

**Appendix J**  
**Common Injuries to Non-Target Species by**  
**Herbicide Active Ingredients**

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**Table 1. Common Injuries to Non-Target Species by Herbicide Active Ingredients for Terrestrial Use**

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs	Grasses	Forbs
2,4-D	Selective herbicide, very limited soil residual activity. Primarily under canopy applications.	Seedlings susceptible to injury (e.g. slowed growth, leader dieback), but conifers otherwise tolerant of rates used on forbs, injury includes chlorosis (leaves produce insufficient chlorophyll) and needle-shed of damaged foliage. More tolerant than deciduous species.	Seedlings may be injured or killed. Tolerant of rates used on forbs, injury includes leaf curling/cupping, twisting, defoliation of damaged foliage. High application rates could result in root absorption and increased injury.	Seedlings may be injured or killed. Many species tolerant of rates used on forbs, injury includes leaf curling/cupping, twisting, chlorosis, defoliation of damaged foliage.	Tolerant after the seedling stage. Reduced seed production if high rates applied during flower to seed-producing stages.	Most families susceptible to some degree. Active plants will tolerate some injury at low rates. No injury to dormant plants from fall applications.
Aminopyralid	Selective herbicide. Soil residual activity. Under and over canopy applications	Mortality of seedlings. If applied within the dripline, root-uptake and injury possible. Injury from application to foliage includes chlorosis, possible needle-shed and branch dieback.	Mortality/severe injury of seedlings/saplings. Deciduous species more tolerant than conifers. Typical injury is minor (leaf curling/cupping).	Possible mortality/severe injury of seedlings. Otherwise, many shrub species tolerant. Temporary injury is minor (leaf curling/cupping).	Grasses tolerant after the seedling stage. Injury/death to seedlings, increased if tank-mixed with 2, 4-D. No injury after 45 days post-germination	Most native forb families moderately tolerant to tolerant.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs	Grasses	Forbs
Chlorsulfuron	Selective herbicide. Slight soil residual activity. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) may result if applied during active foliage growth.	Seedlings may be injured or killed. Otherwise, tolerant at typical use rates for forbs. Some leaf curl/ chlorosis possible if applied during active foliage growth.	Seedlings may be injured or killed. Many species tolerant of rates used on forbs. Some leaf curl/ chlorosis possible if applied during active foliage growth.	Tolerant at low use rates. Foliage and seed production could be reduced.	Borage, mustard, and pea families most susceptible. Many plants in the aster family tolerant at typical use rates.
Clopyralid	Narrow spectrum, selective herbicide. Short-term residual activity. Under and over canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) may result if applied during active foliage growth.	Tolerant of rates used on forbs. Some leaf curl possible if applied during active foliage growth.	Evergreen species tolerant of rates used on forbs. Some leaf curl possible if applied during active foliage growth.	Tolerant after the seedling stage.	Four families primarily susceptible: aster, pea, knotweed, and nightshade. Borage family tolerant. Many families, (e.g. mustard, pink, goosefoot, morning glory) not susceptible. Corm/bulb species not susceptible.
Dicamba	Selective herbicide. Some soil residual activity, primarily during growing season in which applied. Primarily under canopy applications.	If applied within the dripline, root-uptake and injury possible. Application to foliage includes chlorosis, possible needle-shed and branch dieback. More tolerant than deciduous species.	Seedlings may be injured or killed. If applied within the dripline, root-uptake and injury possible. Injury from foliar application includes cupping, curling, epinasty and possible defoliation and branch dieback.	Seedlings may be injured or killed. Injury from foliar application includes cupping, curling, epinasty (increased growth on upper surface of leaf) and possible defoliation and branch dieback. Root-sprouting species recover quickly. Mahogany and bitterbrush more susceptible.	Tolerant after the seedling stage.	Most families susceptible to some degree, pea family especially susceptible.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs	Grasses	Forbs
Fluroxypyr	Selective herbicide for broadleaf weeds along roadsides and in rangeland, non-crop areas, and grazed areas as well as for the control of woody brush. Soil residue up to 4 days on vegetation or fruit.	Most species very tolerant of over and under canopy applications up to maximum label rate. (Used in pine plantations)			For tolerant species such as grasses, no adverse effects would be anticipated from either runoff or the erosion of contaminated soil by wind. Unclear that exposure would cause adverse effects in tolerant species of terrestrial plants, even in the event of a direct spray.	Much more toxic to dicots (e.g., broadleaf plants) than to monocots (e.g., grasses)
Glyphosate	Non-selective, no soil residual. Primarily under canopy applications.	Little to no root uptake. Injury/ death of living tissue (foliage, green stems, non-woody tissue) where sprayed. Otherwise no injury.	Little to no root uptake. Injury/ death of living tissue (foliage, green stems, non-woody tissue) where sprayed. Otherwise no injury.	Injury/death of living tissue (foliage, green stems, non-woody tissue) where sprayed. Otherwise no injury.	Established perennial grass stands tolerant at low use rates, even when mixed with 2,4-D, although foliage and seed production is reduced.	Most families susceptible. Active plants will tolerate some injury at low rates. No injury if dormant.
Imazamox	Active on submerged, emergent and floating broadleaf and monocot species.			<b>Algae-</b> Varies from no adverse effects to slight to moderate growth inhibition. Little information available overall.	Active on submerged, emergent and floating broadleaf and monocot species.	<b>Macrophytes-</b> Will damage many native macrophytic species. Effects include reduced root and shoot growth, curling, chlorosis and/or necrosis and plant death.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs	Grasses	Forbs
Imazapic	Selective herbicide, often used in restoration projects. Some soil residual activity at higher rates. Under and over canopy applications.	Most species very tolerant of over and under canopy applications up to maximum label rate.	Some minor injury may result (e.g. tip chlorosis, minor death of plant tissue).	Most species very tolerant of over and under canopy applications up to maximum label rate.	Many perennial grasses tolerant to very tolerant, application and reseeding of these perennial grasses can take place at the same time. Some perennials and annual grasses more susceptible.	Many families tolerant to very tolerant. Borage, mustard, and goosefoot susceptible. Aster family not susceptible.
Imazapyr	Non-selective herbicide. Slow-acting. Soil residual activity. Over and under canopy applications. Effective control on woody species.	Woody species susceptible. Apply well outside the dripline of nontarget species.	Woody species susceptible. Apply well outside the dripline of nontarget species.	Woody species susceptible. Apply well outside the dripline of nontarget species.	Many grasses susceptible. Used to control cheatgrass, for example.	Most families susceptible.
Metsulfuron methyl	Non-selective herbicide, primarily used on annual grasses. Slight soil residual activity. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) possible.	Seedlings may be injured or killed. Otherwise, tolerant at typical use rates. Injury (e.g. chlorosis) is temporary.	Tolerant, although small seedlings may be injured or killed. Some leaf curl/ chlorosis possible.	Used to control annual grasses. Established stands of perennial native grasses not affected past the seedling stage.	Most families not susceptible at rates used on invasive annual grasses (up to 1.5 oz/ac). Slight, temporary injury may occur.

Herbicide Active Ingredient	Comments	Conifers	Deciduous Trees/Shrubs	Evergreen Shrubs	Grasses	Forbs
Picloram	Selective herbicide. Soil residual activity up to one year after application. Under canopy applications.	If applied within the dripline, root-uptake and injury possible. Application to foliage includes chlorosis, possible needle-shed and branch dieback.	Seedlings may be injured or killed. If applied within the dripline, root-uptake and injury possible. Injury from foliar application includes cupping, curling, epinasty and possible defoliation and branch dieback. Cottonwoods/willows more susceptible.	Seedlings may be injured or killed. Many species are susceptible during active growth, especially when tank-mixed (e.g. with 2,4-D). Sagebrush less susceptible at lower (16 - 24 oz/ac) rates used for forbs. Root-sprouting species recover quickly. Mahogany and bitterbrush very susceptible.	Tolerant after the seedling stage at rates up to 32 oz/ac. Temporary injury including inhibited growth, chlorosis at higher rates.	Many families susceptible to some degree, injury/mortality particularly for aster and pea. Established, deep-rooted plants less so than young or shallow-rooted plants. Corm/bulb species not as susceptible as fibrous-rooted species, will tolerate lower rates with temporary injury (inhibited flowering, leaf damage, etc.)
Sulfometuron methyl	Selective herbicide. Slight soil residual activity. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) possible.	Injury or death at rates above 1 oz/ac, particularly when tank-mixed.	Injury or death at rates above 1 oz/ac, particularly when tank-mixed.	Severe injury to seedlings. Used in establishment of native perennial grasses, which are tolerant once established. Foliage and seed production could be reduced.	Borage, mustard, and pea most susceptible. Many plants in the aster family tolerant at typical use rates.
Triclopyr	Selective herbicide. Soil residual activity during the growing season in which applied. Primarily under canopy applications.	Tolerant at typical use rates. Injury (e.g. needle curl/ chlorosis) may result if applied at high rates.	Many species susceptible, but somewhat tolerant of rates used on forbs. Injury to sprayed foliage including leaf curl, death of plant tissue, defoliation, and branch dieback. Higher rates will cause mortality.	Many species susceptible, but somewhat tolerant of rates used on forbs. Injury includes chlorosis, death of plant tissue, defoliation, branch dieback, etc. Higher rates will cause mortality.	Tolerant after the seedling stage.	Borage, mustard, and peas families most susceptible. Many plants in the aster family tolerant at typical use rates.

Season of use for all herbicides is spring through fall

**Table 2. Common Injuries to Non-Target Species by Herbicide Active Ingredients for Aquatic Use**

Herbicide Active Ingredient	Comments	Algal Species	Graminoids	Macrophytes
Glyphosate	Non-selective herbicide for many broadleaf and monocot species. Readily moved to above ground and below ground plant parts. Active ONLY on floating and emergent vegetation. Does not kill submersed vegetation.	Varies from stimulation of growth (apparently beneficial) to no adverse effects to slight to moderate growth inhibition and injury.	Rate dependent, but may damage or kill wetland grass species. Chlorosis and death of affected tissue. May injure or kill root system depending on species and rate used. Damage on tolerant species is usually temporary.	Glyphosate will damage or kill many native emergent or floating species (e.g. cattails). Effects include wilting, chlorosis, death of plant tissue, and plant death.
Imazamox	Active on submerged, emergent and floating broadleaf and monocot species.	Varies from no adverse effects to slight to moderate growth inhibition. Little information available overall.	Varies from no effect to severe effects. Reduced root and shoot growth. Curling, chlorosis and/or death of plant tissue at stem tips at moderate to high use rates.	Imazamox will damage many native macrophytic species. Effects include reduced root and shoot growth, curling, chlorosis and/or death of plant tissue and plant death.
Imazapyr	Non-selective herbicide for many broadleaf and monocot species. Readily translocated to above ground and below ground plant parts. Active ONLY on floating and emergent vegetation. Does not kill submersed vegetation.	May cause short-term damage to some sensitive species of algae. However, imazapyr is not an effective algaecide and adverse effects from aquatic applications would not be anticipated.	Rate dependent, but may damage or kill some wetland graminoid species. Chlorosis and death of plant tissue of affected tissue. May injure or kill root system depending on species and rate used. Damage on tolerant species is usually temporary. Damage from indirect exposure (e.g. shoreline plants with roots extending into a treated body of water) is not likely.	Imazapyr will damage many native emergent or floating macrophytic species. Effects include reduced root and shoot growth, chlorosis, death of plant tissue and plant death. Sensitive species are likely to be killed. Damage from indirect exposure (e.g. shoreline plants with roots extending into a treated body of water) is less likely.