multilayered, multispecies canopy dominated by large overstory trees; large trees with broken tops or other indications of old and decaying wood; numerous large snags; and moderate to heavy accumulations of large logs on the ground

Late-successional stands ~ Late-successional stands within the Project Area are defined as stands with an average DBH > 24". On the north and east facing slopes, theses stands contain a mix of conifer species and generally exhibit complex structure and abundant DWD. Late-successional stands on south and west facing slope, are typically more open and pine dominated with less DWD. True fir late-successional stands are generally single storied with little understory

Late-successional reserves (LSR) ~ Large blocks of habitat that are distributed across the range of the northern spotted owl and spaced closely enough to facilitate dispersal of owls. Late-successional reserves are managed to provide habitat for late successional and “old growth” species

Management Area (MA) ~ A distinct geographical area with specified objectives and prescriptions

Management Direction ~ A statement of multiple use and other goals and objectives, along with the associated management prescriptions and Standards and Guidelines to direct resource management

Management Indicator Species(MIS) ~ "Certain vertebrate and/or invertebrate species present in the area…. selected because their populations changes are believed to indicate the effects of management activities…additional plant or animal species selected because their population changes are believed to indicate effects of management activities on other species of selected major biological communities or on water quality." (CFR 219.19(a)(1)). Designation does not infer a special degree of protection in or of itself.

Mass Wasting ~ Movement of soil material in landslides and debris torrents

Masticator ~ Equipment that grinds or chews up vegetative material

Matrix ~ Lands outside of reserves and withdrawn areas; lands assigned a regulated timber yield

Monitoring ~ Process of collecting information to evaluate if objective and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned

Montane ~ Pertaining to mountain conditions

National Environmental Policy Act (NEPA) ~ The act that governs how federal agencies assess impacts of management actions on public lands. The process is interdisciplinary and requires consideration of the environmental effects of alternatives and disclosure of those effects.

National Forest System Road ~ A classified Forest road under the jurisdiction of the Forest Service. The term "National Forest System Roads" is synonymous with the term "forest development roads" as used in 23 U.S.C. 205

Noxious Weed ~ Any plant so designated by the Weed Control Regulations and identified on a regional district noxious weed control list. They are generally non-native and resistant to control efforts

Overstory ~ The portion of trees in a forest which forms the uppermost layer of foliage

Passive Crown Fire ~ A fire that remains on the ground surface but exhibits some individual tree or group torching; fire intensity is still fairly low

Peak Flow ~ The greatest stream or river flow occurring in a year from a single storm event

Properly Functioning Condition (PFC) ~ Ecosystems are in PFC when they function within their historic range of variability.

Rain-on-Snow Event ~ Rain falling on a snowpack and rapidly melting the snow, causing the melt water to be added to the rain, creating flood conditions

Reach ~ A segment of stream.

Record of Decision ~ A document separate from but associated with an environmental impact statement that states the management decision and provides the rationale for that decision

Reforestation ~ The natural or artificial restocking of an area with trees

Residence time ~ The amount of time required for a fire front to pass a stationary point. Longer residence times result in greater resource impacts

Residual ~ The trees remaining after harvesting; also known as the crop trees

Resilience ~ An ecosystem's ability to maintain structure and patterns of behavior in the face of disturbance

Rill ~ Very small streams occurring during or directly after precipitation, especially on bare soil, often creating a temporary gully and causing rill erosion

Riparian ~ In general, characterized by being situated on the bank of a river or other body of water; in ecology, the term is applied both to species that live near streams and to the area adjacent to streams where vegetation and microclimate are influenced by the presence of the stream

Riparian Reserves (Riparian Reserves) ~ A land allocation in the LRMP that includes an aquatic ecosystem and the adjacent upland areas directly affecting it. It also includes unstable and potentially unstable lands that are not associated with aquatic areas. Specific Standards and Guidelines provide direction for these areas as outlined in Management Area 10 of the LRMP

Riparian Area/Habitat ~ Land where the vegetation and microclimate are influenced by perennial and/or intermittent water.

Riparian Conservation Area (RCA) ~ As established by the Forest Plan, RCAs are portions of watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. Examples include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. The following categories describe RCAs unless developed and documented through a watershed or site specific analysis:

> **Category 1 –** Fish bearing streams: RCAs consist of the stream and the area on either side of the steam extending from the edge of the active channel to the top of the inner gorge, or to the outer edges of the 100 year floodplain, or to the outer edge of the riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet including both sides of the stream channel), whichever is greatest.
>
> **Category 2 –** Permanently flowing non-fish bearing streams: RCAs consist of the stream and the area on either side of the steam extending from the edge of the active channel to the top of the inner gorge, or to the outer edges of the 100 year floodplain, or to the outer edge of the riparian vegetation, or to a distance equal to the height of one site potential trees, or 150 feet slope distance (300 feet including both sides of the stream channel), whichever is greatest.
>
> **Category 3 –** Ponds, lakes, reservoirs, and wetlands greater than 1 acre: RCAs consist of the body of water or wetland and the area to the outer, edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site-potential trees, or 150 feet

slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond, or lake, whichever is greatest.

Category 4 – Seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides, and landslide-prone areas: This category includes features with high variability in size and site-specific characteristics. At a minimum, the RCAs must include:

a. The extent of landsides and landslide-prone areas.
b. The intermittent stream channel and the area to the top of the inner gorge.
c. The intermittent stream channel or wetland and the area to the outer edge of the riparian vegetation.
d. For Fish Conservation Watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.
e. For watersheds not identified as Fish Emphasis Key Watersheds, the area from the edges of the stream channel, wetland, landslide, landslide-prone area to a distance equal to the height of one-half site potential tree, or 50 feet slope distance, whichever is greatest.

Riparian Management Objective (RMO) ~ Fish habitat objectives established by Inland Native Fish Strategy for pool frequency, large woody debris, water temperature, and width-to-depth ratio on all streams in the project area.

Risk ~ The chance of loss

Risk Ratio (for cumulative watershed effects model) ~ Amount of the disturbance in the watershed relative to the hydrologic or sediment inference point

Road ~ A motor vehicle travelway over 50” wide, unless classified and managed as a trail. A road may be classified, unclassified, or temporary (36 CFR 212.1).

- **Classified Roads:** Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service (36 CFR 212.1).
- **Temporary Roads:** Roads authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be a part of the forest transportation system and not necessary for long-term resource management (36 CFR 212.1).
- **Unclassified Roads:** Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and offroad vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1). The regulations at 36 CFR 223.37 require revegetation within 10 years.

Road Cut ~ Soil or rock material removed during road construction, usually from the upslope side of the road

Road Decommissioning ~ Activities that result in the stabilization and restoration of unneeded roads to a more natural state

Road Fill ~ Soil or rock material placed on the ground as part of the road surface

Road Maintenance ~ The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective

Rosgen Channel Classification ~ The Rosgen classification system was developed by Dave Rosgen and assigns a channel type based on channel slope, width to depth ratio, bed material, entrenchment ratio and sinuosity.

Salvage ~ Removal of recently-dead, dying, or deteriorating trees to minimize the loss of wood products

Sanitation ~ The removal of damaged or susceptible trees, essentially to prevent the spread of insects or disease; an improvement cut

Scoping ~ The process used to identify the scope of issues to be addressed and to determine the significant issues related to a proposed action

Sediment ~ Soil particles in water. Suspended sediment consists of small soil particles carried along by the water's turbulent flow

Sensitive Species ~ Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by a) Significant current or predicted downward trends in population numbers or density or, b) Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Forest Service sensitive species are not "listed" under the Endangered Species Act and may not occur on all the forests within a Forest Service Region. Regional sensitive species lists undergo periodic review and are subject to change. G rankings denote global (range wide) and state status from 1 (critically imperiled) to 5 (demonstrably secure).

Species ~ A unit of classification of plants and animals consisting of the largest and most inclusive array of sexually reproducing and cross-fertilizing individuals, which share a common gene pool.

Silviculture ~ The art and science of growing and tending forest vegetation. It includes controlling the establishment, composition, and growth of forests for specific management goals

Silviculture Prescription ~ A site-specific operational plan that describes the forest management objectives for an area. It prescribes the method for harvesting the existing forest stand, and a series of silviculture treatments that will be carried out to establish a free growing stand in a manner that accommodates other resource values as identified

Site Potential Tree Height ~ The average maximum height of the tallest dominant trees (200 years or older) for a given site class

Skyline Yarding System ~ Moving logs from the stump to the landing either partially or fully suspended by a cable

Snag ~ A standing dead tree

Social Analysis ~ Analysis that uses social science information to determine how proposed actions would affect humans

Soil Porosity ~ State of having pores or holes in the soil that hold air or water; permeability

Soil Productivity ~ The capability of a soil to produce a specific crop such as fiber, forage, etc., under defined levels of management

Stand ~ A community of trees or other vegetation uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities

Stand Density Index (SDI): A relative measure of the amount of stocking on a forest area. Often described in terms of stems per acre

Standard and Guideline ~ A principle requiring a specific level of attainment, a rule to measure against

Stocking ~ The degree to which trees occupy the land, measured by BA and/or number of trees by size and spacing, compared with a stocking standard; that is, the BA and/or number of trees required to fully utilize the land's growth potential. Where tree growth is inhibited due to competition from too many trees, the site is said to be overstocked

Stocking Control ~ See thinning

Suppression Forces ~ Resources used to fight a fire, consisting of firefighters with hand tools at a minimum; may also include fire engines and bulldozers, helicopters and tanker planes

Suppressed Trees ~ Smaller trees in the lower canopy layer

Surface Fire ~ Fire that remains on the forest floor because the combination of fire intensity and ladder fuels is not sufficient to move it into the tree crowns. Only surface fuels and small vegetation are burned

Surface Fuels ~ Loose combustible material on the soil surface, consisting of fallen leaves, twigs, bark, and small branches, as well as grasses, small plants, seedlings trees, dead branches, and logs

Thinning ~ Removing trees from a stand to redistribute the growth potential or to benefit the quality of the residual stand

Threatened Species ~ A United States Fish and Wildlife Service or NOAA Fisheries designation of a plant or animal species that is threatened throughout all or a specific portion of its range.

Torching ~ Ignition and subsequent flare-up of a fire, usually burning from the bottom to the top of a tree or small group of trees

Tree Crown ~ Leafy portion

Turbidity ~ Deposition of substrate material suspended in water

Understory ~ Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

Variable Density Thinning ~ A thinning treatment that results in an irregularly distributed and unevenly stocked stand. Conditions range from widely spaced (40’–60’) trees (those being cultured for large tree attributes) to no-thin areas with dense thickets of trees. Between these extremes, the remaining stand is thinned with variations according to tree species, crown position, tree attributes, slope position, aspect and elevation

Vertical Fuels ~ Standing vegetation, either live or dead.

Viable Population ~ A population, which has the estimated numbers and distribution of reproductive individuals to insure continued existence well distributed in the planning area. To insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.

Water Repellency (for soils) ~ Loss of soil porosity, preventing water from infiltrating and causing water to run off

Watershed ~ An area of land with a characteristic drainage network that contributes surface or ground water to the flow at that point; a drainage basin or a major subdivision of a drainage basin. A watershed address consists of a name and a number (for example, Lower James watershed, 02080206). The 8-digit number is a Hydrologic Unit Code or HUC. The Hydrologic Unit system is a standardized watershed classification system developed by USGS in the mid-1970s. Hydrologic units are watershed boundaries organized in a nested hierarchy by size. They range in size from regions to the smaller cataloging units (HUCs), which are roughly equivalent to your local watershed (example follows).

- **5th field watershed:** A watershed that ranges from about 40,000 to 250,000 acres in size
- **6th field watershed:** A watershed that ranges from about 10,000 to 40,000 acres in size
- **7th field watershed:** A watershed or drainage that ranges from about 2,500 to 10,000 acres in size

Watershed Analysis ~ Watershed analysis is a systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives

Wet Weather Operations Standards ~ Specific information used to help determine when activities are at risk of not meeting BMPs. The guidelines are used to determine if conditions are favorable for wet weather or winter operations, and to provide guidance as to when conditions warrant suspension of operations, when operations may begin or resume, or when and what remedies may be appropriate

Wetlands ~ Those areas that are inundated by surface or ground water with a frequency sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs.

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