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**Forest Service**

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# Bailey, Aeneas, Revis and Tunk Livestock Grazing Analysis

## Final
## Environmental Impact Statement

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Lost Creek

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# Final Environmental Impact Statement

## Bailey, Aeneas, Revis and Tunk C&H Livestock Grazing Analysis

Okanogan County, Washington

August 2014

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Abstract

This Final Environmental Impact Statement (FEIS) documents the detailed analysis of three alternatives for the management of the Bailey, Aeneas, Revis, and Tunk Livestock Grazing Analysis (BART). The BART Grazing Allotments analysis area is located approximately ten miles southeast of Tonasket, Washington. Alternatives include Alternative 1, no grazing, Alternative 2, the proposed action and Alternative 3, current grazing with fencing and rested units. The Selected Alternative is Alternative 2 which would authorize livestock grazing consistent with Forest Plan standards and guidelines while implementing specific resource improvement measures.

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**Figure 1, BART Grazing Analysis Vicinity Map**

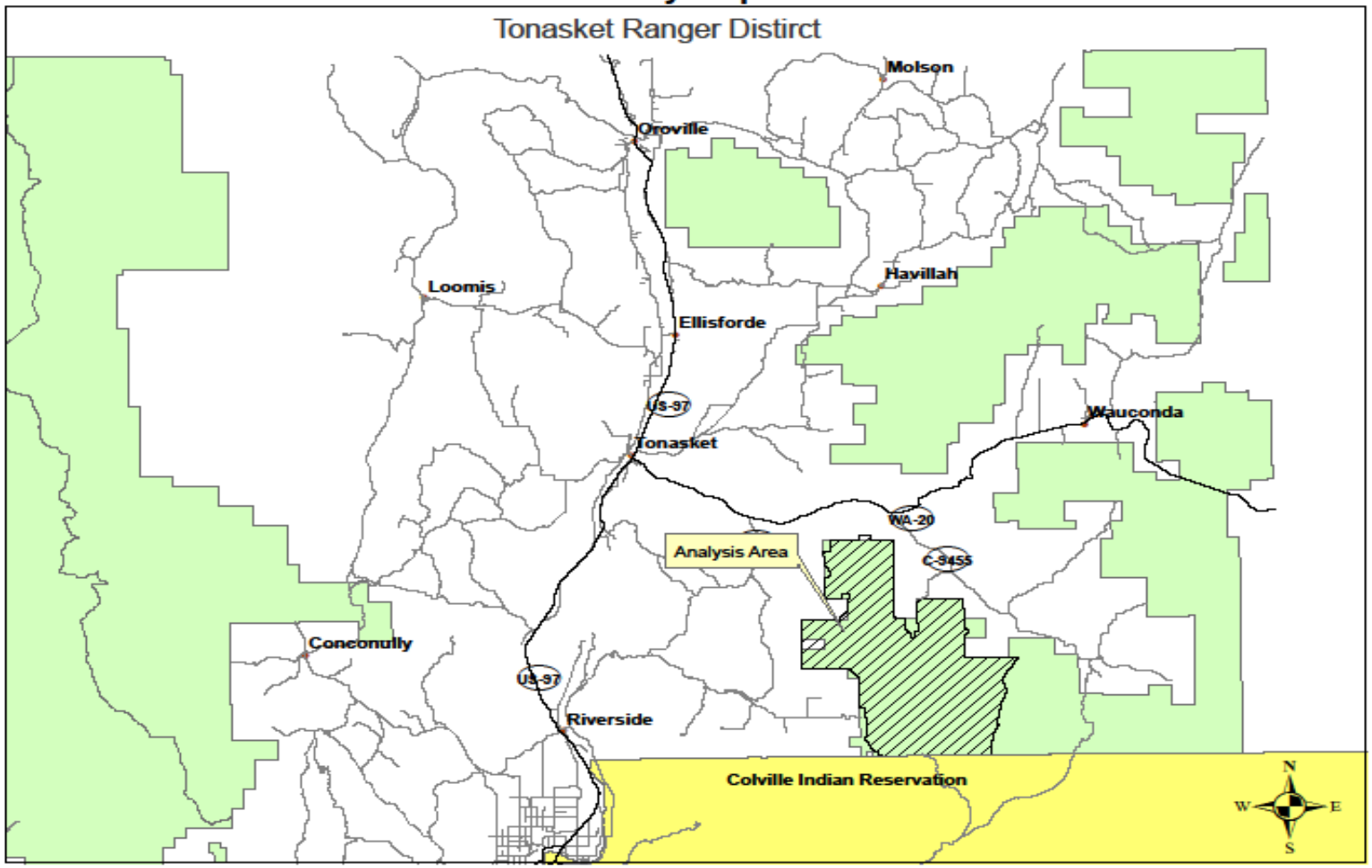


**Figure 1, BART Grazing Analysis Vicinity Map**

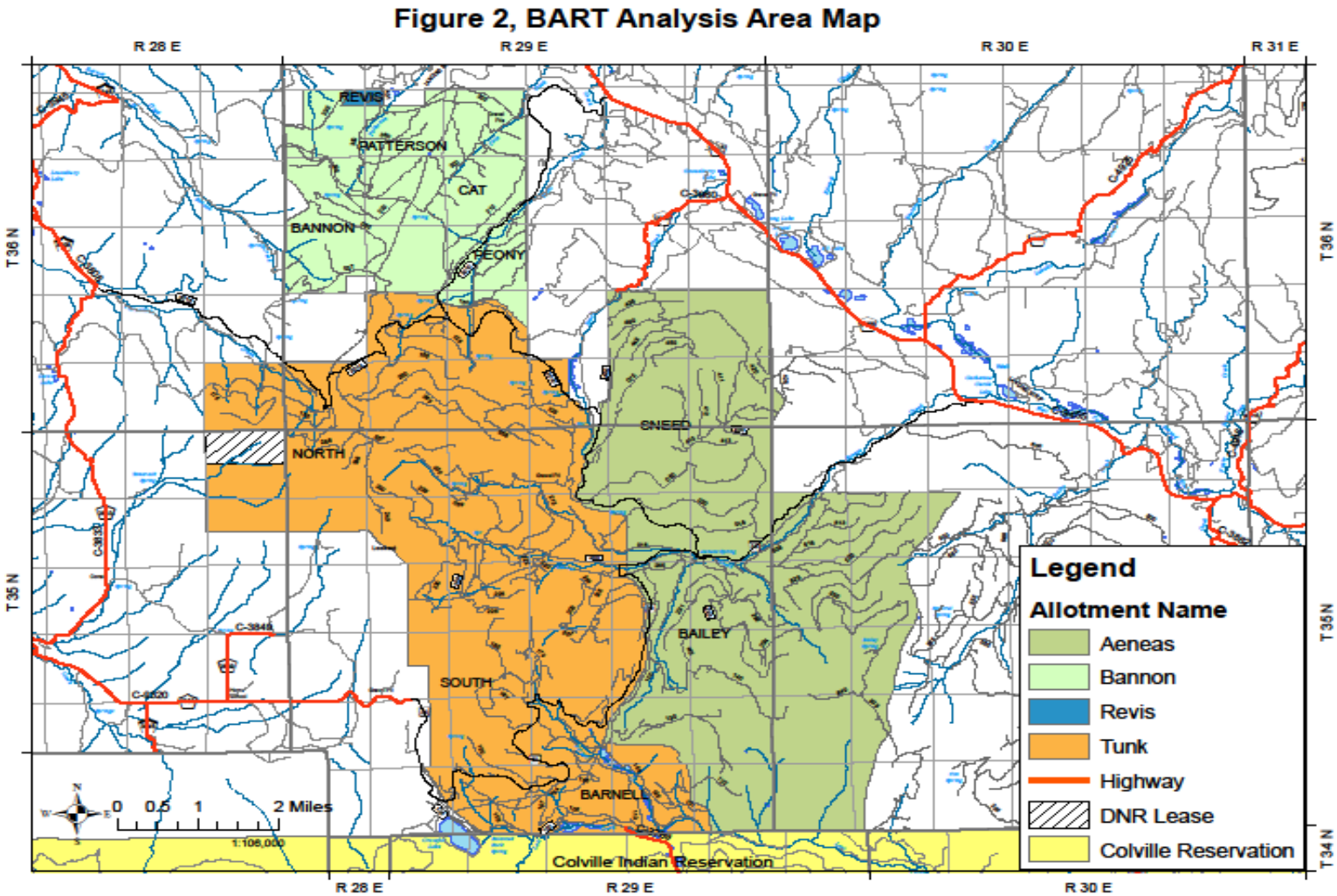


**Figure 2, BART Analysis Area Map**

# CHAPTER 1 - PURPOSE AND NEED

## Introduction

The Tonasket Ranger District proposes to authorize the continuation of cattle grazing within the Bannon, Aeneas, Revis, and Tunk Cattle and Horse Grazing Allotments (herein referred to as BART Grazing Allotments) in compliance with the National Environmental Policy Act (NEPA) and other relevant laws and regulations. This chapter explains the purpose and need for action, the decision framework, and applicable management direction. It describes the proposed action, public involvement, and issues/concerns that were identified during public scoping and by the Interdisciplinary Team.

The Forest Service developed three alternatives: the No Grazing Alternative, the Proposed Action, and an additional action alternative, in response to public comment (scoping) and grazing permittee issues.

This project will implement a land management plan and is not authorized under the Healthy Forest Restoration Act and is thus subject to the objection process at 36 CFR 218, Subparts A and B.

## Analysis Area

The analysis area includes about 36,297 acres of National Forest System lands within Township (T.) 35 North (N.), Range (R.) 28 & 29 East (E.), and T. 36 N., R. 28, 29 & 30 E., Willamette Meridian (W.M.).

This land is managed by Tonasket Ranger District, Okanogan-Wenatchee National Forest, Okanogan County, Washington. The southern portion of analysis area borders lands managed by the Confederated Tribes of the Colville Indian Reservation (CCT). Private lands and lands managed by Washington State Department of Natural Resources (DNR) border the north and west boundaries. Landmark locations include, Bannon Mountain, Tunk Mountain, Crawfish Lake, Aeneas, Barnell, Lost, Cole, Bench, Peony, and Jungle Creeks, and Barnell Meadows. Aeneas, Barnell, lower Jungle Creek, and Lost Creeks are the four major fish bearing streams in the analysis area. Primary access to the four BART allotments is by Forest Service System Roads (FSR) 3000, 3010, and 3015 and Haden Creek County Road (OCR 3789). Approximately 13,698 acres lie within the Bonaparte Creek-Okanogan River Watershed and 22,599 acres lie within the West Fork Sanpoil River Watershed. Watershed Assessments were completed for these two watersheds in 1998 (USDA Forest Service 1998a & 1998b).

### Grazing Permits, Allotment Management Plans (AMPs), and Annual Operating Instructions (AOIs)

Grazing Permits, Allotment Management Plans (AMPs), and Annual Operating Instructions (AOIs) incorporate Forest Plan management direction and other applicable laws, policies and regulatory agency documents (such as ESA consultation), including direction from the project-level NEPA decision. In addition, Forest Service delegated line officers (as recommended by range management staff) have administrative authority and discretion over most operational aspects of permitted livestock grazing management on National Forest System (NFS) lands based on monitoring of rangeland and other resource conditions. Within the scope of the applicable Forest Plan, and the NEPA analysis and resulting decision, term grazing permits, AMPs, and AOIs are subject to modification, based on resource conditions (such as drought, fires) and administrative or regulatory considerations (such as ESA actions and changes in Forest Plans and agency procedures/policies).

Allotment Management Plans (AMPs) contain the pertinent livestock management direction from the project-level NEPA decision. AMPs are part of the grazing permit and can be modified with a letter to the permittee(s) notifying them of the modification, if within the scope of the NEPA decision.

Permittees and the U.S. Forest Service meet, at least annually, to discuss Annual Operating Instructions (AOI) that specify actions needed to implement the management direction set forth in the project-level NEPA decision such as grazing strategies, range improvement needs, monitoring, and any concerns other Forest Service resource specialists raise. Communications continue throughout the grazing season. This allows the Forest Service and permittees to respond promptly if an issue arises to reduce grazing impacts or conflicts. Permittees are encouraged to participate with Forest Service personnel in monitoring, reporting livestock moves, and range improvement (water sources, fences, and corral) needs.

Allotments are managed with strategies that include riding, use of mineral supplements and/or salting pastures (units) to facilitate livestock control and distribution. Range improvements such as: fences, water troughs, cribs[1], stock drives, and corrals are important for livestock control and distribution. A map of existing improvements can be found in Appendix A, Maps, BART Analysis Area, Existing Improvements. Existing water developments are listed in Appendix H, Range Water Development Improvements.

Grazing permits for these allotments have been updated to meet all management direction specified by the Okanogan Forest Plan, as amended. Updated and revised AMPs would become part of the grazing permit (FSH 2209.13 Section 94.1).

Currently, three of the four allotments (Bannon, Aeneas, and Tunk) are permitted to three different local livestock ranchers. The Revis Allotment has not been permitted for the past eight years. Table 1, Current Head Month (HM) by Allotment gives information about current permitted livestock on the allotments.

**Table 1, Current Head Month (HM)[2] by Allotment**

| Allotment | HMs permitted | AUMs | Livestock Number Cow/Calf pairs | Season of Use |
|---|---|---|---|---|
| Bannon | 602 | 806 | 150 | 6/1-9/30 |
| Aeneas | 1203 | 1610 | 300 | 6/1-9/30 |
| Revis# | 32 | 43 | 8 | 6/1-9/30 |
| Tunk | 1556 (1604*) | 2083 | 388 | 6/1-9/30 |

*Includes 48 HMs from adjacent State Department of Natural Resource grazing lease.
#This allotment is presently not grazed.

In general, the Bannon, Aeneas, Revis, and Tunk Allotments have been grazed by cattle since the early 1900's. Actual dates and livestock numbers for the early grazing were not well documented until 1906 when grazing fees began to be collected on forest reserves. Oral histories generally indicate much higher livestock grazing numbers on these areas in the early 1900s than the present. Over time, infrastructure such as water sources, corrals, and fences have been developed in order to improve livestock management and distribution.

More complete pasture descriptions are included in Chapter 3 in the Rangeland Vegetation Section and in the Rangeland Management Specialist report in project files.

[1] Cribs: livestock watering sites developed by digging a hole at the water source, blocking water flow partially (has outlet) with logs or other structural barrier. These form a small pond like structure from which livestock can drink.
[2] HMs = Head Months, one month's use and occupancy of range by one weaned or adult animal cow, bull, steer, or heifer. Calves are not counted. This is a term used mostly for billing purposes to calculate an occupancy level – how many animals for how long.

**Bannon Allotment**

Early records indicate the Bannon area was used with either the Tunk or Aeneas Allotments for livestock grazing. The allotment was fenced in 1957, allowing it to be grazed by 100 cow/calf pairs from June 1 through September 30. In 1968, it was established as the Bannon Allotment. In 1977, a division fence was constructed dividing the allotment into East and West units (pastures). In 1981, a four pasture rotation system, implementing rest, was initiated into the allotment. This was accomplished through construction of two additional fences, dividing both the East and West units. Stocking rates were adjusted upward with these additional fences and predicted increases from transitory forage to 150 c/c pairs, from June 1 through September 30$^{th}$.

Based on recent Range Readiness notes, the range has typically been ready for grazing by June 1$^{st}$ each year. Current production inventories indicate a reliance on transitory range with only a small portion of the allotment containing primary range. In past inspection and inventory notes, including the 1981 Environmental Assessment, and subsequent Allotment Management Plan, Peony Creek was identified as an area with heavy ungulate use that needed to be monitored. Plans to improve its condition relied upon the fences and scheduled rest rotations. The Bannon Allotment is effectively divided with fences between the Patterson, Bannon, Peony Creek and Cat units. The current permitted use is for 150 cow/calf pairs to graze between June 1 and September 30$^{th}$. This is equivalent of 806 animal unit months (AUMs) or 602 HMs. Peony Creek pasture has been rested for 4 of the last 11 years.

**Aeneas Allotment**

Documentation indicates the area was used by both cattle and horses since the early 1900's. The old Allotment management plan reported that up to 700 head of cattle and horses used this area yearlong before Forest Service management was authorized. In 1957, the Tunk and Aeneas Allotments were combined, under the "Aeneas" name. In 1968 the two allotments were again separated and renamed, Tunk and Aeneas.

The current permitted use is for 300 cow/calf (c/c) pairs to graze between June 1 and September 30$^{th}$. This is equivalent of 1610 AUMs or 1203 HMs. The Aeneas Allotment has used a deferred rotation grazing system. The allotment contains two (2) units (pastures): the Sneed (aka: North) unit and the Bailey (aka: South) unit. These units are currently scheduled to be grazed north to south or south to north on alternating years. This provides "deferment" to grazing, but is not considered to be a rest period. Historically, range has been ready by June 1 each year. This unit is bordered to the south by lands owned and managed by the Colville Confederated Tribes (CCT). The last Allotment Management Plan (AMP) was completed in 1969.

**Revis Allotment**

The Revis Allotment contains one pasture and has been historically used with adjacent private lands. According to a 1973 Allotment Management Plan, the area was used by horses through the 1920's. Sometime in the 1930's its use was converted to heavy use by both cattle and sheep. In 1951, it was converted to strictly cattle, stocked at 50 cow/calf pair. Historically, range has been ready by June 1 each year.

This allotment has been rested via non- use for the last eight (8) years (since 2006) although there has been trespass, or unauthorized livestock drift from the adjacent Washington State Department of Natural Resource (DNR) lands and National Forest lands. All cases have been light incidental use. Recent photos

(Tonasket District files) indicate good availability of forage in this allotment. The last AMP analysis for this allotment was completed in 1973. There are no developed water sources on the Revis Allotment.

**Tunk Allotment**

Early records indicate the Tunk Allotment received heavy grazing use from the 1890's through the 1930's. Oral histories noted that over 500 head of cattle and numerous undocumented horses used this allotment. Sheep bands of approximately 800 to 1,200 ewes/lambs each were trailed through the Lost and Barnell Creek areas, along ridgelines of Bailey Mountain and toward Sneed and Bannon Mountains.

The Tunk Allotment is comprised of three pastures; the North, the South, and Barnell/Lost units. The current permitted use is for 388 cow/calf pairs to graze between June 1 and September 30$^{th}$. This is equivalent of 2,083 AUMs or 1,556 HMs. The allotment has been operated under a deferred grazing system. On alternating years, the livestock would enter the South unit first, graze for approximately 1.5 to 2 months, and then move to the North unit and graze for the remainder of the season. On those years, the Barnell unit (Lost and Barnell Creek areas) has scheduled rest.

On the other years, the livestock turn out on the North Pasture and it is used until August 1$^{st}$, depending upon resource conditions. The cattle are then moved to the South unit, with a small portion 50 to 75 c/c pairs moved into the Barnell unit for 2 to 3 weeks (respective to the livestock numbers) at season's end. The South unit would be grazed approximately August 1$^{st}$ to Sept 30$^{th}$, except for the livestock numbers allowed to graze in the Barnell unit that year for 2 – 3 weeks. The last Allotment Management Plan (AMP) was completed in 1969.

## Desired Future Conditions

Desired future conditions (DFCs) and Forest Management Goals provide the objectives against which the proposed action is measured. DFCs are described at both the Forest level (1989 Okanogan Forest Plan, pages 4-1 to 4-9 and 4-27) as well as Forest wide Standards and Guidelines (pages 4-42 to 4-45 in particular) as well as for Management Areas. In this EIS "meeting or moving toward desired future conditions" means that a majority of the significant and analysis issues must be meeting or exceeding the requirement list.

Desired conditions guide grazing management in a manner that is consistent with the Forest Plan and ecological conditions of the project area. Desired conditions provide "end point" management objectives for grazing. They are described in quantitative and qualitative parameters and are designed to be "measurable". Project-level monitoring then can assess the effectiveness of grazing management in moving towards or achieving the desired conditions over time.

The proposed action incorporates an adaptive management strategy, thus desired future conditions are an essential component of the proposed action. Adaptive management incorporates an "implement-monitor-adapt" strategy that provides flexibility to adapt to changes in environmental conditions, or to respond to subsequent monitoring information indicating that desired conditions are not being met.

The desired future conditions for these allotments are derived from management direction and guidance. The desired future condition includes the following elements:

- Grazing would continue in the Management Areas, described starting on page 9, where grazing is planned (Forest Plan page 4-6).

- Range improvements would be provided in accordance with the requirements of each management area (Forest Plan page 4-1). Range improvements would be made compatible with Management Area requirements (Forest Plan page 4-6) with updated allotment management plans (Forest Plan page 4-42) to reflect direction from the amended Forest Plan.
- Grazing on the four allotments would not retard or prevent attainment of RMOs (INFISH/PACFISH GM-1).
- Federally endangered and threatened species would not be jeopardized and would be managed to achieve species recovery levels (FSM 2672.31).
- Sensitive plant and animal species would be managed to ensure viable populations throughout their geographic ranges (FSM 2672.32).
- Forage utilization by livestock would be within standards (Forest Plan 4-43 &-44).
- Structural range improvements would be functioning, maintained to standards, and would enhance riparian ecosystems (Forest Plan 4-45).
- When riparian resource damage is occurring, alleviate damage caused by grazing through proven means. Fencing may be used when other management approaches have not given satisfactory results in the same or similar resource conditions (Forest Plan 4-42, 11-3).
- On Range lands in an unsatisfactory condition, a schedule shall be developed to meet the desired future condition (Forest Plan 4-42, 11-1).
- Healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms.
- Invasive plants do not jeopardize the ability of the National Forest to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts (Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants, Final Environmental Impact Statement, 2005b).

Table 2, Forest Plan Standards, PACFISH/INFISH RMOs, and Existing Condition, below, displays the Forest Plan Standards and Guidelines and INFISH/PACFISH RMOs and compares current conditions to those standards.

**Table 2, Forest Plan Standards, PACFISH/INFISH RMOs, and Existing Condition**

| Habitat Indicator | Forest Plan Standards/ RMOs | Source | Existing Condition |
|---|---|---|---|
| Stream Sediment | <20% fines (1mm) in salmonid spawning habitat | Okanogan FP 1989 | 21-47% |
| Water Temperature. | Maximum temperature below <59F - adult holding habitat and < 48F – spawning/rearing | PACFISH/INFISH 1995 | 53-63$^{o}$F |

| Habitat Indicator | Forest Plan Standards/ RMOs | Source | Existing Condition |
|---|---|---|---|
| Pool Frequency | >80 pools/mi | INFISH 1995 | 5.4-207.6 pools/mile, Avg. = 13.6 pools/mi. based on stream surveys |
| Bank Stability | ≥ 80% (meadow Lost & Barnell) | INFISH 1995 | Field observations<br>7.8 miles = 30% stable banks.<br>2.3 miles = 72% stable banks<br>2.3 miles = 95% stable banks<br>2.8 miles = 0% disturbance. |
| W/D Ratio | <10 | PACFISH/INFISH 1995 | 4.07-13.6 |

## Purpose and Need

The purpose of this analysis is to provide for grazing while reviewing and evaluating the current condition of the allotment; moving current conditions toward the desired condition; and ensuring the allotment plan is consistent with federal law, regulation, and the amended Okanogan Forest Plan (1989).

The current allotment management plans (AMPs), for Tunk and Aeneas Allotments, were signed in 1969. The AMP for Revis was signed in 1973 (allotment currently vacant) and the Bannon AMP was signed in 1981. All of these AMPs predate the 1989 Okanogan Forest Plan. There is a need to comply with the Recission Act of 1995 (Public Law 104-19, Section 504, which directs the Forest Service to complete National Environmental Policy Act (NEPA) analysis on all grazing allotments every 10 years. This analysis is needed to ensure that livestock grazing on the Bannon, Aeneas, Revis, and Tunk allotments is consistent with current law, regulation, and management direction.

Reauthorization of grazing permits within the BART Allotments is needed because:

- Where consistent with other multiple use goals and objectives there is Congressional intent to allow grazing on suitable lands (Multiple Use-Sustained Yield Act of 1960, Forest and Rangeland Renewable Resources Planning Act of 1974, Federal Land Policy and Management Act of 1976 and the National Forest Management Act of 1976) without impairment of the productivity, and surface resources of the land. The Bannon, Aeneas, Revis, and Tunk allotments contain lands identified as suitable for domestic livestock grazing in the Okanogan Forest Plan.
- It is Forest Service Policy to make forage available to qualified livestock operators from lands suitable for grazing consistent with land management plans (36 CFR 222.2 ).
- By regulation, forage producing lands will be managed for livestock grazing where consistent with land management plans (FSM 2203.1).
- The Okanogan National Forest Plan acknowledges grazing as an important use of the National Forest with a focus on coordination of short term and long term planning between livestock use and other resource management (Forest Plan 1989, page 2-27). The goal is to provide a sustained production of palatable forage for grazing by livestock and dependent wildlife species while meeting the needs of other resources and uses at a level which is responsive to site-specific

objectives (Forest Plan, page 4-1 through 4-10) as well as to contribute to the social and economic health of communities which are significantly affected by National Forest management.

Recent surveys of the analysis area identified areas that are of concern that are not meeting or moving toward meeting Forest Plan standards and guidelines including PACFISH/INFISH Riparian Management Objectives (RMOs) or Forest Service Manual direction for these resources, especially in Peony Creek, Aeneas Creek, Lost Creek, Barnell Creek, Cole Creek, Patterson Creek, Chewiliken Creek, and Jungle Creek. Therefore, there is a need to analyze alternatives designed to maintain resource conditions currently meeting ecosystem goals and objectives and to improve conditions not meeting goals and objectives.

There is a need to improve these habitat conditions to move them toward Forest Plan and PACFISH/INFISH standards.

- There is a need for livestock grazing on these allotments to meet multiple use objectives.
- There is a need to revise the BART allotments to incorporate current direction and suitable range conditions.
- There is a need to adjust the season of use and livestock numbers according to current measurements of forage production and monitoring data.
- There is a need to build a corral in the Tunk Allotment in the vicinity of Peony Creek and to replace the corral in Jungle Creek and the associated water development with a corral that is not in the riparian area and outside the proposed exclosure.
- There is a need to install a fence north of Forest Road 30 to restrict livestock access to Aeneas Creek and eliminate access to Jungle Creek and the associated wetlands.
- There is a need to move approximately 1 mile of existing fence on the south side of Aeneas Creek out of the riparian area.
- There is a need to remove existing water developments from riparian areas and fence all existing and new water sources, such as the Bannon water catchment structure, the Cat trough, and the Patterson trough.
- There is a need to reconstruct the Grouse, and other, water developments including installing new spring boxes, pipes, fences, and troughs.
- There is a need to remove a portion of the Revis boundary fence in Section 7 & 8, Township 36 North, Range 29 East, W.M. in order to incorporate management of the Revis On/Off Allotment with the Bannon Allotment (Permitted livestock numbers would not increase from the permitted numbers on the Bannon allotment).
- There is a need to rest the Peony pasture until indicators of Desired Recovery are reached.
- There is a need to disperse livestock use by providing new water sources throughout the allotment by providing 15 to 20 new water sources.
- There is a need to provide a hardened crossing in Aeneas Creek for livestock access and watering.
- There is a need to remove an ineffective, temporary fence along Barnell Creek.

## Summary of the Proposed Action

The Proposed Action is to continue livestock grazing at current levels using a combination of range improvements and adaptive management strategies to meet or move toward meeting the amended Forest Plan Standards and Guidelines, PACFISH/INFISH RMOs, and measurable Desired Future Conditions (DFCs). The Proposed Action would implement adaptive management strategies, including possible construction of additional fences or reductions in season of grazing, if monitoring determines that the allotments do not meet or are not moving towards meeting Forest Plan Standards and Guidelines and

PACFISH/INFISH RMOs. Adaptive management strategies have been developed for the Tunk and Bannon allotments and are designed to occur in Stages (generally 2 - 4 years in duration) that would allow adequate time for range improvements to be constructed and evaluated for effectiveness. Stage 1 implementation would begin within one year once a decision is signed and implemented. It is designed to make range improvements to the current infrastructure by moving structures that are in poor locations, installing additional water developments, and installing/relocating two fences (creating an exclosure area between Jungle Creek and Aeneas Creek). Subsequent Stages, 2 through 4, would include changes in management strategies based on the effectiveness of the range improvements made in previous Stages. A monitoring plan would be implemented and measurable trigger points developed to identify when a specific threshold is about to be reached and changes need to be made (See Chapter 2, Mitigation Measures, Management Requirements, and Best Management Practices, and Monitoring Sections). The construction of additional fences in subsequent years may occur where the permittees and the Forest Service agree that additional fencing would improve livestock management and riparian area conditions. Specific details and locations for each proposed action can be found in Chapter 2, Alternatives Considered in Detail, starting on page 24.

## Scope of the Analysis and Decision to be Made

This FEIS discloses the environmental consequences of implementing the proposed action and alternatives to that action. The scope of this analysis is limited to evaluating the appropriate level of permitted livestock grazing, given considerations of rangeland condition and other Forest Plan goals and objectives. The proposed action and other alternatives do not address recreational livestock, animals authorized under livestock use permits (i.e., where the primary purpose is not livestock production), or outfitter and guide livestock.

The Responsible Official for this analysis is the Forest Supervisor of the Okanogan-Wenatchee National Forest. At the conclusion of the public review and comment period, the Forest Supervisor will decide whether domestic livestock grazing should be authorized on all, part, or none of the analysis area. The decision would also include the number and kind of livestock, season of use, terms and conditions, design criteria, and monitoring, as needed. New allotment management plans, for each allotment, would be prepared and implemented within two (2) years.

The Record of Decision (ROD) will identify the selected Alternative based on the analysis in the FEIS including such factors as how the Alternative meets the purpose and need for action, response to the significant and analysis issues, consideration of the environmental consequences, compliance with the Forest Plan, and response to public comments.

If a decision is made to authorize grazing, Term Grazing Permits, Allotment Management Plans, and Annual Operating Instructions would be issued in compliance with the decision. These are implementing documents and do not constitute decision points. These items are defined below.

**Term Grazing Permits** – authorize a permit holder to graze livestock on specific National Forest System lands. The permit holder is required by the permit to graze under specific terms and conditions designed for resource protection and enhancement. Term livestock grazing permits are typically issued for a 10-year term. Term livestock grazing permits, by themselves, do not authorize the permittee to develop water, construct fences, build roads or trails, manipulate vegetation, or do other ground-disturbing activities.

**Allotment Management Plans (AMP)** – an administrative document developed by the Forest Service that incorporates elements of the decisions made by the Responsible Official. The AMP, documents management requirements and actions decided upon in the Record of Decision.

**Annual Operating Instructions (AOI)** – on an annual basis, these documents provide instructions to the term permit holders regarding management requirements, projects, agreements, and so forth for the current grazing season. They are not decision documents; they simply implement, on an annual basis, elements of the decision.

**Project Record**

This EIS hereby incorporates by reference, the project record. The project record is maintained at the Tonasket Ranger District office. The project record contains all project-specific information including resource reports, the watershed analyses, other results of field investigations, and District Range Permit files. It also includes letters sent to tribes and other government agencies, public mailing lists, legal notices, letters and emails received during scoping and public comment periods, and meeting minutes. The project record may be viewed during regular business hours at the Tonasket Ranger District Office, 1 West Winesap St., Tonasket, WA 98855 in Okanogan County, Washington. Please call ahead to schedule an appointment.

**Maps and Acres Precision**

All map boundaries, map features, and acreage figures are approximations based on best available information at the time, and actual implementation may differ slightly to better reflect on-the ground conditions. All locations, miles of fencing, and unit boundaries and acreages are estimates based on aerial photography and map interpretation and minor changes to locations may occur upon implementation. Acreage figures in this document may vary by up to 1 – 2% depending on interpretation of specific map boundaries.

## Management Direction and Guidance for this Project

**Direction**
A summary of the regulatory framework is provided below. More complete descriptions can be found in documents referenced below and in Appendix G, Regulatory Framework, in the Appendix to this document which tiers to Records of Decisions that have amended the Okanogan National Forest, Forest Plan.

This project tiers to the Final Environmental Impact Statement (FEIS for the **Okanogan National Forest Land and Resource Management Plan, (ONF LRMP or Forest Plan)** (USDA Forest Service 1989), as amended by the Decision Notice and Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH, USDA and USDI 1995) and the Decision Notice and Environmental Assessment for the Interim Strategies For Managing Indigenous Fish-Producing Watersheds in Eastern Oregon and Washington, Western Montana and Portions of Nevada (INFISH, USDA 1995a); and The Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants Final Environmental Impact Statement and Record of Decision (USDA 2005b) .

The Forest Plan includes designated Management Areas (MAs) with Standards and Guidelines for activities within each management area. The MAs that provide guidance for the BART allotments are:

MA 5 (Recreation emphasis), 14 (general wildlife emphasis), 25 (timber/range emphasis) and 26 (deer winter range emphasis). The Standards and Guidelines for each MA direct how AMPs are designed, including the development of structural and non-structural range improvements, forage utilization, and riparian area grazing management. The objective of each MA is described below (See Appendix A, Maps, Management Area Map.

**Management Area 5** (approximately 2 % of the analysis area): Provide opportunities for recreation and viewing in a roaded setting with a visual quality objective of retention or partial retention.

**Management Area 14 (**approximately 25% of the analysis area): Provide a diversity of wildlife habitat, including deer winter range, while growing and producing merchantable wood fiber.

**Management Area 25** (approximately 63% of the analysis area): Intensively manage the timber and range resources using both even-aged and uneven-aged silvicultural practices. Manage to achieve a high present net value and a high level of timber and range outputs while protecting the basic productivity of the land and providing for the production of wildlife, recreation opportunities, and other resources.

**Management Area 26 (**approximately 11% of the analysis area): Manage deer winter range and fawning habitats to provide conditions that can sustain optimal numbers of deer indefinitely, without degrading habitat characteristics such as forage, cover, and soil.

Table 3 displays the Management Area acres and percent of the total project area within the BART allotments.

**Table 3, BART Management Area Acres**

| *Management Area* | *Bannon Acres* | *Percent area* | *Aeneas Acres* | *Percent area* | *Revis Acres* | *Percent area* | *Tunk Acres* | *Percent area* | *Grand Total Acres* | *Percent area* |
|---|---|---|---|---|---|---|---|---|---|---|
| MA 05 | | 0% | 0 | 0% | 0 | 0% | 558 | 2% | 558 | 2% |
| MA 14 | 979 | 3% | 5,091 | 14% | 0 | 0% | 2,845 | 8% | 8,916 | 25% |
| MA25 | 3,622 | 10% | 7,542 | 21% | 75 | 0% | 11,494 | 32% | 22,732 | 63% |
| MA 26 | 955 | 3% | 1,547 | 4% | 0 | 0% | 1,589 | 4% | 4,091 | 11% |
| **Grand Total** | **5,556** | **15%** | **14,180** | **39%** | **75** | **0%** | **16,486** | **45%** | **36,297** | **100%** |

Range Standards and Guidelines that apply to this project include (Forest Plan, pg. 4-42):

> **11-1:** Update range AMPs. Identify lands in unsatisfactory condition. Develop AMPs with specific objectives for these lands on a priority basis under a schedule established by the Forest Supervisor. These objectives shall meet a desired future condition based on existing and potential values for all resources. The AMP shall include: 1) a time schedule for improvement; 2) activities needed to meet forage objectives; and 3) an economic efficiency analysis.
>
> **11-2:** AMPs shall include a strategy for managing riparian areas for a mix of resource uses. A measurable desired future riparian condition should be satisfactory or greater. Range conditions within riparian ecosystems should be in good or better condition class with a stable or upward trend. In conditions classes fair or less, management shall be designed to attain an upward trend. When the current riparian condition is less than satisfactory, objectives shall include a schedule

for improvement. The AMPs shall identify management actions needed to meet riparian objectives within the specified time frame. Measurable objectives shall be set for key parameters.

**11-3:** When riparian resource damage is occurring, determination of the cause of the resource damage shall be made prior to taking action through the allotment management plan. Alleviate damage caused by grazing through proven means. Fencing may be used when other management approaches have not given satisfactory results in the same or similar resource conditions.

- **MA5 -11A:** Manage commercial livestock to reduce conflicts with recreation.
- **MA5-11B:** 85% of annual available browse on winter range shall be for wildlife and 15% for domestic livestock (refer to forage utilization standards in Forest Plan Chapter 4- Forest Wide Standards and Guidelines, pages 4-43/44).
- **MA14-11A:** 85% of annual available browse on winter range shall be for wildlife and 15% for domestic livestock (refer to forage utilization standards in Forest Plan Chapter 4- Forest Wide Standards and Guidelines, pages 4-43/44).
- **MA25-11A:** Specific allotments and portions of allotments that will be intensively managed for transitory range shall be identified according to the following criteria:
    - Intensive transitory range management practices and techniques shall be applied to blocks of at least 100 acres.
    - Specific areas where intensive transitory range management practices will be applied shall be determined following site specific, interdisciplinary analysis associated with the updating and revision of AMPs. Priority should be given to using intensive transitory range to reduce grazing impacts to resources such as riparian areas, recreation uses, or other portions of the range.
    - Up to 5% of suitable timber lands may be managed with intensive transitory range practices.
- **MA25-11B:** Bring fair and poor condition suitable non-transitory rangelands to good condition.
- **MA25-11C:** Maintain improvements on suitable rangelands.
- **MA25-11D:** With improvements, meet “C” or “D” level management on suitable non-transitory rangelands where economically desirable.
- **MA25-11E:** Transitory range structural and nonstructural improvements and grazing systems shall be designed subject to silvicultural, wildlife, and other resource objectives.
- **MA26-11A:** Livestock grazing shall be allowed as long as wildlife habitat values are maintained or are increased.
- **MA26-11B:** 85% of annual available browse on winter range shall be for wildlife and 15% for domestic livestock (refer to forage utilization standards in Forest Plan Chapter 4- Forest Wide Standards and Guidelines, pages 4-43/44).

This project tiers to ***The Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants Final Environmental Impact Statement and Record of Decision (USDA 2005b).*** This document amends all Forest Plans in Washington and Oregon with goals, objectives, and standards

related to invasive plants that complement the Best Management Practices already in effect on the Okanogan-Wenatchee National Forest. The 2005 ROD standards also prescribe prevention, cleaning of equipment, use of weed-free straw and mulch, use of weed-free rock and gravel sources, and prompt re-vegetation with native species or non-invasive non-natives. This Environmental Impact Statement is tiered to this broader-scale analysis (the FEIS), and all activities proposed are intended to comply with the new management direction.

Standard 6 applies to allotment management plans, requiring managers to use available mechanisms to incorporate invasive plant prevention practices into rangeland management. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment management plans, providing annual operating instructions, and adaptive management.

PACFISH/INFISH

The analysis area is bisected by two management plans that amended the Okanogan Forest Plan. On the western portion that drains into the Okanogan River, the Decision Notice and Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH, USDA and USDI 1995) amended the Okanogan Forest Plan in 1995. On the eastern portion, the Decision Notice and Environmental Assessment for the Interim Strategies For Managing Indigenous Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada (INFISH, USDA 1995a) amended the Okanogan National Forest, Forest Plan in 1995. Both PACFISH and INFISH include five components directing management of riparian areas: Riparian Habitat Conservation Areas (RHCAs), Riparian Goals, Riparian Management Objectives (RMOs), Key or Priority Watersheds, and Watershed Analysis. How the five components relate to the project and the analysis area is explained below:

*RHCAs*

PACFISH and INFISH RHCAs (USDA and USDI, 1995: C-6, USDA, 1995a: E-5): Riparian Habitat Conservation Areas (RHCAs) widths range from 300 feet on either side of fish bearing streams and lakes to 50 feet on either side of the non-fish bearing intermittent streams. PACFISH and INFISH Standard and Guidelines for managing livestock activities in RHCAs are summarized as follows:

- Modify grazing practices (e.g., accessibility of riparian areas to livestock, length of grazing season, stocking levels, timing of grazing, etc.) that retard or prevent attainment of Riparian Management Objectives or are likely to adversely affect listed anadromous or inland native fish. Suspend grazing if adjusting practices are not effective in meeting Riparian Management Objectives.
- Locate new livestock handling and or management facilities outside of Riparian Habitat Conservation Areas. For existing livestock handling facilities inside the Riparian Habitat Conservation Areas assure that facilities do not prevent attainment of Riparian Management Objectives or adversely affect listed anadromous/inland native fish. Relocate or close facilities where these objectives cannot be met.
- Limit livestock trailing, bedding, watering, salting, loading, and other handling efforts to those areas and times that will not retard or prevent attainment of Riparian Management Objectives or adversely affect listed anadromous fish.

*Riparian Goals*

PACFISH and INFISH Riparian Goals (Riparian Goals) (USDA and USDI, 1995: C-3, USDA, 1995a: E-2) for the analysis area provide the framework for the aquatic resources analysis. Both management document goals are similar. Riparian Goals establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. The goals describe several watershed, stream, riparian processes that are to be maintained or restored. The pertinent goals to be maintained or restored during planning for the BART project include:

- Stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;
- Natural timing and variability of the water table elevation in meadows and wetlands;
- Riparian vegetation to:
    - Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
    - Provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and
    - Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

*RMOs*

PACFISH and INFISH RMOs (USDA and USDI, 1995: C--6, USDA, 1995a: E-3-4) describe good fish habitat. The numeric values given provide the "criteria" against which attainment, or progress toward attainment, of the riparian goals is measured, and a target toward which managers will aim for as they conduct resource management activities. RMOs for stream systems relevant to the analysis area are: Pool Frequency, Water Temperature, Width-Depth Ratios and Bank Stability (meadow type streams). See the PACFISH/INFISH documents for the specific RMO values, the Aquatics/Fisheries section of Chapter 3, and Appendix G, Regulatory Framework, in the appendix to this document.

**Guidance**

*Watershed Assessments*

The analysis area includes two 10$^{th}$ field Hydrology Unit Code (HUC) watersheds; Okanogan River – Bonaparte Creek (formally known as Bonaparte Creek) and West Fork Sanpoil River. Upper Columbia River Steelhead which is listed as Threatened under the Endangered Species Act (ESA) is present in the Okanogan River and lower Bonaparte Creek. Therefore, the Okanogan River- Bonaparte Creek watershed is designated as a PACFISH Key Watershed. There is no INFISH priority watersheds associated with the BART analysis area. This FEIS incorporates by reference the two Watershed Assessments that provide guidance for the BART Allotments.

About 38 percent (13,698 acres) of the analysis area lies within the Okanogan River-Bonaparte Creek *(Bonaparte Creek Watershed Assessment (*USDA Forest Service 1998a)) that includes portions of Patterson, Peony, Bench, Tunk, Cole, Aeneas and Chewiliken Creeks. The Okanogan River is Essential Fish Habitat for anadromous fish.

Approximately 62 percent (22,599 acres) of the analysis area lies within the West Fork Sanpoil Watershed *(West Fork Sanpoil Watershed Assessment* (USDA Forest Service 1998b)) and includes Crawfish Lake and portions of Jungle, Aeneas, Bailey, Barnell and Lost Creeks. See Appendix A, Maps, Watershed Boundaries.

The Bonaparte Watershed Assessment (1998a) identified livestock grazing along sensitive banks as causing bank sloughing which is increasing sediment to the stream on about 0.6 miles of Peony Creek (portions of segments 1 & 2). The need for additional monitoring was identified to help guide on-going grazing management, determine the effectiveness of management changes on riparian and stream habitat; identify degraded sites needing restoration; and contribute to the data set for modifying RMO's that do not properly fit certain biophysical environments. Riparian/stream restoration was identified as a "Moderate Priority" through modification of grazing practices and agreements with permittees.

The West Fork Sanpoil Watershed Assessment (1998b) identified the need for grazing allotment analysis to determine ecosystem health, including updating Allotment Management Plans in order to prescribe mitigation and opportunities for vegetative improvement and to reduce livestock impacts in riparian areas. Several riparian areas identified in need of restoration and maintenance from grazing impacts included Aeneas Creek – Tributary 2, Reach 1; Barnell Meadows; and Aeneas Creek – Tributary 4, Reach 1 (Jungle Creek).

**Applicable Laws**

In managing livestock grazing on public rangelands, the Forest Service's overall objective is to ensure the long-term health and productivity of these lands and to create multiple environmental benefits that result from healthy watersheds. The Forest Service administers public land grazing in accordance with, but not limited to the following laws. Additional laws and a more complete description are included in Appendix G, Regulatory Framework.

***Federal Land Policy and Management Act of 1976***; This Act formally established the multiple –use mission of the agency and a land use planning process. Pertinent sections of FLPMA relating to rangeland management can be found in Sections 102, 201, 202, 302 - 304, 307, 309, 310, and 401-403.

***Public Rangelands Improvement Act of 1978***: This act established the present grazing-fee formula, reaffirmed grazing boards, and authorized expenditure of funds for range improvements. In addition, the law required both the Secretary of the Interior and the Secretary of Agriculture to undertake, and maintain, an inventory of range conditions and trends on public rangelands. This law also reaffirmed the commitment required by sections 201 and 202 of the Federal Land Policy and Management Act to inventory and identify current public rangeland conditions and trends and manage, maintain, and improve the condition of the public rangelands so that they become as productive as feasible.

***Multiple-Use Sustained-Yield Act of June 12, 1960***: This act formally established the policy of managing national forests for multiple uses, including outdoor recreation, range, timber, watershed, wildlife, and fish purposes.

***Rescissions Act of 1995, Section 504***: This act directed the USFS to complete site-specific National Environmental Policy Act (NEPA) analysis and management decisions for allotments. It also directs the Agency to provide livestock-based economic opportunities in rural communities while contributing to the West's social fabric and identity. Together, public lands and the adjacent private ranches maintain open

spaces in the fast-growing West, provide habitat for wildlife, offer a myriad of recreational opportunities for public land users, and help preserve the character of the rural West.

***The Code of Federal Regulations (CFR):*** Federal regulation (36 CFR 222.2(c)) states that "[f]orage producing National Forest System lands will be managed for livestock grazing and the allotment management plans will be prepared consistent with [forest] plans." Rangeland capability and suitability analysis for livestock grazing was conducted for the BART assessment area in 2014 and is contained in project files.

**Executive Order 13112 of February 3, 1999** states that Federal Agencies have the duty of identifying actions that will affect the status of invasive species; to prevent, detect, and respond to control populations of such species; and not authorize or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species.

## Public Involvement

Originally, public comments were requested in May, 2012. Scoping letters were sent to more than 170 entities, including government agencies, groups, individuals and other parties. Since that time, the BART Grazing Analysis has transitioned from an Environmental Assessment (EA) to an Environmental Impact Statement (EIS) because public comments and internal discussion determined that the proposal may have adverse impacts on stream sediment rates**.** On November 23, 2012, a Notice of Intent was published in the Federal Register to change the analysis from an Environmental Assessment to an Environmental Impact Statement. On November 26 and 27, 2012 scoping letters were sent to approximately 160 entities, including government agencies, groups, individuals, and other parties that had requested information on general forest or specific range projects. All original letters, emails and other scoping comments are contained in the project files.

Interaction with the BART grazing permittees has been ongoing since 2011 and has included at least one field trip and meeting each year.

Government-to-government scoping letters were sent to the Yakama Nation and the Confederated Tribes of the Colville Indian Reservation in May and November, 2012. No comments have been received to date.

The Draft Environmental Impact Statement was sent out for public comment the first part of April with a Notice of Availability in the Federal Register on April 11, 2014 and a Notice of Opportunity to comment in the Wenatchee World on April 16, 2014. Comments were received from three individuals and one government agency.

This project has been listed on the Okanogan-Wenatchee National Forest Schedule of Proposed Actions since April, May, June 2012.

Since all identified National Register of Historic Places sites are avoided or will not be effected by the project undertakings, the determination of: "Historic Properties Present But Avoided/No Effect" was found for this project. Pursuant to the 1997 Programmatic Agreement, consultation the Historic Preservation Office is not required.

## Issues

Issues serve to compare trade-offs identified during the environmental effects or consequences analysis that may occur from a proposed action and alternatives for the decision-maker. The concerns raised during scoping were evaluated against the following criteria:

- Was the concern beyond the scope of the project or not relevant to the action proposed (Would a cause-and-effect relationship exist or not exist as a direct result of the Proposed Action?)
- Was the concern addressed and resolved through application of the Forest Plan standards and guidelines, or other applicable and appropriate best management practices (BMP)?
- Can the concern be addressed and resolved through implementation of project-specific design criteria associated with the Proposed Action?
- Could the concern be addressed in the effects analysis or in a specialist's report?

Issues were addressed in two ways:

- Developing an alternative that best balances and/or resolves potential effects of the proposed action on various resources, including specific actions and design criteria.
- Effects analysis – disclosing and comparing the relative differences in resource effects between alternatives to acceptable thresholds.

One or both of these methods may be used to address an issue.

Based on scoping comments received and internal review, the Interdisciplinary Team identified preliminary issues/concerns for consideration in this EIS. Issues/concerns are of three types:

- Significant issues[3] are defined as those directly or indirectly caused by implementing the proposed action; however, the effects cannot be reduced by normal Best Management Practices (BMPs) or Project Design Criteria (PDCs). Alternatives were developed to address these issues.
- Analysis issues/concerns are defined as those directly or indirectly caused by implementing the proposed action; however, the effects could be reduced with normal best management practices (BMPs) and project design criteria (PDCs). An alternative was usually not developed to address these analysis issues. However, these analysis issues will be tracked in the relevant resource area effects analyses in Chapter 3 and in Tables 14 and 15, Comparison of Alternatives, and Alternative Comparison of each of the INFISH Riparian Management Objectives.
- Issues eliminated from detailed study, or issues not analyzed in detail, are identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The CEQ NEPA regulations require identification and elimination from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3). These are listed in the project file with the rational for eliminating them from detailed study in this analysis. A partial list, five such issues, are addressed in Table 6, Issues not Analyzed in Detail, starting on page 19

[3] Issues = unresolved conflicts/concerns.

The significant issues and the analysis issues were carried through the analysis in order to fully develop and provide comparison of the proposed action and alternatives. The environmental consequences of the proposal are disclosed in Chapter 3 of the EIS. The significant issues are noted below and displayed in Tables 4 and 5, Significant Issues and Indicators, and Analysis Issues and Indictors.

**Significant Issues**

**Riparian Resources –** Livestock grazing have affected riparian and aquatic ecosystems by disturbing streambanks, removing streamside vegetation, and increasing bank erosion, thus adversely affecting fish habitat and other aspects of the aquatic ecosystem. Riparian inventories have documented extensive areas of streambank and riparian vegetation impacts and identified a degrading trend at most sites such that many streams and wetlands are non-functioning (USDA Forest Service 2011c, 2012a, and 2012b). Desired conditions that are not being met include adequate riparian vegetation, stream bank stability; narrow channels connected with adjacent floodplains, adequate ground cover, and water table elevations for functioning mountain meadows. Poor riparian and aquatic habitat conditions in the upper watershed are adversely affecting fish habitat below.

Accelerated erosion and sediment deposition from hill slope and channel processes can impair aquatic function. Stream channel instability caused by excess deposition of sediment can severely impact aquatic life including the food chain, spawning and rearing habitat, in-stream cover, water temperature, and other structural and functional components.

Sediment samples and field reviews of streams within the BART analysis area indicate fine sediment levels are high in most streams throughout the allotments and most spawning habitat in fish bearing streams are above the Okanogan National Forest, Forest Plan standard for fine sediment levels. The high fine sediment levels suggest streams in the analysis area are unhealthy for aquatic resources and this is one of the greatest concerns for fish habitat. The Okanogan National Forest, Forest Plan, as amended (1989) has a standard percent fines necessary to maintain properly functioning spawning habitat of less than 20 percent fines <1mm.

Table 4 below describes the significant issues and the indicators used for effects comparison between Alternatives.

Table 4, Significant Issues and Indicators

| Significant Issue | Significant Issue Indicator(s) |
|---|---|
| **Riparian Resources (Aquatics/Fisheries) :** Livestock grazing has affected riparian and aquatic ecosystems that resulted in degraded aquatic habitat and fish habitat. Livestock can directly trample streambanks, create trailing in active floodplains, and utilize riparian vegetation in a duration and intensity that de-stabilizes stream channels. The results of these impacts can increase floodplain, surface, and stream channel erosion, increase direct solar input to streams, thus making aquatic habitat non-functioning in its ability to support fisheries life history constraints (i.e. spawning and rearing). | Measure or element for evaluation:<br>• Riparian Vegetation Conditions;<br>• Streambank Condition;<br>• Stream Sediment; |

| | |
|---|---|
| **Hydrology**<br>Livestock grazing has affected riparian and aquatic ecosystems by disturbing streambanks, removing streamside vegetation, and increasing bank erosion, thus adversely affecting hydrologic function, fish habitat and other aspects of the aquatic ecosystem. | Measure of element for evaluation:<br>• Riparian Vegetation Conditions (bare soil);<br>• Sediment (turbidity as surrogate);<br>• Temperature; |

**Analysis Issues**

Table 5 below lists the analysis issues considered for this analysis generated from public comments and/or from the project Interdisciplinary Team. Many comments received focused on improving conditions for all resources, in particular, the health of riparian ecosystems.

Table 5, Analysis Issues and Indicators

| Analysis Issues and Indicators | Analysis Issue Indicator(s) |
|---|---|
| **Water Quality (Hydrology)**:<br>Grazing has the potential to indirectly affect beneficial uses and 303(d) listed waterbodies for the pollutants of nutrients, bacteria, and temperature. | Measure or element of evaluation:<br>• Expected trend for *E. coli* bacteria in project area streams;<br>• Expected trend for temperature in project area streams; |
| **Economic Impacts to Permittees and Community, and Efficiency of Management:**<br>Communities in Okanogan County have historical ties to agriculture. For many residents, ranching is more than just a form of employment; it is a way of life and supports long-standing family traditions. Livestock grazing has economic and social importance to these communities. These allotments support agricultural jobs and income as well as the ranching way of life for many families. A reduction of AUMs will cause a negative economic impact to the economy of Okanogan County.<br><br>Smaller pastures will require the movement of cattle by the permittees more often during periods when cattle are difficult to find and move. | Measure or element for evaluation:<br>• Number of jobs created;<br>• Costs of Range Improvements;<br>• Acres Available for Grazing;<br>• Average Days/Months on Allotments;<br>• Number of Head Months or AUMS on Allotment;<br>• Grazing fees received by the Treasury;<br>• Payments to the 25 Percent Fund;<br>• Number of pastures (movement of cattle); |
| **Wildlife:**<br>Additional fencing can create significant barriers or impediments to normal movement and increase energy demands for wildlife.<br><br>Grazing effects the habitats of threatened, endangered, and sensitive (TES) wildlife species, migratory birds (MB), and Management Indicator Species (MIS). | Measure or element for evaluation:<br>• Miles of Fence Removed;<br>• Miles of Potential Additional Fencing;<br>• Design Elements to Reduce Impacts;<br>• Impacts to threatened, endangered, and sensitive species (TES) wildlife species, migratory birds (MB), management indicator species (MIS), and the associated habitats; |

| Analysis Issues and Indicators | Analysis Issue Indicator(s) |
|---|---|
| **Soil Productivity:**<br>Livestock grazing may affect long term soil productivity by reducing effective ground cover and increasing surface erosion. | Measure or element for evaluation:<br>Percent effective ground cover;<br>Estimated soil erosion;<br>Number of isolated areas of impact where trend is not maintained or improved; |
| **Invasive Species:**<br>Ground-disturbing activities associated with livestock grazing can create opportunities for the establishment of invasive weed infestations, which may result in increased invasive weed populations. | Measure or element for evaluation:<br>Number, location, and extent of new infestations in areas used by livestock that are detected while infestations are manageable; i.e. discovered when size and density of the infestation are small enough that they can be eradicated or controlled to prevent further spread; |
| **Range Resources:**<br>Livestock grazing may affect rangeland and riparian vegetation health by altering plant community composition and structure. | Measure or element for evaluation:<br>• Percent and type of vegetation cover and composition relative to desirable and native plant communities; |
| **Recreation:**<br>Permitted domestic cattle livestock grazing may conflict with recreational use of camping areas. | Measure or element for evaluation:<br>▪ Evidence of domestic cattle livestock activity in camping areas used for recreation; |
| **Threatened, Endangered, and Sensitive Plant Species: (Botany)**<br>Livestock can affect sensitive and native plants by grazing and trampling. Some plants of cultural interest to local Indian tribes may be grazed or trampled. | Measure or element for evaluation:<br>• Trampling and grazing around TESP and cultural plant populations;<br>• Decrease of trampling and grazing of sensitive species and habitat;<br>• Percent and type of vegetation cover and composition that is maintained or increasing; |

**Issues not Analyzed in Detail**

Table 6, Issues not Analyzed in Detail, below, lists the issues not analyzed in detail. These issues are 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan or other higher level decision; 3) irrelevant to the decision to be made; 4) conjectural and not supported by scientific or factual evidence; or 5) or are resolved by mitigation that is similar for all action alternatives.

**Table 6, Issues not Analyzed in Detail**

| Issues not Analyzed in Detail | How Resolved |
|---|---|
| **Cultural Resources:**<br>Livestock may damage cultural resources. The heritage program conducted cultural resource inventories within the boundaries of these allotments. These surveys identified numerous cultural resources which are eligible for listing on the National Register of Historic Places. | By mitigation and monitoring that is similar for all action alternatives. |

| Issues not Analyzed in Detail | How Resolved |
|---|---|
| **Special Use Permits**:<br>Livestock may damage improvements permitted under existing special use permits. | Based on past experience the likelihood of damage is small and does not vary between the alternatives. |
| **Climate Change Effects to Wildlife:**<br>As the climate changes, the resiliency of these forest stands would be important for maintaining biodiversity and allowing these stands and species a chance to adapt to the new conditions. | The proposed livestock grazing would have a neutral outcome on the resiliency of the analysis area related to climate change. |
| **Wildlife Corridors:**<br>The analysis area has been identified as the only modeled linkage through the Okanogan Valley that was consistently identified for all focal species of carnivores. | Livestock grazing will not negatively affect the forested stand cover in the analysis area. Annual available browse for wildlife and domestic livestock would be maintained at Forest Plan standards and guidelines based on the appropriate management area. Overall, the BART grazing analysis will not impact the function of these corridors. |
| **Fire/Fuels** | Effects are similar for all action alternatives. The effects of authorizing grazing on the BART allotments, however negligible, will reduce fine fuels availability to fires, as well as retain grazing infrastructure. |

# CHAPTER 2 – ALTERNATIVES

## Introduction

Chapter 2 describes and compares the alternatives of no grazing; the proposed action; and grazing with additional fencing and water developments, and required resting of units until they meet Forest Plan Standards and Guidelines, PACFISH/INFISH Resource Management Objectives (RMOs), and Desired Future Condition for riparian areas. It also discusses alternatives that were considered but dropped from further analysis because they did not meet the purpose and need described in Chapter 1. This chapter is intended to present the alternatives in comparative form, sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14).

Administrative Actions and Other Requirements
Grazing numbers would be based on Head Months. Permits would be based on Average Animal Use and Cow/Calf Pairs or Yearlings.

The action alternatives establish a maximum limit for Head Months for each allotment. Alternatives propose livestock numbers (an average number of livestock) and the average season of use. Flexibility is maintained for annual adjustment of both numbers and/or season as long as the permitted use level (Head Months) is not exceeded. On an annual basis the actual livestock numbers and period of use may be adjusted in response to discussions with resource specialists and in response to resource needs, range readiness, and monitoring results. The grazing season beginning and ending dates could be varied as much as two weeks from the average season of use allowing flexibility for differences in annual range readiness. Flexibility that allows for annual adjustments provides a management tool to help meet riparian and rangeland objectives.

Changes to numbers and season of use would be displayed in the Annual Operating Instructions (AOI). The permit would display the "average" number of livestock for the "average" season of use (Grazing Permit Administration Handbook 2209.13, Section 15.13; these dates and numbers may vary year by year in AOIs but when combined, would be equal to or less than the maximum permitted AUMs).

Permittees are required to perform all annual maintenance of range improvements (i.e. fences and water developments) assigned in their permits. All existing fences and most water developments would be functional before grazing was authorized on particular BART pastures/units. Current ATV/UTV use, as permitted by current regulation and direction, by the permittees and their agents would be maintained, as needed, for management of improvements.

Appropriate administrative actions (see Table 7, Administrative Adaptive Management Actions for Alternatives 2 and 3, below, for examples) would be taken when the permittee's management is not in compliance with the Annual Operating Instructions (AOI). Consequences would occur (as described in FSH 2209.13, Section 16.21). Under the Terms and Conditions of the Forest Service Term Grazing Permit (Part 2, number 8(b) and Part 3) the Forest Officer in charge may modify the permitted livestock numbers to protect resources. This is consistent with Forest Service Manual (FSM 2200).

Short term administrative actions used to manage annual use within the defined limits of the authorization can be implemented without additional NEPA (FSH 2209.13 Section 92.23b.)

If monitoring indicates that changes are needed, other adaptive management strategies to achieve the objectives of the proposed action could include actions described in Table 7, Administrative Adaptive Management Actions for Alternatives 2 and 3, below.

**Table 7, Administrative Adaptive Management Actions for Alternatives 2 and 3**

| **Livestock Grazing Management Actions[1]** | **Short Term/ Administrative Actions/ Annual Use[2]** | **Long Term/ Allotment Management Actions[2]** | **Actions Permittees can Utilize but the FS Can Not Mandate** |
|---|---|---|---|
| Use of salt or supplements to draw livestock toward or away from specific areas | | | X |
| Using riders/herders to minimize cattle use in problem areas. | | | X |
| Change season of use, not to exceed dates listed in the proposed action | X | X | |
| Change animal numbers, not to exceed AUMs listed in the proposed action | X | X | |
| Change animal class. This refers to the type of animals (Ex: yearling, c/c pair bulls, etc., not sheep versus cattle). | X | | |
| Change number of days of livestock utilization. This is sometimes referred to as duration. | X | | |
| Change the grazing system | X | X | |
| Rest from livestock grazing for one or more years | X | | |
| Alteration of trailing routes timing and location | X | | |
| Existing water developments may be improved if not functioning properly by moving the trough, resetting the spring box, expanding fence to capture spring source and protecting the source, hardening the water overflow with rock & gravel, burying pipeline, returning excess water flow to the stream channel, etc. | X | X | |

*[1] The potential management actions are designed to be used either alone or in combination to meet, or at least, move toward the desired resource condition within a timeframe of ten years. All actions are consistent with Forest Plan and other relevant decision documents (Biological Opinion, etc.)*
*[2] These actions do not require NEPA decision and can be implemented through permit administration as long as they are within the range of the NEPA analysis*

## Development of Alternatives

This chapter includes a detailed description of each alternative, a list of design criteria, and other features of the alternatives. Table 11 presents a Summary of Alternatives for all allotments.

The Interdisciplinary Team used information from public scoping comments, the significant issues identified for the project (see Chapter 1), and direction given by the Responsible Official including Forest Plan direction and amendments, existing State and Federal laws, and field-related resource information to formulate a reasonable range of alternatives.

Each alternative is analyzed in detail to disclose environmental consequences associated with its implementation in Chapter 3.

### Alternatives Considered But Eliminated From Detailed Study

Federal agencies are required by the National Environmental Policy Act (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). The following alternatives or components of alternatives were considered, but eliminated from detailed consideration for reasons summarized below.

**Scheduling Rest on all Stream Reaches that are Functioning at Risk**
This alternative considered construction of temporary exclosure fencing along stream segments that are "functioning at risk" including Jungle, Patterson, Peony, Upper and Lower Aeneas, Lost, and Barnell Creeks on both sides to exclude livestock from the riparian areas. This alternative was not fully developed because analysis indicated that other fencing options would do more to address the purpose and need and the amount of fencing, estimated at 40 miles, would be prohibitive and create poor management feasibility for the allotments. Combinations of management activities, including improvements to infrastructure, changes in timing, duration, and frequency of grazing, are being considered based on the specific recovery needs of each stream reach. Scheduling rest as a stand-alone strategy for recovery of all streams that are functioning at risk was eliminated from detailed study since other proposed strategies that allow continued grazing are expected to be successful. If they are not, the final Stage of Alternative 2 and Alternative 3 would require scheduled rest within 5 pastures (Areas A, B, C, D, and Peony pasture) [see Appendix A, Maps, Alternative 2 Map or Alternative 3 Map for locations] where stream reaches are functioning at risk. Reduction in available grazing acres would impose economic impacts to the permittees and the local economy and may not be necessary since it is believed (Alternative 2) that recovery of stream conditions may successfully be accomplished using a combination of improvements such as locating water troughs and corrals away from riparian areas, use of pasture fencing options, and adjustments to timing, duration, and frequency of grazing may be able to accomplish the same objective.

**Reduction of Permitted Grazing Numbers**
An alternative was considered that would have decreased the annual permitted livestock numbers and Head Months to improve riparian conditions. A capability, suitability, and forage production analysis was completed for all allotments in the analysis area (contained in project files). The study showed that forage availability with the currently permitted livestock Head Month numbers is not a limiting factor in the allotments within the analysis area; generally about 80% of available forage for grazing is being utilized.

Reducing numbers as a stand-alone strategy fails to fully consider the stressors on the riparian systems that are slowing or preventing their recovery. It is believed that recovery of stream conditions can successfully

be accomplished using a combination of range improvements such as locating water troughs and corrals away from riparian areas, use of pasture fencing options, fencing of water sources, and adjustments to timing, duration, and frequency of grazing.

In addition, the Head Months proposed in all alternatives considered in detail were established as a maximum limit. Exercising administrative options allows flexibility for periodic adjustments in livestock numbers and timing, if needed, to achieve desired conditions for streams.

**Implement Current Grazing with existing Range Improvements.**
Current grazing, utilizing only existing improvements, was eliminated as an alternative studied in detail because there is a need for changes to reduce riparian impacts of stream embeddedness, soil compaction, bank stability, stream shade, and riparian vegetation conditions, on streams that are "functioning at risk" within the analysis area. This alternative would not fully meet the purpose and need for the project.

**Continue to Manage the Revis and Bannon Allotments as Separate Allotments.**
The Revis allotment, an existing allotment which has not been utilized for a period of about eight years, currently meets all Forest Plan Standards and Guidelines and does not contain any streams. It combines well with the Bannon allotment because they are only separated by a short fence and the Revis allotment has no water developments or source of its own. Based on resource impact analysis of water availability on the Bannon allotment; available forage and forage conditions on the Revis allotment; and lack of hydrologic, aquatic/fisheries, and soils concerns on the Revis allotment, no reason has been identified for not managing the two separate allotments together. Managing these two separate allotments together would allow the removal of the fence between them, which has been under discussion for a number of years. If the two allotments are managed together without increasing the number of Head Months or season of use from the Bannon allotment, grazing impacts should overall be less due to the increased area of use and additional available forage.

**Prescribed Burning to Create Forage.**
The interdisciplinary team discussed the possibility of prescribed burning to enhance forage in these allotments. This alternative was not analyzed in detail because burning activities may temporarily increase the availability of forage, it would not address the cattle distribution problems in sensitive riparian areas. Forage production is currently adequate within the analysis area to sustain permitted AUMs.

**Dropping Trees to Inhibit Livestock Grazing and Trailing in Riparian Areas.**
Dropping trees to inhibit livestock grazing in riparian areas has both a positive and potential negative effect. The trees make it more difficult for livestock to trail up and down the creek since the trees block access to the riparian area. The down side is that the tree fences also effectively fence the livestock into the riparian areas once they get in with poor escape routes for finding ways out and making it difficult for the herder to push them out of the riparian areas once inside.

## Alternatives Considered In Detail

This FEIS assesses the potential effects of three alternatives: a no action alternative and two action alternatives.

The Head Months proposed in all alternatives considered in detail were established as a maximum limit. Exercising administrative options allows flexibility for periodic adjustments in livestock numbers, grazing season, and grazing system, if needed, to achieve desired conditions.

**Alternative 1 – No Grazing**

Under Alternative 1, all Term Grazing Permits would be cancelled, within 2 years, upon implementation of the decision and resolution of the appeal process. No permits would be issued for any of the affected allotments until, or unless, there was a subsequent NEPA analysis and a decision made to re-stock any or all of the allotments. Permittees would be given two years written advance notice of cancellation of their permits as provided for under 36 CFR 222.4 (a)(1).

During the two years notice prior to cancellation of the permits, livestock would continue to be managed under current management regimes for the existing permits.

Allotment exterior boundary fences would be assigned to adjacent permittees for continued maintenance. All other range improvements could be salvaged, if feasible, or would be left in place and allowed to deteriorate over time. Other agency managed lands and private land boundary fences would remain intact with ownership assumed to belong to the respective landowners. Subsequent decisions would need to be made regarding retention of any range improvements for other resource needs.

The purpose of the No Grazing alternative is to describe the resource effects of cancellation of grazing permits, with no livestock grazing taking place. Motorized access and travel management, timber management, road maintenance, recreation, noxious weed management, and fire protection would continue if this alternative was selected.

**Alternative 2 – Proposed Action (Preferred Alternative)**

The proposed action is to continue livestock grazing at current levels (Table 8) using a combination of existing and new range improvements for each allotment and adaptive management strategies for the Bannon and Tunk allotments to ensure that livestock impacts that affect stream embeddedness decrease, do not adversely affect other resource conditions, and reduce the risk of increased costs associated with additional fencing. Monitoring would be used to assess whether or not conditions, where specified, are moving towards Forest Plan Standards and Guidelines and PACFISH/INFISH Riparian Management Objectives (RMOs). The implementation process is designed to occur in Stages that would allow adequate time for range improvements to be funded, constructed, and evaluated for effectiveness (see Table 8, Stage Decision Point Timing, for estimated timing between Stages). Adaptive management strategies for Bannon and Tunk allotments may or may not be implemented based on the effectiveness of the range improvements executed under Stage 1 or subsequent Stages (See BART Analysis Area, Alternative 2 Map, Proposed Action, in Appendix A).

**Table 8, Maximum Permitted Head Months, AUMs, and Season of Use, Alternative 2**

| Allotment | HMs permitted | AUMs | Livestock Number Cow/Calf pairs | Season of Use |
|---|---|---|---|---|
| Bannon | 602 | 806 | 150 | 6/1-9/30 |
| Aeneas | 1203 | 1610 | 300 | 6/1-9/30 |
| Revis[#] | -- | -- | -- | 6/1–9/30 |
| Tunk | 1556 | 2083 | 388 | 6/1-9/30 |

[#] This allotment is presently not grazed, but will be permitted to be grazed in combination with the Bannon Allotment. There will be no increase in permitted numbers, above the Bannon Allotment allocation.

The “on” and “off” dates may vary by up to two weeks to accommodate seasonal changes from year to year. Cattle may be pulled off the allotments early during drought years, depending on resource conditions.

A monitoring plan has been developed, and trigger points for riparian utilization as described below established, to identify when a specific threshold is about to be reached and changes need to be made (generally moving cattle to another pasture). The construction of additional fences and grazing strategies in subsequent Stages may occur where the permittees and the Forest Service agree that additional fencing would improve livestock management and riparian area conditions. Indicators of desired recovery have been established to determine when grazing could be returned to pastures where grazing has been excluded.

Range specialists will coordinate with the permittees to move livestock to other areas should in-season move triggers be met. If end of season monitoring guidelines are exceeded, alternative livestock grazing management practices (i.e. adaptive management) will be implemented for the following grazing season. These adaptive management strategy decisions may consist of a reduction in time and/or numbers, additional fencing, or an adjustment of monitoring standards for future years. Multiple infractions may ultimately result in suspension of numbers, or cancellation of a permit.

The specific move trigger points for Riparian Utilization are:

- Streambank Alteration of 15% (start moving cattle off prior to exceeding 20% alteration);
- Not to go below a 6-inch mean stubble height for grasses, forbs, or sedges along the green line (only to those habitats suitable to providing a stubble height of greater than 6-inches each year and where criteria can be meaningfully measured).

See the Monitoring section starting on page 44, for the complete monitoring plan. Key to the implementation strategy is allowing adequate time during implementation to first, complete the proposed improvements, second, monitor conditions and third, if needed, allow appropriate permit administration to occur before any subsequent Stages would be initiated. The proposed, staged implementation process is described below.

**Implementation Process**

*Stage 1*

All Allotments
Stage 1 is similar between Alternatives 2 and 3. All proposed improvements described in Alternative 2 would be implemented except the six proposed spring sources *inside* the rested pastures and the corral adjacent to Forest Road 3015 would not be developed until pastures being rested under Alternative 3 are ready to be grazed again (all are in the Tunk and Bannon Allotments). These water developments and the corral would be developed prior to the return of grazing. Those six water developments and the corral are identified below in the Stage 1 description. See Appendix A, Maps, BART Analysis Area Alternative 2 Map, Proposed Action or BART Analysis Area, Alternative 3 Map, for location of the structures listed below.

Any of the water development additions or improvements may be excavated by hand or using heavier equipment such as a small excavator or a backhoe (generally on sites having less than a 30% access route and located closer to existing roads). This will be determined on a site specific basis at the time of construction.

Bannon and Revis Allotments:
Remove a portion of the Revis boundary fence, about 1.1 miles in length, in Section (S.) 7 & 8, Township (T.) 36 North (N.), Range (R.) 29 East (E.), within National Forest System land in order to incorporate the Revis Allotment with the Bannon Allotment. (Permitted livestock numbers would not increase on the Bannon Allotment).

Rest the Peony pasture until Indicators of Desired Recovery are reached. The corral located in the NE ¼ of S. 29, T. 36 N., R.29 E., within the Peony Pasture, would be utilized periodically for livestock control while moving cattle between pastures, and during gathering at the end of the grazing season.

Remove the Bannon water catchment structure in the NW ¼ of S. 7, T. 36 N., R. 29 E.

Move the Patterson trough out of the creek at SW ¼ of S. 8, T. 36 N., R. 29 E. and fence the water source.

Along Cole Creek, in the Cat pasture, move the Mike trough out of the inner gorge of the riparian area and install a small exclosure fence to protect the spring source at the creek in the SE ¼ of S. 9, T. 36 N., R. 29 E.

Develop a spring source and place a trough or crib just above the fence dividing the Cat and Peony Pasture, NW ¼ of S. 21, T. 36 N., R. 29 E. Install a small exclosure fence to protect the spring source

Reconstruct the Grouse water development using a backhoe/mini excavator to install a new spring box, pipes, fence, and trough in the SW ¼ of the SE ¼ of S. 19, T. 36 N., R. 29 E..

Reconstruct the pasture water development, including an exclosure fence, in the NE ¼ of the SE ¼ of S. 21, T. 36 N., R. 29 E. (delayed construction until the Peony pasture, being rested, meets DFC and is ready to be grazed again).

Aeneas Allotment:
Install a fence (approximately 1.5 miles long) north of National Forest Road 30 (S. 11 & 12, T. 35 N., R. 29 E.) that would restrict livestock access to Aeneas Creek and eliminate access to lower Jungle Creek and the associated wetlands. This fence would connect to the Aeneas/Tunk boundary fence and the Sneed and Bailey pastures boundary fence. This construction, and the movement of the fence listed below, will create an exclosure area incorporating portions of lower Jungle Creek and Aeneas Creek.

Move approximately 1 mile of existing fence to the south, out of the riparian area on the south side of Aeneas Creek in S. 14, T. 35 N., R. 29 E.

Develop the spring source with a pump and place two troughs above the new fence in the Sneed pasture at Aeneas Creek, S. 12, T. 35 N., R. 29 E.. Install a small exclosure fence to protect the spring source.

Develop the spring source and place a trough in the SW ¼ of the SE ¼ of S. 7, T. 35 N., R. 30 E. Fence around spring source and meadow, < ½ acre.

Develop the spring source and place a trough in the NW ¼ of S. 31, T. 35 N., R. 29 E. Fence around the wetland, < 1/10$^{th}$ acre.

Develop the spring source and place a trough in the SE ¼ of the NW ¼ of S. 11, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source.

Install a hardened, rocked, and fenced, crossing for livestock access and watering at Aeneas Creek. A wire gate would be installed in the fence at this crossing.

Relocate the Jungle Creek corrals away from Jungle Creek, to a location outside of the RHCA, and remove the existing trough from Jungle Creek (S. 11, T. 35 N., R. 29 E., move to along Forest System Road [FSR] 30).

The length and timing of livestock grazing within the Bailey pasture (South pasture) would be adjusted if monitoring determines that habitat indicators such as bank stability, greenline to greenline width and streamside vegetation are not moving towards meeting Forest Plan Standards and Guidelines and INFISH/PACFISH RMOs (FPS and Gs/RMOs) or in the case of seasonal climatic fluctuations such as drought which result in the need to adapt management to changing conditions. Modifying the season of use for the allotment would keep to the two weeks parameter for livestock on and off dates. A likely scenario would be for an early season, reduced grazing period (June 1 to July 1) during alternating years with a mid-season reduced grazing period (July 1 to August 1) during alternate years.

Tunk Allotment:
Continue the current practice of resting the Lost/Barnell pastures every other year. On grazed years, monitoring would be implemented to ensure that conditions along Lost and Barnell Creeks remain on a trajectory towards attaining Forest Plan Standards and Guidelines/Riparian Management Objectives (FPS and Gs/RMOs). Triggers have been developed which would determine the need to move cattle. Use will be authorized based upon meeting FPS and Gs/RMOs. Range readiness for soils and vegetation must be met. This means soils must be firm at the time of livestock turnout, after approximately July 1 and prior to approximately September 1. Livestock use will be authorized during times when aspen and willows are less attractive to browsing. These species are more attractive after the 1st frost, approximately September 1. Upon reaching Indicators of Desired Recovery, additional grazing may be considered.

Construct a corral adjacent to Forest Road (FR) 3015 on the south side of the junction of FSR 3015 and FSR 30150125 in the NW ¼ of S. 29, T. 36 N., R. 29 E. (delayed construction in alternative 3, Area B).

Develop a spring source, place trough, and construct a fence to protect the source and adjacent wetland in the SW ¼ of S. 29, T. 36 N., R. 29 E. (delayed construction in alternative 3, Area B).

Develop a spring source and place a crib or trough in the SE ¼ of the NE ¼ of S. 31, T. 36 N., R. 29 E. Install a small exclosure fence to protect the spring source.

Develop a spring source and place a trough at the spring outside No Name Creek in the NE ¼ of the SE ¼ of S. 36, T. 36 N., R. 28 E. Install a small exclosure fence to protect the spring source.

Develop a spring source and place two livestock watering troughs in the NE ¼ of S. 33, T. 36 N., R. 30 E. Construct a fence to protect the water source and wetland.

Develop a spring source and place a crib or trough in the NW ¼ of the SW ¼ of S. 3, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source.

Develop two springs and place cribs or troughs in the NE ¼ of S. 22, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source (delayed construction in alternative 3, Area C).

Develop a spring source and place crib or trough in the SW ¼ of S. 21, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source (delayed construction in alternative 3, Area D).

Remove a temporary fence along Barnell Creek in S. 27, T. 35 N., R. 29 E., about 0.6 miles in length.

Move the Block water development downhill and install a crib in the NE ¼ of S. 27, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source.

Reconstruct the unnamed water development in the SE ¼ of S. 22, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source.

At Bench Creek, develop a spring source, fence around the spring source for protection, and place a trough below the road in the SE ¼, S. 34, T. 36 N., R. 29 E.

Develop a spring source and place a trough at the spring in the draw in SW ¼, S. 4, T. 35 N., R. 29 E. Fence the water source and wetland (delayed construction in alternative 3, Area C).

Develop a spring source and place a trough at the spring in the NE ¼, S. 4, T. 35 N., R. 29 E. Fence the water source and wetland (delayed construction in alternative 3, Area C).

Develop a spring source and place a trough at the spring in the shallow draw east of Peony Creek and north of FSR 3010 in the NE ¼ of the SW ¼, S. 28, T. 36 N., R. 29 E. Fence the water source and wetland (delayed construction in alternative 3, Area B).

Adaptive Management Strategies for Bannon and Tunk Allotments

***Stages 2, 3, and 4 are shown in an example order for discussion purposes only. Their order of implementation may be modified based on project monitoring results of the associated stream reaches with management actions to be completed first in the stream reaches most in need of reduced riparian impacts from livestock. The order will be determined based on monitoring of conditions described by the Project Fish Biologist and Project Hydrologist.***

*Stage 2, Tunk and Bannon Allotments*

If monitoring of management strategies described in Stage 1 indicates that the health and functions of the riparian resources are degrading as a result of livestock use or resources are not moving towards meeting Forest Plan Standards, DFCs, or preventing or retarding the attainment of INFISH Riparian Management Objectives (RMOs) in Upper Jungle Creek of the Tunk Allotment, then, if agreed to by the permittees, construct fence 2 shown in Appendix A, Maps, BART Analysis Area, Alternative 2 Map, Proposed Action. The proposed fence is designed to aid in livestock management in the Tunk allotment and reduce livestock impacts to Upper Jungle Creek and Aeneas Creek. Livestock grazing would continue within the new fenced pastures unless monitoring indicates that trigger points, indicating a need to move livestock are being reached. Cattle would then be moved to the next pasture or off the Forest.

This fence would be approximately 3.9 miles in length around the north slopes of Jungle Creek and tributaries within the SE ¼ of S. 32, T. 36 N., R. 29 E. and Sections 3, 4, 5, 6, 7, & 8 of T. 35 N., R. 29 E. which will tie into existing fences. This would create an additional pasture (Area C; Appendix A, Maps, BART Analysis Area, Alternative 2 Map, Proposed Action) within the North Unit of the Tunk Allotment that would be grazed as determined by forage capacity and Desired Future Conditions. Active herding

would be authorized through this pasture into the area west and north of the fence along existing routes of stock drives and roads when moving from the North to South pastures.

*Stage 3, Tunk and Bannon Allotments*

If, after monitoring a full grazing season after completion of Stage 2 indicates that the health and function of the riparian resources are not improving as a result of livestock use or resources are not moving towards meeting Forest Plan Standards or preventing or retarding attainment of INFISH Riparian Management Objectives (RMOs) in the Aeneas and Jungle Creek areas of the Tunk Allotment, then Stage 3 adaptive management would be implemented.

With the permittees agreement, this would entail constructing approximately 3.2 miles of fence from the Forest Boundary in S. 17, T. 35 N., R. 29 E., east to Forest Road 30 in S. 23 in order to create an additional pasture (Area D; Appendix A, Maps, BART Analysis Area, Alternative 2 Map, Proposed Action) south of the existing boundary fence between the North and South pastures, that would be grazed as determined by forage capacity. Active herding would be authorized through this pasture into the area west and north of the fence along the existing route of stock drives and roads, when moving from the North to South units.

*Stage 4, Tunk and Bannon Allotments*

If, monitoring a full grazing season following Stage 3 implementation indicates that the health and function of resources is degrading as a result of livestock use or resources are not moving towards meeting Forest Plan Standards, or preventing or retarding attainment of PACFISH/INFISH Riparian Management Objectives (RMOs) in the Patterson and Upper Peony Creek areas of the Tunk and Bannon Allotments then Stage 4 adaptive management would be implemented.

With permittees agreement, this would entail constructing approximately 2.7 miles of fence around Peony Creek within the North pasture of the Tunk Allotment (Sections 28, 29, 30, 32, and 33 of T. 36 N., R. 29 E.). This would create an additional pasture (Area B; Appendix A, Maps, BART Analysis Area, Alternative 2 Map, Proposed Action) within the North pasture that would be grazed as determined by forage capacity and desired conditions. Active herding would be authorized through this pasture into the area west and north of the fence along existing stock drives and roads when moving from the North to South Pastures. With permittees agreement, this would also entail constructing approximately 1.3 miles of fence along Patterson Creek (Area A) in the Bannon Allotment (Sections 8 & 18, T. 36 N., R. 29 E.). A water gap would be installed along this fence in section 8.

*Stage 5, Tunk and Bannon Allotments*

If monitoring does not show improvements from livestock management strategies described above in Stages 1 through 4 or are not protecting the continued health and function of resources or are not yielding improved riparian conditions in streams functioning at risk in the Bannon and/or Tunk allotments, in particular streambank stability, then additional adaptive management measures would be taken to reduce livestock impacts in the Bannon and Tunk allotment(s). Monitoring requirements and parameters are shown starting on page 44. If the stream banks do not begin to stabilize and exhibit signs of healing from trampling effects, such as improved vegetative ground cover, then reductions in the current grazing season, reductions in the numbers of Animal Unit Months (AUMs) of grazing, and/or using a rest/rotation strategy for 2 years for the affected allotments would be implemented (See Table 7, Administrative Adaptive Management Actions for Alternatives 2 and 3, above). If that is not successful, total livestock exclusion from the 4 fenced areas (A, B, C, D) would be implemented. It is expected that the Indicators of Desired Recovery for Re-grazing,

Alternatives 2 and 3 (page 32) and Indicators of Desired Recovery for Re-grazing (page 50), would be fully met prior to the return of grazing on the Bannon and Tunk allotments. Table 9, Stage Decision Point Timing, below, estimates the time for monitoring between moving between the different stages of the project for Alternative 2. This period between starting the project and moving to Stage 5 would be 10 – 13 years.

**Table 9, Stage Decision Point Timing**

| Stage | Estimated Monitoring Time Between Moving to Next Stage (years) | Comments |
|---|---|---|
| 1 | 4 | It is assumed that it will take 2 years to complete removal/reconstruction and construction of items in Stage 1. The construction of the Jungle Creek fence (new fence construction year 1) and moving the Aeneas Creek fence south (year 1) , moving of the Jungle Creek Corral, and construction of most of the water developments and other facilities in the first year with the remainder of the construction in the second year. This would be followed by 2 years of monitoring to determine if management strategies have reduced livestock impacts on riparian areas. Monitoring will look for overall improvement (assume some monitoring locations will improve and some monitoring locations may stay the same or deteriorate). |
| 2+ | 2 - 3 | It is assumed that construction of the 3.9 miles of fence, fence 2, would be completed in one - two years and that would be followed by one year of monitoring to determine if management strategies had reduced livestock impacts on riparian areas and resources are moving towards meeting Forest Plan Standards & Guidelines and PACFISH/INFISH Riparian Management Objectives (RMOs). |
| 3+ | 2 – 3 | It is assumed that the construction of the additional 3.2 miles of fence (fence 3) would be completed in one – two years and that would be followed by one year of monitoring to determine if management strategies had reduced livestock impacts on riparian areas and resources are moving towards meeting Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs. |
| 4+ | 2 - 3 | It is assumed that the construction of the additional 4.0 miles of fence (fences 4) would be completed in one – two years and that would be followed by one year of monitoring to determine if management strategies had reduced livestock impacts on riparian areas and resources are moving towards meeting Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs. |
| 5 | N/A | If improvements and livestock management strategies are not protecting the continued health and function of resources or are not improving riparian conditions in the Bannon and/or Tunk allotment(s), in particular stream banks, additional administrative measures would be taken to reduce livestock impacts, such as reductions in the current grazing season, reductions in numbers, and/or a rest/rotation strategy for 2 years for the affected pastures that have not shown an overall improvement to determine if there is adequate improvement. If no improvements are shown after 2 years, total livestock exclusion from the 4 fenced pastures [A, B, C, D] (only the pastures that have not shown an overall improvement) would be implemented. It is expected that the Standards for When to Re-graze Pastures, Alternatives 2 and 3, below and Indicators of Desired Recovery for Re-grazing on page 50, would be fully met prior to the return of grazing on these pastures. |

+ ***Stages 2, 3, and 4 are shown in an example order for discussion purposes only. Their order of implementation may be modified based on project monitoring results of the associated stream reaches with management actions to be completed first in the stream reaches most in need of reduced riparian impacts from livestock. The order will be determined based on monitoring of conditions described by the Project Fish Biologist and Project Hydrologist.*** *All fences will be constructed within a 2 year*

*period of moving to the next Stage, after Stage 1. The time period between Stages is based on 1 year of monitoring after the fences are constructed. Monitoring will look for overall improvement (assume some monitoring locations will improve and some monitoring locations may stay the same or deteriorate).*

**Indicators of Desired Recovery for Re-grazing, Alternatives 2 and 3**

Pastures would be rested until riparian and aquatic habitats are functioning properly. Suitable conditions for re-grazing include, but are not limited to, bank stability of 90%, or greater, as well as a robust streamside vegetation composition that armors the fine-grained streambanks, resists erosion, provides shade and nutrient input, and inhibits cattle access. Following a few years of rest and some annual monitoring, the ID Team would review the monitoring site for meeting the above desired conditions. The team would assess riparian conditions to determine if the area is ready to handle grazing again and at what intensity.

**Alternative 3**

Alternative 3 was developed to provide cattle grazing and accelerated riparian resource improvement to streams functioning at risk to reduce stream embeddedness and stabilize stream banks that are not meeting Forest Plan Standards and Guidelines, and PACFISH/INFISH Riparian Management Objectives (RMOs). This alternative includes management flexibility to cope with fluctuations in short term environmental changes, such as seasonal weather patterns, while providing the ability to respond to permittee requests for reasonable operational adjustments. Maximum permitted Head Months, AUMs, and the Season of Use are shown in Table 10 below.

**Table 10, Maximum Permitted Head Months, AUMs, and Season of Use, Alternative** 3

| Allotment | HMs permitted | AUMs | Livestock Number Cow/Calf pairs | Season of Use |
|---|---|---|---|---|
| Bannon | 602 | 806 | 150 | 6/1-9/30 |
| Aeneas | 1203 | 1610 | 300 | 6/1-9/30 |
| Revis[#] | -- | -- | -- | 6/1–9/30 |
| Tunk | 1556 | 2083 | 388 | 6/1-9/30 |

[#] This allotment is presently not grazed, but will be permitted to be grazed in combination with the Bannon Allotment. There will be no increase in permitted numbers, above the Bannon Allotment allocation.

The “on” and “off” dates may vary by up to two weeks to accommodate seasonal changes from year to year. Cattle may be pulled off the allotments early during drought years, depending on resource conditions.

This alternative is anticipated to be implemented within a four year time frame (described below) that includes the installation of water developments and fences in the first year (year 1 fence construction and relocation, see maps in Appendix A, Maps, BART Analysis Area, Alternative 3 Map), the construction of a fence in the North Tunk pasture in the second year (fence 2), and the remainder of the proposed fences (fences 3 and 4) would be installed in the 3rd and 4th years. The 4 new pastures (A, B, C, & D, shown in Appendix A, Maps, BART Analysis Area, Alternative 3 Map ) which are not currently meeting Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs would be rested until the desired future condition is met. The intent is for long-term rest of these pastures, likely greater than 10 years.

This alternative incorporates new water developments, fences, rested pastures, and monitoring to accelerate improvement of degraded riparian and stream conditions. Monitoring would determine progress in attainment of Forest Plan Standards and Guidelines, and attainment of PACFISH/INFISH RMOs in both

rested and non-rested pastures. Monitoring results would be used to determine the length of time each non-rested pasture is grazed, as well as progress in achievement of desired conditions in rested pastures.

The same monitoring plan used for Alternative 2 would be used to assess whether or not the desired results for Forest Plan Standards and Guidelines, and PACFISH/INFISH RMOs are being achieved. Trigger points for riparian utilization as described below in Indicators of Desired Recovery for Re-grazing, starting on page 50, have been developed and would be utilized to identify when a specific threshold is about to be reached and cattle need to be moved. For instance, if monitoring indicates that a threshold for stream bank alteration is being reached, that would trigger the need to move cattle to the next pasture or off the allotment prior to the end of the season.

Range specialists will coordinate with the permittees to move livestock to other areas should in-season move triggers be met. If end of season monitoring guidelines are exceeded, alternative livestock grazing management practices (i.e. adaptive management) will be implemented for the following grazing season. These adaptive management strategy decisions may consist of a reduction in time and/or numbers, additional fencing, or an adjustment of monitoring standards for future years. Multiple infractions may ultimately result in suspension of numbers, or cancellation of a permit.

The specific trigger points for Riparian Utilization are:

- Streambank Alteration of 15% (start moving cattle off prior to 20% alteration);
- Stream –site stubble height not to go below a 6-inch mean stubble height for grasses, forbs, or sedges along the green line (this standard only applies to those plants which are capable of exceeding that height each year and to monitoring sites where these monitoring criteria can be meaningfully measured).

See the Monitoring requirements and parameters starting on page 44 for the complete monitoring plan.

Bannon and Revis Allotments
All proposed improvements described in Alternative 2 would be implemented including the construction of 1.3 miles of fence along the west side of Patterson Creek in Sections 8 and 18 of T. 36 N., R. 29 E. A water gap would be installed along the Patterson Creek fence in Section 8.

Aeneas Allotment:
All proposed improvements described in Alternative 2 would be implemented.

Tunk Allotment:
All proposed improvements described in Alternative 2 would be implemented except the six proposed spring sources/water developments and the corral adjacent to Forest Road 3015 *inside* the rested pastures would not be developed until pastures being rested are ready to be grazed again. These spring sources/water developments and corral would be developed prior to the return of grazing in these pastures. These developments are listed below and are shown in Appendix A, Maps, BART Analysis Area Alternative 3 Map.

Construct a corral adjacent to Forest Service Road (FSR) 3015 on the south side of the junction of FSR 3015 and FSR 30150125 in the NW ¼ of S. 29, T. 36 N., R. 29 E. (Area B).

Develop a spring source, place trough, and construct a fence to protect the source and adjacent wetland in the SW ¼ of S. 29, T. 36 N., R. 29 E. (Area B).

Develop two springs and place cribs or troughs in the NE ¼ of S. 22, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source (Area C).

Develop a spring source and place crib or trough in the SW ¼ of S. 21, T. 35 N., R. 29 E. Install a small exclosure fence to protect the spring source (Area D).

Develop a spring source and place a trough at the spring in the draw in SW ¼, S.4, T. 35 N., R. 29 E. Fence the water source and wetland (Area C).

Develop a spring source and place a trough at the spring in the NE ¼, S. 4, T. 35 N., R. 29 E. Fence the water source and wetland (Area C).

Develop a spring source and place a trough at the spring in the shallow draw east of Peony Creek and north of FSR 3010 in the NE ¼ of the SW ¼, S. 28, T. 36 N., R. 29 E. Fence the water source and wetland (Area B).

**Implementation Process:**

Year 1

- Relocate or remove undesirable troughs as described above and in Alternative 2.
- Develop new water sources outside proposed rested areas.
- Construct approximately 1.5 miles of fence north of Jungle Creek in the Aeneas Allotment.
- Move approximately 1 mile of existing fence to the south, out of the riparian area on the south side of Aeneas Creek in S. 14, T. 35 N., R. 29 E.
- Initiate other improvements as described in Alternative 2, above, such as drift fence removal along Barnell Creek, corral removal in Jungle Creek & new construction adjacent to Forest Road 30.

Year 2

- Construct approximately 3.9 miles of fence around the north slopes of Upper Jungle Creek and tributaries within (SE ¼, S. 32, T. 36 N., R. 29 E., and Sections 3, 4, 5, 6, 7, & 8, T. 35 N., R. 29 E.) North Unit of Tunk Allotment that will tie into existing fences, for rest from livestock grazing. Rest would continue until Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs are achieved.

Year 3

- Construct approximately 3.2 miles of fence from the Forest Boundary in S. 27, T. 35 N., R. 29 E., east to FSR 30 in Section 23 south of the existing boundary fence between the North and South units in the Tunk Allotment, for rest from livestock grazing.

Year 4

- Construct approximately 2.7 miles of fence around Peony Creek within the North Pasture. This would create an additional pasture within the North Unit that would be grazed as determined by forage capacity and DFCs (Sections 28, 29, 30, 32, and 33, T. 36 N., R. 29 E.).
- Install approximately 1.3 miles of fence along west side of Patterson Creek in the Bannon Allotment, with a water gap.

Reintroduction of limited livestock grazing would be considered after the Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs in the rested pastures have been reached. This is further

displayed in the Indicators of Desired Recovery for Re-grazing, Alternatives 2 and 3 starting on page 32 and Indicators of Desired Recovery for Re-grazing starting on page 50

## Summary of Alternatives

Table 11, Summary of Alternatives, below, provides a quick summary of some of the key points about each alternative.

**Table 11, Summary of Alternatives**

| | **Alternative 1** | **Alternative 2** | **Alternative 3** |
|---|---|---|---|
| **Grazing** | Grazing would continue for up to 2 years following the decision. After that, no grazing would be allowed without a new NEPA decision. | On an annual basis range management strategies, such as livestock numbers and period of use may be used in response to resource needs, range readiness, and monitoring. The Animal Unit Month numbers shown in Table 8 (page 25 for each allotment is the maximum use limit. | On an annual basis range management strategies, such as livestock numbers and period of use may be used in response to resource needs, range readiness, and monitoring. The Animal Unit Month numbers shown in Table 10 (page 32) for each allotment is the maximum use limit. |
| **Time Frame** | Grazing would continue for up to 2 years following the decision. After that, no grazing would be allowed without a new NEPA decision. | The proposed actions are designed to occur in Stages that would allow adequate time for improvements to be constructed and evaluated for effectiveness. Monitoring would determine the need to implement additional Stages. Expected time frame is less than 15 years. | This alternative is expected to occur over a four year time frame that includes the installation of water developments and construction of a fence along Jungle Creek and movement of a fence south of Aeneas Creek in the first year, the construction of a fence in the North Tunk pasture in the second year, the construction of a fence in the South Tunk allotment in the third year, and the construction of the remainder of the proposed fences in the 4th year. |
| **Pasture Rest** | Grazing would continue for up to 2 years following the decision. After that, no grazing would be allowed without a new NEPA decision. | Rest Peony Pasture until the criteria, listed starting on page 32 and 50, for when to re-graze rested pastures is fully met.<br><br>Continue to rest Lost/ Barnell pastures every other year.<br><br>Monitoring would determine the need for resting pastures A, B, C, | Rest Peony Pasture until the criteria, listed starting on page 32 and 50, for when to re-graze rested pastures is fully met.<br><br>Continue to rest Lost/Barnell pastures every other year.<br><br>Year 3 and beyond, rest pasture C (Jungle Creek pasture) of the north unit of the Tunk allotment until the |

| | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| | | and/or D during Stage 5. The criteria, listed starting on page 32 and 50, for when to re-graze rested pastures would be fully met prior to returning grazing to the above 4 pastures | criteria, listed starting on page 32 and 50, for when to re-graze rested pastures is fully met<br><br>Year 4 and beyond, rest pasture D (North Pasture in South Unit of Tunk Allotment) until the criteria, listed starting on page 32 and 50, for when to re-graze rested pastures is fully met.<br><br>Year 5 and beyond, rest pastures A (East Patterson Creek) and B (Upper Peony Creek) in Barnell and Tunk Allotments, respectively until the criteria, listed starting on page 32 and 50, for when to re-graze rested pastures is fully met |
| **Livestock numbers and Grazing** | 0 AUMs/ 0 HMs after 2 years | Total AUMs 4,451 or Total HMs 3,361* | Total AUMs 4,451 or Total HMs 3,361* |
| **Improvements and Structures** | All current infrastructures would be left to deteriorate over time, or be salvaged, if possible, except for allotment boundary fences that adjoin other allotments outside the analysis area.<br><br>Maintenance of these allotment boundary fences would be assigned to adjacent permittees. | 1.5 miles of fence construction and 1.0 mile of fence relocation, plus spring source protection fencing.<br><br>Monitoring would determine the need for an additional 10.1 miles of optional fence construction per adaptive management.<br>• Bannon/Revis: 1.3 miles<br>• Aeneas: 0 miles<br>• Tunk: 8.8<br><br>Develop 16 new spring sources, including fencing of the water sources, if feasible<br>• Bannon/Revis: 1<br>• Aeneas: 4<br>• Tunk: 11<br><br>Move or reconstruct 7 water | 13.6 miles of fence construction/reconstruction plus spring source protection fencing.<br>• Bannon/Revis: 1.3 miles plus spring protection fences.<br>• Aeneas: 2.5 miles plus spring protection fences.<br>• Tunk: 8.8 miles plus spring protection fences.<br><br>Develop 13 new spring sources, including fencing of the water sources, if feasible<br>• Bannon/Revis: 1<br>• Aeneas: 4<br>• Tunk: 8<br>After rest is completed and prior to the return of cattle to the rested pastures (A, B, C, D, and Peony Pasture) an |

| | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| | | developments including fencing of the water sources, if feasible:<br>• Bannon/Revis: 5<br>• Aeneas: 0<br>• Tunk: 2<br><br>Construct 1 new corral and relocate 1 existing corral. | additional 7 water developments would be installed in the rested pastures, including fencing of water sources, if feasible.<br><br>Move or reconstruct 7 water developments, including fencing of the water sources<br>• Bannon/Revis: 5<br>• Aeneas: 0<br>• Tunk: 2<br><br>Construct 1 new corral and relocate 1 existing corral. |

* Only includes Head Months and AUMs on National Forest System land.

## Mitigation Measures, Management Requirements, and Best Management Practices

### Mitigation Measures

The National Environmental Policy Act defines "mitigation" as avoiding, minimizing, rectifying, reducing, eliminating or compensating for project impacts.

Mitigation measures are important mechanisms used by the BART analysis team to minimize the potential adverse environmental impacts associated with the proposed actions. For the BART analysis, mitigation measures are included in the design of this project and are integral components of Alternative 2, the proposed action, and Alternative 3. For example, alternative design features such as the proposed fences and water developments are designed to reduce adverse impacts to streams and riparian areas. Additional mitigation measures have been developed to minimize, reduce or avoid any potential adverse impacts to other resources such as reducing the risk of noxious weed establishment.

Many mitigation measures are considered to be Best Management Practices (BMPs) for watershed, and vegetation management and General Water Quality Management. Best Management Practices are "practices or combinations of practices that are determined by a State (or designated area-wide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation, to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing impacts to water quality and other resources.

In addition to BMPs, included in the project design, are Forest Plan Standards and Guidelines which are standards for resource protection, vegetation manipulation, riparian areas, soil and water diversity, to be met in accomplishing National Forest System goals and objectives (Okanogan National Forest, Land and Resource Management Plan [LRMP], Final Environmental Impact Statement, [FEIS] USDA, 1989).
All effects analyses in Chapter 3 of this Environmental Impact Statement are based upon the implementation of the Regulatory Framework (Appendix G), project mitigation measures, Management Direction and BMPs. Table 12, Mitigation Measures for BART Grazing Analysis, below, describes the mitigation measures developed specifically for issues relating to this project.

**Table 12, Mitigation Measures and Permit Requirements for the BART Grazing Analysis**

| Mitigation Measure | Objective | Effectiveness/Rationale | Administration |
|---|---|---|---|
| **Noxious Weeds** | | | |
| Coordinate livestock entry with on-going herbicide applications author-ized in previous NEPA decisions (USDA 2000a & 1997b) to treat yellow hawkweed sites in Sections 9, 10, 15, & 16, T. 35 N., R. 28 E. | To avoid livestock grazing on flowering yellow hawkweed before application and until herbicide has dried. | HIGH<br>Label requirements and Noxious Weed Specialist experience | Rangeland Management Specialists or Noxious Weed Specialists |
| Check areas of concentrated livestock use for weed establishment. Treat new infestations under existing NEPA decisions (USDA 2000a and 1997b) and under future invasive species decisions (Okanogan – Wenatchee National Forest Invasives Plant Treatment EIS). | Early detection for preventing spread and facilitating Forest Service control measures | MODERATE to HIGH: Experience | Weed Coordinator & Technicians, Rangeland Management Specialist & Technicians, and the permittees |
| Apply Noxious Weed Best Management Practices (BMPs) and site specific BMPs for preventing noxious weeds during grazing activity. The following is listed in more detail in the analysis file and Appendix I, Noxious Weed Risk Assessment & BMPs. | To reduce the spread of noxious weeds by livestock. | MODERATE to HIGH: Noxious Weed Specialist Experience | Noxious Weed Specialists, Rangeland Management Specialists, and the permittees |
| Use weed-free or weed-seed-free hay or straw (or best available) in permitted areas. | Prevention | MODERATE: Noxious Weed Specialist Experience | Noxious Weed Specialists, Rangeland Management Specialists, the permittees |
| Feed weed-free feed to livestock for several days prior to moving them onto the allotment to reduce the introduction of new invaders and spread of existing weed species. Use transitional pastures when moving animals from weed infested areas to the National Forest and before leaving National Forest System lands. (Transitional pastures are designated fenced areas that can be logistically and economically maintained). | Prevention | MODERATE: Noxious Weed Specialist Experience | The permittees are responsible. |
| If livestock are transported from a weed-infested area, hold them for seven to ten days prior to moving into an uninfected area at a designated holding pen. Monitor holding site for noxious weed introduction. | Prevention | MODERATE to HIGH: Noxious Weed Specialist Experience | Weed Coordinator & Technicians Rangeland Management Specialist & Technicians and the permittees. |

| Mitigation Measure | Objective | Effectiveness/Rationale | Administration |
|---|---|---|---|
| Avoid travel through existing weed patches and minimize the amount of disturbance caused by ATV/UTV travel. | To reduce the risks of spreading existing weed populations throughout the analysis area. | HIGH: Noxious Weed Specialist Experience | Rangeland Management Specialists or Noxious Weed Specialists |
| Discuss weed prevention practices and control measures at annual meetings and include outcomes in the Annual Operating Plans. Items to be addressed in the plan may include: minimizing ground disturbance, weed seed transportation, maintaining healthy vegetation, control methods, re-vegetation, monitoring, reporting, and education. | To reduce the spread of noxious weeds by livestock. | MODERATE to HIGH: Noxious Weed Specialist Experience | Weed Coordinator & Technicians, Rangeland Management Specialist, & Technicians and the permittees |
| Develop weed identification and mapping program for permittees, provide permittees with weed identification material. | Educate and assist in early detection | MODERATE to HIGH: Noxious Weed Specialist Experience | Weed Coordinator, Rangeland Management Specialist & Technicians, and the permittees |
| Exclude livestock from sites with new invaders or manage new invaders in these areas before entry by livestock. | Prevention | MODERATE to HIGH: Noxious Weed Specialist Experience | Weed Coordinator & Technicians Rangeland Management Specialist & Technicians, and the permittees |
| Re-vegetate, reseed, bare soil areas due to grazing activities | Prevent introduction or establishment of weeds | MODERATE to HIGH: Experience | Weed Coordinator & Technicians, Botanist, Rangeland Management Specialist & Technicians, and the permittees |
| Inspect & clean all off road (ex: ATVs/ UTVs) equipment prior to entering the project site. Clean equipment prior to leaving site only if new invaders are present. | Prevention | MODERATE: Experience | Weed Coordinator, Rangeland Management Specialist, & Botanists, and the permittees |
| **Wildlife** | | | |
| Allotment management activities by humans will not be allowed near active wolf den sites during the denning period (late April to late June), to avoid human disturbance of the site. The distance will be determined on a site-specific basis and will depend primarily on topography around the den site. | To prevent human disturbance of wolf denning sites. | MODERATE: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |

| Mitigation Measure | Objective | Effectiveness/Rationale | Administration |
|---|---|---|---|
| Install small mammal escape ramps on all water troughs to be included if Alternative 1, No Grazing, is selected | To prevent water troughs from becoming traps for small mammals, frogs, and salamanders that may fall into a water trough. | HIGH: Experience | Rangeland Management Specialist & Technicians, or other Forest Service personnel |
| All human, prepared livestock and pet foods, and human refuse associated with livestock operations would be properly stored, handled, and disposed of. This includes using canned food or storing food in other sealed containers. All edibles and garbage would be hung out of reach, secured in a solid-sided bear-proof container, burned, or packed out. | To discourage grizzly bears from being attracted to human camps and becoming acclimated to humans. | HIGH: Experience, Grizzly Bear Guidelines (1986) | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| Permittees should take appropriate measures to prevent turnout of sick or diseased animals. Sick or diseased animals would be removed or eliminated as soon as possible after their recognition, so they are not targeted by bears or wolves. | To prevent spread of disease and prevent the death of livestock on the allotments | MODERATE to HIGH: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| Livestock carcasses found on areas of the allotment where they would attract bears and wolves to a potential conflict situation with other livestock, (such as a salting ground, water source, or holding corral) must, in a timely manner, be removed, buried, or otherwise disposed of such that the carcass will not attract bears or wolves. If the dead livestock is near water or designated roads, trails, or recreation sites, it would be moved at least 100 yards before being buried (permit requirement). | To prevent predators (especially grizzly bears) from becoming acclimated to the consumption of livestock | HIGH: Experience, Grizzly Bear Guidelines (1986) | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| Install small mammal escape ramps on all water troughs to reduce potential mortality. The ramps will be monitored by the permittees to determine if they are functioning annually | To prevent water troughs from becoming traps for small mammals, frogs, and salamanders that may fall into a water trough. | HIGH: Wildlife and Rangeland Management Specialists Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| Salt and other livestock attractants will not knowingly be placed near wolf dens or rendezvous sites, to minimize cattle use of these sites. If a new den or rendezvous site is discovered, any previously established salt or attractant location may be relocated. | To prevent disturbance of wolf dens and rendezvous sites. | MODERATE: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |

| Mitigation Measure | Objective | Effectiveness/Rationale | Administration |
|---|---|---|---|
| Utilize wildlife friendly fence construction (see the Structural Range Improvement Handbook, 121.6, 7/77). The fence should be constructed to allow easier wildlife passage. Fences should be low enough for adult animals to jump, high enough for wildlife to crawl under, and minimize the chance of tangling. Recommended: a top wire or rail preferably no more than 40" and a maximum of 42" above the ground; at least 12" between the top two wires; a bottom wire or rail at least 16" and preferably 18" above the ground; smooth wire or rail for the top, smooth wire on the bottom; preferably, no vertical stays. If stays used, consider stiff plastic or composite stays, or regularly maintain wire stays that are easily bent; posts at 12 – 16.5' intervals; and gates, drop-downs, or other passages where wildlife concentrate and cross. | To allow for easier wildlife passage and minimize the chance of entanglement | MODERATE: Experience | Rangeland Management Specialist & Technicians, or other Forest Service personnel |
| The permittees will report any interactions with wolves and other Threatened and Endangered Species and follow appropriate procedures outlined in the Biological Assessment, and/or Annual Operating Instructions. If a wolf den or rendezvous site is found on an allotment, the Forest Service will determine if seasonal restrictions or other requirements are necessary. Because these sites are difficult to locate and can change, this will be assessed on an ongoing basis. | Protect wolves, a State listed species, and cows | MODERATE: Experience | Rangeland Management Specialist & Technicians, Wildlife Biologist, or other Forest Service personnel |
| **Botany** | | | |
| Yearly, prior to turn on onto this pasture, walk and maintain the fence around Barnell Pasture of the Tunk Allotment. If grazing is causing excessive utilization and trampling, move the livestock to another pasture. | This would protect *Carex media* from being damaged by grazing or trampling. It would also protect the habitat in the meadow. | HIGH: Experience | Rangeland Management Specialist & Technicians or other Forest Service personnel. |
| There is an unknown plant; it has not bloomed so identification is not possible, in the Aeneas allotment next to road 3000294. Maintain the fence around the population until the plant can be positively identified. | Sensitive plant species protection. | HIGH: Experience | Rangeland Management Specialist & Technicians or other Forest Service personnel |

| Mitigation Measure | Objective | Effectiveness/Rationale | Administration |
|---|---|---|---|
| Work with the permittees to minimize use in the areas described below:<br>• The upper portion of Aeneas Creek in Section 9, T. 35 N., R. 29 E., close to road 200.<br>• The lower portion of Jungle Creek, Sections 10 & 11, T. 35 N., R. 29 E.<br>• SW ¼ of the NE ¼, Section 13, T. 35 N., R. 29 E., the wetland above the 3000292 road.<br>• Wetlands in the SE ¼ of the NW ¼, Section 21, T. 35 N., R. 29 E., and a large one in the SE ¼ east of road 3000165.<br>• Portions of Lost Creek, especially when close to the road in Sections 33 & 34, T. 35 N., R. 29 E<br>• A hanging wetland in the SE ¼ of the NW ¼, Section 29, T. 36 N., R.29 E., on the north side of a small tributary of Peony Creek.<br>• The upper portion of the East Fork of Peony Creek in the W 1/2 of Section 28, T. 36 N., R. 29 E | Sensitive plant species protection | HIGH:<br>Experience | Rangeland Management Specialist & Technicians or other Forest Service personnel |
| **Cultural Resources** | | | |
| Provide direction to permittees during annual meetings to protect cultural resources. | Cultural resource protection. | HIGH:<br>Experience | Range staff or other Forest Service personnel |
| Do not allow vegetation on or around documented cultural resource sites to be overgrazed. | Cultural Resource protection | HIGH:<br>Experience | Range staff or other Forest Service personnel |
| **Range** | | | |
| Water rights and uses will be assessed as developed water sources are maintained, rebuilt, and developed. | State law | MODERATE:<br>Experience | Rangeland Management Specialist & Hydrologist |
| If the herder and/or permittee are aware of or are notified that stray animals are outside the permitted area, the permittee or their agent are expected to make arrangement for retrieval of strays within 24 hours and make best efforts to find and retrieve them, and notify the Forest Service within 24 hours of their success or failure. | Permit Requirement | HIGH:<br>Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |

| Mitigation Measure | Objective | Effectiveness/Rationale | Administration |
|---|---|---|---|
| Salt would not be left in one place all season. All salt would be placed in the upper reaches of drainages, in the timber, on rock outcroppings, gravel pits, old closed road beds, and old logging landings. No salt would be placed in areas with noxious weeds, sensitive plant populations, or in culturally sensitive areas. Salt would be placed at least ¼ mile from meadows, wet areas, creeks and water developments and would not be placed on or near open roads, in specific dispersed campsites, or within 300 feet of trailheads or trails. Permittees would be asked to identify all salting locations each year with the assistance of the District Range Management Specialist. No salt would remain in a pasture after the cattle have moved on. | To prevent livestock from congregating in areas with noxious weeds, sensitive plant locations, culturally sensitive areas, wet areas, around campgrounds, dispersed camping sites, trailheads, or near open roads. | HIGH: Experience | Rangeland Management Specialist & Technicians, Noxious Weed Specialist, other Forest Service personnel |
| Troughs will be kept level and clean to prevent overflowing. Install water overflow systems and check valve systems on all water troughs to pipe excess water from the troughs back to the creek or spring. If there is overflow, the overflow shall be maintained to ensure the excess water flows through the overflow pipe and off site (usually back to the original water course). | To keep water developments fully functional so they are successful at drawing cattle out of riparian areas. To prevent water from pooling up around water troughs when there is an excess of water in the trough. | MODERATE - HIGH: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| The permittees shall mark all cows in such a way that allows for easy identification of ownership. | Permit Requirement | HIGH: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| Spring boxes will be inspected yearly and kept clean to ensure that water flows freely from the spring box. | To keep water developments fully functional so they are successful at drawing cattle out of riparian areas. | MODERATE: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| Spring boxes, cribs, berms, and dams will be reconstructed and maintained, as needed, to prevent leakage, down-stream erosion, and minimize the risk of failure. Adequate spillways shall be developed and maintained to allow the safe release of water. If needed, spillways will be hardened to ensure that down cutting does not occur. | To keep water developments fully functional so they are successful at drawing cattle out of riparian areas. | HIGH: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |

| Mitigation Measure | Objective | Effectiveness/Rationale | Administration |
|---|---|---|---|
| The permittees will count the number of cows/calves turned onto the allotments and the number taken off the allotments. If animals are unaccounted for when leaving the allotments, the permittees will notify the Forest Service immediately and make a concerted effort to locate the animals. | Permit Requirement | HIGH: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| All new water developments would be installed outside of Riparian Habitat Conservation Areas (RHCAs). For existing water developments inside the RHCA, assure that the facilities do not prevent attainment of RMOs. Relocate or close facilities where these objectives cannot be met. The spring sources would be fenced off or another method will be used to protect the water source (logs, burying perforated pipe, etc.). The fences will be maintained to prevent livestock from trampling or damaging the spring sources. | To keep water developments fully functional so they are successful at drawing cattle out of riparian areas. | MODERATE: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| The spring will be piped from the box or perforated pipe, at least 100' away from the source to a trough or series of troughs to prevent livestock concentrations near the source. The pipe shall be buried deep enough to protect it from animals as well as from freezing or the pipe will be self-draining. | To keep water developments fully functional so they are successful at drawing cattle out of riparian areas. | HIGH: Experience | Rangeland Management Specialists & Technicians, other Forest Service personnel. |
| Leaks in troughs will be fixed or new troughs will be installed to prevent water from running on the ground near the trough. Leaks in pipes will be fixed and lines will be checked to ensure that they are free of air locks. | To keep water developments fully functional so they are successful at drawing cattle out of riparian areas. | MODERATE - HIGH: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |
| Spring sources will be collected into a spring box or perforated pipe. If a spring box is used, gravel will be placed behind and in the spring box to act as a filter. Spring sources will be fenced when feasible. | To keep water developments fully functional so they are successful at drawing cattle out of riparian areas. | HIGH: Experience | Rangeland Management Specialist & Technicians, other Forest Service personnel |

**Monitoring**

Monitoring is a key component of successful management and compliance with pertinent laws and policy. Decisions regarding identifying any need to change management, and the direction that the change should take are based upon evaluation of the results of monitoring. Monitoring would target those indicators that

are annually influenced by livestock grazing (implementation monitoring) and those that indicate the long term condition (effectiveness monitoring). The management objectives were developed with the most pressing issues identified for each site specific location during data collection and analysis. This was primarily developed by analyzing the departure from the existing condition and from the desired conditions.

Implementation monitoring is used to make short-term adaptive decisions regarding removal of livestock and adjustments in timing, intensity, duration, and frequency of grazing. The long term effectiveness monitoring would be used to determine if satisfactory progress is being made toward meeting the management objectives and thus the desired conditions. If not, this would inform the Range Management Specialist of the need to look at the suite of adaptive management options and adjust management strategy.

Range Monitoring

Range monitoring is an on-going component of grazing permit administration. Short-term and long-term monitoring of grazing, plus coordination with other resources, is used to identify program and administrative needs. Grazing programs use monitoring to maintain or sustain ecosystem health. There are a few types of existing short-term and long-term range monitoring on these allotments. These are Condition and Trend Range Ecology plots, Multiple Indicator Monitoring plots, and field inspections and observations recorded by Forest Service personnel.

Range inspections and observations are gathered over the life of a permit and kept in the Range files (2210 files, Tonasket Ranger District) to document grazing levels and vegetative and riparian use across the allotments. These include items such as riparian photos, and written observations by Forest Service personnel. The following describes more recent findings and management adjustments.

Monitoring livestock distribution allows the permittees (through notification or self- monitoring) to move livestock to the uplands, into natural openings, or past timber sale units away from these monitoring sites. These same points would be used for some of the additional, new, planned monitoring proposed later in this section.

Management Indicator Monitoring (MIMs)

Riparian monitoring occurs throughout the allotments. The following areas are currently monitored for utilization and provide “trigger” data for determining the need to move livestock and will mostly be used to determine livestock movement, pasture rest, and re-allowing grazing. Current monitoring sites will be used, where possible. A Map of these sites in located in Appendix A, Maps, Stream Monitoring Sites. The basic rationale for the sites selected for MIMs monitoring in the BART analysis areas is contained in project files. Existing PIBO sites (4 sites) were initially selected via photo interpretation, GIS modeling and field verification as areas where cattle typically access riparian areas, but not in areas of concentrated use. The five new sites were selected after these tributaries were identified as receiving heavier livestock impacts by the District Fish Biologists and District Range Staff. These nine sites are:

- No name Tributary 5 of Upper Aeneas (Tunk Allotment) [NE 1/4 of Sec. 15, T. 35 N., R. 29 E.]
- No name Aeneas Tributary 2 (Aeneas Allotment) [N1/2 of Sec. 13, T. 35 N., R. 29 E.]
- Upper Peony Creek at PIBO site (Tunk Allotment) [NE ¼ of Sec. 29, T. 36 N., R. 29 E.]
- Lost Creek at PIBO site (Tunk Allotment) [SE1/4 of Sec. 34 & SW1/4 of Sec. 35, T. 35 N., R. 29 E.]
- Barnell Meadows (Tunk Allotment) [SE1/4 of Sec. 27, T. 35 N., R. 29 E.]
- Patterson Creek- above 3010395 spur road (Bannon Allotment) [NW1/4 of Sec. 8, T. 36 N., R. 29 E.]
- Peony Creek at PIBO site (Bannon allotment) [NE1/4 of Sec. 21, T. 36 N., R. 29 E.]

- Upper Jungle Creek- (Tunk Allotment) [SW ¼ of Sec. 4, T. 35 N., R. 29 E.]
- Jungle Creek Exclosure (Aeneas Allotment) [SW1/4 of Sec. 11, T. 35 N., R. 29 E.] This site would be monitored to provide a baseline for recovery time for a disturbed site (formerly the site of the Jungle Creek corral and water development) in a newly created exclosure area (this monitoring location provides a baseline site where no grazing should be taking place).

Condition and Trend

There are also existing long-term Condition and Trend Survey areas within BART allotments:

- 3 in the Bannon Allotment,
- 2 in the Aeneas Allotment, and
- 3 in the Tunk Allotment;

**Riparian Monitoring Strategy**

To ensure management direction is followed, as outlined in the Annual Operating Instructions (AOI, annual management instructions to the permittees), the Forest Service conducts allotment monitoring throughout the grazing season. During the development of this NEPA document, the Tonasket Ranger District has developed a monitoring strategy designed to increase effectiveness of range management and to initiate recovery of degraded riparian areas. Particularly, this plan is designed to begin improving unstable streambanks and riparian vegetation. Our monitoring strategy is interdisciplinary and based on Adaptive Management guidance contained in Forest Service Handbook (R-6) 2209.13 Chapter 90 (Part 95), and Forest Service Rangeland Ecosystem Analysis and Monitoring Handbook (R-6) 2209.21. The strategy considers ecological condition of riparian areas, aquatic habitat, and specifically grazing effects to streamside vegetation, stream banks, and water quality among other things. The District will use both Implementation and Effectiveness monitoring to determine if current management is producing the desired results.

The Tonasket Ranger District has monitored annual riparian grazing use at seven riparian sites starting back in 2000. At these sites, the early monitoring was stubble height with ocular observations made on bank trampling and in 2002 monitoring switched exclusively to the percent bank alteration method. Due to data quality concerns during these years, only three sites were considered to have acceptable quality data. Out of these three sites, two sites were monitored twice and one site once. Three of the five surveys observed 30 to 40 percent bank alteration, which is well above the standard of 20%. These results, coupled with documented field observation of effects to stream channel and riparian conditions, indicate changes in allotment management may be warranted. A detailed discussion and the data on the past monitoring of the project area allotments are displayed later in this document and in project files. An extensive field review of the project area conducted in 2011-2012 observed extensive bank trampling and over use of riparian vegetation. Fisheries and hydrology resource specialists reviewed about 15 miles of streams that represented about 30% of the total streams in the project area. Over one half of the streams reviewed have heavy bank trampling (51%) by livestock and most of these reaches had 80 – 100% of the reach's streambanks trampled from livestock. Another 14% of the miles reviewed had moderate bank trampling. The combination of these observations warrants a more rigorous monitoring plan.

A key goal of this project is to initiate riparian improvement of degraded areas while continuing active grazing. In order to achieve this goal, it is necessary to provide added protection of sensitive riparian areas by minimizing time cattle spend in these areas. The project monitoring plan would employ move triggers in addition to annual monitoring.

**Proposed Allotment Monitoring Plan**
Both Implementation monitoring and Effectiveness monitoring would be conducted to determine compliance with Annual Operating Instructions and resource objectives as well as be consistent with the PACFISH/INFISH RMOs, Forest Plan Standards and Guidelines, and the PACFISH/INFISH Biological Opinion (PIBO, USDA 2005a).

The BART project would rely on applicable monitoring protocols identified in the 2011 Multiple Indicator Monitoring (MIM), by Burton et al. (2011).

Riparian monitoring will be done at nine riparian monitoring sites located across the allotments (See Appendix A, Maps, BART Analysis Area, Stream Monitoring Sites and the sites listed earlier in this section). Range, fisheries, and/or hydrology staff will conduct both Implementation and Effectiveness monitoring at these sites.

Implementation Monitoring
Implementation monitoring consists of examining stream channel and riparian vegetation indicators during the grazing season to ensure that allotment management standards are met after cattle are removed from an allotment/pasture (end of growing season). The riparian associated end-point indicators (or move triggers) identified in the PACFISH/INFISH Biological Opinion (PIBO, 2005a), 2011 MIMs (Burton et al. 2011), and adopted by the Tonasket Ranger District (TRD) are stubble height - and one physical parameter - streambank alteration - to monitor current season's use of aquatic and riparian resources. These are widely used to assess the effects of livestock grazing on aquatic/riparian habitat and maintaining or achieving desired future conditions (Clary and Webster, 1989).The standard protocol for monitoring these habitat indictors is once at the end of the season, soon after cattle are removed.

In addition to measuring annual use indicators, the BART AMP will use these indicators as move triggers. Move triggers function to ensure end of season indicator standards are met and to reduce impacts by degraded riparian areas. At each riparian monitoring site, it is proposed to use move triggers that, if they are met, the stream will maintain or move toward attainment of Riparian Management objectives (RMOs). Each of these monitoring sites will have a combination of move triggers appropriate to site conditions. The complete indicator standards/move triggers used are as follows:

Stream-side stubble height standard:

- Not to go below a 6-inch mean of stubble height for grasses, forbes, or sedges along the green line. This standard only applies to those plants which are capable of exceeding that height each year and to monitoring sites where this monitoring criteria can be meaningfully measured.

Streambank alteration standards:

- Not to exceed 20% altered banks

**Stubble height** is a measure of the residual height of key herbaceous vegetation species remaining during or after grazing. A recent study done on the relationship of stubble height to bank alteration showed that the percentage of bank alteration decreased as the stubble height increased (Goss 2013). When trying to initiate recovery in areas with highly erodible streambanks, it is recommended to use a more strict stubble height standard of at least a 6-inch mean (Clary and Webster 1990). Therefore, the objective for stubble height would be to maintain an herbaceous stubble height of 6 inches during the grazing season and after cattle are removed. Once the herbaceous vegetation is grazed to a 6-inch mean, livestock would be moved to the next

pasture or off the allotment. This standard only applies to those plants which are capable of exceeding that height each year and to monitoring sites where these monitoring criteria can be meaningfully measured.

**Bank alteration** is an annual or short-term indicator of the effect of grazing impacts on long-term streambank stability. The end-of-season percent bank alteration standard is 20%, where 80% or more of the banks would be unaltered by livestock. Stream bank stability is generally low across the project area due to over use by livestock and streambanks are highly vulnerable to bank trampling due to fine grained banks. Therefore, the proposal is to use a 15% bank alteration move trigger. This bank alteration trigger is 5% less than the indicator limit, which would ensure the end of season bank alteration value does not exceed the maximum allowed use level.

All riparian monitoring sites will be monitored during each grazing season at least once to determine if livestock use is approaching the standards. If the standards are being approached, livestock would be moved to the next pasture or off the forest. Each site will also be monitored at the end of the season to assist management in making decisions for the following year's operating instructions.

As will be identified in the AOIs, permittees are responsible for moving cattle to the next pasture if move triggers are reached. If the move trigger is not reached, cattle would be moved on the expected move dates established for each pasture.

When standards are not met or operating instructions not followed, such as excessive streambank alteration or herbaceous and shrub utilization, range and aquatic staff will work together with the permittees to further reduce impacts via management changes. For example, our range specialists will coordinate with the permittees to move livestock to other areas should in-season move triggers be met. If this is ineffective, the permittees would be issued a letter of non-compliance and non-compliance actions would be followed as outlined in Grazing Permit Handbook 2209.13 (Part 16.2b). If end of season monitoring guidelines are exceeded, alternative livestock grazing management practices (i.e. adaptive management) would be implemented for the following grazing season. Adaptive management decisions stemming from the previous season's grazing are given to the permittees in terms contained in the Annual Operating Instructions (AOIs) or annual instruction letter for the following grazing season. These decisions may consist of a reduction in time and/or numbers, additional fencing, or an adjustment of monitoring standards for future years. Multiple infractions occurring during the term of consultation may ultimately result in suspension of numbers, or cancellation of a permit as described in Part 16.2b of FSH 2209.13.

<u>Effectiveness Monitoring</u>

Effectiveness monitoring consists of examining trends in habitat indicators to determine if management actions are effective at improving the condition of riparian and aquatic habitats so they move towards meeting Desired Future Conditions (DFC) and Resource Management Objectives (RMOs). The monitoring methods identified by PACFISH/INFISH Biological Opinion (PIBO, 2005a), and described in 2011 MIMs (Burton et al. 2011), and adopted by the Tonasket Ranger District (TRD) includes greenline composition, woody species height class, streambank stability and cover, woody species age class, greenline to greenline width (GGW), substrate (sediment), and residual pool depth and pool frequency. Additionally, photos would be used to demonstrate change and spot temperatures would be taken.

The key indicators that could change during the duration of this AMP include streamside vegetation (greenline composition, wood species height class and age class), bank stability and cover, and greenline to greenline width (GGW). The substrate and residual pool depth and pool frequency are driven by all activities occurring in the project (grazing, roads, logging, recreation, and fire) and are slower to change. Therefore, the project would measure all indicators for a baseline and then would monitoring the above key

indicators on a 3 year frequency thereafter. Sediment and pool condition would be measured once more between years 10 and 15 after initiation of the project. The specific timeline is as follows:

| Effectiveness Indicators | Year 1 | Year 3 | Year 6 | Year 9 | Once during the years 10-15 of the AMP |
|---|---|---|---|---|---|
| Greenline composition | X | X | X | X | X |
| Woody Species Height Class | X | | | | X |
| Streambank Stability and Cover | X | X | X | X | X |
| Woody Species Age Class | X | | | | X |
| Greenline to greenline width (GGW) | X | X | X | X | X |
| Substrate (sediment) | X | | | | X |
| Residual Pool Depth and Pool Frequency | X | | | | X |
| Spot Temperature | X | X | X | X | X |
| Photos | X | X | X | X | X |

The riparian monitoring sites are representative of grazing use specific to the riparian area being accessed and reflect what is happening in the overall riparian area as a result of on-the-ground management actions. The monitoring data would inform project specialists if degraded riparian and aquatic habitat conditions are improving and if current grazing regimes are consistent with the Forest Plan Standard and Guides. Additionally, this monitoring would determine the effectiveness of the different adaptive Stages of Alternative 2. Under Alternative 2, and its adaptive Stage approach, if the measures of stream bank vegetation, bank stability/cover, GGW and photo points show improvement (i.e. a narrowing of the channel and increased bank vegetation), the current stage is deemed successful and it would continue. Alternatively, if the channel cross-section does not change and the existing bank condition and associated vegetation remain, the grazing strategy would proceed to the next management stage.

Below are definitions of the different effectiveness indicators. See MIMs (Burton et al. 2011) for more details.

| | |
|---|---|
| Greenline composition | Greenline composition surveys describe the continuous line of vegetation along the stream. |
| Woody Species Height Class | This indicator estimates the heights of woody plants adjacent to the stream. Woody species height is useful in monitoring trends in woody plant structure adjacent to the stream. |
| Streambank Stability and Cover | Measures bank stability and amount of raw banks |
| Woody Species Age Class | Woody species age class data help determine if woody plants are establishing along the stream bank |
| Greenline to greenline width (GGW) | Measures the width of the stream channel |
| Substrate (sediment) | Measures the percent fine sediment |
| Residual Pool Depth and Pool Frequency | Measures pool depth and number of pools per reach |
| Spot Temperature | Water temperature |
| Photos | Shows visual change at site. |

**Indicators of Desired Recovery for Re-grazing**

Each of the potentially rested units has disturbed riparian areas where a shrub component exists. Therefore, the goal is for adequate woody vegetation to stabilize streambanks with sufficient recruitment, size classes, and species composition to withstand annual high flows and some grazing disturbance. Where shrubs occur, the following conditions should exist:

- The taller age classes should be at least 8 feet tall so they are resistant to browsing.
- Recruitment should have sufficient seedlings/suckers to larger sizes classes to maintain a diverse age/size class distribution
- There should be shrubs/trees representing two or more age/size classes
- It should be difficult to see through the stand, meaning density is high.

An interdisciplinary team (ID Team) would assess riparian conditions using the proper functioning condition riparian vegetation checklist as described in *A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas guidance document* (Prichard et al. 1998). The team would visit a pasture proposed to be no longer rested and determine whether the monitoring site conditions are properly functioning[4], functioning-at risk, or non-functioning. Following a few years of rest and annual monitoring, the team would review the monitoring site for meeting the below desired conditions.

- There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
- There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
- Species present indicate maintenance of riparian-wetland soil moisture characteristics
- Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
- Riparian-wetland plants exhibit high vigor. As an example, there would be few, if any broken stems and abundant young age classes
- Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows

If each of above questions is answered with a "yes", then the site is considered properly functioning and the pasture is ready for grazing. If any of the questions are answered with a "no", the site is functioning at risk or with three or more questions answered "no", the site is considered non-functioning for vegetation. The criteria for having suitable conditions to re-graze are properly-functioning conditions (PFC) where the ID Team agrees each of the above questions is answered "yes".

Other required monitoring is included in Table 13, Monitoring, below.

**Summary of Effects in Relation to Issues**

Table 14, Comparison of Alternatives, below, compares the effects of the alternatives in relation to the issues identified in Chapter 1. Table 15, Alternative Comparison of each of the INFISH Riparian Management Objectives, shows a comparison for each Riparian Management Objective by alternative.

[4] Riparian areas that exhibit a properly functioning condition (PFC) are not the same as desired conditions. A properly functioning riparian is in a state of resiliency that will allow riparian-wetland area to hold together during a high-flow event, sustaining that system's ability to produce values related to both physical and biological attributes. Furthermore, it defines a condition where the riparian-wetland area is physically functioning in a manner that will allow the maintenance or recovery of desired values (e.g., fish habitat, functioning channel processes). A condition of PFC is a prerequisite to achieving desired condition.

The information used to compare alternatives is summarized from Chapter 3, "Existing Condition and Environmental Consequences". For a full understanding of the effects of the alternatives, refer to Chapter 3, as well as the specialist reports available in the project file at the Tonasket Ranger District.

**Table 13, Monitoring**

| Desired Condition | Resource Indicators from Proposed Action | Monitoring Methods and Protocol | Where | When/ Frequency | Who | Correction Strategy |
|---|---|---|---|---|---|---|
| **Range** | | | | | | |
| Livestock Trampling, soil compaction, | To check for improved water quality and soil stability near water developments | Photo at water developments fenced exclusions.<br><br>Saturated soils present.<br>Ground cover ocular estimate 100 ft. transects parallel to water. (i.e. vegetation, bare soil, rock %) | At all fenced exclosures, wet areas (if present) outside and fence lines. | Annually | Range personnel or other Forest Service personnel, permittees | Expand exclosure fence around the wet area, and continue monitoring. If the exclosure exceeds surveyed areas of BART analysis, then additional NEPA would be required. |
| All water development sources and developments are fully functional prior to yearly turn-on to a pasture. | Water sources protected from access by livestock, water pipelines functioning, and water developments fully functional. | Visual Inspection | All springs, water sources, and water troughs monitored annually to determine if operating effectively. | Annually | Range Management Specialists | Water sources, water developments, and water troughs will be repaired prior to turn-on each year. |
| All Riparian Habitat Conservation Areas are protected | Water developments such as troughs and cribs are located outside RHCAs | Visual Inspection | Riparian Habitat Conservation Areas | Annually | Range Management Specialists | Troughs located in RHCAs will be moved out of the RHCA. |

| Desired Condition | Resource Indicators from Proposed Action | Monitoring Methods and Protocol | Where | When/ Frequency | Who | Correction Strategy |
|---|---|---|---|---|---|---|
| **Soils** | | | | | | |
| Soils saturation<br><br>Region 6 Supplement (2500-98-1) to the FSM 2500 Soil Quality Standard is to Leave a minimum of 80% of an activity area in an acceptable soil quality condition. | To avoid soil compaction | Ocular inspection to insure no standing water or soils not too wet to allow grazing. (USDA protocol) | Barnell Meadows | Before livestock turn-out on years scheduled for grazing | Range personnel or other Forest Service personnel, permittees | If standing water is present, delay turn-out until field test meets 0-<10% soil moisture. |
| **Cultural Resources** | | | | | | |
| Protection of Cultural Resources | Loss of vegetation and soil exposure | Utilization Monitoring | Areas of documented cultural resources | Annually during range inspections | Cultural Resource Technician | If negative impacts from grazing are identified, the adverse effects to cultural resources would be mitigated or eliminated by amending grazing practices, authorized in the permit.<br><br>Appropriate mitigation measures would be devised in consultation with SHPO, American Indian tribes, and the permittees. |

| Desired Condition | Resource Indicators from Proposed Action | Monitoring Methods and Protocol | Where | When/ Frequency | Who | Correction Strategy |
|---|---|---|---|---|---|---|
| **Aquatics/Hydrology** | | | | | | |
| State Water Quality standards are being met. Stream temperature and fine sediment data meeting, or moving towards meeting, Forest Plan and PACFISH/ INFISH standards and guidelines and RMOs. | PACFISH/INFISH, RMO stream temperature and fine sediment standard<br><br>WA State Water Quality standards for temperature and Forest Plan, PACFISH/INFISH RMOs for fine sediment.<br><br>Okanogan National Forest, Forest Plan (1989) has a standard percent fines necessary to maintain properly functioning spawning habitat of less than 20 percent fines <1mm.<br><br>PACFISH/INFISH water temperature standard is at or below 59 degrees within adult holding habitat, and below 48 degrees within spawning and | Incidental stream temperature and fine sediment monitored<br><br>. | At MIMs monitoring sites listed under Monitoring on page 44. | Sediment will be sampled as per the MIMs protocol (Wolman Pebble Counts). Snapshots of stream temperatures will be taken when doing MIMs monitoring. | Hydrologist | If trends indicate increasing temperatures in streams, review of the type of stream temperature monitoring will take place and additional, more rigorous monitoring will take place.<br><br>Fine sediment levels are not intended as a monitoring trigger. Sediment levels are an indicator of bank alteration, streambank stability, and greenline width. Bank alteration, streambank stability, and greenline width will be monitored. If these indicators indicate an improvement, sediment levels in streams should also slowly improve. |

| Desired Condition | Resource Indicators from Proposed Action | Monitoring Methods and Protocol | Where | When/ Frequency | Who | Correction Strategy |
|---|---|---|---|---|---|---|
| | rearing habitats (7-day moving average of daily maximum temperature, 7 day consecutive period) [INFISH RMO]. | | | | | |
| **Botany** | | | | | | |
| Monitor grazing impacts to Sensitive Plant Habitat | Protection of Sensitive Plant Habitat | Ocular Observation | • Barnell Meadows<br>• Peony Pasture of the Bannon allotment,<br>• The upper portion of Aeneas Creek in Section 9, T. 35 N., R. 29 E., close to Forest Road 3000200.<br>• The lower portion of Jungle Creek in Sections 10 & 11, T. 35 N., R. 29 E.<br>• The SW1/4 of the NE1/4 of Section 13, T. 35 N., R. 29 E.; the wetland above Forest Road 3000292.<br>• A wetland in the SE ¼ of the NW ¼ of Section 21, T. 35 N., R 29 E., and a large wetland in the SE ¼ east of road 3000165.<br>• Portions of Lost Creek, especially when close to the road, | Periodically while livestock are in these pastures. | Rangeland and Botany Management Specialists & Technicians, Aquatics and Hydrology Specialists and the permittees. | Work with the permittees to move the animals elsewhere. |

| Desired Condition | Resource Indicators from Proposed Action | Monitoring Methods and Protocol | Where | When/ Frequency | Who | Correction Strategy |
|---|---|---|---|---|---|---|
| | | | Sections 33 and 34, T.35 N., R 29 E.<br>• A hanging wetland in the SE ¼ of the NW1/4 of Section 29, T. 36 N., R 29 E., on the north side of a small tributary of Peony Creek.<br>• The upper portion of the East Fork of Peony Creek in the W1/2 of Section 28, T. 36 N., R. 29 E. | | | |

**Table 14, Comparison of Alternatives**

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| **Riparian Resources (Aquatics/Fisheries):** Livestock grazing has affected riparian and aquatic ecosystems that resulted in degraded aquatic habitat and fish habitat. Livestock can directly trample stream banks, create trailing in active floodplains, and utilize riparian vegetation in a duration and intensity that de-stabilizes stream channels. The results of these impacts can increase floodplain, surface, and stream channel erosion, increase direct solar input to streams, thus making aquatic habitat non-functioning in its ability to support fisheries life history traits (i.e. spawning and rearing). | | | |
| Riparian vegetation conditions: | The no grazing alternative would provide accelerated improvements to riparian vegetation – primarily to streambank vegetation. The entire project area would move towards meeting Forest Plan Standards and Guidelines and INFISH/PACFISH RMOs. Riparian ecosystem values would move towards a stable condition at the fastest rate of any of the alternatives. | Alternative 2 involves an adaptive strategy approach that will vary in effects depending on how successful the early Stages are. The final Stage of this strategy would rest the same proposed four pastures as Alternative 3, if habitat conditions are proving to not meet resource objectives.<br>The range of improvements in this alternative includes the following:<br>• Small, negligible improvements if the early Stages are successful. | This alternative would provide accelerated riparian improvement to streamside vegetation in the proposed rested pastures. Riparian vegetation would move towards Forest Plan Standards and INFISH RMOs at a rapid rate in the exclusion areas. The primary management strategy is to fence off large tracks of land around riparian areas with the heaviest livestock pressure. These areas would be rested from grazing until habitat |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| | Riparian vegetation is expected to make substantial recovery after five years with little disturbance. Streamside vegetation would be allowed to develop into dense shrubs, with deep roots to armor and stabilize streambanks. This would happen most quickly in areas where the canopy was open and sunlight hit the forest floor | Continued grazing of sensitive riparian areas would impede recovery. Existing poor conditions would mostly persist for the life of the AMP.<br>• Continued degrading trend if early Stages are unsuccessful. Duration for early Stages is at least 12 years.<br>• If early Stages are unsuccessful, Stage 5b would rest the four pastures that are not meeting resource objectives. Recovery of riparian vegetation would occur at a rapid rate in these rested pastures consistent with the no action trend.<br><br>In rested areas, a measurable increase in streamside vegetation densities that will lead to increased bank stability is expected. Once rested, riparian vegetation would move towards Forest Plan Standards and INFISH RMOs at a rapid rate.<br><br>• Riparian areas outside of the exclosures, which are functioning at risk, would improve slowly and improvements would be small, negligible. Continued grazing of sensitive riparian areas would impede recovery. Overall vegetation conditions would likely remain at risk for several years until watershed conditions improve. Riparian vegetation would move towards Forest Plan Standards and INFISH RMOs, but the rate would be slow and existing conditions would persist, possibly for multiple years. | conditions reach a stable state. Riparian monitoring would determine progress in meeting resource standards and objectives and determine the length of time grazed pastures are used and how long pastures are rested.<br><br>Riparian areas outside of the exclosures, which are functioning at risk, would improve slowly and overall conditions would likely remain at risk for several years until watershed conditions improve. Continued grazing of sensitive riparian areas would impede recovery. Riparian vegetation would move towards Forest Plan Standards and INFISH RMOs, but the rate would be slow and existing conditions would persist, possibly for multiple years. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| Streambank condition: | The no grazing alternative would provide accelerated improvement to unstable streambanks, moving the allotments towards meeting Forest Plan Standards and INFISH/ PACFISH RMOs throughout the project area. Bank trampling and browsing of streamside vegetation from domestic livestock would be eliminated, which would allow for streambanks to stabilize. Most aquatic and riparian ecosystem values would move towards a stable condition at the fastest rate of any of the alternatives.<br><br>Raw, unstable streambanks would be allowed to recover over time. Unstable streambanks would decrease as vegetation became re-established on the banks that would trap additional sediment to rebuild banks naturally. Bank erosion would move towards natural rates and stream sediment levels would decrease. | Alternative 2 involves an adaptive strategy approach that will vary in effects depending on how successful the early Stages are. The final Stage of this strategy would rest the same proposed four pastures as Alternative 3, if habitat conditions are proving to not meet resource objectives.<br><br>The range of improvements in this alternative includes the following:<br><br>• Small, negligible improvements to bank stability if the early Stages are successful. Continued grazing along sensitive stream reaches would impede recovery. Existing poor conditions would mostly persist for multiple years or the life of the AMP.<br>• Continued degrading streambank trend if early Stages are unsuccessful. Duration for early stages is at least 12 years.<br>• If early Stages are unsuccessful, Stage 5b would rest the four pastures that are not meeting resource objectives. Recovery of riparian vegetation would occur at a rapid rate in these rested pastures consistent with the no action trend.<br><br>In rested areas, a measurable increase in streamside vegetation densities that will lead to a substantial improvement in bank stability is expected. Once rested, streambanks would move towards Forest Plan Standards and INFISH RMOs at a rapid rate. | This alternative would provide for accelerated recovery of unstable streambanks by allowing streamside vegetation to re-establish and form deep roots to armor against erosive stream flows. Bank stability would move towards Forest Plan Standards and INFISH RMOs at a rapid rate in the exclusion areas. The primary management strategy is to fence off large tracks of land around riparian areas with the heaviest livestock pressure. These areas would be rested from grazing until habitat conditions reach a stable state. Riparian monitoring would determine progress in meeting resource standards and objectives and determine the length of time grazed pastures are rested.<br><br>Unstable stream reaches outside of the exclosures, which are functioning at risk to non-functioning, would improve slowly and improvements would be small, negligible. Continued grazing along sensitive stream reaches would impede recovery. Overall channel conditions would likely remain at risk to non-functioning for several years until watershed conditions improve. Stream channels would move towards Forest Plan Standards and INFISH RMOs, but the rate would be slow and existing conditions would persist, possibly for multiple years. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| | | • Unstable stream reaches outside of the exclosures, which are functioning at risk to non-functioning would improve slowly and improvements would be small, negligible. Continued grazing along sensitive stream reaches would impede recovery. Overall channel conditions would likely remain at risk to non-functioning for several years until watershed conditions improve. Stream channels would move towards Forest Plan Standards and INFISH RMOs, but the rate would be slow and existing conditions would persist, possibly for multiple years. | |
| Stream sediment: | Elevated stream sediment levels are primarily due to high riparian road densities and riparian grazing. Moving sediment levels to or close to meeting Forest Plan Standards and INFISH RMOs will require making substantial changes to both of these activities.<br><br>The no grazing alternative would provide for accelerated streambank stability, which would result in substantial reductions in bank erosion and stream sedimentation. Eliminating riparian grazing pressure on streambanks would eliminate a major source of stream sedimentation. Stream sediment levels would make a substantial shift towards Forest Plan Standards and | Alternative 2 involves an adaptive strategy approach that will vary in effects on streambank erosion rates and sediment levels, depending on how successful the early stages are. The final stage of this strategy would rest the same proposed four pastures as Alternative 3, if habitat conditions are proving to not meet resource objectives.<br><br>Elevated stream sediment levels are primarily due to high riparian road densities and riparian grazing. Moving sediment levels to or close to meeting Forest Plan Standards and INFISH RMOs will require making substantial changes to both of these activities.<br><br>The range of improvements in this alternative includes the following: | This alternative would provide for accelerated recovery of unstable streambanks by allowing streamside vegetation to re-establish and form deep roots to armor against erosive stream flows. Bank erosion rates would improve substantially in the heaviest use areas, which would move stream sediment levels towards Forest Plan Standards and INFISH RMOs. However, the existing riparian road network would impede full recovery of stream sediment levels.<br><br>Unstable stream reaches outside of the exclosures, which are functioning at risk to non-functioning, would improve slowly and improvements to stream sediment levels would be small, negligible. Continued grazing |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| | INFISH RMOs, but would not reach them without reducing impacts from roads. All streams with bank trampling would move towards a more functioning state at the fastest rate of any of the alternatives | • Small, negligible improvement to bank stability and stream sediment levels if the early stages are successful. Continued grazing along sensitive stream reaches would impede recovery. Cattle would continue to cause bank erosion and sediment delivery. Riparian roads would also contribute to excess sediment in streams. Existing poor conditions would mostly persist for multiple years or the life of AMP.<br>• Continued degrading sedimentation trend if early stages are unsuccessful. Duration for early stages is at least 12 years.<br>• If early stages are unsuccessful, Stage 5b would rest the four pastures that are not meeting resource objectives. Recovery of streambank stability and a reduction in bank erosion rates would occur at a rapid rate in these rested pastures consistent with the no action trend.<br><br>In rested areas, a measureable decrease in unstable banks that would lead to less sediment delivery is expected. Fine sediment levels would improve in the rested streams and larger streams below. Improvements to stream sediment levels may be substantial enough to be measurable. Stream sediment levels would move towards Forest Plan Standards and INFISH RMOs. However, the existing riparian road network would impede full | along sensitive stream reaches would impede recovery. Cattle would continue to cause bank erosion and sediment delivery. Riparian roads would also contribute to excess sediment in streams. Overall channel conditions would likely remain at risk to non-functioning for several years until watershed conditions improve. Stream sediment levels in these areas would move towards Forest Plan Standards and INFISH RMOs, but the rate would be slow and existing conditions would persist, possibly for multiple years. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
|---|---|---|---|
| | | recovery of stream sediment levels.<br><br>Unstable stream reaches outside of the exclosures, which are functioning at risk to non-functioning, would improve slowly and improvements to stream sediment levels would be small, negligible. Continued grazing along sensitive stream reaches would impede recovery. Cattle would continue to cause bank erosion and sediment delivery. Riparian roads would also contribute to excess sediment in streams. Overall channel conditions would likely remain at risk to non-functioning for several years until watershed conditions improve. Stream sediment levels in these areas would move towards Forest Plan Standards and INFISH RMOs, but the rate would be slow and existing conditions would persist, possibly for multiple years. | |
| **Hydrology:** Livestock grazing has affected riparian and aquatic ecosystems by disturbing streambanks, removing streamside vegetation, and increasing bank erosion, thus adversely affecting hydrologic function, fish habitat, and other aspects of the aquatic ecosystem. | | | |
| Riparian vegetation conditions (bare soil): | The no grazing alternative would provide accelerated aquatic/riparian resource improvement – primarily to stream bank and streamside vegetation and bank stability, moving the allotments towards meeting Forest Plan Standards and Guidelines and INFISH/PACFISH RMOs throughout the project area. Bank trampling and browsing would be eliminated. Most aquatic and riparian ecosystem values would move towards a stable condition at the fastest rate of any of the alternatives. | Alternative 2 may result in minor improvements to streambank stability, riparian vegetation, and fine sediment, but with continued riparian grazing, improvements would be minor and not measurable. If Stage 5b is implemented and large areas are rested, recovery in these areas would occur at a fast rate and bank stability and riparian vegetation conditions would improve. Due to the widespread instability, poor channel conditions of the allotment streams, and the extensive road network, improvements to erosion rates and stream sediment levels may not measurably improve under 5b. | This alternative would provide accelerated riparian resource improvement- primarily to stream bank stability and streamside vegetation would move towards Forest Plan Standards and INFISH RMOs in the exclusion areas. The primary management strategy is to fence off large tracks of land around streams with the heaviest bank trampling. These areas would be rested from grazing until habitat conditions reach a stable state. Riparian monitoring would determine progress in meeting resource |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| | Cattle impacts would be removed after two years. The bare soil areas in the stream bottoms would be allowed to recover over time. The bare soil area would decrease as vegetation became re-established on the stream banks. This would happen most quickly in areas where the canopy was open and sunlight hit the forest floor. | In rested areas, a measureable increase in bank stability and possibly a measurable decrease in fine sediment levels in riparian areas that are rested is expected.<br><br>Outside of rested areas, conditions may improve or may not. Some areas will receive more grazing pressure with fewer streams accessible, leading to greater impacts. On the other hand, improved grazing management may reduce use across the allotment, leading to improved conditions. Areas with poor channel and riparian vegetation conditions along streams and wetlands may improve slightly, but it's expected to be minor and not measurable because continuing to graze vulnerable areas would hinder recovery. Degraded vegetation conditions would either remain or have a very slow improvement trend. Physical stream features like fine sediment levels, width/depth ratios, and pool frequencies are unlikely to achieve DFC until a significant reduction in riparian roads occurs and years pass by for conifers to reach maturity. Fine sediment levels and riparian vegetation conditions may continue to deteriorate without rest.<br><br>Permittees would have a larger role in the decision to implement adaptive management measures that would cause some pastures to be rested. | standards and objectives and determine the length of time grazed pastures are used and how long pastures are rested.<br><br>Outside of exclusion areas, conditions may improve or may not. Some areas will receive more grazing pressure with fewer streams accessible, leading to greater impacts. On the other hand, improved grazing management may reduce use across the allotment, leading to improved conditions. Areas with poor channel and riparian vegetation conditions along streams and wetlands may improve slightly, but it's expected to be minor and not measurable because continuing to graze vulnerable areas would hinder recovery. Degraded vegetation conditions would either remain or have a very slow improving trend. Physical stream features like fine sediment levels, width/depth ratios, and pool frequencies are unlikely to achieve DFC until a significant reduction in riparian roads occurs and years pass by for conifers to reach maturity, fine sediment levels and riparian vegetation conditions may continue to deteriorate without rest. |
| Sediment (turbidity as surrogate): | See Aquatics/Fisheries section above. | See Aquatics/Fisheries section above. | See Aquatics/Fisheries section above. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| Temperature | See discussion directly below under Hydrology (Water Quality). | See discussion directly below under Hydrology (Water Quality). | See discussion directly below under Hydrology (Water Quality). |
| Hydrology (Water Quality): Grazing has the potential to indirectly affect beneficial uses and 303(d) listed waterbodies for the pollutants of nutrients, bacteria, and temperature. | | | |
| Expected trend for *E. coli* bacteria in project area streams: | With the removal of grazing, fecal coliform levels in surface waters in the analysis area would decrease and would stay below Washington State standards. | Range practices may directly increase fecal coliform levels in surface water. However, water monitoring of selected areas of grazing have not shown a significant problem (Bennett, 1982). Past water monitoring projects suggest fecal coliform levels increase to levels near the Washington State standards but quickly fall to background levels within one to two miles below the stock concentration. The stream environment is harsh for coliform organisms because temperatures are cool in reaches where adequate shade is provided by riparian vegetation and forest canopy. Other harmful organisms may or may not survive farther downstream. Where riparian shade is not provided, warmer water temperatures may persist in the heat of summer and may support coliform communities. | Range practices may directly increase fecal coliform levels in surface water. However, water monitoring of selected areas of grazing have not shown a significant problem (Bennett, 1982). Past water monitoring projects suggest fecal coliform levels increase to levels near the Washington State standards but quickly fall to background levels within one to two miles below the stock concentration. The stream environment is harsh for coliform organisms because temperatures are cool in reaches where adequate shade is provided by riparian vegetation and forest canopy. Other harmful organisms may or may not survive farther downstream. Where riparian shade is not provided, warmer water temperatures may persist in the heat of summer and may support coliform communities. |
| Expected trend for temperature in project area streams: | Baseline stream temperatures are considered properly functioning across the allotments. Overstory conifers provide adequate shade over most streams, which are unaffected by livestock. There would be some increase in stream shade levels where shrubs and hardwoods could mature and provide an additional shade layer. This alternative would result in some increase in shade and a | Baseline stream temperatures are considered properly functioning across the allotments. Mature and late seral conifers provide a majority of the shade levels for most streams, which are unaffected by livestock.<br><br>Water developments have the potential to affect stream temperature by bringing groundwater to the surface and exposing it to solar warming and decreasing the | Baseline stream temperatures are considered properly functioning across the allotments. Shade levels for most streams are providing adequate shade with conifers providing the overstory canopy, which are unaffected by livestock. This alternative is not expected to reduce shade levels and the existing functioning stream temperatures would remain. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| | slight, immeasurable, improvement in stream temperature. | volume of water in streams. This proportionally small volume effect to the overall hydrologic budget at each site would not result in sufficient reductions to the drainages to effect measurable changes in water temperature.<br><br>Stage 5 would result in a slight improvement in stream shade levels that may have some localized improvements in stream temperature, but it would be an immeasurable improvement. | |
| **Economic Impacts to Permittees and Community, and Efficiency of Management:** Communities in Okanogan County have historical ties to agriculture. For many residents, ranching is more than just a form of employment; it is a way of life and supports long-standing family traditions. Livestock grazing has economic and social importance to these communities. These allotments support agricultural jobs and income as well as the ranching way of life for many families. A reduction of AUMs will cause a negative economic impact to the economy of Okanogan County. | | | |
| Number of jobs created: | No jobs created, estimated 16 jobs lost. Retained labor income of approximately $251,392 lost. | Estimated 16 jobs retained. Retained labor income of approximately $251,392. This could be reduced in Stage 5b if rest of the 5 pastures (A, B. C, D, and Peony Creek) is required. | Estimated 16 jobs retained. Retained labor income of approximately $251,392. This would be reduced as grazing fees are reduced due to lower permitted numbers of livestock with pastures not being available for grazing or reduced seasons of use. |
| Costs of range improvements: | No cost of range improvements since none installed. Some possibility of salvage of some of the range improvements for use elsewhere. | Total range improvement costs would be as little as $74,465 (Stage 1) or as high as $206,083 if all stages implemented. | Total range improvement costs estimated at $206,083 ($74,465 year 1; $45,786 year 2; $37,568 year 3; and $47,664 year 4). |
| Acres available for grazing: | No acres available for grazing after 2 years for permit termination. | Loss of acres available for grazing would be an estimated 594 acres in Stage 1. If Stage 5b was fully implemented (rest) total acres rested would be about 8,000 acres or 22% of the allotments.<br><br>Permittees would have a larger role in the decision to implement adaptive management measures that would cause some pastures to be rested. | Loss of acres available for grazing would be an estimated 594 acres in year 1. Year 2 would add an additional 3,447 acres of rest; Year 3 would add an additional 1,630 acres of rest, and year 4 would add an additional 2,300 acres of rest or a total estimated area of 8,000 acres, or about 22% of the allotment. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| Average days/months on allotments: | No grazing allowed after 2 years for permit termination. | Normal season of use is June 1 to September 30th; 4 months. | Normal season of use is June 1 to September 30th; 4 months. |
| Number of head months or AUMs on allotments: | No grazing allowed on the allotments after 2 years for permit termination. | Up to the following Head Months (AUMs) Bannon = 602 HM (806 AUMs), Aeneas=1203 HM (1610 AUMs), Revis=32 HM (43 AUMs), and Tunk=1556 HM (2083 AUMs). With the combined management of the Revis and Bannon Allotments, the combined total Head Months would not exceed 602 (806 AUMs). As the area of rested pasture increases, the number of head months/AUMs could be reduced if all 5 pastures are rested (Peony, Area A, B, C, and D) or the grazing season could be shortened.<br><br>The permittees would have a greater role in determining if rest, reduction of HM/AUMs, is implemented. | Up to the following Head Months (AUMs) Bannon = 602 HM (806 AUMs), Aeneas=1203 HM (1610 AUMs), Revis=32 HM (43 AUMs), and Tunk=1556 HM (2083 AUMs). With the combined management of the Revis and Bannon Allotments, the combined total Head Months would not exceed 602 (806 AUMs). As the area of rested pasture increases, the number of head months/AUMs could be reduced when all 5 pastures are rested (Peony, Area A, B, C, and D) or the grazing season could be shortened. This decrease could be expected over about a 4 year period and could be expected to last from 5 years to greater than 10 years. |
| Grazing fees received by the U.S. Treasury: | No payments based on grazing fees off National Forest System (NFS) land would be received by the Treasury for the BART allotments. No costs would be incurred for range betterment expenses. | Estimated payments of grazing fees off NFS land received by the Treasury would be $4,580 (25% of fees collected) on the BART allotments. This could be reduced in Stage 5b if rest of the 5 pastures (A, B, C, D, and Peony Creek) is required due to lower permitted numbers of livestock with pastures not being available for grazing or reduced seasons of use. | Estimated payments of grazing fees off NFS land received by the Treasury would be $4,580 (25% of fees collected) for the BART allotments. This could be reduced as grazing fees are reduced due to lower permitted numbers of livestock with pastures not being available for grazing or reduced seasons of use. |
| Payments to the 25 Percent Fund: | No payments based on grazing fees off National Forest System (NFS) lands would be received by Okanogan County for the BART allotments | Estimated payments based on grazing fees off NFS land received by the 25 Percent Fund would be $4,580 (25% of fees collected). This could be reduced in Stage 5 if rest of the 5 pastures is required due to lower permitted numbers of livestock with pastures not being available for grazing or reduced season of use. | Estimated payments based on grazing fees off NFS land received by the 25 Percent Fund would be $4,580 (25% of fees collected). This could be reduced as grazing fees are reduced due to lower permitted numbers or a reduced grazing season with pastures not being available for grazing. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| **Economic Impacts to Permittees and Community, and Efficiency of Management:** Smaller pastures will require the movement of cattle by the permittees more often at times of the year when cattle are difficult to find and move. | | | |
| Number of pastures (movement of cattle): | No grazing allowed after 2 years for permit termination. | There would be up 13 separate pastures. The Peony pasture would be rested under Stage 1. Under the fifth stage, depending on monitoring outcomes, up to 5 pastures could be rested (Peony and Areas A, B, C, and/or D) until triggers are met to return grazing to one, or more of these 5 pastures. In addition, the Barnell/Lost pasture would only be grazed on a limited basis on alternative years, for a reduced period of time, until triggers are reached to return full grazing to this pasture.<br><br>Permittees would have a larger role in the decision to implement adaptive management measures that would cause some pastures to be rested. | There would be up to13 separate pastures. The Peony pasture would be rested the first year; up to 2 pastures would be rested the second year (Peony and Area C); up to 3 pastures the third year (Peony, Area C and D); and up to 5 pastures rested the fourth year and beyond for a period of time (Peony and Areas A, B, C, and D) until the triggers are met to return grazing to those pastures. In addition, the Barnell/Lost pasture would only be grazed on a limited basis on alternative years, for a reduced period of time, until triggers are reached to return full grazing to this pasture. |
| **Wildlife:** Additional fencing can create significant barriers or impediments to normal movement and increase energy demands for wildlife. | | | |
| Miles of fence removed: | No fences removed. There would be some possibility to salvage some of the fence materials for reuse or sale. | Approximately 1.1 miles of fence would be removed between the Revis and Bannon pastures. About 0.6 miles of fence would be removed from the Barnell Meadows area. | Approximately 1.1 miles of fence would be removed between the Revis and Bannon pastures. About 0.6 miles of fence would be removed from the Barnell Meadows area. |
| Miles of potential additional fencing: | There would be no potential of additional fencing since no grazing would be allowed after the 2 years for permit termination. | About 2.5 miles of fence would be constructed or moved during Stage 1 implementation; while, up to, an additional 11.1 miles could be constructed, only as needed, based on monitoring results.<br><br>Permittees would have a larger role in the decision of what fences would be built in Stages 2, 3, and 4. | About 2.5 miles of fence would be constructed or moved during Stage 1 implementation. While an additional 11.1 miles (Stage 2=3.9 miles, Stage 3=3.2 miles, and Stage 4=4.0 miles [2 fences]) would be built. |
| Design elements to reduce impacts: | Livestock would not be present to disturb wildlife, nor would the associated human presence due to | This alternative would reduce the stressors by exotic herbivores. Stressors such as shrub hedging hardwood browsing, and | This alternative would reduce the stressors by exotic herbivores. Stressors such as shrub hedging |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
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| | livestock management activities. Existing range improvements would be left to deteriorate. This means water troughs would not have their wildlife escape ramps maintained and consequently there would be an increased danger of small animals drowning. Also, there would be a risk of wildlife entanglement in the fence wire as the fences deteriorate. | riparian vegetation trampling can be reduced if domestic cattle are managed with added range improvements. These improvements would help the permittees control grazing pastures and lead to more resiliency throughout all habitats for native species in all the allotments. The added 13.6 miles of new fencing, or moved fencing, would have a slight negative impact on wildlife and their movement because of the added entanglement possibilities but with proper maintenance these chances decrease dramatically. | hardwood browsing, and riparian vegetation trampling can be reduced if domestic cattle are managed with added range improvements. These improvements would help the permittees control grazing pastures and lead to more resiliency through-out all habitats for native species in all the allotments. The added 13.6 miles of new or moved fencing would have a slight negative impact on wildlife and their movement because of the added entanglement possibil-ities but with proper maintenance these chances decrease dramatically. |
| **Wildlife:** Grazing effects the habitat of threatened, endangered, and sensitive (TES) wildlife species, migratory birds (MB), and Management Indicator Species (MIS). | | | |
| Impacts to threatened, endangered, and sensitive (TES) wildlife species, migratory birds (MB), management indicator species (MIS), and the associated habitats: | Eliminating grazing by non-native herbivores would allow 100% of forage and habitat to be utilized by wildlife. | Livestock grazing effects on habitat could affect some wildlife species or habitats primarily through disturbance and displacement of wildlife species and by altering vegetation and habitat conditions.<br><br>Suitable habitat for several TES, MB, and MIS species exists throughout the allotments. | Livestock grazing effects on habitat could affect some wildlife species or habitats primarily through disturbance and displacement of wildlife species and by altering vegetation and habitat conditions.<br><br>Suitable habitat for several TES, MB, and MIS species exists throughout the allotments. |
| **Soil Productivity:** Livestock grazing may affect long term soil productivity by reducing effective ground cover and increasing surface erosion | | | |
| Percent effective ground cover: | With the removal of grazing, no adverse impacts to soil resources attributable to livestock grazing would occur within the analysis areas. Recovery of existing detrimental soil conditions due to past and current grazing management would occur through natural means (e.g. freeze/thaw cycles, root | Improvements would occur in localized areas where livestock are excluded or their use is substantially reduced.<br><br>Maintenance of current stocking levels and the season of use would result in effects similar to what is seen with the existing condition. There would be no improvement to soil resources with this action. The | Improvements would occur in localized areas where livestock are excluded or their use is substantially reduced.<br><br>Maintenance of current stocking levels and the season of use would result in effects similar to what is seen with the existing condition. There |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
|---|---|---|---|
| | penetration into compacted soils, etc.). | overall condition of the soil resource is expected to either be maintained or further degraded depending on location within the allotments. For instance, upland soils would likely continue to see very little grazing pressure and should maintain themselves in stable condition. Streambank soils would likely continue to see very heavy grazing pressure and should continue to decline in condition as constant trampling in these areas inhibits any potential recovery.<br><br>In rested pastures, recovery of existing detrimental soil conditions due to past and current grazing management would occur through natural means (e.g. freeze/thaw cycles, root penetration into compacted soils, etc.). | would be no improvement to soil resources with this action outside of rested areas. The overall condition of the soil resource is expected to either be maintained or further degraded depending on location within the allotments. For instance, upland soils would likely continue to see very little grazing pressure and should maintain themselves in stable condition. Streambank soils, where not rested, would likely continue to see very heavy grazing pressure and should continue to decline in condition as constant trampling in these areas inhibits any potential recovery.<br><br>In rested pastures, recovery of existing detrimental soil conditions due to past and current grazing management would occur through natural means (e.g. freeze/thaw cycles, root penetration into compacted soils, etc.). |
| Estimated soil erosion: | With the removal of grazing, no adverse impacts to soil resources attributable to livestock grazing would occur within the analysis areas. Recovery of existing detrimental soil conditions due to past and current grazing management would occur through natural means (e.g. freeze/thaw cycles, root penetration into compacted soils, etc.). | Due to the widespread instability, poor conditions of the allotment streams, and the extensive road network, improvements to erosion rates would not measurably improve habitat conditions.<br><br>Roads identified in a recent timber sale within the BART Allotment Analysis area were modeled, by the project hydrologist, to contribute 28 tons/year, in a dry year, to 166 tons/year, in a wet year (USDA 2013) to project area streams. | Due to the widespread instability, poor conditions of the allotment streams, and the extensive road net-work, improvements to erosion rates would not measurably improve habitat conditions outside of rested pastures.<br><br>Roads identified in a recent timber sale within the BART Analysis area were modeled, by the hydrologist, to contribute 28 tons/year, in a dry year, to 166 tons/year, in a wet year (USDA 2013) to project area streams. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
|---|---|---|---|
| Number of isolated areas of impact where trend is not maintained or improved: | With the removal of grazing, no adverse impacts to soil resources attributable to livestock grazing would occur within the analysis areas. Recovery of existing detrimental soil conditions due to past and current grazing management would occur through natural means (e.g. freeze/thaw cycles, root penetration into compacted soils, etc.). | Improvements would occur in localized areas where livestock are excluded or their use is substantially reduced. The reduction in impacts would have a positive impact on localized conditions of the analysis area, but other areas would likely not improve during the life of this AMP. Overall, the project would move the analysis area in an improved trajectory, but only slightly when considering areas rested and areas with continued grazing.<br><br>A measureable increase in bank stability and possibly a measurable decrease in fine sediment levels in the areas rested is expected. Outside of rested areas, conditions may improve, but not substantially. | Improvements would occur in localized areas where livestock are excluded or their use is substantially reduced. The reduction in impacts would have a positive impact on localized conditions, but other areas would likely not improve during the life of this AMP. Overall, the project would move the analysis area in an improved trajectory, but only slightly when considering areas rested and areas with continued grazing.<br><br>A measureable increase in bank stability and possibly a measurable decrease in fine sediment levels in the areas rested is expected. Outside of rested areas, conditions may improve, but not substantially. |
| **Invasive Species:** Ground-disturbing activities associated with livestock grazing can create opportunities for the establishment of invasive weed infestations, which may result in increased invasive weed populations. | | | |
| Number, location, and extent of new infestations in areas used by livestock that are detected while infestations are manageable; i.e. discovered when size and density of the infestation are small enough that they can be eradicated or controlled to prevent further spread: | There would be no soil disturbance from cattle, thus no spread of invasive species by livestock. Native vegetation would be free to grow and compete with noxious weeds. The potential for new populations of noxious weeds would be reduced; less potential for noxious weeds to establish. There would be fewer opportunities for early detection because there would be no permittees making observations. Increases in ungrazed grasses can increase the risk of wildfire spread which could result in an increase in noxious weeds | Soil disturbance would occur. Spread of some weeds by cattle would still occur, e.g. hound's tongue. Existing vegetation would be grazed, but water developments, a fence, and other range improvements would better manage and disperse cattle. There would be less concentration and over utilization of certain areas, pastures can be rested. Native vegetation could better compete with noxious weeds and limit infestations<br><br>Reduced concentration of livestock would reduce the amount of ground disturbance | Soil disturbance would occur. Spread of some weeds by cattle would still occur, e.g. hound's tongue. Existing vegetation would be grazed, but installation of multiple fences and other range improvements would better manage and disperse cattle. There would be less concentration and over utilization, pastures can be rested. Native vegetation could better compete with noxious weeds and limit infestations.<br><br>Limiting concentration of livestock would reduce the amount of ground disturbance. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
|---|---|---|---|
| **Range Resources:** Livestock grazing may affect rangeland and riparian vegetation health by altering plant community composition and structure. | | | |
| Percent and type of vegetation cover and composition relative to desirable and native plant communities: | The No Grazing Alternative would provide short term accelerated improvement to riparian vegetation. Since no grazing would occur, no monitoring of the MIM (PIBO) would occur or photo plots to document this.<br><br>This Alternative would not differ in rate of upland vegetation improvement between any of the Alternatives. This is because the uplands have already been identified in a desirable or upward trend.<br><br>These statements assume there is no establishment or spread by invasive plant species into either riparian or upland sites. | This alternative is expected to provide some improvement to riparian vegetation, more slowly than Alt 1 and Alt 3. The changes between rates in Alternative 2 & 3 are difficult to specifically predict given the use of adaptive management options a permittee is allowed to utilize to achieve desired resource results.<br><br>The MIM implementation monitoring is short term, and would only indicate short term changes to vegetation, annual use on soils, or bare ground measurement. Associated photos and notes may indicate percentage of plant species composition. MIM monitoring of streambank stability would identify short term changes in bare soil.<br><br>C&T (Condition and Trend) Long Term plots established in Upland Vegetation types will continue to monitor the stable and/or upward trend of plant species composition and desirable ground cover (low percentage bare soil).<br><br>These statements assume there is no establishment or spread by invasive plant species into either riparian or upland sites. | This alternative would provide improvement to riparian vegetation, slightly more slowly than Alt 1 and a little more rapidly than Alt 2. The changes between rates in Alternative 2 & 3 are difficult to specifically predict given the use of adaptive management options a permittee is allowed to utilize to achieve desired resource results.<br><br>The MIM implementation monitoring is short term, and would indicate short term changes to vegetation, annual use on soils, and bare ground measurements. Associated photos and notes may indicate percentage of plant species composition.<br><br>C&T (Condition and Trend) Long Term plots established in Upland Vegetation types will continue to monitor the stable and/or upward trend of plant species composition and desirable ground cover (low percentage bare soil).<br><br>These statements assume there is no establishment or spread by invasive plant species into either riparian or upland sites. |
| **Recreation:** Permitted domestic cattle livestock grazing may conflict with recreational use of camping areas. | | | |
| Evidence of domestic cattle livestock activity in camping areas used for recreation: | There would be no evidence of domestic cattle activity in/on camping areas and trails used for recreation since all cattle, except | The recreation fences around Crawfish Lake and the Aeneas Springs dispersed camping site would continue to need maintenance to keep cows out of those | The recreation fences around Crawfish Lake and the Aeneas Springs dispersed camping site would continue to need maintenance to keep |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
|---|---|---|---|
| | trespass animals, would be removed from the BART allotments. | recreation sites. Cattle would still be able to access the other dispersed sites and trails. | cows out of those recreation sites. Cattle would still be able to access the other dispersed sites and trails. |
| **Threatened, Endangered, and Sensitive Plant Species [TESP] (Botany):** Livestock can affect sensitive and native plants by grazing or trampling. Some plants of cultural interest to local Indian tribes may be grazed or trampled. | | | |
| Trampling and grazing around TESP and cultural plant populations:<br><br>Decrease of trampling and grazing of sensitive species and habitat:<br><br>Percent and type of vegetation cover and composition that is maintained or increasing: | The sensitive species *Carex media*, *Coeloglossum viride*, *Platanthera obtusata*, and *Viola renifolia* may benefit from no trampling or grazing of plants and habitat. However, there may be more competition for sensitive plants from other vegetation that is not grazed.<br><br>Cultural plants such as Yampah and Thimbleberry are expected to maintain themselves, although there would be extra competition from other vegetation. | Trampling and grazing may occur to sensitive species and their habitat. However range improvements such as water developments, a fence, and an extra pasture would better manage and help disperse cattle away from these populations.<br><br>There would be less competition from other vegetation that is grazed. If necessary, extra fences would be built to manage cattle, further reducing impacts to sensitive species and habitat.<br><br>Palatable cultural plants such as Yampah are expected to maintain themselves, although there would be grazing and trampling. Grazing would also reduce associated vegetation, resulting in less competition for cultural plants. | Trampling and grazing may occur to sensitive species and their habitat. However range improvements such as water developments, extra pastures, and a number of fences would better manage and disperse cattle away from these species.<br><br>There would be less competition from other vegetation that is grazed.<br><br>Palatable cultural plants such as Yampah are expected to maintain themselves, although there would be grazing and trampling. Grazing would also reduce associated vegetation, resulting in less competition for cultural plants. |
| **Cultural Resources:** Livestock may damage cultural resources. The heritage program conducted cultural resource inventories within the boundaries of these allotments. These surveys identified numerous cultural resources which are eligible for listing on the National Register of Historic Places. | | | |
| Damage to cultural resources: | The impacts from no grazing will be less than an action alternative, but not much less. | This project received a "No Adverse Effect" determination. Effects are small and cultural resources will be protected through mitigation and monitoring. | This project received a "No Adverse Effect" determination. Effects are small and cultural resources will be protected through mitigation and monitoring. |
| **Climate Change Effects to Wildlife:** As the climate changes, the resiliency of these forest stands would be important for maintaining biodiversity and allowing these stands and species a chance to adapt to the new conditions. | | | |
| Livestock grazing effect on biodiversity: | There would be no livestock effect if they are not present in the allotments. | The proposed livestock grazing would have a neutral outcome on the resiliency of the analysis area related to climate change. | Grazing would have a neutral out-come on the resiliency of the analysis area related to climate change. |

| Issue/Indicator | Alternative 1, No Grazing | Alternative 2, Proposed Action | Alternative 3 |
|---|---|---|---|
| **Wildlife Corridors:** The analysis area has been identified as the only modeled linkage through the Okanogan Valley that was consistently identified for all focal species of carnivores. | | | |
| Livestock grazing effect on wildlife corridors for focal species of carnivores: | There would be no livestock effect if they are not present in the allotments. | Livestock grazing will not negatively affect the forested stand cover in the analysis area. Annual available browse for wildlife and domestic livestock would be maintained at Forest Plan standards and guidelines based on the appropriate management area. Overall, the BART grazing analysis will not impact the function of these corridors. | Livestock grazing will not negatively affect the forested stand cover in the analysis area. Annual available browse for wildlife and domestic livestock would be maintained at Forest Plan standards and guidelines based on the appropriate management area. Overall, the BART grazing analysis will not impact the function of these corridors. |

Below is a table that summarizes consistency with Riparian Management Objectives (RMOs). Since all fish bearing stream reaches in the project area are in the INFISH portion of the project area, consistency is only shown for those streams.

Table 15, Alternative Comparison of each of the INFISH Riparian Management Objectives

| Riparian Management Objective (RMO) | Current Conditions | Alternative One-No Action | Alternative 2 and 3 |
|---|---|---|---|
| Pool Frequency > >80 pools/mi | Average pools per mile = 13.6 | Bank erosion would be substantially reduced across the entire project area with no grazing. Current fine sediment delivery from livestock appears to be substantial and with all grazing stopped, fine sediment delivery to streams would see a marked decrease. This would reduce pool infilling over time. Sediment from the high road densities would slow pool recovery. This alternative would move conditions in a restorative direction, but the riparian roads would prevent full recovery | Where livestock is excluded or pastures rested, bank erosion rates would improve substantially. Where grazing is continued, recovery would be slow. Monitoring and move triggers would ensure use standards are maintained. These measures would pool frequencies, but it would be slow to improve due to sediment from high road densities. Pool frequencies would move towards meeting RMOs, but at a slow rate. |
| Water Temperature $60^{o}$ F. or less | Limited temperature data suggests it is meeting standards. | Temperatures would remain unchanged. | Existing grazing does not appear to be affecting water temperatures. Existing conditions would be maintained. |

| Riparian Management Objective (RMO) | Current Conditions | Alternative One-No Action | Alternative 2 and 3 |
|---|---|---|---|
| Bank Stability (non-forested systems) >80% stable | Bank stability varies on Lost and Barnell Creeks, but most reaches are at 80% or greater. | Bank stability would improve in Lost and Barnell Creeks, likely exceeding the RMO standard. From the literature, bank stability in meadow streams with sedges, rushes, and willows exceeds 90% in natural systems. Conditions would improve and bank stability would likely reach up to 90%. | Bank stability would likely improve in the unstable areas. Conditions are expected to move towards meeting RMO standards at a near natural rate. |
| Large Woody Debris (LWD) >20 pieces per mile, 12" diameter at the small end and >35' in length | Most streams have sufficient LWD | Most streams have sufficient LWD levels. Areas with lower levels are partly due to human factors like past timber harvest. RHCAs have been, and will continue to be protected for natural wood recruitment. Conditions would remain unchanged under this alternative. | Grazing would not affect wood levels in streams. Each action alternative would protect instream wood levels. |
| Width to Depth Ratio < 10 (mean wetted width divided by mean depth) | Range = 4.07-14.9 | With no grazing, banks would stabilize and bank erosion from trampling would stop, leading to lower fine sediment levels. This would increase channel stability and trend towards narrower and deeper channels. However, changes in width:depth ratios can take decades or longer to improve when rested from grazing. The high density of riparian roads, fine sediment levels would continue to be elevated that would slow wide, shallow channels from narrowing. This alternative would move conditions in a restorative direction, but the riparian roads would prevent full recovery. | Reducing grazing pressure along streams or using full rest in large areas would begin to allow stream channels to recover. Wide channels would begin to narrow over time. However, most headwater streams would continue to have grazing and subsequent bank erosion. This coupled with the high density of roads would slow improvement. Width:depth ratios would trend towards meeting RMOs, but would be slow to improve. |

| Riparian Management Objective (RMO) | Current Conditions | Alternative One-No Action | Alternative 2 and 3 |
|---|---|---|---|
| Lower Bank Angle > 75% of banks with <90$^{o}$ angle (i.e.:Undercut)<br><br>(non-forested systems) | Bank angle was 79$^{o}$ in 2005 and 70$^{o}$ in 2010. However, field review of portions of Barnell and Lost Creeks, suggesting they may not be meeting this standard. It needs further review. | There are reaches in both Barnell and Lost Creeks with vertical banks and signs of channel downcutting. This is due to a host of factors like riparian grazing and altered runoff patters from roads and timber harvest. Resting these streams would allow streambank vegetation to reestablish at full capacity. Changes to this habitat feature are likely to take decades or longer before banks establish more undercut banks. It is unknown if these streams are meeting the standard or not with confidence, but its suspected to not meet it. This alternative would move the streambanks towards meeting this RMO standard. | Under each action alternative, the meadow portions of Lost and Barnell Creek would be rested every other year and only grazed for 2 to 3 (75 or 50 cow/calf pairs) weeks on the grazed year. Conditions would likely improve in the unstable areas slowly. Conditions are expected to move towards meeting RMO standards at a near natural rate. |

# Chapter 3 – Existing Condition and Environmental Consequences

## Introduction

This chapter displays the expected effects to the environment that would occur with the implementation of alternatives presented in Chapter 2. The scientific and analytical basis for the alternative comparison at the end of Chapter 2 is presented here.

Environmental consequences are described in terms of direct, indirect, and cumulative effects. Direct effects are those caused by the action, occurring at the same time and place. Indirect effects are caused by the action occurring later in time or further removed in distance, but are still reasonably predicted. Cumulative effects are the incremental effects of the BART AMP alternatives when considered with the overall effects of all past, present, and reasonably foreseeable future actions.

**Past Actions/Events**

- Livestock Grazing, 1900 to the present;
- Beehive Timber Sale, 1992;
- Bannon Fire, 1994;
- Fish Timber Sale, 1996;
- Crawfish Salvage Sale, 1996;
- Sneed Timber Sale, 1998;
- Sneed Fire, 1999;
- Bailey Mountain Fire, 2001;
- Bailey Fire Salvage, 2002;
- Bailout Timber Sale, 2008;
- Coco Timber Sale, 2002;
- Upper Aeneas Timber Sale, 2008;
- BR SBA Timber Sale, 2012 (some site prep, burning, and planting remain to be completed) [Timber Sale closed 12-2013];
- Lost Timber Sale, 2011 (some site prep, and burning remaining);
- Frosty, Frozen and Frosted Timber Sales, 2007-2011 (some site prep, burning, ladder fuel reduction, excavator piling remaining);

In order to understand the contribution of past actions to the cumulative effects of the proposed action, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions on natural events that have affected the environment and might contribute to cumulative effects.

The cumulative effects analyses do not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century and beyond, and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action. In fact, focusing on individual actions would be

less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, residual effects of past human actions and natural events are captured, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest of need for detailed information on individual past actions. Finally, the Council on Environmental Quality (CEQ) issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this EIS is also consistent with Forest Service National Environmental Policy Act Regulations (36 CFS 220.4(f)) July 24, 2008, which state in part:

"CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions."

For these reasons, the analysis of past actions in the cumulative effects analysis is based on current environmental conditions.

Past actions affecting resources are described as part of the existing condition information. For a partial list of past actions, refer to the previous page and Appendix J, Cumulative Effects Project List. This appendix also includes a more complete list of Present (on-going) Actions and Reasonably Foreseeable Future Actions and a summary is listed below.

**Present (On-Going) Actions**

- Crawfish Restoration Project (CR Timber Sale)[100% within BART allotments] (timber harvest, burning, site prep, planting, & road actions) [CR Timber Sale 2013];
- Grazing (adjacent to project area; Tribal, private land, Bailey Allotment);
- Noxious weed treatment under the 1997 and 2000 Okanogan National Forest Noxious Weed Integrated Weed Management EAs;
- Firewood gathering, snag losses, and user-created roads;
- Private land timber harvest;
- Private land hazardous fuels reduction;
- Timber harvest on lands managed by the Confederated Tribes of the Colville Reservation;
- Hazardous fuels reduction on lands managed by the Confederated Tribes of the Colville Reservation;
- Road maintenance;
- Timber harvest and fuels reduction on State, DNR managed lands;
- Bannon Pre-commercial Thinning and Fuels Project (about 25% of precommercial thinning completed, 25% will be contracted in 2014, remaining planned in future years);
- Fire Suppression;
- Recreational Activities including driving for pleasure, fishing in Crawfish Lake, camping at Crawfish Lake campground, hunting, dispersed camping, riding ATVs, and riding snowmobiles;

The future projects not covered by a decision at this time will be thoroughly analyzed and documented in separate, future environmental documents. Since the effects of many of these other projects are unknown at this time, the interdisciplinary team made assumptions about the environmental consequences of the future projects. The basic assumption for every project, on National Forest System (NFS) land is that it will meet amended Forest Plan standards and guidelines. These assumed effects were used in the cumulative effects analyses at the end of each resource section. The reasonably foreseeable future actions used in this analysis and the environmental consequences (assumed or based on previous planning documents) are listed below:

**Reasonably Foreseeable Future Actions**

- Okanogan-Wenatchee National Forests Access and Travel Management Plan Implementation;
- Okanogan-Wenatchee National Forest, Forest Plan, and Forest Plan Implementation;
- Continued timber management, home construction and development on private lands;
- Timber harvest on lands managed by the Confederated Tribes of the Colville Reservation;
- Timber harvest on lands managed by the Department of Natural Resources (DNR);
- Hazardous fuels reduction on lands managed by the Confederated Tribes of the Colville Reservation;
- Hazardous fuels reduction on lands managed by the Department of Natural Resources and private lands;
- System and non-system road closures and decommissioning on NFS lands;
- Culvert upgrades at road-stream crossings in the Bonaparte-Okanogan River watershed on NFS lands;
- Culvert upgrades at road-stream crossings in the West Fork Sanpoil watershed on NFS lands;
- Okanogan – Wenatchee National Forest Invasives Plant Treatment EIS;

Invasive Plant Species Treatment

The Okanogan-Wenatchee National Forest Forestwide Site-Specific Invasive Species Treatment EIS would authorize the treatment of currently existing invasive species across the Okanogan-Wenatchee National Forest and would allow for treatment of infestations that are not currently inventoried through an early detection/rapid response (EDRR) strategy. The proposed invasive species treatments would begin within the next 2 years and continue for approximately 15 years. Invasive plants would be treated using one or a combination of manual, mechanical, cultural, biological, and chemical methods. Priorities for treatment and selection of treatment methods would be consistent with those described in the Region 6, 2005 FEIS/Record of Decision (ROD). This would increase the number of weed treatment options available and increase the area of infested lands that may be treated within the BART allotment. Early detection, rapid response to newly discovered infestations would increase treatment effectiveness and reduce the potential for spread of new populations. The Forestwide EIS is considering alternatives that use a variety of herbicides that may be more effective and cause less environmental effect than those currently approved in the two Forestwide Environmental Assessments.

Access and Travel Management

The Forest is conducting an environmental analysis for travel management planning that will designate motorized public access routes on the Okanogan-Wenatchee National Forest. It would likely change the current policy of motorized access being open unless designated closed, to closed unless designated open. This project is scheduled to be implemented in 2015, or beyond.

Okanogan-Wenatchee Forest Plan Revision

The Colville and Okanogan-Wenatchee National Forests have been working cooperatively to revise their

respective land and resource management plans (Forest Plans). The current Forest Plans are at the end of their intended lifespan. The work in plan revision will guide management for the next decade and beyond. The plans are being revised to reflect resource and social changes, as well as new scientific information.

**Specialist Reports and Project Record**

This Final Environmental Impact Statement incorporates by reference the Rangeland Vegetation, Invasive Species, Botany, Fire and Fuels, Soils, Hydrology, Aquatics/Fisheries, Wildlife, Recreation, Cultural Resources, and Social and Economics Specialist Reports in the BART Grazing Analysis Record (40 CFR 1502.21). Specialist reports are located in the Project Record and contain the detailed data, methodologies, analyses, conclusions, maps, references, and technical documentation that the resource specialists relied upon to reach the conclusions in this environmental impact statement. This information is available for review upon request.

See Term Grazing Permits, in District files, for terms and conditions associated with livestock administration on the BART allotments.

**Forest Plan Consistency**

The proposed action is consistent with the Okanogan National Forest Land and Resource Management Plan (Forest Plan, USDA Forest Service) and its amendments (1989). Applicable Forest-wide and land use designation standards and guidelines have been incorporated. The Forest Service uses design elements in the planning and implementation of land management activities. The application of these elements begins during the planning and design phases of a project.

**Climate/Precipitation Patterns**

The analysis area is in a continental-maritime climate regime, which is a transitional climate influenced by both maritime and continental weather patterns. In eastern Washington, most precipitation occurs from winter snowfall and summer thunderstorm activities. Thunderstorms generally occur as a cloudburst that may drop heavy precipitation along a narrow path. The analysis area commonly has a seasonal snow cover, which can be transient during warmer years and/or lower elevations, and is classified as semi-arid at the lower elevations to sub-humid in the higher elevations. Annual average precipitation ranges from 13-25 inches per year in the hydrologic analysis area, (15-19 within the BART Project Analysis Boundary). Elevation ranges from 1760-6560 ft. above sea level (2880-6000 ft. within the BART Project Analysis Boundary). Approximately 18% (lower elevations) to 47% (higher elevations) of annual precipitation falls as snow within the analysis area. July-September are typically the driest months, characterizing the summer drought climate pattern typical in the northwestern US. Within the proposed action boundary, 53% of the analysis area is identified as a Rain-on-Snow (ROS) regime, while the other 47% is snow-dominated. Estimated storm totals in the analysis area range from 0.35-0.49 inches for a two-year/one hour storm, and 0.94 inches for a 100-yr/one hour storm (Hanson, 2013).

**Plans of Other Agencies**

The CEQ regulation implementing NEPA requires a determination of possible conflicts between the proposed action and the objectives of Federal, State, and Local land use plans, policies, and controls for the area. See the “Other Disclosures” section at the end of this chapter, and elsewhere in the document, for a discussion of compliance with this and other laws.

## Rangeland Vegetation

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed in the BART Grazing Management Range Vegetation Report prepared by Range Management Specialist, Christina Bauman. Reference information is contained in the full specialist report, which is held in the analysis file for the BART Grazing Analysis project and District Range administration files. Discussions of Regulatory Framework as it applies to the Rangeland Vegetation write-up can be found in Appendix G, Regulatory Framework, of this FEIS.

**Issue:** Livestock grazing may affect rangeland and riparian vegetation health by altering plant community composition and structure.

**Indicator:** Percent and type of vegetation cover and composition relative to desirable and native plant communities.

### Scope of Analysis

This report analyzes livestock grazing on the Bannon, Aeneas, Revis, and Tunk Cattle & Horse (C & H) Allotments. (Herein after, the names of the allotments drop the "C&H", ex: Bannon C&H Allotment is called Bannon Allotment). The name "BART" was derived from the allotment name initials.

Information was collected from forage utilization, forage production, range readiness surveys, past allotment management plans, past annual operating instructions, and letters to permittees. It was also collected from discussions with other specialists and permittees. For direct, indirect, and cumulative effects, the project area serves as the analysis area. Current condition and environmental consequences sections cover the concerns raised during the scoping process. Maps of allotments and improvements are in Appendix A, Maps, and the analysis file.

### Background

Prior to the establishment of the National Forest Grazing system, grazing use was unregulated. Historical records in the Tonasket Ranger District 2210 and 2230 files indicate that past livestock use was more intense and occurred for longer durations than currently permitted. The more desirable forage species responded to the heavy use with a loss of plant health and in some areas, an overall decrease in occurrence. Vegetation in riparian areas received heavier use given their livestock attracting properties of drinking water, higher forage production, and open sites. Past Allotment Management Plans document the riparian concerns with objectives to improve riparian conditions (Tonasket Ranger District 2210 files). There are small, isolated areas that reflect the past heavy use in which the composition of the vegetative communities is dominated by highly palatable, but less productive forage species such as Kentucky bluegrass, which was seeded heavily after timber harvest activities in the 1960s. This vegetation has replaced desirable native vegetation, which is slowly reestablishing into meadows without active restoration, and more rapidly in meadows with active restoration (e.g. Barnell Meadows).

Grazing history summaries by allotment are outlined in more detail in the Allotment Descriptions starting on the next page. In general, over the past 30 – 70 years, permitted livestock numbers and season of use were reduced, and grazing management systems were developed for the allotments (2210 and 2230 files, Tonasket Ranger District). During the same time period, monitoring protocols for rangeland vegetation were improved and monitoring was increased.

Livestock grazing can alter range condition and vegetation health if not managed properly. Livestock grazing is monitored for short-term compliance with grazing practices (Implementation monitoring) and long-term effects of those grazing practices (Effectiveness and Condition and Trend monitoring). Short-term monitoring includes field review to ensure adherence to grazing management direction and standards prescribed in the Annual Operating Instructions (AOIs). Long-term trend monitoring tracks rangeland changes over time (FSH 2209.13) and the achievement of goals and objectives that are stated in the project decisions and Forest Plan. Long-term effects are monitored by changes in plant species, density, and percent bare ground. Long-term and short-term monitoring types and results are described in the monitoring section.

**Allotment Descriptions**

The following describes the existing units by allotment. Refer to Appendix H, Range Water Development Improvements, for a list of water development improvements and Appendix A, Maps, BART Analysis Area, Existing Improvements, for a map displaying existing range improvements. Photos of the 2011 Water Development inventory are in the analysis file.

Allotment descriptions contain information regarding permitted livestock numbers and dates. In these descriptions the caveat is added regarding how these dates, numbers, or times may change annually to reflect resource concerns or needs.

In general, dates may shift by up to two (2) weeks either earlier or later depending upon resource conditions. Range Readiness refers to the "defined stage of plant growth at which grazing may begin under a specific management plan without permanent damage to vegetation or soil." It is typically a set of resource conditions where soils are firm enough to withstand grazing ungulate hoof action, and plants have reached a proper phenologic stage to not impair growth or carbohydrate reserve production.

Livestock "turn out" onto National Forest System Lands is authorized in accordance with this standard. Adverse resource conditions such as wildfire or drought can result in a reduced season of use, reduced livestock numbers, and/or early livestock removal requirements. A later Range readiness date results in a later authorized livestock turnout date. This, along with resource review (ex: riparian condition and forage supply), could result in allowing the livestock to remain on the allotment for up to two (2) weeks later than described on the face of the permit. Prior to any such authorization, a review of limited resources, forage, water, and riparian conditions is required.

The topography of the allotments ranges from gentle and rolling in the lower elevations to steep and mountainous in the higher elevations. The variety results in diverse vegetation types, and affects the available forage production.

All four allotments have forested and shrub steppe vegetation. Bannon, Aeneas, and Tunk allotments contain a large component of open canopied drier forest types accompanying denser canopied mixed conifer types at higher elevations. The drier forest types open to shrub steppe vegetation where more forage is produced. The Revis Allotment contains some forested types, but has more primary and secondary range available. There are numerous small (<1 acre) meadows and wetlands dispersed across the Bannon, Aeneas, and Tunk Allotments (Hanson, 2013)

**Bannon Allotment**

Early records indicate the Bannon area was used with either the Tunk or Aeneas Allotments for livestock grazing. Between 1942 and 1957 this allotment was used as a steer pasture. The allotment was fenced in 1957 allowing it to be grazed by 100 cow/calf (c/c) pairs from June 1 through September 30. In 1968 it was established as the Bannon Allotment. In 1977 a division fence was constructed dividing the allotment into East and West units and in 1981 the livestock numbers were increased to 150 c/c pair, from June 1 through September 30. In 1981 a four pasture rotation system implementing rest was initiated into

the allotment. This was accomplished through construction of two additional fences dividing both the East and West units. Stocking rates were adjusted upward with these additional fences and predicted increases from transitory forage. See Table 16, Bannon Allotment History, below, for a summary of the historic use of the allotment.

**Table 16, Bannon Allotment History**

| Time frame | Livestock Numbers & Season |
|---|---|
| Early 1900's to 1942 | Early permit grazing |
| 1942-1957 | Steer Pasture |
| 1957 | Fenced separately as separate allotment 100 c/c pair 6/1-9/30 |
| 1968 | Bannon Allotment is established- 100 c/c pair 6/1-9/30 |
| 1968-1981 | 100 c/c pair 6/1-9/30 |
| 1981-Present | 150 c/c pair 6/1-9/30 |

In 1994 a fire burned through a large portion of the Patterson unit. This area subsequently increased its forage production much higher than allocated for previous stocking levels. Those stocking levels were based on the 1981 allotment analysis which projected less forage production because of a closed canopy. Since the fire, tree canopy closure is gradually reducing forage production to the 1981 projections. About 80% of the fire area is planned for precommercial thinning. About 25% of the proposed area has been precommercially thinned, another 25% will be contracted in 2014, and the remaining is proposed for precommercial thinning in the near future.

Based on more recent Range Readiness notes, the range has typically been ready for grazing by June first each year. Past records indicated that Range readiness frequently occurred in May.

Current production inventories indicate a reliance on transitory range with only a small portion of the allotment containing primary range.

In past inspection and inventory notes, including the 1981 Environmental Assessment, and subsequent Allotment Management Plan, Peony Creek was identified as an area with heavy ungulate use. Plans to improve its condition relied upon the fences and scheduled rest rotations. The Bannon Allotment is divided with fences between the Patterson, Bannon, Peony Creek, and Cat units (pastures).

The current permitted use is for 150 cow/calf pairs to graze between June 1 and September 30$^{th}$. This is the equivalent of 806 AUMs or 602 HMs. The Bannon Allotment has used a deferred, rest rotation grazing system. The Peony unit is scheduled rest every other year. It contains a gathering pen or "corral" that the ranchers sometimes use for a two week period during season's end livestock roundup. The Bannon unit is higher elevation and inaccessible till late in the summer. It is primarily transitory range and receives grazing use near the season's end, just prior to livestock removal.

The Patterson unit (approximately 1,400 acres) is the only suitable unit for early season use. This unit is typically grazed for 1 to 1.5 months depending upon resource conditions. It currently contains three water developments and is bordered by the Revis Allotment on the North. In 2008, the Bannon Mountain trail and trail head with a corral was constructed. It serves both the livestock operations as well as recreation riders.

The Cat unit (approximately 2,100 acres) is the driest unit with the least amount of livestock water available. It has two water troughs and shares a pond with the Patterson unit. Due to its limited water, the rancher has hauled water to the allotment in the past to keep livestock in the unit for a 1 to 1.5 month period.

The Peony unit (approximately 700 acres) is a high forage production unit. In the last 10 years it has received three (non-consecutive) years of rest from grazing, although reports indicate "stray livestock present, with light use" in those years.

The Bannon Mountain unit (approximately 1,400 acres) contains five water developments and is comprised primarily of transitory range. Due to elevation and snow melt factors, it must always be used last in the season.

Inventory of all water developments occurred in 2011, 2012, and 2013. These water developments and conditions are listed in Appendix H, Range Water Development Improvements. The Forest Service is working with the permittees to improve conditions at these developments.

**Aeneas Allotment**

Early documentation indicates the area was used by both cattle and horses since the early 1900's. The old Allotment management plan reported that up to 700 head of cattle and horses used this area yearlong before Forest Service management was authorized.

In 1957, the Tunk and Aeneas Allotments were combined, under the "Aeneas" name. In 1968 the two allotments were separated again. See Table 17, Aeneas Allotment History, below, for a summary of the historic use on the allotment over the past 100 years.

**Table 17, Aeneas Allotment History**

| Time frame | Livestock Numbers, Season |
|---|---|
| Early 1900's to 1930 | Early permit grazing- indication of high numbers |
| 1930's- 1948 | 701 c/c pair permit 5/16-10/15 |
| 1949-1963 | 671-760 c/c pair 6/1- 10/15 & 9/30 |
| 1964- 1967 | RESTED alternating years (754 c/c pair) |
| 1967-1979 | Steady c/c number decrease ( 655 to 379 in 1979 6/1- 9/30 |
| 1979- 1987 | 150 c/c pair, 6/1-9/30 |
| 1987- 1990 | 350 c/c pair,6/1-9/30 * |
| 1990-2002 | 300 c/c pair, 6/1-9/30 |
| 2002-2011 | 350 c/c pair, 6/1-9/30** |
| 2012 – present | 300 c/c pair, 6/1 – 9/30 |

* 1987 had a 150 stocking rate due to timber sale activity.
** 50 c/c pair initially moved from Bailey allotment to Aeneas as a result of the 2001 Bailey Mountain Fire; moved back after 2011.

The current permitted use is for 300 cow/calf pairs to graze between June 1 and September 30th. This is equivalent of 1610 AUMs or 1203 HMs. The Aeneas Allotment uses a deferred rotation grazing system.

The allotment contains two (2) units: the Sneed (aka: North) unit and the Bailey (aka: South) unit. These units are currently scheduled to be grazed north to south or south to north on alternating years. This provides grazing "deferment". Historically, range has been ready by June 1 each year.

The Sneed unit (aka: North) is approximately 5,400 acres where drier conditions exist. Many of the eleven (11) water developments operate only on high precipitation years. It contains 2 holding pens (small corrals) and 1 full corral known as the Jungle Creek corral which is currently located within the Riparian Habitat Conservation Area (RHCA) of Jungle Creek. Oral history indicates it was constructed sometime in the 1970s.

The Bailey unit (aka: South) is approximately 8,800 acres. It contains four developed water troughs, and several loosely documented livestock watering structures known as "cribs." This unit is bordered to the south by lands owned and managed by the Colville Confederated Tribes.

Inventory of all water developments occurred in 2011, 2012, and 2013. These water developments and conditions are listed in Appendix H, Range Water Development Improvements. The Forest Service is working with the permittees to improve water development conditions.

**Revis Allotment**

The Revis Allotment contains one pasture (75 acres) and has been historically used with adjacent private lands. There is no private land boundary fence. According to a 1973 Allotment Management Plan, the area was used by horses through the 1920's. Sometime in the 1930's its use was converted to heavy use by both cattle and sheep. In 1951, it was converted to strictly cattle, stocked at 50 cow/calf pair. Historically, range has been ready by June 1 each year.

This allotment has been rested via non-use for the last eight (8) years although there has been trespass, or unauthorized livestock drift from the adjacent Washington State Department of Natural Resource (DNR) lands and National Forest lands. All cases have been light, incidental use. See Table 18, Revis Allotment History, below, for a summary of the historic use of the allotment.

**Table 18, Revis Allotment History**

| Time frame | Stocking Livestock Type & Numbers | Season |
|---|---|---|
| 1920's to 1930's | Horse (Unknown #s, indications high) | No season described |
| 1930's …. | Cattle & Sheep, High numbers, | No season described |
| 1959-1971 | Permitted 50 cattle | 6/1- 7/1 |
| 1972-1973 | 13 cattle (cow/ calf pair)<br>3 cattle (cow/ calf pair) | 6/15- 7/1<br>6/1- 7/30 |
| 1973-1981 | No permit | |
| 1981- 2009 | Permit 8 cow/calf pair (Non-use 2006-2008) | 6/1- 9/30 |
| 2009- present | Waived back to the FS without preferred applicant. Currently vacant. | |

There are no developed water sources on the Revis Allotment.

**Tunk Allotment**

Early records indicate the Tunk Allotment received heavy grazing use from the 1890's through the 1930's. Most use was undocumented; however, oral histories noted that over 500 head of cattle and numerous undocumented horses used this allotment. Sheep bands of approximately 800 to 1,200 ewes/lambs each were trailed through the Lost and Barnell Creek areas along ridgelines of Bailey Mountain and toward Sneed and Bannon Mountains. See Table 19, Tunk Allotment History, below, for a summary of the historic use of the allotment over the past 100 years.

The Tunk Allotment is comprised of three pastures: the North (approximately 9,800 acres), the South (approximately 5,140 acres) and Barnell (approximately 1,580 acres).

The current permitted use is for 388 cow/calf pairs to graze between June 1 and September 30$^{th}$. This is equivalent of 2,083 AUMs or 1,556 HMs. The allotment has been operated under a deferred grazing system. On alternating years, the livestock would enter the South Unit first, graze for approximately 1.5 to 2 months, and then move to the North unit. On those years, the Barnell unit (Lost and Barnell Creek areas) is scheduled rest. The North unit is grazed between August 1$^{st}$ and September 30$^{th}$ during that

rotation. There is an associated 12 cow/calf pair allocated use from adjacent Washington State Department of Natural Resource lands, which are equivalent to 64 AUMs and 48 HMs. However, the forage allocated is based upon the forage and resource on the non-National Forest System Lands.

**Table 19, Tunk Allotment History**

| Time frame | Stocking Livestock Type & Numbers | Season |
|---|---|---|
| Prior to 1930 | High #s, Reports of 500 cattle | Year round |
| 1932-1948 | 125 c/c pair | 5/16-10/15 |
| 1949-1952 | 100 c/c pair | 6/1- 10/15 |
| 1953-1962 | 94 c/c pair (use between Tunk and Aeneas Allotments | 6/15- 7/1<br>6/1- 7/30 |
| 1963-1968 | 316-765 c/c pair Alternating Rest and Use with Aeneas Allotment | 6/1-9/30 |
| 1969-1981 | 496 c/c pair | 6/1- 9/30 |
| 1982-2008 | 388 c/c pair, | 6/1- 9/30 |
| 2009-present | 288 c/c pair. In the last five years, 100 c/c were in "non- use- personal convenience. The previous two years the same rancher requested and was granted two years drought effect Non-Use resource protection. | 6/1-9/30 |

On the other years, the livestock turn out on the North unit and it is used until August 1st depending upon resource conditions. The cattle are then moved to the South unit with a small portion 50 to 75 c/c pair moved into the Barnell unit for 2 to 3 weeks at season's end. The South unit would be grazed approximately August 1st to Sept 30th minus the livestock numbers allowed to graze in Barnell that year.

The "Beehive" area, west of Tunk Mountain, is typically used by one of the ranchers, while the Chewiliken area is frequently used by another rancher, and the Aeneas/Peony area is utilized by a third rancher. The range is frequently ready by June 1 each year.

The South unit is typically drier and contains two holding pens/corrals which facilitate livestock removal or round up. One of the two holding pens is located near Crawfish Lake, a popular recreational area, and may be used by other forest visitors. This corral has been useful to expedite livestock management but does suffer from frequent vandalism.

The Barnell unit is comprised of the Lost Creek and Barnell Meadows area. A fence was constructed in the 1980s initially dividing the areas. However, since 1990, the two areas have been managed together as the Range and Fisheries staff identified a need to rehabilitate the Barnell area. This was called the Barnell Meadows Restoration Project. It included plantings, fencing off old beaver dams, installing log structures or downed trees in Barnell Creek, and reducing livestock use in the area. Field reviews by Forest Ecologist, Rod Clausnitzer, in 2012, evaluated the Lost Creek system. The system was in a mid to late seral condition with indications of improving community condition. There are indications of previous stream channel degradation (widening channel with sediment deposition) but maintenance of riparian community function and integrity have led to improving trends. Past ecosystem function was probably dependent on beaver activity, as well, but beaver presence was not obvious during the field visit (Clausnitzer, 2014).

Lost Creek and Barnell Meadows continually showed an upward trend of stream bank stabilization. In 2002 through 2008, use was limited to 50 cow calf pair for one month. Ongoing trespass livestock problems from the adjacent Colville Confederated Tribal (CCT) lands to the south have resulted in new

fence construction along the boundary. It is still incomplete, since neither the Forest Service nor the CCT agency have authority to construct boundary fences. The permittees are building it without assistance. Recent harvest activities along the boundary indicate this need will continue. In 2010 and 2011, there was increased grazing within the Barnell unit. Factors contributing to higher grazing levels were found to have occurred: open gates, resource monitoring not met, and the fence between the Barnell and South units was found in disrepair.

Inventory of all water developments occurred in 2011, 2012, and 2013. These water developments and conditions are listed in Appendix H, Range Water Development Improvements. The Forest Service is working with the permittees to improve water development conditions.

**Forage Production**

Forage Analysis is conducted to establish potential livestock numbers, or carrying capacity. The following is a general outline of how it is measured. Forage species are measured across allotments in differing vegetation types. The vegetation types reflect the type of "range" or grazing area that livestock would utilize. Transitory, primary, and secondary are the range types for which forage production is calculated.

Transitory range is created by a timber sale or fuels reduction project's openings created in the overstory. The understory responds with increased vegetative growth and produces palatable available forage. Forage production in transitory range will eventually diminish as canopy cover re-establishes and shades the understory (Spreitzer, 1985). This time lag for canopy cover is considered in forage production calculations. Primary and secondary ranges are those areas which are naturally more open, or permanent range areas such as south facing slopes with shrub steppe communities. Primary range typically has water readily accessible to livestock through constructed water developments or approved and monitored natural sources. Secondary range has very limited water supplies, is utilized less, and AUM availability is adjusted accordingly.

Determining gross forage production is accomplished by clipping and weighing forage vegetation samples in different range types. The clipped forage species are graminoid ("grass like") or small forbs not browse species (aka: shrubs). In this analysis, browse species were not added into the forage capacities or added to forage produced. Browse utilization is limited by Forest Plan standards and guidelines respective to the Management Areas. For instance, the most limiting for domestic livestock browse allowable is up to 15% on browse species in MA 14-11A and MA 26-11B. This allows for Animal Unit Months (AUMs) to be calculated on these vegetation types. It does not allocate browse species such as shrubs to livestock. Although use occurs on shrubs, it is usually lighter. It occurs after the "grass like" species have reached their appropriate utilization levels and the livestock are being moved into other areas.

Measurements are taken to obtain representative biomass production information. It incorporates production with the number of acres of the range types available in each allotment. A percentage of the gross production is set aside first for wildlife forage and habitat. Only then is the remaining forage allocated to grazing livestock. The livestock numbers are not set at an allotment's maximum available forage. The remaining forage, after the wildlife set aside, exceeds the forage allocated for livestock permits. This creates an unallocated forage "buffer" to prevent inadvertent overuse. It provides vegetative structure for habitat and forage for other resources. It allows year to year forage production variances, preventing grazing levels to exceed forage production.

Forage production calculations for the Bannon, Aeneas, Revis, and Tunk Allotments display higher production levels than existing stocking levels. This indicates "Capability." However, forage production does not dictate stocking levels alone. Other resource needs and concerns affect stocking levels, thereby the AUMs which are allocated to the allotment. Specialist input on resource conditions and effects,

accompanied with field measurements and observations influence the allocated time and livestock numbers. Examples include timing when livestock might access a rare plant population or limiting grazing use in an area with riparian concerns. Management Area designations in the Forest Plan direct what percentages of the produced forage is allocated and what the management emphasis items are for each area. The Management Area designations can set aside higher percentages of forage species for wildlife habitat. The detailed forage analysis is in the analysis file with the Rangeland Vegetation Resource report.

The definition of rangeland capability is found in 36 CFR 219.3 and FSM 1905 as follows:

***Capability:*** The potential of an area of land to produce resources, supply goods and services, and allow resource uses, under an assumed set of management practices and at a given level of management intensity. Capability depends upon current resource conditions and site conditions such as climate, slope, landforms, soils, and geology, as well as, the application of management practices, such as silvicultural or protection from fire, insects, and disease.

Capability is the initial step in the determination of suitability. It is portrayed as a separate step both for reasons of clarity and because the actual product of "capability" often has utility in planning beyond its role in the determination of suitability.

GIS data was used to identify areas that meet the following criteria. The best available data was used in making the determinations. The capability threshold values recommended were utilized in this analysis as follows in the GIS query designating the suitability information. Begin with all lands within the project area that are National Forest System (NFS) lands. Lands under other ownerships were eliminated from consideration. Rock outcrops and rubble land, and other rock features were subtracted from the capable range. Plant associations that are not inherently capable of producing more than 200 pounds of forage/acre within their Potential Natural Community (such as badland outcrops, nutrient-poor soils, shallow soils, alkali salt flats, or with sections of 70% or greater crown closure) were subtracted from the capable range. Areas that consist of lakes, reservoirs, ponds, streams, and rivers (e.g. the area covered by water at the high water mark) were subtracted from the capable range.

Because the proposals only considered grazing by cattle, sheep capability thresholds were not considered in this analysis. Therefore, slopes greater than 50% were subtracted from the capable range. Because the capability of developing stock water does not appear to be limiting within the project area, distance to water sources was not considered in the capability analysis. The remaining area is Capable Rangeland.

Table 18, Allotment Capability Summary, below, summarizes the Capability or AUMs available for livestock grazing on National Forest System lands by allotment, post consideration of other resource values (ex: wildlife habitat and forage).

Capable acres result from the identified capable Upland and Riparian acres added together per pasture. Analysis set aside forage for wildlife. These calculations and acreage numbers are displayed in forage production for wildlife. These calculations and acreage numbers are displayed in forage production spreadsheets in the analysis file. They break out production by pasture, upland and riparian types, and both actual and estimated forage production AUM figures. Actual observed production exceeded the Forest Service Manual production estimates.

**Forest Plan Direction and Management Area (MA) designations**

The Forest Plan and Management Area (MA) direction affect how the forage allocations occur. Chapter 1 describes the Management Area direction that applies to the BART analysis area. The acreage location and percentage are displayed in the MA maps and acreage percentage Table 3, BART Management Area Acres, page 10. A brief description of the MAs relative to each allotment follows:

**Table 20, Allotment Capability Summary**

| Allotment | Pasture | GIS Acres | Capable Forage Acres | AUMs[1] | Currently Permitted AUMs |
|---|---|---|---|---|---|
| **Bannon** | | 5556 | 3594 | 927 | 806 |
| | Bannon Mtn. | 1376 | 1003 | 254 | - |
| | Cat | 2083 | 1633 | 414 | - |
| | Patterson | 1404 | 804 | 205 | - |
| | Peony | 693 | 210 | 54 | - |
| | | | | | |
| **Aeneas** | | 14181 | 8519 | 2162 | 1610 |
| | Bailey | 8773 | 4267 | 1060 | - |
| | Sneed | 5408 | 4352 | 1102 | - |
| | | | | | |
| **Revis** | | 75 | 72 | 18 | 0 |
| | | | | | |
| **Tunk** | | 16486 | 9529 | 2435 | 2083 |
| | North | 9766 | 5935 | 1509 | - |
| | South | 5137 | 2795 | 708 | - |
| | Barnell/Lost | 1583 | 799 | 217 | - |

[1]**AUM** (animal unit month) is the amount of forage required by one mature (1,000 lb.) cow, or its equivalent, for one month.

Management Area (MA) 5 emphasizes recreation opportunities. It is a very small portion within the analysis area and some of it is fenced to exclude livestock. A small fraction is contained within the Tunk Allotment.

Management Areas 14 and 26 emphasize management toward wildlife (deer winter range and fawning habitats) yet provides for timber management in MA 14. The percentage of available forage is retained first for wildlife habitat, then the residual for domestic livestock. The timber management activities in MA 14 produce more transitory range, which can provide forage for both domestic and wild animals. The total percentage for MA 14 and 26 are distributed in lower percentages (11 and 24% respectively) across the Bannon, Aeneas and Tunk Allotments than in MA 25. No MA 14 or 26 acres are in the Revis Allotment.

Management Area 25 contains more open landscapes and is typically of slightly lower elevation. These are managed for lighter use, given the vegetation type, the drier site, and less available livestock watering sites. Over half of the Bannon, Aeneas, and Tunk allotments, and the entirety of the Revis Allotments are in this MA.

The forage produced from both the transitory and primary ranges in all four allotments allows even distribution of livestock. Grazing levels are currently complying with Forest Plan grazing utilization Standards and Guidelines, on these allotments, for uplands vegetation. Riparian areas have additional standards and guidelines which direct management.

Table 21, Allowable Use of Available Forage outside Riparian Areas, below, describes the Forest Plan Standards and Guidelines for forage (grass, grass-like, and forbs), and does not include browse of twigs or shrubs, utilization in uplands (Forest Plan Table 4-22, page 4-43):

**Table 21, Allowable Use of Available Forage outside Riparian Areas (1) Maximum Annual Utilization Percentage (2)**

| | Forest | | Grassland | | Shrubland | |
|---|---|---|---|---|---|---|
| Range Resource<br><br>Management Level | Sat. (3)<br><br>Cond. | Unsat. (4) Cond. | Sat. Cond. | Unsat.<br><br>Cond | Sat.<br><br>Cond. | Unsat.<br><br>Cond. |
| B-Livestock use managed within current grazing capacity by riding, herding, and salting. Cost effective improvements used only to maintain stewardship of range. | 40 | 0-30 | 50 | 0-30 | 40 | 0-25 |
| C-Livestock managed to achieve full utilization of allocated forage. Management systems designed to obtain distribution and maintain plant vigor include fencing and water development. | 45 | 0-35 | 55 | 0-35 | 45 | 0-30 |
| D-Livestock managed to optimize forage production and utilization. Cost effective cultural practices improving forage supply, forage use, and livestock distribution may be combined with fencing and water development to implement complex grazing systems. | 50 | 0-40 | 60 | 0-40 | 50 | 0-35 |
| (1). This will be incorporated in annual operating plans and AMPS. AMPS may include utilization standards which are either lower or rarely higher when associated with intensive grazing systems and specific vegetation management objectives which will meet resource objectives. Includes cumulative annual use by big game and livestock. Satisfactory and unsatisfactory conditions are defined in the glossary.<br>(2). Utilization based on percent removed by weight for grass, grass like, and forbs.<br>(3). Satisfactory Condition.<br>(4). Unsatisfactory Condition. | | | | | | |

Table 22, Allowable Use of Available Forage in Riparian Areas, below, describes the Forest Plan Standards and Guidelines for forage utilization in riparian (Forest Plan Table 4-20, page 4-44):

**Grazing Infrastructure**

Grazing management is dependent upon physical infrastructure and communications.

Allotments are managed under the U. S. Forest Service grazing permit system. This system, generally, issues ten year term permits. In general, permits contain requirements of permitted livestock ownership, base property ownership, forest officer direction, range improvement maintenance, allotment maps, compliance with laws and amending documents (ex: Allotment Management Plans (AMPs), Biological Assessment (BA) requirements).

**Table 22, Allowable Use of Available Forage in Riparian Areas (1) (Maximum Annual Utilization Percentages)**

| | Grass and Grass like (2) | | Shrubs(3) | |
|---|---|---|---|---|
| Range Resource<br><br>Management Level | Sat. (4) Cond. | Unsat. (5) Cond. | Sat.<br><br>Cond. | Unsat.<br><br>Cond. |
| B-Livestock use managed within current grazing capacity by riding, herding, and salting. Cost effective improvements used only to maintain stewardship of range. | 40 | 0-30 | 30 | 0-25 |
| C-Livestock managed to achieve full utilization of allocated forage. Management systems designed to obtain distribution and maintain plant vigor include fencing and water development. | 45 | 0-35 | 40 | 0-30 |
| D-Livestock managed to optimize forage production and utilization. Cost effective cultural practices improving forage supply, forage use, and livestock distribution may be combined with fencing and water development to implement complex grazing systems. | 50 | 0-40 | 50 | 0-35 |
| (1). This will be incorporated in AMPS. AMPS may include utilization standards which are either lower or rarely higher when associated with intensive grazing systems and specific vegetation management objectives which will meet objective for the riparian dependent resources. Includes cumulative annual use by big game and livestock. Satisfactory and unsatisfactory conditions are defined in the glossary.<br>(2). Utilization based on percent removed by weight.<br>(3). Utilization based on incidence of use, weight and/or twig length. Example: if 50 leaders out of 100 are browsed, utilization is 50 percent.<br>(4). Satisfactory Condition.<br>(5). Unsatisfactory Condition. | | | | |

Grazing permits and annual instructions for these allotments are updated to meet all management direction specified by the Okanogan Forest Plan. However, three (3) of the four (4) AMPs have not been updated since the late 1960s, early 1970s. The last one was updated in 1981. All four allotments need AMP revision. The updated AMPs will be based on this NEPA document. Updated and revised AMPs would become part of the grazing permit (FSH 2209.13 Section 94.1).

Currently, one of the four allotments is permitted to three different local ranchers. Two allotments are permitted to one rancher. The remaining Revis Allotment is currently vacant. Ranchers holding permits on National Forest System lands are further referenced in this document as “permittees.” Table 23, Current Stocking Head Month by Allotment, below, gives information about the current permitted use of the allotments.

**Table 23, Current Stock Head Month (HM) by Allotment**

| Allotment | HMs[5] permitted | Livestock Number Cow/Calf pairs | Season of Use |
|---|---|---|---|
| **Bannon** | 602 | 150 | 6/1-9/30 |
| **Aeneas** | 1203 | 300 | 6/1-9/30 |
| **Revis** | 32* | 0 | 6/1-9/30 |
| **Tunk** | 1604** | 388 | 6/1-9/30 |

*Previously permitted Head Months for Revis utilized adjacent private lands as part of the allotment. See background information starting on page 82. Standard Forest Service administration accounts for privately controlled lands if included in the permit. If not included in the allotment permit, adjusted to only National Forest System lands.

**Includes 48 HMs on adjacent State lease land.

Permittees and the U.S. Forest Service meet annually to discuss grazing strategies, range improvement needs, monitoring and any concerns other Forest Service resource specialists raise. Communications continue throughout the grazing season. This allows the Forest Service and permittees to respond promptly, if an issue arises, and reduces grazing impacts or conflicts. Permittees are encouraged to participate with Forest Service personnel in monitoring, reporting livestock moves, and range improvement (water sources, fences, etc.) needs.

Allotments are managed with strategies of riding, supplement placement, salting, pastures (units) to facilitate livestock control and distribution. Range improvements (structures such as: fences, water troughs, cribs[6], stock drives, corrals) are important for livestock control and distribution. A list of existing livestock watering sources or water developments, and maps of range improvement locations are found in Appendix A, Maps, and Appendix H, Range Water Development Improvements.

Livestock grazing occurs mainly in lower elevations of allotments where there is a combination of permanent and transitory range. A system of stock driveways, allotment boundary fences, drift fences, pasture division fences, and other fences allow the permittees to control livestock and move them when a pasture approaches 45 percent (outside riparian) forage utilization by livestock. Riparian monitoring uses a livestock move trigger of 10% hoof shear, at key locations. This “trigger” indicates time to initiate livestock moves out of the area, so as to not exceed the 20% threshold required in the PACFISH & INFISH Biological Opinions (PIBO).

Many creek drainages are steep with downed timber in them that restricts livestock movement. Livestock access occurs along the streams to areas which have either been cleared by past timber harvest, fires/burning, or are adjacent to roads. Salting or placing other nutrient supplements on the ridges, away from water sources, helps keep livestock from over utilizing the lowlands (Bailey 2004).

Although grazing systems and conditions have improved from the past, there are still some difficulties in livestock distribution and management. The long term improvements are documented in Condition and Trend transects, range utilization, and production documentation and inspections.

[5]HM = Head Months is a term used for billing purposes to calculate an occupancy level. It assess “how many animals” and for “how long” are billed. It is not a forage measurement. It is calculated via the following formaular (# mature animal days/30.4167) one month’s use and occupancy of range by one weaned or adult anuimal, cow, bull, steer, or heifer. Calves are not counted.

[6] Cribs: livestock watering sites developed by digging a hole at the water source, blocking water flow partially (has outlet) with logs or other structural barrier. These form a small pond like structure which livestock can drink.

The last decade sustained eight consecutive years of drought. The precipitation levels were better in 2011, 2012, and 2013. Water development site inspections were moist or flowing, when during previous years several developments were not. The 2012 grazing season, was the first full year where the livestock operations were not altered for the drought. The previous eight years, drought impacted livestock distribution patterns. Permittees voluntarily reduced livestock numbers for the grazing season in an attempt to reduce resource impacts. However, livestock behavior was a greater factor for areas of use, than livestock numbers. The same areas received similar use as the years with higher livestock numbers. As cattle sought out shade and limited water, utilization levels measured at the water sources were higher than previous years. Some permittees hauled water on other allotments across the district. However, this "water hauling" did not occur on these allotments. Riding efforts continued. The efforts to distribute livestock away from riparian and to uplands were more successful.

**Existing Condition**

The following summarizes the allotments and their respective vegetative conditions. The areas of grazing concern are described in the following and in the Aquatics/Fisheries and Hydrology sections, later in this document.

**Vegetation and Forage**

Forage species vary on all four allotments. Many of the old timber units, roadsides, and landings were seeded with clover (*Trifolium repens*), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), and orchard grass (*Dactylis glomerata*); these grasses are highly palatable and nutritious for livestock (USDA Forest Service 1937). Native grass species that occur on the allotments include alpine timothy (*Phleum alpinum*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), and pinegrass (*Calamagrostis rubescens*). The seeded areas, and native graminoid stands produce the majority of forage for the allotments. The native forested vegetative ecosystems provide forage, but have different levels of production. Drier, open Douglas fir, ponderosa pine forests have less canopy cover, and produce more forage than a denser canopy cover forest, such as a mixed conifer, higher elevation with a closed canopy. The high elevation, closed canopy forest does not produce understory forage species available for grazing. Meadows often contain shrub and hardwood species such as alder, aspen, and birch. Hydrophilic species such as sedges, rushes, and grasses are commonly occupying wetlands and meadows. Native species range from the drier lower elevation Ponderosa pine-Douglas fire/beardless bluebunch wheatgrass to higher elevation subalpine fir/grouse huckleberry plant associations (Williams, 1983). Range condition and trend analysis assessed representative species composition and ecologic condition for vegetative resources.

**Monitoring**

Short-term and long-term monitoring of grazing plus coordination with other resources is used to identify program needs and administration. Monitoring is typically implemented through field inspections, photos, Condition and Trend transects, and Management Indicator Monitoring (MIM). It involves Forest Service resource specialists and permittees.

**Field Inspections**

Field, or sometimes called "range", inspections and observations are gathered and kept in the Range files (2230 files, Tonasket Ranger District) to document grazing levels and vegetative and riparian use across the allotments. These include items such as riparian photos and written observations by Forest Service personnel. The following describes more recent findings and management adjustments.

Some localized problems due to grazing are found on the allotments. The areas of concern which are receiving grazing-related impacts include riparian areas on all of the allotments. Hardwood species such as aspen, alder, and willow are monitored for "browse" use relative to Forest Plan browse utilization standards and guidelines. Typically, most monitoring sites meet the standards, but if approaching the standards, the

livestock are required to move. Aspen management is designed for habitat retention or enhancement. In general, aspen sprouts are browsed by cattle and wet soils on which the stands grow receive livestock trampling. Some meadows near streams with hardwood species were planted with palatable forage species in the past. This makes these areas particularly attractive to cattle and susceptible to overuse and soil damage from hoof action. These sites are monitored annually by Forest Service personnel. Livestock are moved from the hardwood areas per monitoring results. Grazing timing can reduce the amount of browsing which occur on these stands (McInnis et al. 2009). Recent efforts to expand exclusion fences near livestock watering sites have led to more hardwood suckering and grazing protection. Most of the unfenced sites are monitored for utilization by the Rangeland Management Specialists and other Forest Service personnel.

Field, or "range", inspections perform utilization monitoring on a routine basis throughout the grazing season. The monitoring documents species, percent grazed and livestock distribution. Past range inspections and monitoring documented small areas with heavier livestock use. These areas tended to be isolated spots around the allotments, usually in proximity to watering holes, water troughs, salting areas, and areas with high-quality forage. These sites would exceed, but overall pasture grazing use would meet, the Forest Plan Standards and Guidelines. However, use is desired to meet throughout, so resolution is often attained by changing livestock distribution. Adjusting grazing practices changes the use pattern or livestock distribution. Monitoring grazing distribution allows the permittees (through notification or self-monitoring) to move livestock to the uplands, into natural openings, or past timber sale units, away from these sites.

Riparian monitoring occurs throughout the allotments. The following nine (9) areas are currently monitored for utilization to act as "triggers", determining the need to move livestock.

- No name Tributary 5 of Upper Aeneas (Tunk Allotment)
- Upper Jungle Creek (Tunk Allotment)
- Lost Creek at PIBO site (Tunk Allotment)
- Barnell Meadows South Pasture (Tunk Allotment)
- Upper Peony Creek at PIBO site (Tunk Allotment)
- Patterson Creek- above 3010395 spur road (Bannon Allotment)
- Peony Creek at PIBO site (Bannon allotment)
- Jungle Creek Exclosure old PIBO (Aeneas Allotment) as a control comparison
- No name Aeneas Tributary 2 (Aeneas Allotment)

**Condition and Trend Monitoring**

Condition and Trend (C&T) Range ecology plots, sometimes referred to as Parker Three Step, are long term plots (50 + years). These plots establish long-term information on vegetation percent composition, by species. The species are indicators of vegetative health. Ratings for soils display trends for erosion or other factors. A cover and composition description results from this data. Since the 1980's, it has been the practice to add Nested Frequency plot data gathered at the same C&T plots to gain an overall species percentage composition via a Daubenmire plot grid. The lay person may understand these plots to read vegetation percent composition and cover.

These plots monitor the soil conditions, cryptogrammic crust, and plant species composition (vascular and non-vascular) and use photos. They also monitor any potential shift of invasive plant species on site. These were typically established in the 1930's and read in a cycle of approximately every ten (10) years. The last few cycles have incorporated additional photos and nested frequency plots to obtain more species information. These plots identify species, with seral (stage within an ecologic classification) characteristics and indicate a sites ecologic stage. Some plots were lost and then recently relocated. Some plots were not

relocated in the recent re-sampling. Notes indicate some of the plots are possibly lost via old timber sale units or other activities affecting sample effects (ex: small mammal burrowing in soil readings). No plots were established on the Revis Allotment due to its small size. Some plots contain dual names (ex: Aeneas/Bannon) since Bannon was historically managed in conjunction with either the Tunk or Aeneas Allotments.

Condition and Trend transects were reread in 2006, 2010, and 2011. Readings indicated a move toward a stable or positive trend with reduced numbers of invading plant species, stable soils (based on no rilling, erosion) and intact cryptobiotic populations. Table 24, Conditions & Trend (C&T) Summary, below, is a summary based upon review of the plot information. These plots are not established in riparian zones but in the uplands. The Condition and Trend transects indicate a maintained and improved upland range condition.

**Table 24, Condition & Trend (C & T) Summary (vegetation percent composition)**

| Allotment | C&T Number | Year | Recent Trend Assessment re: Forage Rating (upland or meadow) | Recent Trend Assessment re: Soil Rating Stability | Notes |
|---|---|---|---|---|---|
| Bannon | 36 | 1959, 1961, 1980 & 2010 | Good to Excellent | Good to Excellent | Narratives indicate light grazing, logging effects Trend is improving |
| | 41A | 1980 & 2010 | Good to Good | Good to Excellent | Established later. Trend is stable at "Good" |
| | 42 | 1980, 2006 & 2011 | Excellent to Excellent | Excellent to Excellent | Recovering 2006-2010 readings<br>Trend is stable at "Excellent" |
| | | | | | |
| Aeneas | 37 | 1957 | Poor | Excellent | Not relocated |
| | 38 | 1955, 2010 | Good | Excellent | Trend is improving for soils, and stable for forage |
| | 44 | 1959, 2006 | Fair | Excellent | Trend is stable |
| | | | | | |
| Tunk | 40 | 1961, 2010 | Fair to Good | Good to Good | Trend is improving for forage, and stable for soils |
| | 43 | 1957, 2011 | Good to Good | Good to Good | Trend is stable at "Good" |
| | 45 | 1962, 2011 | Poor to Fair | Good to Good | Trend is improving for forage, and stable "Good" for soils |

In summary, this upland monitoring documents percent cover and composition to be in "Good" to "Excellent" condition in most cases, or improving on the one reading in the Tunk allotment that was previously poor. This means the numbers of desirable native plant species has been increasing toward potential native plant community types. There is a reduced presence of non-native or invasive species. That means desirable natives are the primary percentages of plant cover and composition. The soils ratings show "Good" or "Excellent" in all plots

**Management Indicator Monitoring (MIM)**

This monitoring is designed to meet the PACFISH/INFISH Biological Opinion (PIBO) and adds a layer of riparian monitoring. This monitoring provides information relative to species composition and cover within riparian plots. It is less comprehensive to range ecology and trend monitoring than the Condition and Trend monitoring for percent cover and composition, but has value to indicate short-term vegetation changes or disturbances. Photos and observer notes help record changes in vegetation and composition. These notes are not summarized in the table relative to the indicator, but can be surmised from the field observation notes and photos in the files. The table below summarizes met or not met critical compliance with the biological opinion.

**Table 25, A Summary of the Management Indicator Monitoring (MIM) by Creek and Year**

| Bannon Creek | Year | Met Y or N | Notes |
|---|---|---|---|
| Cat | 2002 & 2003 | N/Y | Dropped per Fisheries biologist input- no flow, Past monitoring at seasonal spring site 4'X3' site- |
| Peony* | 2002*, 2003, 2004, 2006 & 2009 | Y & N | Met on some years- not others. Monitored at higher frequency than 5 year protocol due to years not met, and administrative compliance. |

* Plot re-read from previous year not meeting. Notes indicate observer concerned about livestock effects to fragile stream bank.

| Aeneas Creek | Year | Met Y or N | Notes |
|---|---|---|---|
| Jungle | 2001, 2003 & 2009 | N/Y | Located adjacent to corral. Did not meet in 2003; sampler error-taken in snow. Dropped per Fisheries biologist input in 2009 for potential new site designation as sample location; washed out in 2008 & 2009 from flooding. Riparian still monitored via Range inspections |

| Tunk Creek | Year | Met Y or N | Notes |
|---|---|---|---|
| Barnell | 2009 | Y | Met stubble height and streambank stability standard. Site has been modified and eliminated. |
| Lost | 2000, 2004, & 2005 | Y | Stubble height most effective, consistently meets stream bank stabilization % |
| Chewiliken | 2002, 2004, 2009 | N & Y | Met stubble height and streambank stability standard but 1 year it did not meet streambank stability. |
| Peony Creek (North Peony) | 2000, 2002, 2004, 2009 | Y | Met stubble height (3") and streambank stability (< 20%) all years. |

Initially, the monitoring was designed to look at remaining stubble height post grazing along the creek sides. Later, stream bank hoof shear was added to the monitoring protocol. The summary displays results of the grazing meeting the PIBO measures. These measures are based upon measuring remaining plant stubble height post grazing and/or stream bank stability. In most cases, it always met standards. When it did not, grazing was changed to ensure the standards were met in the future. Follow-up surveys were conducted to measure if standards were met after grazing was altered to ensure the change improved the condition. It always met after a change. Table 25, Summary of the Management Indicator Monitoring by Creek and Year, above, is based on PIBO files at the Tonasket Ranger District.

**Revis**

There are no riparian areas located on the Revis Allotment, so no MIM plots.

**Other Concerns**

Other resource concerns on the allotments relate to the interaction of cattle and noxious weeds. Since noxious weeds are an "invasive plant species" and adversely affect the indicator or desirable plant species composition and cover, it is appropriate to mention their interaction as they affect rangeland vegetation cover. Noxious weeds problems are currently being mitigated through Best Management Practices (USDA-FS BMPs, 2001). BMPs are a tool to minimize invasive plant species negative effects to plant cover and composition.

Permittees use BMPs to avoid noxious weed spread. Noxious weeds adversely affect available forage. Some species, such as St. John's wort and hounds tongue, are toxic to grazing animals. This provides additional motivation for the permittees to actively participate in noxious weed prevention and control measures. Weeds are discussed during annual meetings and throughout the grazing season. They report infestations and assist in manual control- hand pulling. Their efforts to meet proper grazing levels and not exceed forage utilization contribute to stable plant communities and thus, available forage. The permittees participate in noxious weed control and prevention. One is volunteering with the district to incorporate early detection rapid response techniques of control, including, but not limited to, coordinating with Forest Service personnel to control specific populations. This rancher currently holds Washington State certification for a public applicator's license and attends noxious weed trainings and meetings throughout the year.

**Climate Change-Soil Carbon and Greenhouse Gas Emissions (GHG)**

The scale for this analysis is the BART analysis area and its relative contribution and impact on the global carbon cycle and global climate change associated with greenhouse gas emissions. It is impossible to assess the impact of global climate change on rangeland ecosystems without high quality, consistent, assessable, soil and vegetation data and models that describe how changes occur in response to stress and disturbance. Quantitatively, or even qualitatively, determining the relative effects of the different alternatives for livestock grazing from these allotments on climate change or the effects from climate change from the proposed project is speculative.

Grazing effects to vegetation is the focal point for several climate change articles and references. In the Utah State "Range Management in the Face of Climate Change" articles; most literature refers to the effects of "intensive agriculture" or heavy grazing. Few articles address the transitory range vegetation described in the BART analysis area. For this analysis purpose, several articles relating to grazing and climate change were reviewed (ex: Belsky and others 1999). According to the recent Environmental Management, Volume 51, pages 474-491 rebuttal to the Beschta et al. 2013 "Adapting to Climate Change ...Ungulates" article, the authors were selective in use of scientific literature... more opinion, than synthesis..., do not acknowledge that practices have changed, and few of the climate change articles are relative to grazing." The results from many articles indicate that prediction is all over the board for effects. However, some common themes flow through most articles. Ecological Assessment for meeting Rangeland Health standards is another approach to improve habitat resiliency, which is linked to

increasing "habitat resilience helping ecosystems withstand climate change" (Catlin, 2011). The analysis reviews other literature relative to the scale of activity and effects.

Grazing lands are estimated to contain 10 to 30 percent of the world's soil organic carbon. (Schuman et al. 2002). Grazing results in redistribution of carbon on the landscape (Stavi et al. 2008). Even though, Alternative 1 is a No Grazing alternative, other wide ranging ungulates do use this area. Free ranging livestock deposit manure across the landscape resulting in aerobic decomposition. Aerobic decomposition of manure generates considerably less methane than does decomposition associated with stockpiling strategies employed in more concentrated livestock production strategies (US EPA 2005b). This "in-effect" land application of manure also results in a buildup of soil carbon that decomposes much more slowly than occurs when composting and represents a potential long-term soil carbon gain (Fellman et al. 2008).

Studies based on modeling and remotely sensed data indicate that proper grazing can improve ecosystem production as measured by soil carbon storage (Li, et al. 2007, Steinfeld and Wassenaar 2007, Reeder et al. 2001, Schuman et al. 2002). Additional studies similarly conclude that certain levels of grazing may increase carbon sequestration (Derner et al. 2005, LeCain et al. 2001, and Ganjegunte et al. 2005).

Several studies indicate that light to moderate levels of grazing have no overall effect on total carbon sequestration (Ingram et al. 2008, Derner et al. 2005, Stavi et al. 2008, Owensby, et al. 2006, Shrestha and Stahl 2007, Ingram et al. 2007), while some studies have found limited to large reductions in soil carbon and increases in $CO_2$ flux associated with grazing (Haferkamp and Macneil 2004, Welker et al. 2004).

Rotational grazing appears to be a viable option for greenhouse gas (GHG) reduction and carbon sequestration credits (Li et al. 2007, Ingram et al. 2008, Sharrow 2008).

**Environmental Consequences**

**DIRECT/INDIRECT EFFECTS**

**Alternative 1**

For all four allotments, grazing would cease on National Forest System lands within two years. All other activity in the assessment area, not connected to grazing, would continue. Livestock use in riparian areas and wet meadows would cease and cattle would no longer trample areas along wetlands. The expected result would be a continued stable improving trend in both upland and riparian vegetation sites, based upon the current trends in grazing monitoring. Range improvements (ex: fences and water troughs) would be allowed to deteriorate and stock trails would not be maintained.

**Vegetation Cover and Composition**

Effects on upland and riparian vegetation are based upon some general assumptions. These assumptions are: 1) active prevention and control measures limit invasive plant species introduction and/or spread, which would offset desired plant ecosystems; 2) recreational livestock use remains at existing levels; 3) wild grazing ungulate use levels remain close to existing levels; and 4) unauthorized "trespass" livestock grazing does not incidentally increase in high enough numbers to utilize the same sites or quantity permitted livestock use.

With livestock forage utilization at zero percent, improved or sustained plant productivity, should occur. This is due to improvements in plant vigor. Removal of livestock grazing would allow for plant species to complete their growth cycle. Plant vigor, soil stability, and ground cover would increase. Adequate litter would be left every year for ground cover to add organic matter into the system and to protect soils from erosion. Grasses, especially cool season grasses, and forbs will be able to produce seeds and in the

quantities needed to establish new seedlings. Plants on site would continue to reproduce; therefore the desired species composition would be maintained.

Upland vegetation cover and composition is expected to maintain or improve slightly. This is due to it currently meeting desired conditions. Upland vegetation, currently with a stable trend, would be expected to slowly improve to an upward trend. An upward trend is still possible given the plant ecology measures species and percent cover relative to 100%. Since 100% doesn't occur in a natural environment, the desirable condition has been met at a "Good" rating. There would still be some grazing and browsing by wildlife and by recreational livestock. The rate of improvement may accelerate because more plant material would be left on-site rather than being consumed.

Existing upland and riparian vegetation would slowly increase in vigor and density, bare ground would decrease over time, and increased vegetation would allow for more sediment to be trapped, decreasing erosion. Sites with stable or upward trends or ecological status would be expected to continue to improve.

There is research that indicates some species (such as bunch grasses) do not increase long term without grazing. Several articles indicate that without active removal of grass tillers (ex: grass blades) the plant becomes decadent and less healthy (Wood, 1997). Other articles, based on professional experience, state that where permitted grazing was eliminated, long-term range ecology plots, showed a high percentage of native species presence, but increased percentage of litter (dead plant material) in plots.

Elimination of domestic livestock grazing may not be expected to lead to rapid improvement on areas that were most heavily impacted by historical livestock use. Areas where livestock gathered on moist soil types for prolonged periods and where non-desirable plant species were established may take more time to recover. Other ongoing forest uses may contribute to effects on vegetation or riparian health. Examples include, but are not limited to areas which were managed with past heavy equipment operations and subsequent seeding of Kentucky bluegrass, may have less ability to recover given less available native species present. The resiliency of Kentucky bluegrass to persist within an ecosystem and the potential soil compaction presence may prevent the establishment of desirable native plant species. An active road system through a meadow may continue to contribute to soil and watershed conditions preventing establishment of more desirable native plants within the community. Roadways can contribute to noxious weed spread given the propensity of plant particulates to be in the undercarriage of vehicles and roadsides provide a potential seed bed for their propagation (Mack 2003). Noxious weeds are not part of desirable plant ecosystem composition.

Plant composition and health affects fuel structure. In general fine fuels, such as grass and forbs, should increase. This may serve to carry more fire in an event. Refer to the Fuels resource report for more information.

**Range Infrastructure/Improvements**

Although range infrastructure or improvements are not determined to be measurable indicators with the vegetation health issue, their effects by alternatives are partially disclosed in specialist's reports such as Social and Economics, Recreation, and Wildlife. Since these structures affect livestock distribution and use, therefore, affecting what vegetative species remain in percent cover and composition, they are mentioned. Most references regarding these effects are described in Alternatives 2 and 3, because those alternatives propose their actual use. This alternative describes their deterioration and removal, so it is only mentioned for comparison. Their deterioration or removal is not expected to affect vegetation. This is based upon the assumption removal involves manual labor, and no heavy equipment.

Fences that are along the private land and National Forest boundaries would be left in place because they are the property of the adjacent landowners. These may be removed or continue to be used and maintained depending on the needs of the other landowners. Most fences would remain in place because current adjacent landowners either own livestock or lease their land to local ranchers. The need to keep those livestock off the National Forest System lands would continue. Vegetation cover and composition is expected to improve in riparian areas.

**Effects Common to Alternatives 2 and 3**

**Vegetation Cover and Composition**
Both Alternative 2 and 3 are likely to see an improvement to vegetative cover and composition in riparian areas. Upland vegetative condition is currently in good or stable ecologic conditions that are expected to continue. More detailed rationale is provided in effects by alternative.

**Range Infrastructure/Improvements**
Although range infrastructure improvements are not determined to be measurable indicators directly with the vegetation composition or cover, their effects by alternative are partially disclosed in the following. Most references regarding these effects are described in grazing in alternatives 2 and 3, because those alternatives propose infrastructure use.

Grazing infrastructure demands for maintenance and monitoring increase with each range improvement constructed. Both Alternative 2, at its final stage and Alternative 3 are equal in administrative requirements to monitor those fence lines, water developments, and other structures which are currently in use. Since the number will be increased, the maintenance requirements increase for the permittees, and the monitoring increase for Forest Service personnel. If final stages are reached for Alternative 2 or if Alternative 3 is implemented, then some mandated rest pastures would not have their internal parameter structures maintained. These are likely to degrade until grazing is restored. More maintenance and monitoring would be necessary for structure integrity and whether or not they provide adequate measures to improve livestock distribution, and thereby, maintain or improve vegetative cover and composition.

**Adaptive Management Strategies Common to Alternatives 2 and 3**

**Permit Administrative Actions**
Term grazing permits may be modified at the request of the permit holder or the Agency. Permit modifications are administrative actions and do not require additional analysis unless they are inconsistent with existing environmental analyses and related decisions. Permit modifications may include the actions described below.

An administrative action could include: modifying the seasons of use, numbers, class of livestock allowed, or the allotment to be used under the permit, because of resource condition, or permittee request. These changes may be implemented at the request of the permittee. Grazing management needs to be responsive to Forest resource condition. It also requires responsiveness to the livestock permittee operational needs. For example, market economics may lead to short-term reductions in breeding cattle and consequently the need to adjust the number of animals grazed in a given year on Forest rangelands. Adjustments to improve attainment of desired resource conditions within an allotment are beneficial to vegetative cover and composition. Where vegetation conditions are healthy, they would be maintained, and expected to improve where monitoring indicated a need for change. The result is expected since these modifications include shortening the period of use to reduce, or eliminate, grazing impacts during periods where plants or other resources are most susceptible to damage, or avoid conflicts. Modifying the season of use for an allotment would be minor, and must keep to the two weeks parameter for livestock on and off dates. Again, this is considered to be beneficial since it is responsive to monitoring results or seasonal climatic fluctuations such as drought. Before approval, proposed changes would be evaluated to

ensure they fall within the scope of the current NEPA analysis (ex: keep within the scope of analyzed Animal Unit Months, limited riparian vegetative resource impacts are within standards and guidelines, etc.

The effect of permit modifications is anticipated to be beneficial to vegetative cover and composition. Modifications could result in decreased bare ground and an increase in species composition where an overall decrease in grazing use on the allotments occurs. Changes would keep the trend in upland and riparian vegetation static to upward and desired conditions would continue to be attained. Therefore, vegetative composition and cover is expected to improve.

Please note, changes in the kind of livestock (ex: changing an allotment from cattle to sheep), are a modification. However, since it is not covered in this analysis, a new environmental analysis would be required.

The effect of administrative changes is anticipated to be beneficial. For example, changing the season of use to avoid grazing impacts or conflicts with critical resource needs eliminates the conflict. Adapting the grazing season in response to seasonal variations in climate and productivity, such as during periods of drought will reduce impacts to vegetation. Matching grazing use to actual resource conditions and productivity allows grazing use to stay in compliance with Forest Plan direction and site specific desired conditions.

Overall, the effect of modifications is anticipated to be beneficial due to their design in direct response to monitoring and management. Reducing the amount of time grazed, or reducing utilization levels, would result in reducing the overall grazing impacts and improve attainment of desired conditions through grazing within the affected area of the allotment.

**Grazing System Modifications**
Modifying the grazing system is an administrative action which provides flexibility to improve range health on the allotments. Incorporating changes by altering patterns of livestock use, pasture deferment, pasture rest, altering the trailing or livestock movement routes, may reduce grazing effects in areas identified through monitoring as not moving toward or maintaining desired conditions at a stable or improving rate. Modifying grazing systems may also be implemented where fire, flood, etc.; detrimentally impact resource conditions or where treatment activities require a rest period to provide for site recovery. Where “rest” occurs, specific recovery criteria for grazing re-establishment would be specified. The effect of changed grazing systems is anticipated to be beneficial. Matching grazing use to actual resource conditions and productivity allows grazing to stay in compliance with Forest Plan direction and site specific desired conditions.

**Range Improvements**
Administratively modifying a permit to improve existing water developments is part of adaptive management. Grazing permit modifications (improving range structures) increase management effectiveness. It is expected to be beneficial to resources by protecting the water source and improving livestock distribution away from riparian areas, thereby reducing livestock impacts. Effectiveness of fences, water developments, and handling facilities is covered in more detail in Alternatives 2 and 3

**Alternative 2**

Table 26, Alternative 2, Head Month, Animal Unit Months, Livestock & Season of Use, below, displays livestock use that would be permitted on the allotments with the following potential seasons of use and maximum head months permitted.

**Table 26, Alternative 2, Head Months, Animal Unit Months, Livestock & Season of Use**

| Allotment | HMs[1] permitted | Capable AUMs[2] | Season of Use[3] |
|---|---|---|---|
| **Bannon** | 602 | 927 | 6/1-9/30 |
| **Aeneas** | 1203 | 2162 | 6/1-9/30 |
| **Revis** | 0 | 18 | 6/1-9/30 |
| **Tunk** | 1604* | 2435 | 6/1-9/30 |

[1] HM (Head Month) is [# mature animal [days/30.4167] one month's use and occupancy of range by one weaned or adult animal cow, bull, steer, or heifer. Calves are not counted. This is a term used mostly for billing purposes to calculate an occupancy level – how many animals for how long.
[2]Capable AUMs (Animal Unit Months) is the amount of forage required by one mature (1,000 lb.) cow, or its equivalent, for one month. The capable AUMS are calculated from forage studies and reserves allocated for wildlife
[3]The **Season of Use** is the time span which the livestock are permitted on the allotment.

The "on" and "off" dates may vary by up to two weeks to accommodate seasonal changes from year to year. Cattle may be pulled off the allotments early during drought years, depending on resource conditions.

This alternative implements Adaptive Management to improve existing riparian/sediment conditions on the allotments. It utilizes "stages" of implementation in response to monitoring success or failure of improving riparian areas. Please refer to Chapter 2 for full description of means or "stages" monitoring and implementation.

This analysis does not detail optional management strategies the permittees can use to attain improved resource conditions. Some management strategies are not mandated, but administratively available to implement. They cannot be mandated through the U.S. Forest Service permit system, but some permittees have already expressed their desire to use these wherever possible to limit the amount of future fencing that could occur if stages are implemented to the fullest extent. These measures include, but are not limited to: increased riding and strategic placement of supplements, (ex: salt or nutrient blocks) which attract livestock away from riparian areas. Monitoring will determine the effectiveness of a stage's implementation on resources. Permittees are encouraged to monitor their grazing so as to be proactive in determining livestock moves.

**Vegetation Cover and Composition**

Vegetation is the primary component assessed in the range resource analysis. Grazing can alter composition and cover through forage utilization and the physical actions (trampling) on vegetation and soils. Vegetative composition and cover is monitored in uplands and riparian areas. Grazing management techniques (ex: range structures or improvements, adaptive management, and administration to implement) affect how livestock graze and the overall effects to resources.

This alternative utilizes "stages" and adaptive management strategies to meet desired conditions for the allotments. The "stages" are those management steps (ex: fences, water developments, rest, reduced season of use or numbers, monitoring, etc.) which are designed to improve resource conditions. The following describes how the stages work toward improving or maintaining vegetative composition and cover.

"Stage one (1)" implements over twenty (20) changes in water developments, some fencing, and changes in the Jungle Creek corral location, and additional corrals to improve livestock distribution away from riparian areas. It rests the Peony unit (pasture) until the indicators of desired recovery is reached.

Stage 1 is expected to improve riparian vegetation cover and composition. Upland vegetation already exists at a desirable state or trend. This is expected to continue. Stage 1 would reduce livestock riparian

use when the range improvements are in place and functioning. Range improvement effectiveness, reducing livestock use in riparian areas, is discussed later in Range Improvement Effectiveness. Also, the ability to use other management options (salting, supplement placement, additional riding) are available for the ranchers to use.

If monitoring indicates these are not improving the riparian conditions, then the subsequent actions described as either "stage" two (2), three (3), four (4), and/or five (5) would add fences where needed. The fencing is to add livestock control and improve distribution. The emphasis is to do this where monitoring dictates the need and not all at once, and to be logistically and economically feasible. It is important to keep in mind that fences do not eliminate potential grazing effects. Things such as cattle breaching fences or gates opened via forest visitors can result in some grazing. However, recovery is expected to rapidly occur on vegetation.

Additional "stages" may not be necessary based upon utilization of range improvements and adaptive management strategies to reduce grazing effects to riparian areas.

**Subsequent "Stages" Effects**

Each subsequent action or "stage" would only be implemented upon the identified areas not meeting Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs, thus, the minimal number of "stages" would be implemented based upon resource need. For example, if "Stage" one (1) attains the desired recovery, then there is no need to implement the other actions. This alternative would improve vegetative conditions across all the allotments over time. Each stage has the goal of improving riparian conditions. Since vegetative composition and cover are part of those conditions, it follows that the effects of implementing these stages affect vegetative cover and composition beneficially, as monitoring indicates need. Improvement may occur more slowly in subsequent stages than in Alternative one (1), which immediately removes permitted grazing from the areas. It would improve equally or slower than alternative three (3), which implements all actions and fences over a shorter period of time, without monitoring to determine success or failure of given range structures.

If the additional stages of Alternative two (2) are identified as needed and proceed forward, grazing is to be managed toward riparian vegetation improvement in all Stages (2-5). Hence grazing with the range improvements effects would be beneficial to vegetation composition and cover only if necessary and if the adaptive management measures do not work.

Alternative 2 provides active monitoring to facilitate a prompt management response to move livestock. This applies to Stage 1, but Alternative 2 contains more emphasis with the triggers by monitoring riparian vegetation conditions in Stages 2 through 5. This is expected to improve vegetation equally through any stages of the alternative.

Monitoring may require an early livestock removal during the grazing season. This may occur if monitoring indicates that Forest Plan Standards and Guidelines and RMOs, or the triggers identified for livestock moves in meeting Desired Future Conditions, are met prior to the end of anticipated grazing schedules in the riparian areas. This is a management option to meet Standards and Guidelines and RMOs with or without the fence construction described in Stages 2 through 5.

This alternative also implements BMPs for noxious weed control and prevention, which maintains range forage levels. See Aquatics/Fisheries, Hydrology, Botany, Soil, and Invasive Species specialist reports. Monitoring is expected to facilitate management and results in improved vegetative cover and composition.

If early removal were to occur, it needs to be clarified that it is not due to lack of forage, if all pastures are grazed, but rather those other resources, such as the identified triggers in riparian areas were not met. It is

appropriate to mention that this alternative does supply adequate forage produced from both the transitory and primary range vegetative type across the allotments. Rather, it is that additional grazing use in those areas would exceed standards and that would mandate a livestock move, removal, or conducting another Stage to allow recovery.

This is true for each Stage as described by the rationale above. In general, riparian vegetation composition and cover is expected to improve through each Stage of implementation (1-5). This is based upon the premise that using more range management structures (water developments and fences) and strategies would reduce livestock impacts on vegetation. The specific rate of improvement is difficult to measure for each individual stage to compare until the respective stage is deemed necessary and adaptive management strategies and "Stage" range improvements are constructed and functioning. Upland vegetation is expected to continue to meet desired composition and cover. If the additional stages are determined necessary, management is expected to show improvement prior to the final stage. The rate of change between stages is difficult to predict given seasonal variances (ex: precipitation) which affect vegetation.

If implementing Stage 1 does not show satisfactory progress towards improving vegetative cover and composition, then Stage 2 would be implemented. Like Stage 1 it would require time to assess its effectiveness. There would be some grazing rest for some areas with a potential reduction in livestock grazing time. If the grazing was altered it would be based upon identified triggers, and could, by adaptive strategies, reduce time or livestock numbers grazed in coordination with the permittees.

Although fencing would be in place, fences do not eliminate potential grazing effects. Cattle may breach fences and gates opened via forest visitors may cause some light grazing to occur. Recovery is still expected to rapidly occur on riparian vegetation for this stage too.

If improvement does not occur in the areas, then effects of subsequent Stages 3 through 4 would be similar. Stage 3 fences Area D on the Tunk Allotment. It is not expected to reduce season or livestock numbers on the Tunk Allotment given the capacity calculations. It may change use, if the triggers are met early for the identified monitoring areas and the additional adaptive management strategies are unsuccessful in reducing use. However, since the strategies are anticipated to be successful, effects to vegetation is expected to be beneficial.

Stage 4 would be implemented if the other stages are unsuccessful. This would fence Areas A and B. This stage is expected to have the same effect for vegetative cover and composition as the other stages. Again, there is the reminder that fences do not eliminate the possibility of incidental grazing, and use of adaptive management strategies within any of the stages facilitate livestock distribution to accomplish this.

If Stage 5 is implemented, it is likely to improve vegetative cover and composition like the other stages. However, it will alter the grazing management more than the earlier stages by providing more grazing rest and reducing more areas where livestock grazed. This would change the locations and time which livestock graze vegetation. This stage restricts the most grazing access. The Tunk Allotment has the most "stages" or design parameters to "rest" and excludes grazing. Stage 5 is likely to alter the grazing forage availability either by season, and/or livestock numbers on the Tunk allotment. The Bannon Allotment contains enough forage base and resources to continue grazing without the use of the Peony pasture. If the Patterson unit is divided and creates a rest pasture, then livestock numbers or grazing season will be reduced to eliminate those reduced forage AUMs and the permitted livestock. If this is not necessary, then no change in numbers or season would be necessary. The Aeneas Allotment allows for grazing in the uplands outside the closely monitored riparian areas. There would be increased use on upland vegetation. There may be a decrease of upland vegetation cover, composition, health, and vigor

with this change. Riparian vegetation is expected to improve with the reduced grazing. Grazing the Revis Allotment expects to cause no change to the vegetation.

Stage 5, to remove livestock grazing if the desired conditions are not reached within the designated fenced areas, would improve vegetative cover and composition in riparian areas. Since the uplands are already in a desirable condition, slight improvement or maintenance for vegetation is likely to occur. However, elimination of those areas from grazing until the desirable condition is met also eliminates the maintenance of all range infrastructures within. These will degrade, and may require reconstruction prior to allowing grazing to resume in these areas. Otherwise, they would not function to maintain or continue improvement of vegetative composition. This effect is the same as Alternative 1 for the Tunk Allotment and in the Bannon Allotment's Patterson unit.

This alternative improves livestock distribution, which lessens the livestock impacts in riparian areas and wet meadows. This alternative continues use in uplands, but does not concentrate grazing use. Therefore, it would improve vegetation in riparian areas and maintain or improve vegetation in the uplands. Rationale regarding range improvement (fences, water developments. etc.) effects is provided in subsequent paragraphs.

**Range Improvements Effectiveness**

The mitigations of additional fences, new pastures, new and reconstructed water developments with water source protection, and other livestock handling facilities (example: new corral away from Jungle Creek) are management methods to improve the vegetative cover and composition. Typically this extends to describe the vegetation on soils, wetlands, and riparian areas within the allotments. The new Jungle Creek corral location is within an old timber sale landing with a few shade trees along Forest Road 3000. The corral would hold cattle for brief time periods to facilitate gathering. The old Jungle Creek corral and water development would be removed. The Condition and Trend range ecology plots for this allotment indicates a stable or improved vegetation and soil condition. The MIM riparian sampling meets standards. Continued grazing would not degrade the ecological trend in these allotments. Plant ecological trend is comprised in part, by plant percent composition and cover. Therefore, if the ecological trend is static or improving, it generally indicates the status of composition and cover is improving.

Maintaining the ecological trend meets the goal to improve vegetative cover and condition. Rationale for grazing effects on vegetation are described based upon observations within the analysis area and standard rangeland management science. These are discussed in some of the following sections. The additional stages are not expected to be necessary based upon the following rationale.

New water developments attract livestock away from resource sensitive areas. Clawson found that the installation of a water trough in an Oregon mountain meadow pasture dramatically reduced the amount of time cattle used a stream and spring in the pasture (Clawson 1993). Since all new and upgraded water developments would be installed outside of Riparian Habitat Conservation Areas (RHCAs) and the spring sources fenced off, the forage would be better utilized within Forest Plan Standards and Guidelines. The proposed water development improvements help livestock distribution. This reduces the amount of monitoring required by rangeland management specialist and the time the permittees must spend to move livestock from concern areas.

Unmanaged or improperly managed grazing can be detrimental to plant communities. The alternatives in this document do not allow for heavy or unmanaged grazing. Therefore plants will not show a loss of vigor or reproduction activity in either the upland or riparian vegetation. Thus, riparian composition and cover are expected to improve at the first stage. It would continue to improve at an unknown rate between the stages.

This is evident through actions previously used within the analysis area. More intensive grazing management in Barnell and Lost Creek areas showed rapid vegetative cover increases. Those management changes are minor in comparison to the changes proposed on the Tunk Allotment in Stage 1. Additionally, vegetative cover has improved with small changes on the Peony unit on the Bannon Allotment. This was where grazing was closely monitored and incorporated a system of using alternating with rest which showed an increase in vegetative cover.

Managed properly, grazing is a natural process that can maintain plant health (Bradford, et al, 2002). A plant subject to overgrazing, either by domestic livestock or wildlife species, would weaken over time. This would make it less able to grow adequate healthy roots, reducing above-ground production of leaf material and reducing its capability to store carbohydrates for the following year's growth, to withstand drought, extreme winters, or additional grazing from herbivores. A plant's ability to continue to grow healthy roots is critical to its survival.

Effects of livestock grazing include impacts directly to individual plants and alteration of their physical environments. Direct impacts from livestock include trampling and removal of plant materials. Indirect impacts such as soil compaction and related reduction in soil and water infiltration, soil erosion, invasive/noxious weed introduction and spread, changes in seed bank, reduction in soil litter, and effects to pollinators may occur under some grazing regimes in some areas (Stoddard et al. 1975).

Research suggests that the effects of livestock grazing on meadows vary depending on the intensity of grazing more than on the timing and duration of grazing. Too much grazing, especially season-long, would weaken the desirable fibrous heavy-rooted grasses and grass-like species. Under intense grazing, livestock can trample and compact the soils, which over time can create hummocks, increase bare ground, and lower the water table. As the desirable plants weaken, less desirable plants move in that survive and thrive on areas with lowered water tables (Chaney et al. 1990).

Manning and Padgett (1995) suggest that management of wet meadows should allow for regrowth at the end of the grazing season to replenish spring growth. The typically wet, fine-textured soils are susceptible to compaction by excessive livestock use. Particularly, if the sod layer is broken and hummocks are already present, this compaction can cause an increase in number and size of hummocks. Under rigorous grazing pressure, especially when accompanied by a drop in the water table, Nebraska sedge can be replaced by other species with wider tolerances to environmental conditions, such as Baltic rush, meadow barley, or Kentucky bluegrass (Chaney et al. 1990). Additional vegetative changes include an increase in forb cover under heavy cattle grazing (Clary and Webster, 1989). Forb species that can be present in converted wet meadows include dock, thistle, water hemlock, yellow pea, dandelion, Western yarrow, aster, and false hellebore. These plants have a deep tap root system and are capable of extracting water from compacted soils.

Dry to moist meadow types are most likely the first plant communities to experience impacts from cattle, and have been affected by cattle grazing more than any other vegetation communities. Early in the season, when water is more abundant, cattle generally stay out of the wet meadow areas, concentrating on the dry to moist meadow vegetation.

The dry/moist and wet meadow type is an important portion of the analysis area and cattle have a tendency to collect in the meadows, especially wet meadow environments. It has been shown that cattle spend more time in the riparian areas mid-late summer season than in the late spring or early summer season when they distribute their time more evenly between the uplands and riparian areas (Parsons, et al. 2003).

Using a grazing strategy in riparian areas that provides for re-growth of riparian plants should leave an adequate amount of vegetation at the time of grazing to maintain plant vigor and provide stream bank

protection. Allowing forage plants to regrow should provide vegetation cover for stream bank protection during the following winter and early spring high flow periods (Clary and Webster 1989). Maintaining appropriate use indicators can help preserve plant vigor, reduce browsing on willows, stabilize sedimentation, and limit stream bank trampling.

Meadows are often comprised of different dominant plant species. Although drier types are closely associated with wetter types, livestock may use drier areas at different times. Livestock use in spring and early summer tends to begin on the dry to moist meadow sites earlier because of accessibility. The wetter meadows are saturated at this time and inaccessible to livestock. The desirable plant species are favored during this time period.

If livestock are in meadow communities early and for extended periods of time, soils can become compacted and less able to absorb and store water. This can result in the phasing out of plants that require more water for longer periods of time, and establishment of plants that can take advantage of greater depths-to-water later in the season. An increase in bare ground and an undesirable change in grasses and forbs increase the potential for the establishment of weedy species.

**Range Infrastructure/Improvements**

Range infrastructure affects grazing management. This alternative utilizes management administration, adaptive management with range infrastructure. These forms of sound range management techniques help improve or maintain resources including vegetative cover and composition. The following discussion explains how the infrastructure and management maintain or improve vegetation.

In Alternative 2, fence construction would be determined by monitoring and identifying their need. Alternative two (2) is easier to implement than Alternative three (3) for range administration and the permittees management processes based upon a couple factors: 1) It would allow only the necessary infrastructure without extraneous labor or inspections on the permit for the fence lines, and 2) It allows livestock behavior patterns to be observed and managed. It may result in a slower recovery of some riparian areas if a measure fails and the time to monitor recovery and construct the next fence line is after a season's grazing effects.

Reducing impacts to areas of concern would benefit the resources, such as vegetation, by allowing more time for permittees to monitor other areas and spending more time on other allotment needs, such as livestock movement, implementing utilization self-monitoring measurements, and tending to range improvements, for monitoring and repair.

Since several new range improvements would be installed in progressive stages with this alternative, using livestock management strategies would still be necessary to improve distribution. These include riding, active herding, and strategic salt-placement. Skovlin found that herding cattle and pushing them to areas with poor accessibility but adequate forage improved uniformity of use in mountainous terrain (Sowell et al. 1999). Proper salting can also be an effective method in improving distribution. Livestock usually go from water, to grazing, then to salt; therefore, it is not necessary to place salt near watering areas. Livestock can be drawn to areas they would otherwise avoid by placing salt away from water (Holechek et al. 2001). Under this alternative, the strategies are expected to be effective livestock distribution tools and thereby improve vegetative cover and composition.

Short term administrative actions may be used as tools to reduce livestock effects. These administrative management strategies are included in both Alternative Two (2) and Alternative Three (3). These actions include salting, changing season of use, change in animal numbers, change in animal class, change in the number of days available for utilization, rest from livestock grazing, change in the grazing system, change in trail routes, and use of riders. The flexibility to promptly implement one or more of these measures

allows management to take actions improving livestock distribution and forage utilization. Again, this would lead to improved vegetative conditions.

Adaptive management strategies of proposed fences, if the water developments first implemented do not work to reduce livestock effects on Upper Jungle Creek and Upper Aeneas Creek sediment levels, may be implemented. The management direction for meeting Forest Plan Standards and Guidelines is still the same as in Alternative 3, but requires more intensive management. As said above, proper watering sources help distribute livestock away from areas which might otherwise receive impact. This reduces the time required by permittees to implement other livestock distribution strategies. This allows them more time to manage the grazing and attain goals of improved livestock distribution which leads to improved vegetative conditions.

Proposals to emphasize rest in the Peony pasture of Bannon allotment until Forest Plan Standards and Guidelines and INFISH/PACFISH RMOs are met are not a substantial change from past actions. Past plans to incorporate rest have met with some improved vegetative cover on Peony Creek. This is shown in the PIBO data on file. Restoration efforts planned from the late 1990's to present, incorporated fences and periodic rest in the Lost/ Barnell meadow area. These examples demonstrate the expected effect of improved riparian health, integrating rest, or changing the grazing times (firm soils, and avoid late season hardwood species browse).

These strategies are based upon soils, vegetative, and riparian health. Timing of cattle grazing can alter the impacts to stream banks. Damage is less to stream banks when cattle preferentially graze uplands. Late summer pastures receive more use in riparian areas (McInnis et al. 2009) while a trend toward greater consumption of shrubs has been observed in fall pastures (2230 files, Tonasket Ranger District). Livestock tend to graze more forage in riparian areas in the late summer, "with late summer, pastures have more concentrated use of riparian vegetation" (Parsons et al. 2009).

The final stage to remove livestock grazing, if the desired conditions are not reached, eliminates the maintenance of all range infrastructures in rested pastures. If the maintenance does not occur, the structures will degrade and would require reconstruction prior to allowing grazing to return to the areas. This effect applies to the Tunk Allotment and to the Bannon Allotment's Patterson unit (the portion that will be rested).

**Forest Plan Compliance**

The existing conditions within the Forest Plan Standards and Guidelines have allowed for grazing throughout the Bannon, Aeneas, Revis, and Tunk Allotments. Grazing under Alternative (2) would be consistent for the management areas (MAs) within the allotments. The capable AUMs beneficially exceed the permitted AUMs proposed in this alternative. This meets resource needs and management area direction.

This alternative uses a series of adaptive management techniques to address the success or failure of mitigation measures. The mitigation measures are designed to increase livestock distribution away from riparian areas identified by the natural resource specialists as needing recovery or improvement. The first stage develops most of the range improvements requested by the permittees. This first stage develops alternative water sources away from riparian areas, has one small riparian enclosure fence, adjusts an existing fence to a better location, installs a hardened crossing, and nearby, installs a pump, to develop water into an otherwise dry location. The alternative also authorizes the ranchers to construct needed corrals to facilitate livestock round up or control. These measures combined are expected to reduce livestock access and use in riparian areas in the analysis area. The water sources are expected to gain the most obvious benefit to vegetation and soil resources.

Grazing under the proposed action would be consistent for the management areas (MAs) within the allotments for the following reasons:

> MA 5 is a very small (<2%) portion of the analysis area. Most is not accessible to livestock.
>
> MAs 14 and 26 set aside forage and habitat as a priority for wildlife species. This allocation is preserved with the proposed action grazing levels.
>
> MA 25 manages toward timber and range resources while providing for other resources. Approximately half of the Tunk, Aeneas, and Bannon Allotments are in this category; and all of the Revis Allotment.

**Other Forest Plan Standards and Guidelines that Apply**

11-1: Update range AMPs. Identify lands in unsatisfactory condition. Develop AMPs with specific objectives for these lands on a priority basis under a schedule established by the Forest Supervisor. These objectives shall meet a desired future condition based on existing and potential values for all resources. The AMP shall include: 1) a time schedule for improvement; 2) activities needed to meet forage objectives; and 3) an economic efficiency analysis.

11-2: AMPs shall include a strategy for managing riparian areas for a mix of resource uses. A measurable desired future riparian condition should be satisfactory or greater. Range conditions within riparian ecosystems should be in good or better condition class with a stable or upward trend. In condition classes fair or less, management shall be designed to attain an upward trend. When the current riparian condition is less than satisfactory, objectives shall include a schedule for improvement. The AMPs shall identify management actions needed to meet riparian objectives within the specified time frame. Measurable objectives shall be set for key parameters.

11-3: When riparian resource damage is occurring, determination of the cause of the resource damage shall be made prior to taking action through the allotment management plan. Alleviate damage caused by grazing through proven means. Fencing may be used when other management approaches have not given satisfactory results in the same or similar resource conditions.

This alternative is expected to meet these requirements as it is designed to improve riparian conditions and an AMP is a product of the analysis.

The alternative meets the Grazing Management Objectives of PACFISH/INFISH as applicable for this analysis. Refer to Aquatics/Fisheries report for details. PACFISH/INFISH amended the Forest Plan. Refer to the Aquatics/Fisheries specialist report for more information.

**Alternative 3**

**Vegetative Cover and Composition**

The proposed livestock stocking and season of use is the same as Alternative 2 as shown in Table 26. However, it has the potential to change rapidly, if livestock triggers and adaptive management measures are not implemented quickly. The available AUMs would decrease as pastures are rested, or results mandated earlier livestock removal.

Alternative 3 effects would be an accelerated recovery effect compared to Alternative 2 but less than Alternative 1 with some exceptions. Vegetative cover and composition is expected to improve in this alternative.

Elimination of domestic livestock grazing, within fenced areas, would not be expected to lead to rapid improvement on areas that were most heavily impacted by historical livestock use. Some of the areas affected by past land use (past timber sale soil compaction and Kentucky bluegrass seeded areas, or areas with ongoing other uses negatively contributing to vegetative composition such as invasive species) would recover more slowly. Others, with ample water supply and less ongoing erosion or compaction contributing factors are expected to recover more rapidly with grazing rest. There would still be some limited grazing in the non-rested areas.

Grazing season or numbers would have to be adjusted to match the capacity of available forage. The infrastructure maintenance requirement would be greater and Forest Service administrative requirements would still be intensive. The action timeframe for administration would be less than Alternative 2, but administration monitoring may be just as intensive. The overall effect is that administrative time relating to ensuring the vegetative composition and cover is improving is still intensive.

Grazing rest and/or reduced grazing pressure would result in improved vegetative health across the allotments. Upland vegetation is expected to remain in a stable, improving, or good condition class. Riparian vegetation is expected to improve in composition and/or cover. More forage would be available in the long term, but less available with grazing rest in some of the pastures as the streambanks recover toward desired recovery conditions.

The management direction for meeting Forest Plan Standards and Guidelines/RMOs is still the same, but would be easier to meet. In the long term, it would be less labor intensive for the permittees riding schedules, additional management requirements, and require less monitoring by Forest Service personnel. However, the initial implementation would have more activities required upon the permittees to construct and maintain fences.

**Range Infrastructure/Improvements**

Grazing infrastructure demands for maintenance and monitoring increases rapidly with Alternative 3. More maintenance and monitoring administratively would be necessary. Several water developments and portions of 2 fences within rested areas would not be maintained and would degrade. They would require reconstruction upon reintroduction of grazing.

The effects would be the same as Alternative 2 with some exceptions. The greatest difference is how it affects grazing infrastructure and management. Since these are tools to improve conditions and the measures of vegetative cover and composition, the effects differ in that the desired recovery is assumed to happen more rapidly, and vegetation composition and cover would improve.

It would implement all of the range improvements (infrastructure) rapidly, except the six (6) water developments in pastures to be rested, without monitoring to determine success or failure of grazing strategies. Those water developments would be implemented prior to the return of grazing to the rested pastures.

Strategies to determine when rest ceases would involve monitoring. The monitoring determines if desirable streambank recovery is met. This may be at least five years of rest for some of the pastures. Range upland and riparian vegetative cover and composition is expected to still improve. This may happen rapidly within a couple years of full implementation. This assumes no extreme natural events such as large scale fires, drought, or serious or erosive storm events occur to skew the result.

Permittees would not be able to implement other livestock distribution or use techniques to reduce riparian impacts in rested pastures. Economic impacts to ranchers could affect the rancher's ability to

manage the livestock more on a daily basis. This is addressed in the Social and Economic analysis later in this chapter.

**Forest Plan Compliance**
Like Alternative 2, the existing conditions within the Forest Plan Standards and Guidelines on forage utilization have allowed for grazing throughout the Bannon, Aeneas, Revis, and Tunk Allotments. Grazing under Alternative 3 would be consistent with the management areas (MAs) within the allotments. The capable AUMs beneficially exceed the permitted AUMs proposed in this alternative. This meets management area direction.

This alternative uses a series of adaptive management techniques to address the success or failure of mitigation measures. The measures are designed to increase livestock distribution away from riparian areas identified by the natural resource specialists as needing recovery or improvement. The first stage develops most of the range improvements requested by the permittees. This first stage develops alternative water sources away from riparian areas, has one small riparian enclosure fence, adjusts an existing fence south of Aeneas Creek to a better location, installs a hardened crossing in Aeneas Creek, and nearby, installs a pump, to develop water into an otherwise dry location. The alternative also authorizes the ranchers to construct needed corrals to facilitate livestock round up or control. These measures combined are expected to reduce livestock access and use in riparian areas. The water sources are expected to gain the most obvious benefit to vegetation and soil resources.

Grazing would be consistent for the management areas (MAs) within the allotments for the following reasons:

- MA 5 is a very small (<2%) portion of the analysis area. Most is not accessible to livestock.
- MAs 14 and 26 set aside forage and habitat as a priority for wildlife species. This allocation is preserved with proposed grazing levels.
- MA 25 manages toward timber and range resources while providing for other resources. Approximately half of the Tunk, Aeneas, and Bannon Allotments are in this management allocation; and all of the Revis allotment.

However, unlike Alternative 2, it eliminates more grazing use as described by the Forest Plan MA descriptions until desired recovery of riparian areas is met.

This alternative meets the Grazing Management Objectives as applicable for this analysis. Refer to Aquatic/Fisheries reports for details.

**Other Forest Plan Standards and Guidelines that apply**:
11-1: Update range AMPs. Identify lands in unsatisfactory condition. Develop AMPs with specific objectives for these lands on a priority basis under a schedule established by the Forest Supervisor. These objectives shall meet a desired future condition based on existing and potential values for all resources. The AMP shall include: 1) a time schedule for improvement; 2) activities needed to meet forage objectives; and 3) an economic efficiency analysis.

11-2: AMPs shall include a strategy for managing riparian areas for a mix of resource uses. A measurable desired future riparian condition should be satisfactory or greater. Range conditions within riparian ecosystems should be in good or better condition class with a stable or upward trend. In condition classes fair or less, management shall be designed to attain an upward trend. When the current riparian condition is less than satisfactory, objectives shall include a schedule for improvement. The AMPs shall identify management actions needed to meet riparian objectives within the specified time frame. Measurable objectives shall be set for key parameters.

11-3: When riparian resource damage is occurring, determination of the cause of the resource damage shall be made prior to taking action through the allotment management plan. Alleviate damage caused by grazing through proven means. Fencing may be used when other management approaches have not given satisfactory results in the same or similar resource conditions.

This alternative, like Alternative 2, meets Forest Plan Standards 11-1, 11-2 and 11-3. This alternative is expected to meet this requirement because it is designed to improve riparian conditions and a new AMP would be a product of the analysis.

The alternative meets the Grazing Management Objectives of PACFISH and INFISH as applicable for this analysis area. PACFISH/INFISH amended the Forest Plan. Refer to the Fisheries/Aquatics specialist report for more information.

**Cumulative Effects**

The cumulative effects analysis of the alternatives is considered where the effects of proposed grazing or no grazing overlaps with the effects of ongoing and future foreseeable activities in time and space. The timeframe for this analysis is expected to span 15 years, the projected life of an Allotment Management Plan (AMP).

Past activities effects are accounted for in existing conditions. Ongoing and future foreseeable activities include, but are not limited to: ongoing grazing, Access and Travel Management Planning, Crawfish Restoration (CR Timber Sale), BR Timber Sale, Lost Timber Sale, Invasive plant treatments, Bannon Pre-commercial Thinning and Fuels treatment, prescribe fuels reduction projects, culvert replacements and upgrades, road closures, timber harvest on Colville Confederated Tribal lands, firewood cutting, grazing on adjacent private, state, and Colville Confederated Tribal lands, recreation (ORV, dispersed camping, and snowmobiling use), wildlife, and fire suppression activities. A complete list of these other activities can be found in Appendix J, Cumulative Effects Project List.

**Cumulative Effects Common to All Alternatives**

**Climate Change**
Since wide ranging free roaming ungulates are still able to graze the analysis area, all three alternatives will have similar cumulative effects for Greenhouse Gas or Soil Carbon. Projected climate change impacts from cumulative effects of all activities releasing GHG around the globe include air temperature increases; sea level rise; changes in the timing, location, and quantity of precipitation; and increased frequency of extreme weather events such as heat waves, droughts, and floods. These changes would vary regionally and affect renewable resources, aquatic and terrestrial ecosystems, and agriculture. While uncertainties would remain regarding the timing, extent, and magnitude of climate change impacts, the scientific evidence predicts that continued increases in GHG emissions will lead to increased climate change (USDA-FS 2009b).

The ongoing and future effects of livestock grazing from these particular allotments on global or regional climate change or the effects of global or regional climate change on the BART allotments, regardless of how the allotment is managed, are speculative. It is doubtful whether any meaningful or measurable effects are assessable and therefore are not likely to be significant.

**Grazing of National Forest System Lands**
Active grazing leases and permits are held on adjacent state and private lands, the Colville Indian Reservation (CCT), and National Forest System lands. Livestock drift from these areas occasionally occurs and would continue to occur regardless of which alternative is chosen. Although generally

reduced, there would still be a limited livestock presence and limited effect on National Forest System lands. Unauthorized grazing is a law enforcement issue, and addressed through the Code of Federal Regulations.

**Alternative 1**

Since cattle would no longer be permitted to graze on the allotments, a few mitigation measures related to other planned projects would not need to be implemented.

The Vegetation management projects such as the Crawfish Restoration (CR Timber Sale) project, and Bailey Restoration Project (BR Timber Sale), implementing burning, thinning and other overstory vegetation management activities, overlap with the current grazing permits. However, with the no grazing alternative, there would be no need for the mitigation measures from these projects regarding grazing. Proposals (such as fences, and water developments) would not be necessary. The slight increase in available forage created by the timber sale projects and prescribed burning, would not change vegetative composition or cover related to grazing since no grazing would occur.

Noxious Weed Best Management Practices for the vegetation management/burning projects that affect grazing (for instance Early Detection Rapid Response (EDRR), equipment cleaning, etc.) would still be implemented and could affect vegetative cover and composition. Refer to Invasives specialist report for more information. If grazing were no longer permitted, the EDRR measures would not be supported nor the volunteer work by the permittees for control measures. There would also be less EDRR through Forest Service range inspections. The proposed Okanogan–Wenatchee National Forest Invasives Plant Treatment EIS effects would not incorporate the volunteer work or EDRR with the permittees. Since permittees are very active in EDRR, the elimination of those efforts may increase the likelihood of a new invasive species changing the vegetative cover and composition negatively somewhere within the analysis area.

Eliminating grazing with the ongoing fuels reduction/prescribed burning may change species composition or cover in areas where severe or higher temperature burns alter soil productivity or where noxious weeds establish. Those sites are usually patchy and small in size (often 1/10 acre or less) within large scale under burning. Frequently, those sites are rehab-seeded against noxious weeds. Therefore, the overall composition and cover typically are not affected.

Wildfire and a no grazing scenario do not anticipate an overlapping effect to vegetative composition and cover. Since grazing typically affects fine fuels in the direct/indirect affects for wildfire burn patterns, (see Fire/Fuels specialist report), the change in vegetation cover and composition would likely stay about the same in site size and location. Composition might change relative to which species are fire tolerant verses those which increase without grazing.

Eliminating grazing would not result in a change of vegetation relative to culvert replacement or their upgrades. Eliminating grazing coinciding with road decommissioning or maintenance would not change vegetation.

Since there is no current interaction between grazing and Special Use permits, no effect is expected by removing cattle.

There would be no interaction between the permittees and compliance with Access and Travel Management. No effect is expected for vegetation.

There would be no interaction between recreationists (hunters, hikers, ATVs, etc.), and grazing, so no pressure moving livestock into undesired locations (vehicle travel, open gates) to affect livestock use on vegetation would occur. No effect to vegetation is expected.

**Alternative 2**

The Crawfish Restoration Project (CR Timber Sale), NEPA analysis and timber sale was recently completed. Road building has commenced and the timber harvest is expected to start during the summer of 2014 and winter 2014/2015. The vegetation management projects such as Crawfish Restoration (CR Timber Sale), Bailey Restoration (BR Timber Sale, recently completed timber harvest), implemented burning, thinning and other overstory vegetation management activities which overlap the current grazing permits on the allotments. Grazing mitigation measures from these projects would be implemented. These measures include postponing construction of improvements after an activity unit (timber sale) is completed and additional aspen monitoring. These measures would continue to improve vegetative composition and cover in aspen stands. They would protect range structures from damage, increasing their effectiveness to disperse livestock over the landscape. This results in sound range practices which retain desired vegetative composition. The forage analysis for these vegetation projects did not show a great increase in forage production. However, their analysis focused on where forage was produced that would either positively attract livestock into uplands (good condition vegetation composition and cover) and away from riparian areas where it is desired to reduce livestock use and increase vegetation cover and composition. The slight increase in available forage created by the timber sale projects and prescribed burning would not change vegetative composition or cover related to grazing. This alternative and the respective vegetative project mitigations are designed to not increase livestock use in riparian areas and increase livestock distribution to uplands.

Grazing with fuels reduction/prescribed burning may change species composition or cover in areas where severe or higher temperature burns alter soil productivity or noxious weeds establish. Those sites are usually patchy and small in size (often 1/10 acre or less) within large scale underburns. Frequently, those sites are rehab-seeded against noxious weeds. Therefore, the overall composition and cover typically is not affected.

Fire suppression is not expected to have an effect to vegetative composition and cover. This is due to the policy that suppression activities restore any Forest Service structures damaged by suppression activities. Effects of grazing with fire are addressed in the Fire/Fuels specialist report. Wildfire effects are evaluated after the event. Post fire the resources are considered and analyzed and activities depend upon the extent and severity of the burn. Vegetation composition and cover effects would be determined at that time. Since grazing may affect fine fuels, it may affect wildfire burn patterns (see Fire/Fuels specialist report). The change in vegetation cover and composition would likely stay about the same in site size and location. Composition might change relative to which species are fire tolerant versus those which increase without grazing.

Noxious weed treatments would continue on all the allotments. Noxious Weed Best Management Practices (BMPs) would continue to be implemented in the grazing strategies. If grazing is permitted, the Early Detection Rapid Response (EDRR) measures would be supported by the volunteer work being completed the permittees implementing control measures. There would also be more EDRR through Forest Service range inspections. Treating noxious weeds helps recover the desirable plant composition and cover in areas where weed populations are established as well as preventing noxious weeds from further displacing desirable plants in new sites. Noxious weed introduction versus the prompt control and reporting by permittees is expected to offset the effects of grazing and noxious weeds. The proposed Okanogan–Wenatchee National Forest Invasives Plant Treatment EIS would incorporate the volunteer work and EDRR done by the permittees. Since permittees are very active in EDRR, these efforts may increase the likelihood of a new invasive species being detected and controlled, prior to its establishment

negatively changing the vegetative cover and composition. Overall, the Forest wide weed control measures (Okanogan–Wenatchee National Forest Invasive Plant Treatment EIS), BMPs, active permittee participation leads to desirable plant composition and cover in the analysis area.

The proposed Access and Travel Management Plan for the Forest is in the planning stage. Road closures, obliteration, or use restrictions, are proposed for a number of roads within the BART assessment area as part of the Upper Aeneas, Bailey Restoration, and Crawfish Restoration projects. Open road systems are likely to act as livestock corridors since livestock can more easily travel on roads. Proposed road decommissioning considered location and inadvertent livestock access to riparian areas. Several of these old roadways increased livestock access to riparian areas. Those which are utilized by the permittees to access range structures, have mitigations in place to continue maintenance. Implementation of the closures from previous NEPA decisions would complicate grazing management activities such as fence and water source maintenance by increasing access time. The maintained range improvements are tools which increase livestock distribution; therefore, they maintain or improve vegetative cover and composition. Road decommissioning is expected to increase plant cover and reduce trailing to some of the riparian areas they had accessed. Decommissioning activities might temporarily displace grazing livestock for a short time. Since duration is short, no effect to vegetation is expected. This is expected to benefit vegetative cover and composition on the old road bed and in the riparian areas they accessed.

Firewood gathering is likely to have little, to no, effect with grazing on understory vegetation composition or cover. Rarely, a wood cutter may fell a tree across a fence, corral, or trough. If this happens, sometimes the wood cutter fixes the fence. If not, and the permittees or Forest Service finds it, the structure would be repaired as soon as possible. The time from the event to the discovery may affect the grazing plan effectiveness short term, a couple of weeks to a month. The effect is likely minor given that a more important structure is likely to be discovered promptly or at the time of its use.

Recreation activities have occurred concurrently within the analysis area with grazing for over a century. Most have no concurrent effect with grazing on vegetation. All-Terrain Vehicles (ATVs) have increased in popularity and use within the analysis area. This use, either displaces grazing livestock through physical disturbance (riders inadvertently scaring the livestock into other places), or can create user-made trails which livestock may incidentally use to access areas within riparian areas. Access might affect vegetative composition or cover. Strategic measures such as salting and riding are expected to draw, push livestock out of riparian areas.

Road maintenance or culvert replacement, upgrade activities have little to no effect on grazing. The machinery could temporarily displace livestock for a brief time, usually less than one hour. It is not likely to displace them into areas they can't already access.

Hazard tree felling would have no effect because the tree locations would be adjacent to roads, and few in number. Hazard trees would not be felled on fences. If it accidentally happened, the fence would be repaired promptly. These trees are scattered and not likely to affect grazing management, thereby, vegetation composition or cover.

There are special use permits for power lines, and the Tunk Mountain Communications site within the analysis area. Livestock rarely access the Tunk Mountain Communication site. There is no water, little forage, steep and talus slopes, and large quantities of down wood so this is not an attractive site to them. No conflict is expected. There are no special use permits for telephone lines within the allotment boundaries. Since the power lines are suspended high above and inaccessible to grazing livestock, no effect is expected to understory vegetation cover and composition.

**Alternative 3**

The effects would be similar to Alternative 2 with some exceptions. The greatest difference is how it affects grazing infrastructure and management. That is described in the Direct and Indirect effects section.

How Alternative 3 relates to ongoing and future foreseeable actions is similar to Alternative 2. However, the effects to vegetation composition and cover may happen more rapidly.

The Crawfish Restoration Project (CR Timber Sale), NEPA analysis and timber sale award was recently completed. Road construction has commenced and the timber harvest is expected to start during the summer of 2014 and winter 2014/2015. The vegetation management projects such as Crawfish Restoration (CR Timber Sale), Bailey Restoration (BR Timber Sale, recently completed timber harvest), implemented burning, thinning, and other overstory vegetation management activities which overlap the current grazing permits on the allotments. Grazing mitigation measures from these projects would be implemented. These measures include postponing construction of improvements until after an activity unit (timber sale) is completed, and additional aspen monitoring has taken place. These measures would continue to improve vegetative composition and cover in aspen stands. These projects would protect range structures from damage, increasing their effectiveness to disperse livestock over the landscape. This results in sound range practices which retain desired vegetative composition. The forage analysis for these vegetation projects did not show a great increase in forage production. However, their analysis focused on where forage was produced that would either positively attract livestock into uplands (good condition vegetation composition and cover) and away from riparian areas where it is desired to reduce livestock use and increase vegetation cover and composition. The slight increase in available forage created by the timber sale projects and prescribed burning would not change vegetative composition or cover related to grazing. Alternative 3 and the respective vegetative project mitigations are designed to not increase livestock use in riparian areas and increase livestock distribution to uplands.

The associated prescribed burning is not expected to change vegetative composition and cover. Grazing with fuels reduction/prescribed burning may change species composition or cover in areas where severe or higher temperature alters soil productivity, or noxious weeds establish. Those sites are usually patchy and small in size (often 1/10 acre or less) within large scale underburn areas. Frequently, those sites are rehab-seeded against noxious weeds. Therefore, the overall composition and cover typically is not affected. The effects of vegetative response to prescribed burning is similar, but might be slightly faster in accumulation than Alternative 2, and less than Alternative 1.

Fire suppression is not expected to have an effect to vegetative composition and cover. This is due to the policy that suppression activities restore structures damaged by suppression activities. Effects of grazing on fire are addressed in the Fire and Fuels specialist report. Wildfire effects are evaluated after the event. Post fire the resources are considered and analyzed and activities depend upon the extent and severity of the burn. Vegetation composition and cover effects would be determined at that time. Since grazing may affect fine fuels, it may affect wildfire burn patterns (see the Fire and Fuels specialist report). The change in vegetation cover and composition would likely stay about the same in site size and location. Composition might change relative to which species are fire tolerant versus those which increase without grazing.

Noxious Weed Best Management Practices (BMPs) would continue to be implemented in the grazing strategies. If grazing is permitted, the Early Detection Rapid Response (EDRR) measures would be supported by the volunteer work being completed by the permittees implementing control measures. There would also be more EDRR through Forest Service range inspections. Treating noxious weeds helps recover the desirable plant composition and cover in areas where weed populations are established as well as preventing noxious weeds from further displacing desirable plants in new sites. Noxious weed introduction versus the prompt control and reporting by permittees is expected to offset the effects of

grazing and noxious weeds. The proposed Okanogan–Wenatchee National Forest Invasives Plant Treatment EIS would incorporate the volunteer work and EDRR done by the permittees. Since permittees are very active in EDRR, these efforts may increase the likelihood of a new invasive species being detected and controlled prior to its establishment negatively changing the vegetative cover and composition. Overall, the proposed Forest wide weed control measures (Okanogan–Wenatchee National Forest Invasive Plant Treatment EIS), BMPs, and active permittee participation leads to desirable plant composition and cover in the analysis area.

The proposed Access and Travel Management Plan for the Forest is in the planning stage and would likely propose additional road closures. Road closures, obliteration, or use restrictions, are proposed for a number of roads within the BART assessment area as part of the Upper Aeneas, Bailey Restoration, and Crawfish Restoration projects. Open road systems are likely to act as livestock corridors since livestock can travel on roads. Road decommissioning considered location and inadvertent livestock access to riparian areas. Several of these old roadways increased livestock access to riparian areas. Those which were utilized by the permittees to access range structures have mitigations in place to continue maintenance. Implementation of the closures from previous NEPA decisions would complicate grazing management activities such as fence and water source maintenance by increasing access time. Maintained range improvements are tools which increase livestock distribution; therefore, they maintain or improve vegetative cover and composition. Road decommissioning is expected to increase plant cover and reduce trailing to some of the riparian areas they had accessed. Activities during decommissioning might temporarily displace grazing livestock for a short time. Since the duration of decommissioning activities is short, no effect to vegetation is expected. This is expected to benefit vegetative cover and composition on the old road bed and in the riparian areas they accessed.

Firewood gathering is likely to have little, to no, effect with grazing on understory vegetation composition or cover. Rarely, a wood cutter may fell a tree across a fence, corral, or trough. If this happens, sometimes the wood cutter fixes the fence. If not, and the permittees or Forest Service finds it, the structure would be repaired as soon as possible. The time from the event to the discovery may affect the grazing plan effectiveness short term, a couple of weeks to a month. The effect is likely minor given that a more important structure is likely to be discovered promptly or at the time of its use.

Recreation activities have occurred concurrently within the analysis area with grazing for over a century. Most have no concurrent effect with grazing on vegetation. All-Terrain Vehicles (ATVs) have increased in popularity and use within the analysis area. This use, either displaces grazing livestock through physical disturbance (riders inadvertently scaring the livestock into other places), or can create user-made trails which livestock may incidentally use to access areas within riparian areas. Access into riparian areas might affect vegetative composition or cover. Strategic measures such as salting and riding are expected to draw/push livestock out of riparian areas.

Road maintenance or culvert replacement, upgrade activities have little to no effect on grazing. The machinery could temporarily displace livestock for a brief time, usually less than one hour. It is not likely to displace them into areas they can't already access.

Hazard tree felling would have no effect because the trees locations would be adjacent to roads, and few in number. Hazard trees would not be felled on fences. If it accidentally happened, the fence would be repaired promptly. These trees are scattered and not likely to affect grazing management or thereby vegetation composition or cover.

There are special use permits for power lines, and the Tunk Mountain Communications site within the analysis area. Livestock rarely access the Tunk Mountain Communication site. There is no water, little forage, steep and talus slopes, and large quantities of down wood so this is not an attractive site to them. No conflict is expected. There are no special use permits for telephone lines within the allotment

boundaries. Since the power lines are suspended high above and inaccessible to grazing livestock, no effect is expected to understory vegetation cover and composition.

## Botany

The section below summarizes the existing condition information, along with the direct, indirect, and cumulative effects from the BART Grazing Analysis project, as analyzed in the Botany Resources Report, by botanist Larry Loftis in the analysis file. Reference information is contained in the full specialist report.

The Forest Service Manual (FSM) chapter 2670 gives direction to manage for sensitive plants. The Okanogan National Forest Land and Resource Management Plan (1989) Standards and Guidelines 6-19, 7-1, 7-11, and 7-14 provides guidance to manage for sensitive plants and plants of cultural interest to local Indian tribes.

**Issue: Livestock can affect sensitive and native plants by grazing or trampling. Some plants of cultural interest to local Indian tribes may be grazed or trampled.**

**Indicator**:

- Trampling and grazing around TESP and cultural plant populations;
- Decrease of trampling and grazing of sensitive species and habitat;
- Percent and type of vegetation cover and composition that is maintained or increasing.

**Scope of Analysis**

This report analyzes livestock grazing on the Bannon, Aeneas, Revis, and Tunk allotments and its effects on botany. The analysis area for this resource covers National Forest System land in the allotments.

**Existing Condition**

There are about 36,297 acres inside the BART analysis area. Adjacent to, and east of the analysis area, there is a large block of more Forest Service land on the Tonasket Ranger District, and farther east, still more on the Colville National Forest. Immediately south of the analysis area is the Colville Indian Reservation which also has large blocks of land managed with goals similar to the Forest Service. Together, these lands consist of many thousands of acres of forest with some riparian and meadow habitat. Most of the analysis area is forested with conifer trees.

Field surveys for sensitive plants were done by Erica Heinlen, Melissa Parks, George Thornton, and Larry Loftis during the summers of 2010, 2011, and 2012. The surveys were done at the time of year when plants are identifiable. The Intuitive Controlled method was used to conduct surveys.

Percent and type of vegetation affects the habitat and existing populations of Threatened, Endangered, Sensitive, and cultural plants. Existing populations and habitat are described by species in this report.

Federally listed or proposed plant species were not found during field surveys. *Howellia aquatilis* and *Spiranthes diluvialis* were not found in the analysis area. Although some small ponds occur in the analysis area, *H. aquatilis* was not found. The lower portions of Aeneas and Lost Creek are low enough in elevation for *S. diluvialis*, but have considerable shade that is not favorable for that species (USDA Forest Service 1998) (USDI Fish and Wildlife Service 1998). Whitebark pine (*Pinus albicaulis*) was not found in the analysis area.

Populations of sensitive plants occur in the analysis area. These species are: *Carex media*, *Coeloglossum viride*, *Platanthera obtusata*, and *Viola renifolia*. None of these species are rare enough for being considered for listing as Proposed, Endangered, or Threatened Plants by the U. S. Fish and Wildlife Service. Table 27, Known Sensitive Plant Populations for each Allotment, below, displays known sensitive plant populations.

**Table 27, Known Sensitive Plant Populations for each Allotment**

| **Species** | **Allotment** | | | |
|---|---|---|---|---|
| | Aeneas | Bannon | Revis | Tunk |
| *Carex media* | 0 | 0 | 0 | 1 |
| *Coeloglossum viride* | 0 | 0 | 0 | 1 |
| *Platanthera obtusata* | 0 | 2 | 0 | 1 |
| *Viola renifolia* | 2 | 0 | 0 | 0 |

Eight species of fungi on the Regional Forester's sensitive species list occur, or could occur, in the northwest portion of the Okanogan-Wenatchee National Forest, with some potential to occur on Tonasket Ranger District. None of these eight are known to occur on the east side of Tonasket Ranger District. Distribution maps show all eight to occur farther west toward the Cascade Mountains (USDI BLM and USDA FS Interagency Special Status and Sensitive Species Program, species distribution maps [Online]) (Castellano et al. 1999, 2003). None of the eight species were found during field surveys in 2010, 2011, or 2012. Their known range is west of the analysis area.

Areas were noted where cows have grazed and trampled populations or habitat, especially in areas close to roads. The grazing and trampling reduces desirable vegetative cover and habitat for sensitive species. Some specific areas are described below:

- The upper portion of Aeneas Creek in T. 35 N., R. 29 E., Section 9 close to Forest Service Road 3000200.
- Parts of the lower portion of Jungle Creek, T. 35 N., R. 29 E., Sections 10 and 11.
- T. 35 N., R. 29 E., Section 13, SW 1/4 of the NE ¼; the wetland above Forest Service Road 3000292.
- A wetland in T. 35 N., R. 29 E., Section 21, SE 1/4 of the NW 1/4.
- Portions of Lost Creek, especially when close to Forest Road 3000100, T. 35 N., R. 29 E., Sections 33 and 34.
- A hanging wetland at T. 36 N., R. 29 E., Section 29, SE 1/4 of the NW ¼, on the north side of a small tributary of Peony Creek.
- The upper portion of the East Fork of Peony Creek, T. 36 N., R. 29 E., Section 28, NW ¼ and SW ¼.

**Cultural Plants**

Populations of *Perideridia gairdneri* and *Rubus parviflorus* were found in the analysis area. The lichen *Bryoria* is a common species in tree canopies. These species are of interest to local Indian tribes as cultural plants (Dumas, pers. comm.) (Turner 1997).

**Other Species**
An unknown plant was found in the Aeneas allotment. The plant has not bloomed, so identification is not possible. A fence has been put around the plant protecting it until it is identified and management actions, if any, can be determined.

**Climate Change**
Climate change has occurred in the past, with cycles of glaciation, warming, cooling, drought, and moisture. The dynamic nature of climate change can affect vegetation, with species population sizes and range varying with conditions (Millar and Brubaker 2006).

In the Pacific Northwest, climate change has been documented by sediment cores from lakes, e.g. (Mack et al. 1979) (Palmer et al. 2002) (Walker and Pellatt 2008) (Nelson et al. 2011). Pollen records from sediment cores show change in the assemblage of plant families and genera occurring as climate varied. Climate has recently been trending warmer and various climate models predict continuing warming (Littell et al. 2010) (Raymond and McKenzie 2012). It is hard to predict the impact of climate on individual plant species, but warming would cause changes for some species, e.g. causing the elevation range that species inhabit to rise (Ettinger et al. 2011) (Lesica and McCune 2004).

In the past native herbivores such as deer, moose, and even a few bison grazed vegetation, tending to follow green vegetation as the season progressed (Lyman 2004, 2008, 2013) (Burkhardt 1996). With the introduction of cattle, grazing became more intense, resulting in overgrazing until regulation reduced the amount of time and number of cows allowed on the range. The effects of climate and grazing vary by elevation of the site, and therefore, would likely continue to vary in the future (Haugo et al. 2010). If climate does continue to change, native plant species can be protected by monitoring range condition and preventing over utilization in the future. Not allowing over utilization would maintain diversity of plant species in the analysis area.

**Environmental Consequences**

**Direct/Indirect Effects**

**Alternative 1 - No Grazing**

**Threatened, Endangered, Proposed, and Sensitive Plants**
The plants *Carex media* and *Platanthera obtusata* as well as some of the *Viola renifolia* occur in association with riparian or wetland habitat. Cattle tend to congregate in moist habitats, especially later in the year (Bryant 1982) (DelCurto et al. 2005) (Gillen et al. 1984; 1985) (Parsons et al. 2003) (Smith et al. 1992). The roads created by past timber sales provide better access for cattle to riparian and other habitat (Roath and Krueger 1982). With livestock not present, plants and habitat would not be trampled. It would be helpful for these species and their habitat, thus giving a beneficial effect.

*Coeloglossum viride* occurs in dry upland habitat. This species might get some benefit from no trampling or grazing of plants, but may have more competition from other plants that are not grazed.

**Cultural Plants**
Populations of *Perideridia gairdneri* and *Rubus parviflorus* were found in the analysis area. The lichen *Bryoria* is a common species in tree canopies. These species are of interest to local Indian tribes as cultural plants (Dumas, pers. comm.) (Turner 1997).

Yampah (*Perideridia gairdneri*) is palatable to cattle, so not grazing would benefit this species (Leege et al. 1981) (Zimmerman and Neuenschwander 1984).

Thimbleberry (*Rubus parviflorus*) is considered fair to poor forage for cattle; therefore there would be no effect from not grazing (Roche 1983, p. 256).

Although there would be extra competition for water and nutrients from ungrazed forbs and grasses, both yampah and thimbleberry are expected to easily maintain themselves with cattle not present.

*Bryoria* lichen grows in tree canopies, where cattle cannot reach it. Likewise it does not have to compete with ground vegetation. Therefore not grazing would have no effect on this species.

**Other Species**
The unknown plant in the Aeneas allotment would not have effects from no grazing.

Cessation of grazing would not cause fragmentation of habitat in the analysis area. Forest, riparian, and meadow habitat would still be present for plant species to grow in. Plant seeds and spores would still be able to freely disperse in the allotments.

Once grazing ceases there would be no effect from cattle to cryptogrammic organisms such as lichens and mosses in and on the soil with this alternative.

**Plant Succession and Fragmentation**
Since cattle would not be present to graze vegetation, grass, forbs, shrub, and tree species would grow and develop, going through the successional process. Plant succession in the allotments would continue without cattle grazing.

**Alternative 2**

**Threatened, Endangered, Proposed, and Sensitive Plants**

**Aeneas Allotment**
A fence would be constructed on the north side of Forest Service Road 3000 and Jungle Creek. This fence would keep cattle from accessing Jungle Creek, creating a small exclusion area. A water gap on Aeneas Creek would be constructed to allow access back and forth between pastures. The water gap would be gated and used only to move cattle back and forth between pastures. The water gap is not on a population of *V. renifolia* and would not cause direct effect. Since the water gap would be gated no change in trailing along Aeneas Creek bank would be expected. The fence would not restrict plant movement, as pollen, seeds, and spores travel over and through fence lines.

A pump would be put in Aeneas Creek, with water being pumped north uphill across Forest Service Road 3000 to new troughs on the dry south facing slope in the Sneed Pasture. These troughs would help attract cattle away from moist habitat in other areas. The fence and extra troughs would reduce trampling in the lower portion of Jungle and Aeneas Creeks, benefitting potential sensitive plant habitat.

Water developments would be built and the spring water sources fenced. A number of papers have noted that water developments attract cattle into upland habitat (Goebel 1956) (Clawson 1993) (McInnis and McIver 2001) (Porath et al. 2002) (Veira and Liggins 2002) (Wyman et al. 2006). By attracting cattle into upland habitat, grazing and trampling of riparian and wetland habitat for sensitive plants would be reduced.

The corrals and trough near Jungle Creek would be moved away from the stream, which would reduce trampling along the creek. Less trampling would benefit potential habitat for sensitive plants.

In the Aeneas Allotment there are two populations of *Viola renifolia*; one grows near a stream, the other in an upland area. Although this plant is low growing and would not be grazed much, trampling may occur to plants. The installation of water developments would reduce grazing and trampling in riparian areas, benefitting the population that is close to water. No fence, water developments, or other activity is planned near the upland population of *V. renifolia*, so direct and indirect effect would not occur to these plants.

An existing fence close to Aeneas Creek would be moved farther south out of the riparian area. This would further reduce livestock trampling on riparian habitat for sensitive plants.

The length and timing of grazing in the Bailey pasture would be adjusted based on monitoring of Aeneas Creek. Varying grazing periods would allow livestock to be better managed. Better management would reduce trampling in a wetland above Forest Service Road 3000292 thus grazing and trampling of riparian and wetland habitat for sensitive plants would be reduced.

**Bannon/Revis Allotment**

The fence separating the Revis Allotment from the Bannon Allotment, Patterson Pasture, would be removed combining management of the two units. Sensitive plants were not found along the fence, so no direct or indirect effect would occur from fence removal. There would be no change in livestock numbers in the Bannon allotment, so grazing and trampling of habitat in the Patterson Pasture would not increase. With more area for animals to graze, cattle would disperse more and not trample potential habitat as much, such as Patterson Creek.

In the Bannon allotment *Platanthera obtusata* occurs in both wetland and riparian habitat. The Peony Creek pasture would be rested until range conditions improve there. Resting this area would reduce grazing and trampling for the habitat along Peony Creek. This would benefit the *P. obtusata* that occurs there.

A water catchment structure would be removed in the northwest portion of Bannon Allotment. This structure is not functioning, so cattle do not use it. No sensitive plants were found in the vicinity of the structure. No direct or indirect effect to sensitive plants would occur by removing the structure.

The trough in Patterson Creek and the Mike trough in Cole Creek would be moved away from the channel of those creeks. Moving the troughs would reduce the amount of trampling along the creek channel, lessening effect on sensitive plant habitat.

A trough or crib would be installed in a draw in the Cat pasture. Developing a water source there would help better distribute livestock so they would not over utilize forage in other areas. Fencing off the spring source would allow the site to recover from trampling, providing potential habitat for sensitive plants. Reconstruction of the Grouse and Pasture water developments would also fence off the water sources and allow habitat recovery at the springs. As mentioned above, developing water sources helps reduce grazing and trampling in riparian and wetland habitat for sensitive plants.

**Tunk Allotment**

*Carex media* and *Platanthera obtusata* both occur in or near riparian or wetland habitat. Cattle are attracted to and tend to congregate in these habitats, grazing and trampling these areas (Bryant 1992) (DelCurto et al. 2005) (Gillen et al. 1984, 1985) (Parsons et al. 2003) (Smith et al. 1992).

The *C. media* population occurs in Tunk Allotment in the Barnell pasture, which would be rested every other year, with grazing to be done for only two to three weeks, depending on if 50 or 75 animals are grazed. This would reduce grazing and trampling by cattle on the plants and benefit the population. The

reduced grazing would also limit foraging and trampling along Lost and Barnell Creeks, benefitting habitat along these drainages.

The *Platanthera obtusata* occurs in a wetland. In Alternative 2, some existing water troughs would be moved out of riparian areas. A number of new troughs and cribs would be developed in uplands. These water developments would help attract cattle into upland habitat (Goebel 1956) (Clawson 1993) (McInnis and McIver 2001) (Porath et al. 2002) (Veira and Liggins 2002) (Wyman et al. 2006). With better distribution, grazing and trampling of *P. obtusata* populations and habitat would be reduced. Fencing off spring sources for these developments would also improve potential habitat for sensitive plant species.

The *Coeloglossum viride* population is tiny, but grows in dry upland habitat that is unlikely to suffer from trampling. There is a chance that cattle might graze the plants, but it occurs in a large area of pinegrass, which is a fair to poor forage plant for cattle. Since pinegrass has reduced palatability, it is less likely to attract cattle into the population area. Incidental grazing could occur, but cattle are unlikely to stay around the population. The population is not near planned water developments or fences, so there would be no direct effect from these activities. No indirect effect would occur to the plants from this alternative.

The construction of troughs and cribs would attract livestock into uplands and reduce trampling on wetlands and riparian areas, including those listed above in the existing condition. Troughs would be constructed outside of Riparian Habitat Conservation Areas (RHCAs) and the water sources would be protected

A new corral would be built in the Tunk Allotment; this corral is not close to known sensitive plant populations or riparian wetland habitat. Construction of the corral would not cause direct or indirect effect to sensitive plants.

An old fence along Barnell Creek would be removed. This fence is not near known sensitive plant locations. No direct or indirect effect would occur to these species from removing it.

**Adaptive Management Strategies Alternative 2**
If the above actions do not accomplish Forest Plan Standards, Desired Future Conditions or PACFISH/INFISH Riparian Management Objectives, then more actions would be implemented in Stages as necessary.

The order of the stages would be dependent on monitoring results. If more improvement is needed based on monitoring, an additional Stage would be implemented.

- In the Tunk Allotment a fence could be constructed north of Jungle Creek and its tributaries, primarily along the ridge between Jungle Creek and Peony Creek. The fence would then go south toward Tunk Mountain and join an existing fence. This fence is not near known sensitive plant populations, and would not have direct or indirect effects on sensitive plants. It could help reduce trampling on sensitive plant habitat in Aeneas and Jungle Creeks.

- A fence could be constructed from the Forest Boundary in T. 35 N., R. 29 E., Section 17, east to Forest Road 3000 to create an extra pasture. This fence is not near known sensitive plant populations, so no direct or indirect effect to populations would occur. It could also help reduce trampling on sensitive plant habitat in Aeneas and Jungle Creeks.

- In the Tunk Allotment North Pasture a fence could be constructed around Upper Peony Creek. This fence is not near known sensitive plant populations, so no direct or indirect effect to sensitive plant populations. It could also help reduce trampling on sensitive plant habitat in Peony Creek.

- In combination with the fence to be constructed in the North Pasture of the Tunk Allotment, a fence could be built west of Patterson Creek with a water gap to allow cattle to water. This fence is not near known sensitive plant populations, so no direct or indirect effect to sensitive plant populations. The fence would allow cattle to be better controlled and distributed, reducing trampling in the creek bed, benefitting potential sensitive plant habitat.

If still more improvement is needed after the Stages listed above have been put in place, additional measures would be implemented. These could include reduction in the grazing season or total livestock exclusion from the four fenced areas.

**Cultural Plants**
Yampah (*Perideridia gairdneri*) is palatable to cattle, so grazing would have direct effect on this species (Leege et al. 1981) (Zimmerman and Neuenschwander 1984). Populations of this plant were noted in the Tunk Allotment. A trough would be installed at a spring hundreds of yards uphill from the populations. With the extra trough uphill and away from the yampah populations, cattle would be less likely to concentrate around the plants, better enabling the population to maintain itself in the analysis area.

Thimbleberry (*Rubus parviflorus*) is considered fair to poor forage for cattle, so it would have minor direct effect from grazing (Roche 1983, p. 256). This species would easily maintain itself in the analysis area.

*Bryoria* lichen grows in all of the allotments. This lichen grows in tree canopies, where cattle cannot reach it. Therefore grazing would have no effect on this species.

**Other Species**
The unknown plant in the Aeneas allotment is fenced off, so cattle cannot graze or trample it. There would be no direct or indirect effect on this plant.

The analysis area is too high in elevation and moist to form cryptogrammic crusts such as form in arid areas of the Columbia Basin (Root and McCune 2012). Total crust cover is inversely related to vascular plant cover, less plant cover results in more surfaces available for colonization and growth of crustal organisms (Belnap et al. 2001 p 14). Nonvascular plant species such as lichens and mosses are noted as occurring in local forest communities but are minor constituents (Williams et al. 1995).

After a fire, sometimes mosses and lichens will cover the bare soil, but this dominance is short lived, as vascular plant species soon reclaim the ground (Hardman and McCune 2010) (Hoffman 1966) (Daubenmire 1952 p 313). After a fire the Forest Service endeavors to keep livestock out of burned areas, so cattle don't trample the ground and damage these plants.

Lichen species occur in dry meadow site soil (Ducherer et al. 2009), but the organisms do not occur in enough quantity to form soil crusts such as occur in the arid Columbia Basin. There is a dry meadow on the south side of Bannon Mountain that would be expected to have some crust organisms in its soil, but again not in enough quantity to form a cryptogrammic crust. There would be some disruption from livestock trampling to these organisms, but unless over grazed the cryptogrammic species would maintain themselves in the soil.

**Grazing and Fragmentation**
There are about 36,297 acres inside the analysis area, with a large block of Forest Service land farther east on Tonasket Ranger District and on the Colville National Forest. These Forest Service lands are managed with similar objectives, e.g. logging, prescribed fire and restoration, recreation, and grazing. Collectively these lands consist of many thousands of acres of forest, with interspersed meadow and riparian habitat. These lands make available habitat for native plant populations to be distributed over the landscape.

These lands are refugia for plant species to maintain themselves on and provide corridors that allow plant seeds and spores to move back and forth.

Immediately adjacent and south of the analysis area is the Colville Indian Reservation. The Colville Indian Reservation manages its ground with similar forest management practices, contributing more refugia and corridors for plant seeds and spores to move through.

Forest Service lands are public lands owned by the U.S. Government and are not available to private entities to be developed for agriculture, residential, or other use. These lands are therefore not broken into small tracts for crop lands, housing development, and large amounts of roads that occur on private land. Private land development breaks up habitat and plant populations into smaller fragments separated by human disturbances that can affect plant habitat and populations, e.g. the Columbia Basin (Quinn 2004). Since Forest Service land in the analysis area is a contiguous block, plant habitats and populations are not separated by land development.

Plant seeds and spores travel over and through fence lines, so plant movement is not restricted by fencing. Fencing does not contribute to fragmentation for plants.

**Grazing and Succession**

Grazing effects on plant succession vary with different plant associations and how steep the ground is. Cattle do not like to graze steep ground, preferring more gentle slopes (Gillen et al. 1984). Early grazing may have affected vegetation succession along creeks, as the Indians were noted as having horses when white explorers came into this area, e.g. Cox (1832). Later grazing by cattle in large numbers may have occurred most of the year, until regulations to control grazing were established. Such grazing would have affected riparian vegetation, reducing the amount of palatable shrub species such as willow (Green and Kauffman 1995). Similarly livestock are prone to browse young aspen sprouts and saplings, reducing the ability of aspen clones to expand after disturbance (Jones et al. 2011).

At lower elevations more forage grows until canopy closure shades it out. The ponderosa pine-Douglas fir/bluebunch wheatgrass Plant Association has bluebunch wheatgrass as an important understory component. Overgrazing on these sites reduces bluebunch wheatgrass and Idaho fescue, but causes arrow leaf balsam root (*Balsamorhiza sagittata*), yarrow (*Achillea millefolium*), silky lupine (*Lupinus sericeus*), and cheatgrass (*Bromus tectorum*) to increase. Grazing also decreases fine fuels and increases tree regeneration (Williams et al. 1995, p. 47) (Williams and Lillybridge 1983, p 25). Grazing, particularly over grazing, reduces fine fuels, thus increasing the intervals between fires, allowing more ponderosa pine to survive and grow. Ponderosa pine would be enabled to invade dry habitat such as shrub steppe on Bannon Mountain. Less grass and herb component would occur in the understory (Brayshaw 1970) (Haugo et al. 2010) (Hessburg et al. 2000).

At higher elevation, in dry and montane forests, less fire would favor shade tolerant species such as Douglas fir. Dense, multilayered closed canopy stands would form instead of more open, park like stands (Haugo et al. 2000) (Hessburg et al. 2000) (Rummell 1951).

In moist meadows overgrazing favors Kentucky bluegrass (*Poa pratensis*), allowing it to increase (Roche 1983 p. 197) (Daubenmire 1952, p. 311). Although Kentucky bluegrass is highly palatable it is able to survive heavy grazing, and will eventually become the dominant species.

At high elevations, e.g. in the subalpine fir stands, these stands do not have enough forage to attract cattle. The subalpine fir/grouse huckleberry Plant Association on the Colville National Forest is described as "Forage production for domestic livestock grazing is generally very low. Early successional stages may produce some grass and shrub forage. Use by livestock is generally low except for cover and bedding on these sites" (Williams et al. 1995, p. 176). In the subalpine fir/ pinegrass Plant Association, in those areas

where there is forage, *Lupinus latifolius* has been noted as an increaser species (Williams and Lillybridge 1983, p. 51). There is no mention of succession being changed by livestock in these plant associations. Likewise Haugo et al. (2010) noted for the Colockum area of north central Washington "…anthropogenic influences on the ecological condition of the subalpine zone are minimal".

One of the objectives of this grazing analysis is to better manage livestock, e.g. with fencing and water developments. Better management would help prevent overgrazing and reduce cattle influence on plant communities and succession in meadow and forested areas.

**Soil Compaction and Regeneration**
Krzic et al. (2001a) compared soil compaction in grazed areas and exclosures in lodgepole pine areas, at two sites near Kamloops and one near Merritt, in southern British Columbia. They found neither total heights nor leader lengths of lodgepole were reduced by grazing treatments. At the same sites Krzic et al. (2001b) stated "Soil physical properties, although less favorable for tree growth on the two disturbance treatments than the mature forest, showed that the majority of the soil profile was not compacted above root-restricting threshold conditions."

Lindgren and Sullivan (2012) considered compaction as one of the direct effects of cattle grazing at two sites in southern British Columbia; one 25 km (15 miles) west of Summerland, the other 75 km (45 miles) northeast of Williams Lake. Fenced exclosures were compared with grazed areas to study herbs, shrubs, and trees. Lindgren and Sullivan state "There was no significant stand density X cattle grazing interactions noted for any of the plant community attributes."

Grazing in the spring after snow melt, when soils are moist can increase soil compaction. However, the Forest Service does not allow turn out of livestock until after range readiness surveys determine that the range is suitable for grazing. Animals are only allowed on the range for the time specified in the permit. By limiting the number of animals and grazing period, soil compaction can be kept low enough to prevent problems with plant regeneration.

**Alternative 3**

**Threatened, Endangered, Proposed, and Sensitive Plants**
The direct and indirect effects for known sensitive plant populations in Alternative 3 would be the same as for Alternative 2. Since the fences described above in adaptive management would be built regardless, better management of cattle would occur sooner. Cattle trampling on riparian and wetland potential sensitive plant habitat could be reduced quicker.

**Cultural Plants**
The direct and indirect effects for cultural plants in Alternative 3 would be the same as for Alternative 2.

**Other Species**
The effects on the unknown plant in the Aeneas allotment would be the same as in Alternative 2. The effects for cryptogrammic species such as lichens and mosses in and on the soil would the same as in alternative 2.

**Grazing, Fragmentation and Succession**
Grazing direct and indirect effects on plant fragmentation and succession would be the same as in Alternative 2.

**Soil Compaction and Regeneration**
Grazing direct and indirect effects on soil compaction and regeneration would be the same as in Alternative 2.

**Cumulative Effects**

The cumulative effects of the alternatives are considered for past, present, and reasonably foreseeable future activities. These activities include, but are not limited to: past and ongoing timber sales, fuel reduction such as prescribed fire, fire suppression, road building, road maintenance, and road closures, noxious weed management, firewood cutting, and recreation such as hunting and snowmobile riding. A complete list of these activities can be found in Appendix J, Cumulative Effects Project list. The boundary for cumulative effects considered for this analysis is the analysis area. The time considered for cumulative effects is to fifteen (15) years in the future.

**Alternative 1**

**Threatened, Endangered, Proposed, and Sensitive Plants**
After two years, grazing would cease. After that, there would not be cumulative effects on sensitive plants for alternative one.

**Cultural Plants**
After grazing ceases, there would be no cumulative effects on cultural plants.

**Other Species**
With the cessation of grazing, there would be no cumulative impacts on the unknown plant in Aeneas Allotment. There would be no cumulative effects on plant succession or fragmentation of populations.

**Alternative 2**

**Threatened, Endangered, Proposed, and Sensitive Plants**

**Vegetation Management**
A number of timber sales have been logged and prescribed burned in the past. In the south part of the analysis area the Bailey Restoration Project (BR SBA Timber Sale) is logged, precommercial thinning and prescribe burning remains to be completed in portions of the Aeneas and Tunk Allotments. The Crawfish Restoration Project (CR Timber Sale) has been sold and harvest is planned for the summer of 2014 and the winter 2014/2015. There would be more logging, precommercial thinning and prescribed fire in the Aeneas and Tunk Allotments from this project. The timber sales and associated prescribed fire activities open up the canopy allowing more light to get to the ground, so more species and generally more forage could grow (Weaver 1951) (Brown 2000) (Dodson and Peterson 2010). The roads constructed for timber sales provided paths that made it easier for cattle to access the analysis area (Williams 1954) (Roath and Krueger 1982). The Bannon Fire Precommercial Thinning Project in the Bannon allotment is thinning saplings in a large area (about 25% of the planned work is completed, 25% will soon be under contract, and 50% is planned to be completed in future years), allowing more vegetation to grow, e, g, forbs, grasses, and shrubs (McConnell and Smith 1970) (Lindgren et al. 2006) (Sullivan et al. 2009). These activities would change distribution of livestock in the analysis area, allowing animals to graze and trample sensitive plant habitat in different areas. Monitoring utilization, and in some places fencing, e.g. Barnell Pasture, would ameliorate this effect.

**Fire Suppression, Fragmentation, and Succession**
There have been wildfires in the past in the analysis area. Fire suppression also occurred, putting many fires out, allowing more young trees to grow, and thus letting the tree canopy to close in many areas, shading out understory plants (Camp 1999). The lack of forage causes livestock to move to more open areas. Sometimes the more open areas include sensitive plant habitat, causing cattle to have a cumulative

impact, e.g. trampling in riparian areas. Areas can be over grazed if not monitored. The repair of the fence around the Barnell Pasture would help protect the riparian habitat there.

In lower elevation timbered areas, grazing, especially over grazing, reduces the amount of grasses and forbs that compete with young trees, so more young trees live and grow. Tree stands then develop dense multilayered structure rather than becoming open and park like. The overstory can develop into large continuous areas of closed canopy. These large stands can separate populations of plants, i.e. cause fragmentation. Cattle tend to avoid large heavily forested areas, preferring more open places with forage (Gillen et al. 1984). As cattle focus on open areas, they graze the plants occurring there heavier, requiring more monitoring to keep overgrazing from occurring. Over utilization could reduce the diversity of plant species in the analysis area and modify plant succession.

Past and recent timber sales such as Upper Aeneas, Bailey, BR SBA, and CR endeavored to reduce the amount of trees with cutting, thinning, and prescribed fire, to better represent historical conditions. The sales break up large blocks of continuous timber, providing habitat for plants to grow and disperse in. Prescribed fire would set back woody saplings and shrubs so that native grasses and forbs can grow. Sale activities allow understory vegetation to grow, so forage is more distributed, helping disperse animals. Monitoring utilization to keep range from being over grazed would reduce cumulative effects from fire suppression and grazing on fragmentation and succession.

The *Carex media* population is near some Crawfish Restoration project units which would create transitory range to attract cattle. However, the population is in a pasture that is to be grazed only a short period of time each year. Since cattle would not be there long, there would be little or no cumulative effect on the plants.

The *Coeloglossum viride* population in the Tunk Allotment occurs in an area that has been previously logged and will be logged again. The logging will open canopy providing more light to stimulate understory vegetation, but the area is relatively open and already has nearly complete cover by pinegrass and other plants. The population occurs in an area where several hundred acres will be logged, so little or no change in grazing patterns would occur around the population. No cumulative effect from increased grazing or trampling to the population is expected from this alternative.

The *Platanthera obtusata* populations in the Bannon Allotment occur in the vicinity of old timber harvest units, but are in a pasture that is fenced off, so cattle access can be controlled. Currently the populations are doing well, and this pasture is to be rested from grazing. While being rested, there would be no cumulative effect on these plants. When grazing is resumed there would be a cumulative effect from grazing and trampling on the populations, however the pasture would be monitored and use not allowed to become excessive. The populations would easily maintain themselves.

The population of *P. obtustata* in the Tunk Allotment is in the vicinity of old timber harvest activity and has trampling occurring, so there is some cumulative effect on this population. Troughs would be developed upslope from the population, which would reduce cattle activity in the area. Although the population would continue to have some trampling, it would maintain itself.

One of the *Viola renifolia* populations in the Aeneas Allotment is in an upland area little used by cattle and not near timber sale units for the Bailey Restoration project. *V. renifolia* is also a low growing plant that is not used much by cattle. This population would have no cumulative effect from trampling or grazing.

The other *V. renifolia* population is near a riparian area that will have ladder fuel reduction as part of the Bailey Restoration project. Ladder fuel reduction would allow more light to get to the ground and create more forage attracting cattle. On the other hand a fence would be built separating the Sneed pasture from

the creek. Cattle in the Sneed pasture that normally water at the creek would not have access, therefore reducing trampling. Overall the cumulative effect would be small, allowing the population to maintain itself.

When considering the past, ongoing, and reasonably foreseeable future actions, along with the effect of the proposed action, the cumulative effect to sensitive plants would not be enough to cause populations to lose viability. Sensitive plants would maintain themselves in the analysis area.

**Cultural Plants**
Thimbleberry occurs between two roads, with cattle moving back and forth to the roads through this population. The Crawfish Restoration project (CR Timber Sale) would harvest units in the vicinity of the population, which would create extra forage and attract cattle. However, the species is considered fair to poor forage and cattle do not utilize this species a lot unless an area is heavily grazed (Roche 1983 p. 256) (Willms et al. 1980) (McLean and Willms 1977). The Forest Service monitors grazing to keep areas from being heavily used, so over utilization would not occur. The species would have some cumulative effect from grazing, roads, and timber harvest, but would maintain itself.

The yampah populations occur in the vicinity of a road and old harvest units. The Crawfish Restoration Project would have timber sale units in the same area. These units will open up the canopy, allowing more light to get to the ground and increase forage. The extra forage will attract more cattle, so more grazing could occur on the plants. However, there would be other Crawfish harvest units west of and upslope from the populations, creating transitory range and helping disperse cattle. With the extra timber harvest units away from yampah, cattle would not concentrate where the populations are, allowing the population to maintain itself in the analysis area.

The lichen *Bryoria* grows in tree canopies, out of reach of cattle and therefore has no cumulative effect from grazing and other activities.

When considering the past, ongoing, and reasonably foreseeable future actions, along with the effect of the proposed action, the cumulative effect to cultural plants would harm individuals of thimbleberry and yampah, but the populations would maintain themselves. The *Bryoria* lichen would not be affected.

**Other Species**
The unknown plant in the Aeneas allotment is fenced in a small enclosure, so cumulative effects from cattle grazing or trampling would not occur to this plant.

**Alternative 3**

**Threatened, Endangered, Proposed, and Sensitive Plants**
The cumulative effects for sensitive plants in Alternative 3 would be the same as in Alternative 2. When considering the past, ongoing, and reasonably foreseeable future actions, along with the effect of the proposed action, the cumulative effect to sensitive plants would not be enough to cause populations to lose viability. Sensitive plants would maintain themselves in the analysis area.

**Cultural Plants**
The cumulative effects for cultural plants in Alternative 3 would be the same as in Alternative 2. When considering the past, ongoing, and reasonably foreseeable future actions, along with the effect of the proposed action, the cumulative effect to cultural plants would harm individuals of thimbleberry and yampah, but the populations would maintain themselves. The *Bryoria* lichen would not be affected.

**Other Species**
The cumulative effects for the unknown plant in Aeneas Allotment in Alternative 3 would be the same as in Alternative 2.

**Determination of Effects**

**Threatened, Endangered, and Proposed Plants**

After analyzing and considering the direct, indirect, and cumulative effects, the following determinations were made:

For *Howellia aquatilis* – No Effect

For *Spiranthes diluvialis* – No Effect

**Table 28, Sensitive Species Determinations of Effects**

| Species | ALT 1 | ALT 2 | ALT 3 |
|---|---|---|---|
| *Carex media* | BI | MIIH | MIIH |
| *Coeloglossum viride* | NI | MIIH | MIIH |
| *Platanthera obtusata* | BI | MIIH | MIIH |
| *Viola renifolia* | BI | MIIH | MIIH |

| | |
|---|---|
| NI = | No Impact |
| MIIH = | 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 |
| WIFV = | Will Impact Individuals Or Habitat With A Consequence That The Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species |
| BI = | Beneficial Impact |

**Sensitive Fungi**
None of the eight species of sensitive fungi known on the Okanogan-Wenatchee National Forest were discovered during field surveys in 2010 and 2011. Since none were found, and their known range is west of the analysis area, these species best fit into Outcome 1: Low likelihood of occurrence, low risk to species viability or trend toward listing (USDI BLM and USDA FS Interagency Special Status and Sensitive Species Program, Attachment 1, Likelihood of Occurrence Key [Online].

## Invasive Species

**Introduction**
The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed and prepared by Noxious Weeds Specialist, Carol Ogilvie. Reference information is contained in the Invasive Species Baseline report, in the analysis file for the BART Grazing Analysis project. Regulatory Framework can be found in Appendix G, Regulatory Framework.

The purpose of this section is to document the effects of proposed activities in the BART Grazing Analysis Area, relative to noxious weed management.

**Issues**
The noxious weed analysis for the BART Grazing analysis area considered only the potential for the spread of existing populations and the risk of introducing new invaders through associated proposed activities.

**Issue:** Ground-disturbing activities associated with livestock grazing can create opportunities for the establishment of invasive weed infestations, which may result in increased invasive weed populations.

**Indicator**:
Number, location, and extent of new infestations in areas used by livestock that are detected while infestations are manageable; i.e. discovered when size and density of the infestation are small enough that they can be eradicated or controlled to prevent further spread.

**Scope of Analysis**
Field surveys were conducted in areas of known noxious weed populations, along roads and within areas of past disturbance. These surveys occurred in 2011, 2012, and 2013 during times when plants were actively growing and flowering. The Natural Resource Information System **(**NRIS) Database was used to determine approximate acreage of documented infestations. All acres for noxious weeds and the extent of infestations are approximate due to the dynamic nature of plant populations. While many noxious weed populations have been GPSed, the extents of many populations were derived by using aerial photographs.

**Background**
Most of the known noxious weed sites within the BART Grazing Analysis assessment area have been treated with a residual herbicide (picloram) or glyphosate since 1998 and/or hand pulled under the Okanogan National Forest Integrated Weed Management Environmental Assessments (Forest Noxious Weed EAs 1997b & 2000a). A reduction in weed density and occurrence within populations that have been treated with herbicide has been observed. However, an invading plant species is not eradicated until its viable propagules (seeds and/or reproductive roots and stolens) are depleted from the soil. In addition, as long as control is less than 100% in a growing season, there will always be viable seeds in the soil, emphasizing that reproduction must be stopped completely if eradication is to succeed. (Sheley and Petroff 1999).

In determining a sites susceptibility to noxious weed invasion, several factors must be considered. The current and potential vegetation types, presence and biological traits of noxious weeds, and the amount of soil disturbance. A conclusion of the Interior Columbia Basin Ecosystem Management Project (ICBEMP 2000b) was that, in general, grasslands, riparian areas, and relatively dry, open forests are more susceptible to noxious weed invasion than are dense moist forests, high montane areas, and serpentine areas. These more readily susceptible areas are typically found east of the Cascade crest where moisture availability is low and soils can be shallow. These areas have been further categorized into Potential Vegetation Groups (PVG); meaning that they represent the vegetation that could occupy a site versus the vegetation that actually occupies the site. These PVGs have, in turn been rated in terms of susceptibility to noxious weed invasion as either high, moderate, or low.

There are numerous vectors for noxious weed seed dispersal and propagation. Noxious weed seeds can be transported by human activity, wind, water, wildlife, and livestock. Diffuse knapweed was likely brought into the area by vehicles and common St. Johnswort could have been brought into the allotment by livestock, other ruminants, or birds. Thistle species and hawkweeds are easily spread through wind-borne seeds.

Domestic and wild grazing animals can both contribute to plant invasion through: (1) selective eating of native plants. Most native plants have a period during their rapid growth phase when they are highly susceptible to defoliation (Olson and Richards 1988), therefore when noxious weeds are present they can gain a competitive edge; (2) ingesting invasive plant seeds in one area and spreading them to other areas

through scat, digestive products, skin, fur and hooves. By removing flowers and vegetative parts through grazing on species with rhizomes and adventitious root buds, root growth and spread can be increased. While most developed seeds are destroyed within the gastrointestinal tract; 5% to 15% of spotted knapweed seeds will pass through sheep, goats, and mule deer. Some of these seeds will remain viable. Wallander, et al. noted that mule deer were still passing viable seeds of leafy spurge after 10 days. (Wallander, et al. 1995). This makes it possible for viable weed seeds to be deposited in numerous locations; and (3) disturbing the soil and creating conditions favorable to invasive plants or the germination of invasive plant seed through scarification (USDA Forest Service 2005b).

Rangeland noxious weeds can have a substantial impact on livestock production including lowering yield and quality of forage, slowing animal weight gain, and poisoning livestock. The financial impact of rangelands weeds is estimated to be $2 billion annually. Knapweed species can reduce grazing capacity by more than 50% (DiTomaso 1999).

**Existing Condition**

Many of the sites within the BART Grazing Analysis assessment area fall under the Eastside Dry or Eastside Moist Forest Potential Vegetation Groups. These PVGs have been determined to have moderate to high susceptibility to weed invasion (R6 IPP FEIS 2005b). Additionally, aggressive noxious weeds already exist within and adjacent to the project area and some soil disturbance is likely to occur as a result of project activities.

Noxious weed inventory and control work was begun in 1994 and has continued every year since then on priority known populations under Okanogan National Forest Integrated Weed Management Environmental Assessments (1997b and 2000a) [IWM EA's].

Eleven different species of non-native invasive plants are known to occur within the BART Grazing Allotments. Of the 36,297 acres contained in the analysis area, less than one tenth of the area is affected by existing noxious weed populations. To prevent these species from becoming a problem, early detection, followed by a rapid response to eradicate these initial infestations, will be necessary.

**Documented New Invaders**

**Diffuse and Spotted Knapweeds** *(Centaurea diffusa, C. maculosa)* Approximately 981 acres are affected by diffuse and spotted knapweed. Knapweed is scattered throughout all allotments primarily along roads. These populations have been treated by herbicide applications and hand pulling since 1998 and dramatic reductions in populations have been observed.

**Orange and meadow hawkweed** *(Hieracium species)* Approximately 197 acres of these two hawkweed species are known to exist within the analysis area, predominately near Crawfish Lake and east of Tunk Mountain. Some sites have been treated annually since discovery and populations have declined dramatically. Several new populations of yellow hawkweeds were discovered during field surveys in 2011 and 2012. These new patches were treated during the 2012 field season with picloram and glyphosate. An integrated weed management program including use of herbicides, periodic applications of fertilizer, controlled grazing (a biotic stressor), and minimizing disturbance, aid in controlling hawkweed infestations.

**Sulfur cinquefoil** *(Potentilla recta)* Approximately 49 acres of the analysis area are affected by this species. Herbicide applications have occurred since 1998 and declines in population density have been observed.

**St. Johnswort** *(Hypericum perforatum)* Approximately 403 acres of the analysis area are affected by this species. Herbicide applications have occurred since 1998 and declines in population density have been observed.

**Musk Thistle** *(Carduus nuntans)* Approximately 8 acres of the analysis area are affected with Musk thistle. These sites have been hand-pulled or sprayed with herbicide and measurable declines in population density have been noted.

**Dalmatian toadflax** *(Linaria Dalmatica)* One small population of approximately 1/10$^{th}$ acre exists near Crawfish Lake. This site has been treated with herbicide and the population is declining.

**Oxeye daisy** *(Leucantheum vulgare)* Approximately 445 acres are known to occur within the analysis area and have been sprayed with herbicide in past years. Population density has been reduced in some locations but new populations were discovered near Crawfish Lake during field surveys in 2011 and 2012.

**Black Henbane** *(Hyoscyamus niger)* Several small, scattered and lightly populated, patches are known to exist within approximately 300 acres near Bench Creek. These populations have been treated with picloram and plants have been reduced. No plants were observed in 2012.

Established invaders known to occur in the analysis area are: Downy Brome *(Bromus tectorum),* Bull and Canada thistle *(Cirsium vulgare, C. arvense),* and Common Mullein *(Verbascum thapsus).* These populations are abundant and well distributed within the analysis area however, total acres are unknown.

**Potential Invaders**

The potential invaders are species that are known to exist on adjacent National Forest lands, private property, and along the roads leading into the allotments. These species are new invaders and listed as B-Designate (requires zero production) within Okanogan County: Spurge flax *(Thymelaea passerine),* Scotch thistle *(Onopordum acanthium*), Yellow starthistle *(Centaurea solstitialis),* Rush skeleton weed *(Chondrilla juncea L.),* and Hoary alyssum (*Berteroa incana*).

**Desired Condition**

This analysis conforms to the requirements of the *Pacific Northwest Invasive Plant Program Final Environmental Impact Statement, Record of Decision* (Forest Service 2005b), hereafter referred to as the 2005 PNW ROD. This project is intended to comply with the *Guide to Noxious Weed Prevention Practices* (USDA Forest Service 2001) supporting the February 3, 1999 Executive Order on Invasive Species, and the *National Strategy and Implementation Plan for Invasive Species Management* (USDA Forest Service 2004). The 2005 PNW ROD describes the Desired Future Condition as: In National Forest Lands across Region Six, healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the region. Invasive plants do not jeopardize the ability of the National Forest to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts.

Both Forest Service National and PNW Regional Noxious Weed Strategies use the term “noxious weeds” to broadly encompass all invasive, aggressive, or harmful non-indigenous species. The more recent term used by the Forest Service is “invasive plants”, which are defined as nonnative plants likely to cause economic harm, environmental harm, or harm to human health (Executive Order 13112, 1999). The terms “invasive plant species”, “noxious weeds” and “weeds” are used interchangeably in this document. At the state level, noxious weeds are defined as a plant that when established is highly destructive, competitive, or difficult to control by cultural or chemical practices. The Washington State Noxious Weed

Control Board selects which plants will be listed as noxious weeds on the state weed list, classified as Class A, B, and C.

**Forest Plan Standards and Guidelines**

The following Forest-wide Standards and Guidelines are relevant to this project:

**12-1** Control noxious weeds to the extent practical.

**12-2** New infestations of noxious weeds should be the first priority for eradication.

**12-3** Emphasis on noxious weed control shall be the prevention of infestations, especially into un-roaded areas and wilderness.

Although the desired future condition of noxious weed populations are not specified in the Forest Plan, it is implied by the discussions of other resources that the desired future condition of the forest would be an absence of new invader noxious weeds.

**2005 PNW ROD Standards**

The following standards from the 2005 PNW ROD are relevant to this project:

**Standard 1:** Prevention of invasive plant introduction, establishment and spread will be addressed in watershed analysis, roads analysis, fire and fuels management plans, Burned Area Emergency Recovery Plans, emergency wildland fire situation analysis, wildland fire implementation plans, **grazing allotment management plans**, recreation management plans, vegetation management plans, and other land management assessments.

**Standard 3:** Use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed-free using the North American Weed Free Forage Program standards or a similar certification process.

**Standard 6:** Use available administrative mechanisms to incorporate invasive plant prevention practices into **rangeland management**. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment management plans, providing annual operating instructions, and adaptive management. Plan and implement practices in cooperation with the grazing permit holder.

**Prevention and Management Strategy**

The current strategy for invasive species management has four elements (USDA Forest Service 2004):

1. Prevention – Stop invasive plants before they arrive.
2. Early detection and rapid response – Find new infestations and eliminate them before they become established.
3. Control and management – Contain and reduce existing infestations.
4. Rehabilitation and restoration – Reclaim native habitats and ecosystems.

Relative to noxious weeds, the prevention strategy is always preferred and employed as the initial strategy. However, due to the nature of noxious weeds, the prevention strategy is often not adequate to ensure complete exclusion of noxious weeds. Failure to attempt to control noxious weed spread and establishment is expected to result in progressive local alteration of ecosystem process, and violation of state and federal laws.

**Climate Change**

Because they are often highly competitive, invasive plant species can alter the plant composition of ecosystems and change their structure and function over large landscape areas. In addition, the fine fuels they often add increases fire frequency in many areas and leads to increased dominance by invasive species and further degradation. Climate change is exacerbating these changes by altering the amount and seasonal distribution of precipitation and seasonal temperature patterns in ways that often favor invasive species (Taush R. J. 2008).

In the West, in particular, a warming climate will often lead to an upward elevational migration of plant species. Because of the rapidity of expected changes in climate, individuals of a native plant species may be lost from their lower-elevation limits faster than they will be able to migrate upward and establish into newly created habitat. This will result in stressed communities with fewer plant species distributed over large areas of the landscape (Taush, R. J. 2008).

As ecosystems become simplified, their trophic levels are truncated and their trophic interactions reduced. Such ecosystems potentially have an increase in the quantity of unused resources. These stressed communities thus become more open and their resources more available for the invasion and establishment of invasive plant species. These invaders may also be better adapted than native species to the new environmental conditions resulting from climate change. An exception might be native species of plants that can migrate from adjacent areas or regions into locations where they previously were excluded by climate as the new locations become more suitable. The greater the change, the more likely this facilitation of invasives will be. On landscape scales, these ecosystem spatial and temporal variabilities have major effects on ecosystem susceptibility to invasive species. Climate change and associated vegetation change interacting with invasive species are also increasingly leading to large wildfires that can further facilitate the establishment of additional invasive plant species.

To prevent these species from becoming a problem, early detection, followed by a rapid response to eradicate these initial infestations, will be necessary.

**Environmental Effects**

Unless otherwise stated, the geographic area used to analyze the direct and indirect effects is the BART Grazing Allotment Area. The area considered for cumulative effects analysis include the actual acres within the grazing allotments, adjacent County, State, private land, and adjoining lands to the south belonging to the Confederated Tribes of the Colville Nation. Cumulative effects analysis for noxious weeds also considers past management activities and natural occurrences that have caused current conditions. This cumulative effects analysis examines the current condition and what incremental effects would occur from ongoing activities and those proposed in the next 15 years.

**Direct and Indirect Effects**

**Alternative 1**
Under this alternative, grazing would be discontinued on the allotments after about a 2 year period. All range improvements would be left on the allotments and would deteriorate without maintenance. Suspension of grazing would reduce soil disturbance and seed dispersal that occurs from livestock. The risk of spread to existing weed populations, and the occurrence of new populations, would be reduced, but not arrested, due to other vectors for spread. Suspending grazing would eliminate the need for cattle managers to visit the allotment areas, therefore, a reduction in the numbers of weed site reports from permittees and range specialists would occur. Suspension of grazing could reduce the vigor of perennial grasses that provide competition; therefore, noxious weed populations could increase in areas where competitive grasses lack vigor.

**Alternative 2-Proposed Action**

**Stage 1, All Allotments**

**Fence Construction and Re-Construction in Aeneas and Tunk Allotments:** Construction of fence lines would result in livestock travel corridors where the risk of weed spread could increase. Approximately 2.5 miles of fence line, including small fences around water developments would occur and would likely result in less than one acre of soil disturbance (2.5 miles x 4' wide divided by 43,560 square feet). Any new fence construction would create minor soil disturbance where noxious weeds could be introduced.

**Fence Removal in Revis and Tunk Allotments:** This activity is not expected to create conditions favorable to noxious weed spread.

**Spring and Water Source Development or Relocation in all Allotments:** These new water developments would be at risk of soil disturbance and thus at risk of weed introduction (less than one acre of disturbance). Mitigation measures such as removing debris from equipment that could contain noxious weed seed and reproductive plant parts before entering the allotment and seeding disturbed soil with competitive grasses would reduce the risk of new introductions and spread of existing populations. Frequent monitoring followed by rapid control response, if needed, would reduce the likelihood of long term weed concerns at these locations. This activity would reduce the risk of weed spread or new weed introductions to riparian areas.

**Corral Relocation and New Construction in Aeneas and Tunk Allotments:** Some soil disturbance is likely to occur with this activity and there would be a risk of weed introduction within and around the corrals. Mitigation measures, including annual monitoring, would ensure that early detection occurs and early control would be implemented. The corrals would also provide opportunities to enclose livestock if needed to allow for passage and containment of noxious weed seeds that may be ingested, thus preventing weed spread and new introductions.

**Pasture Rest in Peony Pasture of the Bannon Allotment:** Allowing this pasture to rest would allow native vegetation to reestablish in areas that have been disturbed and would reduce the amount of weed spread caused by livestock.

**Removal of a Water Catchment Structure in the Bannon Allotment:** Some soil disturbance may occur, however, there are currently no noxious weeds present at this site; therefore, weed spread is not likely to occur. No introduction of new weeds is expected to occur.

**Modification of Season of Use in Bailey Pasture:** This activity is not expected to change the current condition of noxious weeds because the variation in timing would have no effect on current weed populations.

**Stage 2 – Tunk Allotment**

**3.9 Miles of Fence around the North Slope of Jungle Cr. Creating an Additional Pasture with Active Herding through Pasture:** With an adaptive management approach to the proposed use of fence lines, there is less likelihood of fence construction occurring. Approximately 3.9 miles of fencing has been analyzed for construction, as needed, to manage livestock impacts in Stage 2. If the proposed fence lines are not constructed; there would be less disturbance and livestock travel area impacted. If additional fences are constructed, then their development would occur over time, allowing monitoring and control actions to occur, as needed. The construction of fences as adaptive management could create up to 1.9

acres of soil disturbance that would need to be monitored for noxious weeds. Creating new pastures with fencing would provide an opportunity to rest areas and allow disturbed sites to re-vegetate naturally. Active herding through these pastures may occur, therefore, there is a risk of some weed spread occurring.

**Stage 3 – Tunk Allotment**

**3.2 Miles of Fence Construction in Tunk Allotment:** With an adaptive management approach to the proposed use of fence lines, there is less likelihood of fence construction occurring. Approximately 3.2 miles of fencing has been analyzed for construction, as needed, to manage livestock impacts in Stage 3. If the proposed fence lines are not constructed, there would be less disturbance and travel area impacted. If additional fences are constructed, then their development would occur over time, allowing monitoring and control actions to occur, as needed. The construction of fences, as adaptive management, could create up to 1.5 acres of soil disturbance that would need to be monitored for noxious weeds. Creating new pastures with fencing would provide an opportunity to rest areas and allow disturbed sites to re-vegetate naturally. Active herding through these pastures may occur, therefore, there is a risk of some weed spread occurring.

**Stage 4 – Tunk and Bannon Allotments**

**2.7 Miles of Fence around Peony Creek and 1.3 Miles around Patterson Creek:** With an adaptive management approach to the proposed use of fence lines, there is less likelihood of fence construction occurring. Approximately 4 miles of fencing has been analyzed for construction, as needed, to manage livestock impacts in Stage 4. If the proposed fence lines are not constructed, there would be less disturbance and travel area impacted. If additional fences are constructed, then their development would occur over time, allowing monitoring and control actions to occur, as needed. The construction of fences, as adaptive management, could create up to 1.9 acres of soil disturbance that would need to be monitored for noxious weeds. Creating new pastures with fencing would provide an opportunity to rest areas and allow disturbed sites to re-vegetate naturally. Active herding through these pastures may occur therefore there is a risk of some weed spread occurring.

**Stage 5 - Tunk and Bannon Allotments**

**Adaptive Administrative Actions:**
Modifying the seasons of use, numbers, kind and class of livestock allowed, or the allotment to be used under the permit, because of resource conditions, or permittee request, could result in decreased soil disturbance and an increase in species composition where an overall decrease in grazing use on the allotments occurs. Reducing the amount of time grazed or reducing utilization levels would result in reducing the overall grazing impacts. Opportunities for noxious weeds to invade disturbed soil would be reduced.

Adapting the grazing season in response to seasonal variations in climate and productivity, such as during periods of drought, will reduce impacts to vegetation. These changes would limit disturbance that invasive weeds need to establish.

Allowing pastures to rest would allow native vegetation to re-establish in areas that have been disturbed and would reduce the amount of weed spread caused by livestock.

Closing an area to domestic livestock use in an area where conditions cannot sustain grazing use would allow the analysis area to stay in compliance with Forest Plan direction and site specific desired conditions. These changes would limit disturbance that invasive weeds need to establish thus reducing the risk of spread of existing populations and new weed introductions caused by livestock. With closure of an

area, fewer eyes would be on the ground if an invasive species was to establish; it could be identified after the population is able to be controlled.

Levels of acceptable use, such as forage utilization, are set in the Forest Plan and in this Environmental Analysis and are brought forward in the Allotment Management Plans. Where specific allowable use limits are set they may be modified, if needed, to be more restrictive without additional environmental analysis. These changes would limit disturbance that invasive weeds need to establish.

**Summary of Effects of Alternative 2**
The proposed actions in Alternative 2 would have beneficial effects to the current noxious weed populations by improving livestock distribution and lessening soil disturbance. Implementing an adaptive management strategy may reduce the overall amount of ground disturbance created by fence construction and potentially reduce the amount of monitoring needed to ensure early detection. Resting pastures would enable previously overgrazed and trampled areas to regain vigor and health thus making them more competitive to noxious weeds. However, un-grazed grasses could increase the risk of wildfire, thus increasing the risk of disturbed soils susceptible to noxious weed invasion. Overall, fewer acres of soil disturbance are expected to occur within the timeframe projected for this alternative.

The grazing permittees and range management personnel would be present on the active allotments during the growing season which would increase opportunities for early detection of new or increases in existing populations. If additional pastures are created, allowing for other pastures to be rested, then fewer opportunities for early detection would occur.

**Alternative 3**

**Year One, All Allotments**

**Fence Construction and Re-Construction in Aeneas and Tunk Allotments:** Construction of fence lines would result in livestock travel corridors where the risk of weed spread could increase. Approximately 2.5 miles of fence line including small fences around water developments would occur and would likely result in less than one acre of soil disturbance (2.5 miles x 4’ wide divided by 43,560 square feet). Any new fence construction would create minor soil disturbance where noxious weeds could be introduced.

**Fence Removal in Revis and Tunk Allotments:** This activity is not expected to create conditions favorable to noxious weed spread.

**Spring and Water Source Development or Relocation in all Allotments and Reconstruction of Grouse Water Development in Bannon Allotment:** These new water developments would be at risk of soil disturbance and thus at risk of weed introduction (less than one acre of disturbance). Mitigation measures such as removing debris from equipment that could contain noxious weed seed and reproductive plant parts before entering the allotment and seeding disturbed soil with competitive grasses would reduce the risk of new introductions and spread of existing populations. Frequent monitoring followed by rapid control response, if needed, would reduce the likelihood of long term weed concerns at these locations. This activity would reduce the risk of weed spread or new weed introductions to riparian areas.

**Corral Relocation and New Construction in Aeneas and Tunk Allotments:** Some soil disturbance is likely to occur with this activity and there would be a risk of weed introduction within and around the corrals. Mitigation measures including annual monitoring would ensure that early detection occurs and early control would be implemented. The corrals would also provide opportunities to enclose livestock if needed to allow for passage and containment of noxious weed seeds that may be ingested, thus preventing weed spread.

**Removal of a Water Catchment Structure in the Bannon Allotment:** Some soil disturbance may occur, however, there are currently no noxious weeds present at this site; therefore, weed spread is not likely to occur. No introduction of new weeds is expected to occur.

**Pasture Rest in Peony Pasture of the Bannon Allotment:** Allowing this pasture to rest would allow native vegetation to reestablish in areas that have been disturbed and would reduce the amount of weed spread caused by livestock.

**Modification of Season of Use in Bailey Pasture:** This activity is not expected to change the current condition of noxious weeds because the variation in timing would have no effect on current weed populations.

**Year 2, Tunk Allotment**

**3.9 Miles of Fence around the North Slope of Jungle Cr. Creating an Additional Pasture with Active Herding Allowed through Pasture:** The construction of this fence could create up to 1.9 acres of new soil disturbance that would need to be monitored for noxious weeds. Creating new pastures with fencing would provide an opportunity to rest areas and allow disturbed sites to re-vegetate naturally. Active herding through these pastures may occur therefore there is a risk of some weed spread occurring.

**Pasture Rest in Tunk Allotment:** Allowing pasture rest would allow native vegetation to re-establish in areas that have been disturbed and would reduce the amount of weed spread caused by livestock.

**Year 3, Tunk Allotment**

**3.2 Miles of Fence Construction in Tunk Allotment:** The construction of this fence could create up to 1.5 acres of new soil disturbance that would need to be monitored for noxious weeds. Creating new pastures with fencing would provide an opportunity to rest areas and allow disturbed sites to re-vegetate naturally. Active herding through this pasture may occur; therefore, there is a risk of some weed spread occurring.

**Pasture Rest in Tunk Allotment:** Allowing pasture rest would allow native vegetation to re-establish in areas that have been disturbed and would reduce the amount of weed spread caused by livestock.

**Year 4, Tunk and Bannon Allotments**

**2.7 Miles of Fence around Peony Creek and 1.3 Miles around Patterson Creek:** The construction of fences would create up to 1.9 acres of new soil disturbance that would need to be monitored for noxious weeds. Creating new pastures with fencing would provide an opportunity to rest areas and allow disturbed sites to re-vegetate naturally. Active herding through these pastures may occur therefore there is a risk of some weed spread occurring.

**Summary of Effects of Alternative 3**

Much of the direct and indirect effects that would occur with Alternative 2 would also occur with Alternative 3. There would be approximately 13.6 miles of fence line constructed within a four year timeframe and mitigation measures to prevent noxious weeds would occur simultaneously.

Resting pastures would enable previously overgrazed and trampled areas to regain vigor and health, thus making them more competitive to noxious weeds. Un-grazed grasses could increase the risk of wildfire

spread, thus increasing the risk of disturbed soils susceptible to noxious weed invasion. In general, there would be more ground disturbance occurring in the short term (4 years).

There would be fewer site visits by permittees to these rested pastures thus reducing the potential for early detection of new weed sites.

**Cumulative Effects**

**Past, Present, and Reasonably Foreseeable Future Actions**
Integrated Weed Management including manual, chemical, mechanical, cultural, and bio-control methods has occurred (Integrated Weed Management Environmental Assessments, 1997b and 2000a) within the BART assessment area where weed populations exceeded damage thresholds. Noxious weed control is also occurring adjacent to the BART Allotments on Federal, State, County, Tribal, and private lands. The combined effect of noxious weed control on adjoining lands would assist weed control efforts on Tonasket Ranger District by reducing weed populations that could spread onto Forest Service managed land. Reduction in the rate of noxious weed spread is now occurring.

**Alternative 1**
Integrated Weed Management is occurring within and adjacent to the BART Allotments on Federal, State, County, and private lands. Noxious Weed control would continue to occur in these areas. Other activities such as timber harvest, firewood gathering, and recreation are also occurring within and adjacent to this area. Livestock grazing on adjacent lands is also ongoing. These activities can all increase the risk of introduction and spread of noxious weeds. The No Grazing alternative on Federal land in this area could benefit weed control efforts by reducing the risk of spread caused by grazing.

**Alternatives 2 and 3**

Currently the Okanogan-Wenatchee National Forest is analyzing the effects of implementing an invasive plant program as described in the Pacific Northwest Region Invasive Plant Program Final Environmental Impact Statement, April 2005 (PNW ROD 2005b). This analysis would incorporate the desired future conditions, goals and objectives, and treatment methods such as herbicide applications and prevention measures described in the 2005 PNW ROD. Following the anticipated completion of the Forest analysis, it is probable that those treatment methods could be implemented within the BART Grazing area, thus enhancing ongoing weed control efforts.

Several past vegetation management projects have been completed in the analysis watersheds. The vegetation management practices included removing vegetation which ranged from generating created openings to removing a limited amount of crown closure, road construction and maintenance, and fuel reduction. Ground disturbance occurred from these activities, creating opportunities for the introduction or spread of noxious weeds. Mitigation measures for controlling the spread or introduction of new invaders have been implemented for more recent projects such as Upper Aeneas Timber Sale, Bailey Restoration, Crawfish Restoration, and Bannon Fire Pre-commercial Thinning. These projects opened up timbered stands to additional grazing opportunities, thus dispersing livestock over a larger area. Increased livestock access to riparian areas could also occur. Mitigation measures designed to reduce the risk of spread or new introductions that could occur due to these project activities would be implemented and would support and enhance the proposed mitigations for noxious weeds within the BART Grazing Allotment.

Grazing has occurred, and continues to occur, throughout the project area, as well as throughout the analysis watersheds on private, Tribal, and public lands. Past grazing has likely led to the introduction or spread of weeds. Little change in current populations is expected in the analysis area through livestock grazing. The Allotment Management Plan (AMP) would address numbers of livestock on the land and

specific livestock management needs, particularly those around riparian areas that are already known to be disturbed from livestock impacts. Future ground disturbance and noxious weed spread from livestock grazing is expected to be reduced compared to the current situation as a result of implementing the new Allotment Management Plan based on this Environmental Impact Statement.

Firewood gathering and recreational activity has occurred in the past and continues to occur. Firewood gatherers and other recreationists sometimes drive off roads, and can spread weeds on the undercarriage of their vehicles. Livestock may utilize these "user built" roads for forage and movement, thus potentially aiding in the distribution of noxious weed seed. Rehabilitation and monitoring of these user created roads for noxious weeds occurs and would continue to happen as funding is available. Public education regarding noxious weeds is an ongoing part of the Weed management program. A substantial increase in firewood gathering and recreational activity is not expected to occur, therefore, increases in spread rates for noxious weeds from livestock is not expected.

Special Use Permits exist within the analysis area for the Tunk Mountain Communications Site and utility lines. Any future disturbance associated with special use permits would be minimal so no changes to the current condition of noxious weeds is expected to occur by continued livestock grazing.

Wildfire has occurred periodically throughout the analysis watersheds. Wildfire and suppression activities can create niches for weeds to establish where soil disturbance occurred. Because fire location, size, and intensity are unpredictable, it is not possible to predict the level of impact to noxious weed populations, however, rehabilitation efforts, noxious weed monitoring, and control projects would be implemented as part of fire restoration. Livestock grazing can have beneficial effects by reducing the height of grasses that once dry, can exacerbate fire spread. If a catastrophic wildfire did occur, then it is likely that livestock would be relocated until the area returned to a state that could support grazing, therefore, the risk of noxious weeds spreading in the burned area from livestock use would be reduced.

Road maintenance will continue periodically. Activities may include removal of hazard trees, grading of roads, cleaning ditches and culverts, removal of roadside vegetation through mowing, and adding gravel to road surfaces. Mitigation measures would be implemented to reduce the risks of introduction and spread of noxious weeds, therefore, the current condition of noxious weeds along roads combined with grazing impacts is not expected to increase above current conditions.

The new Access and Travel Management Plan for the Okanogan-Wenatchee National Forest is in progress, and there would be some intermixture of effects with this project. The proposed action for the Access and Travel Management Plan is similar, or even more restrictive, for motorized access within the analysis area than the existing Okanogan National Forest Travel Plan. Roads would be closed to motorized access unless designated open. Instead of entire areas being open to cross-country travel by ATVs/UTVs, only access to identified dispersed camping sites would be allowed. More restrictions placed on ATV/UTV use would have a beneficial cumulative effect to noxious weeds by reducing the amount of off road soil disturbance and the risk of weed spread.

**Conclusion**

A Noxious Weed Risk Assessment (See Appendix I, Noxious Weeds Risk Assessment & BMPs) was completed for the BART Grazing Analysis in order to determine the likelihood of spread of existing populations within the analysis area if either of the action alternatives is selected. This Risk Assessment considers the current condition, implementation of grazing improvements, mitigation measures, and best management practices designed to reduce the risk of weed spread. In addition, on-going noxious weed control would continue to occur as funding is available under previous decisions. This combination of grazing improvements and mitigations would reduce the risk of weed spread and introduction of new invaders by lessening the susceptibility of sites to weed invasion. It was determined that there is a

moderate probability that weed spread would occur within the project area in the short term (3 to 5 years) and a low probability that weeds would expand and colonize areas in the long term (5 to 15 years).

Many activities contribute cumulatively to invasive weed management. The effects of these activities can be minimized, but not eliminated, on NFS lands through management requirements and mitigation measures. Additional analysis will be required for those projects planned in the future.

**Irreversible and Irretrievable Commitments**
No known irreversible or irretrievable commitments would occur from implementing this project.

**Forest Plan Consistency**
All alternatives would be consistent with Okanogan Forest Plan Standards and Guidelines 12-1, 2 and 3 and the 2005 PNW ROD, Standards and Guidelines 1, 3, and 6 because prevention and mitigation measures would be implemented in each alternative, neither alternative would impede on-going noxious weed control activities and would improve declining resource conditions that favor noxious weed establishment.

## Fire and Fuels

### Summary

The short section below summarizes livestock grazing and its effects on fire and fuels on the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed and prepared by Fuels Specialist, Shawn Plank contained in the Fire and Fuels Baseline report in the analysis file for the BART Grazing Analysis project.

This report analyzes livestock grazing and its effects on fire and fuels on the Bannon, Aeneas, Revis, and Tunk (BART) allotments. The analysis area for this resource covers the National Forest System land in these allotments.

Grazing on the BART allotment follows the recommendations of the Okanogan-Wenatchee National Forests Land Management Plan and Fire Management Plan as it relates to fire and fuels management within these allotments.

For direct, indirect, and cumulative effects, the analysis includes a review of pre-European settlement historic range of variability in relation to Fire Regime and Condition Class, treatment history within the past twenty years, and manipulation of fire and fuel models to help show the effects of grazing on fine fuels and possible fire behavior within the allotments. In order to model the potential reduction in the fine fuel loadings from grazing the Flammap 5 program, GIS, and the basic 13 Fuel Models (FM) were used to compare the reduction in height and continuity of fine fuels on the landscape. Maps of modeling data, effected environment, range allotments, and improvements are in the analysis file.

The effects of authorizing grazing on the BART allotments, however negligible, will reduce fine fuels availability to fire, as well as retain grazing infrastructure; fences, pens, corrals, and water troughs that can be beneficially used by firefighting personnel in wildfire and prescribed fire situations.

## Soils

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed in the BART Grazing Management Soils Resources Report by Soil Scientist, Erica Nevins, (Lance George

Zone Hydrologist, edited report). Reference information is contained in the full specialist report, which is held in the analysis file for the BART Grazing Analysis project.

**Issue**: Livestock grazing may affect long-term soil productivity by reducing effective ground cover, increasing soil density, and increasing surface erosion.

**Indicators**:

Percent Effective Ground Cover
Estimated soil erosion
Number of isolated areas of impact where trend is not maintained or improved.

A more complete summary of the Regulatory Framework that applies to this project is included in Appendix G, Regulatory Framework, in Appendix E, Soils, in the Soil Resource Baseline Report in project files, and in Chapter 1 in the "Management Direction and Guidance" for this project starting on page 9.

**Background**

Soil productivity is the inherent capacity of a soil to support specific plants, plant communities, or sequence of plant communities. Livestock grazing may directly affect long-term soil productivity by compaction, reduced effective ground cover, and increased erosion. Areas where grazing effects are likely to occur include watering and salting sites, bedding grounds, trailing paths, and other areas of extensive use. Percentage effective ground cover is used as a surrogate to indicate changes to soil productivity as a result of livestock grazing.

**Scope of Analysis**

This report is to provide detailed information and analysis regarding soil resources for the reauthorization of grazing within the Bannon, Aeneas, Revis, and Tunk (BART) allotments. The analysis area for this resource covers National Forest System land in the allotments.

**Existing Condition**

The following sources of information were used to determine the current quality and condition of the soil resource and to analyze the effects of the proposed project and alternatives. Information on the distribution and properties of soil types within the analysis area are included in the Soil Survey of Okanogan National Forest Area, Washington (USDA, 2008) and the Soil Survey of Okanogan County Area, Washington (USDA, 2010). The Landtype Associations of North Central Washington (USDA, 2004) was also used to understand soil origin and development within the analysis area. Field visits were made to the analysis area in May, July, and September 2012 to confirm the accuracy of the soil survey data and to review soil conditions in the analysis area. Detailed information on Landtype Associations and soil properties for the allotments are included in Appendix E, Soils.

The BART allotment analysis area is approximately 36,297 acres which is managed for multiple uses including cattle grazing.

Each allotment has a permitted number of head months and season associated with it. Also associated with each allotment is an array of infrastructure including fences (allotment boundary, pasture, and exclosures), corrals, holding pens, and water developments (e.g. troughs, cribs, and ponds).

**Soil Development**

The Cordilleran Ice Sheet overrode the analysis area as late as 12 to 14 thousand years ago and has strongly influenced topographic expression (Waitt, 1972). This massive ice sheet filled all valleys and

overrode many of the ridges within the analysis area. Glacial drift, which is unconsolidated glacial debris, fills valleys and mantles uplands within the area.

The rest of the analysis area is primarily composed of metamorphic bedrock with igneous intrusions (Stoffel 1990). In glaciated areas, the granitic bedrock has been scoured and abraded by glacial ice which exposed hard, relatively unweathered bedrock. These soils commonly have a high percentage of rock fragments ranging from gravel to boulder in size.

Volcanic ash from Mount Mazama (Crater Lake) was deposited in the analysis area approximately 6,600 years ago. The physical characteristics of this volcanic ash include low bulk density (0.65 to 0.90), a dominance of silt and very fine sand-sized particles, and weak structural development. On northerly aspects, the ash forms a distinct horizon over a variety of parent materials. On southerly aspects, the ash commonly occurs as a component of the surface layer of the soil and is mixed with the underlying parent material.

A small percentage of the analysis area has soils that either formed in alluvium material on flood plains and stream terraces or in organic material on valley bottoms and drainage basins. These soils are typically wet at least part of the year.

**Landtype Associations**

There are three landform types found within the analysis area. *Geomorphic expression or landform* is an excellent surrogate for understanding geomorphic processes because it is the topographic expression of the sum of geomorphic processes as they are influenced by climate, time, geology, and other landscape factors. Although historic processes may or may not be present today because of climate change or other factors, landform genesis have shaped the topography, soil regolith, and stream patterns that continue to influence present day processes. These Landtype Associations are Scoured Glaciated Mountain Slopes – Ga2 equals 26% of the analysis area; Glaciated Mountain Slopes – Ia2 equals 57%; Ia8 equals 15% of the analysis area; and Valley Bottoms/Outwash – Ou6 equals 2% of the analysis area. A description of these landtype associations is contained in Appendix E, Soils. This information is also included in the BART Grazing Management Soils Resources Report by Soil Scientist, Erica Nevins in the analysis file.

**Soil Physical Properties**

Appendix E, Soils, lists soil properties of the soil map units within the analysis area that have bearing on the proposed actions. This information is also included in the BART Grazing Management Soils Resources Report by Soil Scientist, Erica Nevins in the analysis file.

**Soil Productivity**

Soil factors which influence productivity, such as total depth, effective rooting depth, ash thickness, and coarse fragment content vary across the analysis area. The surface soil is considered to be the top A or A/B horizon and is the most productive portion of a soil profile. The depth of the surface soil is dependent on the soil type. The surface soil contains the greatest concentration of soil organic matter, plant available nutrients, and fine roots.

All, but two of the soil map units within the allotments have an ash component. Many have a distinct ash mantle on top of the original parent material. In other map units, the ash has become mixed with the underlying parent material. Soils with surface ash layers tend to be highly productive, on relatively stable erosion environments.

**Soil Erodibility and Risk of Soil Erosion**

Soil erodibilty (K factor) is an estimate of the ability of soils to resist erosion based on the physical characteristics of each soil and the rate of runoff. Surface soil erosion is a natural process that can be accelerated by land management activities including grazing. Soil erosion depends on the parent material,

soil properties (such as soil depth, texture, and rock content), vegetative cover, and slope. In an undisturbed state, the potential for surface erosion of ash soils is generally low. However, if disturbed, ash soils tend to have a higher risk of soil erosion. The susceptibility of detachment and transport is increased and soil erosion is common if running water is channeled on the exposed surface of an ash soil.

As a rule, the greater the percent slope of a site the higher the erosion potential. Soil erosion by water also increases as the slope length increases due to the greater accumulation of runoff.

Soil erosion potential is increased if the soil has little vegetative cover of plants or other cover material. Organic matter reduces erodibility because it reduces the susceptibility of the soil to detachment and increases infiltration, which reduces runoff and thus erosion.

Generally, soils with faster infiltration rates, higher levels of organic matter, and improved soil structure have a greater resistance to erosion. Soils high in clay content have low K values, 0.05 to 0.15, because they're resistant to detachment. Coarse textured soils, such as sandy soils, have low K values, 0.05 to 0.2, because of low runoff even though these soils are easily detached. Medium textured soils, such as silt loam soils, have moderate K values, 0.25 to 0.4, because they are moderately susceptible to detachment and they produce moderate runoff. Soils having high silt content are the most erodible of all soils. They are easily detached, tend to crust, and produce high rates of runoff. Values of K for these soils tend to be greater than 0.4. Soils within the analysis area tend to be moderately susceptible to detachment and they produce moderate runoff.

The potential for surface soil erosion applies to the potential risk of detachment and movement of soil particles down slope. It is important to note that risk of erosion does not equal the rate of erosion. The rate of erosion is the amount of soil loss by erosion over time which is dependent on effective soil cover and other soil stability factors. The current and potential rates of erosion expected from the proposed management actions will be modeled and discussed in depth in the Hydrology Specialist Report (Hanson 2012).

**Soil Compaction**

Soil compaction occurs when soil is compressed, or subjected to some other physical force that exceeds the soil's strength and reduces the pore spaces between soil particles. Compaction of soil can create a platy structure, increase soil bulk density and soil strength, and reduce water infiltration. Factors affecting compaction include soil texture, degree or duration of pressure exerted on the soil surface, and soil moisture content.

As a result of the major soil-forming factors of parent material, climate, and vegetation, the ash soils within the analysis area have developed with naturally low bulk densities. Ash soils also have relatively low clay content. This generally means that there will be very little cohesion and internal bonding in the soil (Johnson et. al. 2007). Low bulk densities result in soils with very low strength (capacity of a soil to withstand forces without experiencing failure) allowing them to be easily compacted.

Mixed soils typically have a larger component of rock fragments within the soil matrix. Soil textures that have descriptions of rock content such as gravelly or cobbly to very or extremely gravelly or cobbly indicate greater rock content in the soil profile. These rock fragments modify the soil texture and provide bearing strength to the soil surface.

Some of the soil map units within the analysis area do have a moderate percentage of rock fragments in the surface horizon (first layer of soil below the soil's surface). Saini and Grant (1980) found that soil compactability significantly decreased as stone content increased. This is because rock fragments below the soil surface support the existing soil structure and decrease the susceptibility to compaction (Poesen and Lavee 1994).

One of the consequences of compaction is an increase in bulk density. Since ash soils have naturally low bulk densities, an increased bulk density might still be relatively low compared to that of other soil types. However, Geist and Cochrain (1991) show that even though ash soils have relatively low bulk densities before and after disturbance, there is a strong association between vegetation growth loss and compaction for these soils.

Soil compaction can also reduce soil infiltration rates and decrease hydraulic conductivity, which increases the potential for erosion and changes landscape hydrology (McNabb et al. 2001).

Soil moisture content is a factor in the degree of soil compaction from management activities. Wet soils will compact more readily than dry soils. Less force is needed to compact a soil at or near field capacity than to compact the same soil when dry.

**Detrimental Soil Conditions**
Existing levels of detrimental soil conditions in the analysis area are due to previous timber/fuels management activities, roads, some dispersed recreation, and past and current grazing practices. Due to these past and ongoing impacts, the analysis area exceeds the FSM 2500 policy that a minimum of 80% of an activity area be in an acceptable soil quality condition. Further discussion in this analysis will focus only on detrimental soil conditions related to grazing which are compaction, puddling, displacement, and erosion.

**Grazing and Soil Quality Interactions**

**Literature on Grazing and Soil Resources**
Cattle grazing can affect the productivity of rangeland soils mainly through the modification of hydrologic properties. The primary means by which this is accomplished are the reduction of vegetative cover and by trampling of the soil surface (Warren et al. 1986).

Livestock grazing on uplands can increase soil compaction and decrease infiltration by grazing protective vegetative cover, reducing soil organic matter, and trampling the soil surface. The physical disturbance and removal of protective vegetation by grazing animals may dislodge soil particles thereby increasing the potential for sediment production. Bohn and Buckhouse (1985) found a similar pattern from cattle grazing in riparian zones. The moist soils in these areas are particularly vulnerable to compaction and its associated reductions in infiltration, root growth, and soil porosity. Wheeler et al. (2002) found reductions in infiltration rates as a result of grazing wetter soils. Soils in riparian areas tend to be moist more often and for longer periods than upland soils which increases the time that they are vulnerable to effects from livestock grazing.

Other locations where impacts from cattle grazing are seen on the landscape are the watering points. M.H. Andrew (1988) defines this phenomenon as “a zone of attenuating animal impact away from each watering point; this zone is called a piosphere.” Pietola et al. (2005) found that after only one grazing season on a sandy loam textured soil, the infiltration rate at a drinking site was only 20% of that under natural conditions.

Pietola et al. (2005) describes the effect grazing can have on the soil resource as the following:

> “Trampling by animals causes soil deformation through soil compaction by the high-ground pressure of hooves and soil homogenization by shear effects. Destruction of soil structure has been shown to occur by cattle trampling even on coarse-textured soils . . . With respect to soil structure deterioration, shearing effects are most disadvantageous, as shearing causes soil homogenization. In combination with water it also induces greater soil swelling followed by normal shrinkage behavior and a complete loss of soil strength. These processes also result in soil puddling. Thorough homogenization and

puddling of the soil at drinking sites of pastures finally result in a reduction of pore sizes and a complete weakening, which contributes to increased surface runoff . . . Destroyed soil structure increases the ponding of water and surface runoff and, consequently, it increases the vulnerability to water erosion. ”

**Existing Soil Condition from Past and Current Grazing**

Observations from field reviews in May, July, and September 2012 indicate that the grazing and soil interactions described in the section above are occurring on the Bannon, Aeneas, and Tunk allotments. The soil surfaces in the wet areas accessible to cattle indicate high levels of trampling resulting in compaction and reductions in infiltration. There is evidence in wet meadows of lasting soil deformation resulting in puddling of the surface due to grazing when the soils are too wet. In these wet areas there was very little evidence of recovery of vegetation or the soil surface after cattle were removed after the 2011 grazing season. Many of the streambanks within these allotments have little vegetation on them and many have been pedestalled considerably from hoof sheer. There is also evidence of severe erosion resulting from cattle trailing along the stream banks. This has resulted in considerable soil loss. The physical disturbance and removal of protective vegetation by grazing animals may dislodge soil particles thereby increasing the potential for sediment production. There is a 15% move trigger for bank alteration, not to exceed 20%. This measure is in place now and has not been successfully implemented resulting in the downward trend in unsatisfactory streambank erosion and in-stream conditions.

Some of the previously developed water locations are in good shape and are preventing extensive soil damage. For instance, the Sneed #2 development on the Aeneas Allotment has an exclosure around the spring source with water being piped to a trough. The soil surface around the trough is vegetated and the riparian vegetation around the spring source is thriving. The Cole development on the Bannon Allotment is another example of a well-designed water development that is resulting in minimal damage to the soil resource. However, the Mike development on the Bannon Allotment is an example of a poorly designed development. The trough associated with this development is down in the stream channel and there is evidence of substantial cattle trampling.

Many of the undeveloped spring sources within the analysis area are being used by cattle for watering. The ones visited during a May 2012 field review indicate considerable cattle trampling, puddling, and compaction. An example of this is the Hill Cow Camp spring on the Aeneas Allotment. The spring is surrounded by productive upland vegetation and the area is being accessed by cattle and used extensively while they’re grazing in the vicinity.

In the uplands, cattle trails are obvious and are highly compacted. Trailing is also evident along many of the fence lines. There is currently an estimated 51 miles of existing fence, including boundary fence, in the project area which the permittees are responsible for maintaining most of. This project could construct an estimated 12.1 miles of proposed new fence; move 1.5 miles of existing fence, and remove up to 2 miles of existing fence. There is evidence of extensive soil loss along these trails which may have contributed to existing sediment concerns discussed in the Hydrology and Fisheries Specialist Reports (Hanson 2012 and Shull 2012).

**Regulatory Framework**

The regulatory framework providing direction for protecting a site's inherent capacity to grow vegetation comes from the following principle sources:

- *Organic Administration Act of 1897*
- *Bankhead-Jones Act of 1937*
- *Multiple Use-Sustained Yield Act of 1960*
- *National Forest Management Act of 1976 (NFMA)*

Short explanations of these laws are contained in Appendix G, Regulatory Framework, in the Appendices for this document.

Forest Service Manual (FSM) chapter 2500 gives direction to manage soils.

The Forest Service Manual (FSM) 2500, Chapter 2550 Soil Management directive establishes the framework for sustaining soil quality and hydrologic function while providing goods and services outlined in forest and grassland land management plans.

The policy outlined in Chapter 2550 that pertains to this analysis is the following:

1. Manage forest and rangeland ecosystems to maintain or improve soil quality.
2. Utilize soils information to assess condition and analyze project effects when planning and implementing activities to ensure sustainable delivery of goods and services without impairing the productivity of the land.

The Region 6 Supplement (2500-98-1) to the FSM 2500, Chapter 2520 directs forests to "design and implement management practices which maintain or improve soil and water quality" and to "emphasize protection over restoration."

The policy outlined in the Region 6 Supplement directs the following:

"When initiating new activities:

1. Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area. (This includes the permanent transportation system.)
2. In areas where less than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent.
3. In areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality.

"Soil Quality Standards": The following regional standards are thresholds beyond which soil quality is adversely impacted. Only standards that could be affected by livestock grazing are included. Refer to the Soils Resource Report for a more complete list of standards.

Leave a minimum of 80% of an activity area in an acceptable soil quality condition. Detrimental conditions, as defined below, also include landings and system roads. Detrimental soil quality conditions and the accompanying criteria for determining when and where these conditions occur include:

a. Compaction, Displacement, Puddling, Severely Burned.

(1) Detrimental Compaction.

a. Volcanic Ash/Pumice Soils (Soils with Andric Properties). An increase in soil bulk density of 20 percent, or more, over the undisturbed level.

b. Other Soils. An increase in soil bulk density of 15 percent, or more, over the undisturbed level, a macro pore space reduction of 50 percent or more, and/or a reduction below 15 percent macro porosity.

Assess changes in compaction by sampling bulk density, macro porosity, or penetration resistance in the zone in which change is relatively long term and that is the principal root development zone. This zone is commonly 4 to 12 inches in depth.

(2) Detrimental Puddling. Detrimental puddling is where the depth of ruts or imprints is six inches or more. Soil deformation and loss of structure are observable and usually bulk density is increased.

(3) Detrimental Displacement. Detrimental displacement is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width.

b. Erosion

(1) Detrimental Surface Erosion. For effectiveness monitoring, detrimental erosion is visual evidence of surface loss in areas greater than 100 square feet, rills or gullies and/or water quality degradation from sediment or nutrient enrichment.

The Okanogan Forest Plan Standard and Guidelines that apply to the proposed action and the soil resource are 11-2 and 11-3.

11-2 AMPs shall include a strategy for managing riparian areas for a mix of resource uses. A measurable desired future riparian condition should be satisfactory or greater. Range condition within riparian ecosystems should be in good or better condition class with a stable or upward trend. In condition classes fair or less, management shall be designed to attain an upward trend. When the current riparian condition is less than satisfactory, objectives shall include a schedule for improvement. The AMPs shall identify management actions needed to meet riparian objectives within the specified time frame. Measurable objectives shall be set for key parameters.

11-3 When riparian resource damage is occurring, determination of the cause of the resource damage shall be made prior to taking action through the allotment management plan. Alleviate damage caused by grazing through proven means. Fencing may be used when other management approaches have not given satisfactory results in the same or similar resource conditions.

**Desired Conditions for Soils**

- Soil quality, productivity, and hydrologic function are maintained and restored where needed. Long-term soil productivity is maintained or enhanced.
- Soil infiltration is high and runoff limited. Sufficient vegetative cover and vegetation spatial arrangement exists to intercept raindrops and reduce raindrop splash erosion. Litter on the soil surface is sufficient to protect soil from erosion and encourage a high rate of infiltration. Bare soil spaces are expected to be small and irregular in shape and are usually not connected. The vegetative structure is usually adequate to capture snow and ensure snowmelt occurs in a subdued manner allowing maximum time for infiltration and reduce runoff and erosion in all but extreme rainfall events.
- Soil compaction is limited in extent.
- None to rare signs of pedestalling in forested and shrub areas or along stream banks.

**Environmental Consequences**

**Direct and Indirect Effects**

**Alternative 1 (No Action/No Grazing)**
Under this alternative, no adverse impacts to soil resources attributable to livestock grazing would occur within the analysis area once cattle are removed in about two years. The percentage of effective ground cover, soil erosion rates, soil compaction, and the number of isolated areas with impacts from grazing will improve over time. Recovery of existing detrimental soil conditions due to past and current grazing management would occur through natural means (e.g. freeze/thaw cycles, root penetration into compacted soils, etc.). However, due to multiple variables, it is not possible to predict the actual rate at which the soils would move toward desired conditions.

**Alternatives 2 and 3**

**Proposed actions common to all allotments**
Unless differences are noted below, the following actions pertain to the Bannon, Aeneas, Revis, and Tunk Allotments.

**Continue livestock grazing at current levels**
Current stocking levels and season of use would be continued if Alternative 2 was selected. Maintenance of current stocking levels and the season of use would result in effects similar to what is seen with the existing condition. There would be no improvement to soil resources with this action. The overall condition of the soil resource is expected to either be maintained or further degraded depending on location within the allotments. For instance, upland soils would likely continue to see very little grazing pressure and should maintain themselves in stable condition. Streambank soils would likely continue to see very heavy grazing pressure and would continue to decline in condition as constant trampling in these areas inhibits any potential recovery. The percentage of effective ground cover, soil erosion rates, soil compaction, and the number of isolated areas with impacts from grazing would remain similar to the existing condition. If adaptive management actions are implemented to correct soil impacts, some slight improvement to soil indicators may occur over time.

**Construction of livestock water developments**
Multiple springs would be developed with exclosures built around the source and water piped down to troughs. Exclosing the source from cattle would stop the puddling and compaction of the wet soils that is currently taking place. These exclosures would also allow for riparian vegetation to recolonize these wet areas.

**Streams and Riparian Areas**
However, there is not expected to be any improvement to other riparian resources (e.g. streams and wet meadows) by developing springs since cattle already access these more extensive riparian areas for water and it's very unlikely that new developments will draw cattle away from watering in streams. Maintenance or improvement of conditions would be dependent on implementing the monitoring plan and moving the cattle at critical trigger points.

**Construction of fences around high priority riparian areas**
These fences would be constructed on an as needed/adaptive management basis. These fences may not improve resource conditions since the areas within them would not be rested. Also, fences are a feature that cattle trail along. These fences would likely result in increased compaction and rutting along cattle trails without a benefit of improved soil conditions within these fenced areas. This project could construct an estimated 12.1 miles of proposed new fence, move 1.5 miles of existing fence, and remove up to 2 miles of existing fence.

The 15% move trigger for stream bank alteration monitoring would continue to be used and permittees would be directed to move their cattle once this has been reached. Stream bank alteration should not be

greater than 20% after the trigger is reached. If trigger point monitoring is successfully implemented and cattle are moved in a timely manner, improvements to soil indicators should improve over time.

Meehan and Platts (1978) demonstrated that soil disturbance was greater in areas overused by livestock. The susceptibility of soils to erosion increased as vegetation deteriorated. Livestock trampling reduced ground cover density and increased bare soil openings, which usually resulted in increased watershed runoff and erosion. With Alternatives 2 and 3, this scenario would continue to occur along the streambanks within the Bannon, Aeneas, and Tunk Allotments. This scenario would continue to result in soil compaction, soil erosion, and a decrease in soil infiltration leading to increased detrimental soil conditions. If trigger point monitoring is successfully implemented and cattle are moved, improvements to soil indicators should improve over time.

**Bannon Allotment Proposed Actions**

**Remove boundary fence with Revis allotment**
The area considered to be the Revis Allotment would be grazed for the first time in about eight years. It is expected that this area would start to see impacts to the soil resources that are similar to what is seen throughout the other three allotments. Maintenance of acceptable conditions would be dependent upon strict implementation of monitoring and administration

**Rest Peony Pasture until Forest Plan Standards and Guidelines are met**
Excluding grazing from Peony Pasture, would help the growth of much needed vegetative cover and the elimination of hoof sheer that is currently occurring. The percent of effective ground cover and erosion should see results in a short time frame. Compaction will take longer to improve with roots and freeze/thaw cycles being the primary drivers for improvement. This pasture has had cattle trespass problems in the past during rest years. Permit administration to insure that trespass cattle are kept out of the Peony Pasture during rest periods is critical to successful soil resource improvement.

**Aeneas Allotment Proposed Actions**

**Install fence north of FSR 3000**
This action would restrict livestock access to Aeneas Creek and lower Jungle Creek and its associated wetlands. This action would eliminate the ongoing erosion loss of soil that is occurring from cattle trailing along these creeks. Protection of the area would facilitate the ability of riparian vegetation to reestablish itself. Soil indicators should see an immediate improvement.

**Pump water to two new troughs in the Sneed Pasture**
This action would provide new water sources for cattle which would potentially reduce the impact currently seen along Aeneas Creek. Successful administration and move trigger monitoring will be needed to ensure any benefits to soil indicators along Aeneas Creek.

**Relocate Jungle Creek Corral**
The relocation of this corral to a previously compacted log landing site would be a benefit to other resources and would not negatively impact soil resources. Since the area of the present corral will be in an exclosure, over time the area around the current corral location would re-vegetate and the detrimental soil conditions should improve. This improvement in soil conditions won't take place during the timeframe of this decision, but the action will facilitate its occurrence.

**Alteration of grazing patterns**
The length and timing of livestock grazing within the Bailey pasture (South pasture) would be adjusted if monitoring determines that habitat indicators such as bank stability, greenline to greenline width, and streamside vegetation are not moving towards meeting Forest Plan Standards and Guidelines, INFISH

RMOs. Adjustments may also occur if seasonal climatic fluctuations such as drought result in the need to adapt management to changing conditions. Modifying the season of use for the allotment would be minor, and must keep to the two weeks parameter for livestock on and off dates. A likely scenario would be for an early season, reduced grazing period (June 1 to July 1) during alternating years with a mid-season reduced grazing period (July 1 to August 1) during alternate years. The elimination of late season grazing in the Bailey pasture should allow for vegetation growth along the stream banks before the end of the growing season. This vegetation growth would provide cover for the soil surface and should, at the very least, slow down the streamside erosion taking place. If trigger point monitoring is successfully implemented and cattle are moved, improvements to soil indicators would improve over time.

**Lost/Barnell Pastures**

The Lost/Barnell Pastures would be rested every other year similar to the current allotment management plan practice. These pastures would only be used for a few weeks during the mid-season. It is critical that these areas are not grazed for a period longer than 2-3 weeks, including the time it takes for the cattle to trail on and off the pasture, due to the wet soil condition in these areas. These soils should not be grazed or made available for livestock use when wet. If trigger point monitoring is successfully implemented and cattle are moved, improvements to soil indicators should improve over time.

A field review on September 5, 2012, after an extensive dry period, showed that multiple areas in these pastures were still very wet. As described earlier, grazing on wet soils can very easily lead to increased compaction and decreased infiltration.

**Construction of a corral adjacent to FSR 3015**

The location of this corral is on an old log landing and is already detrimentally compacted. There should be no additional effect to soil resources from this action.

**Alternative 3**

This alternative is similar to Alternative 2 except that the fences would be built on a schedule and that the areas within them would be rested. Reintroduction of limited livestock grazing into these areas would be considered after criteria, see monitoring plan; in the rested areas have been reached.

Kauffman et al (2004) evaluated three locations where livestock grazing had been removed for 9-18 years. The results indicated that, “livestock removal was found to be an effective approach to ecological restoration, resulting in significant changes in soil, hydrological, and vegetation properties that, at landscape scales, would likely have great effects on stream channel structure, water quality, and the aquatic biota.”

Long-term resting of the proposed large, fenced areas (Areas A, B, C, D, and Peony Creek) could be equated to a landscape-level restoration treatment. It is likely that this treatment would result in measurable improved conditions similar to the effects Kauffman et al. observed. However, it needs to be noted that these areas would have to be rested long-term and that improvements might take at least a decade to become measurable.

Cattle trailing along new fence lines would result in compaction, rutting, and reduced ground cover.

This alternative would stop the continued degradation of soil resources within these allotments and it should move the allotments towards meeting the Forest Service Manual direction for detrimental soil conditions.

**Cumulative Effects**

Cumulative effects include a discussion of the combined, incremental effects of human activities. For activities to be considered cumulative, their effects need to overlap in both time and space with those of the proposed action. For the soil resource, the area for consideration is the BART project area because effects on soils are site specific. Past activities have resulted in areas where soil productivity has been altered. The extent of these impacts was analyzed in the Existing Condition section. This section will analyze past, present, and reasonably foreseeable projects within the project boundary that overlap in space to determine cumulative effects.

**Alternative 1 (No Action/No Grazing)**
There are no cumulative effects associated with the No Action Alternative.

**Alternative 2 (Proposed Action)**

**Commercial and Non-Commercial Treatments**
It is likely that many areas within the analysis area have been harvested multiple times within the past century. From a listing of 36 timber sales of past actions, from 1960 to 1997, six use the word Bailey as part of a sale name. These actions likely contributed to the majority of the present detrimental soil conditions through skid trails, road construction, landings, pile burning, illegal fire wood harvest, etc.

These areas where detrimental soil conditions have exceeded the previously discussed thresholds are vulnerable to a loss of soil productivity. This past activity, combined with the proposed actions included in the Crawfish Restoration Project (decision recently signed, timber sale awarded, and road construction started), could lead to cumulative impacts on soil productivity due to a reduction of soil organic matter, and an increased amount of compaction and soil disturbance. However, the Crawfish Restoration Project (CR Timber Sale) requires mostly over snow logging, except in the Chewiliken Creek drainage. Soil best management practices will be used on the summer harvest units including using existing roads and skid trails. Additional detrimental disturbance from these activities should create minimal additional impacts. There should be no adverse cumulative effects from that proposed action and thus no cumulative effects with the proposed actions for BART.

**Fire**
The Bailey Fire in 2001 was the only fire in recent history, less than 15 years that exceeded 10 acres in size. The majority of this fire burned at low and moderate severities, and it is likely that much of the soil surface that might have been affected by the fire has improved in condition in the last 13 years. The proposed actions for the BART allotments would not create cumulative effects with the diminished fire effects to soils.

**Actions Associated with Roads**
All developed roads have a lasting effect on soil productivity and are considered part of the existing detrimental soil conditions. The recent Bailey Restoration Project, which overlapped with many areas of the BART allotments, proposed to decommission, as funds are available, up to 3.86 miles of road leaving about 131 miles of road in closed status and about 142 miles of road remaining in an open condition within that analysis area. The Crawfish Restoration Project proposed to decommission up to 18.9 miles of road, as funding is available, leaving about ~250 miles of road remaining in that analysis area. The Upper Aeneas Project also proposed road closures which were partially implemented. The decommissioning of roads will decrease soil compaction associated with the road prism. It should also impede cattle movement on the old roads and once they have vegetation established, improve soil productivity.

**Recreation**
Soil disturbance from general motorized use and recreational access has been occurring within the analysis area and would continue in some form indefinitely. This creates ruts and compaction issues, and trails also become vectors for water and sediment delivery to streams. Off-road vehicle use is known to occur within the analysis area and it can sometimes cause substantial detrimental soil disturbance. Activity is sometimes increased due to the increase in sight distance that may occur when vegetative thinning occurs. Illegal off-road use can combine with grazing impacts to increase detrimental soil disturbance and show a downward trend for soil indicators.

**Access and Travel Management**
The Plan would likely change the motorized recreation use in the analysis area, but at this time it is too soon to tell what type of effect that might have on the soil resource. No cumulative effects on soils from the proposed action and recreational uses are expected.

**Summary of Cumulative Effects**
The sum of cumulative effects from vegetation management, roads, illegal off road recreation, illegal firewood harvest, and grazing are estimated to be above the 20% (DSD) threshold. Winter harvest was proposed for most of CR Timber Sale, accept in the Chewiliken Creek drainage because of this threshold being exceeded. The proposed actions may move soil resources towards attaining this goal over time if successful implementation of monitoring trigger points is followed.

**Alternative 3**

Potential cumulative effects for Alternative 3 would be the same as Alternative 2 except for areas left ungrazed, rested, after the installation of the proposed fences. Those areas would begin to improve in terms of increased effective ground cover, reduced soil compaction from trampling action, and improved overall soil resource conditions resulting in less erosion and sediment delivery from livestock.

**Summary of Cumulative Effects for Alternative 3**
The sum of cumulative effects from vegetation management, roads, illegal off road recreation, illegal firewood harvest, and grazing are estimated to be above the 20% detrimental soil disturbance threshold. Winter harvest was proposed for most of CR Timber Sale (Crawfish Restoration Project) because of this threshold being exceeded. The proposed actions may move soil resources towards attaining this goal over time if successful implementation of monitoring trigger points is followed.

**Forest Plan Consistency or Non-consistency**

**Alternative 1**
The no-grazing alternative is consistent with the Okanogan National Forest, Forest Plan and FSM 2550 and the regulatory statues listed in the beginning of this document. Under this alternative, no adverse impacts to soil resources attributable to livestock grazing would occur within the analysis area once cattle are removed in about two years. The percentage of effective ground cover, soil erosion rates, soil compaction, and the number of isolated areas with impacts from grazing will improve over time. Recovery of existing detrimental soil conditions due to past and current grazing management would occur through natural means (e.g. freeze/thaw cycles, root penetration into compacted soils, etc.)

**Alternatives 2 and 3**
Alternatives 2 and 3 are consistent with the Okanogan National Forest, Forest Plan and FSM 2550 and the regulatory statutes listed in the beginning of this document. If successful implementation of trigger point monitoring is achieved and successful administration of range management occurs, soil conditions should improve over time. Rested pastures will see soil indicators improve and if protocols are followed as to when to re-graze rested units are met, conditions will move towards the 20% threshold over time.

**Irreversible and Irretrievable Commitments**

No irreversible commitments of soil productivity would be created as a result of either action alternative associated with this project because soil indicators should improve incrementally over time.

## Aquatics/Fisheries

The section below summarizes existing aquatic and riparian conditions, along with the direct, indirect, and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed in the BART Grazing Management Aquatics Resources Report by District Fish Biologist, Gene Shull. Reference information is contained in the full specialist report, which is located in the analysis file for the BART Grazing Analysis project.

**Riparian Resources**

**Issue:** Livestock grazing has affected riparian and aquatic ecosystems that resulted in degraded aquatic habitat and fish habitat. Livestock can directly trample stream banks, create trailing in active floodplains, and utilize riparian vegetation in a duration and intensity that de-stabilizes stream channels. The results of these impacts can increase floodplain surface and stream channel erosion, increase direct solar input to streams, thus making aquatic habitat non-functioning in its ability to support fisheries life history traits (i.e. spawning and rearing).

**Background:** Riparian inventories have documented extensive areas of streambank and riparian vegetation impacts and identified a degrading trend at most sites such that many streams and wetlands are non-functioning (USDA Forest Service 2011c, 2012a, and 2012b). Desired conditions that are not being met include adequate riparian vegetation, supporting stable stream banks, narrow channels connected to adjacent floodplains, high quality pool habitat, adequate spawning and rearing habitat, adequate ground cover, and water table elevations for functioning mountain meadows. Poor riparian and aquatic habitat conditions in the upper watersheds are adversely affecting fish habitat and other aspects of aquatic ecosystems.

Cattle can have direct effects to fish species when entering occupied habitat. As cattle approach streams to drink or cross, there is potential they could disturb juvenile or adult fish by forcing them to move or reposition. Additionally, livestock can trample trout redds which is reasonably certain to result in partial or total mortality of embryos or juveniles concentrated in the redd.

**Indicators:**

- Riparian vegetation conditions;
- Streambank condition;
- Stream sediment;

**Scope of Analysis**

This report analyzes livestock grazing on the Bannon, Aeneas, Revis, and Tunk Allotments and its effects to aquatic resources. The analysis area for aquatic resources covers National Forest System land in the allotments plus any additional lands within each of the sixth field watersheds in which the allotments lay.

**Existing Conditions**

The proposed project is located in the West Fork Sanpoil and Bonaparte Creek-Okanogan 5th field watersheds. Aquatic habitat conditions within the analysis area are generally in poor condition. Within the analysis area, habitat concerns include unstable streambanks, lack of streamside vegetation, high bank erosion rates, high fine sediment levels, low pool frequencies, high width:depth ratios, and high channel instability. Stream temperature data is limited, but the available information indicates temperatures are meeting resource objectives and Washington State Department of Ecology water quality standards.

Past management activities, such as timber harvest within riparian areas, road construction, and livestock grazing have impacted streams by altering streamside vegetation, de-stabilizing streambanks, and increasing sediment input. Activities that continue to alter and degrade aquatic habitats are the existing forest road network and livestock grazing.

**Stream Habitat**

There are approximately 61 miles of streams within the boundaries of the BART Allotments, which includes about 26 miles of intermittent streams and about 35 miles of perennial streams. Multiple wetlands and springs exist within the analysis area as well. Two types of stream channels exist in the analysis area: meadow type streams and forested type streams.

Lost Creek and Barnell Creek flow through low gradient meadows (1% gradient), which are consistent with Rosgen Type-E channels (Rosgen 1994) under natural conditions. Properly functioning E-type channels are characterized by low width:depth ratios[7] (<10-12) and bank stability is high (≥90%). Streambanks are stabilized with dense vegetation that form densely rooted sod mats and undercut banks. Floodplain habitat is an important component of these channels and when floods occur, water overtops the banks inundating the floodplain. This allows for stream energy to dissipate and brings nutrients and water to vegetation across the floodplain.

Aeneas Creek and the rest of the streams in the analysis area have steeper gradients (2 to ≥6%) and flow through mostly conifer forested areas. Based on stream surveys and field observations, these streams fit the Rosgen B and A channel classifications. Streambanks are composed of fine grained, non-cohesive soils which rely on channel structure and vegetation for maintaining bank stability. Field observations of the few un-grazed areas indicate alders and various shrubs can be dense along streambanks and raw unstable banks are rare.

**Fish Species**

The project analysis area contains native interior redband rainbow trout (redband trout) (*Oncorhynchus mykiss gairdneri)* and non-native eastern brook trout (*Salvelinus fontinalis)*. Aeneas Creek, Lost Creek, and a few of their tributaries are the fish bearing streams in the analysis area (Table 29, Fish Distribution in Analysis Area). Redband trout are native to the analysis area, but the stocking of non-native coastal rainbow trout over the years has replaced and likely hybridized with native redband trout. The redband trout in the analysis area have not been genetically tested and it is unknown if the fish present are pure native redband trout or not. Eastern brook trout are an introduced species native to the eastern United States. Eastern brook trout compete for food and living space with the native resident, less aggressive redband trout.

There are no streams within the project area that contain fish listed on the Endangered Species Act (ESA). The closest point where ESA listed fish occur is over 9 miles below the project area and effects will not travel that distance. The combination of the great distance between ESA fish and the project area and the

[7] Average widths as measured in riffles divided by the average depths in riffles. Higher width:depth ratios are undesirable because they often indicate unstable channels, excess fine sediment, lack of channel complexity, and higher temperatures due to increased sun exposure. Generally, streams with ratios less than 10 considered healthy.

proposed design criteria for the project results in no effect to listed fish. Therefore, this project has no effect to ESA listed fish, their critical habitat, or to any Essential Fish Habitat therefore, there is no requirement to consult with the U.S. Fish and Wildlife Service or National Marine Fisheries Service related to fish impacts.

**Table 29, Fish Distribution in Analysis Area**

| Stream | Redband Trout (mi) | Brook Trout (mi) |
|---|---|---|
| Aeneas Cr | 3.3 | 0.2 |
| Tributary 1 Aeneas Cr | 0.9 | 0 |
| Tributary 2 Aeneas Cr | 1.9 | 0 |
| Tributary 3 Aeneas Cr | 0.3 | 0 |
| Barnell Cr | unknown | unknown |
| Lost Cr | 0.9 | 0.9 |
| Tributary 1 to Tributary 2 Aeneas Cr | 0.3 | 0 |

The Okanogan Forest Land Management Plan identifies all "resident trout", native and introduced, as the management indicator species (MIS) for stream habitat. Redband and brook trout are designated MIS and they are an indicator for habitat conditions. There is no data for population levels in the analysis area, but the poor habitat conditions suggest their production would be low.

**Aquatic Resource Indicators**

Improper livestock use can affect riparian-stream habitats by five primary habitat indicators: streambank stability, riparian vegetation, stream temperature, fine sediment levels, and nutrient levels (Platts 1991, Meehan 1991, Kauffman and Krueger 1984). Existing impacts from grazing on these main habitat indicators are included in the following discussions, except the nutrient level discussion, which is discussed in the Water Resources discussion.

**Streambanks**

Streambank stability is one of several indicators of stream and riparian health. The desired bank stability for streams in the BART allotment is 90%, or greater, with adequate vegetation that provides good root strength and resists both natural and altered stream erosion rates.

Fisheries and hydrology resource specialists reviewed about 15 miles of streams across the allotments, which equals about 30 percent of the total streams in the analysis area. These miles included a range of low gradient streams with easy access to steep streams with little or no access; therefore, the field review is assumed to cover a good representation of all the streams across the allotment. Most streams across the allotments have soft, fine grained streambanks making them vulnerable to trampling from livestock. Stream channels reviewed in the field ranged from low gradient channels with easy cattle access to steep channels with little or no access, allowing for a good representation of all streams across the allotment. Resource specialists estimated the degree and amount of linear bank trampling, which gave an estimate of the overall condition of streambanks for the analysis area (USDA 2011c and 2012). The degree of bank trampling is described as light, moderate, or heavy[8]. About two-thirds of the streams reviewed had

[8] 'Heavy' bank trampling is defined as reaches with streambanks that have greater than 30% bank damage from cattle. Bank damage is defined as banks with bare soil that otherwise would be vegetated, banks are eroding sediment to the stream, and the banks are unstable. 'Moderate' bank trampling is defined as banks with 11-30% bank damage. 'Light' bank trampling reaches have 10% or less bank damaged by cattle. Reaches with no signs of cattle are defined as zero bank impacts from livestock (Cowley 2002).

moderate (14%) to heavy (51%) bank trampling (Figure 3, Streambank Trampling Observations, below). Of the ~7.6 miles of heavy bank trampling, most of the reaches had 80-100% bank trampling.

In addition to the above surveys, the Tonasket Ranger District conducted Tonasket Riparian Assessment Protocol (TRAP) surveys on 50 reaches within the analysis area in 1996 (USDA 1996b). Observations were made on streambank condition, fine sediment levels, streamside vegetation conditions, and riparian vegetation conditions associated from livestock trampling and browsing. Sixty percent of the surveyed reaches had extensive bank cutting/erosion and bank failure.

In the heavily trampled and some moderately trample reaches, streambanks were highly unstable with excessive bank erosion and there were some major shifts in channel form and shape from what would be expected in these types of streams. Bank erosion is at a level where it is exceeding the channel's ability to rebuild banks and is one of the dominant stream processes now. The consequence of bank trampling is widespread channel instability, excessive fine sediment delivery, and shifts in stream channel geomorphologies.

Overall, a majority of the stream channels (~66%) are being impacted by livestock trampling resulting in moderate to high bank instability. The 1996 TRAP surveys suggest streambanks were heavily disturbed and grazing impacts fairly widespread, which are consistent with recent observations and indicate these conditions have persisted over time. An estimated 18% of the streams showed no signs of bank trampling. From the recent field reviews and TRAP surveys, it is assumed the observed proportion of heavy, moderate, and light impacts to streambanks is a good representation of the entire project area stream conditions.

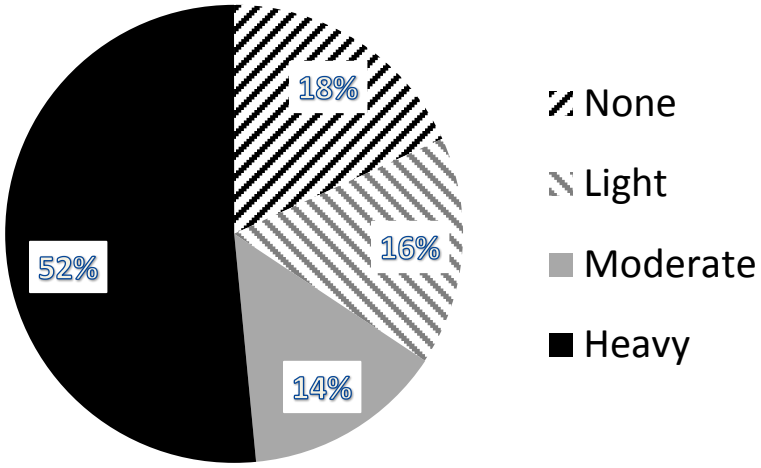


**Figure 3, Percent Streambank Trampling Observed**

**<u>Riparian vegetation</u>**

Within the BART project area, there are an estimated 2,080 acres of designated Riparian Habitat Conservation Area (RHCA) associated with streams and wetlands. Of these acres, an estimated 1,000 acres of riparian zone is present.

Livestock access primarily occurs in the riparian areas in more open conditions where the sunlight allows for shrubs and hardwoods to grow and in the meadow streams. Access to the densely forested reaches is limited and subsequent impacts to vegetation are little to none. Where livestock have access, they browse and trample vegetation. The degree of impacts range from minor browsing and trailing, where vegetation

is mostly intact, to severe browsing and trampling, where most expected vegetation is gone and the remaining species are providing little stream function.

Limited streambank vegetation data exists for the BART analysis area streams. During the field review, livestock impacts to streamside vegetation appeared consistent with the extent and degree of bank trampling observations illustrated in Figure 3, which suggests that close to 65% of the stream-type riparian areas have moderate to heavy browsing and trampling. This equates to about 650 acres of moderately to heavily disturbed riparian vegetation. The PIBO (PACFISH/INFISH Biological Opinion) surveys[9] provided some data on the percent cover of woody species along the greenline[10] on Chewiliken, Peony, Aeneas, and Barnell Creeks. This data suggests woody species are functioning at risk on Peony and Chewiliken Creeks where moderate to heavy grazing occurs. From the limited PIBO data and from the field observations, streambank and other riparian vegetation are functioning at risk or not functioning along most streams observed and this is contributing to streambank instability and stream sedimentation.

**Sediment**

The amount of fine sediment in streams is a common indicator of stream health. The sediment standard for the Okanogan Forest Plan (1989) is for spawning habitat to have less than 20 percent fines (<1mm). Studies on natural functioning streams observed percent fines (<6mm) on channel surfaces to be less than 12 percent and percent fines (<0.85 mm) within gravel (at depth) to be less than 12 percent (Cederholm and Salo 1979, Chapman 1988, Overton et al. 1995).

The Forest Service monitored stream fine sediment levels (<1mm to <6mm) over the years of 1996, 2005, 2010, and 2011. Sediment monitoring methods included Wolman Pebble Counts (Wolman 1954, USDA 2010b) and McNeil core sediment sampling (Table 30, Fine Sediment Levels in BART Analysis Area Streams for <2 mm and <6 mm). Pebble counts measure percent fines less than 6mm on the stream surface. The McNeil core sampler method (McNeil and Ahnell 1964) measures fine sediment in spawning gravels at particle sizes below 0.85 mm. The data is also contained in the project administrative record in project files at the Tonasket Ranger District

Twenty-two pebble counts were collected across the analysis area since 1996 (four of the sites were repeat surveys). Six valid McNeil core samples were taken from Lost Creek and Aeneas Creek, in known spawning habitat. Percent fines measured at all of these sites exceeded properly functioning conditions, some being greater than eight times the desired sediment condition, and the core samples taken in spawning habitat exceeded the Okanogan Forest Plan standards for sediment. In addition to the above sediment surveys, the TRAP surveys noted 25 out of 27 survey reaches having “Significant” or “Heavy” sediment deposition across the analysis area (USDA, 1996). Table 30 summarizes the stream sediment data collected for the project area

Collectively, all sediment samples and field reviews, except one site on Aeneas Creek in 2010, indicate fine sediment levels are high throughout the allotment and in many cases, exceptionally high. The high fine sediment levels suggest streams in the analysis area are unhealthy for aquatic resources and this is one of the greatest concerns for fish habitat.

[9] PIBO surveys refer to the PACFISH/INFISH Biological Opinion ( USDA 2005a) Effectiveness Monitoring sites, called Designated Monitoring Areas, within the project area. See Aquatic/Fisheries Specialist report for more details on these surveys.

[10] The greenline is a lineal line of year around vegetation along a stream’s edge. Changes in soil moisture and vegetation can happen quickly at this location and livestock and other ungulates are attracted to streamside areas, which can affect the condition of streamside vegetation, streambanks, and the streambed (Wyman et al. 2006; Clary and Kruse 2004; Platts 1991).

**Table 30, Fine Sediment Levels in BART Project Area Streams for <2mm and <6mm**

| Pebble Count Data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Stream | Fish Bearing | 1996 | | 2005 | | 2010 | | Properly Functioning Condition (<6mm) |
| | | % <2mm | % <6mm | % <2mm | % <6mm | % <2mm | % <6mm | |
| Chewiliken Cr (PIBO site) | No | -- | -- | 92.62 | 95.46 | 49.05 | 67.2 | <12% |
| Barnell Cr (PIBO site) | Yes | -- | -- | 75.65 | 100 | 91.75 | 91.75 | |
| Peony Cr (PIBO site) | No | -- | -- | 97.09 | 98.07 | 81.03 | 100 | |
| Aeneas Cr (PIBO site) | Yes | -- | -- | 42.26 | 45.14 | 17.39 | 20.16 | |
| Aeneas Cr Reach 2 | Yes | -- | 44.5 | -- | -- | -- | -- | |
| Aeneas Cr Reach 3 | Yes | 47 | 65 | -- | -- | -- | -- | |
| Aeneas Cr Reach 4 | Yes | 27 | 74 | -- | -- | -- | -- | |
| Aeneas Cr site 1 | Yes | 22.1 | 37 | | | | | |
| Aeneas Cr site 2 | Yes | 53.6 | 68.3 | | | | | |
| Aeneas Cr site 3 | Yes | 66.7 | 85.3 | | | | | |
| T2 to Aeneas Cr | Yes | 21 | 23 | -- | -- | -- | -- | |
| T3 to Aeneas Cr | Yes | 34 | 42 | -- | -- | -- | -- | |
| T4 to Aeneas Cr | Yes | 53 | 77 | -- | -- | -- | -- | |
| T5 to Aeneas Cr | Yes | 21 | 23 | -- | -- | -- | -- | |
| Lost Cr site 1 | Yes | 41 | 57 | -- | -- | -- | -- | |
| Lost Cr site 2 | Yes | 68.3 | 74 | -- | -- | -- | -- | |
| Lost Cr site 3 | Yes | 47.5 | 56.4 | -- | -- | -- | -- | |
| Lost Cr site 4 | Yes | 34.3 | 47.1 | -- | -- | -- | -- | |

| McNeil Core Sediment Data | | | | | |
|---|---|---|---|---|---|
| Stream | Fish Bearing | Survey Date | % <0.85mm | % <1mm | Okanogan Forest Plan Standard (<1mm size) |
| Lost Cr Site 1 | Yes | 2011 | 23.4 | 27.1 | <20% |
| Lost Cr Site 2 | Yes | 2011 | 15.8 | 19.6 | |
| Aeneas Cr Site 1 | Yes | 2011 | 41.5 | 47.4 | |
| Aeneas Cr Site 2 | Yes | 2011 | 30.2 | 38.6 | |
| Aeneas Cr Site 3 | Yes | 2011 | 17.8 | 21.3 | |
| Aeneas Cr Site 4 | Yes | 2011 | 36 | 38 | |

**Temperature**

Limited stream temperature data exists for the BART analysis area. Data loggers were placed in Aeneas Creek in 1999 and 2002. The available data suggests stream temperatures are properly functioning across the analysis area.

**Climate Change**

Climate changes in the western US are expected to lead towards an increase in severity of disturbances that would increase biological and physical stresses that compromise the vigor of ecosystems. At least half of the streams in the BART analysis area are estimated to be non-functioning to functioning at risk due to past and present timber harvest, road development, and livestock grazing. As climates change, the stresses of these conditions are expected to be amplified by a hotter and drier climate and the aquatic and riparian systems appear to have low tolerance to future expected changes in climate.

**Environmental Consequences**

Impacts to aquatic habitats associated with improper livestock grazing typically include reduced riparian cover, exposed streambanks, higher sediment levels, greater water temperatures, and higher nutrient levels (Kauffman and Krueger 1984; Clary and Webster, 1989; Overton et. al. 1994; Platts 1991; Platts and Nelson, 1985; Platts, 1979). When given the choice, cows often spend disproportionally more time in riparian areas versus uplands during late summer when temperatures are higher and upland forage dries out (Ames 1977; Roath & Krueger 1982; Gillen et al. 1984). This can be a challenge because riparian areas are the most biologically important habitat across the landscape and often can be easily damaged, as in the case of most streams, wetlands, and springs across the BART analysis area.

Direct effects are discussed as effects to fish in the form of trampling redds and disturbance to individual fish when livestock enter streams. Additionally, expected effects to streambanks and adjacent riparian vegetation are discussed under direct effects. Indirect effects are discussed as the subsequent effects to stream sediment levels and stream temperature.

Table 31, Environmental Consequence Summary by Alternative to the Key Aquatic Resources, below, summarizes the expected effects and their degree of change for each of the alternatives to fish species, streambanks, riparian vegetation, sediment, and temperature.

Alternative 2 would use an adaptive management strategy to improve conditions using progressively more restrictive measures to achieve desired results. Table 31 displays whether each alternative is likely to attain desired conditions or would advance aquatic indicators towards meeting desired conditions. Effects of attaining or moving towards desired conditions and not attaining improvements are displayed for Alternative 2. The expected degree of change in resource conditions for each primary habitat indicator based on the effectiveness of the stage's improvement measures is listed below the table.

**Direct and Indirect Effects**

**Alternative 1**

This alternative would have the highest and most rapid beneficial effects to the aquatic and riparian resources.

**<u>Direct Effects</u>**
The No Action Alternative would have no direct livestock caused effects to any fish species, streambanks, or riparian vegetation.

**Effects to Streambank Condition**
By eliminating grazing, bank instability across most stream reaches would increase as riparian vegetation recovers and direct trampling from livestock no longer occurs. The project area would achieve measurable improvements to streambank stability within 5 to 15 years. This would then reduce the amount of fine sediment delivery to streams across the allotment.

**Table 31, Environmental Consequences Summary by Alternative to the Key Aquatic Resources**

| Alternatives | Stage | Desired Conditions are attained or movement towards desired conditions attained (Yes/No) | Direct Effects | | | Indirect Effects | |
|---|---|---|---|---|---|---|---|
| | | | Fish | Streambank Condition | Riparian Vegetation | Sediment | Temperature |
| No Grazing | | Yes | ++ | +++ | +++ | ++ | + |
| Alt 2 | 1 | Yes | + | + | + | + | + |
| | | No | - | - | - | - | No Change |
| | 2 | Yes | + | + | + | + | + |
| | | No | - | - | - | - | No Change |
| | 3 | Yes | + | + | + | + | + |
| | | No | - | - | - | - | No Change |
| | 4 | Yes | + | + | + | + | + |
| | | No | - | - | - | - | No Change |
| | 5a | Yes | + | + | + | + | + |
| | | No | - | - | - | - | No Change |
| | 5b | Yes | ++ | +++* (+) | +++* (+) | ++* (+) | + |
| Alt 3 | All measures | | ++ | +++*(+) | +++ (+) | ++ (+) | + |

| Change in Resource Conditions | |
|---|---|
| + | Slight improvement, immeasurable change |
| ++ | Moderate improvement, change may be measurable after a few years |
| +++ | Substantial improvement, measurable after a few years |
| - | Slight degrade, continue on downward trend, immeasurable change |
| * | Refers to areas that would be excluded from livestock under Stage 5b and Alternative 3 |

**Effects to Riparian Vegetation**

Most studies tracking responses of riparian vegetation to cattle exclusion have noted rapid increases in height and vigor (Odion and others 1988, Kondolf 1993, Knapp and Matthews 1996, Kauffman and others 1997, Dobkin and others 1998), increased leaf litter accumulation, and decreases in bare substrate (Odion and others 1988, Schulz and Leininger 1990, Dobkin and others 1998). Recovery has shown to vary depending on the resource damaged. For example, streamside vegetation tends to recover the fastest (~5-15 years) when grazing is excluded. Compositional changes from forb- or nonnative grass-dominated communities towards native grass- and sedge-dominated communities have also been widely documented in montane riparian meadows following rest from cattle grazing (Leege and others 1981, Kauffman 1983, Odion and others 1988, Schulz and Leininger 1990, Green and Kauffman 1995). The reestablishment of willows along streams was observed along over-grazed streams within 10 years (Rickard and Cushing 1982). These vegetative improvements lead to increased bank stability and reduced erosion.

Excluding cattle from the project area allotments is expected to have a measurable improvement in riparian vegetation conditions. Because existing conditions are mostly functioning at risk or not properly functioning, eliminating cattle pressure on riparian vegetation would likely result in a large vegetative response. Areas where woody shrubs and hardwoods are limited from grazing, which are most areas accessed across the allotments, would rebound with young seedlings allowed to grow and mature. Over time, bank stability would increase in areas with little or no bank armoring. This would lead to decreased bank erosion and would trend towards lower fine sediment in spawning habitat and pool habitat across the allotment.

**Indirect Effects**

Many studies have shown degraded riparian habitat improves when grazing is eliminated or rested for long periods (Rickard and Cushing 1982, Clary and Webster 1989, Kondolf 1993, Knapp and Matthews 1996, Kauffman and others 1997, Dobkin and others 1998). Recovery has been shown to vary depending on the resource damaged. For example, streamside vegetation tends to recover quickly when grazing is excluded whereas physical changes to fine sediment levels, channel widths, bank angle, and channel incision can take decades or longer to recover to functioning conditions (Clary and Webster 1990, Kondolf 1993, Sarr 2002).

**Effects to Sediment**

Reductions in fine sediment levels in degraded streams, following cattle exclusion has been variable. Many studies have noted decreased bare banks, narrowed wetted channels, and greater proportions of overhanging bank when livestock are excluded, which lead to decreases in stream sedimentation (Kauffman and others 1983, Platts 1983, Knapp and Matthews 1996). Other studies have noticed little or no change to fine sediment levels after several years of monitoring (Kondolf 1993, Bunn 2011, Carolyn et al. 2011, Sarr 2002).

Eliminating grazing in the Peony Creek, Jungle Creek, Lost Creek, and the Aeneas Creek drainages would stop the grazing associated disturbance of streambanks. This would prevent most of the existing streambank erosion and would be expected to substantially reduce the amount of stream sedimentation, potentially having a measurable reduction in stream sediment levels. As an example, riparian exclusion studies have been shown to reduce stream suspended sediment loads by 40 to 80 percent (Owens et al. 1996; Line et al. 2000). Specifically, these studies observed decreased streambank erosion associated with livestock exclusion to result in less sediment delivery to the streams. Generally, once cattle are excluded from degraded riparian areas there is a transition from unstable streambanks to streams with more stable, vegetated banks. Fine sediment levels in analysis area streams and within fish bearing streams would decrease.

**Effects to Stream Temperature**

Baseline stream temperatures are considered properly functioning across the allotments. Overstory conifers, which are unaffected by livestock, provide adequate shade over most streams. There would be some increase in stream shade levels where shrubs and hardwoods could mature and provide an additional shade layer. This alternative would result in some increase in shade and a slight, immeasurable, improvement in stream temperature.

Certain stream attributes are expected to improve under Alternative 1. Streamside vegetation and bank stability would improve the most. This would result in considerably less bank erosion and less sediment delivery across the entire analysis area. Fish habitat conditions would improve and the stream carrying capacity for fish and fish production are likely to improve as well. As an example, Bayley and Li (2008) found fish densities and fish biomass to be higher in streams with no grazing versus grazing, citing better habitat conditions that could support more fish production. Although detailed fish use in Aeneas and Lost Creeks are unknown, the current degraded habitat conditions suggest fish survival and production are potentially low due to high fine sediment levels, wide channels, and lack of cover. Resting these areas is

expected to result in an increase in streamside vegetation that would lead to higher bank stability, reduced erosion, improved spawning habitat, and greater pool frequencies. Improved fish habitat conditions are expected to increase fish production.

This alternative would move the entire analysis area stream system towards meeting Forest Plan Standards, PACFISH/INFISH RMOs, and the identified Desired Future Condition (DFCs). Habitat elements like bank stability and streamside vegetation would likely make substantial progress towards meeting DFCs over the next 5-15 years. The other habitat indicators like sediment, pool frequency/quality, and width:depth ratio would improve.

**Summary of Effects to Region 6 Sensitive Species, and Management Indicator Species (MIS)**
There are no ESA listed fish species or Region 6 sensitive species in the analysis area and therefore, no effects to these species would occur. Eastern brook trout and redband trout are MIS and present in Aeneas, Lost, and Barnell Creeks, and some of their tributaries. This is similar for all alternatives.

Current riparian grazing use across the project riparian areas is heavy and impacts are mostly high. This alternative would stop this disturbance, which is expected to move the project area on an improving trend. Therefore, MIS habitat features are expected to improve under this alternative. With no grazing pressure, fish habitat would show varied levels of improvement. Streamside vegetation and bank stability are expected to improve, relatively quickly. Stream sediment levels are expected to improve with no more banks trampled from livestock. However, forest roads would continue to deliver excessive fine sediment to the stream network. Improvements to stream sediment levels will be slow and may not be measurable with existing roads. Road densities identified in the Crawfish Restoration Project area, within the BART allotment group area, were estimated at 4 miles per square mile. The roads in this area were modeled to contribute 28 tons/year, in a dry year, to 166 tons/year, in a wet year (USDA 2013). Habitat features such as pool frequencies/depths, width/depth ratios, and channel incision are unlikely to measurably change. The no action alternative would have a positive affect to MIS and the effects would be consistent with the Forest Plan and thus continued viability of the MIS is expected on the Okanogan National Forest.

**Alternative 2 (Proposed Action)**

Alternative 2 would use a combination of measures to attract livestock away from riparian areas like off-stream water sources and nutrient supplements and an adaptive management approach of progressively more riparian grazing control to improve degraded riparian areas. Grazing would continue across most of the existing allotments in the first four Stages with a few high-use riparian areas rested for multiple years. Riparian monitoring would determine progress in meeting resource standards and objectives and determine the length of time grazed pastures are used and how long the Peony pasture is rested.

The following discussion analyzes each of the five stages separately and discusses the effects of each if it is successful and if it is unsuccessful. Riparian monitoring would identify whether the stages are successful or not. When a Stage is not successful, after a few years to test it, grazing management would move to the next stage's measures. Stages 2, 3, and 4 are shown below in an example order for discussion purposes only. Their order may be modified based on project monitoring results of the associated stream reaches with the reaches most in need of reducing riparian impacts from livestock scheduled to be completed first. The order would be determined based on conditions described by the Project Fish Biologist and Project Hydrologist and be based on monitoring.

Managing the Revis with the Bannon Allotment would have no effects to aquatic resources. Both areas will be grazed under Alternative 2 as described below.

**Stage 1**

Key elements of Stage 1 are described in detail in Chapter 2 and are summarized as the following:

- Relocate or remove undesirable troughs, which include troughs near streams.
- Develop new off-stream water sources.
- Initiate other miscellaneous improvements (drift fence removal, corral removal & new construction).
- Install fence north of Jungle Creek in Aeneas Allotment. Move existing fence further south, away from creek.

**Direct Effects Stage 1**

**Effects to Fish**

Under Stage 1, cattle would continue to access fish bearing streams in both the Tunk and Aeneas Allotments. Direct effects to fish could occur in Aeneas Creek, its tributaries, Barnell Creek, and Lost Creek. There are no fish in the Bannon Allotment or the Revis Allotment.

Stage 1 would cut off or limit cattle access to some fish bearing stream reaches over what is currently accessible. There are a total of 8.1 miles of redband trout habitat in the BART Allotment area and currently 5 miles (63%) are accessible and 3 miles (37%) are inaccessible due to steep terrain and dense vegetation. Two miles (25%) of redband trout habitat would be fenced off under this alternative, leaving 3 miles total with some cattle access. In the Tunk Allotment, a one mile section of occupied fish habitat would be accessible for two to three weeks mid-summer, every other year, depending on if 50 or 75 animals are allowed to graze in the Lost/Barnell Unit. Two short fish bearing reaches in the Tunk Allotment would be grazed every year, alternating early and late season grazing every year. So, only one of these short fish bearing sections would be grazed during the spawning and egg incubation period. On the Aeneas Allotment, all of Aeneas Creek and lower Jungle Creek would be inaccessible to cattle with the proposed fencing.

Modifying the season of use for the Bailey allotment would be minor and would adhere to the two weeks timing parameter for livestock on and off dates. A likely scenario would be for an early season, reduced grazing period (June 1 to July 1) during alternating years with a mid-season reduced grazing period (July 1 to August 1) during alternate years. The elimination of late season grazing in the Bailey pasture should allow for vegetation growth along the stream banks before the end of the growing season. This vegetation growth would provide cover for the soil surface and should, at the very least, slow down the streamside erosion taking place.

Redband trout are present in Aeneas Creek and its tributaries; Barnell Creek and Lost Creek year around. Spawning occurs from February to June and eggs are in the gravel from February to August. There is the potential for cattle to trample redband trout eggs/alevins when cattle walk in creeks where spawning occurs. Brook trout generally spawn in October to November, when the cows would be off the allotment, so there is no risk of trampling of brook trout redds.

The probability of redd trampling is low due to the few areas accessible to cattle and the shortened period of access. If cows walked on redds the action would likely result in mortality of several eggs (Ballard and Krueger 2005, Belsky et al. 1999, Roberts and White 1992). The Okanogan-Wenatchee National Forest assumes livestock stepping on redds in streams may induce mortality on eggs and pre-emergent fry at least equal to that demonstrated for human wading (Roberts and White 1992). In that investigation, a single wading incident on a simulated spawning bed induced 43% mortality of pre-hatching embryos. Similar disturbance and mortality is expected if a cow walks on a redband trout redd. Due to the low

probability of redd trampling, the direct effects over a 15-year period are not likely to harm the local population of redband trout or brook trout.

If Stage 1 is successful in reducing livestock presence along fish bearing streams, the project is likely to result in some disturbance of rearing juvenile and holding adult redband trout and brook trout when cattle approach or enter streams to cross or water. Displacement of adults and juveniles within the analysis area is expected to be limited to a few minutes while cattle cross or drink water. Juvenile and adult fish are likely to be more vulnerable to predation as they relocate to alternative upstream or downstream habitat. However, fish naturally move between adjacent habitat units, so it would be reasonable to assume that livestock displacing a few fish over a short distance (~20 feet) would be similar to natural localized movements and would not be harmful. These effects over a 15-year period are not likely to measurably affect the overall population of redband trout or brook trout in the West Fork Sanpoil watershed.

If Stage 1 is unsuccessful in reducing livestock presence along fish bearing streams, the project is likely to result in greater disturbance, than if successful, of rearing juvenile and holding adult redband trout and brook trout because livestock would spend more time in and along fish streams. Displacement of adults and juveniles within the analysis area is expected to be limited to a few minutes while cattle cross or drink water because cattle generally would not loiter in streams, but at a more frequent rate than if the Stage is effective. As described above, fish naturally move between adjacent habitat units, so it would be reasonable to assume that livestock displacing a few fish over a short distance (~20 feet) would be similar to natural localized movements and would not be harmful. With increased pressure and subsequent direct effects to fish, the effects over a 15-year period are still not likely to measurably affect the local population of redband trout or brook trout across the West Fork Sanpoil watershed. In this scenario, grazing management would move to Stage 2 after four years.

**Effects to Streambank Condition**

Most streambanks across the allotment consist of fine grained soils that are highly vulnerable to grazing impacts of trampling and trailing. Existing bank trampling and trailing across the allotments is widespread and mostly heavy ($\geq$40% banks trampled). From the field surveys, bank stability is non-functioning or functioning at risk on about 65% of the streams across the allotments (USDA 2012).

In Stage 1, 17 off-stream water developments would be constructed and located throughout the project area. A riparian corral along lower Jungle Creek would be moved outside of the RHCA and this area would be fenced off as a livestock exclosure. The Peony Unit, within the Bannon Allotment, would be fully rested until riparian conditions improve to a more stable state when grazing would be allowed back. Grazing in the Lost/Barnell Unit, within the Tunk Allotment, would be rested every other year and the year grazed, the season would be two or three weeks long in the middle of the summer depending if use is by 50 or 75 animals. In addition to these changes, riparian monitoring would determine appropriate times to move livestock out of a unit using a 15% bank alteration move trigger.

The use of off-stream water sources has had mixed results in reducing cattle presence and impacts in riparian areas. Some studies observed off-stream water sources reduced the amount of time spent along and subsequent impacts to streams (Miner et al. 1992, Chamberlain and Doverspike 2001, McInnis and McIver 2001, Porath et al. 2002). However, Porath et al. (2002) found off-stream water did not reduce the amount of time cattle spent along streams during the hot part of the grazing season, which is when cattle often spend most of their time in riparian areas (Marlow and Pogacnik 1986). Porath et al. (2002) cited cooler air temperatures and more lush forage along streams as attractants that water developments do not address. The Miner et al. (1992) study occurred during the winter when air temperatures across the study area were cold and the cattle were fed hay because natural forage was not available, making this study not very applicable to summer grazing. Since these studies were conducted, more recent studies (discussed below) have shown off-stream water sources sometimes do not reduce impacts or change distribution. Agouridis et al. (2005) found off-stream water sources did not reduce streambank erosion rates when

cattle still had free access to streams. Haan et al. (2010) found that off-stream water sources did not affect the percentage of time cattle spent in streams when they had unrestricted stream access. These studies cited other factors like cooler air temperatures and that preferred forage in riparian areas would still attract livestock to grazing or loafing along streams that off-stream water sources do not provide. Therefore, some reduction in time spent along streams may occur that would lead to reduced stream bank impacts, but there is evidence these developments are not always successful during the hotter part of the grazing season where water is more readily available in perennial streams. Continued streambank and vegetation disturbance is expected to occur with the use of off-stream water developments, but to a lesser degree.

Move triggers would provide a tool to ensure the project meets the end-of-season resource standard of 20% by moving livestock out of the area or to a new pasture before the 20% is reached. For example, using 15% bank alteration move trigger of current years use would cause livestock to start moving out of the area and once completely out, a 20% bank alteration standard would be met, possibly leading to slight improvement in some areas. However, out of the approximately 15 miles of streams reviewed, over half of the streams were observed to have 40% or less bank trampling and most areas had 60% or higher bank trampling (USDA 2012). These observations suggest most streams or reaches have a high level of instability that would be difficult to reverse with continued grazing pressure. Riparian grazing studies that show recovery of degraded streams while actively grazing are limited. Clary (1999) conducted a study in Idaho that examined no grazing, light (20 – 25% utilization) and moderate grazing (35 – 50% utilization) along a wet or partially wet meadow and concluded that all three treatments resulted in improvements in stream bank morphology, as well as vegetation, following historic heavier grazing. A key element of this study was the limited grazing duration of the last two weeks in June. This study showed recovery of a degraded stream channel following a substantial reduction in grazing intensity – summer long grazing down to two weeks of grazing. Limiting bank alteration to no more than 20% on the existing raw, unstable bank conditions would result in some improvement, but it is expected to be minor and unstable bank conditions would continue.

In addition to the new water developments, some existing water troughs located in or right next to streams or springs would be relocated away from these areas to reduce riparian impacts. This would result in reductions to streambank/spring trampling and riparian vegetation browse at the existing sites. The corral next to Jungle Creek would be moved to outside the RHCA, which would eliminate a sediment and nutrient source to a fish bearing stream. The proposed new corral is outside any RHCAs and would not increase riparian impacts; rather it would eliminate bank trampling along Jungle Creek associated with the current riparian corral. Some drift fence would be installed that would not affect riparian resources. Other improvements include some drift fencing in key locations that would allow for better livestock control. Move triggers would provide a tool to move livestock out of the area or to a new pasture before the 20% bank alteration standard is met, possibly leading to slight improvement in some areas.

Areas with full exclusion include the Peony Unit and the exclosure fencing along Aeneas Creek and lower Jungle Creek. Unstable streambanks, with shallow rooted vegetation, would be allowed to grow more deep rooted shrubs and these areas would move towards a stable streambank condition. Areas with stable banks would be maintained. The Lost/Barnell Unit would be rested entirely every other year and have a reduced grazing season one year out of two. During the fully rested year, streambank vegetation would grow without grazing pressure. Willow densities and deep rooted grasses and sedges would increase in density and vigor. On the grazed year, there would be ample time before and after grazing to allow for some growth.

If Stage 1 is successful in reducing livestock presence along degraded streams, the project is likely to result in some improvement to streambank condition from reduced bank trampling and streamside trailing. Bank stabilizing vegetation would increase in heavily degraded areas with reduced use that would move conditions towards more stable streambanks, but the improvement would be small. Continuing to graze degraded streambanks, even at a reduced rate, would allow for little recovery and the

desired future conditions (DFC) would not be attained over the life of the Allotment Management Plan (AMP). Due to the slow recovery of degraded streambanks, changes to fish conditions downstream would be minor and overall poor habitat conditions would have a slight, but immeasurable improvement.

If Stage 1 is unsuccessful in reducing livestock presence along degraded streams, streambank condition would continue on a downward trend, moving further away from the DFCs. Fish habitat conditions would remain in a degraded state. In this scenario, grazing management would move to Stage 2 after four years.

**Effects to Riparian Vegetation**
Most RHCAs are considered functioning at risk due to high riparian road densities, past timber harvest, and widespread riparian grazing. Stage 1 would employ a combination of new water developments, active herding, and move triggers that are expected to reduce cattle presence in riparian areas. This would lead to some reduction in vegetation browse, but according to the literature the reductions in riparian impacts would not be substantial (Agouridis et al. 2005, Haan et al. 2010). Most at-risk riparian areas would continue to be grazed, limiting improvements to riparian vegetation density and vigor. Areas where cattle would be excluded and areas with a reduced season of use would allow for streamside vegetation to increase in density and vigor.

If Stage 1 is successful in reducing livestock presence in degraded riparian areas, the project is likely to result in some improvement to riparian vegetation conditions. Less trampling and browsing of vegetation would lead to higher plant density and vigor, but the level of improvement is expected to be small. Areas functioning at risk or not functioning would improve, but only slightly with continued grazing pressure. Overall conditions would only move slightly towards DFC. Riparian conditions are not expected to reach DFC over the life of the AMP with continued grazing.

If Stage 1 is unsuccessful in reducing livestock presence in degraded riparian areas, the majority of riparian areas would remain in a degraded stage and not improve. Conditions would continue to move away from the DFCs. In this scenario, grazing management would move to Stage 2 after four years.

**<u>Indirect Effects Stage 1</u>**

**Effects to Sediment**
Measures like new water developments, active herding, and improved pasture rotations would reduce cattle presence along streams that would lead to some reduction in bank trampling and subsequent erosion to streams. Additionally, the use of a move trigger of 15% bank alteration is designed to move livestock to the next unit before the bank alteration standard is reached. These improvements are expected to result in only slight reductions in sediment delivery because streambanks are highly unstable and very sensitive to any bank disturbance. Under the proposed alternative, up to 20% bank alteration is permissible and this level of bank alteration is not expected to result in much improvement to existing bank conditions. No scientific studies have demonstrated the proposed improvements and bank alteration standards would recover degraded stream channels like what is present on the BART allotment area. Grazing along streams would occur close to the intensity and duration of existing management and it is unlikely to result in much improvement to bank stability or bank erosion rates.

Areas with full exclusion would cease to have bank trampling and unstable streambanks would heal. Sediment delivery from these areas would move toward natural bank erosion rates, which are low in undisturbed stream reaches. Streambank stability in the Lost/Barnell unit is already high, but effectively reducing the season of use to what is in the permits would reduce grazing pressure and bank stability would improve, and the low bank erosion rates would decrease. This would result in less bank erosion associated with livestock grazing and a slight reduction in sediment delivery to fish habitat in Lost and Barnell Creeks, because existing rates of bank erosion along the creeks is already low.

If Stage 1 is successful in reducing bank trampling and bank vegetation loss along streams, bank erosion rates would decrease. The amount of fine sediment delivery to streams would decrease, resulting in some improvement to stream sediment levels. Due to the high sensitivity of the streambanks with fine sediment particles in the soils, small changes in grazing pressure are unlikely to substantially reduce bank erosion rates. Fine sediment conditions would move slightly towards the Desired Future Condition (DFC), but the changes would not move conditions out of non-functioning, especially with the amount of riparian roads that exist. Fish habitat conditions would remain in a non-functioning state.

If Stage 1 is unsuccessful in reducing bank trampling or bank vegetation loss in degraded riparian areas, fine sediment levels would remain on a downward trend. Fish habitat conditions would see no improvement in fine sediment levels and spawning and rearing would remain in a poor state. In this scenario, grazing management would move to Stage 2 after four years.

**Effects to Stream Temperature**

Baseline stream temperatures are considered properly functioning across the allotments. Mature and late seral conifers, which are unaffected by livestock, provide a majority of the shade levels for most streams.

Water developments have the potential to affect stream temperature by bringing groundwater to the surface and exposing it to solar warming and decreasing the volume of water in streams. In a water development analysis for the Methow Valley, they found the volume of water used by a single water development is estimated at 0.003 cfs. This small amount of water loss was estimated at being <0.3% of the total volume of adjacent streams in all examples analyzed, with most being <0.01%. Further, cattle only directly consume water at development locations for an average of 40 days per season such that a large proportion of the water returns to the ground for most of the year. This proportionately small volume effect to the overall hydrologic budget at each site would not result in sufficient reductions to the drainages to effect measureable changes in water temperature. Alternatively, water developments provide water sources away from streams where cattle can browse vegetation and reduce shade. The use of these would reduce the amount of shade loss, benefiting stream temperatures.

If Stage 1 is successful in reducing bank vegetation loss along streams, stream shade levels would increase slightly and stream temperatures would improve commensurately. Water temperature conditions would remain in a desired functioning state and might see a slight reduction in temperatures across the allotment.

If Stage 1 is unsuccessful in reducing bank vegetation loss in degraded riparian areas, stream temperatures would remain in a functioning condition. Existing livestock grazing is not resulting in shade reductions that measurably degrade water temperatures.

**Summary of Effects to Region 6 Sensitive Species, and Management Indicator Species (MIS)**

Stage 1 would allow for cattle access to MIS habitat in the Tunk and Aeneas Allotments where direct and indirect effects to redband trout and brook trout and their habitat would occur. Direct effects would be as described above under the Direct Effects section.

If Stage 1 is successful in reducing livestock impacts along streams, habitat conditions for MIS would improve slightly. Due to the widespread instability and overall poor conditions of analysis area streams, slight improvements to bank stability, riparian vegetation, and erosion rates would not measurably improve MIS habitat conditions. Important fish habitat elements like pools, spawning beds, undercut banks, width:depth ratios, and fine sediment levels would improve slightly, but fish habitat would remain in an at risk state. The rate of improvement is unlikely to move much towards desired fish habitat conditions over the life of the AMP and fish production would remain in a slightly improved, but limited state.

If Stage 1 is unsuccessful in reducing livestock impacts along streams, habitat conditions for MIS would continue to move away from desired habitat conditions. Fish production would remain in a degraded state with no improvements. In this scenario, grazing management would move to Stage 2 after four years.

**Stage 2**

If, after four grazing seasons following Stage 1 implementation, monitoring indicates that riparian conditions are not moving toward meeting Forest Plan Standards, DFCs, or preventing or retarding attainment of INFISH/PACFISH Riparian Management Objectives (RMOs) and the condition of the resource does not indicate improvement, then Stage 2 would be implemented. Stage 2 includes the following:

- Construct fence 2 shown on the Alternative 2 map in Appendix A, Maps, BART Analysis Area, Alternative 2 Map, Proposed Action, which would be approximately 3.9 miles in length around the north slopes of Jungle Creek and tributaries within the SE ¼ of Section 32, T. 36 N., R. 29 E. and Sections 3, 4, 5, 6, 7, & 8 of T. 35 N., R. 29 E. and would tie into existing fences.

Constructing this fence would create an additional pasture that would allow for more flexibility in pasture rotations.

**Direct Effects Stage 2**

**Effects to Fish**
Under Stage 2, cattle would continue to access fish bearing streams in both the Tunk and Aeneas Allotments. Direct effects to fish in Aeneas Creek, its tributaries, Barnell Creek and Lost Creek would be slightly less than described under Stage 1 with additional pasture along Jungle Creek.

If Stage 2 is successful in reducing livestock presence along fish bearing streams, the project would still result in some disturbance of rearing juvenile and holding adult redband trout and brook trout habitat when livestock access fish streams. The effects would be slightly less than those described under Stage 1, which are not expected to measurably impact the local population.

If Stage 2 is unsuccessful in reducing livestock presence along fish bearing streams, the project would result in a disturbance of juvenile and adult trout as described under Stage 1, which are not expected to measurably impact the local population. In this scenario, grazing management would move to Stage 3 after two to three more years.

**Effects to Streambank Condition**
Stage 2 would include all the measures in Stage 1 plus construction of a large fence around the Jungle Creek and upper Aeneas Creek drainages. Some of the heaviest streamside grazing exists within this new smaller pasture that would provide for better livestock control. This would allow grazing of this area for a shorter duration and the ability to move cows out of the Jungle Creek area once utilization or streambank alteration standards are approached. Changes in use and the subsequent effects from all the measures in Stage 1 would continue under this Stage. See Stage 1 for details.

With more pastures to rotate cattle through and more control over cattle distribution, some reductions in cattle presence along streams in the Jungle Creek and upper Aeneas Creek areas would occur. This would bring about less bank trampling, trailing, and vegetation browse. Streambank condition would improve, some, with reduced pressure. However, continuing to graze areas with unstable banks is expected to result in slight recovery. Studies have found improved pasture rotations often do not substantially reduce riparian impacts (Agouridis et al. 2005, Haan et al. 2010). Most streambanks have fine grained soils, which have shown to be sensitive to bank trampling (Myers and Swanson 1992; Clary and Webster

1989). Allowing grazing to continue to alter these streambanks to an end-of-season standard of 20% bank alteration would provide little recovery over existing conditions. Streams in areas outside of the proposed unit (Area C) would continue to have similar grazing pressure as what occurs currently. Disturbances to streambanks outside of this unit would likely be similar to existing levels or they may increase due to fewer streams available for access during parts of the grazing season.

If Stage 2 is successful in reducing livestock presence along degraded streams, the project is likely to result in some improvement to streambank condition from reduced bank trampling and streamside trailing. The degree of improvement in bank stability would be minor. Bank stability in this new pasture and areas outside of this area would improve with using move triggers, but bank stability improvement would be slow with continued grazing. This small improvement to bank stability would result in some slight improvement in fish habitat conditions downstream, but it would not be measurable to any habitat attributes.

If Stage 2 is unsuccessful in reducing livestock presence along degraded streams, streambank condition would continue on a downward trend, moving further away from the DFCs. Fish habitat conditions would remain in a degraded state that limits production. In this scenario, grazing management would move to Stage 3 after two to three more years.

**Effects to Riparian Vegetation**

Livestock grazing would continue across the allotment group similar to Stage 1, but the addition of a smaller pasture and more rotation options around Jungle Creek would shorten the duration of grazing. Reducing grazing time would reduce the amount of impacts, but this is not expected to result in a measurable improvement to riparian vegetation conditions. Areas with limited or no vegetation would remain in a highly sensitive state and any grazing would impede or prevent the establishment of more deeply rooted vegetation. Streamside vegetation in areas outside of the newly proposed pasture would continue to have similar grazing pressure as what occurs currently. Disturbances to riparian vegetation would likely be similar to existing levels or they may increase due to fewer riparian areas available for access during parts of the grazing season.

Areas where cattle would be excluded under the proposed action include the Peony Unit and lower Jungle Creek and Aeneas Creek in the Aeneas Allotment. Improvements in streamside vegetation in these exclosure areas would be measurable and would substantially improve streambank conditions. Effectively reducing the season of use in the Lost/Barnell Unit to what is in the permit, would allow for willows and sedges to increase in density and vigor.

If Stage 2 is successful in reducing livestock presence in degraded riparian areas, the project is likely to result in some improvement to riparian vegetation conditions. Less trampling and browsing of vegetation would lead to higher plant density and vigor, but the level of improvement is expected to be small and immeasurable. Some areas functioning at risk, or not functioning, would be slow to improve and overall conditions would only move slightly towards DFC over the life of the AMP with continued grazing.

If Stage 2 is unsuccessful in reducing livestock presence in degraded riparian areas, the majority of riparian areas would remain in a degraded stage and not improve. Conditions would continue to move away from the DFCs. In this scenario, grazing management would move to Stage 3 after two to three more years.

**<u>Indirect Effects Stage 2</u>**

**Effects to Sediment**

Stage 2 would achieve some reduction in streambank trampling and trailing through better rotation and cattle distribution. This would reduce the amount of bank erosion within the new Jungle Creek unit. This

would cause a slight reduction in sediment delivery to lower Jungle Creek and Aeneas Creek where redband trout reside. Due the high level of bank instability and high vulnerability with the soft soiled banks, continuing to disturb these streambanks would slow their recovery because bank alteration would occur.

If Stage 2 is successful in reducing livestock presence along degraded streams, the project is likely to result in some improvement to streambank condition thereby reducing bank erosion. However, continuing to graze areas with degraded streambanks, even at a shorter duration, would allow for little recovery in sediment delivery and the DFCs would not be attained over the life of the AMP. A small reduction in streambank erosion and sediment delivery would not measurably improve fine sediment levels in fish conditions downstream, especially with the existing road network.

If Stage 2 is unsuccessful in reducing livestock presence along degraded streams, streambank condition and subsequent sediment delivery would continue on a downward trend, moving further away from the DFCs. Fish habitat conditions would remain in a degraded state that limits production. In this scenario, grazing management would move to Stage 3 after two to three more years.

**Effects to Stream Temperature**
Stage 2 is not expected to reduce shade levels and the existing functioning stream temperatures would remain.

If Stage 2 is successful in reducing bank vegetation loss along streams, stream shade levels would increase slightly and stream temperatures may also likely improve slightly.

If Stage 2 is unsuccessful in reducing bank vegetation loss in degraded riparian areas, stream temperatures would remain in a functioning condition. Existing livestock grazing is not resulting in shade reductions that measurably degrade water temperatures.

**Summary of Effects to Region 6 Sensitive Species, and Management Indicator Species (MIS)**
Stage 2 would allow for cattle access to MIS habitat in the Tunk and Aeneas Allotments where direct and indirect effects to redband trout and brook trout and their habitat would occur. The direct effects to fish would be the same as described under the Direct Effects section under Stage 1.

If Stage 2 is successful in reducing livestock impacts along streams, habitat conditions for MIS would improve - slightly. Due to the widespread instability and poor conditions of the allotment streams, slight improvements to bank stability, riparian vegetation, and erosion rates would not measurably improve MIS habitat conditions. Important fish habitat elements like pools, spawning beds, undercut banks, width:depth ratios, and fine sediment levels would improve slightly and fish habitat would remain in an at risk state. The rate of improvement is unlikely to move much towards desired fish habitat conditions over the life of the AMP and fish production would remain in a slightly improved, but limited state.

If Stage 2 is unsuccessful in reducing livestock presence along fish bearing streams or tributaries, the project is likely to result in the same level of disturbance to fish and their habitat that exists currently. Because the project area only covers a small portion of the entire fish habitat within the West Fork (WF) Sanpoil watershed, the effects over a 15-year period are still not likely to measurably affect the local population of redband trout or brook trout across the whole watershed.

**<u>Stage 3</u>**

If, after two to three grazing seasons, monitoring indicates that the project is not moving toward meeting Forest Plan Standards, DFCs, or preventing or retarding attainment of INFISH/PACFISH Riparian

Management Objectives (RMOs) and the condition of the resource does not indicate improvement, then Stage 3 would be implemented. Stage 3 includes the following:

- Construct approximately 3.2 miles of fence from the Forest Boundary in S. 17, T. 35 N., R. 29 E., east to Forest Service Road (FSR) 30 in S. 23 in order to create an additional pasture south of the existing boundary fence between the North and South pastures, that would be grazed as determined by forage capacity and DFCs.

**Direct Effects Stage 3**

**Effects to Fish**
Under Stage 3, cattle would continue to access fish bearing streams in both the Tunk and Aeneas Allotments. Direct effects to fish in Aeneas Creek, its tributaries, Barnell Creek and Lost Creek, would be slightly less than described under Stage 2 with the additional pasture rotations. Constructing a fence on the south side of Aeneas Creek would reduce the amount of time cattle can access occupied fish habitat, thereby reducing the amount of direct effects to fish.

If Stage 3 is successful in reducing livestock presence along fish bearing streams, the project would still result in some disturbance of rearing juvenile, and holding adult redband trout and brook trout habitat when livestock access fish streams. The effects would be slightly less than those described under Stage 2, which are not expected to measurably impact the local population.

If Stage 3 is unsuccessful in reducing livestock presence along fish bearing streams, the project would result in a disturbance of juvenile and adult trout as described under Stage 2, which are not expected to measurably impact the local population. In this scenario, grazing management would move to Stage 4 after two to three more years.

**Effects to Streambank Condition**
Stage 3 would include all the measures in Stage 1 and 2 plus construction of a large fence around the south side of upper Aeneas Creek. Similar to Stage 2, this stage offers additional livestock control. Grazing this area would be of a shorter duration and once utilization standards are met, livestock would be moved out of the area. Changes in use and the subsequent effects from all the measures in Stages 1 and 2 would continue under this Stage.

This alternative provides additional pastures to rotate cows and more control over cattle distribution, some reductions in cattle presence along tributaries to Aeneas Creek would occur. This would bring about less bank trampling, trailing, and vegetation browse. Streambank condition would improve in this area with reduced grazing pressure. However, the degree of improvement is not expected to be measurable to existing streambank conditions as described under Stage 2.

If Stage 3 is successful in reducing livestock presence along degraded streams, the project is likely to result in some improvement to streambank condition from reduced bank trampling and streamside trailing. The effects would be a slight improvement over Stage 2, but with continued grazing along unstable and highly sensitive streambanks, the improvements would be immeasurable.

If Stage 3 is unsuccessful in reducing livestock presence along degraded streams, streambank condition would continue on a downward trend, moving further away from the DFCs as described under Stage 2. In this scenario, grazing management would move to Stage 4 after two to three more years.

**Effects to Riparian Vegetation**
Livestock grazing would continue across the allotments similar to Stages 1 and 2, but the addition of a smaller pasture and more rotation options around the south side of the Aeneas Creek drainage would

shorten the duration of grazing. Reducing grazing time would reduce the amount of impacts, but this is not expected to result in much of an improvement. Areas with limited or no vegetation would remain in a highly sensitive state because continued grazing pressure would impede or prevent the establishment of more deeply rooted vegetation.

Vegetation conditions in the exclusion areas along Lost and Barnell Creeks would be the same as described under Stage 2.

If Stage 3 is successful in reducing livestock presence in degraded riparian areas, vegetation conditions would show an improvement. The effects would be a slight improvement over Stage 2, but with continued grazing along at-risk riparian areas, the improvements would be immeasurable.

If Stage 3 is unsuccessful in reducing livestock presence in degraded riparian areas, the majority of riparian areas would remain in a degraded stage and not improve as described under Stage 2. In this scenario, grazing management would move to Stage 4 after two to three more years.

**Indirect Effects Stage 3**

**Effects to Sediment**
Stage 3 would achieve some reduction in streambank trampling and trailing through better rotation and cattle distribution, which would reduce the amount of bank erosion in the upper Aeneas Creek drainage. This would cause a slight reduction in sediment delivery to lower Aeneas Creek as described under Stage 2.

If Stage 3 is successful in reducing livestock presence along degraded streams, the project is likely to result in some improvement to streambank condition. The effects would be a slight improvement in stream sediment levels over Stage 2, but with continued grazing along unstable and highly sensitive streambanks, the improvements would be immeasurable.

If Stage 3 is unsuccessful in reducing livestock presence along degraded streams, streambank condition and subsequent sediment delivery would continue on a downward trend as described under Stage 2. In this scenario, grazing management would move to Stage 4 after two to three more years.

**Effects to Stream Temperature**
Stage 3 is not expected to reduce shade levels and the existing functioning stream temperatures would remain as described in Stage 2.

**Summary of Effects to Region 6 Sensitive Species, and Management Indicator Species (MIS)**
Stage 3 would allow for cattle access to MIS habitat in the Tunk and Aeneas Allotments where direct and indirect effects to redband trout and brook trout and their habitat would occur. Direct effects to fish would be the same as described under Stage 2.

If Stage 3 is successful in reducing livestock impacts along streams, habitat conditions for MIS would improve – slightly. The effects would be a slight improvement over Stage 2, but with continued grazing along unstable and highly sensitive streambanks, the improvements would be insignificant.

If Stage 3 is unsuccessful in reducing livestock presence along fish bearing streams or tributaries, the effects would be the same as described under Stage 2.

**Stage 4**

If, after a full grazing season following Stage 3 implementation, monitoring indicates that the project is not moving toward meeting Forest Plan Standards, DFCs, or preventing or retarding attainment of

PACFISH/INFISH Riparian Management Objectives (RMOs) and the condition of the resource does not indicate improvement, then Stage 4 would be implemented. Stage 4 includes the following:

- Construct approximately 2.7 miles of fence around Peony Creek within the North pasture of the Tunk Allotment (Section 28, 29, 30, 32, and 33 of T. 36 N., R. 29 E.). This would create an additional pasture within the North pasture that would be grazed as determined by forage capacity and desired conditions.
- Construct approximately 1.3 miles of fence along Patterson Creek in the Bannon Allotment (Sections 8 & 18, T. 36 N., R. 29 E.) A water gap would be installed along this fence in section 8.

**Direct Effects Stage 4**

**Effects to Fish**
Under Stage 4 cattle would continue to access fish bearing streams in both the Tunk and Aeneas Allotments. Direct effects to fish in Aeneas Creek, its tributaries, Barnell Creek, and Lost Creek would be slightly less than described under Stage 3 with the additional pasture rotations.

If Stage 4 is successful in reducing livestock presence along fish bearing streams, the project would still result in some disturbance of rearing juvenile and holding adult redband trout and brook trout habitat when livestock access fish streams. The effects would be slightly less than those described under Stage 3, which are not expected to measurably impact the local population.

If Stage 4 is unsuccessful in reducing livestock presence along fish bearing streams, the project would result in a disturbance of juvenile and adult trout as described under Stage 1, which are not expected to measurably impact the local population. In this scenario, grazing management would move to Stage 5a after two to three more years.

**Effects to Streambank Condition**
Stage 4 would include all the measures in Stage 1, 2, and 3 plus construction of a large fence around upper Peony Creek and along Patterson Creek. As with the other newly constructed units, this stage would allow for better livestock distribution and reduced grazing periods in this area as described under Stage 2.

If Stage 4 is successful in reducing livestock presence along degraded reaches in the upper Peony Creek drainage, the project is likely to result in some improvement to streambank condition from reduced bank trampling and streamside trailing. The effects would be a slight improvement in bank stability over Stage 3, but with continued grazing along unstable and highly sensitive streambanks, the improvements would be immeasurable.

If Stage 4 is unsuccessful in reducing livestock presence along degraded streams, streambank condition would continue on a downward trend, moving further away from the DFCs as described under Stage 2. In this scenario, grazing management would move to Stage 5a after two to three more years.

**Effects to Riparian Vegetation**
Livestock grazing would continue across the allotment group similar to Stage 1, but the addition of two smaller pastures and more rotation options around the upper Peony Creek drainage and Patterson Creek would reduce the duration of grazing in these areas.

If Stage 4 is successful in reducing livestock presence in degraded riparian areas, the project is likely to result in some improvement to riparian vegetation conditions. The effects would be a slight improvement over Stage 3, but with continued grazing along at-risk riparian areas, the improvements would be immeasurable.

If Stage 4 is unsuccessful in reducing livestock presence in degraded riparian areas or the level of use does not reverse the condition trend, the majority of riparian areas would remain in a degraded stage and not improve as described under Stage 2. In this scenario, grazing management would move to Stage 5a after two to three more years.

**Indirect Effects Stage 4**

**Effects to Sediment**
Stage 4 would achieve some reduction in streambank trampling and trailing through better rotation and cattle distribution in the upper Peony Creek drainage and Patterson Creek. This would reduce the amount of bank erosion within the new unit. This would cause a slight reduction in sediment delivery to lower Peony Creek and to Bonaparte Creek, where trout reside.

If Stage 4 is successful in reducing livestock presence along degraded streams, the project is likely to result in some improvement to streambank condition thereby reducing bank erosion. The effects would be a slight improvement over Stage 3, but with continued grazing along unstable stream reaches, the improvements would be unmeasurable.

If Stage 4 is unsuccessful in reducing livestock presence along degraded streams, the effects would be the same as described under Stage 2. In this scenario, grazing management would move to Stage 5a after two to three more years.

**Effects to Stream Temperature**
Stage 4 is not expected to reduce shade levels and the existing functioning stream temperatures would remain.

**Summary of Effects to Region 6 Sensitive Species, and Management Indicator Species (MIS)**
Stage 4 would allow for cattle access to MIS habitat in the Tunk and Aeneas Allotments where direct and indirect effects to redband trout and brook trout and their habitat would occur. Direct effects to fish would be the same as described under Stage 1, which was estimated to be a low probability of measurably impacting the local population.

If Stage 4 is successful in reducing livestock impacts along streams, habitat conditions for MIS would improve – slightly. The effects would a slight improvement over Stage 3, but with continued grazing along unstable and highly sensitive streambanks and riparian areas, the improvements would be insignificant.

If Stage 4 is unsuccessful in reducing livestock presence along fish bearing streams or tributaries, the effects would be the same as described under Stage 2.

**Stage 5**

If improvements and livestock management strategies described above in Stages 1 through 4 do not protect the health and function of aquatic resources in functioning condition or are not improving the riparian conditions in streams functioning at risk in the Bannon or Tunk allotments, then additional adaptive management measures would be taken to reduce livestock impacts in the Bannon and Tunk allotment(s). Proposed measures include reductions in the current grazing season, reductions in the numbers of Head Months of grazing, and/or using a rest/rotation strategy for two years for the affected allotments. If that is not successful, total livestock exclusion/resting from the 4 fenced pastures [A, B, C, D] (only those pastures that have not shown an overall improvement) would be implemented. It is

expected that the Indicators of Desired Recovery would be fully met prior to the return of grazing on the Bannon and Tunk Allotments within the four rested pastures and within the Peony Creek pasture.

Adjusting grazing season, specifically avoiding late summer grazing can reduce grazing impacts to woody shrubs and allow some growing season for browsed forage along streams. Rest rotations, where pastures are rested every other year, allow stream channels that are functioning-at-risk to grow vegetation for a season and improve bank stability without grazing pressure. If these initial measures do not result in the desired recovery, the four new large pastures would be rested for multiple years. This would result in substantial aquatic and riparian habitat recovery as described under the no action alternative.

**Direct Effects**

**Effects to Fish**
Stage 5 would reduce livestock presence along fish bearing streams through shortened season, rested pastures (every other year), or multi-year pasture rest around upper Aeneas and Jungle Creek areas. Cattle would continue to have some access to fish bearing streams under each of these scenarios, but the full pasture rest option would have the least impacts. Cattle and fish interactions would be few in number and the effects over a 15-year period are not likely to measurably affect the local population of redband trout or brook trout across the West Fork Sanpoil watershed.

**Effects to Streambank Condition**
Stage 5 would reduce grazing pressure on many areas with heavily trampled streambanks. The combination of more pastures to rotate cows, better distribution of livestock, shortened grazing season, and/or using a rest rotation strategy and ultimately resting large portions of the allotment would reduce the amount of time cattle spend along at risk stream reaches. This would bring about less bank trampling, trailing, and vegetation browse at varying degrees.

If the shortened grazing season or rest rotation portion of Stage 5 is successful in reducing livestock presence along degraded streams, the project is likely to result in some improvement to streambank conditions from reduced bank trampling and streamside trailing. However, continuing to graze areas with degraded streambanks, even at a shorter duration, are expected to only allow for minor improvements to bank stability because of the unstable nature of most streambanks. This is consistent with studies that observed only minor reductions in riparian impacts when using improved pasture rotations (Agouridis et al. 2005, Haan et al. 2010). Therefore, recovery of degraded streambanks when continuing to graze would be slow and may not show measurable improvements over the life of the AMP. It is expected that small improvements to bank conditions would not measurably reduce bank erosion and therefore would not measurably improve sediment conditions downstream.

If a shortened grazing season or rest rotation is unsuccessful, grazing management would then rest the pastures with streams not showing improvement until a date when conditions are functioning properly. Under this scenario, conditions would improve in these areas and fish habitat conditions downstream would improve as well. However, the mostly poor condition of the fish habitat in Aeneas and Lost Creek are influenced by other management activities and would have continued grazing in some drainage areas that would limit the level of improvement of fish habitat conditions.

Streams outside of the proposed fencing like Chewiliken Creek, upper Barnell Creek, tributaries to Aeneas Creek (Aeneas Allotment), and tributaries to Lost Creek would continue to be grazed. The use of move triggers and utilization standards may allow these areas to improve at a slow rate. Alternatively, the highly unstable streambank conditions and high sensitivity to hoof shear may make substantial improvement difficult. Sensitive areas may receive more livestock use with fewer streams and areas with cool, lush forage available. If this occurred, these sensitive areas may continue to degrade and overall recovery of the entire project area could be limited. In other words, the existing conditions would not

change much. Areas with streambanks functioning at risk would likely remain in a degraded condition with continued grazing for multiple years and have a slow improvement in the best case scenario.

**Effects to Riparian Vegetation**
Grazing management would either shorten the grazing season or fenced pastures would have a rest rotation in order to allow more growing season free of grazing disturbance. This would lead to some reduction in riparian vegetation use, resulting in some improvement of riparian vegetation in these areas. Reducing grazing time would reduce the amount of impacts, but with continued use, the level of improvement is expected to be minor. Areas with limited or no vegetation that are non-functioning or are at risk with a downward trend are expected to remain in a highly sensitive state. Riparian grazing studies that show recovery of degraded streambank vegetation while actively grazing are limited. Clary (1999) conducted a study that resulted in improvements to streamside vegetation, following a reduction of summer long grazing down to a two week grazing period, while using utilization standards. Limiting bank alteration to no more than 20% or using a 6-inch stubble height standard would limit livestock use along streams, thereby allowing more vegetation to grow and moving conditions on a positive trend. However, continuing to graze these areas is expected to limit recovery rate and magnitude. Poor conditions are expected to be slow to improve.

If Stage 5 is successful in reducing livestock presence along degraded streams through the first planned measures (shortened season or using a rest rotation strategy), the project would result in some improvement to riparian vegetation. However, continuing to graze areas with degraded riparian vegetation, even at a shorter duration, would slow recovery and the DFCs would not be attained over the life of the AMP.

If a shortened grazing season or rest rotation is unsuccessful, grazing management would then rest those of the large pastures, not showing adequate improvement, until a date when conditions are functioning properly. Under this scenario, conditions would improve in these areas and riparian vegetation would improve at a fast rate with no grazing pressure.

Riparian areas outside of proposed fencing like Chewiliken Creek, upper Barnell Creek, tributaries to Aeneas Creek (Aeneas Allotment), and tributaries to Lost Creek would continue to be grazed. Areas that are functioning at risk would improve slowly and overall conditions would likely remain at risk for several years until watershed conditions improve. This is because cattle are expected to put more pressure on the remaining accessible riparian areas to access water, forage, and cool temperatures (Ohmart 1996). Using move triggers would help reduce impacts and move conditions on an improving trend, but the rate of improvement would be slow and is not expected to improve substantially over the life of this AMP.

**<u>Indirect Effects Stage 5</u>**

**Effects to Sediment**
Stage 5 would achieve some reduction in streambank trampling and trailing through either a shortened grazing season or alternating pasture rest. This would cause a slight reduction in sediment delivery to lower Jungle Creek and Aeneas Creek where redband trout reside. Due the high level of bank instability and high vulnerability of soft soiled banks, continuing to disturb sensitive streambanks in the four pastures would slow their recovery and would continue bank erosion.

If a shortened grazing season or rest rotation is unsuccessful in achieving resource objectives, grazing management would then rest those of the four large pastures not showing improvement until a date when conditions are functioning properly. Under this scenario, stream bank conditions would improve in these areas and riparian vegetation would improve at a fast rate with no grazing pressure. Bank stability would improve and likely reach a fully functioning state in 5-15 years.

Streams outside of the proposed fencing like Chewiliken Creek, upper Barnell Creek, tributaries to Aeneas Creek (Aeneas Allotment), and tributaries to Lost Creek would continue to be grazed. Areas that are functioning at risk would improve slightly with more active management, but the degree of improvement is expected to be minor and immeasurable. Cattle are expected to continue to access these areas, but under a more controlled manner. Riparian grazing studies that show recovery of degraded streams while actively grazing are limited. Clary (1999) conducted a study in Idaho that examined no grazing, light grazing, 20 – 25% utilization, and moderate grazing, 35 – 50% utilization along a wet or partially wet meadow, and concluded that all three treatments resulted in improvements in streambank morphology, as well as vegetation, following historic heavier grazing. A key element of this study was the limited grazing duration of the last two weeks in June. This study showed recovery of a degraded stream channel following a substantial reduction in grazing intensity – summer long grazing down to two weeks grazing. Limiting bank alteration to no more than 20% on the existing raw, unstable bank conditions would result in some improvement, but it is expected to be minor and unstable bank conditions would continue. Due to the unstable nature of streams across the project area, recovery is expected to be minor and immeasurable in areas where grazing would continue. Alternatively, the recommended management action for situations like this is for an adequate period of full rest to initiate the recovery process (Clary and Webster 1989; Clary and Webster 1990).

**Effects to Stream Temperature**

Stage 5 would result in a slight improvement in stream shade levels that may cause some localized improvements in stream temperature, but it would be an immeasurable improvement.

**Summary of Effects to Region 6 Sensitive Species, and Management Indicator Species (MIS)**

Stage 5 would allow for cattle access to MIS habitat in the Tunk and Aeneas Allotments where direct and indirect effects to redband trout and brook trout and their habitat would occur. The effects would be similar to those described under Stage 1.

If a shortened grazing season or rest rotation is unsuccessful in achieving resource objectives, grazing management would then rest those of the four large pastures that have not shown adequate improvements (shown as A, B, C, and D in Appendix A, Maps, BART Analysis Area, Alternative 2 Map, Proposed Action) until a date when conditions are functioning properly. Under this scenario, stream bank conditions would improve in these areas and riparian vegetation would improve at a fast rate. Bank stability would improve and likely reach a fully functioning state in 5-15 years. Streams outside of the proposed fencing like Chewiliken Creek, upper Barnell Creek, tributaries to Aeneas Creek (Aeneas Allotment), and tributaries to Lost Creek would continue to be grazed. Cattle are expected to continue to use riparian areas for water and cooler air temperatures, resulting in some continued riparian impacts. Areas that are functioning at risk would result in some improvement with using move triggers, but continued disturbance would impede recovery.

Streambank stability and riparian vegetation would improve under this alternative, especially if the full rest of pastures A, B, C, and D is implemented. In fact, improvements to these indicators would be expected to be enough to be measurable if the full rest option occurs. Other important fish habitat elements like pools, spawning beds, undercut banks, width:depth ratios, and fine sediment levels would remain close to their existing conditions and fish habitat would remain in a poor state even under the full rest stage. This is due to the presence of other actions in the project area, mostly being the existing road network. The rate of improvement is unlikely to move much towards desired fish habitat conditions over the life of the AMP and fish production would remain in a slightly improved, but limited state.

## Alternative 3

Alternative 3 would provide accelerated riparian resource improvement, primarily to stream bank stability and streamside vegetation, which would move degraded habitat indicators towards Forest Plan Standards, INFISH RMOs, and DFCs in the exclusion areas. The primary management strategy is to fence off and exclude grazing from large tracts of land around streams with the heaviest bank trampling, until habitat conditions reach a stable state. Riparian monitoring would determine progress in meeting resource standards and objectives and determine the length of time pastures are rested.

Combining the management of Revis Allotment with the Bannon Allotment would have no effects to aquatic resources because there are no streams within the Revis Allotment. Both areas will be grazed under Alternative 3 as described below.

### Direct Effects

**Effects to Fish**
Under Alternative 3, the large riparian exclosures would prevent access to about 2.5 miles of fish habitat, leaving only the two lower tributaries of Aeneas Creek and Lost Creek with potential for direct effects to redband trout and brook trout. These exclosures would be completed by year four of the new AMP. Direct effects would occur when cattle access occupied fish streams. The effects would be the same as resting pastures A, B, C, and D under Stage 5b of Alternative 2, but would occur much sooner in the AMP process.

**Effects to Streambank Condition**
Under Alternative 3, much of the heavy bank trampling along streams would be excluded from livestock pressure and degraded banks would be allowed to recover. These areas include the Peony Creek drainage and most of the Aeneas Creek drainage. With no grazing pressure, bank vegetation would begin to re-establish and provide soil stability that leads to building more natural banks and substantially reducing bank erosion in the areas with the highest grazing impacts. As described under Alternative 1, several studies have demonstrated degraded streambanks improve when grazing is eliminated or rested for long periods (Rickard and Cushing 1982, Clary and Webster 1989, Kondolf 1993, Knapp and Matthews 1996, Kauffman and others 1997, Dobkin and others 1998). Streamside vegetation tends to recover the fastest (~5-15 years) when grazing is excluded, but features like channel width, bank stability, fine sediment levels, bank angle, and incision can take longer to recover or may never recover to functioning conditions (Clary and Webster 1990, Kondolf 1993, Sarr 2002). Streambank conditions and bank stability should measurably improve and move towards attaining the identified DFCs where streams are excluded from livestock pressure.

Outside of these rested areas, conditions are expected to improve with the use of move triggers and utilization standards. However, the combination of highly unstable streambank conditions, sensitive streambank soils, and continued grazing disturbance would make improvement difficult and slow. Several sensitive areas would continue to receive livestock impacts that would slow overall recovery of the entire project area.

Overall, this alternative would cause a substantial reduction in streambank impacts to almost half of the riparian areas across the allotments. The proposed exclusion areas encompass most of the heavy impact riparian use areas, so the worst functioning areas would see considerable improvement in streambank function. This action alternative would result in the fastest improvement to non-functioning or functioning at risk RHCAs across most of the project area.

**Effects to Riparian Vegetation**
Under Alternative 3, close to half of the RHCAs would be fully or partially rested (Lost/Barnell - every other year). This would allow for fast recovery of over-browsed and trampled vegetation along streams, springs, and wetlands. Riparian vegetation tends to reach a high level of recovery in ~5-15 years following livestock exclusion (Clary and Webster 1990, Kondolf 1993, Sarr 2002). This level of protection is expected to substantially improve riparian vegetation in these areas, which would move some of the heavily grazed riparian areas towards properly functioning conditions. Areas of high bank instability would improve as bank stabilizing vegetation establishes. Springs and wetland vegetation, within the exclosures and spring exclosures, would likely rebound quickly.

Grazing of riparian vegetation would continue in RHCAs outside of the rested pastures resulting in a negative effect to riparian vegetation. The use of move triggers and utilization standards would limit browsing, allowing these areas to improve at a slow rate. Highly unstable and largely early seral vegetation conditions are expected to show slow improvement with continued grazing pressure.

Overall, this alternative would cause a substantial reduction in riparian vegetation impacts to almost half of the riparian areas across the allotment area. The protected areas are within the highest riparian use areas, so the worst functioning areas would see considerable improvement in riparian function. This action alternative would result in the measurable improvement of non-functioning or functioning at risk RHCAs across the analysis area comparable to the No Action Alternative.

**Indirect Effects**

**Effects to Sediment**
Excluding grazing from the Peony Creek, Jungle Creek, and Aeneas Creek drainages, would stop most all livestock associated bank erosion occurrence and sediment sources would be substantially reduced in these areas. Riparian exclusion fencing has been shown to reduce stream suspended sediment loads by between 40 and 80% (Owens et al., 1996; Line et al., 2000). Generally, once cattle are excluded from riparian areas there is a transition from unstable banks with heightened bank erosion to streams with more stable, vegetated banks and substantially less bank erosion.

Varied levels of streamside grazing would continue in each of the allotments, but with the riparian exclosures and other BMPs, livestock induced bank erosion and stream sedimentation would be substantially reduced on about half of the most impacted streams. This would move stream sediment levels in a positive direction towards meeting Forest Plan Standards and recommended sediment levels for healthy fish streams. Fish habitat and production, as related to stream sediment levels, would improve the most under action Alternative 3 in the Aeneas Creek drainage and reductions in sediment may be measurable over time.

**Effects to Stream Temperature**
Baseline stream temperatures are considered properly functioning across the allotments. Shade levels for most streams are providing adequate shade with conifers providing the overstory canopy, which are unaffected by livestock. This alternative is not expected to reduce shade levels and the existing functioning stream temperatures would remain.

**Summary of Effects to Region 6 Sensitive Species, and Management Indicator Species (MIS)**
Alternative 3 would construct exclosures and rest most high-impacted riparian areas within the first four years of implementation. Cattle access to fish habitat and their tributaries would be restricted over existing access. Cattle would still have access to Lost Creek, Barnell Creek, and two tributaries to Aeneas Creek where direct effects to redband trout and brook trout would occur. Potential direct effects include disturbing juvenile and adult fish and redband trout spawning and egg incubation. Grazing would impact MIS habitat from direct disturbance and from disturbances to streams above occupied habitat.

Habitat conditions for MIS would improve under Alternative 3 because much of the habitat would be excluded from livestock use. The areas of fish habitat with continued access would be monitored closely to ensure resource standards are met. Therefore, direct effects to the fish and their habitat would be substantially less than at the present. Sediment levels would have some improvement, but it may or may not be measurable with other existing management actions in the project area.

In summary, Alternative 3 would rest large areas of the BART allotments that would allow recovery at the fastest rate similar to Alternative 1, the No Action Alternative. Fully resting degraded riparian areas has been shown to yield rapid recovery of streamside vegetation and bank stability. Bank erosion is expected to return to natural rates and fine sediment levels would improve. Fine sediment would remain elevated with the existing riparian roads, but habitat conditions for fish would be improved overall. In the long-term (years to decades), MIS habitat features are expected to continue to improve since grazing would cease in the most heavily impacted pastures until triggers to allow re-grazing have been met. Therefore, the effects of the action to MIS are consistent with the Forest Plan and thus continued viability of MIS is expected on the Okanogan National Forest.

**Cumulative Effects**

Potential cumulative effects were analyzed by considering the proposed activities in the context of past, present, and reasonably foreseeable actions. The aquatics analysis has a geographic boundary area of the BART allotments and areas immediately downstream in Bonaparte Creek, Aeneas Creek, and Lost Creek. The time span is approximately 100 years in the past when grazing began followed by timber harvest and road construction about 50 years ago, to 15 years in the future, the estimated time until the allotment management plan would be updated again. The cumulative effects for past actions have been described as the existing condition for this analysis area. The general effects of past actions are also summarized below.

**Past Actions**

Activities since the early 1900s have altered riparian function and resulting fish habitat, as well as hindered fish productivity downstream of the project area. Past activities affecting the riparian areas include ground based logging in much of the project area, extensive cattle grazing, extensive road construction, including valley bottom placement of roads next to stream channels, recreation activities in riparian areas, firewood cutting, and fire suppression. Current aquatic and riparian conditions, partly resulting from historical activities, includes extensive unstable streambanks, high fine sediment levels, and most streamside vegetation is fragmented and lacks the species and/or density to stabilize streambanks, protect against erosive flows, and maintain moist soils. Riparian areas, especially streambanks, streamside vegetation, and springs in some areas, have been impacted by livestock including areas adjacent to ephemeral draws, intermittent streams, and perennial streams.

Past road development in the project area artificially increased the drainage network with ditch-lines and road surfaces, created multiple points of chronic sediment delivery, permanently removed riparian habitat, increased the presence of mass soil failures, and altered the recruitment and transport of instream wood. This has led to increased stream sediment levels, higher bank erosion, and loss of riparian vegetation. These values were potentially exacerbated by multiple past wildfire events affecting the project area: Bannon Fire (1994), Sneed Fire (1999), and Bailey Mountain Fire (2001).

Historic livestock grazing has caused heavy disturbance of the project area landscape. Typical impacts from livestock include reducing or eliminating riparian vegetation, increasing stream temperature, causing streambank erosion, increasing sediment levels, and altering nutrient levels (Platts 1991; Meehan 1991). Within the BART project area, historic over grazing has led to high bank instability, high fine sediment levels, and poor riparian vegetation conditions from bank trampling, trailing, and riparian browsing.

Similar to roads, the Bannon Fire (1994), Sneed Fire (1999), and Bailey Mountain Fire (2001) exacerbated this activity.

**Present and Ongoing Actions**

The extensive road network continues to support all forms of recreation by the public, commercial forest product access and egress, private home ingress and egress, and use by the Forest Service to administer and manage the Forest. Road densities in the analysis area are approximately 4 mi/mi$^2$, with many roads located inside RHCAs and along streams. This density has been observed as causing negative effects to aquatic habitat (Lee et al. 1997), particularly adding excess fine sediment to the system. Several roads also parallel streams, eliminating potential riparian vegetation areas. This has led to increased stream sedimentation, bank trampling, and vegetation loss from improved livestock and human access to riparian areas and is considered one of the two key activities degrading aquatic habitat.

These roads facilitate activities ranging from recreation (ATV use, snowmobile use, hunting, dispersed camping), firewood gathering, creation of user-built roads, and others. Some of these have ancillary effects on riparian and aquatic resources. The extensive road network also requires regular road maintenance.

Fire suppression continues and changes the frequency and intensity of wildfires. Several wildfires have occurred in the project area over the last two decades. The Frosty HFRA and Bailey Restoration project are ongoing efforts in project area sub-watersheds. Hazardous fuels reduction also continues on lands within the Upper West Fork Sanpoil River Sub-watershed within the Colville Reservation. These activities have had varied effects to streambanks, sediment, and riparian vegetation and contribute to existing conditions.

Current grazing impacts to aquatic habitat are widespread and heavy throughout the project area. This is one of the key activities degrading aquatic habitats. Much of the existing streambanks and riparian vegetation across the project area receives moderate to heavy use that results in degraded habitat conditions. Specifically, bank stability is mostly low, fine sediment levels high, and riparian vegetation is fragmented.

Achieving Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs in the general project area relies chiefly on improvements in grazing management and reducing impacts from riparian roads.

**Reasonably Foreseeable Future Actions**

Road construction has begun on the Crawfish Restoration Project (CR Timber Sale) with timber harvest projected to begin later this summer. This project will harvest trees, burn parts of the project area, and open and put heavy vehicle use on the road network. Provided riparian and aquatic mitigations are followed, impacts to fine sediment levels and other riparian functions such as streambanks would be minor to none. Restorative road projects like road decommissioning and closure would improve the sediment baseline, but would not be expected to measurably reduce stream sediment levels with all the other riparian roads and with continued riparian grazing.

Road maintenance activities would continue. Sedimentation levels as a result of earlier poor road treatments would decrease and stabilize. The Forest Access and Travel Management Plan Implementation project would eventually be implemented, which is likely to decrease the existing level of impact associated with dispersed camping, ORV, and vehicle use in riparian areas, most significantly by creating clear guidance for road and dispersed camping use. Road crossing upgrades to provide improved hydrologic capacity and fish passage will also be conducted in the foreseeable future resulting from the Bailey Restoration project, mostly in the Aeneas Creek drainage.

Prescribed fire would continue within project area watersheds but as with current and recent fuels reduction impacts, future effects would be minimal. Similar actions are likely to take place across the south project area boundary on the Colville Reservation in areas that drain into, and include, Lost Creek, which could have some ongoing temperature and fine sediment effects.

**Alternative 1**

Considering past, present, and reasonably foreseeable future actions, with the anticipated effects of the Crawfish Restoration Project, aquatic habitat, the No Action alternative would provide the most benefit to aquatic resources. Local fish would benefit most from the no grazing action and the existing viability would be maintained. Substantial recovery to streambanks and riparian vegetation is expected to occur. Other indicators like fine sediment, pool habitat, and other indicators would improve but may not measurably improve. With the existing road network, achievement of the DFCs would not occur without a substantial reduction in road related impacts.

**Alternative 2**

Cumulative effects of Alternative 2, when combined with past, ongoing and reasonably foreseeable future activities, would result in some reduction of impacts along sensitive streams leading to some habitat improvement. However, improvements would be minor and have a slow progression with continuing to graze degraded riparian areas for most of the duration of this alternative. Up to four pastures would be rested if the previous adaptive management measures are unsuccessful, but this would occur only after 12 – 14 years of implementation.

If pastures are rested, streambank and riparian vegetation would improve rapidly without grazing pressure and degraded habitat conditions would trend towards meeting Forest Plan Standards and RMOs. These riparian indicators are expected to improve substantially in 5 to 10 years. As banks stabilize, bank erosion rates would move towards lower natural rates. Sediment delivery would subsequently decrease, which would improve sediment levels in fish habitat. Existing roads would prevent stream sediment levels from achieving RMO and DFC levels.

Outside of these areas, grazing would continue to cause impacts to fine sediment levels, streambanks, riparian vegetation, and disturbances to individual fish. Negative habitat effects should decrease in these areas somewhat with the use of off-site water sources, placement of salt, active range riding, and using utilization standards, but the high vulnerability of streambanks to grazing would not change. Degraded streams that continue to get grazing pressure are expected to show slight improvements to bank stability and riparian vegetation. Bank erosion rates should decrease, thereby reducing sediment delivery and leading to lower stream sediment levels. These improvements are not expected to show measurable improvements.

Overall, there would be some improvements to degraded aquatic/riparian systems across the analysis area. Where management can reduce riparian grazing pressure, impacts would be less and subsequently, degraded conditions should not continue on a downward trend and should improve. The structure of this adaptive alternative would result in slight recovery with active grazing if measures are successful. If the early stage measures are not successful, the four proposed pastures would be rested. The rest stage would not be implemented until 12 – 14 years after implementation of this alternative, during which grazing impacts would occur that do not meet standards. Therefore, this alternative would improve conditions but they would be slow and minor for most of the AMP duration. Overall, the project would move the analysis area in an improved trajectory, but only slightly when areas with continued grazing and other activities like riparian roads are considered. The current low resiliency to climate change is not expected to change much. The probability of future disturbances like wildfires would be reduced with the recent and foreseeable fuels reduction projects associated with the Bailey and Crawfish Restoration projects.

A measureable increase in bank stability and possibly a measurable decrease in fine sediment levels in streams in the areas rested are expected. Outside of rested areas, conditions may improve slightly, but not substantially. Physical stream features like fine sediment levels, width:depth ratios, and pool frequencies are unlikely to achieve DFC until a significant reduction in riparian roads occurs and years pass by for conifers to reach maturity, poor fine sediment levels and riparian vegetation conditions would continue. The cumulative effects are within the scope of anticipated effects to aquatic resources determined in the Okanogan National Forest Land and Resource Management Plan EIS (USDA FS, 1989:IV-93 and IV-94).

**Alternative 3**

Cumulative effects of Alternative 3 on aquatic resources, when combined with past, ongoing, and reasonably foreseeable future activities in the project area would result in some localized improvements, but overall aquatic habitat conditions would remain largely in a non-functioning or functioning at risk condition. Aquatic habitat in rested areas would improve without grazing pressure and degraded habitat conditions would trend towards meeting Forest Plan Standards and RMOs. Outside of these areas, habitat conditions should improve with the use of off-site water sources, placement of salt, active range riding, and using utilization standards, but the extent of improvement would be small.

Within the rested pastures, streambank vegetation and bank stability is expected to improve substantially in the next 5-10 years. Without the livestock pressure, degraded areas would be allowed to heal and vegetative recovery would be rapid. As banks stabilize, bank erosion rates would move towards lower natural rates. Sediment delivery would subsequently decrease, which would improve sediment levels in fish habitat. Existing roads would prevent stream sediment levels from achieving Resource Management Objectives (RMO) or Desired Future Condition (DFC) levels.

Areas outside of the rested pastures are expected to experience some improvement with the use of move triggers, utilization standards, and other measures. However, the heavy impacted areas are unlikely to have much recovery with continued riparian grazing. Raw streambanks will continue to be vulnerable to hoof sheer and allowing for up to 20% bank alteration on these areas will make any improvements slow and difficult. Young riparian vegetation, trying to establish tends to be preferred forage, will be an attractant for browsing. Bank erosion rates may improve, but improvement is expected to be slight. Stream sediment levels in these areas are not likely to measurably improve with existing roads.

Improvements that occur in Alternative 3 would occur in localized areas where livestock are excluded or their use substantially reduced. The reduction in impacts would have a positive effect on localized conditions of the analysis area, but other areas would show only slight improvement during the life of the AMP. Overall, the project would move the analysis area in an improved trajectory, but only slightly when considering areas rested, areas with continued grazing, and the existing riparian road network. The current low resiliency to climate change is not expected to change much. The probability of future disturbances like wildfires would be reduced with the recent and foreseeable fuels reduction projects associated with the Bailey and Crawfish Restoration projects.

A measureable increase in bank stability and possibly a measurable decrease in fine sediment levels in the areas rested are expected. Outside of rested areas, conditions may improve, but not substantially. The cumulative effects are within the scope of anticipated effects to aquatic resources determined in the Okanogan National Forest Land and Resource Management Plan EIS (USDA FS 1989:IV-93 and IV-94).

**Summary of Effects**

Alternative 3 does the best job of achieving resource objectives and moving habitat conditions towards meeting Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs of the action alternatives.

Resting the areas with the heaviest riparian impacts would result in achieving Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs in a shorter timeframe. For example, unstable streambanks are expected to achieve desired stability in 5-15 years. The other habitat indicators would move towards meeting RMOs at the faster rate of the two action alternatives.

Alternative 2 would result in improved habitat conditions, but recovery would be slow with continued grazing or if the stages are unsuccessful. It would take up to 12 years before the rest stage would be implemented. If conditions improve in earlier stages, it would be slower than full rest associated with Stage 5b. Habitat conditions would improve, but bank stability would take longer to improve with the highly unstable nature of most streams across the project area. Compared to the No Action Alternative, this alternative is expected to result in the slowest recovery and existing conditions would remain or only slightly improve over the life of the AMP. This alternative would be consistent with PACFISH/INFISH RMOs, but improvements to stream conditions would be slow to occur.

**Consistency with Standards and Guidelines**

**2-14**: Management activities around small intermittent headwater streams shall not deteriorate water quality in larger fish bearing streams below. Water quality may experience some short-term temperature and turbidity increases.

- Rotating livestock between pastures, range improvements, and adaptive management measures and the proposed resting of pastures described in Chapter 2 will distribute livestock use across a larger area and minimize impacts in any one stream or pasture. The Annual Operating Instructions (AOI) allows the Forest Service to monitor and make in-season and annual adjustments to grazing, if impacts are exceeding riparian/aquatic use thresholds. Continued use of upland water developments and installation of exclusion, riparian, and additional drift fencing and cattle guards would reduce impacts to sensitive stream habitat identified in the analysis area. However, only the measures which include full rest of the four new pastures would result in measurable improvements to turbidity.
    - Alternative 1 would move the entire project area towards achieving the prescribed DFCs and meeting the Okanogan Forest Plan Standards and Guidelines.
    - Alternative 2 would move portions of the project area towards achieving the prescribed DFCs in the rested pastures. Measurable improvements to indicators like streambank and riparian vegetation is not expected to occur within the life of the AMP.
    - Alternative 3 would move portions of the project area towards achieving the prescribed Forest Plan Standards and Guidelines and DFC in the rested pastures. Overall this alternative's rate of recovery would be fast in the rested pastures, but slow in the areas outside these pastures. Some measureable improvements to indicators like streambanks and riparian vegetation within the rested pastures is likely to occur within the life of the AMP.

**3-1**: Maintain or enhance biological, chemical, and physical qualities of Forest fish habitat.

- Rotating livestock between pastures, range improvements, pasture rest, and adaptive management described in Chapter 2 will distribute livestock use across a larger area and minimize impacts in any one stream or pasture. The Annual Operating Instructions (AOI) allows the Forest Service to monitor and make in-season and annual adjustments to grazing if impacts are exceeding riparian/aquatic use thresholds. Continued use of upland water developments and installation of exclusion, riparian, and additional drift fencing and cattle guards would reduce impacts to the most sensitive stream habitat identified in the analysis area. However, only the measures which

include rest of the four new pastures would result in measurable improvements to streambank stability and riparian vegetation in fish habitat. Stream sediment levels in fish habitat are not likely to measurably improve under either action alternative.

- Alternative 1 would move the entire project area towards achieving the prescribed DFCs and would meet the Okanogan Forest Plan Standards and Guidelines.
- Alternative 2 would move portions of the project area towards achieving the prescribed Forest Plan Standards and Guidelines and DFCs. This alternative's rate of recovery is expected to be slow, such that existing poor biological and physical qualities of fish habitat would last for most, if not all, of the life of this AMP (~12-15 years). This Alternative would move conditions in a positive direction, thereby enhancing these conditions and would be consistent with the Forest Plan Standards and Guidelines.
- Alternative 3 would move portions of the project area towards achieving the prescribed Forest Plan Standards and Guidelines and the DFCs. Overall, this alternative's rate of recovery would be fast in the rested pastures, but slow in the areas outside the rested pastures. Some measureable improvements to indicators like streambanks and riparian vegetation within the rested pastures is likely to occur within the life of the AMP. This Alternative would move conditions in a positive direction, thereby enhancing these conditions and would be consistent with Forest Plan Standards and Guidelines.

**3-3**: Sediment in fishery streams shall be maintained at levels low enough to support good reproductive success of fish populations as well as adequate instream food production by indigenous aquatic communities to support those populations[11].

- All fine sediment monitoring indicates fine sediment levels are high across the allotments. McNeil Core sediment sampling, which looked at the proportion of <1mm sediment particles in spawning habitat at depth showed the average percent fines exceed Forest Plan standards. With continued grazing along streams with low bank stability and high sensitivity to trampling, along with the amount of riparian roads across the analysis area, fine sediment levels are expected to show little improvement under either action alternative.
  - Alternative 1 would move the entire project area towards achieving the prescribed DFCs for fine sediment. Fine sediment conditions would improve, but are likely to remain above Forest Plan standards until substantial reductions in riparian road-stream connectivity is completed. This alternative would meet the Forest Plan direction because it would cease any sediment delivery associated with cattle grazing.
  - Alternative 2 would move portions of the project area towards achieving the prescribed Standards and Guidelines. Grazing would continue to cause bank erosion and sediment delivery to the stream system, which is estimated to be well above the Forest Plan standards. This alternative would improve sediment conditions and be consistent with this Forest Plan Standard.
  - Alternative 3 would move portions of the project area towards achieving the prescribed Standards and Guidelines. Grazing would continue to cause bank erosion and sediment delivery to the stream system, which is estimated to be well above the Forest Plan standard. This alternative would improve sediment conditions and be consistent with this Forest Plan Standard.

[11] Okanogan Forest Plan standard for fines (≤1.0mm) in spawning areas (pool tail-outs and glides) should be maintained at less than 20 percent as the area weighted average.

**11-2:** AMPs shall include a strategy for managing riparian areas for a mix of resource uses. A measurable desired future riparian condition should be satisfactory or greater. Range condition within riparian ecosystems should be in good or better condition class with a stable or upward trend. In condition classes fair or less, management shall be designed to attain an upward trend. When the current riparian condition is less than satisfactory, objectives shall include a schedule for improvement. The AMPs shall identify management actions needed to meet riparian objectives within the specified time frame. Measurable objectives shall be set for key objectives.

- Riparian conditions overall are in less than satisfactory condition. Measurable DFCs were established by the project fish biologist and hydrologist (See Desired Future Condition starting on page 4 of this document). Management actions that would move habitat conditions towards meeting DFCs were identified through the planning process. Measurable objectives for streambank alteration and grass/forb stubble height were established.
    - Alternative 1 would move the entire project area towards achieving the prescribed DFCs at the fastest rate. This alternative would meet the Forest Plan direction as it's expected to result in substantial recovery and would meet the Forest Plan Standards and Guidelines.
    - Alternative 2 would move portions of the project area towards achieving the prescribed DFCs. This alternative's rate of recovery is expected to be slow, such that desired conditions are not expected to be achieved for streambank stability and streamside vegetation for most if not all of the life of this AMP (~12-15 years). This Alternative would move conditions in a positive direction, but the rate of improvement would be slow. It would meet the Forest Plan direction.
    - Alternative 3 would move portions of the project area towards achieving the prescribed DFCs. This alternative would have a 4 year schedule for moving the worst areas towards meeting DFCS to start recovery. The un-rested areas may see some improvement, but they may not. Overall, the project area as a whole would improve and this would meet the Forest Plan direction.

**11-3:** When riparian resource damage is occurring, determination of the cause of the resource damage shall be made prior to taking action through the allotment management plan. Alleviate damage caused by grazing through proven means. Fencing may be used when other management approaches have not given satisfactory results in the same or similar resource conditions.

- The current grazing management approach is causing damage to aquatic and riparian resources. Some studies suggest some components of the proposed actions can reduce riparian impacts, but other studies suggest they are not effective. If they prove ineffective, exclosure fencing would be used in the most damaged areas.
    - Alternative 1 would move the entire project area towards achieving the prescribed DFCs at the fastest rate. This alternative would meet the Forest Plan direction as it's expected to result in substantial recovery and would meet the Forest Plan Standards and Guidelines.
    - Alternative 2 would use an adaptive management approach to making improvements. If the early measures do not work, large exclosures would be used to initiate the recovery process. This Alternative would be consistent with Forest Plan direction.
    - Alternative 3 would move portions of the project area towards achieving the prescribed DFCs. Fencing is a well proven means to initiate recovery of damaged riparian areas. This Alternative would be consistent with Forest Plan Standards and Guidelines.

PACFISH and INFISH standards for grazing management in RHCAs are similar, but not quite the same. Only INFISH is quoted below since there is only inland native fish in the project area.

**GM-1:** Modify grazing practices (e.g., accessibly of riparian areas to livestock, length of grazing season, stocking levels, timing of grazing, etc.) that retard[12] or prevent attainment of Riparian Management Objectives or are likely to adversely affect inland native fish. Suspend grazing if adjusting practices is not effective in meeting Riparian Management Objectives.

- The goal of the project is to improve degraded aquatic and riparian resources through the use of new pasture rotations, off-site water developments, drift fencing, and large scale pasture rest if need be. Due to the unstable condition of most streams and their high vulnerability to grazing, recovery will be slow and likely immeasurable where grazing is continued. Where rest occurs, degraded habitat would improve at a faster rate and move streams in these areas towards attaining Riparian Management Objectives and riparian standards.
    - Alternative 1 would move the entire project area towards achieving the prescribed DFCs at the fastest rate and at a near natural rate of recovery. This alternative would meet Forest Plan direction and PACFISH/INFISH RMOs.
    - Alternative 2 would move portions of the project area towards achieving the prescribed DFCs. However, this alternative's rate of recovery is expected to be slow, such that desired conditions are not expected to be achieved for streambank stability and streamside vegetation for most, if not all, of the life of this AMP (~12-15 years). Although improvements would be slow, conditions would trend conditions towards meeting Desired Future Conditions (DFCs) and would meet the Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs.
    - Alternative 3 would move portions of the project area towards achieving the prescribed DFCs immediately, once the fences were constructed. Once the fences are built, this Alternative would move the most degraded areas towards recovery at rate near the natural rate of recovery and this would meet the Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs.

**GM-2:** Locate new livestock handling and/or management facilities outside of RHCAs. For existing livestock handling facilities inside the Riparian Habitat Conservation Areas, assure that facilities do not prevent attainment of Riparian Management Objectives. Relocate or close facilities where these objectives cannot be met.

- The Jungle Creek corral would be moved to a location outside of the RHCA. This is the only handling facility within a RHCA, so this standard would be met for each action alternative.

**GM-3:** Limit livestock trailing, bedding, watering, salting, loafing, and other handling efforts to those areas and times that would not retard or prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

- Both action alternatives propose to move watering and other handling facilities outside of RHCAs. Livestock trailing and bedding along streams would continue in some sensitive areas. Alternative 2 would improve habitat conditions in a few of the most degraded areas and Alternative 3 would improve habitat conditions in more of the most degraded stream areas. In these areas, degraded habitat conditions would trend towards meeting PACFISH/INFISH RMOs,

[12] Under INFISH, the term 'retard' is further defined as "to slow the rate of recovery below the near natural rate of recovery if no additional human caused disturbance was placed on the system." (INFISH pg. A-3)

such as bank stability and fine sediment levels, because stream bank stability would improve with less or no grazing pressure. Outside of the rested areas, sensitive stream reaches and riparian areas would continue to be disturbed. Habitat conditions may improve slightly in the areas outside of the proposed rested areas, but they may also not improve because there will be fewer areas for livestock to water and access cooler loafing areas and less riparian forage.

- Alternative 2 and 3 would use measures to reduce trailing, bedding, watering, and loafing along sensitive riparian areas. If these measures work, riparian habitat conditions would improve. They would occur fastest under Alternative 3. With both alternatives reducing use along sensitive areas, they both would meet the Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs.

**GM-4:** Adjust wild horse and burro management to avoid impacts that prevent attainment of Riparian Management Objectives or adversely affect inland native fish (INFISH).

- Wild horse and burro management is not part of the BART grazing analysis.

Improvements to streams across the project area, and downstream on private lands, are expected that would move fish habitat conditions towards meeting RMOs, but at varying rates and levels of improvement. High road densities and continued grazing in portions of the allotments would slow the rate of recovery, but conditions would move on a positive trend. Overall, the BART project alternatives are consistent with the PACFISH and INFISH RMOs and the recovery guidance in these management documents.

## Hydrology

The section below summarizes the existing condition information, along with the direct, indirect, and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed in the BART Grazing Management Aquatics Resources Report by District Hydrologist, Molly Hanson and edited by R. Lance George, Zone Hydrologist. Reference information is contained in the full specialist report, which is held in the analysis file for the BART Grazing Analysis project. The Regulatory Framework for this analysis can be found in Appendix G, Regulatory Framework and is only summarized in this section.

### Methods for Analysis

Water resource conditions were compared with standards and guidelines from the Okanogan National Forest Land and Resource Management Plan (1989), the PACFISH/INFISH RMOs (USDA, 1995a, USDA and USDI 1995), and Desired Future Conditions (DFC) for streams in the project area developed by the BART project interdisciplinary team (ID Team). These guiding documents and the DFCs helped characterize the relative “health” or condition of the riparian areas and provided resource targets toward management that would maintain or move conditions toward attaining these DFCs.

Existing conditions were determined through field observations, information provided in other resource reports, and a review of literature. Field observations were conducted to identify potential issues for water quality, stream bank stability, floodplain function, wetlands/wet meadows, and riparian areas.

This analysis assumes that consistent management of natural resources on National Forest System lands meeting the Okanogan-Wenatchee National Forest Plan guidance will be adequate to minimize the recognized impacts of activities on water and soil resources.

One assumption made in this analysis is that monitoring protocols and trigger points (thresholds) for ending grazing are followed (through effective permit administration), thus maintaining ground cover conditions consistent with Region 6 Standards that are adequate to protect soil productivity from wind and water erosion and prevent sedimentation into the stream.

Another key assumption for the analysis is the Riparian Habitat Conservation Areas (RHCA) that are placed along intermittent and perennial streams, ponds, lakes, reservoirs, and wetlands provide a buffer zone that will trap sediment that may move during project implementation and keep sediment from entering streams and water features (USDA 1989). Research has shown the amount of surface cover to be one of the most important variables in determining surface erosion rates (Seyedbagheri, 1996). Increased ground cover reduces erosion, transport, and sedimentation into streams during rainfall by reducing concentrated overland flow. Water velocity is reduced through buffer strips (RHCAs) and roots maintain soil structure, allowing water to infiltrate into the soil. As water slows or infiltrates it releases its sediment load, reducing transport to the stream. Vegetation covers the stream, regulating temperature, and utilizes nutrients transported in the water, improving water quality (USDA, 2012). RHCA buffer widths are specified in INFISH/PACFISH, Standard Widths Defining Interim RHCAs starting on page A-5 of the INFISH document and C-8 of the PACFISH document. PACFISH and INFISH amended the Okanogan National Forest, Forest Plan and are measured from each edge of the stream where a 300 foot buffer would extend from each side of the stream for a total RHCA width of 600 feet for Category (Class) 1 streams. Each perennial stream and water body on the Forest is in one of four RHCA classes: Class I, affording the highest level of protection; Class II-III, affording a high level of protection; or Class IV, affording a moderated level of protection.

**Riparian Resources**

**Issue:** Livestock grazing has affected riparian and aquatic ecosystems by disturbing streambanks, removing streamside vegetation, and increasing bank erosion, thus adversely affecting hydrologic function, fish habitat, and other aspects of the aquatic ecosystem.

**Background:** Desired conditions that are not being met include loss of riparian vegetation, unstable stream banks, widening and downcutting of stream channels, decreasing percent ground cover, and loss of water table elevations in meadows.

**Indicators:**

- Riparian vegetation conditions (bare soil);
- Sediment (turbidity as surrogate);
- Temperature;

**Water Quality**

**Issue:** Grazing has the potential to indirectly affect beneficial uses and 303(d) listed waterbodies for the pollutants of nutrients, bacteria, and temperature.

**Background:** Since the watershed assessments were written in 1998, the existing listings remain for the Sanpoil and Okanogan watersheds far downstream of the project. And two more streams draining the watershed, downstream of the analysis area, have been listed.

**Indicators:**

- Expected trend for *E.coli* bacteria in project area streams;
- Expected trend for temperature in project area streams;

**Scope of the Analysis**

This report analyzes livestock grazing on the Bannon, Aeneas, Revis, and Tunk Allotments and its effects to water resources. The analysis area for water resources covers National Forest System lands in the allotments plus any additional lands within each of the sixth field watersheds in which the allotments lay.

**Existing Condition**

**Watershed Analysis**
Both the Bonaparte and Sanpoil watersheds have completed watershed analyses (USDA 1998a and 1998b). The watershed analyses were reviewed to determine if water quality issues were identified and if livestock grazing was identified as causing aquatic/riparian resource issues. In both watershed analyses it was found that:

- livestock grazing was identified as an issue resulting in increased bank shear and stream sedimentation, and degraded water quality on and below National Forest System lands.
    - water quality was identified as a limiting beneficial use on lower Bonaparte Creek downstream of the analysis area.
    - grazing along Peony Creek and its tributaries were specifically identified as issue areas that degrade water quality and contribute excess sediment to fish habitat downstream.
    - grazing areas along Aeneas and lower Jungle Creek were identified as issues to stream processes.
- High road densities and a large number of stream crossings were documented as sources for accelerated sediment production in the analysis area streams and were sediment deposition areas that will continue to store trapped sediment.
- Objectives are needed to return Aeneas and Peony Creeks riparian areas to a proper functioning condition and to increase water quality through increased functioning of the riparian zone.
- There were existing needs to modify grazing practices to reduce riparian and aquatic impacts.

**Water Rights Review for the Proposed Action**
A review of the Washington Department of Ecology, Water Rights database confirmed that the Forest Service does have valid existing water rights within the BART Allotments for livestock use and for the proposed spring developments (ftp://www.ecy.wa.gov/wr/GWIS_Data/). The Range staff will administer the water rights for the proposed developments.

**Municipal Watersheds**
There are no municipal watersheds within the allotment on the Okanogan-Wenatchee National Forest or in the watersheds that drain the allotments to Bonaparte Creek or the West Fork Sanpoil Rivers.

**Source Water Protection Zones**
There are no designated source water protection zones in the analysis area and there are no proposed actions that would impact water availability, water quality, or water quantity of groundwater resources below the Forest boundary.

**Existing Inventories, Monitoring, and Research Literature Review**
Topographic maps, GIS data, and field review were used to identify water features. The Project Hydrologist spent ten field days reviewing watershed conditions and cattle use in the analysis area between August and October 2012. These reviews inventoried the riparian and water resources present

within the analysis area and documented stream bank stability, and ground cover conditions within the stream corridors and wetland RHCAs within the Allotments.

Review of stream bank and wetland conditions within the BART Allotments is crucial for identifying grazing impacts. There are multiple field indicators that provide evidence of direct, indirect, and cumulative impacts that livestock have to water resources.

**Watershed Conditions**

**Precipitation Patterns**
Precipitation patterns are described on page 77 of the EIS and are only summarized here. The analysis area is in a continental-maritime climate regime, which is a transitional climate influenced by both maritime and continental weather patterns. Most precipitation occurs from winter snowfall and summer thunderstorm activities. The analysis area commonly has a seasonal snow cover, which can be transient during warmer years and/or lower elevations, and is classified as semi-arid at the lower elevations to sub-humid in the higher elevations (Montgomery Water Group et al. 1995). Annual average precipitation ranges from 15-19" (USDAGIS 2011). Approximately 18% (lower elevations) to 47% (higher elevations) of annual precipitation falls as snow (WRCC 2011). Within the proposed action boundary, 53% of the analysis area is identified as a Rain-on-Snow (ROS) regime, while the other 45% is snow-dominated. Estimated (NOAA Atlas 2, Volume IX, 1973) storm totals in the analysis area range from 0.35-0.49 inches for a two-year/one hour storm, and 0.94 inches for a 100-yr/one hour storm.

**Watershed Characteristics**
The BART proposed action analysis boundary is located within two 5$^{th}$ field watersheds; Bonaparte Creek/Okanogan River (HUC 1702000602), and West Fork Sanpoil River (HUC 1702000402). Within these watersheds, a hydrologic analysis area was defined (with nine smaller (6$^{th}$ field) sub-watersheds; Cape Labelle Creek, Aeneas Creek, Upper West Fork Sanpoil River, Upper Lost Creek, Peony Creek Lower Bonaparte Creek, Chewiliken Creek, Upper Tunk Creek, and Tamarack Spring . Unless otherwise mentioned, within the hydrology report, "analysis area" means the hydrologic analysis area of the nine 6$^{th}$ field watersheds. Table 32, Analysis Area Watersheds and Management Areas, below, describes the proportion of various watersheds, sub-watersheds, and PACFISH/INFISH management areas within the analysis area.

Most of the northwestern portion of the analysis area in the Bonaparte Watershed drains into the Okanogan River via the Chewiliken Creek, Tunk Creek, and Peony Creek sub-watersheds. Streams on the eastern and southern sides of the analysis area drain into the West Fork Sanpoil Watershed, which ultimately drains to the Columbia River above Grand Coulee Dam.

**Runoff Patterns**
Annual stream flow in the analysis area, and the landscape surrounding the analysis area is typically dominated by snowmelt which serves to feed the shallow groundwater that supplies summer flow. Shallow groundwater sources include wet meadows, riparian areas, and sub-channel aquifers of streams. These shallow groundwater systems serve as water reservoirs that add flow and temperature moderation (i.e. cool in summer, warm in winter) to stream channels. During drier summer months, evapotranspiration demands typically match or exceed precipitation with little to no surplus for groundwater recharge. As a result, snowmelt infiltration is a very important process for shallow and deep groundwater recharge.

**Table 32, Analysis Area Watersheds and Management Areas***

| Hydrologic Unit Code (HUC) and HUC Code | Mgmt. Strategy | Project Area Acres | Percent of HUC 12 |
|---|---|---|---|
| Sanpoil River Sub-basin (HUC8) 17020004 | INFISH | | |
| West Fork Sanpoil River Watershed (HUC10) 1702000402 | | | |
| Cape Labelle Creek (HUC12) 17020040201 | | 1,929 | 6.4% |
| Aeneas Creek (HUC12) 17020040202 | | 14,334 | 85.1% |
| Upper West Fork Sanpoil River (HUC12) 17020040203 | | 502 | 1.4% |
| Upper Lost Creek (HUC12) 17020040204 | | 5,834 | 16.8% |
| Okanogan River Sub-basin (HUC8) 17020006 | PACFISH | | |
| Okanogan River - Bonaparte Creek Watershed (HUC10) 1702000602 | | | |
| Peony Creek (HUC12) 170200060204 | | 9,414 | 46.8% |
| Lower Bonaparte Creek (HUC12) 170200060205 | | 1,021 | 3.1% |
| Chewiliken Creek (HUC12) 170200060207 | | ,1472 | 8.7% |
| Upper Tunk Creek (HUC12) 170200060208 | | 1,154 | 4.6% |
| Tamarack Spring (HUC12) 170200060209 | | 637 | 6.3% |
| Total Project Area | | 36,297 | N/A |

*Acres are approximate.

Soil compaction reduces surface permeability which increases the rate that water is routed out of the watershed during snowmelt and precipitation events which reduces shallow aquifer recharge. Soil compaction also damages the subsurface reservoir holding capacity. Although it is likely that impacts to wetland and riparian areas from grazing have altered wetland and riparian areas and reduced their ability to supplement flows and moderate temperatures, the natural variability of these systems makes the amount of alteration difficult to quantify.

**Landtype Associations**

There are three landform types found within the analysis area. *Geomorphic expression or landform* is an excellent surrogate for understanding geomorphic processes because it is the topographic expression of the sum of geomorphic processes as they are influenced by climate, time, geology, and other landscape factors. Although historic processes may or may not be present today because of climate change or other factors, landform genesis have shaped the topography, soil regolith, and stream patterns that continue to influence present day processes. (See the Soils Section, page 139, and Appendix E, Soils)

**Soil Physical Properties**
See Appendix E, Soils, and the Soils Specialist report in the analysis file for specific soil properties that have bearing on the proposed actions.

Upland soils were observed during the field trips to the allotment and indicators of soil movement were looked for to determine if accelerated erosion was occurring. Several indicators of soil movement on range watersheds are listed in Anderson (1974) and include rills, gullies, trampling displacement, soil remnants, erosion pavement, lichen lines, wind-scoured depressions, aeolian deposits, and alluvial deposits. Most of the upland soils have very good ground cover and almost no accelerated erosion was seen as indicated by the lack of the indicators of accelerated erosion on most of the allotment. Many areas of the allotment were not used, particularly under the conifer stands where down timber makes it difficult for livestock to walk through.

**Riparian Resources**
Surveys determined that many stream and riparian habitats were in a degraded condition that included compaction, stream bank instability, low amounts of shade, poor width to depth ratio, and high sediment rates, especially in Peony Creek, Aeneas Creek, Lost Creek, Barnell Creek, Cole Creek, Patterson Creek, and Jungle Creek.

Livestock directly impact stream, riparian, and wetland resources in a number of ways that may occur when cattle over-graze or impact riparian areas: (1) Woody and hydric herbaceous vegetation along a stream can be reduced or eliminated; (2) streambanks can collapse due to livestock trampling; (3) without vegetation to slow water velocities, hold the soil, and retain moisture, erosion of streambanks can result; (4) the stream can become wider and shallower, and in some cases downcut; (5) the water table can drop; and (6) hydric, deeply rooted herbaceous vegetation can die out and be replaced by upland species with shallower roots and less ability to bind the soil. These effects can lead to instability in water volume, increased summer water temperature, loss of pools and habitat adjacent and connected to streambanks, and increased substrate & fine sediment within waterways (NOAA 2004). Indirect impacts to stream and wetland resources from livestock grazing may result from decreased groundcover, increased upland erosion, and increased sediment delivery to streams and wetlands.

Livestock grazing is directly impacting stream, riparian, and wetland resources in a number of ways within the accessible riparian areas within the allotments. Livestock trample stream banks, create trails and crossings at water sources, and stock utilization of plants reduces groundcover in riparian corridors; trampling of the ground surface by livestock hooves is causing displacement of soil and groundcover along the saturated soils along Peony, Patterson, Cole, Aeneas, Jungle, Chewiliken, and Barnell Creeks. Livestock grazing may indirectly impact stream, riparian, and wetland resources through trampling and shearing by hooves, crushing of vegetation, and compacting soils, thus reducing vegetative cover and soil productivity. Reduction in ground cover in the stream corridor causes an increase in bare soil and increased erosion potential, which reduces stream bank stability; and increases in bare soil areas on stream banks, trails, and at stream crossings increasing the potential for sedimentation into streams. Livestock grazing may have impacts that extend outside the immediate stock use area which may affect the condition of the larger watershed through: sedimentation into streams affect water quality downstream, impacts to groundcover may increase riparian and upland erosion within the watershed (if all upper watersheds are grazed, then the cumulative effect of grazing is spread to a larger area). Table 33, Analysis Area Streambank Conditions, below, presents the percent bank alteration of surveyed stream channels with impacts from cattle grazing presently.

**Table 33, Analysis Area Streambank Conditions**

| Allotment | 6th Field Watershed | Stream | Survey Miles | Perennial (miles) | Miles stream bank alteration | % Bank alteration of surveyed streams |
|---|---|---|---|---|---|---|
| Bannon/ Revis | Peony Creek | Peony | 1.5 | 1.5 | 0.8 | 53% |
| | | Patterson Creek | 1.7 | 0.1 | 0.6 | 35% |
| | | Cole Creek | 1.3 | 0 | 0.85 | 65% |
| Tunk | Aeneas Creek | Aeneas | 0.5 | 0.35 | 0.35 | 70% |
| | | Jungle | 1.7 | 1.6 | 0.8 | 47% |
| | Chewiliken Creek | Chewiliken | 1.6 | 1.2 | 1.0 | 63% |
| | Upper Lost | Barnell | 2.1 | 2.1 | 1.5 | 71% |
| | Peony Creek | Peony | 2.1 | 0.7 | 0.2 | 28% |
| Aeneas | Aeneas Creek | Aeneas | 1.8 | 0.8 | 0.5 | 27% |

Cowley (2002) suggests bank alteration (trampling) up to 30% can be naturally repaired each year, but more than that cannot. Instability arises when bank alteration exceeds 30%, which is the case for surveyed portions of Peony, Patterson, Cole, Aeneas, Jungle, Chewiliken, and Barnell Creeks. Most of the impacts were from cattle trampling and compacting saturated soils in stringer meadows where grazing impacts may be reducing the streambanks and wetlands ability to hold water. The deep hoof prints into the wetted soils increase the amount of bare soil area in the floodplain and streambank area exposed to surface runoff and raindrop impacts, thus increasing the potential for erosion and sedimentation to the stream. When cattle congregate in the riparian area, fecal wastes can increase bacterial concentrations in water through livestock defecation in a stream or riparian area. Water quality can be indirectly affected by the resulting increased soil runoff and erosion, and sediment delivery to adjacent riparian areas and streams (Holechek et al. 2001). Impacts are often greater in riparian zones because they are preferred because of the availability of shade, water, and more succulent vegetation (Platts 1991). Over longer time periods, grazing can result in increased fine sediment loads from stream bank erosion, loss of riparian habitats by stream channel widening, or degradation and lowering of water tables through channel degradation. Loss of riparian vegetation can cause increased stream temperatures due to loss of overhanging vegetation resulting in reduced shade.

There are significant increases in bare ground on the streambanks at trails and crossings due to concentrated dry-season grazing. Concentrated use of the riparian areas and spring sources cause cattle to congregate near stream channels during the dry season which has decreased ground cover that protects the soil surface from erosion. Even though the streams are dry during the summer, the cattle are still attracted to the dry streams because of the present stringer meadows along the streams that have pools of water available during the dry season (George et al. 2004). These bare ground areas within the streambanks are sources of sediment. Sediment is addressed in terms of risk of occurrence in terms of bare soil area created by cattle disturbance. Alternatives that allow higher levels of streambank disturbance from grazing activities would produce more sediment. Mitigation measures center on reducing risk and the expected reduction in sediment delivery. The stream banks are most altered at cattle crossings (bare of vegetation, changed channel geometry, width:depth ratio). Table 34, Cattle Crossings per Watershed (Surveyed Areas), below, shows the number of crossings observed per stream (within the surveyed area). Patterson Creek has the most crossings and Lost Creek had the fewest. Patterson Creek had limited water and cattle seemed to trail up and down the drainage and cross back and forth to the wet spots to water. As the spots dried up later in the season, the use intensified at the spring source, which was documented as a single crossing, yet it is ~0.02 acres.

**Table 34, Cattle Crossings per Watershed (Surveyed Areas)**

| Stream Name | Number of Crossings | Total Miles | Surveyed Miles | Percent Surveyed |
|---|---|---|---|---|
| Aeneas Creek | 4 | 17.1 | 2.3 | 13% |
| Barnell Creek | 5 | 5.2 | 2.1 | 40% |
| Chewiliken Creek | 4 | 3.7 | 1.6 | 43% |
| Cole Creek | 4 | 1.7 | 1.3 | 76% |
| Jungle Creek | 6 | 5.1 | 1.7 | 33% |
| Upper Lost Creek | 0 | 2.6 | 1.0 | 38% |
| Patterson Creek | 23 | 2.2 | 1.7 | 77% |
| Peony Creek | 2 | 5.2 | 3.6 | 69% |

The crossings, trails, and bedding areas that create bare soil within the immediate stream area are cattle related sources of erosion and sedimentation. There were 48 crossings documented in the 2012 field survey, which reviewed about 36% of the streams in the allotment areas. These cattle crossings and the associated bare soil and altered streambanks are the source of grazing related sediment and increase the amount of sediment in the system produced by road crossings. Also, the more times the cattle cross the stream, the more likely to increase fecal coliform counts from disturbance of bottom sediments and cow manure in streams. The number of crossings and the amount of bare soil area within the stream bottom is directly related to impacts to water quality. Reduce the sediment sources and the impacts to water quality will also be reduced.

Range practices may directly affect water quality by increasing stream sedimentation. Sediment data collected by the Project Fish Biologist indicate that grazing in the riparian area is degrading water quality in terms of sediment impact to aquatics. Evaluation of riparian vegetation suggests that more shade should be present along the streams in the grazing allotments to maintain adequate shade for fish habitat and also for moderating stream temperatures.

**Fecal Coliform (E. coli)**

Fecal coliform levels in surface water may also increase. However, water monitoring of selected areas of grazing have not shown a significant problem (Bennett, 1982). Past water monitoring projects on the Okanogan National Forest Plan suggests fecal coliform levels increase to levels near the Washington State standards but quickly fall to background levels within one to two miles below livestock concentrations. The stream environment is harsh for coliform organisms because temperatures are cool in reaches where adequate shade is provided by riparian vegetation and forest canopy. Other harmful organisms may or may not survive farther downstream. Where riparian shade is not provided, warmer water temperatures may persist in the heat of summer and may support coliform communities. It is likely there are localized areas where Washington standards are exceeded in the project area, but the effects most likely are temporally and spatially short-lived.

**Riparian Vegetation Conditions**

During field review in late summer 2012, ~30% of the streams within the allotments were surveyed by the Project Hydrologist for indicators of bank trampling within the Patterson, Cole, Peony, Aeneas, Tunk, Jungle, Lost, and Barnell drainages within the allotments. There was a distinct pattern of concentrated use along all of the streams where water was present and access was easy. In these areas bank alteration was extensive and in exceedence of the 20% bank alteration standard. Sediment was entering the stream not only at normal cattle crossings but along large stretches of the stream in high use areas and from trails along the stream. Most of the areas had perennially wet soils that were saturated and had standing water at the time of field review (September and October 2012). The ash-capped soils are highly sensitive to disturbance from hoof action, shear, and trampling, especially in the wetted areas that extend across the floodplains of the inner gorges. Where cattle can access these wet areas, due to a lack of topographical or

vegetative barrier, cattle traffic through the area has destabilized the vegetative mat on top of the ash-capped soils and the vegetation's roots have been exposed, trees have toppled and stream bank material has been lost and destabilized. This has led to the stream width increasing to the extent of the floodplain in some places. The soils are then exposed to erosion during spring runoff. The amount of bare soil that is created by cattle trailing, watering, grazing, and crossing within the riparian areas (RHCAs) was quantified during field review to document streambank disturbance directly related to cattle use in 2012.

The Project Hydrologist surveyed 15.65 miles of stream, 8.35 miles had water present (53% of stream miles), and 6.6 miles of streambank were mechanically altered with bare soil exposed from cattle disturbance. These 6.6 miles equal ~42% of the surveyed streambank area, which had been measurably impacted from cattle grazing and is primarily due to concentrated use at stream crossings. This observed impact can be expanded to describe the grazing related impacts at stream crossings within the entire allotment. This ~42% is well above the 20% bank alteration standard (See Hydrology Field Report in the Analysis File for site specific details).

Bank alteration and lack of vegetation was largely due to grazing in wetted soils (above >10% soil moistures) and lack of alternate water sources. The trampling and compaction of the wetted soils reduces the hydrologic function of the floodplain.

**Floodplains**

Floodplains are defined by Executive Order 11988 as "lowland and relatively flat areas adjoining inland and coastal waters". Floodplains have also been defined in various ways but for this analysis, these areas are defined as flat areas adjacent to streams that are composed of unconsolidated depositional material derived from sediments transported by the related stream, based on definitions contained in (Fairbridge 1968). Most of the main large streams in the area have floodplains or very small areas adjacent to the stream where sediment may become deposited during high flows. These floodplains are about 20 to 40 feet wide and have very low cropped vegetation in the open areas. The perennially wetted soils have been compacted and pedestaled from hoof action. Less than 1" stubble height predominates the open meadow areas where floodplains are wider and the valley is less steep. Where the valleys are steeper and narrow, many trees have fallen in the riparian area along the stream channels that makes it difficult for livestock to graze. There are no indications that livestock grazing are affecting the function of the floodplains where the access is limited, however, where access is not impeded, the floodplains/stringer meadow wetland areas are heavily impacted across the entire bottom (Hydrology Field Report 2012).

GIS indicates that approximately 1030 acres of the allotments are located within the river bottom and adjacent floodplain, and stream terraces (Riparian Reserves acres from LRMP GIS). However, field review of riparian habitat indicates that much less riparian exists (where water is present in the stream channel). The total riparian reserve acres related to the surveyed wetted length is estimated at 274 acres of riparian area. The survey of cattle related impacts to the streambanks and adjacent floodplains indicate that extensive areas of the stream bank within the floodplain has been altered, width to depth ratio is increased, banks are laid back providing more bare soil area to be exposed to erosion from the streambanks and streambank soils have been compacted from hoof action.

**Streambank Conditions**

In general, the most widespread impact livestock have in stream-type riparian areas is trampling of stream banks (Bengeyfield, 2006). Improper livestock grazing can lead to the mechanical breakdown of streambanks (Kauffmann et al. 1983, Marlow and Pogacnik 1985) and the removal of riparian vegetation (Platts 1981, Kauffman et al. 1983). These effects tend to destabilize banks, which leads to a host of problems for streams like increased bank erosion, stream sedimentation, increased channel widths, filling in pool habitat, degrading spawning habitat, and changing the shape of the channel (Meehan 1991).

There are two main stream types in the BART Allotment analysis area – meadow type and forested type streams. Lost Creek and Barnell Creek are the primary meadow type streams and Aeneas Creek, Peony Creek, Jungle Creek, Chewiliken Creek, and Patterson Creek are the primary forested type streams.

Lost Creek and Barnell Creek flow through low gradient meadows (1%), which would be Rosgen Type-E channels (Rosgen 1994) under natural conditions. These types of channels are characterized by low width/depth ratios (<10-12) and bank stability is high (≥90%). Streambanks are stabilized with dense vegetation that forms densely rooted sod mats and undercut banks. Floodplain habitat is an important component of these channels and when floods occur, water overtops the banks inundating the floodplain. This allows for stream energy to dissipate and brings nutrients and water to vegetation across the floodplain. Past and present management [grazing, timber harvest, & roads] have degraded portions of these channels by bank trampling and vegetation loss that has induced streambank erosion leading to channel widening and incision, and adjustments that have converted channel geo-morphology, including changes to the peak/base flow regime contributing to the channel down-cutting and isolation of flows from their floodplain. Heavy trampling occurs in both dry and wet areas along these streams and the shrub densities appear to be significantly reduced compared to densities in reaches fenced off from cattle on the Colville Tribal lands. Case in point, sections of Lost Creek and lower Barnell Creeks are currently classified as F and C-type channels that were likely E-type channel reaches prior to disturbance. Degradation and transformation of these channel types from their original form result in increased sedimentation, widened stream geometry (increased width/depth ratio), and increased susceptibility to solar warming. These extensive changes in channel shape and function are a challenge to repair and streams often cannot be restored to connect with their former floodplains.

Aeneas Creek, and all other streams, have steeper gradients (2 to ≥ 6%) and flow through mostly conifer forested vegetation conditions. Based on stream surveys, these streams fit the Rosgen Type-B5-6 and A5-6 channel classification. Streambanks are composed of fine grained, non-cohesive soils which rely on deep rooted bank vegetation for maintaining bank stability. Vegetation along these channels consists of herbaceous ground cover, shrubs, and spruce/lodgepole/fir conifer overstory. Field observations of the few un-grazed areas indicate alders and various shrubs can be dense along streambanks and raw unstable banks are rare. Most of the perennial flowing streams in the allotment are being impacted by livestock, based on surveys of perennial and intermittent channels in 2011 and 2012. Common conditions include high channel instability caused from decades of bank trampling and streambank vegetation loss. Deeply rooted vegetation, which is important to stabilize these soft streambanks, is largely non-existent on the BART allotment streams. Streambanks are being physically damaged by cattle trampling and hoof shearing and have resulted in reductions in the cover and vigor of bank vegetation. This has led to increased bank erosion, increasing width/depth ratios, and channel incision. Other symptoms of these conditions include low pool frequencies and high fine sediment loading in fish spawning habitat, affecting native interior redband trout habitat, a Region 6 sensitive species.

Vegetative ground cover in the allotment is predominantly upland vegetation. There is continuous riparian vegetation where cattle cannot access streams. Access is the controlling factor for bank stability. The banks tend to be more stable when the hillsides on either side of the stream bottom are steep and densely vegetated with lodgepole pine and brush. The banks are also stable where downfall protects the streambanks and limits access to the stream. The banks are unstable where cattle can access the stream.

The stream banks within the allotment consist primarily of ash-capped alluvial glacial outwash and have a range of vegetation cover, depending upon location within the watershed and the allotments. The stream bank vegetation ranges between dense conifer overstory with little to no bank vegetation, to continuous shallow rooted grasses and forbs in the more open stringer meadows and old landing areas. The stream banks of the streams in the allotments are either thinly vegetated due to the alteration of the bank material from grazing or densely vegetated with bank stabilizing shrubs, grasses, sedges, and trees where downfall has limited cattle access.

The lack of aquatic vegetation and moderate amounts of channel bed scouring and deposition indicates that the channel bed moves during high flows. The stream bank material consists of fines and large cobbles and boulders, where boulders persist, fines have been washed away. Tree roots provide bank stability and hold the fine alluvium in place, however trampling of wetted floodplain soils has caused the fines to be de-stabilized and washed downstream, causing the banks to widen past the tree root systems and trees to topple. Deposits of fine sediment were observed in every stream reach that was surveyed and increased below cattle crossings and where trails were at the top of the bank.

Bare ground in riparian areas is exposed to water erosion in two ways. The first is channel erosion. The second, which affects all rangelands, is rain-splash. The top layer of soil is usually the most permeable and fertile and often the most resistant to detachment. Loss of this layer reduces fertility and infiltration. This results in a downward trend in plant productivity and increases overland flows, which leads to accelerated erosion (Warren *et al*. 1986, Holechek 2001). Bare ground in the streambanks are composed of highly erodible ash capped and unconsolidated glacial till soils. These soils are extremely susceptible with each hoof print due to the thin vegetative mat, where tree and shrub roots stabilize the ash-cap. When cattle disturb the soil, the ash-cap is displaced, pushed through the tree roots, and washed away. The closer the impact is to the steam channel, the less distance detached soil particles have to travel before entering a water way and adding to the sediment loading of the stream. Significant amounts of sediment can cause a channel to adjust, which in turn can create more streambank erosion, which can cause more channel adjustments.

**Wetlands and Riparian Areas**

There are 177 acres of mapped "National Wetland Inventory" (NWI) polygons within three of the four allotments representing 8 NWI Classes (Cowardin et al. 1979), with areas estimated from existing Forest Service GIS coverages along with NWI streamcourses (refer to Table 35, Physical Areas and Approximate Percentage Wetlands in each 6th Field HUC, below). There were additional wet stringer meadows observed in the field.

**Table 35, Physical Areas and Approximate Percentage Wetlands in each 6th Field HUC: (USFS GIS Data and USFWS 2010)**

| 6th Field HUC Code | 6th Field Watershed Name | Area ($Mi^2$) | Area on US Forest Service Land ($Mi^2$) | Percent of area in Wetlands |
|---|---|---|---|---|
| 170200040202 | Aeneas Creek | 26.4 | 22.4 | 0.2% |
| 170200040201 | Cape Labelle | 47.0 | 3.0 | |
| 170200060207 | Chewiliken Creek | 26.4 | 2.3 | 1.6% |
| 170200060205 | Lower Bonaparte Creek | 51.7 | 1.6 | |
| 170200060204 | Peony Creek | 31.5 | 14.7 | 1.3% |
| 170200060209 | Tamarack Spring | 15.8 | 1.0 | 0.5% |
| 170200040204 | Upper Lost Creek | 54.2 | 9.1 | 3.7% |
| 170200060208 | Upper Tunk Creek | 38.9 | 1.8 | 0.2% |
| 170200040203 | Upper West Fork Sanpoil River | 56.7 | 0.8 | 1.9% |

One wet meadow was reviewed in the field; 10 acres of 123 acres were used by livestock. Therefore, ~8% of the wetland was disturbed. The soil surface had bare soil areas (hoof prints, hoof shear, trampling, and indicators of accelerated erosion or compaction are present). Additional wetland areas can be assumed to show the same detrimental effects but the proportion of the impacts will vary greatly, depending on multiple factors (ease of access, soils, size, gradient, available forage, etc.).

During field visits in the summer of 2012, concentrated livestock use of wetlands, springs, seeps, and stream channels was observed at several areas of concern. Most are usually less than ¼ acre. Impacts included: destabilized banks and compacted soils in riparian and wetland areas in the analysis area (Hydrology Field Report 2013 in the analysis file).

**Springs-**All trough/spring sites are monitored annually by Forest Service personnel for livestock use. Water developments are maintained, as needed See Appendix H, Range Water Development Improvements, for 2011, 2012, and 2013 Inventory Notes. Springs are also monitored and used in addition to other triggers, to notify the permittees of effects or determine that the livestock need to be moved. Some toughs are located adjacent to streams and are attracting cattle use in riparian areas

**Water Quality**

**Water Quality Standards**

The State of Washington has designated the streams draining the Okanogan and Sanpoil River watershed above the National Forest boundary as Antidegradation Segments. This indicates that the existing water quality is better than the established standards for the designated beneficial uses. Water quality is required by state regulation to be maintained at this level. State antidegradation rules require that water quality not be lowered to any measurable extent where feasible methods exist to prevent or significantly reduce that effect. Even where measurable lowering of water quality is being prevented, antidegradation rules require that no activity cause or contribute to a violation of the numeric turbidity criteria or harm the existing or designated uses established in the state standards for the specific water bodies.

Classification and designation of water quality uses and standards for the area encompassed by the allotments is extracted from the State of Washington "Use designations – Fresh Waters" (WAC173-201-600) http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-600 . Waters within the analysis area are protected for the uses of salmonid spawning, rearing, and migration; primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values. Since the waters are on National Forest System lands, they are additionally protected for the designated uses of: "Core summer salmonid habitat"; and "extraordinary primary contact recreation".

These designations describe the Washington State Department of Ecology (DOE) criteria for water temperature, turbidity, and fecal coliforms. Although there are no ESA-listed salmonids in the analysis area, resident salmonids such as redband trout (Regional Foresters Sensitive Species listed) and eastern brook trout, which are found in the analysis area, require cool water with low sediment loads.

Water quality parameters (with Washington State Water quality criteria) most likely susceptible to change by grazing are turbidity and bacteria (fecal coliforms). Washington State Department of Ecology (DOE) Standards for these parameters are in Table 36, DOE Criteria for "Core Salmonid Habitat" and "Extraordinary Primary Contact Recreation" Water per WAC 173-201A-200, below.

**Water Quality Monitoring Data**

INFISH/PACFISH requires stream temperature and sediment monitoring for management of fish habitat RMOs. These data will serve as proxy data for water quality measurements since none of the drainages within the allotments are listed on the State's 2008/2012 Water Quality Assessment given the requirements of Sections 303(d) and 305(b) of the Clean Water Act (DOE 2008, 2012b) [http://www.ecy.wa.gov/programs/wq/303d/2008/index.html]. There are no DOE long term monitoring stations within or immediately downstream of the allotments. No records were found in DOE's "EMI Database Search", and no water quality monitoring data was available in the Environmental Protection Agency (EPA) STORET (STOrage and RETrieval) Data Warehouse for streams in the allotments.

**Table 36, DOE Criteria for "Core Salmonid Habitat" and "Extraordinary Primary Contact Recreation Water, per WAC 73-201A-200**

| Category | Criteria |
|---|---|
| Core Summer Salmonid Habitat – Temperature | 16 C (60.8 F)<br>(7-day average of maximum daily temperature) |
| Turbidity | Turbidity shall not exceed:<br>5 NTU over background when the background is 50 NTU or less;<br>**or**<br>10 percent increase in turbidity when the background turbidity is more than 50 NTU. |
| Fecal Coliform | Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 ml, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 100 colonies/100 ml |

Water temperature is meeting INFISH/PACFISH standards, but sediment is not. Fecal coliform has no recent data.

**Stream Temperatures**

The Forest Plan water temperature standard directs the Forest to meet state water quality standards and prevent measurable increases in water temperature (1989 Forest Plan Watershed S&G-2-19). According to the Washington Department of Ecology this would mean maintaining maximum water temperatures at or below 64°F (18°C) within migration and rearing habitat and below 61°F (16°C) within spawning habitats (DOE 2008).

PACFISH/INFISH RMOs require that no measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period). Temperature data regarding salmonids is covered in the Aquatics/Fisheries Report.

Limited stream temperature data exists for the BART analysis area. Data loggers were placed in Aeneas Creek in 1999 and 2002. The 7-day average maximum temperatures were 56.9 in 1999 and 59.1 in 2002, suggesting temperatures are within standards for fish habitat. Stream temperatures are close to the upper limit for temperatures as prescribed by PACFISH/INFISH standards and monitoring is warranted to establish trends.

No data is available for Lost Creek, but it is assumed to be elevated due to source water from Crawfish Lake and the creek is largely in a meadow with high sun exposure. Livestock are reducing streamside vegetation in several areas across the allotment and may have some effect to localized temperatures, but most forested streams have conifer overstories to maintain some stream shade. Overall, stream temperature is expected to be within guidelines for fish habitat.

Stream temperatures are strongly controlled by riparian vegetation shading, channel width to depth ratio, and shallow subsurface flow into and out of the main channel. Grazing has reduced riparian vegetation in the area (through browse), widened and reduced the depth of stream channels (through bank trampling), and reduced the availability of shallow subsurface flow (through bank and wet area trampling) in several locations within the allotments. Stream shade/canopy however has not been modified to the extent to impact water temperatures in the analysis area because all streams meet Washington State DOE temperature criteria for core salmonid habitat (See the Aquatic/Fisheries Report in the Analysis File).

**Sediment**
While all watersheds have some sedimentation occurring from natural processes (mass movement, high flows, erosion), typically natural processes are of short duration, have a wide variation of particle sizes, and allow organism and flow recovery. Natural sedimentation contributions to water are not regulated by DOE or the Clean Water Act. Anthropogenic derived sedimentation in a watershed can typically be a chronic contribution, usually made up of smaller particles, is more difficult for organisms to adapt to, and can be a major detriment to water quality.

The amount of fine sediment in streams is a common indicator of stream and riparian health. The Okanogan National Forest, Forest Plan (1989) has a standard percent fines necessary to maintain properly functioning spawning habitat of less than 20 percent fines <1mm. Other scientific literature recommend percent fines (<6mm) on channel surfaces less than 12 percent and fines (<0.85mm) in gravel at depth less than 12% represent properly functioning substrate character in fish habitat (Cederholm and Salo 1979, Chapman 1988, Overton et al. 1995, Kemp et al. 2011).

The following Forest-wide Okanogan National Forest standard and guideline for fisheries addresses sediment under "Fisheries":

"**3-3:** Sediment in fishery streams shall be maintained at levels low enough to support good reproductive success of fish populations as well as adequate instream food production by indigenous aquatic communities to support those populations."

"Fines - Fines (< or = to l.0 mm) in spawning areas (pool tail-outs and glides) should be maintained at less than 20 percent as the area weighted average."

The BART project area lies within the West Fork Sanpoil River and Okanogan River-Bonaparte Creek 10$^{th}$ field watersheds. Soils in these watersheds have a layer of volcanic ash on top, which tends to have weak structural characteristics and are easily compacted, displaced, or rutted. According to the project soil specialist, when ash soils are in an undisturbed state, the potential for surface erosion is generally low meaning when soils are uncompacted and have vegetation covering it. However, when disturbed, ash-cap soils tend to have high surface erosion rates (See the Soils Section). Sources of erosion and subsequent stream sedimentation in the analysis area are primarily forest roads and livestock grazing (USDA 1998a and 1998b). Past tractor logging on the ash soils has resulted in compaction in the uplands that can cause surface erosion (See the Soils Section).

**Livestock Trampling**
Livestock trampling on streambanks often leads to increased stream sediment levels either through direct introduction of particles from bank trampling or by creating raw areas on streambanks that are susceptible to erosion by subsequent high flows (Skovlin 1984, Platts 1981, Clary and Webster 1990). Past and present field reviews and surveys indicate streambank impacts from livestock grazing are largely heavy across the analysis area. Streambanks are composed of fine particle sizes with the ash-cap soils that are easily disturbed and erosion rates are high when disturbed. Based on the amount of moderate to heavy bank trampling across the analysis area, riparian grazing is estimated to contribute a substantial amount of fine sediment to the stream network and to fish habitat.

**Roads**
Riparian roads are one of the main human factors contributing to high in-stream fine sediment levels. There is an estimated 235.5 miles of roads contained in the BART analysis area boundary, including 93.4 miles of open roads and 142.1 miles of closed roads. The existing total road density within the analysis area is 4.0 miles per square mile and the open road density is 1.6 miles per square mile. Road densities are high in nearly all sub-watersheds in the analysis area (Table 37, Estimated Road Densities, Stream

Crossings, and Riparian Roads for the BART Analysis Area Sub-watersheds), below, and riparian road crossings are abundant throughout.

**Table 37, Estimated Road Densities, Stream Crossings, and Riparian Roads for the BART Analysis Area Sub-watersheds**

| Watershed | Sub-Watershed | Road Density (miles of road/sq. mi.)[13] | Riparian Roads (%) | Stream Crossings (Fish-bearing) |
|---|---|---|---|---|
| Okanogan-Bonaparte | Chewiliken Creek | 4.75 | 7.5 | 14 (0) |
| | Peony Creek | 4.5 | 5.9 | |
| | Tunk Creek | NA[14] | - | 1 (0) |
| | Lower Bonaparte Creek | NA[14] | 4.5 | |
| West Fork Sanpoil | Upper Lost Creek | 4.0 | 9.6 | 30 (4) |
| | Middle West Fork Sanpoil | 1.6 | - | |
| | Upper WF Sanpoil (Aeneas Cr.) | 4.2 | 10.2 | 37 (11) |
| Analysis area | Combined | 4.0 | 8.5 | 103 (15) |

Increasing road density tends to correlate with declining stream habitat conditions and aquatic integrity (Lee et al. 1997, McCaffery et al. 2007) due to increased sediment delivery and deposition as well as alteration of flow pattern. There is little information on thresholds for what constitutes a 'high' road density where roads impact aquatic resources. One study by Cederholm et al. (1981) looked at road densities and their influence on stream sediment levels in Coho spawning habitat in the Clearwater River Basin in the Olympic Peninsula. The study found densities above 4 miles/square mile to be responsible for 2.6-4.3 times the natural rate of sediment production to streams. In a different study, Quigley et al. (1997) reviewed several thousand drainages on USFS and BLM-managed forested lands across the west to determine correlations between road densities and fish habitat and presence. They found that bull trout were likely absent in drainages where road densities exceed about 1.1mi/mi$^2$; westslope cutthroat were likely to be absent in drainages where road densities exceed 0.6-1.7 mi/mi$^2$; and interior redband trout were likely to be absent when road densities exceed about 1.5 mi/mi$^2$ (Quigley et. al. 1997). Based on the limited literature and the number of roads in the analysis area, it is reasonable to assume the road densities are high and are likely a major contributor to the existing fine sediment levels in the BART analysis area.

**Fine Sediment Data**

The Forest Service has monitored fine sediment levels (<1mm to <6mm) in analysis area streams in the years of 1996, 2005, 2010, and 2011. Sediment measurements include Wolman pebble counts and McNeil core sediment sampling (Table 38, Fine Sediment Levels in BART Analysis Area Streams, below). Pebble counts measure the percentage of fines less than 2 mm and less than 6 mm on the stream surface substrates and the McNeil core sampler measures the percent fine sediment <1mm and <0.85mm in spawning gravels, at depth. Twenty-two pebble counts have been collected across the analysis area since 1996 (four were repeat sites). The percent fines (<6mm) ranged from 20.2 to 100 percent fines and the average was 63.2 percent (Table 38). Where percent fines, less than 2mm, are well above 20% and in fish bearing reaches, its assumed the smaller <1mm particle sizes are above 20% and spawning habitat sediment levels are not meeting the Okanogan Forest Plan standard. A total of six spawning sites were sampled across Aeneas and Lost Creeks with the McNeil core sampler. Each of the sites had more than 20% fines in the <1mm size class further indicating sections in these streams are not meeting the fine

[13] Within project area boundary only.

[14] High road density values result from very small analysis areas. Ex. Peony Creek comprises about 85 acres (0.13 miles$^2$ of the project area but contains about two miles of road, equaling 16 mi/mi$^2$.

sediment Forest Plan Standards (Table 38). Additionally, particles <0.85mm ranged from about 18 to over 40 percent, which are well above suitable spawning habitat for salmonid species. Field ocular estimates made during the 2011 and 2012 found several other streams to have high fine sediment levels. Collectively, sediment samples and field estimates indicate fine sediment levels exceed the Forest Plan standard in most streams throughout the allotments. See Appendix A, Maps, for stream locations.

**Table 38, Fine Sediment Levels in BART Analysis Area Streams**

| Pebble Count Data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Stream | Fish Bearing | 1996 | | 2005 | | 2010 | | Properly Functioning Condition (<6mm) |
| | | % <2mm | % <6mm | % <2mm | % <6mm | % <2mm | % <6mm | |
| Chewiliken Cr (PIBO site) | No | -- | -- | 92.62 | 95.46 | 49.05 | 67.2 | <12% |
| Barnell Cr (PIBO site) | Yes | -- | -- | 75.65 | 100 | 91.75 | 91.75 | |
| Peony Cr (PIBO site) | No | -- | -- | 97.09 | 98.07 | 81.03 | 100 | |
| Aeneas Cr (PIBO site) | Yes | -- | -- | 42.26 | 45.14 | 17.39 | 20.16 | |
| Aeneas Cr Reach 2 | Yes | -- | 44.5 | -- | -- | -- | -- | |
| Aeneas Cr Reach 3 | Yes | 47 | 65 | -- | -- | -- | -- | |
| Aeneas Cr Reach 4 | Yes | 27 | 74 | -- | -- | -- | -- | |
| Aeneas Cr site 1 | Yes | 22.1 | 37 | | | | | |
| Aeneas Cr site 2 | Yes | 53.6 | 68.3 | | | | | |
| Aeneas Cr site 3 | Yes | 66.7 | 85.3 | | | | | |
| T2 to Aeneas Cr | Yes | 21 | 23 | -- | -- | -- | -- | |
| T3 to Aeneas Cr | Yes | 34 | 42 | -- | -- | -- | -- | |
| T4 to Aeneas Cr | Yes | 53 | 77 | -- | -- | -- | -- | |
| T5 to Aeneas Cr | Yes | 21 | 23 | -- | -- | -- | -- | |
| Lost Cr site 1 | Yes | 41 | 57 | -- | -- | -- | -- | |
| Lost Cr site 2 | Yes | 68.3 | 74 | -- | -- | -- | -- | |
| Lost Cr site 3 | Yes | 47.5 | 56.4 | -- | -- | -- | -- | |
| Lost Cr site 4 | Yes | 34.3 | 47.1 | -- | -- | -- | -- | |

| McNeil Core Sediment Data | | | | | |
|---|---|---|---|---|---|
| Stream | Fish Bearing | Survey Date | % <0.85mm | % <1mm | Okanogan Forest Plan Standard (<1mm size) |
| Lost Cr Site 1 | Yes | 2011 | 23.4 | 27.1 | <20% |
| Lost Cr Site 2 | Yes | 2011 | 15.8 | 19.6 | |
| Aeneas Cr Site 1 | Yes | 2011 | 41.5 | 47.4 | |
| Aeneas Cr Site 2 | Yes | 2011 | 30.2 | 38.6 | |
| Aeneas Cr Site 3 | Yes | 2011 | 17.8 | 21.3 | |
| Aeneas Cr Site 4 | Yes | 2011 | 36 | 38 | |

In addition to the above sediment surveys, the TRAP surveys found many stream reaches to have high fine sediment levels (USDA, 1992-1996). Fine sediment levels were assessed on 47 stream reaches and over half had levels reported as heavy to substantially high sediment levels. Cattle trails and vegetation browse was rated as causing moderate to substantial impacts to riparian vegetation, which often leads to increased bank erosion and stream sedimentation levels. Data from these surveys are consistent with recent observations and suggest high stream sediment has been widespread for years.

**Turbidity**

Turbidity is a measure of optical clarity of water and is measured in Nephelometric Turbidity Units (NTUs). NTU readings increase as the number of fine particles in the water increase, so sediment delivery to streams will increase NTU readings. Background turbidity levels in the analysis area are below 50 NTUs, which places waters in the analysis area in the "5 NTU over background" category for allowable increased sediment levels. For reference, any visible cloudiness in stream water from human-caused sources is likely exceeding the 5 NTU threshold set by DOE for water quality.

Increased turbidity can be short-lived, related to intense precipitation events, or high stream flows. Once particles settle out of the water, turbidity will decrease, but fine sediment is still in the channel available to be re-mobilized by higher flows, and decreasing water quality. Stream bed sediment regulation and impacts are more fully described in the aquatic/fisheries resource section of this report (Shull 2013).

**Fecal Coliform**

Except for some minerals, metal data collected from streams in the early 1980's (A. Robert Grant, Inc. 1982), direct fecal coliform, physical properties, metals and nutrients sampling data are not available for streams within the analysis area. There are no 303(d) listed waters within the analysis area, and the nearest 303(d) listed water is approximately 7.0 miles downstream of the Forest Service boundary, in Lower Tunk Creek. Bonaparte Creek has also been identified as impaired on the 2012 and 2008 303(d) list for exceeding bacteria and pH standards and requires a plan for improving water quality, titled a Total Maximum Daily Load (TMDL). These sites are well below the analysis area and not likely affected by actions on National Forest System lands (USDA 1998a and 1998b). It is likely that there are localized areas where Washington standards are exceeded in the project area, but the effects most likely are temporally and spatially short-lived.

**Watershed Analysis Review for Water Quality**

Watershed assessments documented that the majority of the stream systems on National Forest System lands within the Bonaparte and West Fork Sanpoil watersheds have no or little cumulative effect to downstream water quality on fish habitat because streams flow underground (intermittent surface flow), effectively filtering sediment and reducing water temperatures in the summer months. Water quality may become degraded in these streams; however, when the water flows underground it filters sediment and decreases water temperatures during the summer months.

Stream systems that maintain surface flow, including Lost Creek, Aeneas Creek, and West Fork Sanpoil River, may have minor cumulative downstream effects to water quality and fish habitat from these perennial streams due to functional depositional areas downstream of National Forest System lands.

Water quality degradation due to cattle grazing and watering within the allotment area in Peony Creek and its tributaries on National Forest System lands is affecting water quality, and it is likely that generated sediment is entering the fish bearing portions of Peony Creek. The health of riparian and aquatic habitat along Bonaparte Creek is slightly to severely impacted downstream of National Forest lands. The major problems are sedimentation and loss of riparian vegetation. Factors contributing to

these problems include grazing, proximity of roads to the creek, and channelization and head-cutting of Bonaparte Creek. (USDA 1998a).

Water temperatures are within State water quality standards for the West Fork Sanpoil watershed and for the Bonaparte watershed on National Forest System (NFS) lands. The Okanogan River has documented periods of violation of Washington State water quality standards for temperature and pH levels.

Water quality was identified as a limiting beneficial use on lower Bonaparte Creek downstream of the analysis area, however there is no hydrologic connection between the drainage from the project area to this stream from Upper Bonaparte and Patterson Creeks because these streams flow underground with intermittent surface flow (USDA 1998a). Water quality is not a limiting beneficial use on the West Fork of the Sanpoil River. There is no Washington State Department of Ecology (DOE) listed 303(d) or 305(b) waters of concern within the analysis area, nor within the West Fork Sanpoil Watershed (DOE 2008, 2012a).

Since the watershed assessments were written in 1998, the existing listings remain for the Sanpoil River and the Okanogan River far downstream of the project, and 2 more streams were add to the 303(d) listings, Bonaparte Creek and Tunk Creek for reaches downstream of the project area. The summary of Category 5, 303(d) listings for waters below the project area are:

- Bonaparte Creek: pH, Bacteria, 2012, 2008
- Sanpoil River: Bacteria, 2012, 2008, 2004; Dissolved Oxygen (DO) , 2012, 2008
- Tunk Creek: Bacteria and pH, 2012, 2008
- Okanogan River: Temperature, 2012, 2008, 2004

**Environmental Consequences**

**Desired Condition**

The Okanogan Forest Plan provides direction for the Bannon, Aeneas, Revis, and Tunk project area (USDA Forest Service 1989). Riparian management objectives that apply to this project are: to maintain and improve riparian function, maintain water quality and habitat capability, and integrate fish and riparian habitat management into other multiple use activities. Pertinent goals to the proposed activity under the Okanogan Forest Plan are to maintain or improve continued long-term soil productivity and to provide for the continued supply of high quality water which meets established standards. The structural and functional properties of these dynamic, multi-age riparian communities will be managed to promote infiltration, bank and channel stability, provide resiliency to disturbance, and maintain or improve water quality (USDA Forest Service 1989a, pg. 4-2). Refer to Appendix G, Regulatory Framework, for a more complete discussion of Okanogan National Forest, Forest Plan Standards and Guidelines that pertain to hydrology and range resources.

**Forest Plan**

Riparian area management will strive to provide an ecosystem fully occupied by historic plant community types. The structural and functional properties of these dynamic, multi-age communities will be managed to promote bank and channel stability, provide resiliency to disturbance, and aquatic diversity. Riparian management will also promote the capability for detention and storage of water during flood events and the inherent ability to provide long-term stability of critical summer base flows. Riparian areas will be managed to provide a continuing supply of large wood to streams in order to maintain the quality and quantity of fish habitat that is characteristic of the streams potential.

PACFISH and INFISH Riparian Goals (Riparian Goals) (USDA and USDI, 1995: C-4, USDA, 1995a: E-2) for the analysis area provide the framework for the aquatic resources analysis. Both management

document goals are the same. Riparian Goals establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. The goals describe several watershed, stream, riparian processes that are to be maintained or restored. The pertinent goals to be maintained or restored during the planning for the BART project include:

- Stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;
- Natural timing and variability of the water table elevation in meadows and wetlands;
- Riparian vegetation to:
    - Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
    - Provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and
    - Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

**Riparian Management Objectives**
PACFISH and INFISH RMOs (USDA and USDI 1995: C-4, USDA 1995a: E-3) describe good fish habitat and also tie to riparian function and water quality. The numeric values given provide the "criteria" against which attainment, or progress toward attainment, of the riparian goals is measured, and a target toward which managers will be aiming for as they conduct resource management activities. RMOs for stream systems relevant to the analysis area are: Water Temperature, Width-Depth Ratios and bank stability (meadow type streams). See the PACFISH and INFISH documents for the specific RMO values and Appendix G, Regulatory Framework, for a more complete discussion.

**Key/Priority Watersheds**
PACFISH Key Watersheds (USDA and USDI 1995:C-19) and INFISH Priority Watersheds (USDA 1995a: E-13) were established to provide a pattern of protection across the landscape where anadromous fish and inland native trout would receive special attention and treatment. Priority in these watersheds would be to protect or restore habitat and to restore degraded habitat.

The analysis area includes two 5$^{th}$ field Hydrologic Unit Code (HUC) watersheds: Okanogan River-Bonaparte Creek (Bonaparte) and West Fork Sanpoil River (Sanpoil). Upper Columbia River steelhead, which is listed as Threatened under the Endangered Species Act (ESA), is present in the Okanogan River and lower Bonaparte Creek. Therefore, the Bonaparte watershed is designated as a PACFISH Key Watershed. There are no INFISH priority watersheds.

**Direct and Indirect Effect**

**Alternative 1 – No Action**
Cattle impacts would be removed after two years. The bare soil areas in the riparian zones, wet meadows, trailing areas along fences, etc. would be allowed to recover over time. The bare soil area would decrease as vegetation became re-established. This would happen most quickly in areas where the canopy was open and sunlight hit the forest floor. Where streambanks and other areas are shaded, recovery of vegetation would be slower. As vegetation regenerated and stream banks were able to heal, erosion and sedimentation from these bare areas would be reduced over time, therefore, impacts to water quality would be reduced. Water temperature will improve over time as vegetation on streambanks shades more of the stream network. The introduction of E. coli from livestock will cease and water quality will improve. Literature has indicated that after 5 years without cattle, recovery would be noticeable.

**Alternative 2 (Proposed Action)**
This alternative would implement adaptive management strategies that include installation of water developments in the first stage. Developing off stream water may reduce impacts to springs, streams, and riparian areas. Grazing would continue across most of the existing allotments in the first four stages with a few areas of high use riparian areas rested at the beginning. Riparian monitoring would determine progress in meeting resource standards and objectives and determine the length of time grazed pastures are used and how long the Peony pasture is rested. Monitoring results would also determine if it was necessary to implement another stage. Where spring sources are fenced, immediate improvements to riparian vegetation and streambanks will be observed because disturbance to the fragile wet soils will be eliminated. Stage 5 would reduce numbers of cattle and days of use if other adaptive management strategies are not effective. This should result in improvements to the existing condition regarding hydrologic resources.

Under Alternative 2, cattle would continue to access streams in the Tunk, Aeneas, and Bannon Allotments. Direct effects to streambanks from trampling, trailing and crossings, stock utilization of plants that reduces groundcover in riparian corridors, and trampling of the ground surface by livestock hooves would continue to cause displacement of soil and groundcover. If adaptive management actions are implemented, these actions would continue to occur in Aeneas Creek, its tributaries, Barnell Creek, and Lost Creek, but a slight improvement in watershed condition should occur.

Alternative 2 would cut off or limit cattle access to some stream reaches over what is currently accessible. This will lessen impacts to the excluded reaches and all of the indicators pertaining to water quality (sediment, temperature, E. coli, and riparian vegetation) would improve over time.

The implementation of adaptive management strategies and their effects upon the indicators of riparian vegetation conditions, stream temperature, and sediment are documented in the Aquatic/Fisheries Report. The following are general comments upon the effect of the actions upon water quality and watershed condition of the project area.

**Bannon and Revis Allotments**
Resting the Peony Pasture until triggers for re-grazing are reached would remove the annual impacts to the riparian and stream resources and allow regeneration of vegetation on raw streambanks and bare soil areas. This would improve watershed conditions over time. Resting the pasture would also reduce the introduction of fecal coliform and thus improve water quality.

Removing boundary fence between the Revis and Bannon Allotments would decrease trailing along the current fence and have no hydrologic impacts.

Remove the Bannon water catchment (guzzler) structure in the NW1/4 of Section 7, T. 36 N., R. 29 E. All of the springs in the allotment have been impacted by wildlife and livestock grazing use. Removal of the guzzler and non-functional water developments may improve spring function by returning water back to the riparian system and out of conveyance systems.

Development of spring sources and placing of troughs needed for off-site water for cattle may help to alleviate pressure on riparian water sources. Without source protection fencing (proposed where feasible), cattle still have unrestricted access to riparian spring and stream resources in the allotment. By not reducing the direct impacts from cattle grazing, trailing, or crossings and the disturbance to streambanks, compaction and displacement to wetted soils, and erosion and sedimentation will persist.

Creating off-site watering opportunities through the development of the spring sources, and constructing fence around the stream, wetland, or spring source for protection, and placement of, or relocating troughs

out of the immediate stream zone, is an effective combination of BMPs for managing cattle impacts to water quality. These combined BMPs may help to alleviate pressure on riparian water sources. This combined with source protection fencing, cattle will have reduced access to riparian spring and stream resources in the allotment, thus reducing the direct impacts from cattle grazing, trailing, or crossings and the disturbance to streambanks, compaction and displacement to wetted soils. Erosion and sedimentation will decrease in the areas where access is limited.

Soils are perennially wet above the current Patterson trough location. The wetland extent has been trampled, soils have been pedestalled, and ponding of water is extensive across the flood plain. The trough relocation is the first step to remedy the spring/wetland/stream impacts at this site. If this does not result in an improvement at this site, then it is proposed to construct the fence with a water gap as described in the Proposed Action Adaptive Management, Stage 4. Installation of the fence and water gap along the west side of Patterson Creek would allow for better control of cattle and reduce the impacts to Patterson Creek and the spring source. This in combination with trough relocation may reduce impacts to wetlands, springs, and streambanks and improve water quality and watershed condition.

Provided that the proposed action is not effective at meeting Forest Plan standards and guidelines and PACFISH/INFISH RMOs, fence construction combined with the off stream/spring water developments, hardened watering areas, and water gaps would work towards improving water quality and watershed condition. There may be observable impacts until cattle are excluded from riparian areas, wetlands, and streams. This staged implementation of adaptive management allows for monitoring how the activities work to improve conditions.

**Aeneas Allotment**

Install fence (approximately 1.5 miles long) north of Forest Road 30 that would restrict livestock access to Aeneas Creek and eliminate access to lower Jungle Creek and associated wetlands. This fence would connect to the Aeneas/Tunk boundary fence and the Sneed and Bailey pastures boundary fence. The fence would allow for better control of cattle and reduce the impacts to Jungle Creek.

Development of multiple new spring sources and placing of new troughs provide needed off site water for cattle. This BMP may help to alleviate pressure on riparian water sources, however without source protection fencing (proposed where feasible), cattle still have unrestricted access to riparian spring and stream resources in the allotment. This may not lead to a reduction of direct impacts from cattle grazing, trailing, or crossings and the disturbance to streambanks, compaction, and displacement to wetted soils. Erosion and sedimentation will persist.

Creating off-site watering opportunities through the development of multiple new spring sources, and constructing fence around the stream, wetland, or spring source for protection, developing a hardened crossing for livestock watering access, and placement of new or the relocating of existing troughs out of the immediate stream zone is a good combination of BMPs for managing cattle impacts to water quality. These combined BMPs may help to alleviate pressure on riparian water sources. In combination with source protection fencing, cattle will have reduced access to riparian springs and stream resources in the allotment. This may lead to a reduction of direct impacts from cattle grazing, trailing, or crossings and the disturbance to streambanks, compaction and displacement to wetted soils. Erosion and sedimentation will decrease in the areas where access is limited. Installation of a hardened water crossing on Aeneas Creek would allow for better control of cattle and reduce the impacts to the streambanks, and wetted soils. This action in combination with trough relocation may reduce impacts to wetlands, spring, and streambanks. This would also reduce the addition of fecal coliform directly into streams.

Provided that the proposed action is not effective at meeting Forest Plan Standards and Guidelines and PACFISH/INFISH RMOs, fence construction combined with the off stream/spring water developments, hardened watering areas and water gaps would improve watershed conditions. There may be observable

impacts until cattle are excluded from riparian areas, wetlands, and streams. This staged implementation of adaptive management allows for monitoring how the activities work to improve conditions.

Total livestock exclusion from the riparian and stream zone areas would be the most effective way to eliminate impacts. The Alternative offers multiple adaptive management strategies that allow for improvement over time.

The length and timing of livestock grazing within the Bailey pasture (South pasture) would be adjusted if monitoring determines that habitat indicators such as bank stability, greenline to greenline width, and streamside vegetation are not moving towards meeting the Desired Future Condition (DFC) or in the case of seasonal climatic fluctuations such as drought which result in the need to adapt management to changing conditions. Administrative adaptive management measures, as outline in Table 7, may be used for modifying the season of use for the allotment but they must keep to the two weeks timing parameter for livestock on and off dates. A likely scenario would be for an early season, reduced grazing period (June 1 to July 1) during alternating years with a mid-season reduced grazing period (July 1 to August 1) during alternate years. Later season grazing will help to reduce impacts to the wetted soils. Grazing on soils with >10% soil moisture is when soils receive the greatest impacts. If soil moisture guidelines are followed, an improvement to watershed conditions may occur over time. Monitoring impacts and using trigger point criteria to move cattle are necessary to ensure adaptive management actions result in improved watershed conditions.

**Tunk Allotment**

Continue to rest the Lost/Barnell pastures every other year. Resting the pastures should improve overall watershed conditions if monitoring protocols are followed. The construction of additional spring sources may improve watershed condition and water quality, but this needs monitoring to ensure riparian areas are not over-utilized. A trigger or threshold has been developed where a change in management would be initiated to ensure that conditions remain on a trajectory towards attaining DFC. This should improve watershed conditions. Grazing would be authorized between July 1 and September 1 on alternate years until DFC is reached. Monitoring will be completed after the season of use to ensure groundcover conditions are met. Grazing may be allowed when soil moisture conditions have been met. If BMPs regarding soil moisture are implemented, overall watershed conditions should improve.

Construction of a corral adjacent to the junction of Forest Road 3015 and Forest Road 3015125 will create a bare soil area underneath the footprint of the corral and along access points. The location is outside of the RHCA and due to proper placement away from streams, springs, wetlands and water sources, there will be no impacts to riparian areas from erosion and sedimentation.

Removal of a temporary fence along Barnell Creek will not affect water resources. Cattle would still have access to the riparian areas and impacts would continue to occur.

**Alternative 3**

Alternative 3 would provide accelerated riparian resource improvements primarily to stream bank stability and streamside vegetation and would move towards Forest Plan Standards and Guidelines, PACFISH/INFISH RMOs, and DFCs in the exclusion areas. The primary management strategy is to fence off large tracts of land around streams with the heaviest bank trampling that would be rested from grazing until habitat conditions reach a stable state. Riparian monitoring would determine progress in meeting resource standards and objectives and determine the length of time grazed pastures are used and how long pastures are rested.

The implementation of adaptive management strategies and their effects upon the indicators of riparian vegetation conditions, stream temperature, and sediment are documented in the Aquatics/Fisheries

Section, starting on page 152. The implementation of Alternative 3, in addition to adaptive management effects upon these indicators, is also covered by the Aquatics/Fisheries Report. The following are general comments upon the effects of the actions upon water quality and watershed condition of the project area.

Reintroduction of limited livestock grazing would be considered after Forest Plan Standards and Guidelines, PACFISH/INFISH RMOs, and indictors to allow regrazing in the rested areas have been reached. Currently these are not being met, and if pastures are rested until these indicators are obtained, grazing will have fewer impacts on the improved watershed condition and the watershed will be more resilient to these impacts.

This alternative was developed to provide cattle grazing and accelerated riparian resource improvement-primarily to repair stream bank instability and sediment levels that are not meeting Forest Plan Standards and Guidelines, INFISH/PACFISH RMOs, and DFCs. This alternative also includes management flexibility to cope with fluctuations in environmental and social conditions such as, short-term climate changes, and the ability to respond to permittee requests for reasonable operational adjustments.

This alternative would implement a four year strategy that includes the installation of water developments, moving the Jungle Creek corral, fencing north of Jungle Creek (above Forest Road 30, and moving the fence south of Aeneas Creek, in the first year. The construction of a fence in the North Tunk pasture in the second year, and the remainder of the proposed fences would be installed in the 3rd and 4th years. This alternative would rest these new pastures (Areas A, B, C, D, and Peony Creek) with the most sensitive riparian areas, which are not currently meeting Forest Plan Standards, INFISH/PACFISH RMOs, and DFCs.

This alternative relies on an adaptive management strategy that incorporates new water developments, fences, rested pastures, and monitoring. Monitoring would determine progress in attainment of Forest Plan standards, INFISH/PACFISH RMOs, and DFC in both rested and non-rested pastures. Monitoring results will be used to determine the length of time each non-rested pasture is grazed and progress in achievement of desired conditions in rested pastures.

A monitoring plan would be used to assess whether or not the desired results for Forest Plan Standards and Guidelines, INFISH/PACFISH RMOs, and DFCs are being achieved and triggers (see Chapter 2, Indicators of Desired Recovery for Re-grazing, Alternatives 2 and 3 on page 32, and Indicators of Desired Recovery for Re-grazing on page 50) would be developed and utilized to identify when a specific threshold is about to be reached and cattle need to be moved. For instance, if monitoring indicates that a threshold for bank alteration is being reached, the threshold would trigger the need to move cattle to the next pasture or off the allotment prior to the end of the season.

**Bannon and Revis Allotments**

All proposed improvements described in Alternative 2 would be implemented including the construction of 1.3 miles of fence along the west side of Patterson Creek in Sections 8 and 18 of T. 36 N., R. 29 E. A water gap would be installed along this fence in Section 8.

**Aeneas Allotment:**

All proposed improvements described in Alternative 2 would be implemented.

**Tunk Allotment:**

All proposed improvements described in Alternative 2 would be implemented except the six proposed water developments *inside* the rested pastures that would not be developed until pastures being rested are ready to be grazed again. These water developments would be developed prior to the return of grazing in these pastures.

**Implementation Process:**

Year 1
Relocate or remove undesirable troughs. Placement of troughs out of the stream and away from spring sources with exclosure fencing protecting the source would follow BMPs and reduce the impacts to water quality and watershed conditions.

Development of new water sources outside of proposed rested areas. The water developments will be completed to National Water Quality BMPs (as noted in report) and impacts to water resources will be reduced. Exclosure fences around the springs will improve water quality from the reduction of fecal coliform directly into the water.

Install a new fence north of Jungle Creek in the Aeneas Allotment. Move the existing fence, south of Aeneas Creek, further south, away from creek. These fences will allow for better control of cattle and reduce the impacts to Jungle and Aeneas Creeks. This in combination with trough relocation may reduce impacts to wetlands, springs, and streambanks. The use at these sites will be monitored to evaluate effectiveness. The fences may create additional trailing along them, but this should allow for riparian resources to improve.

Initiate other miscellaneous improvements such as drift fence removal in Barnell Creek, corral and water trough removal in Jungle Creek, and construction of two new corrals in upland areas.

The use at these sites will be monitored to evaluate effectiveness at the Jungle Creek monitoring site in the S ½ of Section 11, Township 35 North, Range 29 East, W.M.

Year 2
Installation of a fence around the north slopes of Jungle Creek and tributaries in the Tunk Allotment that will tie into existing fences to create a new pasture that will be rested from livestock grazing until the DFC is met. The fence will allow for better control of cattle and reduce the impacts to stream and spring sources. This, in combination with trough construction and relocation in earlier phases, may reduce impacts to wetlands, springs, and streambanks. The pasture (Area C) will be monitored to evaluate effectiveness at the Upper Jungle Creek monitoring site in Section 4, Township 35 N., Range 29 E., W.M.

Year 3
Install a fence from the Forest Boundary in Section 17, T. 35 N., R. 29 E. east to Forest Road 30 in Section 23; south of the existing boundary fence between the North and South unit in the Tunk Allotment to create a new pasture that would be rested from livestock grazing until the DFC condition is met. The fence will allow for better control of cattle and reduce the impacts to stream and spring sources. This in combination with trough construction and relocation in earlier stages may reduce impacts to wetlands, springs, and streambanks. Area D use will be monitored to evaluate effectiveness at No Name Tributary 2 monitoring site in NE 1/4, Section 15, Township 35 North, Range 29 East, W.M.

Year 4
Install a fence around the Upper Peony headwaters in the North Unit of the Tunk Allotment to create a new pasture that would be rested from livestock grazing until the DFC is met. The fence will allow for better control of cattle and reduce the impacts to streams. This, in combination with new troughs and trough relocations, from prior stages, may reduce impacts to wetlands, springs, and streambanks. Area B use will be monitored to evaluate effectiveness at the Peony Creek monitoring site in the NE ¼ of Section 29, Township 36 North, Range 29 East, W.M.

Install a fence along the west side of Patterson Creek in the Bannon Allotment, with a water gap, to allow for better control of cattle and reduce the impacts to Patterson Creek. This, in combination with new

troughs, trough relocations, and water gaps, from previous stages, may reduce impacts to wetlands, springs, and streambanks. Area A use of the Bannon allotment will be monitored to evaluate effectiveness at the Patterson Creek monitoring site in the NW ¼ of Section 8, Township 36 North, Range 29 East, W.M. Adaptive management and the effective monitoring of impacts to resources for moving cattle off of pastures when trigger points are reached should improve water quality and overall watershed conditions.

**Cumulative Effects**

Cumulative effects include a discussion of the combined, incremental effects of human activities. For activities to be considered cumulative their effects need to overlap in both time and space with those of the proposed actions. For water resources, the area for consideration is the 6th field watersheds included in the proposed BART Allotment review. The timeline considered is from approximately 100 years in the past to 15 years in the future. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects (CEQ 2005).

Livestock grazing may have cumulative impacts that extend outside the immediate stock use area which may affect the condition of the larger watershed through impacts to ground cover that may increase riparian and upland erosion within watersheds increasing sedimentation into streams which could affect water quality downstream.

**Past and Present Actions**

Past actions relevant to stream and riparian resources are long term grazing, timber harvest, road construction and maintenance, and recreation. Cumulatively, livestock grazing, logging, and road management are the most widespread activities with the longest duration in the analysis area, beginning over 100 years ago.

**Timber Harvest:** Past timber harvest has compacted upland soils, leading to increased runoff and sediment yield. This can change the patterns of runoff from large areas in watersheds by changing vegetation groundcover conditions and reducing the ability to trap and filter sediment before it reaches the stream. Where harvest occurred adjacent to streams, coarse wood debris was reduced, also reducing the effectiveness of the groundcover in the watershed.

**Roads:** Extensive road construction occurred throughout most of the allotment areas. This has led to increased runoff and sediment yield, and where present adjacent to streams, they decreased the amount of riparian vegetation along streams.

Forest roads produce the largest component of sediment to the stream systems and livestock grazing contributes sediment at cattle crossings, unprotected water sources, and cattle trails.

**Recreation:** Recreation uses in the analysis area have had minor effects on aquatic and riparian function. There are a few trails that cross streams resulting in localized sediment delivery and a few dispersed recreation sites that have disturbed riparian vegetation.

**Foreseeable Actions**

**Vegetation Treatments**: all vegetation/canopy alterations within the watersheds discussed in the analysis have similar possible effects: increasing stream temperatures, increasing stream sediment, increasing duration of effective discharge, and increasing peak flows. Vegetation Treatments on National Forest

System (NFS) lands are designed to minimize riparian shade reduction, but it is unknown what riparian shading practices are maintained on non-USFS lands. Projects are designed to not increase stream temperatures in the long run, so there is no additive effect with other actions. Specific practices during harvest on non-USFS lands may contribute at the watershed scale to overall compaction, but since the Proposed Action is designed to not increase this measure, there would be no combined cumulative effect on compaction. Specific practices during harvest on non-USFS lands may contribute at the watershed scale to overall sedimentation, but since the Proposed Action is designed to not increase this measure, there would be no combined cumulative effect on sedimentation. Ongoing canopy reduction will contribute to prolonging flow alteration in any given watershed. Specifically, Crawfish Restoration (CR Timber Sale; road construction started, harvest expected to start summer/fall 2014 and winter 2014/2015) and Bailey Restoration Project (BR Timber Sale, timber harvest completed) has the potential to further cause flow alteration in Aeneas Creek, increasing the likelihood that Aeneas Creek may begin to demonstrate measureable increased peak flows on USFS lands. Vegetation alteration on Tribal lands along Lost Creek combined with vegetation treatments in Lower Lost Creek in the Crawfish Restoration Project (CR Timber Sale) may combine to produce measureable flow alteration at the channel scale in Lost Creek, but most likely these alterations would remain below detectable levels.

**Grazing**: Currently, grazing is demonstrating a measureable impact on the analysis area. Riparian shade is often reduced by browse which has stunted the effective shrub cover that can shade streams and stabilize stream banks. As mentioned in the Existing Condition, extensive areas of unstable streambanks are contributing to stream sedimentation and the primary mechanism for these destabilized banks is hoof shear from cattle use.

The **Crawfish Restoration** project (CR Timber Sale) was designed to minimize and even reduce current road-related sediment input into streams, so essentially the combined effect with the grazing allotments is a potential reduction in sediment. However, vegetation removal and prescribed burning usually result in an increase of forage for cattle, and attract them to new areas and their adjacent riparian areas, which could increase riparian compaction, destabilize banks, and reduce riparian shade. In the implementation process, livestock impacts would be monitored and changes in livestock management strategies would be implemented to minimize damage to these riparian areas. Effective range management would be key to ensure detrimental impacts do not occur where vegetation removal has increased forage.

**Public Use of Lands**: Firewood gathering and recreation occurs in the analysis area and can increase soil compaction, and disturbance to stream banks, which could increase sediment contributions from the stream banks. Illegal harvest in riparian zones could affect shading and increase summer stream temperatures.

**Road Maintenance**: Timely and proper road maintenance will reduce the amount of road-related sediment contributions in the area, as well as reducing the potential for culvert and road fill failures. Immediately following ditch clearing and surface grading there is often a pulse of sediment to streams, but leaving light vegetation in road ditches, ensuring drainage ditches route to vegetated buffers, would mitigate this effect. In addition, cattle often congregate at the pools created by undersized culverts, exacerbating the channel widening at these locations. Improving culvert sizes to reduce these pools would lessen the attractiveness of these crossing incrementally.

**Alternative 1**

The No Action alternative would not add any cumulative effects from grazing to the existing aquatic and riparian resources in the analysis area. The proposed livestock grazing activities, on the BART Allotment area, would not occur and areas where current grazing management impacts streams, hydrology, springs, wetlands, and fish and their habitat would stop. Grazing access points that result in bank trampling and streamside vegetation removal would no longer occur and these areas would improve, leading to

improved aquatic and riparian habitat conditions, because no direct, indirect, or cumulative effects would occur after two years.

**Alternative 2**

The cumulative effects of Alternative 2, when combined with past, ongoing, and reasonably foreseeable future activities, may result in the ongoing maintenance of degraded and marginal riparian habitats. Rested areas would improve without grazing pressure and degraded habitat conditions would trend towards meeting Forest Plan Standards and water quality related RMOs for sediment and stream temperature. Outside of these areas, grazing would continue to cause impacts to fine sediment levels, streambanks, and riparian vegetation. Negative habitat effects should decrease in these areas, somewhat, with the use of off-site water sources, proper placement of salt, active range riding, and using utilization standards, but the high vulnerability of streambanks to grazing would not change. Degraded streams with continued grazing pressure are unlikely to improve incrementally since the level of disturbance exceeds the rate at which the streambanks and vegetation require to thrive when there is unrestricted access to the streams and wetlands. The unstable condition of the heavy bank trampled areas are unlikely to recover even with light grazing due to high level of bank instability and lack of root stabilizing vegetation. Improvements from Alternative 2 would occur in localized areas where livestock are excluded or their use substantially reduced. The reduction in impacts would have a positive effect on localized degraded areas that are rested while other areas would likely not improve during the life of this AMP. Overall, the project would move the analysis area incrementally in an improved trajectory with continued grazing and other activities like riparian roads.

A measureable increase in bank stability and a measurable decrease in fine sediment levels in the areas rested should occur. Outside of rested areas, conditions may improve, but not substantially. Physical stream features like fine sediment levels, width/depth ratios, and pool frequencies are unlikely to achieve DFC until a significant reduction in riparian roads occurs. Conifers would take time to reach maturity and riparian vegetation would require time to establish deep roots necessary for bank stability. Overall watershed condition should improve incrementally in areas that are rested and in areas where grazing pressure is reduced either through reduction in numbers or through adaptive management.

**Alternative 3**

The cumulative effects of Alternative 3 on stream resources, when combined with past, ongoing, and reasonably foreseeable future activities would result in continuing effects to streambank stability, riparian vegetation recovery, soil disturbance, erosion and sedimentation into the stream. Rested areas would improve without grazing pressure and degraded habitat conditions would trend towards meeting Forest Plan Standards and water quality related RMOs (sediment and temperature). Outside of these areas, grazing would continue to cause impacts to fine sediment levels, streambanks, and riparian vegetation along the streams. Negative habitat effects should decrease in these areas somewhat with the use of off-site water sources, placement of salt, and using utilization standards, but the high vulnerability of streambanks to grazing would not change.

Degraded streams will continue to receive grazing pressure and are unlikely to improve dramatically outside of rested areas. Areas where heavy bank trampling has occurred are unlikely to recover with light grazing due to a high level of bank alteration and a lack of root stabilizing vegetation. Improvements that occur in Alternative 3 would occur in localized areas where livestock are excluded or their use is substantially reduced. The reduction in impacts would have a positive impact on localized conditions of the analysis area, but other areas would likely not improve during the life of this AMP. Overall, the project would move the analysis area in an improved trajectory, but only slightly when considering areas rested and areas with continued grazing.

A measureable increase in bank stability and a measurable decrease in fine sediment levels in the areas rested should occur. Outside of rested areas, conditions may improve, but not substantially. Overall

watershed condition should improve incrementally in areas that are rested and in areas where grazing pressure is reduced either through reduction in numbers or through adaptive management.

**Irreversible and Irretrievable Commitments**

No irretrievable or irreversible commitments to water quality would be created as a result of any alternative.

**Compliance with Direction**

**Water Quality Antidegradation Rules**

Water quality was identified as a limiting beneficial use on lower Bonaparte Creek downstream of the analysis area. There is no hydrologic connection between the drainages from the project area to lower Bonaparte Creek because Upper Bonaparte and Patterson Creeks flow underground with intermittent surface flow (USDA Forest Service 1998a). The actions proposed in Alternatives 1, 2, and 3 would improve water quality conditions within the allotment area over time when bare banks become re-established with groundcover and unstable streambanks heal from hoof disturbance.

State antidegradation rules require that water quality not be lowered to any measurable extent (e.g., 5 NTU for turbidity) where feasible methods exist to prevent or significantly reduce that effect. Even where measurable lowering of water quality is being prevented, antidegradation rules require that no activity cause or contribute to a violation of the numeric turbidity criteria or harm the existing or designated uses established in the state standards for the specific water bodies.

Water quality is not a limiting beneficial use on the West Fork of the Sanpoil River. There is no Washington State Department of Ecology (DOE) listed 303(d) or 305(b) waters of concern within the analysis area, nor within the West Fork Sanpoil Watershed (DOE 2008, 2012b). The main stem of the Sanpoil River has two 303(d) listings (for fecal coliform and temperature) downstream of the analysis area. The location of these impaired waters is approximately 30 miles downstream of the analysis area. This project would have no measureable effect on the stream temperatures within the planning area or the downstream segments of the Sanpoil River. With project activities, required mitigation, and monitoring/preventing increased cattle use of the riparian zones, none of the treatments would remove streamside shading, and therefore treatments would not affect these parameters or exacerbate the 303(d) fecal coliform listings downstream.

Because Best Management Practices (BMP's) mitigation measures would be fully implemented (fence building, spring development and trough relocation, see Chapter 2), water quality standards and the anti-degradation policy (Chapter 173-201A WAC) are expected to be met. Full implementation of BMPs has been shown to be an effective method in preventing and controlling nonpoint source water pollution. Implementation and effectiveness monitoring from past projects has shown that the proposed design standards are successful in meeting Forest Plan requirements. Monitoring would be conducted during the project by range administrators and other specialists in order to validate implementation and effectiveness of BMPs and assure compliance with the Clean Water Act and State water quality regulations.

**Compliance with Executive Orders**

Implementation of mitigation measures for Riparian Reserves (moving troughs out of stream bottoms, fencing spring sources, building fences to reduce access to riparian areas, and improving spring developments) would ensure compliance with EO 11988 Floodplain Management and EO 11990 Wetland Protection, because design standards would reduce the risk of detrimental impacts to floodplain and wetland resources.

**Executive Order 11988 – Floodplain Management**
Issued May 24, 1977, this Executive Order requires agencies to provide leadership and take action to minimize adverse impacts associated with the occupancy and modification of floodplains and reduce risks of flood loss. http://www.archives.gov/federal-register/codification/executive-order/11988.html.

None of the proposed Alternatives would result in an action resulting in an adverse impact resulting from any occupancy or modification of floodplains. No occupancy is proposed and any change in use within floodplains will improve over the existing condition. The EIS meets the intent and is in compliance with this Executive Order.

**Executive Order 11990 – Protection of Wetlands**
Issued May 24, 1977, this Executive Order requires agencies to take action to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.
http://www.archives.gov/federal-register/codification/executive-order/11990.html.

The alternatives will remove livestock (Alternative 1), defer impacts through rest (Alternative 3) or will improve livestock distribution and use which in turn will allow for some recovery and reduced utilization of currently high use wetland areas (Alternative 2). No occupancy is proposed and any change in use within wetlands will improve over the existing condition. The BART AMP meets the intent and is in compliance with this Executive Order.

## Wildlife

### Introduction

The section below summarizes the existing condition information, along with the direct, indirect, and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed and prepared by District Wildlife Biologist, Matthew Marsh. Reference information is contained in the Wildlife Baseline report, in the analysis file for the BART Grazing Analysis project. Regulatory Framework can be found in Appendix G, Regulatory Framework of this FEIS.

**Issues**
The analysis issues were identified and the indicators below were relevant to the proposed action and selected to evaluate the current condition with respect to wildlife resources:

**Fence Entanglement of Land Mammals (Analysis Issue)**
**Issue:** Additional fencing can create significant barriers or impediments to normal movement and increase energy demands for wildlife.

**Background:** Although terrestrial mammals are often observed negotiating fences with apparent ease, fencing can create significant barriers or impediments to normal movement and increase energy demands (Hayden, J. et al. 2008). Construct wildlife friendly fences to allow wildlife passage (see the Structural Range Improvement Handbook, 121.6, 7/77). Wildlife-friendly fencing will save livestock operators time and money by reducing fence repairs (Cox, M. et al. 2009).

**Indicators:**

- Miles of fencing removed;
- Miles of potential additional fencing; and
- Design elements to reduce impacts.

**Grazing Effects on Threatened, Endangered, and Sensitive Wildlife Species (Analysis Issue)**
Issue: Grazing effects the habitats of threatened, endangered, and sensitive (TES) wildlife species, migratory birds (MB), and Management Indicator Species (MIS).

**Background:** Grazing affects the habitats of threatened, endangered, and sensitive (TES) wildlife species, migratory birds (MB), Management Indicator Species (MIS) or species of recreational significance and could affect some wildlife individuals or habitat. Suitable habitat for several TES, MB, and MIS species exists throughout the allotments.

**Indicators:**

- Impacts to threatened, endangered, and sensitive (TES) wildlife species, migratory birds (MB), management indicator species (MIS), and the associated habitats.

**Climate Change (Issue not analyzed in detail)**

**Background:** As the climate changes in the future, the resiliency of these dry forest stands would be important for maintaining biodiversity and allowing these stands and species a chance to adapt to the new conditions. Cattle grazing may not promote this resiliency. This reinforces the need to have resilient habitat that is better able to handle climate change. The proposed livestock grazing would have a neutral outcome on the resiliency of the analysis related to climate change.

**Wildlife Corridors (Issue not analyzed in Detail)**

**Background:** The analysis area has been identified as the only modeled linkage through the Okanogan Valley that was consistently identified for all four focal species of carnivores in (Singleton et Al. 2002) and in the 2010 Washington Wildlife Habitat Connectivity Work Group Columbia Plateau Eco-region report (WHCWG 2010). This is a key linkage "corridor" between the North Cascades and the Kettle Range to the east and north into Canada (Singleton et al. 2002, WHCWG 2010). Livestock grazing under this analysis will not negatively affect the forested stand cover in the analysis area. Annual available browse for wildlife and domestic livestock would be maintained at Forest Plan standard and guidelines based on the appropriate management area. Overall, this grazing analysis will not impact the function of this corridor.

**Scope of the Analysis**

The proposed BART Range project area comprises approximately 36,297 acres on National Forest System Land within portions of several 5th field hydrologic units code (HUC) on the Tonasket Ranger District. Habitats of the individual species determined the size of the area used for effects analysis for that species. For example, wide ranging carnivores would have a larger effects analysis area when compared to a more sedentary species.

A written discussion of cumulative effects for each species can be found in each species' section. Cumulative effects are overall impacts of all past, present, and reasonably foreseeable future actions. Actions that were considered include: timber sales; fire and effects of fire suppression; grazing; noxious weed management; and recreation. Typically, this block of NFS lands or the HUC 10 watersheds where this project is located were used for cumulative effects boundaries. The State, private, and Colville Reservation lands adjacent to the National Forest were considered. Again, the habits of the individual species determined the size of the area used for cumulative effects analysis for that species. The analyses for lynx and grizzly bears included the appropriate management unit boundaries for those species.

All reasonably foreseeable projects that may occur within the next decade were included, although additional projects may arise in the future. The reasonably foreseeable projects are listed at the beginning

of this chapter starting on page 74. This project, when considered cumulatively with the other projects, would not hinder the recovery goals for Canada lynx or grizzly bears. This project, when considered cumulatively, would not result in a trend towards federal listing for the sensitive species analyzed in this document. Cumulative effects of this project on MIS and other species of interest would also be minor. Refer to Table 40, Wildlife Effects Comparison by Alternative**,** below**,** for the effects assessment.

Domestic livestock can affect wildlife species directly by trampling on individuals or eggs of smaller-statured species, such as reptiles or amphibians (Bull 2009), or by physically displacing larger species such as mule deer (Mackie 1981, Coe et al. 2001). Grazing by domestic livestock can affect wildlife species by altering the composition and structure of plant communities (Robinson and Bolen 1989). Grazing shortens the height of herbaceous vegetation, which can reduce security and nesting cover for some species, increase the susceptibility of some small mammals and birds to predation, and reduce the biomass of insects and other invertebrates which are an important food source for other wildlife species (Krausman et.al. 2009). Grazing by livestock also reduces the amount of forage available for wildlife, and, if excessive, can result in the establishment of invasive plant species. However, the altered vegetation caused by livestock can have positive effects for some wildlife species (Johnson 1981, Bock et al. 1993, Ivey 1996) or insignificant effects on others (Johnston and Anthony 2008). In addition, grazing of grass and forbs can stimulate growth of adjacent shrubs and small trees and rejuvenate perennial bunchgrasses (Robinson and Bolen 1989).

**Management Indicator Species (MIS)**

The management requirements from the National Forest Management Act and its implementing regulations are legal requirements. The management requirements relating to wildlife are those identified in 36 CFR 219.19. The selection of wildlife species which represent other wildlife species with similar habitat requirements, and which would be the focus of management and monitoring, fulfilled the part of the management requirements for maintaining viable populations of existing native and desirable non-native wildlife populations on planning areas on the Okanogan National Forest (ONF). Management Indicator Species were those chosen to represent limiting conditions for old forest, snags and defective trees, lodgepole pine habitat, and riparian habitat on the Forest as described in the Okanogan National Forest Land and Resource Management Plan Final EIS (USDA Forest Service 1989). MIS for the Okanogan are mule deer, Pine marten, pileated woodpecker, three-toed woodpecker, barred owl, northern spotted owl (west of Methow and Chewuch rivers), ten species of primary cavity excavators, ruffed grouse, and Canada lynx. The Canada lynx has been listed under the Endangered Species Act since the Forest Plan and is addressed in that section as well. A forest-wide analysis of Management Indicator Species was completed to assess the viability across the planning unit (USDA Forest Service 2011b). The MIS analysis in this document uses the forest –wide analysis (USDA Forest Service 2011b) as a reference to support the findings.

**Existing Condition**

The existing habitat conditions within the allotments have been shaped by past management activities, including grazing, timber harvest, and fire. The vegetative structure and composition is improving for these allotments in most areas. There are still areas that need improvements and this analysis addresses them.

These allotments are for cattle, with no sheep, goats or horses permitted. General vegetation types vary from the dry ponderosa pine-bunchgrass to subalpine forests. A display of estimated acres of plant association groups (PAGs) by allotment are displayed in the wildlife report in the analysis file. There would be no road construction as a part of this allotment management plan project; therefore, Forest Plan road density analysis is not required. There would be no timber harvest as part of this allotment management plan; therefore, a Forest Plan deer cover analysis is not required.

Wildlife habitats present in the analysis area include both forested and non-forested. These included a variety of biophysical environments. Efforts have been made to standardize classification of wildlife habitats (Chappell et al. 2001). As described in Chappell et al. (2001), the primary wildlife habitats present in the analysis area are the eastside mixed conifer forest and montane mixed conifer forest. Other wildlife habitats present in varying amounts in the analysis area include the forested types: upland aspen forest; and non-forest types: eastside grasslands, open water (lakes, rivers, and streams), herbaceous wetlands, montane coniferous wetlands, and eastside riparian wetlands. In addition, there are habitat elements present in the analysis area, such as rock outcrops and cliffs, which are not tied to a particular habitat type.

The forested wildlife habitats lump together the biophysical forest types described above and in the vegetation section of this document as follows:

- Montane mixed conifer forest includes the subalpine fir and Engelmann spruce plant associations (cold dry, cold mesic, and very moist biophysical forest types).
- Eastside mixed conifer forest includes the Douglas-fir and Douglas-fir / ponderosa pine plant associations (primarily the hot dry, warm dry, cool dry, and cool mesic forest biophysical forest types).

Table 39, Habitat Types, below, displays the acres of each type of wildlife habitat within the analysis area. The upland aspen forest is located within the coniferous forest types as small groups varying in size from a quarter acre to several acres in size. Acreages and percentages have been rounded, so the totals may not be exact.

**Table 39, Habitat Types**

| Habitat Type | Acres | Percent |
|---|---|---|
| Eastside Mixed Conifer Forest | 26297 | 72 |
| Montane Mixed Conifer Forest | 9890 | 27 |
| Non-forest | 496 | 1 |
| Totals | 36683[15] | 100 |

Currently there are approximately 51 miles of fence in the analysis area (short portions may be natural barriers, such as cliff faces). These fences are made up of pasture, allotments, riparian, and boundary fences. See Appendix A, Maps, BART Analysis Area, Existing Improvements for current fence locations. The current fencing is mostly maintained by the permittees as part of their allotment improvements responsibilities (boundary fence maintenance is between the permittees and the adjacent landowner). Fences are routinely maintained in the early summer before “turn-on” and occasionally throughout the grazing season. Permittees are allowed to repair fences with the aid of vehicles, ATV/UTV’s, horses, hand tools, and mechanical equipment such as chainsaws. Due to the large amount of fence miles, maintenance cannot always keep up with demand, leaving places where trees and animals have damaged the fence. These damages loosen and break the barbed wire and cause the wire to sag, which increases the potential for wildlife to become entangled and subsequently harmed.

There is no critical or proposed critical habitat for any threatened, endangered, or proposed wildlife species to be listed under the Endangered Species Act.

[15] This acreage figure varies slightly from figures used elsewhere in the document due to including some of the “undesignated” acreage not included in Table 3, BART Management Area Acres, page 10. This figure contains about 320 acres of Department of Natural Resource (DNR) land surrounded on three sides by NFS land which is managed in conjunction with this project

This project is in the Interior Columbia Basin Ecosystem Management Project's Northern Glaciated Mountains ERU 7 (Ecological Reporting Unit) (Wisdom et al. 2000). Wisdom et al. (2000) described the broad-scale trends in source habitats for species within the Interior Columbia River Basin. They defined source habitats as those characteristics of macro-vegetation that contribute to stationary or positive population growth for a species in a specified area and time. Current conditions are discussed in more detail for each individual species under the Effects section. This facilitates comparison of the alternatives and effects for each individual species.

## Environmental Consequences

### Direct and Indirect Effects

**ALTERNATIVE1**
The removal of livestock from these allotments would result in positive effects for several wildlife species. Domestic livestock are exotic herbivores that did not evolve in these ecosystems, and neither did these ecosystems evolve with an herbivore that behaves exactly like domestic livestock. Native ungulates, such as mule deer, evolved in the presence of predators such as gray wolves, mountain lions, coyotes, and bears. Wolves have been severely reduced in these ecosystems and are no longer present in sufficient numbers to limit ungulate impacts to vegetation by altering ungulate behavior and populations (Beschta et al. 2012). In ecosystems where wolves have been reintroduced, such as Yellowstone National Park, populations of ungulates such as elk have been restricted and their behavior has changed, although there remains debate on whether the causes are attributable to wolf reintroduction (Smith et al. 2003). It is argued that the elk no longer focus on feeding on riparian vegetation, willows, and aspen and must now distribute more evenly over the landscape to avoid predators.

As with native ungulates, in the absence of major predators, domestic livestock tend to spend most of their time in areas with abundant food and water (riparian areas) and need to be lured away (troughs and salt) or forced out (riding). The no grazing alternative would move these allotments toward a more natural system. By removing the exotic herbivore from the system there would be reduced competition for forage and space. The Forest Plan standards and guidelines regulate how much competition is allowed, but with the absence of domestic livestock, 100% of the forage would be available for native wildlife. Livestock would be absent from riparian areas and therefore, these areas, which provide quality forage, nesting, and fawning habitat, would have an increased potential to provide high quality habitat for native species. With climate change becoming more evident, this alternative would eliminate the stressors that exotic herbivore species have on the landscape and lead to more resiliency throughout all habitats for the native species. Removing or reducing livestock across large areas of public land would alleviate a widely recognized and long-term stressor and make these lands less susceptible to the effects of climate change (Beschta et al. 2012).

Livestock would not be present to disturb wildlife, nor would the associated human presence due to livestock management activities. Existing range improvements would be left to deteriorate. This means water troughs would not have their wildlife escape ramps maintained and consequently there would be an increased danger of small animals drowning. Also, there would be a risk of wildlife entanglement in the fence wire as the fences deteriorate.

**ALTERNATIVE 2**
This alternative would continue grazing at or below the current level with range improvements and adaptive management strategies to meet or move toward meeting the amended Forest Plan Standards and Guidelines, PACFISH/INFISH RMOs, and measurable Desired Future Conditions (DFCs). The implemented adaptive management strategies include: possible construction of an additional 12.6 miles of new fences, the relocation of one mile of existing fence, or reductions in season of grazing if monitoring determines that the allotments do not meet or are not moving towards meeting Forest Plan

Standards and Guidelines and PACFISH/INFISH RMOs. These adaptive management strategies are designed to occur in Stages (generally 2 - 4 years in duration) that would allow adequate time for range improvements to be constructed and evaluated for effectiveness.

**Stage One:** Implementation would begin, as soon as possible, once a decision is signed. Many of the Stage one improvements and pasture resting are continued yearly. The new and reconstructed water developments, spring source fencing, new and relocated fencing, hardened water crossing, and new and relocated corral/pens would benefit wildlife from current conditions. Stage one would benefit wildlife by providing additional watering sites for cattle to avoid heavy concentrations of cattle at the current water troughs. Moving troughs out of riparian areas would avoid excessive hoof shear/trampling and cattle congregation in the riparian areas where ground nesting birds like ruffed grouse nest and mule deer have their fawns. The removal and addition of a corral and fence out of Jungle Creek to a new location along the 3000 road would improve the riparian habitat at Jungle Creek by causing less hoof and vehicle traffic during June (turn-on) and September (turn-off) at the current corral location. The new corral location is better suited for heavy vehicle traffic and is outside the riparian area, unlike the current location next to Jungle Creek. Overall this first stage would result in improvement to habitat conditions and improved forage, nesting, fawning, and distribution for wildlife.

The subsequent Stages, 2 through 4, would include changes in management strategies based on the effectiveness of the range improvements made in previous stages. A monitoring plan would be implemented and measurable trigger points developed to identify when a specific threshold is about to be reached and changes need to be made (See Chapter 2, Mitigation Measures, Management Requirements, and Best Management Practices and the Monitoring Sections, starting on pages 37 and 44).

***The following stages order may be modified based on project monitoring results of the associated stream reaches with the reaches most in need of reducing riparian impacts from livestock scheduled to be completed first. See Chapter Two- Proposed Action for specific details.***

**Stage Two:** Installing a new fence along the north slopes of Jungle Creek and tributaries in the Tunk Allotment would provide an additional pasture for management. In the short term, during fence construction this would cause wildlife to avoid the area where workers are working. In the long term, this additional fence structure would improve overall wildlife forage and riparian habitat by giving range managers the ability to control this as a separate pasture. This added fencing would have a slight negative impact to deer and birds. The added fencing could increase the chance of entanglement to terrestrial species. Proper yearly maintenance would be a key to reducing any negative impacts to wildlife from the added fencing. Overall this second stage would result in improvement to habitat conditions and improved forage, nesting, fawning, security, and distribution for wildlife.

**Stage Three:** Installing a new fence in order to create an additional pasture south of the existing boundary fence between the north and south units in the Tunk Allotment would benefit wildlife in the long term. This additional fence would help range managers have an increased ability to control this allotment by making a separate pasture. In the short term, during fence construction, this would cause wildlife to avoid the area where workers are working. In the long term, this additional fence structure would improve overall wildlife forage and riparian habitat by giving range managers the ability to control this as a separate pasture. This fencing would have a slightly higher negative impact to deer and birds from added fencing compared to Stage Two. The added fencing could increase the chance of entanglement to terrestrial species. Proper yearly maintenance would be a key to reducing any negative impacts to wildlife from the added fencing. Overall this third Stage would result in improvement to habitat conditions and improved forage, nesting, fawning, security, and distribution for wildlife slightly higher than Stage Two.

**Stage Four:** Installing a new fence around the upper Peony headwaters and installing a new fence along

the west side of Patterson Creek would benefit wildlife in the long term. These additional fences would help range managers have an increased ability to control these areas as separate pastures. In the short term, during fence construction, this would cause wildlife to avoid the area where workers are working. In the long term, these additional fences would improve overall wildlife forage, security habitat, and riparian habitat by giving range managers the ability to control these areas from cattle use. This stage would have a slight higher negative impact to deer and birds from added fencing compared to Stage Three. The added fencing could increase the chance of entanglement to terrestrial species. Proper yearly maintenance would be a key to reducing any negative impacts to wildlife from the added fencing. Overall this fourth Stage would result in improvement to habitat conditions and improved forage, nesting, fawning, security, and distribution for wildlife slightly higher than Stage Three.

**Stage Five:** This stage is the last effort strategy to be implemented if stages 2-4 are not determined to be successful based on the monitoring plan (See Table 9, Stage Decision Point Timing on page 31 of Chapter 2). There would be a reduction in the current grazing season within units and there would be total livestock exclusion from fenced areas. This stage would benefit wildlife by having less competition and complete avoidance with cattle from historic areas where cattle and wildlife have intermixed. Overall, this fifth and final Stage, would result in actions leading to less competition, more available forage, and habitat close to what would have occurred historically.

In addition to the specific five Stages, this alternative would improve stock drives by clearing and maintaining them. Vegetative structure, such as in riparian areas, would potentially be improved over current conditions due to better livestock distribution and utilization. Construction and maintenance of these range features, maintenance of the previously built range improvements, as well as the permittees being present to manage their livestock, could disturb wildlife in the area. Permittees would also occasionally be on roads open to administrative use only, thereby potentially disturbing wildlife in areas where motorized use is limited. The disturbance should be low in intensity, and short in duration when it does occur. Range riding by horse, typically has less disturbance than motorized travel.

With climate change becoming more evident based on long term global temperature patterns; this alternative would reduce the stressors by exotic herbivores. Stressors such as shrub hedging, hardwood browsing, and riparian vegetation trampling can be reduced if domestic cattle are managed with added range improvements. These improvements would help the permittees control grazing pastures and lead to more resiliency throughout all habitats for native species in all the allotments. The added 12.6 miles of new fencing would have a slight negative impact on wildlife and their movement because of the added entanglement possibilities, but with proper maintenance, these chances decrease dramatically. See Table 40, Wildlife Effects Comparison by Alternative**,** below, for specific species effects determinations for this alternative.

Typical disturbance that range permittees would cause would result in short-term avoidance of the immediate vicinity around activities related to range maintenance. Although there would be some avoidance, new and maintained fences and water developments would improve habitat conditions. This would result in more forage, nesting, and fawning habitat being available for wildlife in certain locations due to improved livestock distribution. Because this area receives use from recreationists and other forest users, the disturbance associated with livestock management is expected to be relatively minor.

Overall, this alternative would result in improvements to habitat conditions, forage, nesting, security habitat, and fawning habitat, see Table 40, Wildlife Effects Comparison by Alternative**,** below, for specific species effects determinations.

Grazing would continue at levels that meet Forest Plan standards which would retain some of the grass, forbs, and shrubs within these stands. Although the impacts would be less than those seen historically when grazing may have been less regulated, there would still be an impact. These ecosystems did not evolve with

an herbivore that behaves as domestic livestock do, so impacts may be unavoidable as would be expected with an exotic species. These impacts to the ecosystem are sometimes changes in plant species composition and hence, availability for wildlife. However, the proposed grazing levels are not expected to adversely impact wildlife habitat, given the adherence to grazing Forest Plan Standards and Guidelines.

New water developments, combined with the reconstruction of water developments, new fences, and new pastures, would increase livestock controls, improve livestock distribution and improve available forage for livestock and wildlife. This would help reduce livestock impacts to riparian areas such as hoof shear and trampling. There are numerous aspen stands scattered around the different allotments that vary in size, vigor, and composition. Hadfield and Magelssen (2004) found that aspen stands on the Okanogan-Wenatchee National Forest were commonly browsed by cattle and deer, but not severe enough to prevent aspen sprouts from growing into larger stem sizes. Cattle typically browse on aspen during late summer and fall when sugar levels increase with the onset of cold weather, so a redistribution of livestock throughout the allotments would have the benefit of keeping the cattle from browsing these important hardwood sites.

In the long term, this alternative would add human disturbance associated with commercial grazing because of the added fence construction and maintenance. Other human activities would continue as well as the recreationists and other forest users within the allotments.

**ALTERNATIVE 3**

The physical components (ex: fences, new water developments, corrals, etc.) of Alternative 3 is the same as Alternative 2. Alternative 3 would result in improvements to vegetative structure, wildlife habitat and have very similar disturbance as addressed in Alternative 2. The key difference is that this alternative would install the identified new fences, water troughs, and have rested pastures as part of a four to six year implementation process rather than an adaptive management approach. The Bannon, Revis, and Aeneas Allotments would be the same as Alternative 2 except that the changes would occur over a four year period rather than through an adaptive management approach that could take more than ten years. In the Tunk Allotment all of the Alternative 2 changes would be the same except for that the new pastures would be created with new fencing within four years. See Alternative 3 in Chapter 2 for specific details. These new pastures would be rested from cattle grazing until the riparian areas in these pastures meet desired recovery upon completion of the pasture fences. New water developments would be created from identified spring sources to provide additional water sources (see Chapter 2 for specific locations of water troughs).

New and reconstructed water developments, fencing, and corral/pens would aid in improving livestock distribution and reduced competition to wildlife. Stock drives would be cleared and maintained. This would result in improvements to habitat conditions and improved forage, nesting, fawning, and security habitat availability and distribution for wildlife. Overall, vegetative structure, and especially riparian vegetation, would improve over current conditions due to more controlled livestock distribution, utilization, and pasture resting. The construction and maintenance of these new range features, maintenance of the previously built range improvements, as well as the permittees being present to manage their livestock, could disturb wildlife in the area. Permittees would also occasionally be on roads open to administrative use only, thereby potentially disturbing wildlife in areas where motorized use is limited. The disturbance should be low in intensity, and short in duration when it does occur.

Typical disturbance that range permittees would cause results in short-term avoidance of the immediate vicinity by wildlife around activities related to range maintenance. Although there would be some avoidance, new and maintained fences and water developments would improve habitat conditions which would result in more forage, nesting, and fawning habitat being available for wildlife in certain locations due to improved livestock distribution. Because this area receives use from recreationists and other forest users, the disturbance associated with livestock management is expected to be relatively minor.

Short term administrative actions may be used as tools to reduce livestock effects. These adaptive management strategies include salting, changing season of use, changes in animal numbers, changes in number of days available for utilization, rest from livestock grazing, changes in the grazing system, changes in trail routes, and the use of riders on a weekly basis.

With climate change becoming more evident based on long term global temperature patterns, this alternative would reduce the stressors by exotic herbivores. Stressors such as shrub hedging, hardwood browsing, and riparian vegetation trampling can be reduced if domestic cattle are managed with added range improvements. These improvements would help the permittees control grazing pastures and lead to more resiliency throughout all habitats for native species in all the allotments. The added 12.6 miles of new fencing would have a slight negative impact on wildlife and their movement because of the added entanglement possibilities, but with proper maintenance, these chances decrease dramatically. See Table 40, Wildlife Effects Comparison by Alternative**,** below, for specific species effects determinations for this alternative.

Overall this alternative would result in improvements to habitat conditions, forage, nesting, security habitat, and fawning habitat. This improvement would be slightly higher than Alternative 2 because the new rested pastures would be created over a four year time frame. Range management within the new pastures would be able to place cattle in pastures where it is best suited based on suitable and available forage. The ability to graze cattle in smaller, controlled pastures that are specifically designed outside of riparian areas would benefit riparian area health and allow wildlife to forage and use riparian areas as they did before cattle were introduced to the landscape.

**Sensitive Species**

The Bannon, Aeneas, Revis, and Tunk allotments do not contain habitat for the ash-throated flycatcher, ferruginous hawk, harlequin duck, or upland sandpiper. Ash-throated flycatchers, ferruginous hawks, and upland sandpipers are not known to occur on the Tonasket Ranger District. There are no large, open water bodies to support grebes. Harlequin ducks are not known to inhabit the Tonasket Ranger District. This analysis area is below the elevation range for sensitive butterflies such as Lustrous Copper, Melissa Arctic, Subarctic Darner, Astarte Fritillary, Freija Fritillary, Labrador Sulphur, and the Subarctic Bluet. The proposed grazing activities would have “no impact” on these sensitive species.

The following table lists a summary of species analyzed, effects determinations, and rationale. It is named “Table 40, Wildlife Effects Comparison by Alternative.”

**CUMULATIVE EFFECTS**

In addition to the ongoing and future foreseeable projects listed in the beginning of Chapter 3, the State, Federal, Tribal, and private lands adjacent to the National Forest were considered. Again, the habits of the individual species determined the size of the area used for the cumulative effects analysis for that species. All known projects that are reasonably foreseeable within the next decade were included, although additional, currently unknown projects may arise in the future.

**Past Actions**

The most influential management activities has been selective tree harvest, fire suppression, stand replacing wildfire, grazing, noxious weed invasion, and land subdivisions. This has likely resulted in a change in forest and range composition and habitat connectivity.

**Table 40, Wildlife Effects Comparison by Alternative**

| Species Name | Probability of Occurrence | Alt 1: No Grazing | Alt 2: Proposed Action | Alt 3: Grazing w/ changes | Remarks |
|---|---|---|---|---|---|
| **Threatened and Endangered Species** | | | | | |
| **Canada Lynx (*Lynx Canadensis*) T (also MIS)** | **Low** | **NE** | **MANLAA** | **MANLAA** | **There are 22,946 acres (85%) of the Tunk LAU within the analysis area. No lynx known to be present. Potential disturbance to wide ranging carnivores while range management activities occur. Area is linkage to other LAU's and Canada.**<br><br>*alternatives would not contribute to a negative trend in viability on the Okanogan National Forest. |
| **Grizzly Bear (*Ursus arctos horribilis*) T** | **Low** | **NE** | **MANLAA** | **MANLAA** | **Currently not known to be present within the analysis area. Verified occurrence north of project area approximately 35 miles (near Chesaw in 2002). Potential disturbance to wide ranging carnivores while project activities ongoing. Area is linkage between Cascades, Canada, and Selkirk populations. Outside of any grizzly bear recovery zone; Potential for human-livestock-grizzly interaction with a high volume of human recreation activities and grazing periods during non-denning season. See Carnivore Conservation Measures in Chapter 2, mitigation.** |
| **Sensitive Species** | | | | | |
| **American Peregrine Falcon (*Falco peregrinus anatum*)** | **Low** | **NI** | **NI** | **NI** | **No cliffs/rocky outcrops in the analysis area; no peregrines known to use the area.** |
| **Bald Eagle (*Haliaeetus leucocephalus*)** | **Low** | **MIIH** | **MIIH** | **MIIH** | **Not known to nest, but are present in the analysis area. Crawfish lake (80 acres) is present within the analysis area, so potential to prey on fish. Big game winter range (MAs 5, 14, and 26), so potential for carrion. Dead cattle may be source for carrion resulting in disturbance by negative human interactions. It's recommended to follow proper disposal methods addressed in the Carnivore Conservation Measures in Chapter 2.** |
| **California Wolverine (*Gulo gulo luteus*)** | **Low** | **NI** | **NI** | **NI** | **Not known to be present, outside USFWS modeled habitat. No cirque basin or talus denning habitat present. Limited dispersal habitat. Big game winter range (MAs 5, 14, and 26), so potential for carrion. The USFWS published a proposed rule in the Federal Register (Vol.7, No.23/Monday, February 4, 2013) that the distinct** |

| Species Name | Probability of Occurrence | Alt 1: No Grazing | Alt 2: Proposed Action | Alt 3: Grazing w/ changes | Remarks |
|---|---|---|---|---|---|
| | | | | | **population segment of the North American wolverine (Gulo gulo luscus) occurring in the contiguous United States as a threatened species under the Endangered Species Act of 1973, as amended; the BART analysis is outside the modeled habitat.** |
| **Common Loon (*Gavia immer*)** | **High** | **NI** | **NI** | **NI** | **Crawfish Lake is 80 acres; suitable habitat for nesting is very limited. A pair of loons nested in 2012 and 2013 on Crawfish Lake with help from an artificial nesting platform. This is the first documented nesting pair on Crawfish Lake in the past decade. Loons have been regularly seen on the lake during spring and summer months. High densities of recreational cabins surround the entire lake make nesting difficult. No Impact is anticipated with grazing.** |
| **Gray Flycatcher (*Empidonax wrightii*)** | **Mod** | **NI** | **MIIH** | **MIIH** | **Ponderosa pine habitat in the lower elevations; proposed action plans to improve overall range conditions making dry forest sites healthier. Potential disturbance to nests and prey (insects) abundance.** |
| **Gray Wolf (*Canis lupus*)** | **High** | **MIIH** | **MIIH** | **MIIH** | **Increasing potential for wolf presence as animals disperse from the Colville Reservation, Methow Valley, Northeastern Washington, or Canada. None known to be present within the analysis area. In the last 24 months the Colville Tribe has collared four (4) wolves and identified two different packs (Nicin, Strawberry) as part of the state and tribal wolf management plans approximately 6 miles east of the project area. 2011 pictures of two single lone wolves on the reservation 12 miles to the east and on National Forest lands 15 miles to the northeast. A 2010 sighting of a lone wolf in the Pine Creek area 15 miles to the West on private land. Potential for negative human-livestock-wolf interaction. Potential disturbance to wide-ranging carnivores while project activities ongoing. See Carnivore Conservation Measures in Chapter 2.** |
| **Great Gray Owl (*Strix nebulosa*)** | **Mod** | **NI** | **MIIH** | **MIIH** | **Unknown to occur within the analysis area; 2011 and 2012 surveys within the Crawfish Restoration boundary did not find occupancy near best available habitat. Habitat is present. Some potential impacts to prey habitat through vegetation alteration although non-significant.** |

| Species Name | Probability of Occurrence | Alt 1: No Grazing | Alt 2: Proposed Action | Alt 3: Grazing w/ changes | Remarks |
|---|---|---|---|---|---|
| **MeadowFritillary (*Boloria bellona*)**<br>**Peck's Skipper (*Polites peckius)***<br>**Tawny-edged Skipper (*Polites Themistocles*)**<br>**Great Basin Fritillary (*Speyeria egleis*)**<br>**Silver-bordered Fritillary (*Boloria selene)*** | **Mod**<br>**High**<br>**Mod**<br>**Mod**<br>**Mod** | **NI**<br>**NI**<br>**NI**<br>**NI**<br>**NI** | **MIIH**<br>**MIIH**<br>**MIIH**<br>**MIIH**<br>**MIIH** | **MIIH**<br>**MIIH**<br>**MIIH**<br>**MIIH**<br>**MIIH** | **Habitat present in open meadows, marshes, bogs, open riparian areas, and grassy habitat; known to occur on the east side of the County; unknown presence in the project area; potential disturbance if present as well as vegetation alteration within meadows. Exact effects of different grazing intensities or no grazing unknown for habitats within the Tonasket RD, but in other areas studies have shown greater abundance in grazed areas compared to other management regimes (Swengel 1996, 1998). Overgrazing is likely harmful for the species (Miller and Hammond 2007). Peck's Skipper has a known record in Crawfish Lake area.** |
| **Pacific Fisher (*Martes pennanti pacifica*)** | **Low** | **NI** | **NI** | **NI** | **Some montane mixed conifer habitat present; species not currently known to be present in the analysis area or east of Cascade Crest; analysis area lower in elevation than expected for fishers. Potential future reintroduction east of the Cascade Crest has been discussed by wildlife agencies. Until natural or artificial reintroduction occurs east of the Cascades, there is No Impact to Fishers.** |
| **Sandhill Crane (*Grus Canadensis*)** | **Low** | **NI** | **NI** | **NI** | **Not known to be present within the analysis area; some meadows present within the analysis area but no cranes ever documented.** |
| **Sharp-Tailed Grouse (*Tympanuchus phasianellus*)** | **Low** | **NI** | **NI** | **NI** | **Not known to be present within analysis area; Present and historic leks are nearby in the mid elevations of Tunk Valley 4 miles to the west. Project activities would not disturb resident birds.** |
| **Townsend's Big-Eared Bat (*Corynorhinus townsendii*)** | **Mod** | **NI** | **MIIH** | **MIIH** | **Some cliff/rocky outcrops and large snags that may provide roosting habitat for bats. Potential disturbance if present during grazing activities and management. Impacts to vegetation and therefore habitat impacts for insects.** |
| **Western Gray Squirrel (*Sciurus griseus*)** | **Low** | **NI** | **NI** | **NI** | **Not known to occur within the project area or on this block of land on the Tonasket Ranger District. Some ponderosa pine habitat present.** |
| **White-Headed Woodpecker (*Picoides albolarvatus*)** | **Low** | **NI** | **MIIH** | **MIIH** | **Not known to occur within the analysis area; observed male/female pairs in 2008 to the east within previously thinned stands in the Lyman Lake area; pine habitat present. Best potential habitat is in the Bannon and Revis allotments. Potential disturbance to nest trees if dead and defective trees are cut for range fence maintenance and improvements. New fencing may also fall potential nest trees.** |

| Species Name | Probability of Occurrence | Alt 1: No Grazing | Alt 2: Proposed Action | Alt 3: Grazing w/ changes | Remarks |
|---|---|---|---|---|---|
| **Zigzag darner (*Aeshna sitchensis*)** | **Low** | **NI** | **MIIH** | **MIIH** | **Not known to occur within the analysis area. Potential habitat around Barnell Meadow and Lost Creek.** |
| **Management Indicator Species** | | | | | |
| **American Marten (*Martes Americana*)** | **Low** | **NI** | **MIIH** | **MIIH** | **Montane mixed conifer stands are present in the analysis area; although most of the project area is Eastside mixed conifer (drier forests); species not known to be present within the Tunk block or on the east side of the Tonasket Ranger District; Potential habitat at the higher elevations of Bailey Mtn. within the MR Cell and Aeneas Mtn. Potential disturbance mainly by range management activities to wide-ranging carnivores while activities are ongoing.**<br><br>*alternatives would not contribute to a negative trend in viability on the Okanogan National Forest. |
| **Barred Owl (*Strix varia varia*)** | **High** | **NI** | **MIIH** | **MIIH** | **Known to be present; potential disturbance; Impacts to vegetation and therefore habitat impacts for insects and prey.**<br><br>*alternatives would not contribute to a negative trend in viability on the Okanogan National Forest. |
| **Mule Deer (*Odocoileus hemionus*)** | **High** | **NI** | **MIIH** | **MIIH** | **Known to be present; roughly 36% of the analysis area is in Mule deer winter range MAs 5, 14, and 26; summer habitat also present; Forest Plan standard and guidelines for wildlife browse is monitored and managed as per Management Area (MA). Limited competition for resources during permitted grazing periods as deer shift their diet to shrubs and forbs and cattle primarily graze on grasses. With an October 1 turn-off date, early fall browse on hardwoods (aspen and willow) is limited but present. If cows are left to linger and stay past turn off period, the potential for domestic browse on aspen can be negative to new aspen clone growth. The added 12.6 miles of new fence in Alts. 2 or 3 would have a slight negative impact on mule deer and their movement because of the added entanglement possibilities but with proper maintenance these chances decrease dramatically. There are no migratory deer herds in this analysis area making the added fencing for the resident deer population easier to maneuver** |

| Species Name | Probability of Occurrence | Alt 1: No Grazing | Alt 2: Proposed Action | Alt 3: Grazing w/ changes | Remarks |
|---|---|---|---|---|---|
| | | | | | **because of year-round familiarity. Alts. 2 or 3 would have a non-significant effect on mule deer and their winter range.**<br><br>*alternatives would not contribute to a negative trend in viability on the Okanogan National Forest. |
| **Pileated Woodpecker (*Dryocopus pileatus*)**<br>**Three-Toed Woodpecker (*Piocoides tridactylus*)**<br>**<u>Other Primary Cavity Excavators, including:</u>**<br>**Black-Backed Woodpecker (*Picoides arcticus*)**<br>**Downy Woodpecker (*Picoides pubescens*)**<br>**Hairy Woodpecker (*Picoides villosus*)**<br>**Lewis's Woodpecker (*Melanerpes lewis*)**<br>**Northern Flicker (*Colaptes auratus*)**<br>**Williamson's Sapsucker (*Sphyrapicus thyroideus*)**<br>**Yellow-Bellied Sapsucker (*Sphyrapicus varius*)** | **High** | **NI** | **MIIH** | **MIIH** | **Most if not all species present; habitat present; potential disturbance during active stock management activities (turn-on, turn-off, and range management); very minimal impacts on prey habitat for some species that are ground foragers or aerial foragers by grazing itself. Potential disturbance to nest trees if dead and defective trees are cut for range fence maintenance and improvements. New fencing may also fall potential nest trees. Alts. 2 or 3 would have a non-significant effect on nesting and foraging habitat.**<br><br>*alternatives would not contribute to a negative trend in viability on the Okanogan National Forest. |
| **Ruffed Grouse (*Bonasa umbellus*)** | **High** | **NI** | **MIIH** | **MIIH** | **Known to be present; riparian/aspen habitats within the project area; potential disturbance during active stock management activities (turn-on, turn-off, and range management) activities are ongoing and potential trampling of individuals and nests; impacts to habitat from livestock browsing within riparian areas throughout the grazing season. With an October 1 turn-off date, early fall browse on hardwoods (aspen and willow) is limited. If cows are left to linger and stay past turn off period the potential for domestic browse on** |

| Species Name | Probability of Occurrence | Alt 1: No Grazing | Alt 2: Proposed Action | Alt 3: Grazing w/ changes | Remarks |
|---|---|---|---|---|---|
| | | | | | **aspen can be negative to new aspen clone growth. Alts. 2 or 3 would reduce the level of riparian use by cattle as outlined in chapter 2.**<br><br>*alternatives would not contribute to a negative trend in viability on the Okanogan National Forest. |
| **Other Species of Interest** | | | | | |
| **Bighorn Sheep (*Ovis Canadensis*)** | **Low** | **NI** | **NI** | **NI** | **Not known to use the project area; outside of known range on the Tonasket District.** |
| **Blue Grouse (*Dendragapus obscurus*)** | **High** | **NI** | **MIIH** | **MIIH** | **Known to occur within the project area; identified winter habitat on ridge tops within the analysis area outside grazing timeframe; Minor impacts to habitat through vegetation alteration and minimal potential reduction of nesting habitat due to trampling during the grazing season because of a June 1st turn-on time, when most nesting grouse have hatched.** |
| **Northern Goshawk (*Accipiter gentilis*)** | **High** | **NI** | **MIIH** | **MIIH** | **Known to occur within the project area; habitat present; old nests occurred in analysis area, although no active nests identified within the last decade. Potential disturbance if present during range management and improvement activities. Grazing itself will have no impact to nesting habitat or retard the development of large trees.** |
| **Other Migratory Birds (MB)(Land Birds)** | **High** | **MIIH** | **MIIH** | **MIIH** | **A variety of habitats and species present; impacts to vegetation and therefore habitat for birds and their food. The June 1st turn-on date for grazing helps reduce the potential negative effects to nesting habitat. Trampling of nest, reduction of vegetation, and feeding habitat would be assumed.**<br><br>**Based on the Executive Order (EO 13186) a Memorandum of Understanding between the USFS and USFWS was signed in late 2008 (USDA and USFWS 2008) (FS Agreement #08-MU-1113-2400-264). The MOU outlines the responsibilities for both parties regarding migratory birds, including the USFS's responsibilities regarding consideration of migratory birds in NEPA projects. The MOU was used to help guide the development of this effects analysis.**<br><br>**See Land Bird section in the wildlife report for more detailed information.** |

| Species Name | Probability of Occurrence | Alt 1: No Grazing | Alt 2: Proposed Action | Alt 3: Grazing w/ changes | Remarks |
|---|---|---|---|---|---|
| **Other Raptors** | **High** | **NI** | **MIIH** | **MIIH** | **A variety of raptor species likely present; historic raptor nests known to occur within the analysis area; impacts to prey habitat through vegetation alteration.** |
| **Habitats** | | | | | |
| **Connectivity** | **High** | **NI** | **NI** | **NI** | **Connectivity exists to varying extents; This area has been identified as a key wildlife corridor linkage zone in Singleton et al. 2002 and the 2010 Washington Wildlife Habitat Connectivity Work Group Columbia Plateau Eco region report. In Singleton et al. 2002 the BART analysis would have a "cell" with "good" habitat characteristic because of (forested land cover, low human population density, and low road density). No new roads would be constructed under this analysis. This grazing analysis would not impact this key linkage zone.** |
| **LOS/Old Growth** | **High** | **NI** | **NI** | **NI** | **LOS/Old Growth exists to varying extents; would not be impacted by this analysis.** |
| **Seral Stage Analysis** | **High** | **NI** | **NI** | **NI** | **The different seral stages exist in varying quantities; would not be impacted by this analysis.** |

NE = No Effect
MANLAA = May Affect, Not Likely to Adversely Affect
NI = No Impact
MIIH = May Impact Individuals or Habitat, not likely to result in a trend toward federal listing or loss of viability.
E = Endangered
T = Threatened
MIS= Management Indicator Species
* = Management Indicator Species viability determination for the Okanogan National Forest
Records come from electronic databases, GIS, records on file at Tonasket RD, and local knowledge.

The following past management activities are broad-based and have occurred on federal, state, and/or private lands. This may have resulted in minor, negative, or beneficial effects on some wildlife species and their habitats.

Timber harvests have generally included changes in vegetation composition and structure, which includes reductions of large ponderosa pine and increases in denser stands of small to medium size ponderosa pine with grand fir and Douglas-fir. These treatments have resulted in reduced populations of species associated with open stands of large ponderosa pine and Douglas-fir, and increased populations of species associated with denser stands. Wildlife species more dependent on the herbaceous component or early seral conditions may have benefited from such actions.

Loss of snags and coarse woody debris (CWD) from previous timber harvests and public firewood gathering has negatively affected species associated with these structural components.

Road construction has negatively affected wildlife species through direct habitat loss and displacement, as well as indirectly affecting species through increased human disturbance.

Increased public recreation has affected wildlife species due to increased human disturbance.

Fire suppression has resulted in denser forested stands benefiting species associated with these conditions while negatively affecting species associated with more open, fire-dependent conditions.

Livestock grazing has modified ground nesting cover and big game forage in some areas. Range improvements such as fences have added additional obstacles for wildlife species to navigate through.

Large wildfires have resulted in short and long-term changes in cover types that may affect seasonal movements of terrestrial wildlife.

Noxious weed invasions due to ground disturbance have impacted and continue to affect wildlife habitat in site specific areas.

**Present/Reasonably Foreseeable Future Action**

Future actions that may cumulatively affect the wildlife resources in relation to past and present actions are as follows: livestock grazing on public and private lands, forest management activities on private and public lands, recreation such as ATV use and trails, firewood cutting, and fire suppression. Inclusive to these actions, is the ongoing and future development of subdivisions surrounding the project area. These actions are similar to those that have occurred in the past, but may not sustain the same level of effects due to new research findings and techniques, monitoring, and mitigation measures.

**Alternative 1**

In the case of the No Grazing Alternative (Alternative 1), grazing would cease on these allotments. That would cause a decrease in grazing related impacts to wildlife within this block of National Forest System lands. There would be less competition for resources and less disturbance from grazing management activities and non-native ungulates. There may still be incidental grazing from “trespass” or unauthorized livestock grazing. The only expected cumulative effects would result from the deterioration of existing range fences, water developments, and corrals. Wildlife would no longer have the access to developed watering systems as a drinking source. Fences and other similar structures would deteriorate to form wildlife entrapments with wire or debris. Wildlife escapement ramps in water troughs would deteriorate consequently increasing the likelihood of small animals drowning.

**Alternatives 2 and 3**
Livestock grazing would continue into the future within and adjacent to the project area. As described in several recent publications (Abella et al. 2007, Binkley et al. 2007), past heavy livestock grazing in ponderosa pine ecosystems aided in the loss of old growth habitats. Livestock reduced fine fuels, and reduced competition of grasses, forbs, and shrubs on sapling trees. This resulted in dense stands that are more prone to insects, disease, and high severity fire. The change in understory vegetation and biodiversity may take a long time to recover.

The activities considered for cumulative effects are described at the beginning of Chapter 3. However the continued forest uses such as recreation (hunting, ATV, camping, hiking, horseback riding, etc.), firewood gathering, timber sales, wildfire and prescribed fire are all things which are usually mitigated through project planning. The cumulative effects of ongoing road maintenance occurs across the analysis area which may include (grading, culvert cleaning, hazard tree felling, etc.) would have a minor short term avoidance by wildlife. Noxious Weed control measures are unlikely to affect wildlife by adding human disturbance by foot and motor vehicles including areas closed to public vehicle traffic. Special Use Permits (new or the existing underground ones such as power and phone lines) are unlikely to affect wildlife because they require mitigation designed to eliminated or reduce the effects in project planning such as timing restrictions and avian reflectors.

Grazing, timber harvest, fire suppression, and recreation, would continue on the adjacent land ownerships. Wildlife habitat would be altered positively or negatively, depending on the species' requirements. The effects are described in Table 40, Wildlife Effects Comparison by Alternative, above. Additional disturbance is likely to result from the human presence in those areas.

The southern part of this project area is adjacent to the Colville Indian Reservation border. Similar activities may occur on the reservation as do on National Forest System lands and other ownerships. Timber management, fuels reduction, grazing, and recreation all can be expected to occur. Impacts of these activities would be similar to that elsewhere on National Forest System lands. Disturbance due to human presence and noise can be expected, as well as habitat alteration through vegetation management and grazing. This habitat alteration may be beneficial for some wildlife species and not for others.

The new Access and Travel Management Plan is in progress, and there would be some intermixture of effects with this project. The proposed action for the Access and Travel Management Plan is similar, or even more restrictive, for motorized access within the analysis area than the existing Travel Plan. Roads would be closed to motorized access unless designated open. Instead of entire areas being open to cross-country travel, only access to identified dispersed camping sites or up to 300' corridors along open routes would be allowed. There would be some intermixture of effects to habitats because motorized use would be restricted to designated routes and would therefore reduce the impacts on vegetation and therefore wildlife habitat.

Overall, the incremental cumulative effect of this project would be minor for Alternatives 2 and 3, but slightly greater than the No Grazing Alternative. Both habitat and wildlife condition would be improved. Consequently, there may be increased wildlife use of the allotments due to improved habitat conditions. Climate change may add an additional stress to the landscape into the future if exotic and native herbivores continue to utilize the analysis area at the levels they currently do.

Table 40, Wildlife Effects Comparison by Alternative, above, summarizes the species analyzed in this document, the effects determination for each, and the rationale. A written discussion of the effects for each species can be found in the full specialist's report in the project file. Species occurrences comes

from historic Tonasket Ranger District data, other state and federal databases, and local knowledge. Unique habitat types, such as old growth, are also analyzed in a separate section following the species analyses in the full specialist's report in the analysis file.

Grizzly bear and Canada lynx are the only federally listed Threatened or Endangered species that may be present within the analysis area. The BART grazing project is located outside established grizzly bear recovery zones and lynx critical habitat. The nearest grizzly bear sighting was 25 miles north near the town of Chesaw on private lands in 2002, but none since. The project is located within the Tunk Lynx Analysis Unit, and there are no lynx currently known to be present. Because the presences of both of these species can't be ruled out, it is assumed that this project may have impacts to both species because this area has been identified as a linkage "corridor" between the North Cascades and known populations to the east and north into Canada (Singleton et al. 2002, WHCWG 2010). This project would not hinder the recovery of both federally Threatened species, and the determination for both is that the project May Affect, but is Not Likely to Adversely Affect.

**Forest Plan Consistency**
The proposed action is consistent with the forest wide wildlife standards and guidelines, management area standards and guidelines (MA5-11B, 14-11A, 25-11E, and 26-11A and B) and forest wide deer cover percentages for summer and winter ranges.

## Cultural Resources

### Introduction

The following section summarizes the existing condition information, along with the direct, indirect, and cumulative effects from the Bannon Cattle and Horse (C&H), Aeneas C&H, Revis C&H, and Tunk C&H Allotments (herein referred to as BART), as analyzed in the Cultural Resources Specialist Report, by Lindsey Smith, Assistant Forest Archaeologist. Reference information is contained in the full specialist report in the analysis file. Regulatory Framework can be found in Appendix G, Regulatory Framework, of this FEIS.

### Consultation with Tribes

Many of the previously described laws, regulations, and directives instruct the Forest Service to consult with American Indian tribes, the State, and other interested parties on the cultural resource management process. Consultation on the BART grazing analysis has been conducted in accordance with NHPA, NEPA, and Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments". Government to Government consultation letters were sent to the Confederated Tribes of the Colville Reservation and the Yakama Nation on May 4, 2012 and November 26, 2012. To date, there have been no concerns raised during scoping regarding the effects of grazing activities on cultural resources.

Documentation of compliance with the NHPA in accordance with the 1997 Programmatic Agreement is contained in District files. The project received a "No Adverse Effect Determination.

### Scope of Analysis

The BART grazing analysis area of potential effect (APE) includes all National Forest system lands administered by the Tonasket Ranger District that are within the designated boundary established for this project. The cultural resources effects analysis, including cumulative effects, focuses on cultural resources

identified within the project boundaries. The proposed action would not have indirect effects (i.e., visual, auditory, atmospheric) on cultural resources that are outside of the proposed analysis areas.

No specific issues were raised relating to cultural resources. Cultural Resource surveys and effects relate to meeting existing laws, regulations, and directives.

**Existing Condition**

Cultural resources are fragile, non-renewable resources that chronicle the history of people traversing and utilizing the natural landscape. Cultural resource identification efforts in the BART allotments have focused on three primary types of resources: prehistoric archaeological sites, historic archaeological sites, and traditional cultural properties (TCPs), which are valued places to contemporary Indian and non-Indian communities. Cultural resource identification efforts have included pedestrian field inventories, literature reviews, traditional cultural properties research, Geographic Information Systems (GIS) analysis, and consultation with American Indian tribes that are historically associated with the area. The Okanogan-Wenatchee National Forest defines cultural resources as a locus of purposeful and interpretable human activity containing physical manifestations of that activity (i.e. one or more features with or without artifacts; one or more formal tools found in association with other cultural materials; diverse cultural materials in densities beyond the level of one or a few lost artifacts; or physical manifestations of human activity that in the professional opinion of an archaeologist are indicative of purposeful human activity). These resources are typically at least 50 years old and are considered valuable if they have yielded or could yield scientific or scholarly information important in prehistory or history.

Twenty (20) previous cultural resource surveys and inventory projects have taken place within portions of the BART analysis area. These surveys amounted to approximately 7,127 acres of 100% intensive pedestrian survey and the discovery of 26 cultural resources. In accordance with the 2006 *Grazing Allotment Review Strategy for Section 106 Compliance* an additional 330 acres were surveyed at 100% for the BART Grazing Analysis. This survey investigated all locations of the proposed undertakings outlined in Alternatives 2 and 3. In addition, surveys for cultural resources occurred at all water developments, spring sites, proposed fence locations and proposed fence removal locations within the BART Allotments (see specialist report for list of locations). These surveys resulted in the recordation of two (2) new cultural resource sites. All 28 cultural resources found within the BART allotments date to the late 19$^{th}$ and early 20$^{th}$ centuries. No cultural resources dating to the prehistoric (Pre A.D. 1750) or proto-historic (A.D. 1750-1811) periods have been recorded within the analysis area.

The most commonly observed cultural resources within the BART grazing analysis area are historic features associated with late 19$^{th}$ and early 20$^{th}$ century homesteading and livestock grazing and early 20$^{th}$ century Forest Service land management. These features include cabins, corrals, troughs, water developments, seasonal camps, refuse dumps, utility corridors, and lookout towers. Homesteaders moved into the Aeneas Valley area and developed the communities of Anglin (northwest of the BART allotments), Synarep (west of the BART allotments) and Aeneas (east of the BART allotments), following the opening of the area to mineral entry and settlement. Homesteaders also settled in the Chewiliken and Tunk Valleys west of the BART analysis area. Several cabin sites occur within the BART allotments along Peony Creek and near Barnell Meadows and Lost Creek. Forest range allotment records reflect permitted cattle, sheep and horse grazing within the BART allotments along the primary water ways (Peony, Aeneas, Barnell and Lost Creeks).

Following a number of devastating wildfires in the early 1900s the Forest Service actively began establishing lookout towers. During the early 1930s a lookout tower was constructed on Tunk

Mountain and a tent cabin and crow's nest were established on Bailey Mountain. Historic phone lines were constructed to each tower to allow communication between the lookouts and Ranger or guard stations. The tent cabin on Bailey Mountain was destroyed in the 1950s and the original lookout on Tunk Mountain was replaced in 1966 with the current lookout that is now under private ownership. Additionally, the Tunk Mountain site continues to be used by multiple agencies as the location of communication towers and associated structures.

Complete site avoidance is the preferred method of management for cultural resources that have yielded, or may have the ability to yield scientific data. Due to the nature of grazing activities, the sites within the BART APE cannot always be avoided. If negative impacts from grazing are identified, the adverse effects to cultural resources would be mitigated or eliminated by amending grazing practices authorized in the permit.

The NHPA, NEPA, and other authorities require that federal agencies consider the impact of their actions on cultural uses of the natural environment such as those practiced by present-day communities of American Indians. Resources of contemporary tribal interest may include traditional cultural properties (TCPs), areas important for the practice of Indian religion, Indian sacred sites on federal lands, and areas that support cultural uses of the natural environment (i.e. subsistence use of plants, water or animals). An ethnographic overview was conducted in 2012 for lands in the southwestern and central portions of the BART grazing analysis area (see specialist report). The primary purpose of this investigation was to document the presence or absence of TCPs or other areas of traditional or cultural use for the Confederated Tribes of the Colville Reservation. The report summarized a thorough literature review including historic documents, archaeological site records and reports and anthropological texts available through the Washington State Department of Archaeology and Historic Preservation (DAHP), the Okanogan-Wenatchee National Heritage Program, the Okanogan County Historical Society, and the Washington State University Library. Bibliographic resources pertaining to the region were reviewed for information regarding cultural landscape, traditional world views, traditional religious views and practices, subsistence practices and rituals, the occupancy of land, and the use of resources. The study found no TCPs or traditional tribal use or gathering areas within the southwestern and central portions of the BART grazing units. To date, neither the Confederate Tribes of the Colville Reservation or the Yakama Nation have identified TCPs or traditional gathering or use areas within the BART allotments.

**Environmental Consequences**

**Direct and Indirect Effects**

**ALTERNATIVE 1**

The No Grazing Alternative would have no direct and little indirect effects on cultural resources. Under this alternative, grazing would cease on National Forest System lands. Range improvements such as fences and water troughs would be allowed to deteriorate and stock trails would not be maintained. This alternative would virtually eliminate the likelihood of livestock disturbance and damage to cultural resources. However, as a consequence of no grazing, heavier fuel loads from an increased growth of forage could intensify the risk of wild fires. Wild fires have the potential to negatively affect the physical integrity of archaeological sites and historic properties. Ground fires would pose the greatest hazard to fire sensitive cultural resources, as sites with moderate to high fuel loads could experience higher temperature, and longer lasting burn overs. Cabins would be most vulnerable, as the historic range developments tend to be in wet areas or within stream flows. This alternative offers low impact preservation-in-place management for existing cultural resources regardless of their eligibility.

**ALTERNATIVES 2 and 3**

Livestock grazing may cause direct and indirect impacts to cultural properties resulting in physical changes to the resource. Areas where livestock tend to congregate (e.g. bedding grounds, water sources) may have a higher likelihood of containing buried cultural deposits because these locations would have been attractive for settlement and/or repeated use over time. Concentrated livestock activity in areas featuring springs, seeps, and terraces could cause negative impacts to cultural materials. The types of impacts that can occur are:

- Trailing, which can displace and/or break artifacts, and denude vegetation thereby destabilizing the soil causing erosion or compaction
- Wallowing, which causes subsurface disturbance to cultural resources containing buried deposits thereby compromising the stratigraphic integrity of a site
- Trampling, which causes artifact displacement and breakage
- Rubbing, which causes damage to standing structures

Livestock related range improvements can also impact sites. Impacts can be direct (e.g. the construction of a corral on an archaeological site) or indirect (e.g. the placement of a salt lick or water trough in an area that will concentrate stock use near cultural resources). Since the Grazing Alternatives would not change the intensity of grazing, and would disperse livestock across the allotments, and would manage use according to the AMPs, no additional impacts to sites from grazing within the analysis area are expected.

Under Alternatives 2 and 3, a number of site-specific range developments have been proposed in the BART allotments. These developments include the construction of new fence lines, the replacement or repair of old fence lines, the removal, replacement or repair of cribs, troughs and corrals, and the enhancement of water development features and spring sites. The locations of all proposed site-specific actions identified in Alternatives 2 and 3 were field surveyed for cultural resources. Following survey, an analysis of effects to cultural resources within the BART Allotments was documented in a specialist report. No cultural resources were found in the immediate vicinity of the site-specific proposed action APEs. Therefore, these activities would have no effects to cultural resources. Furthermore, the proposed riparian protection undertakings and spring development modifications could eliminate potential cattle impacts to subsurface cultural resources by closing sensitive wetlands and riparian areas to grazing. The proposed rest, rotation system would likely improve vegetation conditions by stabilizing the soil around cultural resources that could be indirectly affected by erosion.

Under Alternatives 2 and 3, permit renewal provides for the continued monitoring of grazing practices, archaeological review of proposed range projects, and inspections of known or newly identified cultural properties in the allotments. The results of this work would trigger adjustments in management practices (as appropriate) to ensure that cultural resources are considered and managed to standard. Vegetation cover is the primary source of protection for the surface condition and integrity of archaeological sites. Cultural resources within the BART allotments will continue to be monitored for soil stability and integrity. Cultural materials are not likely to be affected in areas where surface vegetation remains intact to protect soil integrity. Specific direction concerning the continued management of grazing-related features, or activities near known cultural resources in the BART APE would be addressed in Annual Operating plans. In the event that cultural resources could not be avoided or protected, appropriate mitigation measures for the affected cultural resource would be devised in consultation with the SHPO, American Indian tribes, and permittees.

**Cumulative Effects**

**Common for all Alternatives**

Past and future forest management projects have the potential to impact cultural resources within the BART grazing analysis area. Typical vegetation management activities, such as timber harvesting, thinning, fuels management, and vegetation reduction, as well as other activities like fence repair, culvert replacement and stock water enhancement can cause surface disturbance that may affect the integrity of cultural resources. Implementation of activities outlined in the two action alternatives should prevent, or at least reduce impacts that may affect cultural resources within the allotments. However, the cumulative effects of land and resource management undertakings, unauthorized surface collecting and/or illegal digging, and natural erosion would still be evident at these sites.

Under **Alterative 1** (No Grazing), grazing would not contribute to the cumulative effects of long term impacts to cultural resources within the BART analysis area. Eliminating livestock grazing within the BART allotments could contribute to an increase in fine fuels that would support more frequent wildfire. Frequently occurring wildfire would cumulatively affect cultural resources, especially fire-sensitive sites, as features or artifacts were burned away during repeated events. Additionally, intensive wildfire would remove protective vegetation cover, exposing archaeological sites and increasing the risk of subsequent soil erosion. However, a return to a fire-dominated, naturally managed environment may actually reduce heavy fuel loads and have beneficial long term effects of fire on cultural resources.

All project undertakings identified under **Alternatives 2 or 3** will avoid National Register eligible or potentially eligible cultural resources per Section 106 of the NHPA. Ground disturbing management activities within each allotment currently avoid all known cultural resources. Any potential impacts that cultural resources might incur from foreseeable future actions within the BART allotments would be mitigated per the 1997 Programmatic Agreement with the Washington State SHPO.

**Consistency with Direction and Regulations**

Heritage and Tribal interests are regulated by federal laws that direct and guide the Forest Service in identifying, evaluating and protecting cultural resources. All of the alternatives would comply with federal laws. The Okanogan-Wenatchee National Forest Plan tiers to these laws, therefore the proposed action alternatives meet Forest Plan Standards. With the completion of the cultural resources inventory under the terms of the 1997 Programatic Agreement with Washington SHPO, the Grazing Allotment Review Strategy for Section 106 Compliance, which implements the Regional Forester policy letter of May 19, 2006, “Grazing Permit Reauthorization and National Historic Preservation Act” (Goodman 2006), and by providing the interdisciplinary team with appropriate input as per NEPA, all relevant laws and regulations have been met.

## Recreation

The section below summarizes the existing condition information, along with the direct, indirect, and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed and prepared by Elizabeth Peterson, Recreation and Vegetation Management Staff. Reference information is contained in the Recreation Baseline report, which is held in the analysis file for the BART Grazing Analysis project. The Regulatory Framework can be found in Appendix G of this FEIS.

**Issue:** Permitted domestic cattle livestock grazing may conflict with recreational use of camping areas.

**Indicator:** Evidence of domestic cattle livestock activity in camping areas used for recreation.

**Scope of the Analysis**

The scope of the analysis for direct, indirect, and cumulative effects to recreation is the BART Grazing Analysis project area. The analysis area for the recreation resource covers National Forest System lands in the allotments. The time period considered for cumulative effects is up to 15 years into the future. The BART Analysis area is in a moderately popular recreation area on the Tonasket Ranger District.

**Existing *Condition Summary***

The BART Grazing Analysis area is in a moderately popular recreation area on the Tonasket Ranger District. The most popular forms of recreation in the analysis area include camping at the Crawfish Lake Campground, camping in a dispersed site, hunting, ATV riding, and snowmobiling.

**Background**

***CRAWFISH LAKE CAMPGROUND***
The Crawfish Lake Campground is a 19-site campground located on the shores of Crawfish Lake. Each site has a picnic table, fire grate, and parking spur. There are two outhouses and a bulletin board. Approximately 500 people camp there each year. The campground is nearly full, every weekend and holiday between Memorial Day and Labor Day, and during the general firearm hunting season in October. Week days see the campground about half full. The first campers usually arrive in early to mid-May, and the end of general firearm season marks the end of camping each fall.

Crawfish Lake is a small lake popular for fishing from shore or from small boats. It is the main draw for people using the campground, and for others who visit the lake on day-trips. There is a small parking area and native-surface boat launch, but no other improvements (such as docks) on the lake. A fence to prevent cattle from getting into the campground area is currently located east of the campground in Section 33.

***DISPERSED CAMPING***
Some of the visitors who camp in the project area prefer to not stay in a developed campground, but instead pull off one of the roads and set up camp among the trees. This dispersed camping is especially popular during the general firearm season in October, and with large groups looking for a place where everyone can camp together throughout the camping season. Most of these campers stay in some sort of recreational vehicle, although some stay in tents.

There are scattered dispersed camping sites in the project area. The sites include an access road leading to a parking area with little to no ground vegetation and a campfire ring. Some sites also have minor structures constructed, such as poles for hanging game, primitive outhouses, or pole structures to support tarps. The campsites are small - generally less than one acre. They are scattered throughout the project area along open roads, such as the site near the Bannon corral and the site adjacent to the 3010 road. A more developed dispersed site is located at Aeneas Springs. This site does have a toilet facility. Currently there is a partial fence located around Aeneas Springs that was intended to prevent cattle from getting into the dispersed site. This fence is inadequate as cattle have numerous opportunities to breach that fence. The fence needs to be rerouted and maintained in order to facilitate exclusion of cattle.

During the general firearm season, in October, many of the existing sites are used, with occasional new ones becoming established. For the remainder of the summer, the sites are very rarely used. The amount of area used for dispersed camping is increasing slowly over time as the number of people coming to the project area increases. The number of people recreating in the project area has been increasing (Interagency

Committee on Outdoor Recreation, 2013). Most people have their "favorite spots", and camp there year after year. If their spot is taken when they arrive, they generally move to another spot, or make a new one.

The Interagency Committee on Outdoor Recreation for Washington State estimates that, there has been a 10 point increase in the number of people camping in dispersed sites, and a 9 point increase in the number of people hunting (Interagency Committee for Outdoor Recreation, 2013). Since the most concentrated use period in the dispersed campsites is during hunting season, the overall number of people using dispersed sites will likely increase. During general firearm season, there will be a gradual increase in the number of people in the project area, and the number of people using dispersed campsites. Outside of hunting season, the estimated increase in the number of people will not exceed the capacity of the existing dispersed sites.

The structure of the forest influences the size and location of the dispersed campsites. Surrounding trees and vegetation limit the size of existing sites, and new sites are generally only established in open stands where people can drive a vehicle to a clearing in the forest.

There are currently no limitations on people driving off an existing road to an established or new campsite.

***HUNTING***
Deer hunting during the general firearm mule deer season in October brings the highest number of people to the project area at one time. Most hunters come to the area three to five days before the season begins, and set up camp at a dispersed campsite, or in Crawfish Lake Campground. Many stay throughout the season (two to three weeks long) while some just stay for the weekends, some leave after they get a deer, and others come to the project area to hunt, and stay elsewhere. The hunters drive the roads, walk cross-country, or use ATVs to canvas the area. Bear and bird hunters also visit the area during those hunting seasons as well as the members of the Colville Confederated Tribes. Most of the people have been coming to the project area for generations.

***ATV RIDING***
Located in the project area is the Bannon Mt. Trailhead which accesses old roads and trails off of the 3010 road system for recreational ATV riding. Currently, any closed road can be used by ATV riders as well. ATV use is moderate in the area and most riders stay on the roads or trails. Occasionally, some illegal cross-country use does occur, but the damage is minimal in most areas.

***SNOWMOBILING***
Roads 3000, 3000100, and 3000200 are part of the groomed snowmobile network on the Tonasket Ranger District. Each year, snowmobilers access the area from the Crawfish SnoPark, located at the intersection of roads 3000 and 3000100. Most of the traffic is on the groomed routes.

**Environmental Consequences**

**Desired Condition**

The desired conditions for recreation resources are:

- Opportunities for a wide variety of recreation experiences
- Recreational user conflicts with other users is reduced or addressed
- Recreational areas are managed in an environmentally responsible manner

**Direct and Indirect Effects**

**Alternative One -No Grazing**
There would be no short-term or long-term impacts to the people camping in the campground, dispersed sites, hunting, or snowmobiling if the proposed action is not implemented. Recreation fences around Crawfish Lake and the Aeneas Springs dispersed camping site would not need to be maintained to keep cows out of those areas since they would no longer be present. ATV use would continue.

**Alternative Two – Proposed Action**
There would be no direct or indirect effects to hunting and snowmobiling with implementation of the proposed action since these activities are during periods of time when cows should not be present. There would be no closures of the campground, dispersed campsites, or roads, so the existing opportunities would continue. The recreation fence around Crawfish Lake would continue to need maintenance to keep cows out of that recreation site. Installation of a fence in the Aeneas allotment north of Road 30 in this alternative would eliminate the need to maintain the additional fence around Aeneas Springs dispersed site to keep cattle out. Recreationists could sometimes encounter cattle and the evidence of cattle presence (i.e. signs of grazing, cow manure, bare ground) in places where camping may occur. ATV riders would still encounter cattle when riding in the area.

**Alternative Three**
There would be no direct or indirect effects to hunting and snowmobiling with implementation of this alternative. There would be no closures of the campground, dispersed campsites, or roads, so the existing opportunities would continue. The recreation fence around Crawfish Lake would continue to need maintenance to keep cows out of that recreation site. Installation of a fence in the Aeneas allotment north of Road 30 in this alternative would eliminate the need to maintain the additional fence around Aeneas Springs dispersed site to keep cattle out. Recreationists could sometimes encounter cattle and the evidence of cattle presence (i.e. signs of grazing, cow manure, bare ground) in places where camping may occur. ATV riders would still encounter cattle when riding in the area.

**Cumulative Effects**

**Past, Present, and Reasonably Foreseeable Actions**
This cumulative effects analysis considers effects of past, present, and reasonably foreseeable future actions within the Allotment boundaries. The geographic boundary for the cumulative effects analysis are the Allotment boundaries, and the temporal boundary is the period of time when the activities associated with this project are occurring and fifteen years into the future. The only activity that would have a longer term temporal boundary is changes to the road system. Closing, opening, or decommissioning roads would continue to affect recreation. No proposed actions in the BART project would affect road management except a few additional gates and /or cattle guards would be encountered.

**Timber Sales -** The Bureau of Indian Affairs on the Colville Reservation has implemented a timber sale within 3 miles of the Reservation boundary adjacent to the analysis area. This timber sale would not have any foreseeable recreational effects on the Crawfish area unless fences were damaged enough to allow cattle to enter the Crawfish Lake campground.

Road closures associated with ongoing projects such as Bailey Restoration and Crawfish Restoration could have a future effect on dispersed recreation and hunting activities in the project area by limiting access for those wanting to camp near a road or those using roads to access hunting areas.

Winter harvesting of the Crawfish Restoration project within the analysis area could have a short term effect on winter recreation, particularly snowmobiling where the roads have been plowed for harvesting activities.

**Road Management -** The Access and Travel Management Plan for the Okanogan-Wenatchee National Forest is currently in process. The proposed action for the Access and Travel Management would be more restrictive on motorized use within the analysis area than is currently in place in the Forest Travel Plan. Under the Access and Travel Management Plan, roads would be closed to motorized use unless designated open. Only access to designated dispersed camping sites or within the 300 feet corridors along open routes would be allowed. This could have an effect on the access to existing dispersed sites for camping and hunting activities.

**Alternative One – No Grazing**
Camping in the Crawfish Campground and in any dispersed site would be free of grazing cows. The only cows that could be a concern are those on private land or from the adjacent Colville Reservation that may wander near the area. Current fences would not be maintained.

**Alternative Two – Proposed Action**
Installation of a fence in the Aeneas allotment north of Road 30 would eliminate the need to maintain an additional fence currently around the Aeneas Springs dispersed site to keep out cattle. No changes are scheduled for the current fencing near Crawfish Lake.

**Alternative Three -**
As in Alternative Two, the installation of a fence in the Aeneas allotment north of Road 30 would eliminate the need to maintain an additional fence currently around the Aeneas Springs dispersed site to keep out cattle. No changes are scheduled for the current fencing near Crawfish Lake.

**Summary**

The effects of the BART Grazing Analysis project, when combined with effects from other past, present, and reasonably foreseeable actions and events in the cumulative effects area, would not have any substantial adverse effects on recreation resources. Overall, no substantial adverse effects to public recreational use of the area campground, trails, and dispersed sites are expected from this project.

**Forest Plan Consistency**

The proposed activity is consistent with the Okanogan National Forest Plan standards for recreation in Management Area 5 where livestock grazing is permitted and Management Area 17 (Crawfish Lake Campground) where livestock grazing is generally only permitted when it is compatible with site objectives.

## Social and Economics

The section below summarizes the existing condition information, along with the direct, indirect and cumulative effects from the Bannon, Aeneas, Revis, and Tunk Grazing Analysis project, as analyzed and developed by Christina Bauman, District Range Management Specialist, Carol Ogilvie, Invasive Plant Specialist, and Washington Office Economist Kawa Ng. Reference information is contained in the Social and Economic Baseline report, in the analysis file for the BART Grazing Analysis project. Regulatory Framework can be found in Appendix G, Regulatory Framework, of this FEIS.

## Introduction

One of the Forest Plan and National Forest grazing permit program goals is to provide stability to local ranch operations. Permittees within the analysis area are dependent on Forest-administered rangelands. National Forest allotments are an important part of the total year-round ranch operation. They provide high quality forage for cow/calf herds at a time when home pastures are growing and being harvested for winter hay. The objective of this report is to describe the existing conditions of the social and economic environment and address environmental justice issues, and the social and economic consequences of the alternatives.

The social and economic implications of forest resource management are of interest to local residents surrounding the forest, users of the forest, and to people throughout the United States. Residents in Okanogan County will be most likely to experience the direct social and economic impacts of the BART AMP project. Visitors to the Forest may also be affected while recreating in the analysis area. Future forest management issues will be of interest to people both locally and nationally. These issues are discussed and analyzed by alternative in the following social and economic analysis.

## Background

Scoping for this project highlighted social and economic concerns related to potential disturbance of historic range use, and the potential effects on local economies and lifestyles due to changes in livestock grazing practices.

Communities in Okanogan County have historical ties to agriculture. For many residents, ranching is more than just a form of employment; it is a way of life and supports long-standing family traditions. Livestock grazing within the Baily, Aeneas, Revis, and Tunk (BART) livestock grazing analysis area has economic and social importance to these communities. These allotments support agricultural jobs and income as well as the ranching way of life for many families. However, due to the multiple use nature of National Forest System (NFS) lands, grazing may conflict with other land management goals such as providing healthy ecosystems and recreational opportunities, as clearly expressed through comments received for this project. There is conflicting support locally for this multiple-use management.

However, in general most commenters expressed concern for the wellbeing of the forest ecosystems. Below are some examples from comments received.

"We love the land and our way of life or we would have left it decades ago. The meadows, riparian areas, and creeks look like they did 70 years ago. We feel that we have a love for the land around us and work hard to maintain the grass, fences, water, etc. and always have. We hope some of our children will be able to follow in our footsteps."

"Make sure that we are not only protecting the land for its native inhabitants but also ensure that this land is as worthy of enjoyment for generations to come. "

"We agree with the intention to meet Forest Plan Standards while still providing opportunities for livestock grazing."

"The BART EIS mentioned a potential reduction of AUMs. A reduction of AUMs will cause a negative economic impact to the economy of Okanogan County".

"…In the current economy, if we do not have the National Forest permits, to put it bluntly, we will lose our way of life and quite frankly, our livelihood".

Several comments brought forward questions about the ability of the Forest to follow through with the selection of either action alternative in light of declining Federal budgets and reductions in personnel. Concerns included the Forest's ability to effectively administer the permit, ensure needed monitoring was conducted, and ensure that proper evaluation of key areas was completed. It is impossible to forecast the financial situation the Forest will be working under and, therefore, the question of whether budgets will provide what is needed to perform these duties cannot be answered. However, this analysis does compare between alternatives, estimates of these administrative costs so that the impacts to administrative duties can be viewed.

Other comments received expressed concern about how fencing would be paid for or completed. FSM 2240 establishes allowable uses for Forest appropriated funds and identifies allotment infrastructure management cost responsibilities. In summary, costs of materials, labor, and maintenance of infrastructure is the onus of the benefiting party or activity. As such, permittees are responsible for costs associated with infrastructure supplies, labor for installation, and maintenance needed for allotment management, while the Forest retains cost obligations associated with all resource protection fences identified. This analysis compares the costs for fence infrastructure across alternatives and by year.

Some comments received expressed support for the proposed action to continue grazing because of the concern of the impact the loss of this practice would have on the local rural economy. Conversely, comments received also expressed concerns regarding additional costs of the proposed action on the small ranching operation. This analysis evaluates estimated operational costs and employment needs to compare across alternatives.

**Issues**

Communities in Okanogan County have historical ties to agriculture. For many residents, ranching is more than just a form of employment; it is a way of life and supports long-standing family traditions. Livestock grazing has economic and social importance to these communities. These allotments support agricultural jobs and income as well as the ranching way of life for many families. A reduction of AUMs will cause a negative economic impact to the economy of Okanogan County.

Smaller pastures will require the movement of cattle by the permittees more often at times of the year when cattle are difficult to find and move.

**Indicators**

The economic analysis focuses on several key indicators of change by alternative:

- Number of Jobs Created,
- Costs of Range Improvements,
- Acres Available for Grazing,
- Average Days/Months on Allotments,
- Number of Head Months or AUMs on Allotments,
- Grazing Fees received by the Government,
- Payments to the 25 Percent Fund,
- Number of Pastures (movement of cattle),

**Analysis Area**

The study area for this analysis consists of Okanogan County, Washington State. This County contains the National Forest System (NFS) lands of concern and the majority of economic activity associated with grazing on the BART Grazing Allotments.

**Existing Condition**

This section provides a comprehensive evaluation of the existing conditions in the analysis area, including demographic, employment, and income trends. The demographics section includes a variety of factors that describe the local residents; those factors include: population, age, and ethnicity. Employment and income are reported for the non-farm and farm economic sectors. The non-farm sector is made up of local businesses of all industries, grouped together according to similarities in the goods and services offered. While the farm sector includes all types of agricultural including the livestock industry. Assessing employment and income by sector will aid in the identification of those industries important to the economic sustainability of the region, and those potentially dependent on the activities taking place on the NFS lands.

**Analysis Methods and Tools**

The regional economic contributions of grazing to the economy of Okanogan County are estimated based on permitted HMs (Head Months), which are a measure of access to forage by cattle. Employment, income and output are estimated using a 2009 IMPLAN® model for Okanogan County. IMPLAN® (Impact Analysis for Planning, Minnesota IMPLAN Group, Inc.) is a regional economic impact analysis system. The IMPLAN model determines how much a given activity, such as the sale of livestock, contributes to the local economy. The interactions among different sectors within the local economy are traced by the model; and it calculates the employment, income, and output effects resulting from a direct impact on the economy. In this case, the direct impact is the sale of cattle, which are raised in part on forage from an allotment on National Forest System lands. The sale of cattle stimulates private sector activity that contributes to employment, income and output in the analysis area.

The first step of this analysis uses IMPLAN® to derive the response coefficient specific for the cattle sector in Okanogan County. The response coefficient for the cattle sector represents the employment, income and output associated with each million dollars of final demand to the cattle industry. Final demand represents the cattle industry's goods and services sold to all the other sectors in the local economy. A Forest Service computer program called FEAST (Forest Economic Analysis Spreadsheet Tool) applies the cattle sector response coefficients to the total industrial output in order to generate the estimated economic contributions. FEAST calculates the total industrial output by using data on price and inventory to convert Forest Service permitted HMs to an estimate representing a change in total industrial output attributable to grazing. These estimates of economic contribution do not include the total number of ranchers and their employees. This is a conservative method of calculation, as it takes into account only the proportion of the total industrial output that is attributable to forage provided from the allotment. A less conservative method of analysis would claim that all of the income from the sale of the cattle, along with all of the associated labor and output, is made possible by grazing on the Forest Service allotment. In agricultural operations family members often provide significant amounts of the labor. Excluding unpaid, family labor, as the Forest Service method does, may lead to an underestimation of employment effects (USDA, Grinspoon, Ng, 2013).

**BLM 'Grazing Contribution Ratio' Methodology**

The set of contribution ratios used are based on a recently developed methodology by The Bureau of Land Management (BLM), in order to estimate the economic contribution of forage based on AUMs. This method is unique in its incorporation of unpaid / family labor into the calculation. In agricultural

operations family members often provide significant amounts of the labor. Excluding unpaid / family labor may lead to an underestimation of the direct employment effect. In areas where unpaid or family labors constitute a large share of the total labor on ranches and farms, the BLM approach paints a more complete picture.

The process for calculating these contribution ratios are documented in Larson (2012). Effectively, the process involved extracting information pertaining to the cattle industry (NAICS 112111) for the State of Washington from the Agricultural Census, the American Community Survey, as well as from the 2010 IMPLAN® data and software system. To calculate the indirect and induced effects, farm production expenses information from the Ag Census are used as input to the IMPLAN® model. Income and GDP results are inflated from 2010 to 2012 dollars using a GDP deflator.

Social and economic data for this report also includes countywide data taken from the following: 2010 Census from Washington State, Okanogan County; A Profile of Agriculture for Okanogan and Ferry Counties from the Economic Profile system-Human Dimensions Toolkit, Agriculture and Socio-Economic Measures reports (EPS-HDT); Land ownership change and the Ranching Economy in the Okanogan Valley and Eastern Okanogan County, Washington, Headwaters Economics, 2008; and data provided by the Government Accounting Office (GAO), United States Department of Agriculture and local knowledge of the area including historical livestock grazing practices within Okanogan County provided by grazing permittees. Agricultural employment estimates are developed by the Labor Market and Economic Analysis branch of the Employment Security Department. Estimates are based on a monthly survey of agricultural producers conducted by Employment Security.

**Existing Condition Summary**

**Demographics**

Okanogan County is located in North Central Washington, bordered on the north by British Columbia, Canada, the Columbia River to the south, the Cascade Mountains to the west, and Ferry County to the east. The County covers 5,268 square miles (3,371,520 acres), making it the largest county in Washington State. Approximately 1,205,299 acres (35%) is private farm land. The Colville Indian Reservation, located in the southeast corner of the county, occupies approximately 700,000 acres (about 20%) of Okanogan County and is an integral part of the heritage of the county. State and Federal lands make up 45% of the land base.

The estimated population of Okanogan County as of 2012 is 41,275 people and ranks 24$^{th}$ in population within Washington State. The county has an unincorporated population of 24,544, while the incorporated population is 16,527. The overall population density is 7.8 persons per square mile compared to 101.2 for the State of Washington *(U.S. Census Bureau, Population Division June 2012).* Between 2000 and 2011, the population of Okanogan has increased just 0.4%.

**Age, Gender, and Ethnicity**

According to Mark A. Berreth, Washington State Regional Labor Economist, Okanogan County's population distribution is higher at both the oldest and youngest ages than the state.

Okanogan County's population of individuals aged 65 and older was 17.2 percent compared to Washington state at 12.3 percent.

The proportion of county residents under 18 years old was identical to that of the state at 23.5 percent in 2010.

There were slightly more residents under 5 years old in Okanogan County at 6.8 percent than in the state at 6.5 percent.

As of 2011, the median age of residents in Okanogan County was approximately 42.9 years.

Females made up 49.5 percent of Okanogan County's population, slightly less than that of the state (50.2 percent), (Berreth, 2012).

Okanogan County distinguishes its demographic makeup with its significantly larger American Indian/Alaskan Native population (12 percent) than that of the state (1.5 percent). This is due to the concentration of the Colville Confederated Tribes in this area. Hispanics are also more prevalent in the county (18.1 percent) compared to the state (11.2 percent) and is likely due to the abundance of seasonal agricultural employment. According to the US Census data reported in 2012, the majority of the population in the study area self-identifies as white. White residents account for approximately 83.5 percent *(Source: U.S. Census Bureau Quick Facts).* Table 41, Racial and Ethnic Distribution for Okanogan County, below, displays the racial and ethnic distribution for Okanogan County.

**Table 41, Racial and Ethnic Distribution for Okanogan County**

| Race or ethnicity | Population Numbers for Okanogan County | % Okanogan County Population | % Washington State Population |
|---|---|---|---|
| White Persons | 28,092 | 83.5% | 82.0% |
| Black Persons, | 131 | 0.5% | 3.8% |
| American Indian and Alaska Native Persons | 4,391 | 12.0% | 1.8% |
| Asian Persons | 223 | 0.8% | 7.5% |
| Native Hawaiian and Other Pacific Islander Persons | 27 | 0.2% | 0.7% |
| Persons Reporting Two or More Races | 987 | 3.0% | 4.3% |
| Persons of Hispanic or Latino Origin | 7,227 | 18.1% | 11.6% |

Source: U.S. Census Bureau 2010

**Employment**

Agriculture and forestry are the major economic generators for the county and are the foundation for the North Central Washington region that includes Okanogan County. From 1970 to 2010, farm employment grew from 4,426 to 5,230 jobs. Farming which includes all forms of agricultural production, including livestock production, employs approximately 5,016 people (EPS-HDT), both full and part time or 20.9 % of employment for Okanogan County. Of those, 1,489 (30%) are considered as Farm Proprietors who are self-employed either full or part time as non-corporate farm operators. In 1970, farm proprietors represented 36.4 percent of all farm employment. By 2010 this percentage had dropped to 32.5% (EPS-HDT). The 2013 Washington State Employment Security Department Monthly Employment Report for January 2013 shows the unemployment rate in Okanogan County was 12.8% (not seasonally adjusted). While unemployment rates have decreased slightly overall since 2011, Okanogan County currently ranks 6$^{th}$ highest in the State. The trend in seasonal unemployment rates correspond to the seasonal agricultural work available. Unemployment rates typically increase during the winter months of December through February.

Based on query results from the Local Employment Dynamics (LED) database, the largest job holder group in 2010 was those age 55 and older with 24.8 percent of the workforce. This group was followed closely by the 45 to 54 age group with 23.1 percent of the workforce.

In 2010, males held 48.7 percent and women held 51.3 percent of the jobs in Okanogan County. There were substantial differences in gender dominance in employment groups:

Male-dominated industries included construction (86.1 percent), mining (86 percent), utilities (72.6 percent) and manufacturing (70.9 percent).

Female-dominated industries included healthcare and social assistance (79.1 percent), finance and insurance (75.9 percent), educational services (68.4 percent) and professional, scientific and technical services (67 percent).

Regionally over the year, total agricultural employment increased in all of Washington State. The largest increase (3,460 jobs) was in the North Central region which includes Okanogan County.

Government, retail trade, services, and manufacturing are major employers within Okanogan County.

Recreational opportunities within the county have provided employment. Many of the activities such as hiking, hunting, fishing and winter sports occur on State and Federally managed lands. Hunting season and fishing season, typically draws larger numbers of people into the area. Stores that sell sporting goods benefit during this period. Recreation-based employment is seasonal and service-oriented, with wages generally at the lower end of the pay scale. Table 42, 2011 Farm Employment Comparison, below, compares farm employment (including livestock) and non-farm employment between Okanogan County and the United States. The term "farm" in this data source includes all forms of agricultural production, including livestock operations. Farm Earnings is the net income from sole proprietors, partners, and hired laborers arising directly from the production of agricultural commodities, either livestock or crops. It includes net farm proprietors' income, wages and salaries, pay in kind and supplements to wages and salaries of hired farm laborers. It specifically excludes income from non-family farm corporations. Farm Proprietors income is income received by sole proprietorships and partnerships in the operation of farms. It excludes income received by corporate farms. Non-farm earnings is the sum of wage and salary disbursements, supplements to wages and salaries, and proprietor' income for all industries except farm.

Animal production as of 2011 accounted for just 18.6 percent of the total employment in Okanogan County.

**Table 42, 2011 Farm Employment Comparison**[16],[17]

| | Okanogan County | United States |
|---|---|---|
| Total Employment | 23,677 | 175,834,700 |
| Farm Employment | 4,412 (18.6%) | 2,635,000 (1.5%) |
| Farm Proprietors Employment | 1,489 (6.3%) | 1,884,000 (1.1%) |
| Non-Farm Employment | 19,265 (81.4%) | 173,199,700 (98.5%) |

## Income

Okanogan County fits the profile of a rural, isolated county with an economy that is slow growing and underperforming compared to Washington State and the nation. Currently, farm earnings make up approximately 20% of the total earnings in the County with livestock production making up approximately 0.6% of that (EPS-HDT, 2013).

The long-term economic trend shows that from 1970 to 2010, the role of livestock ranching has declined as a share of total county-wide farm income (Headwaters Economics 2008). In Okanogan County the production of cattle and calves ranked 5th in agricultural commodities in Washington State between 2008 and 2010 (USDA). Table 43, Personal Income from Farm Employment, 2011, below, compares personal

[16] Data sources U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, Washington, D.C. Table CA25N
[17] Personal income in this table does not include income received by corporate farms.

income from farm employment in Okanogan County and the United States. Personal income in this table does not include income received by corporate farms).

**Table 43, Personal Income from Farm Employment, 2011 (Thousands of $2012)**

| | Okanogan County, WA | United States |
|---|---|---|
| Earnings by Place of Work ($1,000) | 889,044 | 9,652,737,179 |
| Farm Earnings | 177,525 (20%) | 104,917,960 (1.1) |
| Farm Proprietors' Income | 111,039 (12.5%) | 79,470,556 (0.8%) |
| Non-Farm Earnings | 711,519 (80.0%) | 9,547,819,219 (98.9%) |

Farm employment often pays below average wage rates, but this can vary by farm sub-sector and by geography. Table 44, Average Annual Wages in 2011, below, compares average annual wages of farm and non-farm labor, indicating that average annual wages in Okanogan County are slightly over ½ of the national average. According to the US Department of Agriculture Economic Research Service, as of 2011 the poverty rate in Okanogan County was 21.7% while Washington States overall poverty rate was 13.9%.

**Table 44, Average Annual Wages in 2011 ($20lls)**

| | Okanogan County, WA | United States |
|---|---|---|
| Total Private and Public | $26,133 | $48,040 |
| Total Private | $21,078 | $47,815 |
| Farm | $15,184 | $27,469 |
| Crop Production | $14,933 | $25,984 |
| Animal Production | $25,943 | $30,892 |
| Non-Farm | $24,637 | $47,959 |

Realized net income from agricultural production including livestock operations is derived from the total of cash receipts and other income minus production expenses. Table 45, Farm Business Income, 2011, below, is a comparison of farm business income between Okanogan County and the United States for 2010.

**Table 45, Farm Business Income, 2011 (Thousands of $2012s)**

| | Okanogan County, WA | United States |
|---|---|---|
| Total Cash Receipts & Other Inc. ($1,000) | 327,739 | 447,487,869 |
| Cash Receipts from Marketing's | 315,837 | 409,347,870 |
| Livestock & Products | 28,607 | 195,393,973 |
| Crops | 287,230 | 213,953, 897 |
| Other Income | 11,907 | 38,139,999 |
| Government Payments | 1,228 | 10,640,248 |
| Imputed Rent & Misc. Income | 10,674 | 27,499,751 |
| Total Production Expenses | 190,578 | 334,857,009 |
| Realized Net Income (Receipts – Expenses) | 137,161 | 112,630,860 |
| Value of Inventory Change | 865 | -5,107,646 |
| Total Net Income Including Corp. Farms | 138,026 | 107,523,214 |
| Ratio: Total Cash Receipts & Other Income/Total Production Expenses | 1.72 | 1.34 |

From 1970 to 2011, net income including corporate farms grew from ½ million dollars to $138.0 million, a 25,703.6 percent increase. Cash receipts from livestock and products grew from $8.4 million to $28.6

million, a 241.2 percent increase. These figures demonstrate the long term health of the farm economy within Okanogan County.

Of the 1,205,229 acres of farm land in Okanogan County, 706,965 acres (58%) are in permanent pasture and rangeland. Much of Okanogan County is experiencing the conversion of private agricultural lands to other uses, including residential development. Omak, the largest community in the county and the regional center for services and trade, is experiencing a great deal of growth with commercial development spreading north and south along U.S. Highway 97. There is also increasing commercial development in the area between Tonasket north to the Canadian border. Future development of existing small parcels and further agricultural land ownership change could affect the area's working ranches by adding to or removing available grazing land. Fifty three (53) percent of the acreage in large ranches that changed hands between 1993 and 2008 left the working ranch landscape, going to developers (24%), investors (14%), amenity buyers (15%), and government (6%) (Headwaters Economics, 2008).

In places where agriculture increasingly operates alongside a larger, non-agricultural economy and greater range of adjacent land uses, farms and ranches continue to be important. They contribute to local economic diversity. The scenery they provide can be part of the mix of amenities that attract and retain people and businesses across a range of industries, and they are often an important part of local culture and community vitality (EPS-HDT).

Those ranches that remain in production have necessarily increased production. Leasing grazing land is an important strategy they have used to do so and will be increasingly important if land values increase, especially relative to returns from livestock sales. Ranchers in Okanogan County appear to have fewer diversification options such as fee hunting and guest ranching than in other areas of the Western United States with greater name recognition as wildlife and scenic retreats (Headwaters Economics, 2008).

Together, these factors have led to a rate of ownership change of large ranches on par with or exceeding some of the fastest growing and fastest changing areas in the rural West. The nature of the outcomes of ownership change in the Okanogan Valley and eastern Okanogan County include a large degree of subdivision, with as yet limited residential development. Amenity-oriented acquisition of large ranches with the intent of keeping them intact is far less prevalent in this area than in other, high-amenity areas of the West (Headwaters Economics 2008).

Economic strains intensify as operational costs increase without associated increases in the prices received for livestock products. The average 300 cow/calf operation in the western United States typically yields a two percent investment return. This return is often too low to support a ranching family. Under these conditions, many family members must either seek employment outside of the ranch to make ends meet (Knight et al. 2002) or increase the average herd size required to "support a family" to a minimum of 500 or more. Some increase in production has been possible in mountain valley ranching through the application of advances in animal husbandry and farming techniques, but feed availability, both in terms of summer forage and winter feed, represents an ongoing limiting factor on herd size expansion. Land values and the availability of leased land strongly affect ranch viability by constraining opportunities to acquire additional feed.

Ranches in Okanogan County utilize a combination of on-ranch pasture and leased grazing land. Ranches typically require winter feed for three or more winter months, with more for mothering cows with calves or for hold-over calves. This system of moving cattle to other pastures in the spring through fall maximizes the use of prime agricultural lands for hay production. The longer cattle are kept off these lands, the greater the opportunity to produce two or more hay crops. The more herbage produced, the more cattle that can be held over the winter, and the rancher/permittee is better able to time the selling of their stock to take advantage of market prices. Through history, the beef market has been very volatile,

with great highs and lows in the domestic market. In Okanogan County ranchers grow hay and or corn for silage, but most also purchase hay from neighboring counties in the Columbia River Basin. The purchase of winter feed is a long-standing trend in the Okanogan Valley, but has become increasingly problematic in recent years due to increase costs of hay and fuel. Hay prices are affected by costs of production, climate variability, transportation costs, and competition from non-local hay buyers (large volumes of Columbia Basin hay are exported overseas and also to high end recreational markets on the Pacific Coast). In addition, recent demand for the production of ethanol has increased competition for hay.

Prices for leasing private grazing land range between $10.00 and $20.00 per AUM. The fee depends upon the agreement made between the land owner and the lessee. The lessee may assume maintenance costs for use of the land, thus reducing the cost per AUM or the lessee may choose to simply graze livestock and pay the land owner for all maintenance costs *(*Asmussen, 2013*)*.

**Social Values**

Okanogan County has a long history of mineral mining, logging, agriculture and livestock ranching. The communities developed to support these industries and provide amenities important to rural lifestyles. Many large ranches and orchards have been family owned through several generations and continue to remain in family ownership. More recently, there has been an increase in the numbers of large tracts of land being purchased for the values of farming, solitude, and recreation. The relatively small communities within this county are well integrated and provide numerous social activities to celebrate the rich and diverse heritage. When mitigating for ecological concerns, there are both direct and indirect economic impacts to the permittees and the local economies. Economic impacts would have a social impact to rural life styles.

**Livestock Grazing on National Forest System Lands**

Grazing is allowed on National Forest System lands for the purpose of fostering economic development for private ranchers and ranching communities by providing ranchers access to additional forage. Particularly in the western states, where the BLM and Forest Service manage anywhere from 30 to almost 85 percent of the land. Access to federal forage increases the total forage available to ranchers, enabling them to increase the number of livestock they can support and sell.

Recent Forest Service range management practices, policies, and procedures require more active involvement by the permittees in the form of planning participation, multiple resource management, monitoring active livestock management, and cost-share of rangeland improvement projects. A special report published in 1992 by the Oregon State University Extension Service concluded that: “changes in federal grazing policies and regulations may have led to relative asset devaluation in the federal land dependent sector of the western livestock industry in Eastern Oregon” (Obermiller, 1992*)*.

The same study found that although grazing fees on private land are considerably higher than Forest Service land, overall grazing costs are much higher on Forest Service land. The increased expense associated with grazing on public land was attributed to: the cost of taking animals on and off of federal land, livestock management, maintenance of range improvements, and higher death loss (Obermiller, 1992). Locally, the estimated average cost for grazing on Forest Service land, is about $25.00 per AUM. This cost estimate considers, fuel and vehicle expenses, transportation of and use of horses or ATVs, and labor expenses (Asmussen, 2013).

Washington State Department of Agriculture estimates that there is an average of 3.7 cattle per 100 acres in Okanogan County, or 124,746 cattle raised annually. In Okanogan County, the Washington State Department of Natural Resources (DNR) allows livestock grazing on about 325,023 acres. About 27 % is under grazing leases and the rest is allowed by permit only. Permits and Leases are re-issued for 10 year intervals. The Bureau of Land Management (BLM) administers 75 grazing leases on approximately 3,681

acres in Okanogan County. These leases are re-issued every 10 years. The Forest Service administers approximately 383,000 acres of grazing leases within Okanogan County; 67 grazing allotments, of which 43 of these are managed by the Tonasket Ranger District. Grazing is awarded by permit only and is re-issued every 10 years. These permits are Term, Term On/Off, or Term Private Land Grazing Permits for various seasons of use, generally ranging from June 1 through September 30.

Lands within the BART planning area generally become ready for livestock use in mid-May or early June depending on the weather, aspect, and amount of snow pack. The cattle remain until late summer or until the end of September depending on when use criteria (triggers) are met or when the permitted grazing season ends. Annual adjustments in the timing, intensity, or duration of livestock grazing may be necessary if resource conditions are not trending towards or achieving objectives. Flexibility is needed to address resource concerns. Thus, herd numbers may change up or down, and pastures may be rested in the following year. Wildfires and prescribed fires may cause portions of allotments to be rested for a period of time.

Currently, the total livestock permitted to graze on the four BART allotments is 4,541.3 cow/calf pairs. In an average summer grazing season a calf could gain approximately 250 pounds live weight. These four allotments could annually produce approximately 149,250 pounds of beef worth approximately $199,995 in 2011, depending on the market price the month of the sale. However, gross income from livestock production has been relatively stagnant and net profits have been declining for about 25 years. The permits are equivalent to 3,393 Head Months (or 4,541.3 Animal Unit Months). Approximately twenty five (25) percent of grazing fees collected are returned from the U. S. Treasury to the local community for roads and schools.

**Regional Economic Contribution of Cattle Grazing On the BART Allotments**

Ranching operations have economic linkages with other sectors of the economy other than the livestock and agricultural sectors. In fact, changes in grazing activities on NFS lands have implications for the overall regional economies surrounding Okanogan County. The aim of this economic contribution analysis is to estimate the gross regional product, income, and the number of jobs sustained / supported by AUMs permitted to graze on the four BART allotments.

It is important to stress that this analysis does not attempt to calculate the economic impacts from all cattle and their ranchers; rather, this AUM-based analysis estimates only the share of employments, income, and Gross Domestic Product (GDP) derived from permitted grazing on FS allotments. As an example, when a total of 10 permits are granted to 10 individual ranchers, the economic impact is not 10 jobs. One of the reasons is that most ranchers use FS forage for only a portion of their operations, meaning that FS forage accounts for a fraction of the annual feed and forage requirements. So in this example, while 10 ranchers may receive permits to graze on FS allotments, only a portion of their operations' forage comes from FS land. Therefore, using an AUM-based approach, this analysis aims to estimate those economic contributions derived from forage provided by authorized grazing on the four BART allotments. Table 46, Summary of Economic Contributions, below, summarizes the estimated economic contributions to the region's economy from permitted grazing on the four BART allotments (4,541 AUMs).

Permitted grazing on the four BART allotments contributed approximately $477,000 in GDP[18], $251,000 in labor income, as well as supported / sustained about 16 full and part time jobs. These results reflect indirect and induced economic effects – private sector activities stimulated by FS grazing entering the region's economy – in addition to direct employment and income effects.

[18] Technically GRP (Gross Regional Product) since this is not a national analysis.

**Table 46, Summary of Economic Contributions**

| Regional Economic Contributions from Grazing on the Four BART Allotments* | | |
|---|---|---|
| | Regional Economic Contributions | *Contribution Ratios for Washington State* |
| Full and Part Time Employments | 16 | *3.56 jobs per 1,000 AUM* |
| Labor Income ($2012) | $251,392.01 | *$55,356.83 per 1,000 AUM* |
| Value-added / GDP ($2012) | $477,404.99 | *$ 105,125.18 per 1,000 AUM* |
| **AUMs permitted: 4541.3* | | |

It is important to note that this analysis employs IMPLAN® to estimate the indirect portion of the employment effects; therefore, the reported job figure here is expressed in terms of 'annual average' of both full and part time total wage and salary employees, as well as self-employed jobs. This method of counting employment is a standard convention and consistent with methods used by the U.S. Bureau of Labor Statistics. One cannot discern the number of hours worked or the proportion that is full time vs. part time. It is also important to reiterate the employment contributions calculated are reported simply as jobs, not full time equivalents (FTEs). The impacts include both full time and part time employment, so a person with more than one job could show up more than once in the data. This prohibits comparisons to population data and inferences about the effect on unemployment rates.

Labor income includes all forms of employment income: in addition to wages, it also includes benefits and proprietor income.

The value-added (GDP) contributions consist of (1) employee compensation –wages and salaries plus benefits paid by local industries; (2) proprietor income – income from self-employment; (3) other property income – corporate income, rental income, interest and corporate transfer payments; and (4) indirect business taxes – sales, excise, fees, licenses and other taxes paid, including non-income based payments to the government. GDP (or value-added in IMPLAN) is a popular and widely used metric that measures economic activities and outputs, taking into account the incremental value added to a product or service at each step of the production process.

It is also critical to note that IMPLAN is a static model representing a snapshot in time. The state-level IMPLAN model used (Washington state) in this analysis is for the year 2010 (the latest available IMPLAN data as of 2012). It reflects only the structure and state of the economy in 2010. Moreover, IMPLAN is used to examine "marginal" changes; results are valid only for relatively small changes to the regional economy. In other words, the results hold with the assumption that there is no substantial resource management action in the region large enough to change the underlying structure and trade relationships of the local economies.

As shown in Table 46, Summary of Economic Contributions, above, the estimated employment, income and GDP contributions are calculated by multiplying the amount of AUMs permitted (4,541.3) with a set of 'contribution ratios'. These contribution ratios represent the employment, income, and GDP effects resulting from a one thousand AUMs worth of forage requirement (USDA, Ng, 2013).

**Environmental Justice and Civil Rights**

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) provides the following definitions in order to provide guidance on compliance with 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." (CEQ 1997).

A large portion of the BART analysis area is within the West Fork Sanpoil Watershed and is a part of the former "North Half" of the Colville Indian Reservation where the Colville Indians reserved certain hunting, fishing, gathering, and water rights. The Tribe regulates their tribal members who exercise their rights to hunting and fishing on the North Half. There are also implied water rights arising from Antoine v. Washington, particularly with respect to fishing, yet the scope and extent of such rights were not clarified by the Supreme Court. It is the Forest Service policy to recognize that unadjudicated water rights may exist and that management activities will not be undertaken that could impact such rights.

According to the US Department of Agriculture Economic Research Service, as of March 28, 2013 the poverty rate in Okanogan County was 21.7% while Washington States overall poverty rate is 13.9%. Farm employment often pays below average wage rates in part due to the seasonal nature of associated work. Based on this, it is reasonable to assume that the poverty rate is higher among individuals employed in the agriculture sector than those employed in other sectors. Given the high poverty rates, it is important to consider the impact of alternative development scenarios on local income, and the potential effect on low income populations.

**Civil Rights**

A Civil Rights Impact Analysis (CRIA) is an analytical process used to determine the scope, intensity, direction, duration, and significance of the effects of an agency's proposed employment and program policies, actions, and decisions.

Disparate impact, a theory of discrimination, has been applied to the BART Grazing planning process in order to reveal any such negative effects that may unfairly and inequitably impact beneficiaries regarding program development, administration, and delivery.[19] The objectives of this review and analysis are to prevent disparate treatment and minimize discrimination against minorities, women and persons with disabilities and to ensure compliance with all civil rights statutes, Federal regulations, and USDA policies and procedures.

In the 2000 Census survey, people were defined as having a disability if one or more of the following conditions were true:

- They were aged 5 or older and responded "yes" to a sensory, physical, mental, or self-care disability.
- They were aged 16 years or older and responded "yes" to a disability affecting going outside the home.
- They were between the ages of 16 and 64 and responded "yes" to an employment disability.

[19] For more information on disparate impact theory, see The Evolution of Disparate Impact Theory of Discrimination, *Harvard Journal of Legislation, vol. 44 2007* (http://www.law.harvard.edu/students/orgs/jol/vol44_2/gordon.pdf)

The impact analysis, Table 47, Washington Counties and State Total Persons with Disabilities, below, considered the potential for Forest Service management actions to adversely affect all area residents, with particular attention to any potential disproportionate impacts on minority and/or low-income residents, women, or persons with disabilities.

**Table 47, Washington Counties and State Total Persons with Disabilities**

| | Total disabilities | Total population: | % with disabilities |
|---|---|---|---|
| Okanogan | 14,367 | 39,564 | 36 |
| State | 1,774,141 | 5,894,121 | 30 |

The Forest Service does not maintain records on the minority status of permit holders or their employees and does not discriminate in the permitting process.

**Environmental Consequences**

The previous sections assessed social and economic conditions and trends. The following section will consider the potential consequences of alternative management scenarios on the social and economic environment.

**Data and Methodology**

To evaluate the effects of each alternative, the analysis criteria described in the Existing Condition section was used to determine the revenue and employment values. The social and economic analysis focuses on the indicators that include the number of permitted head months (HM), the expected revenue for the number of livestock grazed, the time spent on the allotment, and the change in cost to the permittees and to the agency. Social impacts were determined by identifying how management changes may alter the conditions and trends presented in the Existing Condition section.

Many formulas are based on a price per animal unit month (AUM) -- that is the amount of forage that a cow and her calf eat in a month (or one bull, one steer, one horse or 5 sheep). For the purpose of this analysis, AUMs are converted to Head Months (HMs). This equates to one month's use and occupancy of the range by one animal. For grazing fee purposes, it is a month's use and occupancy of range by one weaned or adult cow with or without calf, bull, steer, heifer, horse, burro, or mule.

**Assumptions**

The economic efficiency analysis does not provide a full accounting of all costs and benefits. The only benefits considered are program revenues (i.e., Grazing receipts). The only costs considered are direct expenditures. Therefore, the estimates of present net value do not fully account for the social costs and benefits of management actions.

The economic impact of grazing was estimated using authorized levels. However, actual use is permitted annually based on various factors, such as current forage conditions. Therefore, the estimated economic impact of grazing is likely to overstate the jobs and income provided.

The framework for the social analysis employs generalities. Area residents and forest users have diverse preferences and values that may not be fully captured in the description of social consequences. Nevertheless, generalities are useful for assessing social impacts based on particular forest related interests. The consumer surplus of ranchers is calculated by subtracting the sum of Forest grazing fees (HMs multiplied by the federal grazing fee) from the replacement cost of this forage from private

providers (HMs multiplied by private grazing fee). Consumer surplus is the difference between what ranchers are willing to pay for forage and what they are required to pay for forage.

Permittees have family members that assist with operations on a regular basis and may or may not draw a wage. This assistance may include range riding, livestock round up, or maintenance of improvements. For the purpose of this report, based on the results of the IMPLAN analysis, there would be 16 jobs affected.

The fee charged for grazing on National Forest System lands is set using a formula first called for under the Public Rangelands Improvement Act (PRIA) of 1978. The formula results in a price per animal unit month (AUM) -- that is the amount of forage that a cow and her calf eat in a month. Fees can also be assessed per Head Month (HM). This equates to one month's use and occupancy of the range by one animal. For grazing fee purposes, it is a month's use and occupancy of range by one weaned or adult cow with or without calf, bull, steer, heifer, horse, burro, or mule.

The evaluation of economic costs for allotment infrastructure discussed in this analysis is based on current market estimates (Table 48, Baseline Costs Used for Infrastructure Economic Comparisons). These estimates are not intended to establish the final costs of proposed improvements, but instead are meant to allow a comparison across alternatives and were estimated using the following assumptions:

Fence materials are for 4-strand barbed wire fence.

Labor rates were estimated at a rate of $20 per hour per person, for a 5 person crew working 10 hour days, achieving 0.5 miles/day of fence construction.

Average rate of clearing and leaving slash of $300/acre is thought to not be adequate for a linear feature and the cost was doubled to more adequately represent costs expected.

Reconstruction labor costs are higher because older materials must be removed and new materials replaced, increasing time needed to accomplish distances.

Reconstruction right-of-way (ROW) costs are estimated to be lower since it is less labor intensive to maintain a clearing.

Spring development materials include a trough, pipeline, head box and associated plumbing parts and a pump, where needed.

**Table 48, Baseline Costs Used for Infrastructure Economic Comparisons**

| Infrastructure | Materials | Labor | ROW Clearing |
|---|---|---|---|
| Fence Construction | $9,000/mile | $2,000/mile | $700/mile |
| Fence Reconstruction | $9,000/mile | $2,500/mile | $200/mile |
| Fence Removal | n/a | $500/mile | n/a |
| Spring Development | $2,500/each | $1,000/each | n/a |
| Corral Development | $2,500 | $2,000 | $500 |
| Ram Pump with Materials | $200.00 | $50 | n/a |
| Hardened Stream Crossing | $1,000 | $1,500 | n/a |

### Direct and Indirect Effects

As the Affected Environment section described, the analysis area is experiencing a number of trends that compromise their social and economic resiliency. The consequences of a loss of grazing opportunities on the Forest could be exacerbated by expected future conditions and trends. Recall several conditions and trends and their implications for study area residents:

Low population density generally indicates less developed infrastructure, which contributes to social and economic isolation.

Low (or negative) population growth signals stagnant or declining economic opportunities in the study area.

High poverty rates and low per capita income indicate less access to capital needed to start businesses and expand economic opportunities.

Low education rates signal lower human capital, which is an important element of social and economic well-being.

A high median age in the study area suggests that retirees make up a large percentage of the population, which means that a smaller percentage of area residents are employed (or seeking employment) compared to the state and nation.

The entire analysis area is dependent on livestock grazing for employment and income. The study area for this analysis consists of Okanogan County, Washington State. This County contains the National Forest System (NFS) lands of concern and the majority of economic activity associated with grazing on the BART Grazing Allotments.

Under all management scenarios, these trends and conditions are expected to continue. However, the elimination of livestock grazing on the BART allotments could accumulate with the consequences of these trends to produce results that are more pronounced than predicted by the economic impact analysis. Fewer opportunities for residents to engage in agricultural activities could hasten population decline and increase poverty rates. Fewer economic opportunities in the analysis area would also likely contribute to the out-migration of young individuals in search of educational and employment opportunities. Fewer young and educated individuals would reduce the probability that new businesses would locate in the study area. The impact of grazing decisions on these trends would likely be minimal; any decisions regarding Forest management are unlikely to change the trajectory of these trends. Nevertheless, the removal of grazing from the BART Allotments could, particularly for some individuals, magnify existing social and economic trends.

As agricultural lands are lost to development, communities bear higher costs. Privately owned and managed agricultural land generates more in local tax revenues than it costs in services. Carefully examining local budgets in cost of community services (COCS) studies shows that nationwide farm, forest and open lands more than pay for the municipal services they require, while taxes on residential uses consistently fail to cover costs. (AFT, COCS Okanogan County 2007).

The reduction in the farm and ranch land base can change the relationship between agricultural operations and public lands. The conversion of farm and ranch land to residential subdivisions is important to public land managers for a number of reasons: (1) the growth of the wildland-urban interface and the cost of protecting homes from wildfires; (2) the spread of weeds onto public lands; (3) the loss of access to public lands for recreation; (4) the loss of wildlife habitat and wildlife movement corridors that cross private-public land boundaries: and (5) the potential for conflict among user groups (EPS-HDT).

**Effects on Environmental Justice and Civil Rights**

As noted in the Income section, the current poverty rate in Okanogan County is 21.7 percent and the current unemployment rate is 12.8 percent. As indicated by the IMPLAN analysis, 16 full and part-time

jobs are associated with livestock grazing on the BART allotments. In addition, farm earnings in Okanogan County make up about 24.4% and livestock earnings is just 0.6% of that. This finding suggests that individuals who work in the agriculture sector have relatively low incomes. Based on this, it is reasonable to assume that the poverty rate is higher among individuals employed in the agriculture sector than those employed in other sectors (e.g., government). The cost of elimination of grazing on the BART Allotments could fall most heavily on individuals most vulnerable to economic change.

This project may generate a disparate impact on low income populations however minorities, women, or persons with disabilities are not likely to experience a disparate impact. The project alternatives are also not likely to result in civil rights impacts to Forest Service employees or customers of its programs.

There would be little if any cumulative effects to the county economy or social condition from other current or reasonable foreseeable future activities on National Forest lands within the BART assessment area. The Crawfish Restoration project would generate revenue from the sale of timber however, it is uncertain how much if any of this revenue would contribute to the local economy.

**Alternative 1**

**Economy**

Alternative 1 would prohibit approximately 3,393 cows (total Head Months) [4,541.3 AUMs] from grazing on the Allotments. The three term grazing permits associated with the allotments would be cancelled. Eliminating cattle from the allotments could affect the economic viability of the livestock operations for the permittees due to the cumulative costs associated with securing additional range or buying supplemental feed to accommodate herd sizes consistent with current permitted numbers, fencing and establishing water on the additional range, increased trucking costs, and labor costs associated with moving cattle. The intensity of the effects would depend upon the available options for the permittees; access and availability of private land, availability of forage and the costs associated with those options. Additionally, the intensity of the effects would also depend on the size of their total operations, debt structure, business goals and objectives, and the market for cattle.

Using an average private grazing fee in Okanogan County of $15.00 (Asmussen, 2013) per HM, the private replacement cost of NFS-managed forage would be $50,895 (Total number of HMs x 4 month average x $15.00) (USDA NASS 2013). In contrast, the cost of NFS-managed forage would be $18,322 (Total HMs (3,393) multiplied by the federal grazing fee of $1.35 multiplied by an average of 4 months). Therefore, the replacement of NFS-managed forage for private forage would cost ranchers an additional $32,573 (private land forage cost minus NFS grazing fee). However, fees account for only one portion of the total cost of grazing. One must account for transportation, maintenance, and labor costs as well. As noted previously in the Income section, locally fees for private land grazing vary between $10.00 and $20.00 per AUM and the average cost to the permittee for grazing livestock on National Forest is $25.00 per AUM when all costs of doing business are considered. Nevertheless, it is possible that the reduction in available forage through the elimination of grazing on the BART allotments could increase the private grazing fees, due to increased demand from ranchers seeking forage replacement opportunities.

Comparable grazing opportunities would be difficult, if not impossible to find near the permittees home ranches. There would be a decrease in profitability for the ranches that would in turn contribute to the existing reduction in profitability to the county and its ranching community. If the permit cancellations resulted in the end of their ranching businesses and sale of their base properties, the benefits of open space provided by these properties could be diminished or lost. The permittees with term private land (Private inholdings) permits would be required to fence approximately 2.25 miles of the property boundaries if they continued grazing on their private land.

Alternative 1 would eliminate all permittees costs associated with the allotment. The magnitude of the direct effects of this alternative is considered to be the three ranching operations currently holding permits for the allotments under consideration and the Government.

The BART allotments receive $4,580 from permit fees which makes up approximately 9% of the range program on the Tonasket Ranger District. Annual administration costs would be reduced accordingly. There would be no revenue collected, thus reducing taxes collected and a loss in return to the Treasury and to the County. Grazing fee income to the Forest Service would be reduced. There would be minimal mitigation costs.

Alternative 1 would have the greatest negative social impact to local communities as the elimination of all grazing on all allotments could cause ranching operations to go out of business or drastically change their current level of operation. If individuals and families move from the area, communities may lose their leaders, volunteers, participants, or other types of community energy and capacity in terms of residents.

If Alternative 1, No Grazing, were selected there would be an economic and social effect. As the Okanogan-Wenatchee National Forest and other national forests in the Pacific Northwest Region (Oregon and Washington) prepare more allotment management plans, it is anticipated the overall amount of cattle utilizing National Forest System lands may be reduced. As family ranching becomes less profitable, the number of people employed in and enjoying this life-style would decline locally, regionally, and nationally, potentially creating a social minority group.

**Employment**

Selection of this alternative would have an adverse effect upon the permittees and their employees. As many as three families (permit holders and employees) would potentially be affected by this alternative. Alternative 1 would result in approximately 16 fewer jobs in the analysis area than Alternatives 2 and 3.

**Forest Values**

If selected, Alternative 1 would result in abandonment of all infrastructures in place. The investments made to date in internal pasture fences, allotment boundary fences, spring developments, and other structures owned by the government would be lost. If a subsequent decision is made to retain any of these improvements, funding would need to be secured for their maintenance or adjacent permittees would be reassigned maintenance responsibility. Assigning maintenance responsibility to adjacent permittees would in turn increase their operational costs.

Without livestock grazing as a tool for vegetation management, especially fine fuels reduction, the Forest Service would need to consider other hazard fuels reduction techniques to manage the vegetation. This may slightly increase the cost for fuels reduction projects.

Some livestock trails would no longer be maintained that recreationists use. The cost to maintain these trails would be eliminated. Recreationists may move to other areas to find better trails.

Livestock would be eliminated as a source of e-coli and sediment in the streams, therefore the water quality should show some improvement.

**Direct and Indirect Effects Common to Alternatives 2 and 3**

**Economy**

The continuation of grazing on the allotments would allow the current permittees to maintain their current level of ranching operations. They would continue to contribute to the livestock based portion of the local economy, providing taxable income to the Treasury and local counties. Their base properties would continue to contribute to open space in the Tonasket area. Money for the proposed mitigation projects

would be spent locally on materials and labor. Maintaining stability to the local ranching community would reduce fragmentation of land ownership and continue management of private natural resources. Permittees would be responsible for approximately one half the costs of improvements.

**Employment**
Sixteen full and part time jobs, as calculated by IMPLAN would be retained by continued livestock grazing.

**Forest Values**
Improvements to water quality within the BART analysis area would have a positive effect on the local economy based on recreation activities.

Livestock trails and corrals would continue to be maintained by the permittees and utilized by recreationists.

Existing water developments would continue to be maintained by the permittees, which could be used by wildlife for water. Because Okanogan County is a popular destination for hunting this could benefit local business by retaining and promoting the health and diversity of wildlife.

**Alternative 2**

Improvements made and associated impacts would depend upon the success of the initial proposed action items and any subsequent adaptive management stages of implementation that may occur. One objective of Alternative 2 is to implement an Adaptive Management strategy that empowers the permittees to actively support improvements in riparian conditions, thus reducing the risk that additional costs would be accrued. Alternative 2 could realize a best case scenario with lowest costs and minimal effects. As each additional Stage is implemented there would be an increase of costs and affects directly to the permittees and the Forest Service and indirectly to the economy in Okanogan County.

**Economics**
Under Alternative 2, all Stages, approximately 594 acres in the Peony pasture would be rested from grazing until riparian conditions improve.

About 2.5 miles of fence would be constructed or reconstructed during Stage 1 implementation, while the additional 11.1 miles would be constructed only as needed based on monitoring results. New fencing costs are approximately $11,700 per mile for materials and construction. There are two new corral locations, and 16 new water developments or complete reconstruction of existing water developments proposed in Alternative 2. The costs for corral construction are approximately $5,000. The purchase of materials and installation of a new water development, or complete reconstruction, would be approximately $2,500 each and the hardened water crossing on Aeneas Creek could be contracted for about $2,500. The Ram pump would need an additional $250 in materials. The total mitigation costs for Alternative 2 would range from $74,465 for Stage 1 implementation to $206,083 assuming that it would require all developments described in subsequent Stages to achieve Standards and Guidelines and RMOs. Because the Forest Service pays a percentage of material costs for fencing, there would be additional costs to the Government as more fences are constructed. The Forest Service portion of the fence construction costs would be up to $33,525 if all fences are constructed. The Forest Service portion of the water development costs would be up to $17,200.

Table 49, Project Costs of Fence Construction in Alternative 2, Stages 1 through 4, below, displays the projected costs of fence construction through the proposed Stages of Alternative 2.

**Table 49, Projected Costs of Fence Construction in Alternative 2, Stages 1 through 44**

| Fencing | New Miles | Estimated Material Cost | Estimated Labor Cost | Total Labor & Material |
|---|---|---|---|---|
| Stage 1, Required fence reconstruction and new installation | 2.5 | $5,625 | $20,790 | $26,415 |
| Stage 2 | 3.9 | $9,750.00 | $36,036.00 | $45,786.00 |
| Stage 3 | 3.2 | $8,000.00 | $29,568.00 | $37,568.00 |
| Stage 4 | 4.06 | $10,150.00 | $37,514.00 | $47,664.00 |
| Total | 13.6 | $33,525 | $123,908 | $157,433.00 |

Table 50, Project Costs of Water Developments, below, displays the projected costs of new and reconstructed water developments through the Stages of Alternative 2. These costs are based on the current dollar value and not adjusted for inflation.

**Table 50, Projected Costs of Water Developments**

| Trough Reconstruction | Number Needed | Estimated Material Cost | Estimate Labor Cost | Total Labor & Material |
|---|---|---|---|---|
| New | 15 | $15,000.00 | $22,500.00 | $37,500.00 |
| Reconstruct or Move | 2 | $2,000.00 | $800.00 | $2,800.00 |
| Crib Conversion | 1 | $200.00 | $400.00 | $600.00 |
| Total | | $17,200.00 | $23,700 | $40,900.00 |

The following table displays the project costs of improvements that would occur in Stage 1 based on the current dollar value which represents the minimum costs of implementing Alternative 2. Also shown are the total maximum costs associated with subsequent Stage implementation through Stage 4. Table 51, Cost Estimates for Alternative 2, Stages 1 through 4, below displays the estimated costs of improvements for Alternative 2 through Stage 4.

**Table 51, Cost Estimates for Alternative 2, Stages 1 through 4**

| | Estimated Minimum Costs for Stage 1 | Estimated Additional Costs for Stage 2 | Estimated Additional Costs for Stage 3 | Estimated Additional Costs for Stage 4 |
|---|---|---|---|---|
| Fencing | $26,415 | $45,786 | $37,568 | $47,664 |
| Water Developments | $40,300 | 0 | 0 | 0 |
| Hardened Crossing | $2,500 | 0 | 0 | 0 |
| Ram Pump | $250 | 0 | 0 | 0 |
| Corral Construction | $5,000 | 0 | 0 | 0 |
| Total Estimated Costs | $74,465 | $120,251 | $157,819 | $206,083 |

**Stage 5 Implementation**

If improvements and livestock management strategies described above in the Adaptive Management Actions of Stages 1 through 4 are not protecting the continued health and function of resources or are not improving the riparian conditions; specifically: the stream banks do not begin to stabilize and exhibit signs of healing from trampling effects such as vegetative ground cover, then additional measures would be taken to reduce livestock impacts to the streams. This may be a reduction in the current grazing season in the unit, reduced numbers, or total livestock exclusion from the fenced areas. The total amount of land rested or excluded from livestock use could total up to 8,000 acres, or up to 22% of the BART allotments. Rested pastures would be in the Bannon and Tunk allotments. Further costs associated with Stage 5 if

implemented are difficult to determine, however, it is presumed that these actions would result in the permittees having to utilize alternative forage sources which may not be readily available during the summer grazing period. As stated in the Income section, the current average cost of leasing private land (if available) for grazing is approximately $15.00 per AUM.

These allotments make up approximately 9% of the range program on the Tonasket Ranger District. Approximately 170 person-days are spent annually to administer the district range program. Total administration and monitoring requirements for Alternative 2 would be approximately 50 person-days; these days are calculated for the first 3 years of the AMP implementation. Monitoring results would determine the success of the Stage 1 proposed actions and mitigation measures. These results would also determine if additional Stages would be implemented. If the monitoring indicates additional adaptive management is needed, then the days estimated for monitoring would continue. However, if the proposed action and mitigation measures are successful then monitoring days would decrease, but implementation monitoring would continue.

**Employment**

In Alternative 2, The permittees may choose to do additional riding to move livestock more frequently to ensure livestock do not linger in riparian areas. This may increase job opportunities but will cost the permittees additional money.

While it is expected that16 jobs would be retained under this alternative, the number could fluctuate if additional adaptive management Stages are implemented since there may be an increased need for additional labor for fence construction.

**Effects on Environmental Justice and Civil Rights**

There would be no disparate effects to minorities, women, or persons with disabilities. If additional Adaptive Management Stages occur, there would be increased costs to the permittees in materials, labor and loss for forage from pasture resting, or reduced season of use. As stated in the income section, the poverty rate for Okanogan County is 21.7 % and Farm income in Okanogan County is below that of other sectors. The potential for increases in costs for materials and labor and loss of forage from pasture resting could fall most heavily on individuals most vulnerable to economic changes. One objective of Alternative 2 is to implement an Adaptive Management strategy that empowers the Permittees to actively support improvements in riparian conditions, thus reducing the risk that additional costs would be accrued.

**Alternative 3**

The effects of Alternative 3 would be similar to Alternative 2 (if Alternative 2 were to reach Stage 5 implementation) however the time frame for full implementation is 4 years. Environmental and economic impacts would occur more rapidly.

**Economics**

Alternative 3 would have an adverse effect on the permittees by increasing the amount of costs in materials and labor and loss of grazing on up to 8,000 acres, about 22% of the BART allotments, because pastures would be rested. This would also increase the amount of time required for fence construction. The maximum cost estimates in Alternative 2 would apply to Alternative 3 and would occur within a 4 year time frame, as available funds allowed.

Because the Forest Service pays a percentage of material costs for fencing, there would be additional costs to the Government of up to $33,525 for fences and up to $17,200 for water developments. Monitoring by the Forest Service is expected to take approximately 60 person-days per year for Alternative 3 because of the additional miles of fencing, thus increasing costs to the Government.

**Employment**
While it is expected that16 jobs would be retained under this Alternative, the number could increase due to the extent of fence construction required. While this may improve the number of jobs, it would also increase costs to the permittees.

**Effects on Environmental Justice and Civil Rights**
There would be no disparate effects to minorities, women or persons with disabilities. There would be increased costs to the permittees in materials, labor, and loss for forage from pasture resting or reduced season of use. As stated in the income section, the poverty rate for Okanogan County is 21.7 % and Farm income in Okanogan County is below that of other sectors. The cost of implementing Alternative 3 could fall most heavily on individuals most vulnerable to economic changes.

**Cumulative Effects**

**Cumulative Effects Common to Alternatives 2 and 3**

**Economy**
The planning for the Crawfish Restoration Project (CR Timber Sale) has been completed and the timber portion sold and awarded (CR Timber Sale); road construction for the timber harvest has started. Proposed additional timber sales on State, private, or Tribal lands, if implemented, would provide revenue to the timber based economic sector, however depending upon the purchaser it is unknown whether these would benefit Okanogan County. It is possible that the purchaser may not be a locally owned timber company therefore they may not produce a detectable beneficial cumulative effect to the economy in Okanogan County. However, should locally owned timber companies purchase sales and the current market is favorable for wood products then combined with livestock grazing in the BART allotments, there could be a positive cumulative effect for Okanogan County.

The Access and Travel Management Plan for the Forest is in the planning stages and is considered a reasonably foreseeable future project. Road closures, obliteration, or restrictions are proposed for several roads within the BART assessment area under the Upper Aeneas, Bailey Restoration, and Crawfish Restoration Projects. These closures, if implemented, would complicate management activities such as fence and water source development and maintenance by increasing access time. Permittees may need to hire additional help for maintenance in order to transport materials to job sites. This would adversely impact permittees from increased time and profit loss.

**Employment**
The Crawfish Restoration Project and timber sales on State, private or Tribal lands, if implemented, could provide jobs within Okanogan County. Retaining the estimated 16 jobs resulting from livestock grazing on the BART allotments, would have a beneficial cumulative impact to employment in the county.

Socially, Alternatives 2 and 3 would have greater benefit and value to a larger number of interest groups than Alternative 1. People who are interested in protecting and improving resources including wildlife and fish habitat, and increasing hunting and fishing opportunities would see their values reflected more in these Alternatives.

**Environmental Justice and Civil Rights**
Increased costs or loss of grazing opportunities associated with BART would not have a positive impact on the poverty rate for Okanogan County. As stated in the income section, the poverty rate for Okanogan County is 21.7 % and Farm income in the County is below that of other sectors. This raises the possibility of environmental justice consequences because of the added costs and complications associated with road closures could fall most heavily on individuals most vulnerable to economic changes.

There is no legal requirement to allow people with disabilities the use of motor vehicles on roads, trails, or other areas that are closed to motor vehicles. Restrictions on motor vehicle use that are applied consistently to everyone are not discriminatory, therefore, there would be no disparate cumulative effects to minorities, women or persons with disabilities associated with either Alternative 2 or 3.

**Irreversible and Irretrievable Commitments**

Selection of any Alternative is not anticipated to result in adverse or disproportionate effect upon, nor displacement of minorities, or increases in taxes that would constitute an economic hardship. There would be no negative effects on public health.

## Compliance with Executive Orders

### Executive Order 11988 – Floodplain Management

Issued May 24, 1977, this Executive Order requires agencies to provide leadership and take action to minimize adverse impacts associated with the occupancy and modification of floodplains and reduce risks of flood loss; http://www.archives.gov/federal-register/codification/executive-order/11988.html.

None of the proposed Alternatives would result in an action resulting in an adverse impact resulting from any occupancy or modification of floodplains. No occupancy is proposed and any change in use within floodplains will improve over the existing condition. This EIS meets the intent and is in compliance with this Executive Order.

### Executive Order 11990 – Protection of Wetlands

Issued May 24, 1977, this Executive Order requires agencies to take actions to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands; http://www.archives.gov/federal-register/codification/executive-order/11990.html.

The Alternatives will either remove livestock (Alternative 1) or will improve livestock distribution and use (Alternatives 2 and 3), which in turn will allow for some recovery and reduced utilization of currently high use wetland areas. No new construction is proposed to be located in wetlands except fencing of water sources for water developments which would be beneficial. The BART AMP meets the intent and is in compliance with this Executive Order.

### Executive Order 12898 Consumers, Civil Rights, Minority Groups, Low Income Populations, and Women

Executive Order 12898 (59 Fed. Reg. 7629, 1994) directs Federal Agencies to identify and address, as appropriate, any disproportionate adverse affect to minority or low-income populations. None of the activities proposed would have disproportionate effects on low income or minority populations. None of the Alternatives would negatively affect women, American Indians, other minorities, or consumer groups. Civil Rights would not be affected by any of the Alternatives. The project includes both permittees and Forest Service employee accomplished work. The U.S. Department of Agriculture prohibits discrimination in its employment practices based on race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status.

## Other Required Disclosures

### Climate Change and Carbon Cycling

The effects of proposed livestock grazing in the BART allotments on climate change and carbon cycling, aren't measurable and are likely insignificant at the national or global scales.

The context of this analysis is that the BART Livestock Grazing Analysis project area is too small for a direct evaluation of potential climate change effects caused by the proposed actions to improve ecosystem health and move them to a "good" condition. Current understanding of climate change science suggests it is difficult, if not impossible, to establish a cause-and-effect relationship between grazing activities and climate change at the project level. Therefore, climate change and carbon cycling were not used or evaluated as a significant or analysis issue during the NEPA process and was not used to compare climate change or carbon cycle effects between Alternatives. Individual resource sections, where appropriate, included short write-ups on climate change and carbon cycling on their resource. Uncertainty in climate change effects is expected because it is not possible to meaningfully link individual project actions to quantitative effects or climate patterns.

At the same time, increasing levels of interest among the general public suggest there is some value in disclosing existing understanding, particularly to identify key areas of uncertainty and demonstrate consistency with national and international strategies and objectives. To that end, a short science overview is provided below.

Predicted climate change at a local project level carries a high degree of uncertainty, but some general projections are possible for the purpose of environmental analysis. Current predictions for climate change for the Pacific Northwest region call for increased overall warming, increased winter precipitation, decreased summer precipitation, which will result in warmer, wetter winters and warmer, drier summers (Mote and Salathe, 2010). The depth, extent, and duration of the snowpack in the Pacific Northwest Region are projected to decrease, especially at the lower elevations (Elsner et al. 2010, Mote 2003) Seasonal runoff patterns are likely to shift to an earlier spring peak flow and lower overall summer flows, especially in snowmelt-dominated watersheds (Barnett et al. 2005).

The Proposed Actions would affect National Forest System lands by implementing reduced grazing impacts on riparian areas and moving riparian areas to a "good" condition which should improve the capability of the landscape to withstand climate change stresses. The success of the proposal to move riparian areas to a "good" condition may be reduced by expected warmer summer temperatures, lower rainfall during the next century, and earlier run-off.. A project of the size proposed would contribute such minimal amounts of greenhouse gas that its impact on global or national climate change would be infinitesimal. Therefore, the Proposed Action's direct and indirect contribution to greenhouse gasses and climate change would be utterly negligible in the context of long-term climate patterns. In addition, because the direct and indirect effects would be negligible, the Proposed Action's contribution to cumulative effects on greenhouse gasses and climate change would also be negligible. The minor scope of the Proposed Action suggests it would be inappropriate to attempt to isolate climate change effects that are directly or indirectly attributable to implementation of the BART project.

Management practice that maintains or moves plant associations to a "good" condition appears to be consistent with maintaining the soil organic pool (Henderson et al., 2004; Brown and Thorpe, 2008, Sharrow 2008).

The Intergovernmental Panel on Climate change (IPCC) has summarized the contributions to climate change of global human activity sectors in its Fourth Assessment Report (IPCC 2007). The top three anthropogenic (human-caused) contributors to greenhouse gas emissions (from 1970 – 2004) are: 1). Fossil fuel combustion (56.6% global total), 2). Deforestation (17.3%); and 3). Agricultural waste/energy (14.3%). IPCC subdivides the deforestation category into land use conversion and large scale

deforestation. The BART project does not fall within any of these main contributors of greenhouse gas emissions. Forest land would not be converted into a developed or agricultural condition.

**Irreversible and Irretrievable Commitments**

NEPA regulations also state that the Forest Service must show any irreversible or irretrievable commitments of resources that may result from the Alternatives. An irreversible commitment is a permanent resource loss including the loss of future options. It usually applies to nonrenewable resources, such as minerals or cultural resources, or to factors that are renewable only over long periods, such as soil productivity. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time, at a great expense. or because the resource has been permanently destroyed or removed. An irretrievable commitment is the loss of use or production of a natural resource for some time. Fossil fuel needed for operations and transportation associated with this project would be irreversibly lost, but this is unsubstantial in the context of regional, national, or global use. This analysis determined that damage to streambanks from grazing has caused stream embeddedness which has adversely affected aquatic reproduction. This loss of aquatic reproduction is irretrievable, but not irreversible. Damage to streambanks and stream embeddedness may take many years to repair on their own.

**Short-term Use versus Long-term Productivity**

Grazing is a short-term use of the land. There would be no trade-off of long term productivity at the expense of short-term use.

**Probable Adverse Environmental Consequences that are Unavoidable**

All probable adverse environmental consequences are described earlier in this chapter.

**Potential Conflicts with Plans or Policies of Other Jurisdictions**

- Effects on threatened, endangered, and sensitive species are disclosed earlier in this chapter and in the Biological Evaluations for plants, fish, and terrestrial wildlife contained in the project record. There would be no adverse effects on any species to threaten viability.
- The Alternatives comply with State and Federal air quality regulations because there would not be any effect on air quality.
- None of the Alternatives would conflict with American Indian treaty rights or provisions. The Yakama Indian Nation and Confederated Tribes of the Colville Reservation were consulted regarding this project but they did not respond with any concerns.
- Best Management Practices would be implemented to meet State and Federal water quality regulations.

**Prime Farm, Range, or Forest Land**

The Alternatives comply with the Federal Regulations for prime land. No ‘prime’ forestland would be affected. The analysis area does not contain any prime rangeland or farmland.

**Public Health and Safety**

No public health or safety problems are anticipated with any Alternative. None of the drainages within the allotments are listed on the State’s 2008 and 2012 Water Quality Assessment given the requirements of

Sections; 303(d) and 305(b) of the Clean Water Act. There are no 303(d) listed waters within the analysis area, and the nearest listed 303(d) listed water is approximately 7.0 miles downstream of the Forest Service boundary, in Lower Tunk Creek. Bonaparte Creek, the Sanpoil River, and the Okanogan River have also been identified as impaired on the 2012 and 2008 303(d) list for exceeding bacteria, dissolved oxygen (DO), and pH standards and require a plan for improving water quality, titled a Total Maximum Daily Load (TMDL). These sites are well below the analysis area and not likely to be affected by actions on National Forest System lands (see Hydrology section earlier in this chapter).

**Inventoried Roadless Areas, Potential Roadless Areas, Roadless Area Conservation Rule, and Unroaded/Undeveloped Character**

There is no Inventoried Roadless Area (IRA) within the BART Grazing Assessment Area.

Draft potential Wilderness Areas (PWAs) have been identified as part of the Forest Plan Revision process. No Potential Wilderness Areas were identified within the BART Grazing Assessment.

There are four areas that might be considered to have unroaded/undeveloped character. These are in the Beehive Mountain area, the area south of Tunk Mountain (though there is an overhead power line running through this area), the area west of Forest Road 3000165, and in the Bailey Mountain area. None of the proposed activities in the BART Allotment Management Plan project would substantially change unroaded/undeveloped character. Livestock grazing does not affect manageability for these areas, nor does it impact the surroundings or opportunities for primitive recreation and challenge. It may reduce the natural integrity, appearance and opportunity for solitude of the areas because livestock and their droppings may be offensive to recreationists seeking a natural experience in the unroaded/undeveloped area. The only new developments proposed affecting these areas are about one and a half miles of proposed new fence in Stages 2 and 3, and proposed new water developments.

This project is consistent with the District Court of Wyoming's injunction against the Roadless Conservation Area Rule because the project was not altered in any way to implement the RACR, and would have been designed the same way regardless of whether it was in inventoried roadless or not. It is therefore consistent with both court rulings.

**Visual Quality Objectives**

This project is consistent with the visual quality objectives of the area, mostly maximum modification, over the allotments. Visual quality is not expected to change as a result of any project activities. Livestock and evidence of livestock grazing would be visible from all roads on the allotments.

**Wild and Scenic Rivers**

There are no existing or potentially eligible Wild and Scenic Rivers in the analysis area.

**Forest Plan Consistency**

The proposed action is consistent with the Okanogan National Forest Land and Resource Management Plan (Forest Plan, USDA Forest Service) and its amendments (1989). Applicable Forest-wide and land use designation standards and guidelines have been incorporated. The Forest Service uses design elements in the planning and implementation of land management activities. The application of these elements begins during the planning and design phases of a project.

# Chapter 4
# Consultation and Coordination

The Forest Service consulted with the following individuals, tribes, Federal, state, and local agencies, and non-Forest Service persons during the development of this environmental impact statement (EIS).

## List of Preparers

### Christina Bauman –Lead Rangeland Management Specialist, Tonasket Ranger District

B.S. in Rangeland Ecosystems and Management, 1989, Washington State University, Pullman, WA, Post graduate studies in Botany at Blue Mountain Community College and Whitman Colleges, 1990. Twenty nine years' experience in natural resource management agencies (county, state, and federal). Twenty seven years' experience with the Forest Service; twenty three years in Rangeland Management, and four years in Botany.

### Phil Christy – District NEPA Coordinator, Special Uses, Tonasket Ranger District

B.S. in Forest Management, 1971, University of Washington, Seattle, WA. Post graduate studies in Forest Engineering (Forest Engineering Institute), 1980, Oregon State University, Corvallis, OR. 36 years' experience with the Forest Service in project level environmental analysis, special uses, minerals, timber sales, recreation, and fire.

### R. Lance George – North Zone Hydrologist

B.S. in Environmental Science, Minor in Biology, 1993, Slippery Rock University, Slippery Rock, PA, Dual M.S. in Forest Engineering/Forest Science (Hydrology and Soils), 2006, Oregon State University, Corvallis, OR. 15 years natural resource management experience (State and Federal Agencies); 5 years employed as Zone Hydrologist with U.S. Forest Service.

### Molly Hanson - Forest Hydrologist, Okanogan-Wenatchee National Forest

B.A. in Environmental and Resource Management, Geography, Minor in GIS, 2000, Western Washington University, Bellingham, WA, M.S. Earth Surface Process, Geography, 2005, University of Utah, Salt Lake City, UT, 6 years' experience as a hydrologist in Washington and Utah, 2 years' experience as a wildland firefighter.

### Kim Lancaster – Archaeologist, Tonasket Ranger District

B.A. in Anthropology (concentration on Archaeology), Western Washington University, Bellingham, WA, 2002; M.A. in Archaeology from Prescott College, Prescott, AZ, 2008, Twelve years' experience in planning and implementation of cultural resource investigations for federal and state agencies.

### Maura Laverty, Range & Invasives Program Manager, Okanogan-Wenatchee National Forest

B.S. in Range Management from Washington State University, Pullman, WA, 1987, 26 years as a range specialist with the Forest Service.

### Larry Loftis – District Botanist, Tonasket Ranger District

B.A. in Biology, 1977, Southern Oregon State College, Ashland, OR. Post graduate studies in Botany at Oregon State University, 1990 and 1991, Corvallis, OR. Twenty three years' experience as a botanist. Twelve years' experience as a forestry technician.

**Matt Marsh – District Wildlife Biologist, Tonasket Ranger District**

B.S. in Natural Resources/Wildlife Ecology, 2002, Washington State University, Pullman, WA, Six years of experience as a professional wildlife biologist with the Forest Service and the Washington Department of Natural Resources. Five years experiences as a Forester with the Washington Department of Natural Resources.

**Kawa Ng – Economist – Ecosystem Management Coordination Staff, Washington Office**

PhD in Ecological Economics from Colorado State University, Fort Collins, CO, a Master of Science in Applied and Resource Economics and a Bachelor of Sciences in Natural Resource Management from the University of Alaska, Fairbanks, AK.

**Carol Ogilvie – Noxious Weed Specialist, Tonasket Ranger District**

A.A.S. in Forestry from Spokane Community College, Spokane, WA, Washington State Public Pesticide License for Agriculture, Forest, and Ornamental Weed Control, 23 years' experience in invasive plant management, 8 years as a steering committee member for the Okanogan County Coordinated Weed Management Area. 25 years as a Licensed Washington State Public Operator and Consultant for herbicide application.

**Betsy Peterson – Vegetation Management and Recreation Staff, Tonasket Ranger District**

B.S. in Recreation Resource Management, 1990, University of Montana, Missoula, MT. A.A.S. in Natural Resource Management, 1988, Spokane Community College, Spokane, WA, 27 years of experience in silviculture, timber inventory, and recreation with the Forest Service.

**Shawn Plank – Assistant Fire Management Officer, Tonasket Ranger District**

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# Appendix A

# Maps

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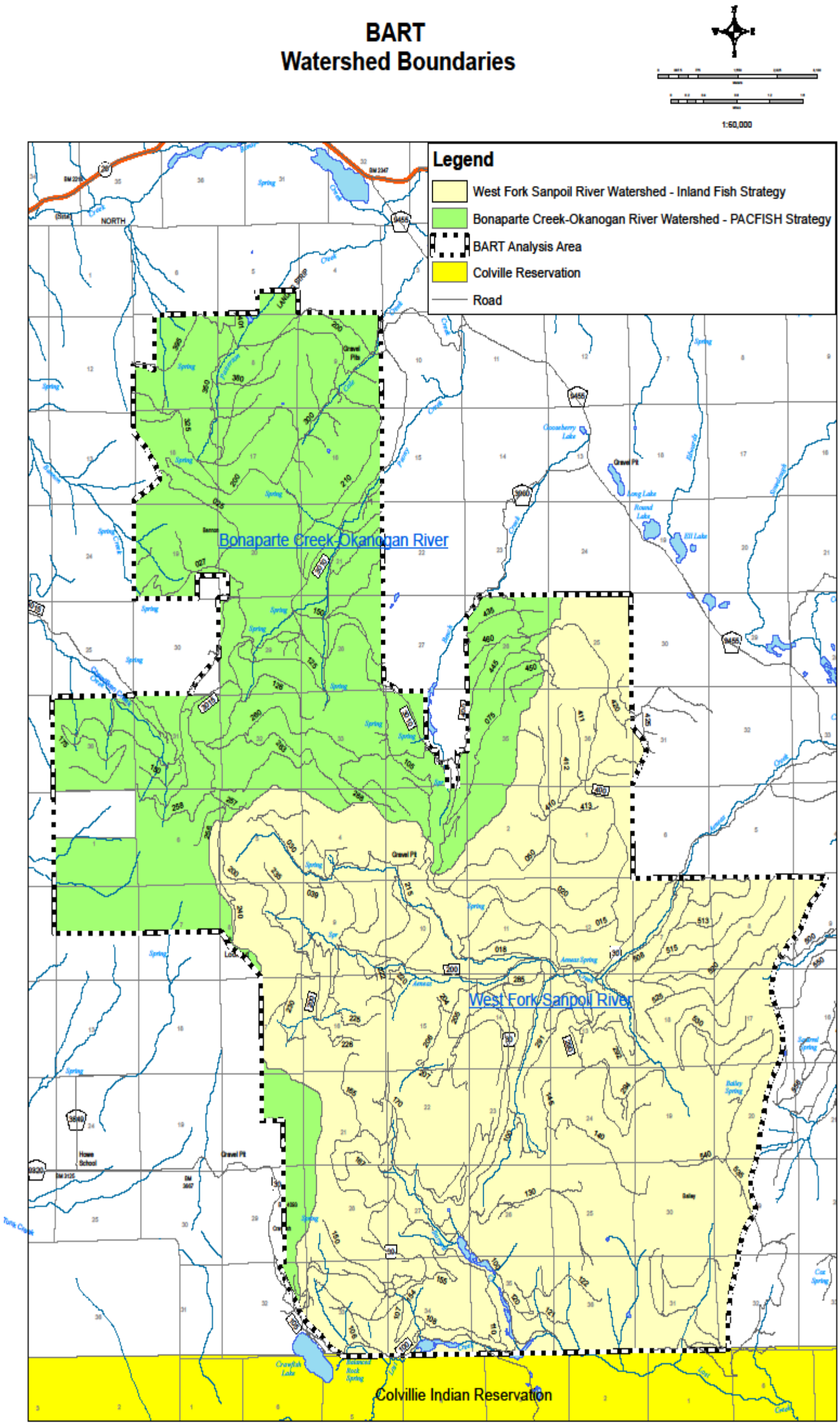


**Figure A-1, BART Watershed Boundaries**

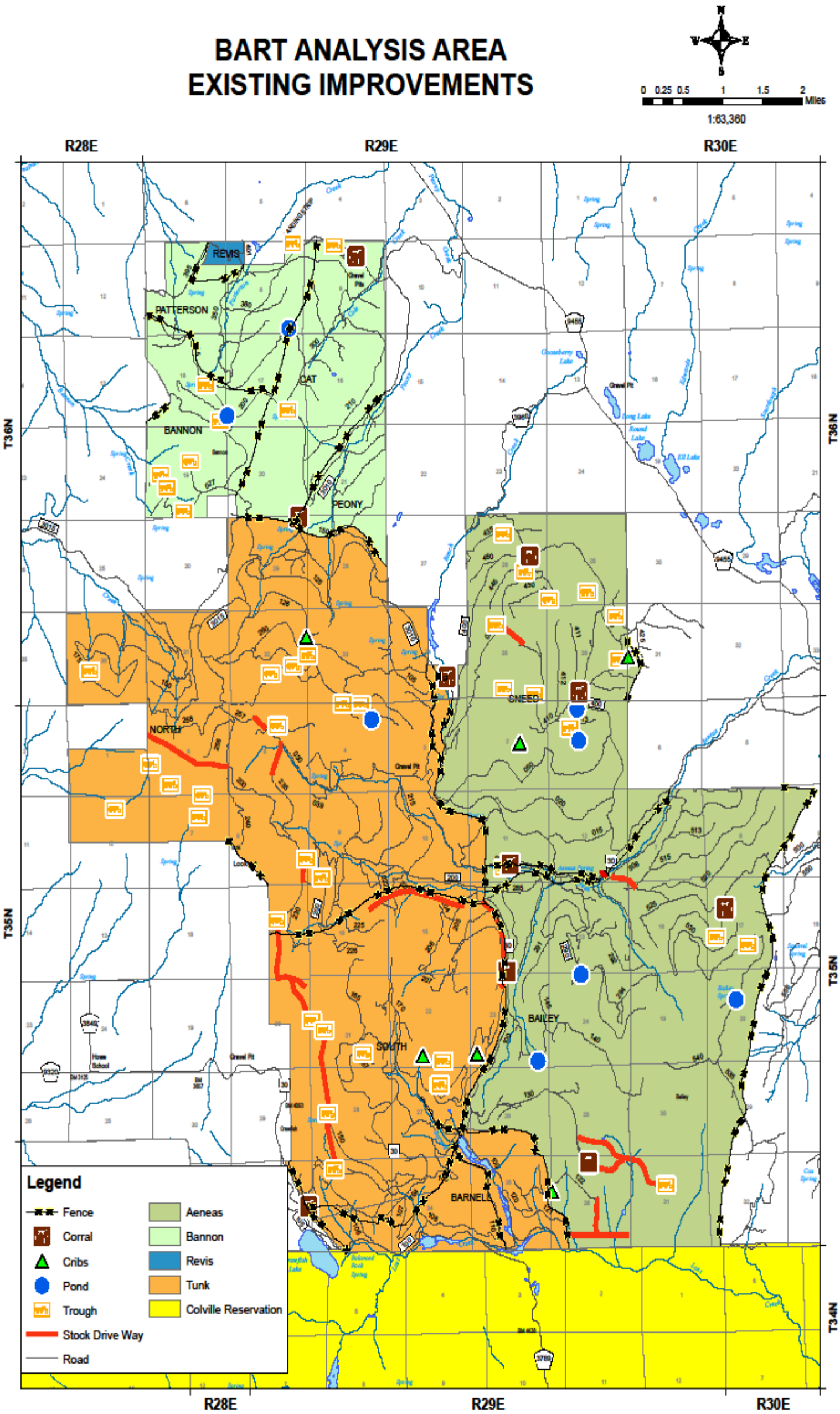


**Figure A-2, BART Analysis Area Existing Improvements**

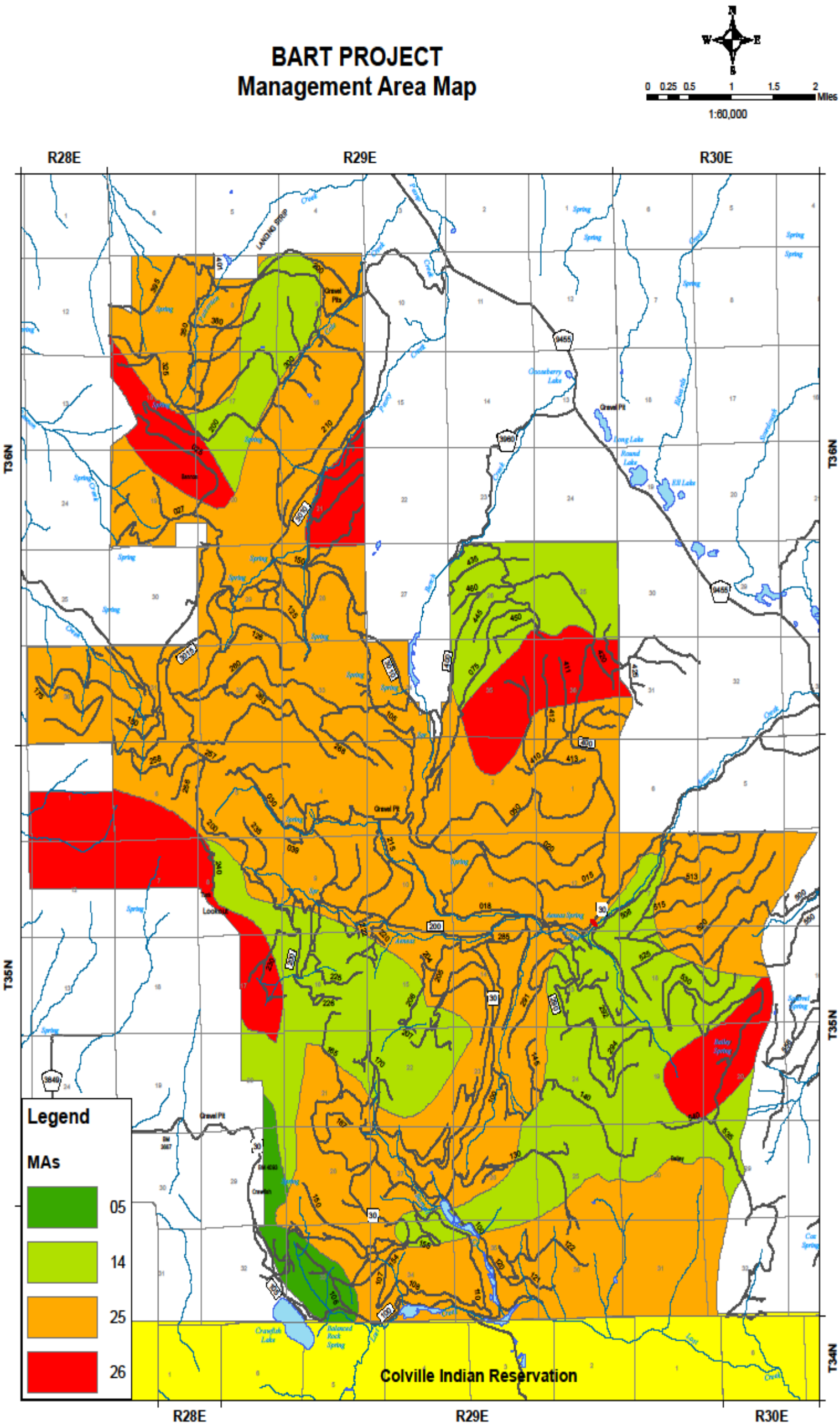


**Figure A-3, BART Project Management Area Map**

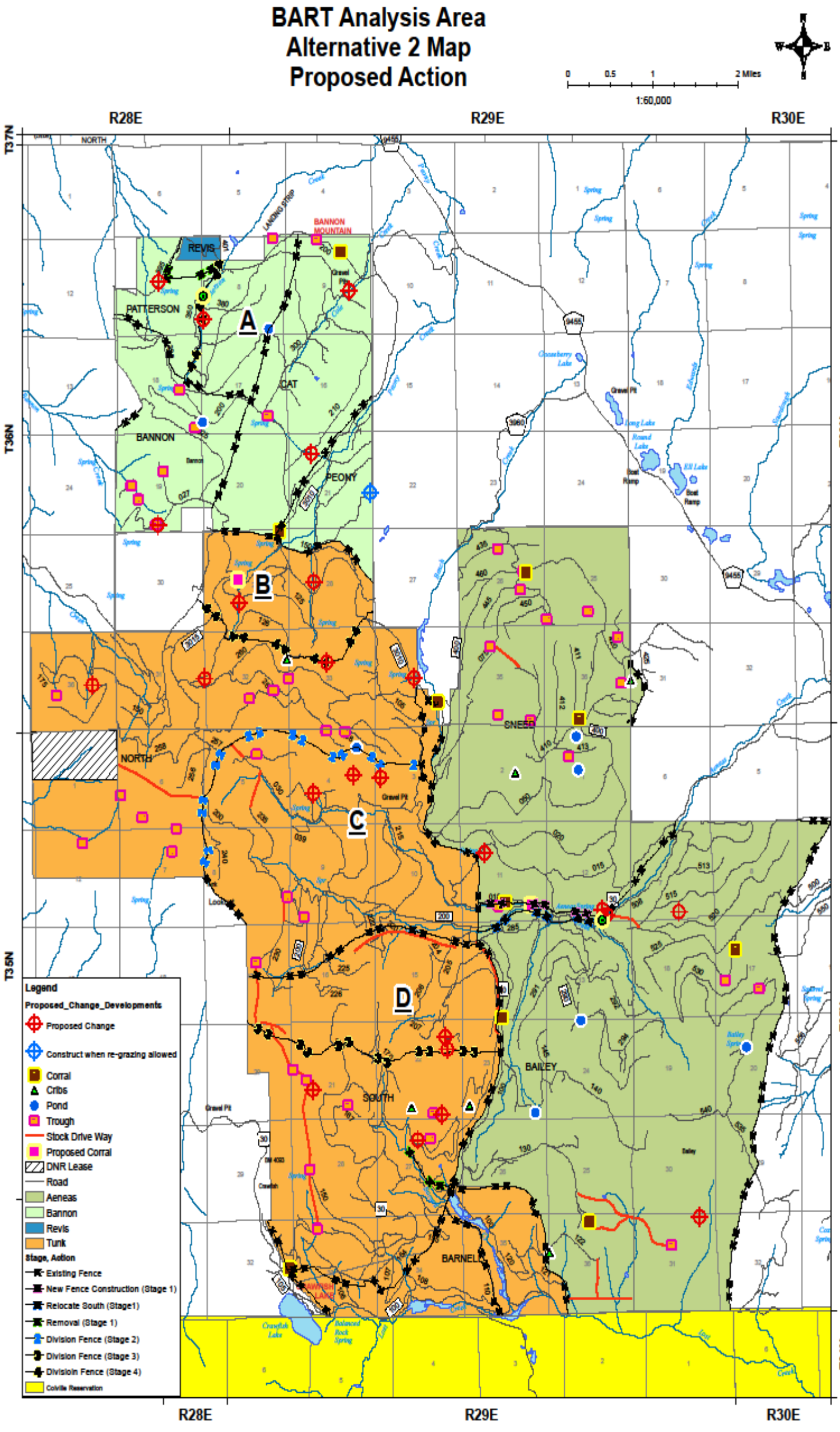


**Figure A-4, BART Analysis Area, Alternative 2 Map, Proposed Action**

# BART Analysis Area
# Alternative 3 Map

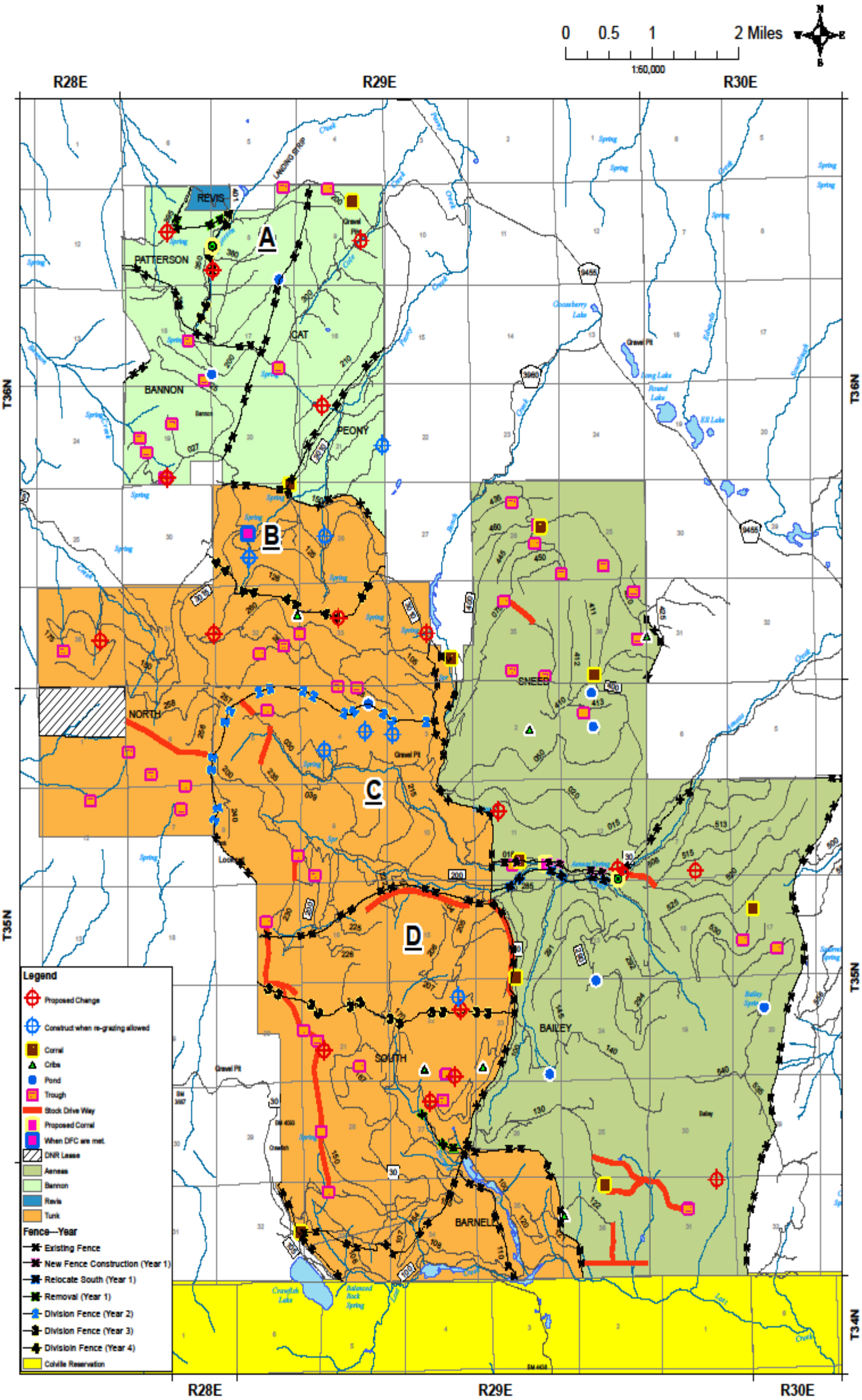


**Figure A-5, BART Analysis Area, Alternative 3 Map**

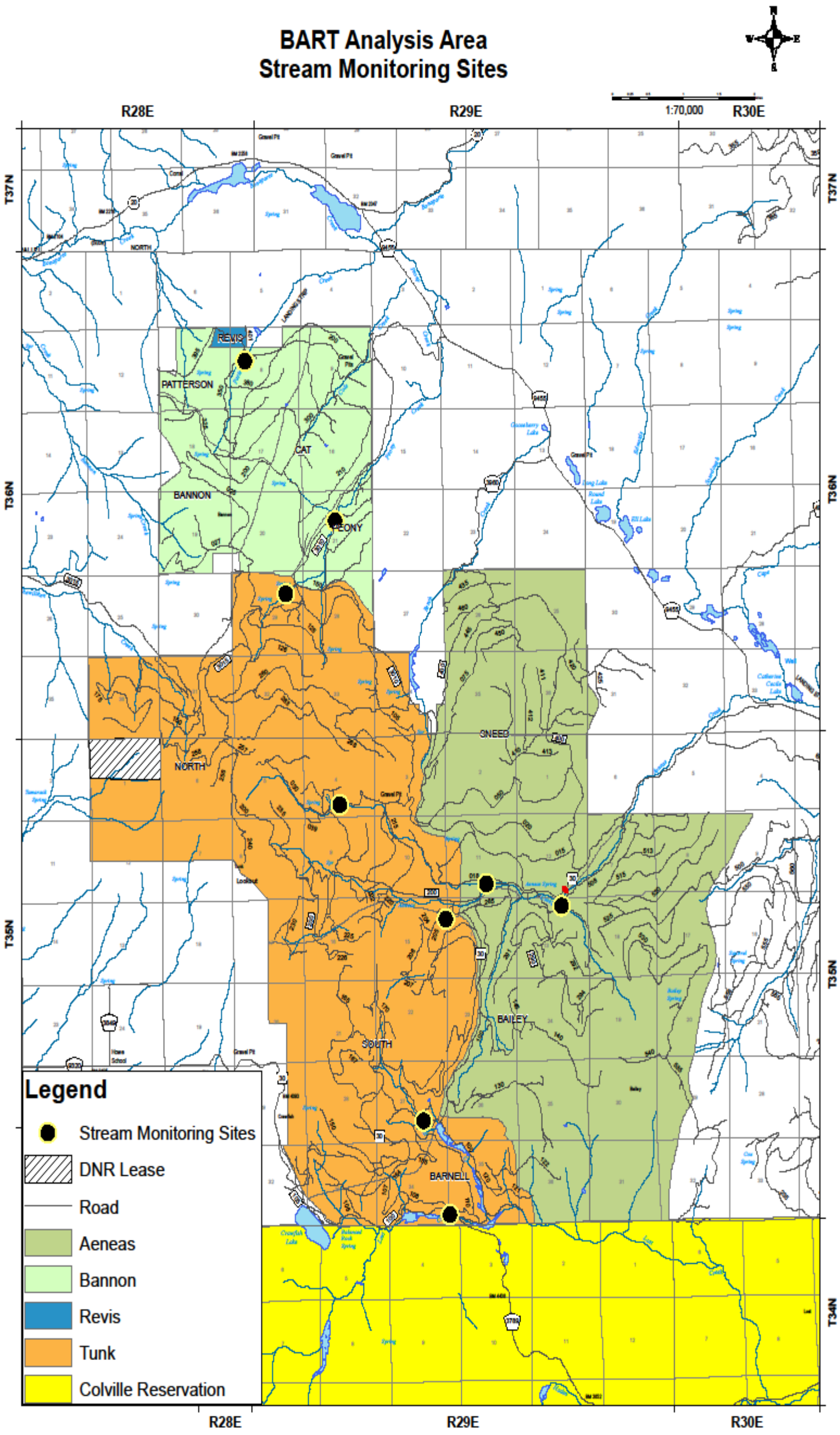


**Figure A-6, BART Analysis Area, Stream Monitoring Sites**

# Appendix B

## Acronyms, Abbreviations, Glossary

| | |
|---|---|
| AMP | Allotment Management Plan |
| AOI | Annual Operating Instructions |
| ATV | All-Terrain Vehicle |
| AUM | Animal Unit Month |
| BA | Biological Assessment |
| BE | Biological Evaluation |
| BLM | Bureau Of Land Management |
| BMP | Best Management Practice |
| CCT | Colville Confederate Tribes |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| cfs | Cubic Feet per Second |
| CWA | Clean Water Act |
| CWE | Cumulative Watershed Effect |
| DEIS | Draft Environmental Impact Statement |
| DFC | Desired Future Condition |
| DOE | Washington Department of Ecology |
| DNR | Washington Department of Natural Resources |
| DSC | Detrimental Soil Conditions |
| E | Endangered (see ESA) |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EPA | Environmental Protection Agency |
| ESA | Endangered Species Act |
| FEIS | Final Environmental Impact Statement |
| FS | U.S. Forest Service |
| FSH | Forest Service Handbook |
| FSM | Forest Service Manual |
| GIS | Geographic Information System |
| HM | Head Month |
| HUC | Hydrologic Unit Code |
| IDT | Interdisciplinary Team |
| IMPLAN | Impact Analysis for Planning (trademark name) |
| INFISH | Inland Native Fish Strategy |
| LRMP | Land and Resource Management Plan |
| MA | Management Area |
| MANLAA | May Affect, Not Likely to Adversely Affect |
| MIIH | May Impact Individual Habitat |

| | |
|---|---|
| MIS | Management Indicator Species |
| MOU | Memorandum Of Understanding |
| NE | No Effect |
| NEPA | National Environmental Policy Act |
| NF | National Forest |
| NFMA | National Forest Management Act |
| NFS | National Forest System |
| NHPA | National Historic Preservation Act |
| NI | No Impact |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NTU | Nephelometric Turbidity Unit |
| OHV | Off Highway Vehicle |
| ONF | Okanogan National Forest |
| PACFISH | Interim strategies for managing anadromous fish–producing watersheds in eastern Oregon, Washington, Idaho, and portions of California |
| PIPO | PACFISH/INFISH Biological Opinion |
| RHCA | Riparian Habitat Conservation Area |
| RMO | Riparian Management Objectives |
| ROD | Record Of Decision |
| RPA | Forest and Rangeland Renewable Resources Planning Act |
| SHPO | State Historic Preservation Office |
| T | Threatened (see ESA) |
| TMDL | Total Maximum Daily Load |
| UCR | Upper Columbia River |
| USDA | U.S. Department of Agriculture |
| USDI | U.S. Department of The Interior |
| USFWS | U.S. Fish And Wildlife Service |

**A:**

**Access:** The mode by which activities are pursued and how well users can travel to or within the setting.

**Adaptive Management:** A system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes are met or re-evaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain.

**Adverse effects to soil, water quality, and riparian resources:** Direct, indirect, and cumulative impacts to soil quality, surface water, and groundwater resources and riparian structure, function, and processes that prevent achievement of land management plan desired conditions, goals, and objectives for water resources; attainment of applicable Federal, State, or local water quality standards; or other water quality related requirements.

**Affected environment**: The natural, physical and human-related environment that would be sensitive to changes from implementation of the alternatives.

**Allotment:** Rangeland and /or forestland area designated for the use of a prescribed number and kind of livestock under a specific plan of management.

**Allotment Management Plan (AMP):** A long-term operating plan for a grazing allotment document prepared in consultation with the permittees involved that specifies the program of action for implementation of the forest plan as related to livestock grazing activities. Each allotment on National Forest System lands is required to have an Allotment Management Plan.

**Allowable use:** The degree of utilization considered desirable and attainable on various parts of a ranch or allotment considering the present nature and condition of the resource, management objectives and level of management. A baseline utilization percentage established in a Forest Plan.

**Alternative**: A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. Each alternative represents a different way of achieving a set of similar management objectives.

**Analysis area:** One or more capability areas combined for the purpose of analysis in formulating alternatives and estimating various impacts and effects.

**Animal Unit Month (AUM):** The amount of dry forage required by one mature (1,000 lb.) cow, or its equivalent for one month based on a forage allowance of 26 pounds per day. Not synonymous with animal-month. The term AUM is commonly used in three ways (a) stocking rate, as in "X acres per AUM", (b) forage allocations, as in "X AUMs in Allotment A", and (c) utilization, as in "X AUMS taken from Unit B."

**Annual Operating Instructions (AOI):** A set of instructions developed by the US Forest Service and given to the Grazing Permittee on an annual basis, that explains the specific pastures to be used, and adjustments to the Allotment Management Plan for the current year.

**Aquatic:** Within water.

**Aquatic ecosystem:** The stream channel, lake, or estuary bed, water, and biotic communities and the habitat features that occur therein (Forest Service Manual [FSM] 2526.05).

**Available forage:** That portion of the forage production that is accessible for use by a specified kind or class of grazing animal.

**B:**

**Bankfull or bankfull discharge:** The elevation of the bank when flooding begins. The bankfull level is associated with the streamflow that just fills the channel to the top of its banks where water begins to overflow onto the floodplains. Bankfull discharge largely controls the form of the watercourse. It is at this discharge level that stream waters just begin to flow over the banks and into the floodplain. The bankfull stage corresponds to the discharge at which channel maintenance is the most effective; that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work results in the average morphologic characteristics of channels. Bankfull discharge is associated with a momentary maximum flow that, on the average, has a recurrence interval of 1.5 years as determined using a flood frequency analysis. (Dunne and Leopold 1978). In stable rivers, bankfull is reached when the water cannot be contained within its banks and flooding begins. In entrenched streams, bankfull width is restricted, and more difficult to determine, but the top of depositional features is typically bankfull. On aggrading streams, the bankfull discharge is no longer contained within the banks during a bankfull event, often causing excessive flooding. A stream's bankfull discharge may increase or decrease with hydrologic modifications, changes in impervious land surfaces, or vegetative cover types that alter the rates of water movement through the watershed (Rosgen 1996).

**Bare ground/Bare soil:** All soil surfaces not covered by vegetation, rock or litter.

**Beneficial use:** Different ways in which natural waters are used by humans and nature. Human uses include drinking water, bathing, recreation, agricultural, and industrial water supplies. Natural uses include growth and propagation of fish and associated aquatic life, wildlife, and furbearers. Use specified in water quality standards for each waterbody or segment whether or not it is being attained. Types of uses include public water supplies; protection and propagation of fish, shellfish, and wildlife; recreation; agriculture; industry; navigation; marinas; groundwater recharge; aquifer protection; and hydroelectric power (EPA 2007).

**Best Management Practices (BMP):** A practice or combination of practices that are the most effective and practical means of achieving resource protection objectives (primarily water quality protection) during resource management activities.

**Best Management Practices (BMPs) for water quality:** Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (36 CFR 219.19).

**Big game:** Those species of large mammals normally managed as sport hunting resources.

**Biological Assessment (BA):** An assessment or study required by the Endangered Species Act of 1973 to determine the potential effects of a proposed management action on threatened and endangered species or their habitats. The U.S. Fish and Wildlife Service review Biological Assessments and requests that all threatened, endangered, proposed threatened or endangered, and Category 1 "candidate species be addressed.

**Biological Evaluation (BE):** The legal record of finding for Pacific Northwest Regional Forester sensitive species.

**Biotic:** The assemblage of native and exotic plants and animals associated with a particular site or landscape, including microorganisms, fungi, algae, vascular and herbaceous plants, invertebrates, and vertebrates. These assemblages and their biotic and abiotic relationships serve landscape and watershed functions by promoting soil properties supporting water infiltration and storage, energy and nutrient fixation, recycling and transfer, species survival, and sustainable population dynamics.

**Browse:** Leaf and twig growth of shrubs, woody vines, and trees available for use by animals. Also, to search for or consume browse.

**Buffer (PACFISH/INFISH):** A defined distance from the stream.

**Buffer zone:** (1) A protective, neutral area between distinct environments. (2) An area that acts to minimize the impact of pollutants on the environment or public welfare.

## C:

**Canopy cover:** The percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread by foliage of plants. Canopy cover is measured along a line intercept transect. Small openings within the canopy are included. The sum of canopy cover of several species may exceed 100 percent. (Syn. Crown Cover).

**Capability:** Defined as the potential of an area to produce resources under an assumed set of management practices at a given intensity.

**Carrying Capacity:** The maximum stocking rate possible without inducing damage to vegetation or related resources. It may vary from year to year on the same areas due to fluctuating forage production. (Syn., grazing capacity).

**Channel morphology:** Form and structure of stream bank which is that portion of the channel bank cross section that controls the lateral movement of water; includes channel dimensions, patterns, and profile.

**Climate Change:** A significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors that include oceanic processes (such as oceanic circulation), biotic processes, variations in solar radiation received by Earth, plate tectonics and volcanic eruptions, and human-induced alterations of the natural world (i.e. such as groundwater recharge projections in southern British Columbia for the 2080s range from -10% to +23% relative to historical recharge) .

**Connectivity:** Creating or maintaining networks of habitat that connect fragmented habitats, thus linking population segments of wildlife. Connectivity allows gene flow and enhances long-term species survival.

**Consultation (Endangered Species Act):** A process between a Federal agency and the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service that determines whether a proposed Federal action is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Formal consultation is required if a proposed Federal action may affect a listed species or designated critical habitat, unless the Services concur in writing that a proposed action "is not likely to adversely affect" listed species or designated critical habitat [50 CFR §402.02, 50 CFR §402.14].

**Cover:** The area covered by the combined aerial or basal parts of plants and mulch expressed as a percent of the total area, percentage of ground area covered by aerial parts of live plants, litter, gravel, and rocks.

**Crib:** Livestock watering sites developed by digging a hole at the water source, blocking water flow partially (has outlet) with logs or other structural barrier. These form a small pond like structure where livestock can drink. Typically, the water source is fenced excluding and protecting water sources from livestock.

**Critical habitat**: As defined under the Endangered Species Act, Critical Habitat is the area determined necessary for a listed species to make a successful recovery. Within the geographical area constituting critical habitat are the physical or biological features essential for the conservation of a species.

**Cultural Resources:** Archaeological and cultural places of prehistoric and historic human activity including aboriginal mounds, forts, buildings, earth works, village locations, burial grounds, ruins, caves, petroglyphs, pictographs or other locations which are the source or prehistoric cultural features and specimens. Areas associated with human use capable of providing scientific or humanistic understanding of past human behavior, cultural adaption, and related spiritual value for members of an affiliated culture.

**Cumulative effect**: The impact on the environment resulting from the incremental impact of the action added to other past, present or future actions. They can also result from individually minor but collectively significant actions taking place over a period of time.

**D:**

**Deferment:** Delay of livestock grazing on an area for an adequate period of time, to provide for plant reproduction, establishment of new plants, or the restoration of vigor in existing plants. Generally defined as delay of grazing until the seed of the key forage species is mature.

**Deferred grazing:** The use of deferment in grazing management of a management unit, but not in a systematic rotation including other units.

**Deferred rotation:** Any grazing system that provides for a systematic rotation of deferment among pastures. Moving grazing animals to various parts of a range in succeeding years or seasons to provide for seed production, plant vigor, and for seedling growth.

**Density:** The number of individuals per unit area. It is not a measure of cover.

**Desired future condition/Desired condition:** The future condition of a landscape that meets management objectives. Desired future condition is based on ecological (such as desired plant community), social, and economic considerations during the land and resource management planning process. Desired future condition is usually expressed as ecological status or management status of vegetation (species composition, habitat diversity, age, and size classes of species) and desired soil qualities (conditions of soil cover, erosion, compaction, sedimentation, loss of soil productivity). A description of the landscape as it could reasonably be expected to appear at the end of the planning period if the plan goals, objectives, standards, and guidelines for that landscape are fully achieved.

**Direct effect:** Effects on the environment that occur at the same time and place as the initial cause or action.

**Disease:** Transmission of and exposure to infectious agents or congenital defects which interfere with normal functions of an animal or plant.

**Dispersal:** The process where individuals leave one habitat or landscape to seek another habitat or landscape in which to live.

**Diversity:** The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan (National Forest Management Act Planning Regulation).

**Drought:** An extended period of below normal precipitation which causes damage to crops and rangelands; diminishes natural stream flow; depletes soil and subsoil moisture; and because of these effects, causes social, environmental, and economic impacts. To further define drought in quantitative terms that can be used to trigger the onset of drought, the use of the Society for Range Management's definition is recommended: "Prolonged dry weather when precipitation is less than 75% of the average amount."

**E:**

**Ecosystem:** Organisms together with their biotic and abiotic environment, forming an interacting system and inhabiting an identifiable space.

**Effectiveness:** Monitoring to evaluate whether the specified BMPs had the desired effect.

**Effects**: The results expected to be achieved from implementation of actions relative to physical, biological, and social (cultural and economic) factors resulting from the achievement of outputs. Examples of effects are tons of sediment, pounds of forage, person-years of employment, and income. There are direct effects, indirect effects, and cumulative effects.

**Effects determinations (Endangered Species Act consultation):**

- **Likely to Adversely Affect (LAA):** A determination made when adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial.
- **May Affect, Not Likely to Adversely Affect (NLAA):** A determination made when any effects to listed species or designated critical habitat may occur, but are deemed discountable, insignificant, or beneficial.
- **No Effect (NE):** A determination of NE is applicable if (a) there are no listed or proposed species or designated or proposed critical habitat occurring in the area, or (b) the project will have no direct or indirect effect whatsoever on listed or proposed species.

**Endangered species:** Any animal or plant species in danger of extinction throughout all or a significant portion of its range, as designated by the U.S. Fish and Wildlife Service or National Marine Fisheries Service under provisions of the Endangered Species Act.

**Environment:** The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

**Environmental Analysis:** An analysis of alternative actions and their predictable long and short-term environmental effects. Environmental analyses include physical, biological, economic, social, and environmental design factors and their interrelations.

**Environmental Consequences:** A situation that naturally or logically follows as a result of an action. Commonly used in environmental impact statements for discussions about how the human environment, which includes the natural and physical environment and the relationship of people with that environment, is influenced by government actions.

**Environmental Impact Statement** (**EIS):** The documentation of environmental effects and action required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review. It is a formal document that must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines, and directives of the agency responsible for the project proposal.

**Ephemeral (stream):** Streams that flow only during and immediately after precipitation. A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all times above the zone of saturation (Briggs 1996).

**Erosion:** The wearing away of the land's surface by water, wind, ice, or other physical processes. It includes detachment, transport, and deposition of soil or rock fragments.

**Exclosures**: Generally, structures designed to exclude animals from a specific area.

**F:**

**Fen:** Ancient wetland ecosystem dependent on nutrient-rich local or regional groundwater flow systems maintaining perennial soil saturation and supporting continuous organic soil (i.e., peat) accumulation (Bedford and Godwin 2003, Chimner et al. 2010, Clymo 1983, Cooper and Andrus 1994, Gorham 1953). Groundwater controls fen type, distribution, plant community composition, pH, water chemistry, and micro-topography (Volume 1: National Core BMP Technical Guide, page 157).

**Floodplain:** The area adjacent to the active stream channel which is inundated during flows that exceed bankfull level. The floodplain acts as an energy dispersion zone during flood flows, and functions as an area of deposition. The lowland and relatively flat areas adjoining inland streams and standing bodies of water and coastal waters, including debris cones and flood-prone areas of offshore islands, including at a minimum, that area subject to a 1-percent chance of flooding in any given year (FSM 2527.05).

**Flow:** See stream flow

**Forage:** Browse and herbage which is available to and may provide food for grazing animals or be harvested for feeding; to search for or consume forage.

**Forage production:** Weight of forage produced within a designated period of time on a given area.

**Forb:** Any broad- leafed, herbaceous plant other than those in the Phocaea (grass) Cyperaceous (sedge) and Juncaceous (rush) families.

**Fry:** Newly hatched, active feeding post larval fishes; may include all fish stages from hatching to fingerling

**Functioning at Risk (proper functioning condition):** Riparian-wetland areas that are in a functional condition but an existing soil, water, or vegetation attribute categorizes them with a reversible loss in capability and increased vulnerability to irreversible degradation based upon evaluation of current conditions and processes. See also Proper Functioning Condition.

**G:**

**Geographic Information System (GIS)**: A computer software platform designed to facilitate the assembly and analysis of diverse data sets pertaining to specific geographic areas using spatial locations of the data as the basis for the information system

**Goal:** The desired state or condition that a resource management policy or program is designated to achieve. Narrower and more specific than objectives, goals are usually not measurable and may not have specific dates by which they must be reached. Objectives are developed by first understanding one's goals.

**Grass:** Plants of the Gramineae family, usually herbaceous plants with narrow, parallel-veined, two-ranked leaves.

**Grassland:** Lands on which the vegetation is dominated by grasses, grass-like plants, and/or forbs. Non-forest land shall be classified as grassland if herbaceous vegetation provides at least 80% of the canopy cover excluding trees.

**Grazing:** Consumption of native forage from rangelands or pastures by livestock or wildlife.

**Grazing allotment:** An area where one or more livestock operators graze their livestock. An allotment generally consists of federal land but may include parcels of private or state-owned land.

**Grazing management:** The manipulation of grazing animals to accomplish desired results when considering animal, plant, land, or economic responses.

**Grazing permit:** Official written permission to graze a specific number, kind, and class of livestock for a specified time period on a defined rangeland.

**Grazing season:** (1) On public land, an established period for which grazing permits are issued. (2) The time interval when animals are allowed to utilize a certain area.

**Grazing system:** A specialization of grazing management, which defines the periods of grazing and non-grazing. Grazing system should consist of at least the following: the number of pastures; number of herds; length of grazing period; length of non- grazing periods for any given unit in the system. Examples are Deferred Rotation and Rest Rotation.

**Greenline:** 1). The first perennial vegetation from the water's edge. Riparian areas that are in high seral status with stable stream banks will exhibit a continuous line of vegetation at the bankfull discharge level. Rocky stream types may have a significant amount of rock causing breaks in the vegetation. This rock is considered part of the green line. Other breaks may occur in the first perennial band of vegetation (watercourses or bare ground). The amounts of these (perennial vegetation, rock, and bare ground) should be recorded. 2). The greenline is a lineal line of year around vegetation along a stream's edge. Changes in soil moisture and vegetation can happen quickly at this location and livestock and other ungulates are attracted to streamside areas, which can affect the condition of streamside vegetation, streambanks, and the streambed (Wyman et al. 2006; Clary and Kruse 2004; Platts 1991).

**Ground cover:** The percentage of material, other than bare ground and erosion pavement, covering the land surface. It may include live vegetation, standing dead vegetation, litter, cryptograms, and rock over ¾ inch. Ground cover plus bare ground would total 100 percent. Material on the soil surface that impedes raindrop impact and overland flow of water. Ground cover consists of all living and dead herbaceous and woody materials in contact with the ground and all rocks greater than 0.75 inches in diameter.

**H:**

**Habitat type:** The collective area which one plant association occupies or will come to occupy as succession advances, based on the vegetation and its associated environment.

**Head month:** Tenure of one herbivore on National Forest System land for a period of one month. Head Months (# mature animal days/30.4167) one month's use and occupancy of range by one weaned or adult

animal cow, bull, steer, or heifer. Calves are not counted. This is a term used mostly for billing purposes to calculate an occupancy level – how many animals for how long.

**Headwaters:** The most extreme upstream areas of a watershed.

**Herbaceous:** Vegetation growth with little or no woody components, such as graminoids and forbs.

**Herding**: A strategy for managing livestock where the manager maintains the animals in a "herd" and moves them from area to area as a group.

**Hydrologic function:** The ability of a stream to transport water and sediment in a balanced condition. The degree and rate of transport is the result of the natural watershed characteristics, including precipitation, geology, landforms, and vegetation. These characteristics have defined over time, average conditions of stream flow, quantity and character of sediment moving through the system, and composition of the materials forming the bed and banks of the channels. Stream systems that are in a balanced condition exhibit a relatively stable channel structure with only minor annual changes. Also, the ability to safely capture, store and release water in a system.

**I:**

**Impacts:** The effect of one thing upon another. Impacts may be beneficial or adverse. See "Effects" and "Environmental Consequences."

**Implementation monitoring:** Monitoring to evaluate whether BMPs were carried out as planned and specified in the environmental assessment, environmental impact statement, other planning document, permit, or contract (MacDonald et al. 1991).

**Indicator species:** A species selected because its population changes indicate effects of management activities on the plant and animal community. A species whose condition can be used to assess the impacts of management actions on a particular area.

**Indirect effects**: Secondary effects which occur in locations other than the initial action, significantly later in time, or to one resource that in turn, affects another resource. i.e.: effects to vegetation that may reduce prey species for a raptor.

**Infiltration rate:** Rate of absorption and downward movement of water into the soil layer.

**INFISH:** Interim direction to protect habitat and populations of resident native fish outside of anadromous fish habitat in eastern Oregon, eastern Washington, Idaho, western Montana, and portions of Nevada.

**Inner gorge:** A geomorphic feature that consists of the area of channel side slope situated immediately adjacent to the stream channel and below the first break in slope above the stream channel. Debris sliding and avalanching are the dominant mass wasting processes associated with the inner gorge (USDA Forest Service 2000).

**Interaction**: Direct contact or close proximity between two or more entities.

**Interested parties:** An individual, group or organization that has submitted a written request to the authorized officer to be provided an opportunity to be involved in the decision making process for the management of livestock grazing on specific grazing allotments or has submitted written comments to the authorized officer regarding the management of livestock grazing on a specific allotment.

**Intermittent stream:** A stream that does not flow year-round, but does interact with a water table to receive groundwater outflow during part of the year. A stream or reach of stream channel that flows, in its natural condition, only during certain times of the year or in several years. Characterized by interspersed, permanent surface water areas containing aquatic flora and fauna adapted to the relatively harsh environmental conditions found in these types of environments (Briggs 1996).

**Introduced (species):** A non-native species that has been intentionally or unintentionally released into an area as a result of human activity.

**Intuitive Controlled (Survey):** This type of survey is the most commonly used and most efficient method of surveying for TES plants, animals, or cultural resources. Potential suitable habitat, sites, is identified and the survey effort is focused on those areas. When conducting intuitive controlled surveys, an area somewhat larger that the identified suitable habitat, area, is searched to validate current suitable habitat, site, definitions.

**Invasive plant:** An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13122, 2/3/99). Used interchangeably with "noxious weed."

**Invasive species:** A non-native species introduced into an ecosystem as a result of human activities. Plant species that will invade or increase following disturbance or continued heavy grazing.

**Irretrievable:** Applies primarily to the use of nonrenewable resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports site. If the use is changed, timber production can be resumed. The timber production lost is irretrievable, but the action is not irreversible.

**Irreversible:** Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or those factors such as soil productivity that are renewable only over a long time period. Irreversible also includes the loss of future options.

**Issue:** An "issue" is defined as a point of discussion, debate, or dispute about the environmental effects of the proposed action. It may represent an "unresolved conflict."

**K:**

**Key area:** A relatively small portion of rangeland which because of its location, grazing or browsing value, and/or use, serves as a monitoring and evaluation site. (A key area guides the general management of the entire area of which it is a part, and will reflect the overall acceptability of current grazing management over the range.)

**L:**

**Lake:** An inland body of standing water, perennial or intermittent, that occupies a depression in the Earth's surface and is too deep to permit vegetation to take root completely across the expanse of water.

**Land Management Plan (LMP):** An individual planning document adopted under the National Forest Management Act and 36 CFR 219 that provide direction for management of a Forest Service administrative unit.

**Landscape:** Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

**Landscape scale:** A scale of ecological evaluation that includes multiple habitats, ecosystems, and land uses.

**Listed species:** Any species of fish, wildlife, or plant determined to be endangered or threatened and listed under Section 4 of the Endanger Species Act (ESA).

**Litter:** The uppermost layer of organic debris on the soil surface, essentially the freshly fallen or slightly decomposed vegetal material.

**Livestock Number:** Approximate number of cow/calf pairs. Other classes of livestock can be grazed under this with the appropriate animal conversion factors (example: cow = 1, cow/calf = 1.32, and bull = 1.5).

**M:**

**Management Indicator Species (MIS)**: A species selected in the Okanogan National Forest, Forest Plan because its population changes indicate effects of management activities on the plant and animal

community. A species whose condition can be used to assess the impacts of management actions on a particular area.

**Management Requirements:** Actions intended to reduce or prevent undesirable effects to rangeland resources by livestock grazing and/or provide for the progression of existing conditions toward desired conditions.

**Meadow:** An area of perennial herbaceous vegetation, usually grass or grass-like. Openings in forests and grasslands of exceptional productivity in arid regions, usually resulting from high water content of the soil, as in streamside situations and areas having a perched water table. Low-level grassland near a stream, lake, or other waterbody.

**Migration or migratory:** A term used to refer to the movement of individuals or genes (gene flow) across a landscape; typically refers to movements from one seasonal habitat to another, or between breeding and non-breeding habitats.

**Mitigation measures:** Planning actions taken to avoid an impact altogether, to minimize the degree or magnitude of the impact, reduce the impact over time, rectify the impact, or compensate for the impact (40 CFR 1508.20). Mitigation is defined as "measures designed to reduce or prevent undesirable effects" and is used to reduce adverse environmental effects below the "significance" level and resolve issues and concerns.

**Monitoring:** (Grazing Activities) The practice of tracking the utilization rates and overall effects of grazing over time, through repeated collection of data. Food plants are examined and measured to determine what percentage has been eaten, trampled, or lost to other causes. Other plants in the area (e.g., willows and other woody species) are examined, and observations are recorded regarding trampling or other damage. Records are maintained of livestock stocking rates (number of cattle per unit of area per unit of time), and all changes are recorded. Significant climatological events are noted (e.g., hard freezes, heavy rains, floods, droughts, high temperatures).

**Municipal watershed:** A watershed that serves a public water system as defined in the Safe Drinking Water Act of 1974, as amended (42 U.S.C. §§ 300f, et seq.), or as defined in State safe drinking water statutes or regulations (FSM 2542.05).

**N:**

**National Core Best Management Practices (BMPs):** The nationally standardized set of general, non-prescriptive BMPs for the broad range of activities that occur on National Forest System lands as specified in the National Core BMP Technical Guide (FS-990a). The National Core BMPs require development of site-specific BMP prescriptions based on site conditions and local and regional requirements to achieve compliance with established State, tribal, and national water quality goals. (FSM 2532.05). 158 Volume 1: National Core BMP Technical Guide.

**National Core BMPs Monitoring Protocols:** The nationally standardized set of procedures for monitoring the implementation and effectiveness of the National Core BMPs as specified in the National Core BMP Monitoring Technical Guide (FS-990b) FSM 2532.05).

**National Environmental Policy Act (NEPA):** The Act which declared a National policy to encourage productive and enjoyable harmony between humans and their environment, to promote efforts that will prevent or eliminate damage to the environment and biosphere, to stimulate the health and welfare of humans, to enrich our understanding of the ecological systems and natural resources important to our Nation; and to establish a Council on Environmental Quality.

**National Forest Management Act (NFMA):** A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act, which requires the development of Regional and Forest plans and the preparation of regulations to guide that development.

**National Forest System (NFS):** All National Forest land reserved or withdrawn from the public domain of the United States; all National Forest lands acquired through purchase, exchange, donation, or other means; the National Grasslands and land utilization projects administered under Title III of the Bankhead-Jones Farm Tenant Act (50 Stat. 525, 7 U.S.C. 1010-1012); and other lands, waters, or interests therein which are administered by the Forest Service or are designated for administration through the Forest Service as a part of the system.

**Native species:** Species that are a part of the original fauna or flora of an area.

**NEPA analysis:** Analysis conducted during the preparation of documents required under the National Environmental Policy Act, particularly environmental assessments and environmental impact statements.

**Non-Point Source Water Pollution (NPS):** Pollution caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. These pollutants include: excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas; oil, grease, and toxic chemicals from urban runoff and energy production; sediment from improperly managed crop and forest lands, and eroding stream banks; salt from irrigation practices and acid drainage from abandoned mines; bacteria and nutrients from livestock, and other animal wastes. Any source of water pollution that does not meet the legal definition of "point source" in Section 502(14) of the Clean Water Act. Non-point sources of water pollution generally originate at indefinable or diffuse sources, and do not discharge at specific locations (FSM 2532.05).

**Non-Use:** (1) Absence of grazing use on current year's forage production. (2) Lack of exercise temporarily, of a grazing privilege on grazing lands. (3) An authorization to refrain, temporarily, from placing livestock on public ranges without loss of preference for future considerations.

**Noxious weed:** A plant designated as noxious weeds by the Secretary of Agriculture or by the responsible State or County official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being non-native or new to or not common to the United States or parts thereof." (FSM 2080.5)

## O:

**Objective:** The planned results to be achieved within a stated time period. Objectives are subordinate to goals, narrow in scope, and shorter in range. Objectives must specify time periods for completion, and products or achievements that are measurable.

**Overgrazed:** Continued heavy grazing that exceeds the recovery capacity of the community and creates a deteriorated range.

## P:

**PACFISH:** Interim strategies for managing anadromous fish-producing watersheds in Eastern Oregon and Washington, Idaho, and portions of California.

**Palatability/Palatable:** The relish an animal shows for a particular plant as forage. This varies with succulence, fiber content, nutrient and chemical content, and morphological features such as spines or thorns. Palatability and preference are sometimes incorrectly used interchangeably.

**Pasture:** A subdivision of area within an allotment usually delineated by topographical features or fences.

**Pedestalled:** An evidence of soil erosion, where soil has been eroded from around a piece of ground cover (such as a clump of grass, or a piece of gravel), leaving the ground cover on a pedestal of un-eroded soil.

**Perennial** (plants)**:** One with a life cycle of three or more years.

**Perennial** (stream): Perennial stream means a well-defined channel that contains water year round during a year of normal rainfall with the aquatic bed located below the water table for most of the year. Groundwater is the primary source of water for a perennial stream, but it also carries storm water runoff. A perennial stream exhibits the typical biological, hydrological, and physical characteristics commonly associated with the continuous conveyance of water. A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in areas adjacent to the stream (Briggs 1996).

**Permittee** (Range Permittee): An individual who has been granted a Federal permit to graze livestock for a specific period on a range allotment

**Plant association:** A kind of climax plant community consisting of stands with essentially the same dominant species in corresponding layers.

**Plant community:** An assemblage of plants occurring together at any point in time, thus denoting no particular ecological status.

**Plant composition:** The proportions of various plant taxa in relation to the total on a given area. It may be expressed in terms of cover, density, or weight.

**Plant vigor:** Plant health.

**Point source:** Any discernible, confined, and discrete conveyance, such as pipes, ditches, or channels, from which pollutants are or may be discharged (CWA section 502(14); 40 CFR 122.2).

**Pollutant:** Dredged spoil; solid waste; incinerator residue; filter backwash; sewage; garbage; sewage sludge; munitions; chemical wastes; biological materials; radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended [42 U.S.C. 2001 *et seq.*]); heat, wrecked, or discarded equipment; rock, sand, and cellar dirt; and industrial, municipal, and agricultural waste discharged into water (CWA section 502[6], 40 CFR 122.2).

**Pollution:** The manmade or man-induced alteration of the chemical, physical, biological, or radiological integrity of water (CWA section 502[19]; 40 CFR 130.2 [c]).

**Pond:** An inland body of standing water, perennial or intermittent, that occupies a depression in the Earth's surface and is shallow enough to permit vegetation to take root completely across the expanse of water. A pond may be natural or manmade.

**Practicable:** Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR 230.3). Resource objectives should also be considered when determining practicable alternatives to meet a project's overall purposes.

**Practice:** The recommended means for achieving the Best Management Practice (BMP) objective. Not all recommended practices will be applicable in all settings; other practices may not be listed in the BMP that would work as well, or better, to meet the BMP objective in a given situation. State or local rules or regulations may require some recommended practices in some locations. The practices are written in general, non-prescriptive terms. State BMPs, regional Forest Service guidance, land management plan standards and guidelines, monitoring results, and professional judgment are used to develop site-specific BMP prescriptions to apply the recommended practices on the ground. (Volume 1: National Core BMP Technical Guide, page 159).

**Preferred alternative**: The alternative that is disclosed by the selecting official as the alternative that is most likely to be selected for implementation, when a Draft Environmental Impact Statement is submitted to the public.

**Prescribed fire:** Prescribed fire (Rx fire) is defined as fire applied in a knowledgeable manner to forest fuels on a specific land area under selected weather conditions that produce the fire behavior and fire

characteristics required to attain planned fire treatment and resource management objectives to accomplish predetermined, well-defined management objectives.

**Prescription:** Management practices selected to accomplish specific land and resource management objectives.

**Productivity:** (1) Soil productivity: the capacity of a soil to produce plant growth, due to the soil's chemical, physical, and biological properties (such as depth, temperature, water-holding capacity and mineral, nutrient, and organic matter content). (2) Vegetative productivity: the rate of production of vegetation within a given period. (3) General: the innate capacity of an environment to support plant and animal life over time.

**Project area:** Area of analysis for this proposal.

**Project file**: An assemblage of documents that contain all the information developed or used during an environmental analysis, and is summarized in an Environmental Impact Statement. The file is part of the administrative record.

**Proposed action**: In terms of the National Environmental Policy Act, the project, activity, or action that a Federal agency proposes to implement or undertake. The proposed action is sent to the public and interested agencies for their review and comment. Comments are then used to develop alternatives to the proposed action.

**Public land:** Land owned by the federal, state, county, or local government with multiple uses and intended for public use.

**R:**

**Range or rangeland:** All land-producing or capable-of-producing native forage for grazing and browsing animals and lands that have been revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. It includes all grasslands, shrublands, and those forest lands which continually or periodically, naturally or through management, support an understory of herbaceous or shrubby vegetation that provides forage for grazing or browsing.

**Range allotment:** A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under a range allotment management plan. It is the basic land unit used to facilitate management of the range resource on National Forest System lands and associated lands administered by the Forest Service.

**Range condition:** A generic term relating to present status of a unit of range in terms of specific values or potentials. Specific values or potentials must be stated. Also defined as the present state of vegetation of a range site in relation to the climax (natural potential) plant community for that site.

**Range improvement.** Any activity or program on or relating to rangelands which is designed to improve production of forage; change vegetative composition; control patterns of use; provide water; stabilize soil and water conditions; and provide habitat for livestock and wildlife. The term includes, but is not limited to, structures, treatment projects, and use of mechanical means to accomplish the desired results (Public Rangelands Improvement Act of 1978, 43 U.S.C. 1902). The following types are included:

- **Range improvement (Nonstructural):** Practices and treatments undertaken to improve range or facilitate livestock management, excluding structural improvements, such as seeding and spraying.
- **Range improvement (Structural):** Improvements requiring construction or installation to improve the range or facilitate livestock management, such as fences, wells, reservoirs, pipelines, and stock tanks.

**Range management:** The science and art of planning and directing rangeland use in order to obtain maximum sustained economic livestock production consistent with the conservation and/or improvement of the related natural resources: soil, water, vegetation, wildlife and recreation. Scientific range management

stands on the premise that the range resources can be improved and grazed perpetually by domestic stock and, at the same time, produce high-quality watershed, wildlife, recreation and, where suitable, forest products.

**Range of variability**: The range of sustainable conditions in an ecosystem which is determined by time, processes (such as fire), native species, and the land itself. For instance, ecosystems that have a 10 year fire cycle have a narrower range of variation than ecosystems with 200-300 year fire cycle. Past management has placed some ecosystems outside their range of variability. (Also called the historic range of variability, or natural range of variation.)

**Range Readiness:** The defined state of plant growth at which grazing may begin under a specific management plan without permanent damage to vegetation or soil. Usually applied to seasonal range. To be determined by the Range Management Specialist with input from the Interdisciplinary Team (IDT)

**Rangeland health:** The status or stage of condition of an area based on what is expected of the area. The condition is based in biotic, hydrologic and soil factors.

**Reach** (stream): An expanse of a stream channel.

**Record of Decision (ROD):** A concise public document separate from but associated with an environmental impact statement that publicly and officially discloses the responsible (decision making) official's decision (and rationale for the decision) about the alternatives assessed in the environmental impact statement, and the alternative chosen to implement.

**Redd:** Most salmonids deposit their eggs in nests called redds, which are dug in the streambed substrate by the female. Most redds occur in predictable areas and are easily identified by an experienced observer by their shape, size, and color (lighter than surrounding areas because silt has been cleaned away). Spawning surveys utilize counts of redds and fish carcasses to estimate spawner escapement and identify habitat being used by spawning fish. Annual surveys can be used to compare the relative magnitude of spawning activity between years.

**Rehabilitation:** A putting back into good condition, re-establishing on a firm, sound basis.

**Resilient, resilience, resiliency:** (1) The ability of a system to respond to disturbances. Resiliency is one of the properties that enable a system to persist in many different states or successional stages. (2) In human communities, refers to the ability of a community to respond to externally induced changes such as large economic or social forces.

**Rest:** Leaving an area ungrazed, thereby foregoing grazing of a forage crop. Normally, rest implies absence of grazing for a full growing season.

**Rest rotation:** A system in which one part of the range is ungrazed for an entire grazing year or longer, while other parts are grazed for a portion, or perhaps all, of a growing season.

**Restoration:** A putting or bringing back into a former, normal or unimpaired state or condition.

**Rill:** Very small, steep sided channel carrying water. This landscape feature is intermittent and forms for only a short period of time after a rainfall.

**Riparian area:** Area with distinctive soils and vegetation located between a stream or other body of water and the adjacent upland. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation. Riparian ecosystems are distinguished by the presence of free water within the common rooting depth of native perennial plants during at least a portion of the growing season. Riparian ecosystems are normally associated with seeps, springs, streams, marshes, ponds, or lakes. The potential vegetation of these areas commonly includes a mixture of water (aquatic) and land (phreatic) ecosystems. A transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem that is identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

**Riparian Habitat Conservation Areas (RHCA):** Portions of watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. Riparian Habitat Conservation Areas include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams; (2) providing root strength for channel stability; (3) shading for streams; and (4) protecting water quality.

**Riparian pasture:** Riparian pastures are designed to protect riparian values. They may be smaller areas of rangeland containing both upland and riparian vegetation that are managed together as a unit to achieve riparian objectives, or they may be streamside pastures containing only riparian vegetation.

**Riparian species:** Plant species occurring with the riparian zone. Obligate species require the environmental conditions within the riparian zone; facultative species tolerate the environmental conditions, and may occur away from the riparian zone.

**Riparian vegetation:** Plant communities dependent upon the presence of free water near the ground surface (high water table).

**Riparian zone:** The banks and adjacent areas of water bodies, watercourses, seeps and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a moister habitat.

**Rosgen Channel Types:** An alpha-numeric classification system for communicating the type of stream channel that exists. Streams are grouped by entrenchment (the ease in which water flows onto the floodplain or is confined in the stream channel), the bankfull width/depth ratio, the sinuosity (or degree of meandering), water surface slope, and streambed rock size. The system goes from A-G and 1-6. "A" channel types are steep headwater streams. "B" channel types typically have water surface slopes between 2 and 4%. "C" channel types are lower gradient streams that typically have floodplains and point bars. "D" channel types drain glacially outwash areas. "E" channel types are extremely low gradient, have very sinuous channel patterns, don't have point bars and have vegetation creating a very narrow, deep channel dimension. "F" and "G" channel types typically have been incised and are evolving into a different channel type.

**Rotation Grazing:** A grazing scheme where animals are moved from one grazing unit in the same group of grazing units to another without regard to specific graze; rest periods, or levels of plant defoliation.

**S:**

**Salting:** (1) Providing salt as a mineral supplement for animals. (2) Placing salt on the range in such a manner as to improve distribution of livestock grazing.

**Satisfactory Range Condition:** A satisfactory Range Condition exists when the desired future condition is being met and short term objectives are being achieved to move the range toward the desired future condition.

**Scoping:** The Council on Environmental Quality (CEQ) defines scoping as "…an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify public issues, to obtain public comment at various stages of the analysis process, and to determine the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis needed.

**Season of use:** The time during which livestock grazing is permitted on a given range area, as specified in the grazing permit. This is when livestock can be on the allotments on most years. For years with early or late springs, livestock may be turned on two weeks earlier or later than the on-date shown; during drought years, livestock may be brought off the allotments before the turn-off dates.

**Sediment:** Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from its site or origin by air, water, gravity, or ice.

**Sedimentation:** The process of depositing solid fragmented material, such as silt and sand, which is transported and deposited by water, ice, or wind.

**Sensitive species:** All species that are under status review, have small or declining populations, or live in unique habitats. In the Forest Service, sensitive species are designated by Regional Foresters.

**Seral:** Pertaining to the successional stages of biotic communities.

**Seral Stage:** The developmental stages of an ecological succession. Refers to the stages that plant communities go through during succession. Seral stages are described as early, mid, or late in relation to the potential natural community that would occur over a long period of time absent disturbance. Developmental stages have characteristic structure and plant species composition. Early seral refers to plants that are present soon after a disturbance or at the beginning of a new successional process (in riparian areas-usually shallow-rooted, weak stemmed colonizing plants that grow quickly and filter very fine sediment-often grasses).

**Shrub:** A plant with persistent, woody stems and relatively low growth. Generally produces several basal shoots (stems) and many branches.

**Significant issue:** relevant issues most important to the decision at hand.

**Soil:** In this document "soil" means soil outside of stream channels.

**Soil stability/Site stability:** The capacity of an area to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water.

**Soil compaction**: A physical change in soil properties that results in a decrease in porosity and an increase in soil bulk density and soil strength.

**Soil productivity:** The capacity of a soil, in its normal environment, to support plant growth.

**Spawning:** The production or depositing of eggs by aquatic organisms. Depending on the species, many fish spawn in different methods and at different times of the year.

**Species composition:** Proportions of various plant species in relation to the total on a given area. Proportions may be expressed in percentages based on weight, cover, density, etc.

**Stability**: The ability of the channel banks and bottom to resist the erosive powers of flowing water. Inherent stability refers to the potential stability of a riparian system.

**Stable:** The condition of little or no perceived change in plant communities that are in relative equilibrium with existing environmental conditions; describes persistent but not necessarily culminating stages (climax) in plant succession. Implies a high degree of resilience to minor perturbations.

**Stock Water Development:** Development of a new or improved source of stock water supply, such as a well, spring, pond, trough, crib, together with a storage and delivery system.

**Stream bank**: Sides of the stream channel.

**Stream channel**: Long trough-like depression that is normally occupied by the water in a stream.

**Stream flow:** The rate at which water travels in a river or stream channel.

**Stream substrate:** The mineral and/or organic material that forms the bed of the stream. The composition of the streambed (substrate) is an important factor in understanding how a stream functions. It influences channel form and hydraulics, erosion rates, sediment supply, and habitat conditions for fish and other aquatic organisms. Simply put, steep mountain streams with beds of boulders and cobbles will act differently than low-gradient streams with beds of sand or silt. Therefore, measurement of every sample point should include a basic characterization of bed material.

**Stressor**: A specific action or condition that causes an animal to experience stress and the subsequent physiological results of that stress.

**Structure:** How the parts of ecosystems are arranged, both horizontally and vertically. Structure might reveal a pattern, or mosaic, or total randomness of vegetation.

**Stubble height:** Residual vegetation/stubble height is that measure of the herbaceous vegetation remaining at the end of the growing season just prior to winter dormancy. Stubble height is the average height measured from the soil surface to the height of actively growing leaves. A 4-inch stubble height is a direct measurement indicating that a forage plant is clipped off or broken at 4 inches above the ground. Stubble height can serve as an indirect indicator of trampling, soil compaction, stream bank damage, and shrub browsing, as well as a direct measure of herbaceous plant defoliation.

**Substrate:** Inorganic materials that comprises the bottom and banks of a watercourse. See stream substrate.

**Succession** (plant)**:** the gradual supplanting (replacement) of one community of plants by another in a particular ecosystem or landscape following a disturbance.

**Suitability:** The appropriateness if applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone (passed). A unit of land may be suitable for a variety of individual or combined management practices.

**Suitable range:** Land which produces or has the inherent capability to produce 50 pounds or more of palatable forage per acre, can be grazed on a sustained-yield basis, and is or can be feasibly made accessible for use.

**Suitable habitat:** Landscape that has all necessary habitat requirements to sustain a population through time.

**T:**

**Term grazing permit:** Official written permission to graze a specific number, kind, and class of livestock for a specified time period (usually for a ten-year term) on a defined rangeland, in which the land (allotment) contains only federal land.

**Terrestrial:** Living on land.

**Threatened and Endangered Species (TES):** Species identified by the Secretary of Interior in accordance with the 1973 Endangered Species Act, as amended.

**Threatened species:** Any plant or animal species likely to become endangered within the foreseeable future throughout all or a part of its range as designated by the U.S. Fish and Wildlife Service or National Marine Fisheries Service under the Endangered Species Act. See Endangered Species.

**Total Maximum Daily Load (TMDL):** The sum of the individual waste load allocations for point sources and load allocations for both nonpoint sources and natural background sources established at a level necessary to achieve compliance with applicable water quality standards [75-5-103(32) MCA]. In practice, TMDLs are water quality restoration targets for both point and nonpoint sources that are contained in a water quality restoration plan or in a permit.

**Trailing:** The planned ambulatory movement of cows across a landscape or within a corridor to reach a destination where grazing or use will be allowed.

**Transitional pastures**: A designated fenced area that can be logistically and economically maintained.

**Trend:** The direction of change in a plant community or a measured attribute of that plant community as observed over time. The change in direction could be in vegetation, ground cover, or noxious plants, non-

native invasive plant species features over time. Most of the time trend should be described as "meeting", "moving toward", or "not meeting" a desired plant community.

**U:**

**Unsatisfactory range condition/Unsatisfactory condition:** Unsatisfactory Range Condition exists when the desired future condition is not being met and short term objectives are not being achieved to move the range toward the desired future condition.

**Unstable soils:** Those soils that have properties that make them susceptible to dislodgement and downslope transport of soil and rock material under direct gravitational stress. The process includes slow displacement such as creep and rapid movements, such as landslides.

**Unsuitable range:** Unsuitable range is defined in the Forest Plan as: 1) produces less than 50 pounds of forage per acre per year; 2) cannot be grazed on a sustained-yield basis; or 3) cannot feasibly be made accessible for use by livestock.

**Uplands:** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the foot slope zone of the hill slope continuum.

**Use:** (1) The proportion of current year's forage production that is consumed or destroyed by grazing animals. May refer either to a single species or to the vegetation as a whole, degree of use. (2) Utilization of range for a purpose such as grazing, bedding, shelter, trailing, watering, watershed, recreation, forestry, etc.

**Utilization percentage:** Grazing use of current growth, usually expressed as a percent of the current growth (by weight) that has been removed.

**Utilization standards**: The prescribed level of grazing by livestock which will achieve specific objectives including maintenance of vegetation and soil condition. Standards established to guide the use and removal of forage and measured in terms of the percent of the plant that is removed.

**V:**

**Vector:** Literally 'a carrier'. An animal, vehicle, wind, water course, etc. carrying seeds of noxious weeds.

**Vegetation:** Plants in general, or the sum total of the plant life above and below ground in an area.

**Vegetation management:** Activities designed primarily to promote the health of forested and non-forested vegetation for multiple-use purposes.

**Vegetation type:** A plant community with distinguishable characteristics.

**Vegetative:** Relating to nutritive and growth functions of plant life, in contrast to reproductive functions. This should not be confused with vegetation.

**Viability**: The demographic and genetic status of an animal population whereby long term persistence is likely.

**Vigor:** Relates to the relative robustness of a plant in comparison to other individuals of the same species. It is reflected primarily by the size of a plant and its parts in relation to its age and the environment in which it is growing.

**W:**

**Water gap:** An opening of fenced areas providing access to a developed or natural water supply permitting one watering facility to serve two or more pastures

**Water quality:** The physical, biological and chemical components of stream or lake waters and the degree to which their combined characteristics support beneficial uses. The chemical, physical, and biological integrity of surface water and groundwater (pg. 160, Volume 1: National Core BMP Technical Guide).

**Water right:** A property right granted by a State for the use of a portion of the public's surface or ground water resource obtained under applicable legal procedures.

**Waterbody:** Features such as rivers, streams, reservoirs, lakes, ponds, wet meadows, fens, bogs, marshes, and wetlands. A waterbody may be perennial, intermittent, or ephemeral.

**Waters of the United States:** (1) All waters that are currently used, were used in the past, or may be susceptible to be used in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; (2) all interstate waters, including interstate wetlands; (3) all other waters, such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds that the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including any such waters (a) that are or could be used by interstate or foreign travelers for recreational or other purposes, (b) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce, or (c) that are used or could be used for industrial purposes by industries in interstate commerce; and (4) all impoundments of waters otherwise defined as waters of the United States under this definition, including (a) tributaries of waters identified in paragraphs 1 through 4 of this definition, (b) the territorial sea, and (c) wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (7) of this definition (40 CFR 122.2).

**Watershed:** A topographically discrete unit or stream basin that includes the headwaters, main channel, slopes leading to the channel, tributaries and mouth area. The land area from which surface runoff drains into a stream, channel, lake, reservoir, or other body of water; also called a drainage basin.

**Weed:** Any unwanted or undesirable plant, whether grass, forb, shrub or tree.

**Wet meadow:** A meadow where the surface remains wet or moist throughout the growing season, usually characterized by sedges and rushes.

**Wetland:** Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that, under normal circumstances, do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 122.2) [Volume 1: National Core BMP Technical Guide, pg. 161].

**Width to depth ratio:** A ratio that divides the bankfull width by the average depth of the bankfull channel. A higher value is typically wide and shallow, whereas a lower value is narrower and deeper.

**Wild ungulate:** Hoofed animals such as deer, elk, moose, and big horn sheep.

**Winter range:** Range that is grazed/utilized during the winter months.

**Woody species cover:** The sums of the percent cover of woody species along the greenline.

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# Appendix D

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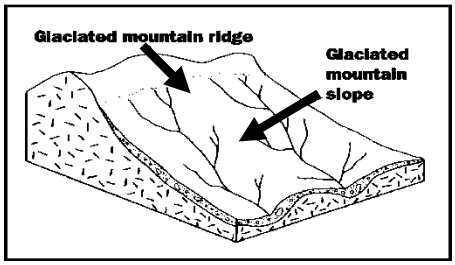
# Appendix E
# Soils

**Landtype Associations**

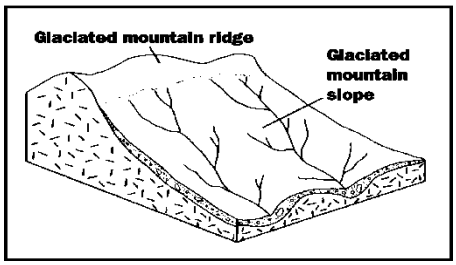
There are three landform types found within the analysis area. *Geomorphic expression or landform* is an excellent surrogate for understanding geomorphic processes because it is the topographic expression of the sum of geomorphic processes as they are influenced by climate, time, geology, and other landscape factors. Although historic processes may or may not be present today because of climate change or other factors, landform genesis have shaped the topography, soil regolith, and stream patterns that continue to influence present day processes.

Scoured Glaciated Mountain Slopes – Ga2 equals 26% of the analysis area



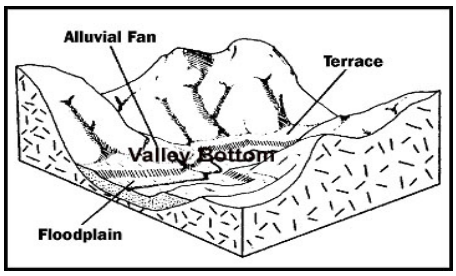

Landform Ga2 occurs on moderate relief mountain slopes and smooth convex ridges. Continental and alpine glaciation was the common landforming processes. Slopes were scoured leaving bedrock close to the surface which tends to control topographic expression and vegetative patterns. Slope gradients range from 20-45% with steeper gradients along breaklands bordering higher order streams. Residual soils are shallow and poorly developed but pockets of glacial till may occur along lower slopes and draws. Veneers of loess and ash are not uncommon. Landforms are dissected by moderate gradient, lower order, and intermittent streams. Bedrock and geologic structure strongly influence stream pattern and density. Drainage pattern varies from weak rectangular to dendritic, and sub-parallel along steeper side slopes.

Glaciated Mountain Slopes – Ia2 equals 57% and Ia8 equals 15% of the analysis area




Landforms Ia2 and Ia8 occur on moderate relief mountain slopes and smooth, moderately broad convex ridges mantled with glacial till. Landforms were shaped by continental or alpine glacial ice sheets. Glacial till deposits occur typically in deeper draws and north facing slopes and are shallow or absent along ridges. Slopes are commonly less than 45%. Bedrock and geologic structure often control topographic expression but vegetation patterns are influenced by depth of glacial deposits and elevation. Valleys are mildly V-shaped to U-shaped. Slopes are dissected by well defined, moderate to high gradient, intermittent and perennial streams in a sub-parallel to dendritic pattern. Streams are moderately to deeply incised. Seeps and springs are common along concave lower slopes.

Valley Bottoms/Outwash – Ou6 equals 2% of the analysis area




Landform Ou6 occurs on nearly level terraces and floodplains in broad valley bottoms. Glacial/fluvial outwash deposition was the primary land forming process. Slopes gradients range from 0 to 20% and are generally less than 10% and are dissected by high energy, low gradient, perennial streams. Stream channels most commonly meander but may be braided in some reaches. Substrate is usually comprised of stratified sand to cobble size material but very large boulders are not uncommon. Ponds, marshes and overflow channels may occur. Valley bottoms are subject to frequent flooding. Subsurface and in-stream flow may be in continuity. Included within this landform are alluvial fans and colluvial deposits located along the valley sides.

**Soil Physical Properties**

Tables 1 – 4 list properties of the soil map units within the analysis area that have bearing on the proposed actions.

**Table 1. Soil Properties for the Aeneas Allotment**

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| *Soil Survey of Okanogan National Forest* | | | | | | | | |
| 105 | 57 | Andic Eutrocryepts-Cryaquolls complex, 0 to 35 percent slopes | volcanic ash 7 to 14 inches thick over glacial till, colluvium and residuum | Andic Eutrocryepts | ashy silt loam | 0-5 | 0.85 | .37 |
| 110 | 50 | Aquandic Endoaquolls-Haplosaprists complex, 0 to 10 percent slopes | volcanic ash 7 to 14 inches thick over alluvium or glacial till | Aquandic Endoaquolls | mucky peat | 0 | 0.2 | (blank) |
| 130 | 4 | Cassal ashy loam, 5 to 25 percent slopes | mixed volcanic ash 12 to 18 inches thick over glacial till | Loamy-skeletal, isotic, frigid Vitrandic Haploxerolls | ashy loam | 0 | 1.2 | .37 |
| 132 | 425 | Chumstick-Mineral-Rock outcrop complex, 15 to 35 percent slopes | mixed volcanic ash 10 inches to 20 inches thick over bedrock | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | stony ashy sandy loam | 15-35 | 1.25 | .32 |
| 133 | 534 | Chumstick-Mineral-Rock outcrop complex, 35 to 65 percent slopes | mixed volcanic ash, 0 inches to less than 60 percent of soil depth, mixed with colluvium and residuum derived from granitic and metamorphic rocks | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | very stony ashy sandy loam | 35-60 | 1.25 | .32 |
| 153 | 621 | Devore-Rock outcrop complex, warm, 15 to 35 percent slopes | volcanic ash 7 to 14 inches thick over colluvium and residuum from metamorphic rock | Loamy-skeletal, isotic Haploxerandic Haplocryepts | stony ashy fine sandy loam | 15-35 | 0.75 | .28 |
| 154 | 270 | Devore-Rock outcrop complex, warm, 35 to 65 percent slopes | volcanic ash 7 to 14 inches thick over colluvium and residuum from metamorphic rock | Loamy-skeletal, isotic Haploxerandic Haplocryepts | stony ashy fine sandy loam | 15-35 | 0.75 | .28 |
| 173 | 25 | Goddard-Lithic Haploxerepts complex, 0 to 15 percent slopes | Volcanic ash 7 to 14 inches thick over glacial outwash | Sandy-skeletal, isotic, frigid Andic Haploxerepts | ashy fine sandy loam | 0-15 | 0.9 | .24 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 219 | 675 | Louploup-Stepstone complex, 3 to 15 percent slopes | volcanic ash 14 to 30 inches thick over glacial till | Ashy over loamy, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-5 | 0.83 | .32 |
| 220 | 37 | Louploup-Stepstone complex, 15 to 35 percent slopes | volcanic ash 14 to 30 inches thick over glacial till | Ashy over loamy, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-5 | 0.83 | .32 |
| 223 | 1724 | Manley-Devore complex, 15 to 35 percent slopes | volcanic ash 14 to 25 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic Xeric Vitricryands | ashy fine sandy loam | 0-40 | 0.78 | .28 |
| 224 | 594 | Manley-Devore complex, 35 to 65 percent slopes | volcanic ash 14 to 25 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic Xeric Vitricryands | ashy fine sandy loam | 0-40 | 0.78 | .28 |
| 230 | 54 | Merkel cobbly ashy sandy loam, 35 to 65 percent slopes | mixed volcanic ash 10 to 30 inches thick over glacial till from granite | Loamy-skeletal, isotic, frigid Vitrandic Dystroxerepts | cobbly ashy sandy loam | 15-35 | 1 | .32 |
| 258 | 79 | Nevine ashy silt loams association, 20 to 40 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy silt loam | 0-10 | 0.85 | .43 |
| 263 | 3738 | Nevine-Merkel complex, 15 to 35 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-30 | 0.85 | .28 |
| 264 | 116 | Nevine-Merkel complex, 35 to 65 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.85 | .28 |
| 267 | 123 | Nevine-Wilma complex, 35 to 65 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.85 | .28 |
| 268 | 1628 | Nevine-Wilma-Rock outcrop complex, 15 to 35 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.85 | .28 |
| 274 | 879 | Newhorn ashy fine sandy loam, 15 to 35 percent slopes | volcanic ash 7 to 14 inches thick over glacial till | Loamy-skeletal, isotic, frigid Andic Haploxerepts | ashy fine sandy loam | 0-10 | 0.78 | .28 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 292 | 132 | Peka-Donavan complex, 15 to 35 percent slopes | mixed volcanic rock 10 to 18 inches thick over glacial till | Loamy-skeletal, mixed, superactive, mesic Vitrandic Haploxerolls | stony ashy sandy loam | 15-35 | 1.2 | .20 |
| 306 | 472 | Republic ashy loam, 0 to 15 percent slopes | mixed volcanic ash 7 to 15 inches thick over alluvium and glacial till | Coarse-loamy, isotic, frigid Vitrandic Haploxerolls | ashy loam | 0 | 1.2 | .32 |
| 310 | 22 | Resner ashy loam, 20 to 40 percent slopes | volcanic ash 14 to 22 inches thick over glacial outwash and glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic Xeric Vitricryands | ashy loam | 0 | 0.8 | .28 |
| 311 | 553 | Resner-Sitdown complex, 0 to 15 percent slopes | volcanic ash 14 to 22 inches thick over glacial outwash and glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic Xeric Vitricryands | ashy silt loam | 0-10 | 0.75 | .32 |
| 322 | 9 | Sacheen loamy sand, 35 to 65 percent slopes | glacial outwash or glaciofluvial deposits derived from granite | Mixed, frigid Typic Xeropsamments | loamy sand | 0 | 1.2 | .17 |
| 334 | 57 | Sitdown stony ashy sandy loam, 0 to 15 percent slopes | volcanic ash 10 to 14 inches thick over glacial outwash and glacial till | Sandy-skeletal, isotic Vitrixerandic Haplocryepts | stony ashy sandy loam | 15-35 | 0.88 | .24 |
| 345 | 32 | Stepstone ashy fine sandy loam, 3 to 15 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | .28 |
| 346 | 72 | Stepstone ashy fine sandy loam, 15 to 35 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | .28 |
| 347 | 968 | Stepstone-Torboy complex, 0 to 15 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | .28 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 374 | 19 | Vanbrunt-Swakane-Rock outcrop complex, 35 to 65 percent slopes | mixed volcanic ash 7 to 19 inches thick over colluvium and residuum from granite | Loamy-skeletal, isotic, mesic Vitrandic Haploxerolls | stony ashy sandy loam | 15-35 | 1.35 | .28 |
| 400 | 192 | Wapal-Sacheen complex, 35 to 65 percent slopes | mixed volcanic ash 7 to 14 inches thick over glacial outwash | Sandy-skeletal, isotic, frigid Vitrandic Haploxerepts | stony ashy coarse sandy loam | 15-35 | 1.38 | .20 |

**Table 2. Soil Properties for the Bannon Allotment**

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| *Soil Survey of Okanogan National Forest* | | | | | | | | |
| 132 | 808 | Chumstick-Mineral-Rock outcrop complex, 15 to 35 percent slopes | mixed volcanic ash 10 inches to 20 inches thick over bedrock | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | very stony ashy sandy loam | 35-60 | 1.25 | .32 |
| 133 | 61 | Chumstick-Mineral-Rock outcrop complex, 35 to 65 percent slopes | mixed volcanic ash, 0 inches to less than 60 percent of soil depth, mixed with colluvium and residuum derived from granitic and metamorphic rocks | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | very stony ashy sandy loam | 35-60 | 1.25 | .32 |
| 140 | 11 | Conconully extremely stony ashy loam, 0 to 25 percent slopes | mixed volcanic ash 10 to 14 inches thick over glacial till | Coarse-loamy, mixed, superactive, mesic Vitrandic Haploxerolls | extremely stony ashy loam | > 60 | 1.28 | .37 |
| 208 | 238 | Lithic Haploxerepts-Conconully complex, 15 to 45 percent slopes | volcanic ash 8 to 20 inches over bedrock | Lithic Haploxerepts | cobbly ashy sandy loam | 15-35 | 1.25 | .37 |
| 219 | 66 | Louploup-Stepstone complex, 3 to 15 percent slopes | volcanic ash 14 to 30 inches thick over glacial till | Ashy over loamy, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-5 | 0.83 | .32 |
| 220 | 427 | Louploup-Stepstone complex, 15 to 35 percent slopes | volcanic ash 14 to 30 inches thick over glacial till | Ashy over loamy, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-5 | 0.83 | .32 |
| 263 | 1627 | Nevine-Merkel complex, 15 to 35 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-30 | 0.85 | .28 |
| 268 | 318 | Nevine-Wilma-Rock outcrop complex, 15 to 35 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.85 | .28 |
| 274 | 20 | Newhorn ashy fine sandy loam, 15 to 35 percent slopes | volcanic ash 7 to 14 inches thick over glacial till | Loamy-skeletal, isotic, frigid Andic Haploxerepts | ashy fine sandy loam | 0-10 | 0.78 | .28 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 292 | 153 | Peka-Donavan complex, 15 to 35 percent slopes | mixed volcanic rock 10 to 18 inches thick over glacial till | Loamy-skeletal, mixed, superactive, mesic Vitrandic Haploxerolls | stony ashy sandy loam | 15-35 | 1.2 | .20 |
| 307 | 366 | Republic ashy loam, 15 to 35 percent slopes | mixed volcanic ash 7 to 15 inches thick over alluvium and glacial till | Coarse-loamy, isotic, frigid Vitrandic Haploxerolls | ashy loam | 0 | 1.2 | .32 |
| 310 | 199 | Resner ashy loam, 20 to 40 percent slopes | volcanic ash 14 to 22 inches thick over glacial outwash and glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic Xeric Vitricryands | ashy loam | 0 | 0.8 | .28 |
| 343 | 215 | Stapaloop ashy fine sandy loam, 0 to 25 percent slopes | mixed volcanic ash 7 to 21 inches thick over glaciofluvial deposits | Coarse-loamy, isotic, frigid Vitrandic Haploxerepts | ashy fine sandy loam | 0 | 1.33 | .32 |
| 347 | 477 | Stepstone-Torboy complex, 0 to 15 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | .28 |
| 374 | 443 | Vanbrunt-Swakane-Rock outcrop complex, 35 to 65 percent slopes | mixed volcanic ash 7 to 19 inches thick over colluvium and residuum from granite | Loamy-skeletal, isotic, mesic Vitrandic Haploxerolls | stony ashy sandy loam | 15-35 | 1.35 | .28 |
| 400 | 28 | Wapal-Sacheen complex, 35 to 65 percent slopes | mixed volcanic ash 7 to 14 inches thick over glacial outwash | Sandy-skeletal, isotic, frigid Vitrandic Haploxerepts | stony ashy coarse sandy loam | 15-35 | 1.38 | .20 |

**Table 3. Soil Properties for the Revis Allotment**

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| *Soil Survey of Okanogan National Forest* | | | | | | | | |
| 132 | 90 | Chumstick-Mineral-Rock outcrop complex, 15 to 35 percent slopes | mixed volcanic ash 10 inches to 20 inches thick over bedrock | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | very stony ashy sandy loam | 35-60 | 1.25 | 0.32 |
| 263 | 31 | Nevine-Merkel complex, 15 to 35 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-30 | 0.85 | 0.28 |
| 347 | 34 | Stepstone-Torboy complex, 0 to 15 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | 0.28 |
| *Soil Survey of Okanogan County* | | | | | | | | |
| 242 | 15 | Chumstick-Mineral-Rock outcrop complex, 15 to 35 percent slopes | mixed volcanic ash (10 to 20 inches thick) over bedrock | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | very stony ashy sandy loam | 35-60 | 1.25 | 0.32 |
| 405 | 8 | Nevine-Merkel complex, 15 to 35 percent slopes | volcanic ash (14 to 30 inches thick) over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.2 | 0.28 |
| 504 | 3 | Stepstone ashy fine sandy loam, 3 to 15 percent slopes | volcanic ash (14 to 24 inches thick) over glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.2 | 0.28 |
| 506 | 47 | Stepstone-Torboy complex, 0 to 15 percent slopes | volcanic ash (14 to 24 inches thick) over glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.2 | 0.28 |

**Table 4. Soil Properties for the Tunk Allotment**

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| *Soil Survey of Okanogan National Forest* | | | | | | | | |
| 108 | 13 | Aquandic Cryaquepts, 0 to 3 percent slopes | volcanic ash 7 to 14 inches thick over alluvium | Aquandic Cryaquepts | ashy silt loam | 0 | 0.88 | .43 |
| 110 | 172 | Aquandic Endoaquolls-Haplosaprists complex, 0 to 10 percent slopes | volcanic ash 7 to 14 inches thick over alluvium or glacial till | Aquandic Endoaquolls | mucky peat | 0 | 0.2 | (blank) |
| 112 | 15 | Aquic Dystrocryepts, 0 to 15 percent slopes | mixed volcanic ash 7 to 11 inches over glacial till and alluvium | Aquic Dystrocryepts | ashy fine sandy loam | 0 | 1.25 | .37 |
| 130 | 4 | Cassal ashy loam, 5 to 25 percent slopes | mixed volcanic ash 12 to 18 inches thick over glacial till | Loamy-skeletal, isotic, frigid Vitrandic Haploxerolls | ashy loam | 0 | 1.2 | .37 |
| 132 | 641 | Chumstick-Mineral-Rock outcrop complex, 15 to 35 percent slopes | mixed volcanic ash 10 inches to 20 inches thick over bedrock | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | very stony ashy sandy loam | 35-60 | 1.25 | .32 |
| 133 | 269 | Chumstick-Mineral-Rock outcrop complex, 35 to 65 percent slopes | mixed volcanic ash, 0 inches to less than 60 percent of soil depth, mixed with colluvium and residuum derived from granitic and metamorphic rocks | Loamy-skeletal, isotic, frigid Lithic Ultic Haploxerolls | very stony ashy sandy loam | 35-60 | 1.25 | .32 |
| 140 | 23 | Conconully extremely stony ashy loam, 0 to 25 percent slopes | mixed volcanic ash 10 to 14 inches thick over glacial till | Coarse-loamy, mixed, superactive, mesic Vitrandic Haploxerolls | extremely stony ashy loam | > 60 | 1.28 | .37 |
| 142 | 27 | Conconully extremely stony ashy loam, 25 to 65 percent south slopes | mixed volcanic ash 10 to 14 inches thick over glacial till | Coarse-loamy, mixed, superactive, mesic Vitrandic Haploxerolls | extremely stony ashy loam | > 60 | 1.28 | .37 |
| 150 | 12 | Cryofluvents, 0 to 5 percent slopes | mixed alluvium | Cryofluvents | loam | 0-5 | 1.3 | .32 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 153 | 247 | Devore-Rock outcrop complex, warm, 15 to 35 percent slopes | volcanic ash 7 to 14 inches thick over colluvium and residuum from metamorphic rock | Loamy-skeletal, isotic Haploxerandic Haplocryepts | stony ashy fine sandy loam | 15-35 | 0.75 | .28 |
| 181 | 5 | Histic Cryaquepts-Cryohemists complex, 0 to 10 percent slopes | organic soil material over alluvium and glacial till | Histic Cryaquepts | mucky peat | 0 | 0.2 | (blank) |
| 209 | 129 | Lithic Haploxerepts-Donavan-Rock outcrop complex, 15 to 45 percent slopes | volcanic ash 8 to 20 inches over bedrock | Lithic Haploxerepts | cobbly ashy sandy loam | 15-35 | 1.25 | .37 |
| 214 | 54 | Lithic Haploxerepts-Wilma-Rock outcrop complex, 35 to 65 percent slopes | (blank) | (blank) | cobbly ashy sandy loam | 15-35 | 1.25 | .37 |
| 219 | 178 | Louploup-Stepstone complex, 3 to 15 percent slopes | volcanic ash 14 to 30 inches thick over glacial till | Ashy over loamy, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-5 | 0.83 | .32 |
| 220 | 215 | Louploup-Stepstone complex, 15 to 35 percent slopes | volcanic ash 14 to 30 inches thick over glacial till | Ashy over loamy, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-5 | 0.83 | .32 |
| 221 | 76 | Manley ashy fine sandy loam, 0 to 15 percent slopes | volcanic ash 14 to 25 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic Xeric Vitricryands | ashy fine sandy loam | 0 | 0.78 | .28 |
| 223 | 3237 | Manley-Devore complex, 15 to 35 percent slopes | volcanic ash 14 to 25 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic Xeric Vitricryands | ashy fine sandy loam | 0-40 | 0.78 | .28 |
| 224 | 476 | Manley-Devore complex, 35 to 65 percent slopes | volcanic ash 14 to 25 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic Xeric Vitricryands | ashy fine sandy loam | 0-40 | 0.78 | .28 |
| 232 | 135 | Merkel-Wilma complex, 35 to 65 percent slopes | mixed volcanic ash 10 to 30 inches thick over glacial till from granite | Loamy-skeletal, isotic, frigid Vitrandic Dystroxerepts | cobbly ashy sandy loam | 15-35 | 1 | .32 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 260 | 312 | Nevine-Louploup complex, 3 to 15 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0 | 0.85 | .28 |
| 263 | 2828 | Nevine-Merkel complex, 15 to 35 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-30 | 0.85 | .28 |
| 264 | 480 | Nevine-Merkel complex, 35 to 65 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.85 | .28 |
| 267 | 145 | Nevine-Wilma complex, 35 to 65 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.85 | .28 |
| 268 | 1111 | Nevine-Wilma-Rock outcrop complex, 15 to 35 percent slopes | volcanic ash 14 to 28 inches thick over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.85 | .28 |
| 292 | 72 | Peka-Donavan complex, 15 to 35 percent slopes | mixed volcanic rock 10 to 18 inches thick over glacial till | Loamy-skeletal, mixed, superactive, mesic Vitrandic Haploxerolls | stony ashy sandy loam | 15-35 | 1.2 | .20 |
| 306 | 92 | Republic ashy loam, 0 to 15 percent slopes | mixed volcanic ash 7 to 15 inches thick over alluvium and glacial till | Coarse-loamy, isotic, frigid Vitrandic Haploxerolls | ashy loam | 0 | 1.2 | .32 |
| 307 | 16 | Republic ashy loam, 15 to 35 percent slopes | mixed volcanic ash 7 to 15 inches thick over alluvium and glacial till | Coarse-loamy, isotic, frigid Vitrandic Haploxerolls | ashy loam | 0 | 1.2 | .32 |
| 309 | 85 | Resner ashy loam, 0 to 20 percent slopes | volcanic ash 14 to 22 inches thick over glacial outwash and glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic Xeric Vitricryands | ashy loam | 0 | 0.8 | .28 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 310 | 37 | Resner ashy loam, 20 to 40 percent slopes | volcanic ash 14 to 22 inches thick over glacial outwash and glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic Xeric Vitricryands | ashy loam | 0 | 0.8 | .28 |
| 311 | 1457 | Resner-Sitdown complex, 0 to 15 percent slopes | volcanic ash 14 to 22 inches thick over glacial outwash and glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic Xeric Vitricryands | ashy silt loam | 0-25 | 0.75 | .32 |
| 312 | 43 | Resner-Sitdown complex, 15 to 35 percent slopes | volcanic ash 14 to 22 inches thick over glacial outwash and glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic Xeric Vitricryands | ashy silt loam | 0-25 | 0.75 | .32 |
| 318 | 12 | Rock outcrop-Rubble land complex, 5 to 100 percent slopes | (blank) | (blank) | unweathered bedrock | | 0 | (blank) |
| 343 | 176 | Stapaloop ashy fine sandy loam, 0 to 25 percent slopes | mixed volcanic ash 7 to 21 inches thick over glaciofluvial deposits | Coarse-loamy, isotic, frigid Vitrandic Haploxerepts | ashy fine sandy loam | 0 | 1.33 | .32 |
| 345 | 195 | Stepstone ashy fine sandy loam, 3 to 15 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | .28 |
| 346 | 1419 | Stepstone ashy fine sandy loam, 15 to 35 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | .28 |
| 347 | 2172 | Stepstone-Torboy complex, 0 to 15 percent slopes | volcanic ash 10 to 24 inches thick over glacial till from granite | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.75 | .28 |
| 400 | 249 | Wapal-Sacheen complex, 35 to 65 percent slopes | mixed volcanic ash 7 to 14 inches thick over glacial outwash | Sandy-skeletal, isotic, frigid Vitrandic Haploxerepts | stony ashy coarse sandy loam | 15-35 | 1.38 | .20 |

| Map Unit | Acres | Map Unit Name | Parent Material | Taxonomy | Surface Texture | % Surface Rock Fragments | Bulk Density | K Factor |
|---|---|---|---|---|---|---|---|---|
| 408 | 70 | Wilma-Lithic Haploxerepts-Rock outcrop complex, 15 to 35 percent slopes | volcanic ash 10 to 14 inches thick over colluvium and residuum from metavolcanics and granite rock | Loamy-skeletal, isotic, frigid Andic Haploxerepts | gravelly ashy fine sandy loam | 15-35 | 0.8 | .37 |
| *Soil Survey of Okanogan County* | | | | | | | | |
| 340 | 2 | Lithic Haploxerepts-Donavan-Rock outcrop complex, 15 to 45 percent slopes | volcanic ash or mixed volcanic ash (4 to 12 inches thick) over colluvium and residuum | Lithic Haploxerepts | cobbly ashy sandy loam | 15-35 | 1.25 | 0.37 |
| 354 | 2 | Manley ashy fine sandy loam, 0 to 15 percent slopes | volcanic ash (14 to 25 inches thick) over glacial till | Ashy over loamy-skeletal, glassy over isotic Xeric Vitricryands | ashy fine sandy loam | 0 | 0.2 | 0.28 |
| 402 | 4 | Nevine-Louploup complex, 3 to 15 percent slopes | volcanic ash (14 to 30 inches thick) over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.2 | 0.28 |
| 405 | 8 | Nevine-Merkel complex, 15 to 35 percent slopes | volcanic ash (14 to 30 inches thick) over glacial till | Ashy over loamy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-10 | 0.2 | 0.28 |
| 506 | 30 | Stepstone-Torboy complex, 0 to 15 percent slopes | volcanic ash (14 to 24 inches thick) over glacial till | Ashy over sandy or sandy-skeletal, glassy over isotic, frigid Typic Vitrixerands | ashy fine sandy loam | 0-15 | 0.2 | 0.28 |
| 557 | 15 | Wapal-Sacheen complex, 35 to 65 percent slopes | mixed volcanic ash (10 to 20 inches thick) over glacial outwash | Sandy-skeletal, isotic, frigid Vitrandic Haploxerepts | stony ashy fine sandy loam | 15-35 | 0.2 | 0.2 |

# Appendix F

## Distribution List for Final Environmental Impact Statement

Tribes

Confederated Tribes of the Colville Reservation
Yakama Nation
Amelia AM Marchand, Confederate Tribes of the Colville Reservation, History/Archaeology Program

Federal, State, and Local Agencies

Advisory Council on Historic Preservation, Washington DC
APHIS PPD/EAD, Deputy Director, Riverdale, MD
Chief of Naval Operations (N45), Washington, DC
DOE, NEPA Policy & Compliance, Washington, DC
Environmental Protection Agency, Region 10, Theogene Mbabaliye, Seattle, WA
Environmental Protection Agency, Region 10, EIS Review Coordinator, Seattle, WA
Federal Aviation Administration, Regional Director, Renton, WA
Federal Highway Administration, Washington (HDA-WA), Olympia, WA
National Agriculture Library, Beltsville, MD
Natural Resource Conservation Service, National Environmental Coordinator, Washington DC
NOAA Fisheries Service, Seattle, WA
Northwest Power Planning Council, Portland, OR
Okanogan County Commissioners
U.S. Army Corps of Engineers, Portland, OR
U.S. Coast Guard, Commandant CG-47, Washington, DC
U.S. Fish and Wildlife Service, Wenatchee Field Office
Bureau of Indian Affairs, Robert Compton, Nespelem
OEPC

Individuals and Organizations

Alliance for the Wild Rockies, Michael Garrity
Daryl Asmussen
Jerry Asmussen
Ray Campbell
Conservation Northwest, George Wooten, Associate
Jake Cunningham
Congressman Doc Hastings, Yakima Office
Okanogan Cattlemen's Association, Jim Hutton
Corey Keeton
Lester Kinney
Casey and Nicole Kuchenbuch
The Lands Council, Mike Petersen
Moshe Levine
Jean Public
Alan Rice, et al.
Donald W. Smith
Vic Stokes

Ryan Stucker
Jim Utt
Melvin & Violet Utt
Todd Vejraska
Craig & Louis Vejraska
Washington Cattlemen's Association, Jack Field, Executive Vice President
Ted Weitman
Albert and Ruthann Wilson
Ron Wilson
Steven M. Winnie

# Appendix G

# Regulatory Framework

## Direction

In managing livestock grazing on public rangelands, the Forest Service's overall objective is to ensure the long-term health and productivity of these lands and to create multiple environmental benefits that result from healthy watersheds. The Forest Service administers public land grazing in accordance with, but not limited to, the following laws and guidance documents:

## Laws

***Federal Land Policy and Management Act of 1976 (FLPMA)***: This Act formally established the multiple-use mission of the Agency. Pertinent sections of FLPMA relating to rangeland management can be found in Sections 102, 201, 202, 302-304, 307, 309, 310, and 401-403.

***Endangered Species Act:*** Section 7 (a)(2) of the Endangered Species Act (ESA) of 1973 as amended, requires federal agencies to review actions authorized, funded, or carried out by them, to ensure such actions do not jeopardize the continued existence of federally listed species, or result in the destruction or adverse modification of listed critical habitat.

The Forest Service consults with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) if projects could potentially affect listed species or critical habitat. The Forest currently has three programmatic consultation documents with these regulatory agencies that cover much of the Forest's program of activities for several years.

***National Historic Preservation Act of 1966 (NHPA), Executive Order 11593, 36 CFR 800.9 (Protection of Historic Properties):*** The National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470), as amended, is the foremost legislation that governs the means to identify, administrate, and preserve objects and landscapes significant to cultural and social heritage for the enrichment of future generations. Implementing regulations that clarify and expand upon the NHPA include ***36 CFR 800 (Protection of Historic Properties), 36 CFR 63 (Determination of Eligibility to the National Register of Historic Places), and 36 CFR 296 (Protection of Archaeological Resources)***.

The Pacific Northwest Region (R6) of the Forest Service, the Advisory Council on Historic Preservation (ACHP), and the Washington State Historic Preservation Office (SHPO), signed a programmatic agreement (PA) regarding the management of cultural resources on National Forest System lands in 1997. The 1997 PA outlines specific procedures for the identification, evaluation, and protection of cultural resources during activities or projects conducted on Forest Service lands. It also establishes the process that the SHPO utilizes to review Forest Service undertakings for NHPA compliance. The Grazing Allotment Review Strategy for Section 106 Compliance, which implements the Regional Forester policy letter of May 19, 2006, "Grazing Permit Reauthorization and National Historic Preservation Act" (Goodman 2006), is the region's interagency guidance for performing heritage reviews of grazing permit reauthorizations. Section 106 requires documentation of a determination of whether each undertaking would affect historic properties.

The ***Archaeological Resources Protection Act (ARPA) of 1979***, ***the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990***, and ***Executive Order 13007 (Indian Sacred Sites)*** also guide Forest Service decision-making as it relates to cultural resource management.

***Clean Air Act:*** The Clean Air Act (CAA) Amendments of 1977 gives federal land managers an affirmative responsibility to protect the air quality related values (including visibility) within Class 1 areas.

***Clean Water Act:*** The Clean Water Act (CWA) of 1977 and subsequent amendments, established the basic structure for regulating discharges of pollutants into the waters of the United States. It gives the Environmental Protection Agency (EPA) the authority to implement pollution control programs, and to set water quality standards for all contaminants in surface waters. The Act makes it unlawful for any person to discharge any pollutant into waters of the United States, unless a permit has been obtained under its provisions. The EPA delegated implementation of the CWA to the States; the State of Washington recognizes the Forest Service as the Designated Management Agency for meeting CWA requirements on National Forest System lands.

*Washington State Department of Ecology MOA:* Section 303(d) of the Federal Clean Water Act requires Washington State (Department of Ecology) to periodically prepare a list of all surface waters where pollutants have impaired the beneficial uses of water (for drinking, recreation, aquatic habitats, etc.). Types of pollutants include high temperatures, fecal coliform, excess nutrients, low levels of dissolved oxygen, and toxic substances. The Forest Service, Pacific Northwest Region 6 and the Washington State Department of Ecology meet this management mandate under a Memorandum of Agreement (MOA) with emphasis on reducing effects of roads on water quality.

***Public Rangelands Improvement Act of 1978***: This act established the present grazing-fee formula, reaffirmed grazing boards, and authorized expenditure of funds for range improvements. In addition, the law required both the Secretary of the Interior and the Secretary of Agriculture to undertake, and maintain, an inventory of range conditions and trends on public rangelands. The federal grazing fee is currently set using the fee formula established in 1978 and modified in 1986. The formula is adjusted annually using indices of private land grazing lease rates (Forage Value Index, FVI), prices received for beef cattle (Beef Cattle Price Index, BCPI), and costs of beef production (Prices Paid Index, PPI). The FVI tracks price movement in the private forage market and was the only index originally proposed to be included in the fee formula.

***Multiple-Use Sustained-Yield Act of June 12, 1960***: The Multiple-Use, Sustained-Yield Act of 1960 requires that national forests shall be administered for a variety of uses including outdoor recreation, range, timber, watershed, and wildlife and fish purposes. This act formally established the policy of managing national forests for multiple uses, including for grazing. The Act directs the Forest Service to achieve and maintain outputs of various renewable resources in perpetuity without permanent impairment of the land's productivity.

***Rescissions Act of 1995, Section 504***: This act directed the USFS to complete site-specific National Environmental Policy Act (NEPA) analysis and management decisions for allotments. In so doing, the Agency provides livestock-based economic opportunities in rural communities while contributing to the West's social fabric and identity. Together, public lands and the adjacent private ranches maintain open spaces in the fast-growing West, provide habitat for wildlife, offer a myriad of recreational opportunities for public land users, and help preserve the character of the rural West.

***The National Forest Management Act (NFMA) (section 36 CFR 219.19):*** The National Forest Management Act of 1976 (NFMA) charges the Secretary of Agriculture with ensuring research and continuous monitoring of each management system to safeguard the land's productivity including soil quality standards for detecting soil disturbance and indicating a loss in long-term productive potential. NFMA requires that the Forest Service manage fish and wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species in the planning area.

***The Migratory Bird Treaty Act (MBTA)/Landbird Conservation Plan (Presidential Executive Order 13186, and FS/FWS MOU, Jan. 2001):*** This act requires federal agencies to assess project actions that may affect avian species covered by these doctrines and their habitats. The MBTA outlines responsibilities of federal land management agencies relative to landbird conservation and the MOU provides interim direction on implementation of the MBTA.

***Organic Administration Act of 1897:*** The Organic Administration Act of 1897 (16 U.S.C. 473-475) authorizes the Secretary of Agriculture to establish regulations to govern the occupancy and use of National Forests and "…to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States."

***Bankhead-Jones Act of 1937:*** The Bankhead-Jones Act of 1937 authorizes and directs a program of land conservation and land utilization, in order thereby to correct maladjustments in land use, and thus assist in controlling soil erosion, preserving natural resources, mitigating floods, conserving surface and subsurface moisture, protecting the watersheds of navigable streams, and protecting the public lands, health, safety, and welfare.

***Magnuson – Stevens Fishery Conservation and Management Act:*** It is the primary law governing marine fisheries management in the United States. The law was originally enacted as the ***Fishery Conservation and Management Act of 1976*** and has been amended many times over the years. Two major recent sets of amendments to the law were the ***Sustainable Fisheries Act of 1996*** and then 10 years later the ***Magnuson-Stevens Fishery Conservation Reauthorization Act of 2006.*** The goal of the act was to end overfishing. The most recent version, authorized in 2007, includes seven purposes: 1. Acting to conserve fishery resources; 2. Supporting enforcement of international fishing agreements; 3. Promoting fishing in line with conservation principles; 4. Providing for the implementation of fishery management plans which achieve optimal yield; 5. Establishing Regional Fishery Management Councils to steward fishery resources; 6. Developing underutilized fisheries; and 7. Protecting essential fish habitats.

## The Code of Federal Regulations (CFR), Executive Orders, and Policy

The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government. Minimum specific management requirements are identified in 36 CFR 219.27, to accomplish goals and objectives for the National Forest System.

- The National Environmental Policy Act requires integrated use of the natural and social sciences in all planning and decision-making that affects the human environment. The human environment includes the natural and physical environment, and the relationship of people to the environment (**40 CFR 1508.14**).
- Title 40, Code of Federal Regulations for NEPA (**40CFR 1502.23**) addresses non-commodity values, stating "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."
- **Executive Order 12898** (February 11, 1994) on Environmental Justice directs federal agencies to identify and address agency programs that may have a disproportionately high and adverse environmental effects on minority populations, low-income populations, or Indian tribes. The order directs federal agencies to focus attention on the human health and environmental effects to ethnic minorities (American Indians, Hispanics, African Americans, and Asian and Pacific-Islander Americans), disabled people, and low-income groups.
- The **Civil Rights Policy** for the USDA, Departmental Regulation 4300-4 dated May 30, 2003, states that the following are among the civil rights strategic goals; (1) managers, supervisors, and other employees are held accountable for ensuring that USDA customers are treated fairly and equitably, with dignity and respect; and (2) equal access is assured and equal treatment is provided in the delivery of USDA programs and services for all customers. This is the standard for service to all customers regardless of race, sex, national origin, age, or disabilities.

- Under **section 504 of the Rehabilitation Act of 1973**, no person with a disability can be denied participation in a Federal program that is available to all other people solely because of his or her disability.
- Federal regulation (**36 CFR 222.2(c)**) states that "[f]orage producing National Forest System lands will be managed for livestock grazing and the allotment management plans will be prepared consistent with [forest] plans."
- Federal regulations (**36 CFR 218)** is the process by which the public may file objections seeking predecisional administrative review for proposed projects and activities implementing land management plans and documented with a Record of Decision (ROD) or Decision Notice (DN). The final rule carries out the direction in the Consolidated Appropriations Act of 2012, section 428. Section 218.10 describes objection time periods and processes.
- Federal Regulations (**36 CFR 214)** is the process for Postdecisional Administrative Review for Occupancy or Use of National Forest System Lands and Resources. The United States Department of Agriculture issued this final rule to update, rename, and relocate the administrative appeal regulations governing occupancy or use of National Forest System (NFS) lands and resources. This final rule simplified the appeal process, shortened the appeal period, and reduced the cost of appeal while still providing a fair and deliberate procedure by which eligible individuals and entities may obtain administrative review of certain types of Forest Service (Agency) decisions affecting their occupancy or use of NFS lands and resources. The final rule also moves the provision entitled "Mediation of Term Grazing Permit Disputes" to a more appropriate location in the range management regulations. Section 214.4 describes Decisions that are appealable.

## Final Environmental Impact Statements

Additional guidance for the analysis area is provided by the following Final Environmental Impact Statements. This project implements (is tiered to) these documents:

### Okanogan National Forest Land and Resource Management Plan [LRMP] (FEIS 1989)

The Forest Plan includes Forestwide Standards and Guidelines, and also includes designated Management Areas (MAs) with Standards and Guidelines for activities within each management area. The MAs that provide guidance for the BART allotments are: MA 5 (recreation emphasis), 14 (general wildlife emphasis), 25 (timber/range emphasis) and 26 (deer winter range emphasis). The Forestwide Standards and Guidelines and Standards and Guidelines for each MA direct how AMPs are designed including the development of structural and non-structural range improvements, forage utilization and riparian area grazing management. The objective of each MA is described below. Individual standards and guidelines are only repeated once even though they may apply to several different resource areas.

**Management Area 5**: Provide opportunities for recreation and viewing in a roaded setting with a visual quality objective of retention or partial retention. (approximately 2 % of the project area).

**Management Area 14**: Provide a diversity of wildlife habitat, including deer winter range, while growing and producing merchantable wood fiber (approximately 24% of the project area).

**Management Area 25**: Intensively manage the timber and range resources using both even-aged and uneven-aged silvicultural practices. Manage to achieve a high present net value and a high level of timber and range outputs while protecting the basic productivity of the land and providing for the production of wildlife, recreation opportunities, and other resources (approximately 62% of the project area).

**Management Area 26**: Manage deer winter range and fawning habitats to provide conditions that can sustain optimal numbers of deer indefinitely, without degrading habitat characteristics such as forage, cover, and soil (approximately 11% of the project area).

**Forestwide Range Standards and Guidelines that apply to this project include (LMRP, pg. 4-42 to 4-45)**

**11-1:** Update range AMPs. Identify lands in unsatisfactory condition. Develop AMPs with specific objectives for these lands on a priority basis under a schedule established by the Forest Supervisor. These objectives shall meet a desired future condition based on existing and potential values for all resources. The AMP shall include: 1) a time schedule for improvement; 2) activities needed to meet forage objectives; and 3) an economic efficiency analysis.

**11-2:** AMPs shall include a strategy for managing riparian areas for a mix of resource uses. A measurable desired future riparian condition should be satisfactory or greater. Range conditions within riparian ecosystems should be in good or better condition class with a stable or upward trend. In conditions classes fair or less, management shall be designed to attain an upward trend. When the current riparian condition is less than satisfactory, objectives shall include a schedule for improvement. The AMPs shall identify management actions needed to meet riparian objectives within the specified time frame. Measurable objectives shall be set for key parameters.

**11-3:** When riparian resource damage is occurring, determination of the cause of the resource damage shall be made prior to taking action through the allotment management plan. Alleviate damage caused by grazing through proven means. Fencing may be used when other management approaches have not given satisfactory results in the same or similar resource conditions.

**11-4** and **11-5:** These standard and guidelines are forage utilization tables that can be found in the Forest Plan. Forage utilization is divided by riparian and uplands for livestock and wildlife.

Table 52, Allowable Use of Available Forage Outside Riparian Areas[1]. (Maximum annual utilization percentage)[2].

| | Forest | | Grassland | | Shrubland | |
|---|---|---|---|---|---|---|
| Range Resource Management Level | Sat.[3] Cond. | Unsat.[4] Cond. | Sat. Con | Unsat. Cond. | Sat. Cond | Unsat Cond |
| B-Livestock use managed within current grazi capacity by riding, herding, and salting. Cost effective improvements used only to maintain stewardship of range. | 40 | 0-30 | 50 | 0-30 | 40 | 0-25 |
| C-Livestock managed to achieve full utilizatio of allocated forage. Management systems designed to obtain distribution and maintain plant vigor include fencing and water development. | 45 | 0-35 | 55 | 0-35 | 45 | 0-30 |
| D-Livestock managed to optimize forage production and utilization. Cost effective cultural practices improving forage supply, forage use, and livestock distribution may be combined with fencing and water developmen implement complex grazing systems. | 50 | 0-40 | 60 | 0-40 | 50 | 0-35 |

1. This will be incorporated in annual operating plans and AMPS. AMPS may include utilization standards which are either lower or rarely higher when associated with intensive grazing systems and specific vegetation management objectives which will meet resource objectives. Includes cumulative annual use by big game and livestock. Satisfactory and unsatisfactory conditions are defined in the glossary.
2. Utilization based on percent removed by weight for grass, grasslike, and forbs.
3. Satisfactory Condition.
4. Unsatisfactory Condition.

Table 2, Allowable Use of Available Forage in Riparian Areas[1]. (Maximum annual utilization percentage).

| | Grass and Grass Like[2] | | Shrubs[3] | |
|---|---|---|---|---|
| Range Resource Management Level | Sat.[4] Cond | Unsat.[5] Cor | Sat. Cond. | Unsat. Cond. |

| | | | | |
|---|---|---|---|---|
| B-Livestock use managed within current grazing capacity by riding, herding, and salting. Cost effective improvements used only to maintain stewardship of range. | 40 | 0-30 | 30 | 0-25 |
| C-Livestock managed to achieve full utilization of allocated forage. Management systems designed to obtain distribution and maintain plant vigor includ fencing and water development. | 45 | 0-35 | 40 | 0-30 |
| D-Livestock managed to optimize forage producti and utilization. Cost effective cultural practices improving forage supply, forage use, and livestock distribution may be combined with fencing and water development to implement complex grazing systems. | 50 | 0-40 | 50 | 0-35 |

1. This will be incorporated in AMPS. AMPS may include utilization standards which are either lower or rarely higher when associated with intensive grazing systems and specific vegetation management objectives which will meet objective for the riparian dependent resources. Includes cumulative annual use by big game and livestock. Satisfactory and unsatisfactory conditions are defined in the glossary.
2. Utilization based on percent removed by weight.
3. Utilization based on incidence of use, weight and/or twig length. Example: if 50 leaders out of 100 are browsed, utilization is 50 percent.
4. Satisfactory Condition.
5. Unsatisfactory Condition.

**11-6:** Range structural and non-structural improvements and maintenance shall conform to the resource emphasis of the Management Area and shall be specified in the Allotment Management Plan.

**11-7:** Range improvements and practices shall not be designed to increase livestock use in riparian ecosystems but should enhance riparian ecosystems.

***Implementation of the Forest Plan Direction:***

Existing AMPs and grazing permits will be in compliance with Forest Plan direction on the first revision of the AMPs following Plan implementation.

In implementing the Forest Plan, any necessary adjustments between existing permitted livestock numbers and Plan direction will be made by evaluating management direction for allotments, and determining if a change in management intensity for the allotment is necessary. Factors influencing this decision will include: permit status, condition of improvements, funds available, priority needs on other allotments, and ability to meet standards and guidelines in this Forest Plan.

**Forestwide Riparian and Fisheries Standards and Guidelines that apply to this project include (LRMP, pg. 4-30 to 4-32):**

**2-2:** When management activities occur in riparian ecosystems, they shall be designed to rehabilitate, maintain, or enhance the riparian ecosystem, and the adjoining aquatic ecosystem.

**2-4:** Maintain vegetation on stream banks that is needed to provide cover and stream bank stability.

**2-9:** In streamside management units (SMU) class I, II, and III streams, management activities shall not degrade water quality for aquatic resources below current Washington State water quality standards (Chapter 173-201 WAC), except for temporary changes because of permitted activities.

**3-1:** Maintain biological, chemical, and physical qualities of Forest fish habitat.

**3-2:** Rehabilitate fish habitats where past management activities have adversely affected their ability to support fish populations. Those fish habitats identified as having impacts from management activities shall be managed to show an upward trend with at least a 5 percent increase in condition per year until objectives for the habitat are met.

**3-3:** Sediment in fishery streams shall be maintained at levels low enough to support good reproductive success of fish populations as well as adequate instream food production by indigenous aquatic communities to support those populations with a specific standard of fines (<1mm) in spawning areas (pool tail-outs and glides) should be maintained at less than 20 percent as the area weighted average.

**3-4:** Manage streams for high quality pool habitat consistent with the potential for the Stream to provide it through natural or artificial means.

- Low Gradient (<3 percent) - Streams should maintain at least one high quality pool for every three channel widths (bank full width)
- High Gradient (≥3 percent) - Streams should maintain at least one high quality pool for every six channel widths (bank full width).

**Forestwide Botany Standards and Guidelines that apply to this project include (LMRP, pg. 4-36 to 4-38)**

**6-19:** Sensitive plants and animals should be protected.

**7-1:** Maintain a Forestwide cultural resource overview that summarizes and compiles information on archaeology, on history, and on native plants used as food, medicine, and for religious purposes by Native American Tribes. Specific locations may be confidential.

**7-1l:** Manage to perpetuate native plant species used for food, medicine, and religious purposes by Native American Tribes consistent with goals of the Management Area.

**7-14:** Coordinate with Native American Tribes, regarding cultural resources of suspected prehistoric origin and to identify key native plant gathering areas and species.

**Forestwide Noxious Weed Standards and Guidelines that apply to this project include (LMRP, pg. 4-45)**

**12-1:** Control noxious weeds to the extent practical.

**12-2:** New infestations of noxious weeds should be the first priority for eradication.

**12-3:** Emphasis on noxious weed control shall be the prevention of infestations, especially into unroaded areas and wilderness.

**Forestwide Hydrology Standards and Guidelines that apply to this project, besides what are listed under Riparian and Fisheries include (LMRP, pg. 4-31 & 4-45 to 4-46):**

**2-14:** In streamside management units class IV streams, management activities shall not deteriorate water quality below current Washington State water quality standards for downstream SMU class I, II, and III streams. Water quality changes in class IV streams may involve some short-term temperature and turbidity increases.

**13-4:** Use the existing, mutually developed process to implement the State Water Quality Management Plan on lands administered by the Forest Service as described in Memorandum of Understanding (MOU) between the Washington State Department of Ecology and USDA, Forest Service (7/79). and 'Attachment A' referred to in this MOU (Implementation Plan for Water Quality Planning on National Forest System Lands in the Pacific Northwest 12/78).

**13-11:** Water use rights should be obtained from the Washington State Department of Ecology when water is needed for uses not defined in the 1897 Organic Act or other legislation defining reserved rights.

**Forestwide Wildlife Standards and Guidelines that apply to this project include (LMRP, pg. 4-34 to 4-36)**

**6-2:** Habitat capability shall be assessed during project planning**.**

**6-8:** Manage disturbing activities so they occur outside of critical periods to protect wildlife (e.g., identified parturition areas, nesting sites, wintering areas)

**6-17:** Threatened and endangered species shall be managed according to recovery plans. Coordinate management with U.S. Fish and Wildlife Service and the Washington State Departments of Fisheries and Wildlife.

**6-18**: Consultation with the U.S. Fish and Wildlife Service shall be initiated when threatened or endangered species may be affected by resource proposals.

**Management standards that are pertinent for this cultural resource effects analysis include:**

- Conduct a professionally supervised cultural resource survey on National Forest lands to identify cultural resource properties. Use sound survey strategies and the Okanogan-Wenatchee National Forest Cultural Resource Inventory Survey Design and site location predictive model.
- Evaluate the significance of sites by applying the criteria for eligibility to the National Register of Historic Places (Parker and King, 1998).
- Consider the effects of all Forest Service undertakings on cultural resources. Coordinate the formulation and evaluation of alternatives with State and Federal agencies, and with leaders and the Tribal Historic Preservation Officer (THPO) of American Indian tribes with historic ties to the project planning area.

**Discrete Forest Plan Management Area Direction for Grazing**

**MA 5**

**MA5 -11A**: Manage commercial livestock to reduce conflicts with recreation.

**MA5-11B**: 85% of annual available browse on winter range shall be for wildlife and 15% for domestic livestock (Refer to forage utilization standards in the Forest Plan, Chapter 4 - Forestwide Standards and Guidelines, pg. 4-43 & 44).

**MA 14**

**MA14-11A:** Eighty-five percent of the annual available browse (shrubs) shall be for wildlife and 15 percent for domestic livestock (Refer to forage utilization standards in the Forest Plan, Chapter 4 - Forestwide Standards and Guidelines, pg. 4-43 & 44).

**MA 25**

**MA 25-11A:** Specific allotments and portions of allotments that will be intensively managed for transitory range shall be identified according to the following criteria:

1) Intensive transitory range management practices and techniques shall be applied to blocks of at least 100 acres.

2) Specific areas where intensive transitory range management practices will be applied shall be determined following site specific, interdisciplinary analysis associated with the updating and revision of the AMPs. Priority should be given to using intensive transitory range to reduce grazing impacts to resources such as riparian areas, recreation uses, or other portions of the range.

3) Up to five percent of suitable timber lands may be managed with intensive range practices.

**MA 25-11B:** Bring fair and poor condition suitable non-transitory rangelands to good condition.

**MA 25-11C:** Maintain improvements on suitable rangelands.

**MA 25-11D:** With improvements, meet C or D level management on suitable non-transitory rangelands where economically desirable.

**MA 25-11E:** Transitory range structural and nonstructural improvements and grazing systems shall be designed subject to silvicultural, wildlife, and other resource objectives.

**MA 26**

**MA26-11A:** Livestock grazing shall be allowed as long as wildlife habitat values are maintained or are increased.

**MA 26-11B:** Eighty-five percent of the annual available browse shall be for wildlife and 15% for domestic livestock. (Refer to forage utilization standards in the Forest Plan, Chapter 4 - Forestwide Standards and Guidelines).

## PACFISH/INFISH

The project area is bisected by two management plans that amended the Okanogan Forest Plan. On the west side, The Decision Notice and Environmental Assessment for the Interim Strategies for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH, USDA and USDI 1995a) amended the Okanogan Forest Plan in 1995. On the east side, Interim Strategies For Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada (INFISH USDA 1995b) amended the Okanogan Forest Plan in 1995. The key difference between these management documents is PACFISH watersheds house salmon and steelhead and INFISH watersheds house inland trout species.

Both PACFISH and INFISH includes five components directing management of riparian areas: Riparian Habitat Conservation Areas (RHCAs), Riparian Goals, Riparian Management Objectives (RMOs), Key or Priority Watersheds, and Watershed Analysis. How the five components relate to the project and project area is explained below:

### RHCAs

PACFISH and INFISH RHCAs (USDA and USDI 1995a:C-6, USDA 1995b: E-5): RHCA widths range from 300 feet on either side of fish bearing streams and lakes to 100 feet along non-fish bearing intermittent streams. The PACFISH and INFISH Standard and Guidelines for managing livestock activities in RHCAs are as follows:

### Riparian Goals

PACFISH and INFISH Riparian Goals (Riparian Goals) (USDA and USDI 1995a: C-4, USDA 1995b: E-2) for the project area provide the framework for the aquatic resources analysis. Both management document goals are the same. Riparian Goals establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. The goals describe several watershed, stream, riparian processes that are to be maintained or restored. The pertinent goals to be maintained or restored during the planning for the BART project include:

- Stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed.
- Natural timing and variability of the water table elevation in meadows and wetlands.
- Riparian vegetation to:
    - Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
    - Provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and
    - Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

**Riparian Management Objectives**

PACFISH and INFISH RMOs (USDA and USDI 1995: C-4, USDA 1995a: E-3) describe good fish habitat and also tie to riparian function and water quality. The numeric values given provide the "criteria" against which attainment, or progress toward attainment, of the riparian goals is measured, and a target toward which managers will be aiming for as they conduct resource management activities. RMOs for stream systems relevant to the project area are: Pool Frequency, Water Temperature, Width-Depth Ratios and bank stability (meadow type streams). See the PACFISH and INFISH documents for the specific RMO values and Appendix J, PACFISH/INFISH Riparian Management Objectives.

The following Standards and Guidelines apply (this is a combination of INFISH and PACFISH Standards and Guidelines):

*PACFISH*

- **GM-1:** Adjust grazing practices (e.g., length of grazing season, stocking levels, timing of grazing, etc.) to eliminate impacts that are inconsistent with attainment of Riparian Management Objectives (RMOs). If adjusting practices is not effective, eliminate grazing.

- **GM-2:** Locate new livestock handling and/or management facilities outside of Riparian Habitat Conservation Areas (RHCAs). For existing livestock handling facilities inside the Riparian Habitat Conservation Areas, assure that facilities do not prevent attainment of Riparian Management Objectives are met. Where these objectives cannot be met, require relocation or removal of such facilities.

- **GM-3:** Limit livestock trailing, bedding, watering, salting, loading, and other handling efforts to those areas and times that will assure Riparian Management Objectives are met.

- **GM-4:** Adjust wild horse and burro management to eliminate impacts that are inconsistent with attainment of Riparian Management Objectives

*INFISH*

- **GM-1:** Modify grazing practices (e.g., accessibility of riparian areas to livestock, length of grazing season, stocking levels, timing of grazing, etc.) that retard or prevent attainment of Riparian Management Objectives (RMOs) or are likely to adversely affect inland fish. Suspend grazing if adjusting practices is not effective in meeting RMOs and avoid adverse effects on listed anadromous fish.

- **GM-2:** Locate new livestock handling and/or management facilities outside of Riparian Habitat Conservation Areas (RHCAs). For existing livestock handling facilities inside the Riparian Habitat Conservation Areas, assure that facilities do not prevent attainment of Riparian Management Objectives. Relocate or close facilities where these objectives cannot be met.

- **GM-3:** Limit livestock trailing, bedding, watering, salting, loading, and other handling efforts to those areas and times that will not retard or prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

- **GM-4:** Adjust wild horse and burro management to avoid impacts that prevent attainment of Riparian Management Objectives or adversely affect inland native fish.

**Key/Priority Watersheds**

PACFISH Key Watersheds (USDA and USDI 1995a: C-19) and INFISH Priority Watersheds (USDA 1995b: E-13) were established to provide a pattern of protection across the landscape where anadromous and inland native trout would receive special attention and treatment. Priority in these watersheds would be to protect or restore habitat and to restore degraded habitat.

The project area includes two 5$^{th}$ field Hydrologic Unit Code (HUC) watersheds: Okanogan River-Bonaparte Creek (Bonaparte) and West Fork Sanpoil River (Sanpoil). Upper Columbia River steelhead, which are listed as Threatened under the Endangered Species Act (ESA), are present in the Okanogan River and lower Bonaparte Creek. Therefore, the Bonaparte watershed is designated as a PACFISH Key Watershed. There is no INFISH priority watersheds associated with the BART project area.

- PACFISH: About 38 percent (14,209 acres) of the analysis area lies within the Okanogan River-Bonaparte Creek *(Bonaparte Creek Watershed Assessment,1998a)* that includes portions of Patterson, Peony, Bench, Tunk, Cole, Aeneas and Chewiliken Creeks. The Okanogan River is Essential Fish Habitat for anadromous fish.
- INFISH: Approximately 62 percent (22,600 acres) of the analysis area lies within the West Fork Sanpoil Watershed *(West Fork Sanpoil Watershed Assessment,1998b)* and includes Crawfish Lake and portions of Jungle, Aeneas, Bailey, Barnell and Lost Creeks.

**Watershed Assessments**

Both the Bonaparte and Sanpoil watersheds have completed watershed analyses (USDA 1998a and 1998b). The watershed analyses were reviewed to determine if water quality issues were identified and if livestock grazing was identified as causing aquatic/riparian resource issues. In both watershed analyses it was found that:

- Livestock grazing was identified as an issue resulting in increased bank shear and stream sedimentation, and degraded water quality on and below National Forest System lands.

    - Water quality was identified as limiting beneficial use on lower Bonaparte Creek downstream of the project area.
    - Grazing along Peony Creek and its tributaries were specifically identified as issue areas that degrade water quality and contribute excess sediment to fish habitat downstream.
    - Grazing areas along Aeneas and lower Jungle Creek identified as issues to stream processes.

- High road densities and a large number of stream crossings were documented as sources for accelerated sediment production in the analysis area streams and sediment deposition areas will continue to store trapped sediment.
- Objectives are needed to return Aeneas and Peony Creeks riparian areas to a proper functioning condition and to increase water quality through increased functioning of the riparian areas.
- There were existing needs to modify grazing practices to reduce riparian and aquatic impacts.

In the Sanpoil watershed analysis, grazing areas were identified in tributaries to Aeneas Creek and lower Jungle Creek as creating issues to stream processes. In both documents, the recommended actions included modifying grazing practices to reduce riparian and aquatic impacts.

### The Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants Final Environmental Impact Statement and Record of Decision (USDA, Forest Service 2005).

The Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants, Final Environmental Impact Statement, April 2005 describes the Desired Future Condition as: In National Forest Lands across Region Six, healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the region. Invasive plants do not jeopardize the ability of the National Forest to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts.

The Invasive Species ROD includes standards and guidelines for preventing invasive plants. Standard 6 applies to allotment management plans, requiring managers to use available mechanisms to incorporate invasive plant prevention practices into range land management. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment management plans, providing annual operating instructions and adaptive management.

This document amends all Forest Plans in Washington and Oregon with goals, objectives, and standards related to invasive plants that complement the Best Management Practices already in effect on the Okanogan-Wenatchee National Forest. The 2005 ROD standards also prescribe prevention, cleaning of equipment, use of weed-free straw and mulch, use of weed-free rock and gravel sources, and prompt revegetation with native species or non-invasive non-natives. This Environmental Impact Statement is tiered to this broader-scale analysis (the FEIS), and all activities proposed are intended to comply with the new management direction.

<u>Record of Decision Standards</u>

The following standards from the 2005 PNW ROD are relevant to this project:

**Standard 1:** Prevention of invasive plant introduction, establishment and spread will be addressed in watershed analysis; roads analysis; fire and fuels management plans, Burned Area Emergency Recovery Plans; emergency wildland fire situation analysis; wildland fire implementation plans; **grazing allotment management plans**, recreation management plans, vegetation management plans, and other land management assessments.

**Standard 3:** Use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed-free using the North American Weed Free Forage Program standards or a similar certification process.

**Standard 6:** Use available administrative mechanisms to incorporate invasive plant prevention practices into **rangeland management**. Examples of administrative mechanisms include, but are not limited to, revising permits and grazing allotment management plans, providing annual operating instructions, and adaptive management. Plan and implement practices in cooperation with the grazing permit holder.

**National Strategy and Implementation Plan for Invasive Species Management (USDA, Forest Service 2004)**

Prevention and Management Strategy

The current strategy for invasive species management has four elements (USDA Forest Service 2004):
5. Prevention – Stop invasive plants before they arrive.
6. Early detection and rapid response – Find new infestations and eliminate them before they become established.
7. Control and management – Contain and reduce existing infestations.
8. Rehabilitation and restoration – Reclaim native habitats and ecosystems.

Relative to noxious weeds, the prevention strategy is always preferred and employed as the initial strategy. However, due to the nature of noxious weeds, the prevention strategy is often not adequate to ensure complete exclusion of noxious weeds. Failure to attempt to control noxious weed spread and establishment is expected to result in progressive local alteration of ecosystem process, and violation of state and federal laws.

**Executive Order 13112 of February 3, 1999** states that Federal Agencies have the duty of identifying actions that will affect the status of invasive species; to prevent, detect, and respond to control populations of such species; and not authorize or carry out actions that it believes are likely to casue or promote the introduction or spread of invasive species.

## Manual Direction

Forest Service Manual (FSM) chapter 2670 gives direction to manage for sensitive plants.

Forest Service Manual (FSM) 2500, Chapter 2550 Soil Management directive establishes the framework for sustaining soil quality and hydrologic function while providing goods and services outlined in forest and grassland land management plans.

The policy outlined in Chapter 2550 that pertains to this analysis is the following:

1. Manage forest and rangeland ecosystems to maintain or improve soil quality.

4. Utilize soils information to assess condition and analyze project effects when planning and implementing activities to ensure sustainable delivery of goods and services without impairing the productivity of the land.

The Region 6 Supplement (2500-98-1) to the FSM 2500, Chapter 2520 directs forests to "design and implement management practices which maintain or improve soil and water quality" and to "emphasize protection over restoration."

The policy outlined in the Region 6 Supplement directs the following:

"When initiating new activities:

4. Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area. (This includes the permanent transportation system.)

5. In areas where less than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent.
6. In areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality.

### Okanogan-Wenatchee National Forest Restoration Strategy

An adaptive ecosystem management to restore landscape resiliency, (2012, version) ecosystem management is the overarching principle guiding the restoration strategies implemented by all projects. Manipulation or management of an ecosystem, such as a watershed, does not, by itself constitute ecosystem management because essential components are lacking. Christensen et al. (1996) suggest that ecosystem management include the following:

1) Long-term ecological sustainability as a fundamental value (guided by historical variability and tempered by potential climate change);

2) Clear, operational goals;

3) Sound ecological models and understanding;

4) Understanding of complexity and interconnectedness;

5) Recognition of the dynamic character of ecosystems;

6) Attention to context and scale;

7) Acknowledgment of humans as ecosystem components;

8) Commitment to adaptability and accountability;

## Water Rights Review for the Proposed Action

A review of the Washington Department of Ecology, Water Rights database confirmed that Forest Service does have valid existing water rights within the BART Allotments for livestock use and for the proposed spring developments (ftp://www.ecy.wa.gov/wr/GWIS_Data/). The Range staff will administer the water rights for the proposed developments.

## Municipal Watersheds

There are no municipal watersheds within the allotment on the Okanogan-Wenatchee National Forest or in the watersheds that drain the allotment to Bonaparte Creek or the West Fork Sanpoil River.

## Source Water Protection Zones

There are no designated source water protection zones in the project area and there are no proposed actions that would impact water availability, water quality or water quantity of groundwater resources below the Forest boundary.

# Appendix H

## Range Water Development Improvements

The following tables outline the range improvement condition from 2011, 2012, and 2013 inspections. The "Needs" column displays those which require reconstruction and specifics to their status.

Not all water developments would be fixed the first year. They will be prioritized by resource needs and accomplished as funding allows. All identified with "Needs" would be accomplished within the first five years of the signing of the Allotment Management Plan.

**Bannon Water Developments 2011, 2012, & 2013 Inventory Notes**

| Development Name | Pasture | Condition | Type | Inspection Notes |
|---|---|---|---|---|
| Cole | **Cat** | Good | Trough | Overflow pipe not working, spring box needs a lid |
| Cat | | Good | Trough | Trough needs cleaning and overflow maintenance |
| Mike | | Fair | Trough | Needs overflow work |
| Frog Pond/Ridge Lake | **Cat/ Patterson** | Fair | Pond | Moderate trampling around pond |
| Patterson | **Patterson** | Fair | Trough | Needs cleaning and hose maintenance |
| Water Catchment | | Poor | Trough | Recommend removal. No water in catchment, trough needs work |
| Ruth | | Poor | Trough | Needs more fence, trough is leaking, rusted, and needs cleaning |
| Big Tree | **Patterson/ Bannon Mtn.** | Good | Pond | Excavated pond with trampled edges |
| Bannon Mtn | **Bannon Mtn.** | Fair | Trough | Older trough, no inflow, shot outflow |
| Dan | | Fair | Trough | Not working, needs work |
| Corral/Bannon Creek | | Fair | Trough | Not flowing through pipe, fence partially down, needs work |
| Albert | | Fair | Trough | Not flowing through pipe, needs work |
| Grouse | | Fair | Trough/ old crib | Not working, needs work, it has been worked on a few times |
| Rotten Tree | | Good | Trough | Double trough, needs newer materials, fence around headbox down |

| Development Name | Pasture | Condition | Type | Inspection Notes |
|---|---|---|---|---|
| Pasture | **Peony** | Fair | Trough | Pipe not flowing |

**Aeneas Water Developments 2011, 2012 & 2013 Inventory Notes**

| Development Name | Pasture | Condition | Type | Inspection Notes |
|---|---|---|---|---|
| Sneed 1 | **Sneed/North** | Good | Trough | Fence partially down, overflow pipe needs to be reattacked |
| Sneed 2 | | Poor | Trough | No water flow, trough needs cleaning |
| Sneed 3 | | Good | Trough | |
| Coyote | | Fair | Trough | Not working, lacks water |
| Beezer | | Fair | Trough | Not working, spring appears dry |
| Emilie/Vance | | Good | Trough | |
| Justin | | Good | Trough | |
| Hill | | Good | Crib | |
| Thorton | | Good | Trough | |
| Hill Cow Camp | | Fair | Spring | Needs fence |
| Kathy | | Fair | Trough | Not working, water is foul |
| Wildhorse | | Good | Crib | |
| Amy/Bullfrog | | Good | Trough | |
| Jared | | Fair | Pond | Excavated pond upslope from Amy water development, heavily trampled |
| Corral | | Fair | Trough | Not sure why not functioning, low water |
| Middle Richwood | | Fair | Pond | Excavated pond, heavily trampled |
| Ron | **South** | Good | Trough | Need oveflow |
| Corey | | Good | Trough | Need overflow |
| Bull Basin | | Good | Pond | Small pond, minimal trampling |
| Karen/Buss | | Fair | Trough | Fence down around spring, needs overflow checked |
| Bailey Mtn. Spring | | Good | Spring | Lots of use by livestock |
| Al Spring | | Good | Trough | Needs overflow |
| Corey Crib | | Poor | Crib | Not really a crib, heavily trampled, under development, not functioning |

| Development Name | Pasture | Condition | Type | Inspection Notes |
|---|---|---|---|---|
| Spring near Ron WD | | Fair | Pond | Heavy trampling |
| Bailey Lake | | Fair | Pond | Moderate trampling |

**Tunk Water Developments 2011, 2012, & 2013 Inventory Notes**

| Development Name | Pasture | Condition | Type | Inspection Notes |
|---|---|---|---|---|
| Birthday | **North** | Fair | Trough | Not working, old trough still there, new trough was removed |
| Tamarack | | N/A | Spring | Permittee wants to develop, proposed development |
| Norman | | Good | Trough | |
| Chewilikin 2 | | Good | Trough | |
| Fulford | | Good | Trough | Needs overflow pipe |
| Unknown near Fulford | | Fair | Trough | Pipe needs worked on |
| Cox | | Good | Trough | Pipe reattached in 2013 |
| Larsen | | Good | Trough | |
| Carmen | | Good | Crib/trough | |
| Ray | | Good | Trough | Needs overflow pipe, worked on in 2013 |
| Horsecamp | | Fair | Trough | Heavily trampled, edge functional |
| Hart | | Good | Trough | |
| Tunk | | Good | Trough | |
| Fritz | | Good | Trough | |
| Jicks | | Good | Trough | |
| Lodgepole/Lela | | Good | Trough | |
| Unknown/Abandoned Tincan | | Poor | Trough | Not working, not on permits |
| Bigfill | **South** | Good | Trough | |
| Double | | Good | Crib | Needs work |
| Single | | Good | Trough | Needs wildlife escape ramp |
| Eberle | | Good | Crib | |
| Block | | Fair | Missing | Needs trough, water flowing through the pipe |

| Development Name | Pasture | Condition | Type | Inspection Notes |
|---|---|---|---|---|
| Pine | | Good | Crib | |
| Bobtail | | Good | Trough | Springbox and trough need cleaning |
| Hardy | | Good | Trough | |
| Line | | Fair | Abandoned | Water is still there but need trough |

There are no water developments on the Revis Allotment. Since this initial inventory, the Forest Service has worked with the permittees in 2011, 2012, and 2013 to improve the conditions. However, some of the work may not be authorized until the BART analysis has been completed and decisions are signed.

# Appendix I

## Noxious Weeds Risk Assessment & BMPs

The Forest Service Manual 2080 Noxious Weed Management (effective 11/29/1995) includes a policy statement calling for a risk assessment for noxious weeds to be completed for every project.

**2080.03 Policy.** When any ground disturbing action or activity is proposed, determine the risk of introducing or spreading noxious weeds associated with the proposed action.

1. For projects having moderate to high risk of introducing or spreading noxious weeds, the project decision document must identify noxious weed control measures that must be undertaken during implementation.

2. All hay, cubed hay, straw, mulch, and other such products used or stored on national forest lands will be state certified as weed free **(FSH 6309.12 sec. 42 and 42.1).**

3. Where States have enacted legislation and have an active program to make weed-free forage available, Forest Officers shall issue orders restricting the transport of feed, hay, straw, or mulch which is not declared as weed-free, as provided in 36 CFR 261.50(a) and 261.58(t).

4. Use contract and permit clauses to prevent the introduction or spread of noxious weeds by contractors and permittees. For example, where determined to be appropriate, use clauses requiring contractors or permittees to clean their equipment prior to entering National Forest System lands.

**Purpose:** To identify vectors for weed spread and changes in habitat that might favor the introduction of new weed species into a proposed project area, or might further spread weeds that already exist within the project boundaries.

**Risk Factors**

*Vulnerability of vegetation to invasion:* High ☐ Medium **X**☐ Low☐

*Explain:* Many of the sites within the BART Grazing Allotment project area fall under the Eastside Dry or Eastside Moist Forest Potential Vegetation Groups. These PVGs have been determined to have moderate to high susceptibility to weed invasion (R6 Invasives Plant Program (IPP) FEIS, 2005). Additionally, aggressive noxious weeds already exist within and adjacent to the project area and spread could occur as a result of livestock grazing. With current, on-going weed control measures, maintaining health and vigor of perennial grasses and reducing overall grazing pressure, weed populations would be substantially reduced or eliminated.

*Soil disturbance:* High ☐ Medium ☐ Low **X**☐

*Explain:* While some soil disturbance may occur where livestock tend to congregate the amount and severity would be minimal. Trigger points would be implemented that would cause changes to the grazing strategy before the damage threshold is reached. Disturbed areas beyond the

damage threshold would be seeded with grasses to provide competition to noxious weeds. Monitoring and control would occur, ensuring early detection of noxious weeds.

*Risk of transporting new infestations into the project area:* High ☐ Medium **X**☐ Low ☐
*Explain:* There is some risk that vehicles traveling in the area could transport noxious weed seed on tires or under carriages because of existing noxious weeds along travel routes. There is some risk that livestock could transport seed from infested fields onto National Forest. Livestock and wildlife movement can spread noxious weeds. Educating Permittees and encouraging holding and feeding livestock in weed free locations for three to ten days prior to release on National Forest would reduce the potential to spread new infestations onto forest. Proposed range improvements are designed to reduce adverse effects of grazing by preventing overgrazing and disturbance in riparian areas. Members of the public who visit the project area to collect firewood may introduce new noxious weeds into the project area from their vehicles, tools and pets. Weed free hay and feed products are required on National Forest System land. The project area would be monitored by grazing permittee and their employees annually.

*Are there known infestations in the project area?* Yes, see weed specialist report for BART Grazing Allotment.

*Are weed prevention and control mitigation measures included in the Proposed Action?* Yes, see weed specialist report for BART Grazing Allotment.

**Determination of Weed Risk**
It is my determination that the proposed BART Grazing Allotment Management plan would result in a *low* risk. There is a medium risk that invasive species will increase their distribution and abundance as a result of continued grazing in the short term. There is a *low* risk that any of the invasive species would become established invaders in the long term.

*Likely effectiveness of the proposed weed prevention and control measures?* The proposed weed prevention and control measures will be very effective if they are followed for the proposed action.

**Prepared By:** Carol Ogilvie, Invasive Plants Program Manager **Date: November 2, 2012**

## Noxious Weed Best Management Practices (BMPs)

Grazing Management Best Management Practices (BMPs) are established guidelines for managing grazing allotments to prevent or reduce the risk of noxious weed introduction and spread.

**Goal 1.** Consider noxious weed prevention and control practices in the management of grazing allotments.

- Grazing 1. Include weed prevention practices, inspection and reporting direction, and provisions for inspection of livestock concentration areas in allotment management plans and annual operating instructions for active grazing allotments.
- Grazing 2. For each grazing allotment containing existing weed infestations, include prevention practices focused on preventing weed spread and cooperative management of weeds in the annual operating instructions. Prevention practices may include, but are not limited to:
    - Altering season of use
    - Exclusion
    - Activities to minimize potential ground disturbance
    - Preventing weed seed transportation
    - Maintaining healthy vegetation
    - Weed control methods
    - Revegetation
    - Inspection
    - Reporting
    - Education

**Goal 2.** Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds. Minimize transport of weed seed into and within allotments.

- Grazing 3. If livestock are potentially a contributing factor to seed spread, schedule use by livestock in units with existing weed infestations which are known to be susceptible to spread by livestock, to be prior to seed-set or after seed has fallen.
- Grazing 4. If livestock were transported from a weed-infested area, annually inspect and treat allotment entry units for new weed infestations.
- Grazing 5. Close pastures to livestock grazing when the pastures are infested to the degree that livestock grazing will continue to either exacerbate the condition on site or contribute to weed seed spread. Designate those pastures as unsuitable range until weed infestations are controlled.

**Goal 3.** Maintain healthy, desirable vegetation that is resistant to weed establishment.

- Grazing 6. Through the allotment management plan or annual operating instructions, manage the timing, intensity (utilization), duration, and frequency of livestock activities associated with harvest of forage and browse resources to maintain the vigor of desirable plant species and retain live plant cover and litter.

- Grazing 7. Manage livestock grazing on restoration areas to ensure that vegetation is well established. This may involve exclusion for a period of time consistent with site objectives and conditions. Consider practices to minimize wildlife grazing on the areas if needed.

**Goal 4.** Minimize disturbed ground conditions favorable for weed establishment in the management of livestock grazing.

- Grazing 8. Include weed prevention practices that reduce ground disturbance in allotment management plans and annual operating instructions. Consider for example: changes in the timing, intensity, duration, or frequency of livestock use; location and changes in salt grounds; restoration or protection of watering sites; and restoration of yarding/loafing areas, corrals, and other areas of concentrated livestock use.
- Grazing 9. Inspect known areas of concentrated livestock use for weed invasion. Inventory and manage new infestations.

**Goal 5.** Improve effectiveness of weed prevention practices through awareness programs and education. Promote weed awareness and prevention efforts among range permittees.

- Grazing 10. Use education programs or annual operating instructions to increase weed awareness and prevent weed spread associated with permittees' livestock management practices.
- Grazing 11. To aid in their participation in allotment weed control programs, encourage permittees to become certified pesticide use applicators.

# Appendix J

## Cumulative Effects Project List

**Past Activities/Events (some are still ongoing)**

- Beehive Timber Sale, 1992
- Fish Timber Sale. 1996
- Crawfish Salvage Sale. 1996
- Sneed Timber Sale, 1998
- Bailey Fire Salvage, 2002
- Coco Timber Sale, 2002
- Bailout Timber Sale, 2008
- Upper Aeneas Timber Sale, 2008
- Frosty, Frozen and Frosted Timber Sales, 2007-2011 (some site prep, burning, ladder fuel reduction, excavator piling remaining)
- Lost Timber Sale, 2011 (some site prep, and burning remaining)
- BR SBA Timber Sale, 2012 (some site prep, burning, and planting remain to be completed).
- Bannon Fire, 1994
- Sneed Fire, 1999
- Bailey Mountain Fire, 2001
- Livestock Grazing, 1900 to the present

**On-going**

- Crawfish Restoration Project (CR Timber Sale) [about 50% overlap] (timber harvest, burning, site prep, planting, & road actions); harvest expected summer 2014 and winter 2014/2015.
- Timber harvest on lands managed by the Confederated Tribes of the Colville Reservation, over a 1,000 acres just south of common boundary
- Grazing (adjacent to project area; Tribal, private land, Bailey Allotment)
- Noxious weed treatment (under existing Forest-wide and District EAs)
- Firewood gathering, snag losses, and user-created roads
- Recreation - snowmobiling, OHV use, dispersed camping
- Private land timber harvest
- Private land hazardous fuels reduction
- Timber harvest on lands managed by the Confederated Tribes of the Colville Reservation
- Hazardous fuels reduction on lands managed by the Confederated Tribes of the Colville Reservation
- Road maintenance
- System and non-system road closures and decommissioning.
- Timber harvest and fuels reduction on State, DNR managed land.
- Bannon Pre-commercial Thin and Fuels Project (about 30% precommercial thinning contracted)

**Reasonably Foreseeable Future Actions**

- New Forest Plan Implementation
- Access & Travel Management Plan Implementation.
- Potential future wildland fire.

- Continued timber management, home construction and development on private lands (estimated several hundred acres per year).
- Hazardous fuels reduction on lands managed by the Confederated Tribes of the Colville Reservation (over 1000 acres of on-going timber sales with planned fuel reduction treatments).
- Okanogan-Wenatchee National Forest Invasive Plant Treatment Environmental Impact Statement (IPTEIS).
- Culvert upgrades at road-stream crossings in the West Fork Sanpoil Watershed.
- Culvert upgrades at road-stream crossings in the Bonaparte-Okanogan River Watershed.
- System and non-system road closures and decommissioning