Chapter VI Environmental Consequences

In this chapter:

- **Impacts of the Methods**
- **Impacts of the Alternatives**
- **Cumulative Impacts**

This chapter describes the potential environmental impacts of the various methods and program alternatives, by environmental resource (vegetation, water wildlife etc.) and human resource (land uses, visual, health & safety, etc.).

Vegetation

The following section discusses general impacts of vegetation management on vegetation.

General Impacts

Target Vegetation

Bonneville is aiming to control the growth of target vegetation. Target vegetation includes the following:

- tall-growing vegetation in the right-of-way or microwave beam path;
- tall-growing vegetation that is *off* the right-of-way but that could fall or bend into the line;
- noxious weeds on our rights-of-way or other Bonneville land;
- trees or woody stemmed shrubs on access roads;
- any vegetation within substations, switchyards, or radio/microwave sites; and
- trees that are outside substations but that could fall into the substation or onto the substation fence.

While we are aiming to control target vegetation, impacts could also occur on non-target vegetation. Changes could also occur to the overall vegetation structure and diversity on the right-of-way.

Non-target Vegetation

Impacts on non-target vegetation from general vegetation management (regardless of the method used) could include the following:

- trampling, crushing, or accidental removal of plant species;
- increased exposure to direct sun and weather;
- change in plant community composition and diversity;
- changes in soil moisture, nutrient level, and soil structure due to compaction; and
- increase in noxious weed invasion.

While workers conduct vegetation maintenance along the right-of-way, they or their vehicles could trample or crush non-target vegetation. Non-target plant species also could be accidentally removed or parts of the plant cut. The vegetation would be more affected by these impacts if they were to occur during the growing season than during the winter, when plants are dormant and usually less affected by disturbances. Regardless of maintenance timing, many species would recover from the impacts by the following season. Plants that are plentiful in the area would re-establish themselves through roots or seed dispersal.

Structure and Diversity

Controlling tall-growing vegetation can also affect vegetation structure (plant community composition) and diversity. In grassland or shrub areas, these characteristics do not change much because these naturally occurring low-growing plant communities need little or no treatment.

In forested areas, the dynamics of the plant community on the right-of-way change constantly. Trees in adjacent forests send a continuous flow of tree seeds to the right-of-way, pushing the succession of plant development on the right-of-way toward a forest condition (Bramble and Byrnes, 1983). This trend toward a developing forest is found more along the edge of the right-of-way. By contrast, plants associated with open areas that have developed since initial right-of-way clearing are found more abundantly at the center of the right-of-way (Brisson et al., 1997).

Where tree seedlings on the right-of-way are allowed to develop and grow to the point that they become a threat to the line, plant diversity can be reduced. The many young developing trees will compete with striving meadow-plant species and reduce the overall diversity of plant species in the area—leaving only forest or developing forest-type plant species.

When big trees that have provided a canopy are removed, plants living below are exposed to sunlight and weather. Some plants might die from this exposure; some plants, more tolerant of varying conditions, would survive but could suffer from sunburnt foliage for a growing season or two. Still others might use the opportunity of open space to reproduce and dominate the area.

In some cases, this change in conditions and subsequent plant development might reduce the diversity of species in the plant community. This would happen under two main conditions: (1) if those plant species taking over were the same as those within the forest, or (2) if those species were aggressive invasive plants (such as blackberries or noxious weeds) that could dominate and out-compete other plant species.

Noxious weeds are non-native plants that act as pioneer species: they colonize and take over disturbed sites such as newly cleared rights-of-way. (The amount of ground disturbance and, consequently, the extent of the opportunity, depends on the method of control used.) Noxious weeds threaten the existence of most native plants and greatly reduce plant diversity.

In forested areas, maintaining rights-of-way so that only small or no trees can grow can increase the overall diversity of plant species in the area. This right-of-way open space, when surrounded by shaded woods, provides a habitat for meadow-type plants—shrubs and grasses—to flourish. These meadow plants do not grow in shaded forests and could be species that lie dormant until favorable growing conditions arise. (Bramble & Burns, 1983)

When trees (such as unstable danger trees) in a forested area are removed along the right-of-way, the remaining trees, formerly inside the forest, are exposed to weather, which can cause the foliage to sunburn or the trees to freeze. The trees that make up the new "edge" are vulnerable to being blown down by winds because their root mass is not as strongly developed for resistance. (This fact is often considered when trees are being reviewed for removal—it is important to leave an edge of trees that are more stable and resistant to blow-down.)

Threatened, Endangered, and Sensitive (TES) Plants

In the last several years, Bonneville has discovered TES plant populations on various portions of our rights-of-way. Those plants include the Federally listed *Lomatium bradshawii* (Bradshaw's desert parsley) and two species recently proposed for listing: *Erigeron decumbens var. decumbens* (Willamette Valley daisy) and *Lupinus sulphureus ssp. Kincaidi* (Kincaid's sulfur lupine). Within National Forests, the USFS gives Regional and Forest designations to plant species. Through plant surveys, Bonneville has identified several sensitive plant species that are listed as "Forest Sensitive" within National Forests in Wyoming, California, and Oregon.

BLM also has designated as "sensitive" plants that need protection on the lands that the agency manages. Bonneville develops plans to protect sensitive species in coordination with either the land manager or responsible Federal agency to prevent impacts from our vegetation management program.

TES plants can be affected by change in vegetation structure on rights-of-way. Plants that are shade-tolerant can be adversely affected when the trees are removed. Most shade plants are sensitive to sunlight, and would die.

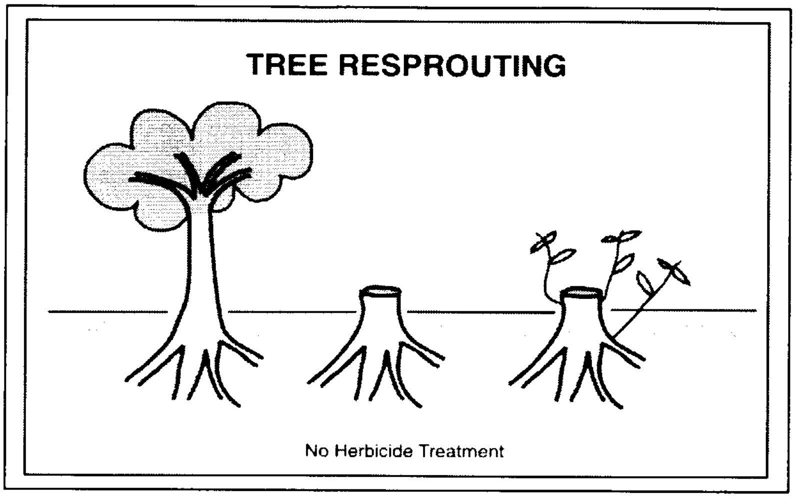
However, controlling certain vegetation types in some environments can actually encourage TES plants species to grow. This phenomenon might result from controlling other vegetation that would normally out-compete TES plants. A study conducted in Georgia, Maryland, and Virginia uncovered a significant number of rare plants on powerline easements, in comparison to those in surrounding landscapes (Sheridan et al., 1997). In central Oregon, on our own rights-of-way, *Astragalus peckii* (Peck's milk vetch) has been identified on our access roads. It appears that the site disturbance has favored the establishment of this species in some areas.

The following sections discuss method-specific impacts of vegetation management on vegetation.

Manual Impacts

Manual techniques are very selective: they generally affect only the vegetation that has been targeted for cutting. As noted above, surrounding vegetation could be crushed or damaged by workers or debris. The main (negative) impact of manual brush-cutting is that it encourages regrowth of multiple-stemmed sprouts for certain species.

Figure VI-1: Resprouting Consequences of Cutting without Herbicide Follow-up



Most deciduous trees will resprout when cut; some will also send up suckers through the roots. In Bonneville's service territory, these types of trees include alder, cottonwood, maple, and willow. To kill these trees, the roots must be killed also. Otherwise, with every cycle of tree cutting, more sprouts (or stems) grow; over time, the tree stem density increases. Resprouts grow back thick and keep low-growing shrubs from establishing themselves. Therefore, it is difficult to try to convert to a low-growing plant community using manual techniques alone (no follow-up herbicide treatments) to eliminate tall brush in plant communities that have re-sprouting species.

A study by Nowak et al. (1993) compared tree densities and species composition on powerline corridors in New York State over a 16-year period and across a wide range of management schemes, environmental conditions, and plant communities. On corridors where managers used periodic selective hand-cutting with no herbicide treatments, an increase in tree density was observed. On corridors where managers used herbicides to remove trees periodically and selectively, they observed tree populations remaining at constant low density.

Conifers (cone-bearing trees such as pines, fir, cedar, spruce, and hemlock) tend not to sprout or send up suckers when cut. However, if the conifer is cut above the lowest branch, the branch will become the "leader" and the tree will continue to grow.

For landscaped areas at non-electric facilities, such as around substation offices or maintenance headquarters, manual techniques (weed pulling, hoeing, trimming) would have no impact on non-target vegetation—unless the wrong plant were pulled or hoed.

Mechanical Impacts

Mechanical techniques (e.g., using mowers or troller-choppers) are non-selective or much less selective than manual methods: they tend to clear or cut all vegetation within the path. This could have impacts on any species that Bonneville would want to encourage to grow (such as low-growing brush, forbs, and grasses) or would need to avoid (such as TES plants).

Using some kinds of mechanical equipment (especially blading and roller-chopper types) can disturb the ground, encouraging noxious weeds to invade and grow. Others types, such as walking brush controllers, have minimal impact on soil. Noxious weeds tend to be extremely resilient and opportunistic species, with quick germination and regeneration rates. Any change in the environment that affects the composition of vegetation or exposes the soil can allow noxious weeds or other undesirable species to dominate.

Mechanical methods usually encourage deciduous species to resprout. Therefore, if the right-of-way is dominated by deciduous species, the use of mechanical clearing would most likely increase the tree-stem density of the right-of-way over time.

Grounds maintenance at non-electric facilities would consist mostly of mowers for lawns. Lawn mowing would have no impacts on non-target vegetation.

Biological Impacts

Insects and pathogens used to eat or control vegetation are highly selective for specific plants (usually noxious weeds) and therefore would not affect non-targeted vegetation. These biological controls are tested to ensure they are host-specific (Pacific Northwest Weed Control Handbook, 1997), and that they will not switch to crops, native flora, or endangered plant species in the absence of their host weed.

Herbicide Impacts

The degree to which herbicides affect non-target vegetation depends on two factors: (1) the specific herbicide used (whether it is selective or non-selective), and (2) whether the herbicide comes in contact with non-target vegetation. Such contact can occur through the application technique, drift (when herbicide drifts through the air or blows away from the area), water or soil movement, and accidental spills or accidental or careless applications. Effects of the specific herbicide on non-target vegetation depend on the "selectivity" of the herbicide. A selective herbicide kills only one type of vegetation (e.g., broadleaf plants). A non-selective herbicide might kill a number of plant types (e.g., broadleaf and grasses). The more selective a particular herbicide, the less the potential for non-targeted vegetation to be harmed.

Whether the herbicide comes in contact with non-targeted vegetation can depend on the application technique. Because **spot herbicide applications** treat individual plants (stump treatment or injection), there is little-to-no potential for the herbicide to contact non-targeted vegetation.

Localized herbicide applications, which treat individual or small patches of plants, might possibly spray non-target plants in the process of treatment or come in contact with the herbicide through direct application and/or drift. Localized treatments are not likely to cause much drift because relatively small areas are treated and the person who applies the herbicide (the applicator) has a high degree of control.

Aerial and broadcast applications treat large areas, rather than individual plants; if there were any non-target plants in the area, the herbicide would come in contact with them. These two application categories also have a greater potential to cause herbicide drift, because there is usually a relatively long distance between the spray source (e.g., a truck or helicopter) and the plants or area treated. If there is any wind or other drift-causing factor during application, the herbicide might blow off-target and potentially come in contact with non-targeted plants. Adhering to label instructions and weather restrictions and using adjuncts in the herbicide to increase droplet size would minimize or eliminate this potential drift.

Rain or erosion can sometimes move herbicides off-site through soil or water, allowing the herbicide to come in contact with vegetation outside the intended treatment area. The likelihood of this happening depends on the mobility of the particular herbicide, its persistence, the soil type, the proximity to water of the initial application, and the amount of rain (if any) present during and/or immediately after application. For a more detailed discussion of herbicide migration, please see the **Water** and **Soil Resource** sections of this chapter.

Regardless of technique, accidental spills of herbicide could cause herbicides to come in contact with non-targeted vegetation. However, legal requirements and applicator training emphasize prevention of such spill. The impacts of herbicide spills could range from low to high, depending on the persistence and mobility of the herbicide involved, as well as on how quickly and thoroughly a spill is cleaned up.

In electrical and non-electric facilities, *all* vegetation is targeted because no vegetation can be allowed (for safety reasons). Therefore, any "non-target" vegetation effects from electrical and non-electric facility vegetation management would occur only if herbicides were to move off the treatment area. The likelihood of the herbicides moving off-site and the impacts of that movement would be the same as discussed above and later in the **Water** and **Soil** sections of this chapter.

Debris Disposal Impacts

Large amounts of woody debris scattered on the surface of the ground can crush vegetation, shade the vegetation surroundings and increase soil moisture, and temporarily lower the quantity of soil nitrogen available for plant growth until decomposition of the material is nearly complete.

Burning vegetation debris can in some cases help seeds (including noxious-weed seeds) to germinate. Bare or blackened soil from burnt slash piles could expose soil to noxious weed invasion. The ash from burning can increase nutrient levels needed by some plants. However, burning of plant debris also causes nitrogen and carbon to evaporate, which can diminish soil productivity.

In the rare event that fire escapes from a burn pile, surrounding vegetation would definitely be affected by a potential wildfire. Careful monitoring of slash-pile burns and adherence to safety procedures would reduce the likelihood of such events.

If tractors or other heavy equipment were used to stack debris, rutting and compaction, which could adversely affect soil productivity, could potentially affect plant growth.

Chipped debris can crush, smother, and shade plants if the chips are laid on the plant. Using heavy equipment for chipping can also crush non-targeted vegetation or affect the soil in which it grows through compaction and rutting.

Mitigation Measures

The following mitigation measures would be observed to reduce impacts on vegetation:

- Consider the following steps or mitigation measures to promote a semi-stable low-growing plant community:

1. Remove existing tall-growing vegetation. If using manual methods to eliminate deciduous (resprouting-type) species, do follow-up herbicide treatments to ensure that the roots are killed.
2. Replant or reseed with ground cover if none exists or if there is a low potential for natural revegetation by low-growing species (and a high potential of natural revegetation by tall-growing species).
3. Maintain, by selectively eliminating tall-growing vegetation before it reaches a height or density to begin competition with low-growing species.
4. As much as practical, be careful not to disturb low-growing plants. When possible, use only selective vegetation control methods (such as spot herbicide applications) that have little potential to harm non-target vegetation.

- Avoid removing vegetation where it will not grow up into the safety zones for the transmission line.
- Cut conifers below the lowest live limb to eliminate the continued growth of lateral branches.
- Use only those biological control agents (insects) that have been tested to ensure they are host-specific.
- Take full responsibility for controlling noxious weeds on fee-owned property.
- Enter into active noxious weed control programs with land owners/managers or county weed control districts where Bonneville activities may have caused or aggravated an infestation.
- *Where appropriate*, provide herbicides or biological control agents to landowners.
- *Consider, when practical*, washing vehicles that have been in weed-infested areas (removing as much weed seed as possible) before entering areas of no known infestations.
- *Consider, when practical*, re-seeding soil disturbed areas with approved weed-free seed.
- Determine whether any T&E plant species are potentially present in the project area (through the use of T&E maps, specialist's determination, or T&E list from the USFWS).

- *If T&E plant species are potentially present in the project area,* determine whether they are likely to be affected. If project is likely to affect but not *adversely* affect T&E species, obtain concurrence from the USFWS.
- *If it is determined that the project is likely to adversely affect T&E plant species,* initiate formal consultation with the USFWS and prepare a Biological Assessment according to 40CFR Part 402.
- Apply mitigation measures (such as timing restrictions, or specific method use) resulting from T&E determinations or consultations.
- Follow herbicide product label directions for appropriate uses, restrictions etc.
- Use herbicide-thickening agents (as appropriate), label instructions, and weather restrictions to reduce the drift hazard to non-target plants.
- Ensure that there is no danger of granular herbicides being washed from the areas of application.
- Do not apply pellet herbicides within three times (3X) the crown width (or dripline) of an off-right-of-way tree.
- *In the rare case of an herbicide spill,* follow all herbicide spill requirements including containment and clean-up procedures.
- Visit rights-of-way after treatments to determine whether target vegetation was controlled and whether non-target plants were affected.
- Where cost-effective and to the extent practicable, *use regionally native plants for landscaping.*

Water

Controlling the growth of vegetation can affect surface water (such as streams, rivers, ponds, lakes, and wetlands) and can potentially affect groundwater (aquifers and wells). Vegetation management is not expected to affect floodplains (it would not change land contours or affect floodwater flow).

The following section discusses general impacts of vegetation management on surface water and groundwater resources.

General Impacts

Removal of streamside (or riparian) vegetation, regardless of the method used, can affect surface water by the following:

- increasing surface runoff;
- promoting erosion and sedimentation, which reduces water quality;
- reducing shading and increasing water temperatures; and
- limiting organic plant debris, and thus the amount of nutrients, entering the water.

Any impacts on water can in turn affect fish and other aquatic species (such as invertebrates, beavers, nutria, salamanders, turtles, and plants), as well as people (drinking water, swimming, fishing, etc.).

Potential groundwater impacts would be herbicide-method-specific, and impacts are discussed under that section.

The following sections discuss method-specific impacts of vegetation management on water.

Manual Impacts

Manual techniques, especially hand methods, are very selective and have a low potential to affect aquatic resources. The greatest potential impacts would be the chance of minor fuel or oil spills from power tools and the release of bar oil during operation of the equipment.

Mechanical Impacts

Because some large machinery used to control vegetation disturbs the soil (either by scraping it or by compaction or rutting from the wheels of the tractors), this method has the greatest potential to cause erosion, which can directly or indirectly affect water quality. Erosion can affect water quality by causing increased turbidity (sediments suspended in water), sedimentation (sediments that settle to the bottom), and/or surface-water run off.

Wetlands can be affected by machines compacting the typically soft, saturated soils. Small, non-distinct streams and wetlands have the greatest potential to be affected because they are small and can be overlooked.

As with manual techniques (chainsaws), mechanical machinery has the potential for oil leaks and spills that could contaminate water.

Biological Impacts

Insects that are used to eat target vegetation would have little or no effect on the aquatic environment.

Herbicide Impacts

Herbicides could affect water resources if the herbicide were to reach those resources. The herbicides proposed for Bonneville use are limited to terrestrial use and would not be applied to water. The potential for a land-applied herbicide to reach water would depend on the herbicide's physical properties and the site conditions. Using herbicide-free buffer zones around water sources is an effective means of keeping herbicides out of water bodies (Norris and Charlton, 1995).

The four most significant means of offsite movement are runoff, leaching, drift, and misapplication/spills. **Runoff** is the surface or lateral migration through rainfall or erosion. **Leaching** is the downward (or vertical) migration through the soil. **Drift** is the airborne movement of herbicides through wind or evaporation. **Misapplications** and **spills** are caused by not following the label instructions/restrictions or by the accidental spilling of a herbicide during mixing, application or equipment cleaning.

Surface water could be affected by any of these means of herbicide movement, whereas groundwater would be potentially affected only by leaching.

Runoff and Leaching

There are three physical properties which, when combined with site conditions such as climate and geology, determine the runoff and leaching potential of a herbicide. They are:

- **Persistence** - Persistence is the length of time a chemical stays active. It is measured by its half-life. The longer the half-life of a chemical, the more persistent it is. The half-life is affected by many variables, including sunlight, microorganisms, chemical degradation, etc
- **Soil Adsorption** - Soil adsorption is the tendency of a chemical to bind to soil particles. Soil adsorption is expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil.
- **Solubility** - Solubility is the tendency of a chemical to dissolve in water. Solubility is expressed as the amount of a chemical dissolved in a known amount of water measured in mg/l (ppm).

Herbicides have to be relatively persistent in order to have either leach or runoff potential (non-persistent herbicides do not stay active long enough to create a risk). If an herbicide has a high soil adsorption, it is more likely to run off with soil movement. If it has low soil adsorption, it is more likely to leach down through the soil. If a herbicide is highly soluble in water it is more likely to leach; with low solubility, it is more likely to run off. Table VI–1, next page, shows how the various factors combine for leach or runoff potentials. See Table VI-6 (page 175) for the physical properties and off-site movement potentials (leaching and runoff) for each proposed herbicide.

Table VI-1: Runoff and Leach Potential

Main Physical Properties	Leach Potential	Runoff Potential
Persistence	Persistent *half-life greater than 100 days*	Persistent *half-life greater than 100 days*
Soil Adsorption	Low soil adsorption *K(oc) less than 500*	High soil adsorption *K(oc) greater than 500*
Solubility	High solubility *greater than 30 mg/l*	Low solubility *less than 30 mg/l*

Even if an herbicide has runoff or leaching potential, the likelihood of it reaching a water body also depends on site characteristics such as climate and geology. For example, if a persistent herbicide with a high potential for leaching to groundwater were used at a site with low annual precipitation, and the depth to groundwater was over 30 m (98 ft.), the overall potential for that herbicide ever to reach groundwater before complete degradation is quite low. Conversely, the same herbicide, applied at a site with high annual rainfall, coarse underlying soils, and groundwater depths less than 30 m (98 ft.) would have a higher relative potential of reaching groundwater. No one factor can be used to anticipate the ultimate behavior of a herbicide. By understanding these factors, following label instructions and restrictions and applying herbicide-free buffers, applicators can virtually eliminate the potential of herbicides reaching water bodies.

Herbicides used at the level and intensity typical for Bonneville vegetation management do not tend to pose substantial risks of leaching into groundwater. In western Oregon and Washington, the many soil microorganisms and high precipitation levels combine to degrade and/or dilute herbicides to the level where little or no trace would occur in groundwater. In other portions of Bonneville's service area, low precipitation, combined with deep groundwater aquifers, prevents herbicides from reaching ground water (BLM, 1985: p. 40).

Application technique can also have a slight impact on leaching and runoff potential. Applications that are applied to an area (broadcast and aerial techniques) tend to also have herbicide applied to soils and are more likely to run off or leach than techniques that apply herbicide to the plant only (spot or localized techniques).

Drift

Herbicides can also reach water through drift—the airborne movement of herbicides beyond the intended contact area. The three primary factors that contribute to drift are as follows: (1) application technique, (2) weather conditions, and (3) applicator error. Aerial and broadcast applications are more likely to reach water through drift, because the herbicide is sprayed from a helicopter/plane or through a large hose and must settle through the air to reach the target. Spot and localized applications are less likely to cause drift because these applications are targeted to specific plants and the volume of herbicide sprayed through the air is less.

Wind speeds and air temperatures (and their effect on herbicide evaporation) affect the potential for herbicides to drift. With winds over 5 mph and/or high temperatures, drift is likely.

Misapplications and Spills

Misapplications and spills are caused by failure of the applicator to follow label instructions and restrictions and by applicator carelessness. Most experts agree that misapplications and spills are the leading cause of impacts on non-target resources. The impacts of herbicide spills would depend on the persistence and mobility of the spill, as well as on how quickly and thoroughly a spill is cleaned up.

Site Conditions

Site conditions also determine the likelihood of herbicide reaching water resources. **How close herbicides are applied to water resources** determines the potential for herbicides to reach water. Buffers (defined widths of non-treated land) are the most common mitigation measure used to protect such environments. Bonneville must use prescribed no-spray or limited-herbicide-use buffers. Because of this, herbicide use generally does not occur near water systems, thereby reducing greatly the potential for contamination.

The **type of water resource** determines the potential for contamination if herbicide were to reach the water body. Small, still water bodies (such as ponds and small wetlands) are the most likely to be affected: if herbicide were to reach the water, there would be little movement or volume of water to help disperse or dilute the chemical. By contrast, large fast-moving rivers would be less likely to be affected because the amount and turbulence of the water would help dilute the herbicide quickly.

Rainfall is a major factor: with heavy rainfall, herbicides are more likely to be washed from the targeted site toward water bodies, particularly when granular formulations of herbicides are used.

The vegetation, ground cover, or soil type between a sprayed area and a water body can affect whether herbicide movement will reach water. Thick vegetation might block drift or absorb an herbicide moving through water or ground before it reaches a water body. On the other hand, if no vegetation existed, the herbicide would have a greater potential to wash toward the water body.

From a watershed perspective, the **concentration and amount of the herbicide applied** can influence the risk of water contamination. Because powerlines are linear in nature, the area of land treated with herbicides would be relatively small (narrow strips across the landscape) compared to the surrounding area. The ratio of treated to untreated surface area in any given watershed is usually sufficiently low to permit rapid dilution. This ratio is much lower than that for the concentrated areas or blocks of land typical of herbicide treatments in agricultural and forestry practices.

For example, across a "section" (a 259-ha or 640-ac. block of land), aerial application of herbicides on a right-of-way (30 m or 100 ft. wide) would result in about 2-to-3% of the section being treated. By contrast, treatment areas of 10-to-25% per section can occur in forestry practice, and areas greater than 75% per section are common in agricultural treatments.

A right-of-way treatment using spot or localized applications would result in an even lower percentage of treated area.

If an herbicide does reach water, the toxicity determines what kind of impact it might have. For example, all chemicals can be toxic to aquatic organisms if present in high enough concentrations (please see **Fish** for more information on impacts of herbicides in surface water, and Table VI-6, page 175, for herbicide ecological toxicity).

Debris Disposal Impacts

Debris disposal would affect surface water if the cut vegetation or wood chips were put into the water. Clumps of vegetation could cause or contribute to debris torrents (rapid flows of a mixture of water, soils, rock, and organic debris). These debris torrents tend to occur during heavy rainfall, where tree-clearing operations have taken place on mountainsides or where stream channels have been clogged by debris. Vegetation debris should not be disposed of in water.

Mitigation Measures

The following mitigation measures would be applied for water resources.

- In riparian areas, use selective control methods and take care not to affect non-target vegetation.
- In riparian areas, leave vegetation intact, where possible.
- Recognize that any discharge of material (displaced soils) within a water of the U.S. may be subject to U.S. Army Corps of Engineers regulations under the Clean Water Act.
- Do not permit debris from tree falling, cutting, or disposal to fall into or be placed in any watercourse, spring, pond, lake, or reservoir, *unless* there is approval from the appropriate authorities for stream habitat projects.
- *If burning piled vegetative debris,* do not burn in or next to watercourses.
- *For all methods using machinery or vehicles (i.e. chainsaws, trucks, graders)* keep the equipment in good operating condition to eliminate oil or fuel spills.
- Do not wash equipment or vehicles at a stream.
- Follow herbicide product label directions for appropriate uses, restrictions etc.
- Use herbicide thickening agents (as appropriate), label instructions, and weather restrictions to reduce the drift hazard to water resources.
- Ensure that there is no danger of granular herbicides being washed from the areas of application.
- Notify inspector and the State of any amount of herbicide spill in or near water.
- Always use siphon prevention devices/methods when filling herbicide tanks from domestic water supplies.
- Consider climate, geology and soil types in selecting the herbicide with lowest relative risk of migrating to water resources.
- Protect surface water and groundwater by observing all riparian buffer zones and pesticide-free zone guidelines. Tables VI-2 and VI-3 below list required water buffer widths to be used for the specified method or herbicide application technique.

- *Before herbicide application*, thoroughly review the right-of-way to identify and mark, if necessary, the buffer requirements.

Table VI-2: Riparian Buffer Zones

Method	Buffer Width From Habitat Source, i.e., Stream or Wetland
Ground-disturbing Mechanical Methods	
Slopes under 20% Slopes over 20%	10.7 m (35 ft.)[1] No disturbance.
Herbicide Application Methods	
Spot	3 m (10 ft.)[2] (Standard may be relaxed for capsule injection of glyphosate up to the water's edge.)
Localized	10.7 m (35 ft.)[1]
Broadcast	15.2 m (50 ft.)[3]
Aerial	30.5 m (100 ft.)[2]
Mixing, Loading, Cleaning	100 m (328 ft.)[3]

[1] USDA, NRCS, Conservation Practice Standard, Riparian Forest Buffer, Code 391A, 1997
[2] USDOI-BLM Standard
[3] USDOE-BPA Best Management Practice

Table VI-3: Herbicide-free Zones

Zone	Buffer Width
Agricultural Irrigation Source (Wet or Dry)	30.5 m (100 ft.)[1]
Domestic Water Well	30.5 m (100 ft.)[1]
Public Water Intakes/Spring Developments	100 m (328 ft.) Upslope[1]
Secondary Containment Liners, Vaults and Lagoons	Up to Edge of Containment Feature[1]
Storm Drains that Discharge Offsite	2 m (6 ft.) Radius[1]

[1] USDOE-BPA Best Management Practice

These are generalized standards. Other Federal agencies, as well as State and local authorities, may have stricter or more relaxed buffer zone requirements for the protection of these and other resources, such as sole-source aquifers, fisheries, recreation areas, etc.

- Monitor to determine whether desired results for water resources were achieved or whether follow-up mitigation measures are necessary (e.g., erosion control measures).
- *For electric yards within 100 m (328 ft.) of wells, streams, rivers, or wetlands,* determine whether the water body should be monitored for potential herbicide contamination.
- *Where cost-effective and to the extent practicable,* seek to minimizing runoff from non-electric facilities' landscaping.
- *Where cost-effective and to the extent practicable,* implement water-efficient practices at non-electric facility landscaping, (such as the use of mulches, efficient irrigation systems, audits to determine exact landscaping water-use needs, and recycled or reclaimed water and the selecting and siting of plants in a manner that conserves water and controls soil erosion).

Soils

The following section discusses general impacts of vegetation management on soils.

General Impacts

The removal of vegetation, regardless of the method used, can affect soil through erosion and by altering soil nutrients.

Erosion

The degree of soil erosion varies throughout the Bonneville service area: erosion depends on differences in climate, vegetation, soil properties, and land-use patterns. Climate affects erosion primarily through intense individual storms rather by yearly precipitation totals.

West of the Cascade Mountains, the climate is maritime. The moist and relatively warm climate fosters the development of deep soils, while rainfall rates are generally slow enough to allow water to soak into the soil. However, slopes cleared of vegetation are susceptible to erosion by water; mass movement is also a dominant erosion process.

East of the Cascades, a drier, more continental climate predominates. Vegetation is a mosaic of grasslands, with coniferous forest present at higher elevations. Intense storms are common; they produce significant amounts of rainfall during a relatively short time. Soils in the eastern, more arid portions of the Bonneville service area are also subject to wind erosion from strong steady winds over areas of sparse ground cover.

Erosion is a natural ongoing process. However, erosion rates can markedly increase when vegetation is cleared, regardless of the method used. Vegetation cover is important in controlling erosion. The vegetative canopy and the organic layers covering the soil dissipate the erosive energy of raindrops and reduce runoff. Plant roots also strengthen and bind the soil together.

If a great deal of vegetation were cleared or damaged on steep slopes, soils could destabilize and cause erosion in a variety of ways. Both runoff and soil moisture content can increase. Increased runoff, combined with the removal of vegetation and protective soil organic layers, can result in elevated erosion levels. In addition, more water would stay in the soils (instead of being taken up by the plants that have been removed) and add to the soil mantle weight, heightening the potential for mass movement.

Erosion from direct physical disturbance during vegetation clearing depends on the control method that is used. **See discussions of the methods below.**

Nutrients

Vegetation management can alter the chemistry of the soil. For example, removing nitrogen-fixing plants, such as red alder or ceanothus, can reduce soil nitrogen and associated plant productivity. Removing brush cover can eventually reduce the quantity of carbon in the soil if revegetation does not occur. Removing logs and other plant material deprives soils of the nutrients and structural components provided by decaying organic material. Removing vegetation can also reduce evapotranspiration (if revegetation does not occur) which allows more water to leach soluble nutrients from the soil and decomposing organic matter, reducing productivity. In addition, soil erosion often increases after removing vegetation. Erosion can transport organic matter and nutrients off-site.

The following sections discuss method-specific impacts of vegetation management on soils.

Manual Impacts

Manual impacts on soil include disturbance of the duff layer in only a very small area, not enough to cause substantial impacts on the soil as a resource. There is some potential for soil contamination from chainsaw oil.

Mechanical Impacts

Mechanical techniques, especially blading or soil-disturbing type equipment, have the greatest impacts on soils. Ground-disturbing heavy equipment can expose soils, compact soils, and disturb the physical arrangement of soils.

Exposing soils can make them vulnerable to erosion and/or drying out. Soil compaction increases soil density by compressing soil particles together, reducing the volume of unoccupied air spaces. Compaction reduces the soil's ability to take in water, thus increasing surface runoff and higher erosion levels. Compaction also possibly inhibits growth of beneficial fungi (known as mycorrhizal fungi) that provide nutrients to plant roots. Plant development is also restricted in compacted soils: aeration is poor and root growth is impeded. As a result, soil productivity is adversely affected

Disturbing the physical arrangement of soils (e.g., displacing topsoil or removing the organics-rich duff layer) can both increase erosion and slow plant growth and regeneration potentials.

Mowers are one of the most common mechanical techniques used to clear vegetation along Bonneville-maintained access roads. The vehicle (typically a tractor) generally remains on the road while the mower swings to the side to cut roadside shrubbery to the desired level. While soils can be disturbed, they tend to be less disturbed than if equipment were driven directly over vegetation.

Biological Impacts

Insects used to control noxious weeds would not affect soils.

Herbicide Impacts

When herbicides are used, some of the chemical can end up in the soil. Once in the soil, herbicides can reduce soil microbes' numbers and/or change species composition. This reduction and change can affect soil productivity, including the ability of soils to support certain vegetation. Many herbicides, such as 2,4-D, glyphosate, and mefluidide, break down quickly and have very temporary effects on soil microbes. Herbicides that do not break down relatively quickly (e.g., isoxaben, tebuthiuron) may have longer-lasting effects. For instance, if an area is re-treated often and regularly, herbicides may build up in the soils and can reduce soil productivity before breaking down.

The potential effects on soil microbes can also depend on the application technique. Since aerial broadcast application typically covers a much broader treatment area, affected microbe populations might take longer to recover because there will be fewer adjacent populations to recolonize. Conversely, spot and localized applications affect much smaller areas: microbes might quickly recolonize affected soils from adjacent, unaffected areas.

The effect on soil microbes also depends on the existing vegetation, climatic factors, and soil properties.

Rights-of-way would be treated with relatively small amounts of herbicide with long-time spans between treatments, so there would be little potential for impacts on soil microbes.

In electrical yards, the soil is treated intentionally to keep plants from growing, and the regular use of herbicides would affect the microbes within the electrical yard. If herbicides were to migrate offsite into adjacent soils, microbes (and thus soil productivity) could be affected.

Debris Disposal Impacts

Large amounts of woody debris scattered on the surface can decrease the amount of soil nitrogen available for plant growth until debris decomposition is nearly complete, and can temporarily (a year or so) increase soil moisture

Burning piles of debris would affect the small pile area by possibly killing soil microbes, making soils hydrophobic (unwettable), and creating a bare exposed area vulnerable to erosion. If tractors were used to pile debris, equipment traffic could compact soils and reduce soil productivity. Rutting caused by heavy equipment traffic could also concentrate runoff and cause localized increases in erosion. Destruction of soil organic matter from hot slash fires also reduces the soil stability, which can lead to substantial localized erosion. Ash created from burning can add to soil nutrients, but burning of organic matter also causes nitrogen and carbon to evaporate, which can diminish soil productivity

Adding large amounts of organic debris from chipping might reduce the availability of soil nitrogen to plants and inhibit plant growth until decomposition of organic debris is almost complete. Equipment traffic could also cause compaction and rutting and result in a localized loss of productivity and increased erosion.

Mitigation Measures

The following mitigation measures would be observed to reduce impacts on soils:

- Do not use ground-disturbing mechanical equipment to clear on slopes over 20%.
- Use mechanical clearing or heavy equipment when the ground is sufficiently dry to sustain the equipment and excessive rutting will not occur.
- Consider reseeding or replanting seedlings on slopes with potential erosion problems.

- *If burning vegetative debris piles,* keep piles relatively small to keep intense and prolonged heat from damaging the soil horizons.
- *For non-electric facilities and where cost-effective and to the extent practicable,* implement water-efficient practices at non-electric facility landscaping in a manner that controls soil erosion.

Fish and Other Aquatic Species

General Impacts

Potential impacts on aquatic species are closely related to those just described under **Water Quality** and **Soils**. Erosion impacts on soil cause water-quality problems; whenever the water quality of a fish-bearing stream is affected, so are fish. Specifically, fish are affected by turbidity, sedimentation, loss of large organic debris, loss of shading (and associated temperature increases), and exposure to hazardous substances.

As with water-quality and soil impacts, general vegetation control causes loss of tree-shading and some erosion impacts, regardless of the method used. Erosion increases turbidity and sedimentation that can reduce fish feeding success. In severe cases, sedimentation can keep fry (early-stage fish) from emerging, or fill in or reduce the deeper pools preferred by fish, especially trout.

If large trees are cut down and removed within riparian zones, stream shading could be lost immediately, and the large woody debris that would later fall into streams and provide shelter for fish (an important component of aquatic systems) would be removed. Reduced shading can increase stream temperatures.

However, because rights-of-way are linear, they tend to have little impact on stream temperatures—usually less than a hundred meters (about 300 feet) of any stream is typically affected. Loss of shading generally gains importance only if it occurs where other activities are also causing losses in riparian shading at a watershed level. A study of right-of-way crossings in forested areas in New York found that water temperatures were not significantly greater in right-of-way reaches than in forested reaches (Peterson, 1993).

Loss of in-stream woody debris can reduce salmonid population, eliminate spawning beds (the debris plays a role in sedimentation storage), reduce pool area, reduce fish cover, and cause sudden flows of sedimentation (Burns, 1972; Heede, 1972; House and Boehne 1985; Lisle 1986).

A study conducted on right-of-way crossings of headwater trout streams in forested areas in New York (Peterson, 1993) found a greater abundance of fish within rights-of-way stream reaches than in forested reaches. This was attributed to the greater water depth and pools in the right-of-way.

The study suggested that removal of the forest canopy in rights-of-way caused the significant increase in sunshine, which in turn encouraged dense low-growth vegetation on streambanks and in-stream bars. In contrast, the forested streambanks usually held only scattered herbs and an occasional sapling or mature tree, and in-stream bars were unvegetated. Added rootmass of the forb and shrub layer appears to have stabilized the streambank and increased resistance to erosion.

The stabilized banks restricted increases in stream width during peak flows and instead probably resulted in increased streambed erosion. That increase is the probable cause of the observed increase in depth and pools.

The following sections discuss method-specific impacts of vegetation management on water.

Manual Impacts

Power-tool use near water can potentially cause water contamination with minor amounts of chainsaw oil or minor fuel spill. An oil skim on water, while highly unlikely, can deplete oxygen levels and cause fish kills. This impact is more likely for fish living in ponds than for fish living in rivers or streams, since the flow of water in streams would move and disperse small amounts of oil.

Mechanical Impacts

Because some mechanical methods of clearing or cutting vegetation can disturb or compact soils, these methods are most likely to cause erosion-related fish impacts (in addition to the potential erosion caused by general tree removal). Fish are temporarily affected when water is affected by turbidity, sedimentation, and local increases in surface-water runoff from mechanical techniques. Some equipment, such as walking brush-cutters, minimizes ground disturbance.

Biological Impacts

No additional impacts would result from this technique. Insects used for noxious weed control could potentially be an additional food source for fish.

Herbicide Impacts

If herbicides were to reach water bodies, fish and other aquatic species could potential be affected. (Please see **Water** for the potential for herbicides to reach water bodies.) The potential for an herbicide to have detrimental effects on fish or aquatic species depends on the toxicity of the herbicide and the sensitivity of the species, and the amount of herbicide present and how much the fish is exposed (how quickly the herbicide dissipates or is broken down).

Many of the herbicides proposed for Bonneville use are *low in toxicity* to fish. Table VI-4 shows the ratings used by scientists in determining the toxicity categories for aquatic species. The ratings are based on the amount of herbicide product (in milligrams) that would be needed in a liter of water in order create a toxic impact on fish. Generally, the more herbicide that it takes to kill a fish, the less toxic the herbicide is on that fish. Please see Table VI-6 (page 175), for the toxicity ratings of the proposed herbicides on aquatic species.

Table VI-4: Herbicide Toxic Ratings for Aquatic Species

Risk Category	Aquatic (mg/l)
Very Highly Toxic	<0.1
Highly Toxic	0.1 - 1
Moderately Toxic	>1 – 10
Slightly Toxic	> 10 – 100
Practically Non-toxic	>100

There is little potential for fish to be exposed to herbicides: mitigation measures would keep herbicide out of water (buffer zones and label instructions), and only a relatively small amount of area would be treated within a landscape (a linear right-of-way strip of land, or an electrical facility). If there were exposure, the amount of time a fish would be exposed to herbicides would be low, because of dilution. The turbulent action of streams and rivers and the large water volumes of lakes would rapidly dilute herbicides (unless the water body was still or small). If contamination occurred from runoff caused by heavy precipitation, the precipitation would add large quantities of water directly to the water body, further diluting the herbicide. Avoiding those herbicides that are more toxic to fish in the vicinity of fish-bearing lakes or ponds would reduce the potential for adverse effects.

An herbicide's label is its primary communication to users. It reflects the numerous scientific studies and regulatory reviews generated by EPA's registration process, which provides assurance that the potential benefits of use outweigh any potential risks: that, when used according to label directions, it will not cause unreasonable adverse effects on humans, fish, or the environment. The law requires herbicide users to read and follow label specifications. Through specific and general language, the label addresses potential and actual risks to fish (e.g., a label might state that drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas).

Debris Disposal Impacts

Debris disposal techniques have little additional impact on fish (as long as the debris does not get into the water), because a small portion of the area is treated. Deliberate placement of large woody debris in streams can, in some cases, benefit fish. Large logs create cover and sediment storage, helping to offset the loss of trees naturally falling into the water.

However, large masses of small, leaf-bearing branches can completely block channels and reduce dissolved oxygen levels by rapid decomposition of leaves (Bryant, 1983), a negative impact for fish.

Mitigation Measures

The following mitigation measures would apply for fish and aquatic species.

- Apply all appropriate mitigation measures for water bodies.
- Apply all appropriate T& E mitigation measures outlined in **Wildlife** section.

Wildlife

The following section discusses general impacts of vegetation management on wildlife.

General Impacts

Managing vegetation along rights-of-way and access roads can affect wildlife in two fundamental ways: (1) by directly disturbing or harming animals during treatments and/or (2) by changing habitat conditions.

Direct Disturbances

General direct disturbances from managing the vegetation on the right-of-way include removing trees that have nesting birds in them or other animals that use them for shelter. The presence of humans can scare animals and birds, causing them to flee or be stressed.

Animals such as deer, elk, and moose can be affected if clearing interrupts their wintering or birthing habitats.

Habitat Changes

The most obvious habitat changes from vegetation management occur in forested areas. About 13,680 km (8500 mi.) of Bonneville's transmission-line corridors cross forested areas. Removing trees changes habitats if the trees have been used for nesting, perching places, homes for small animals (such as squirrels), a food source, or protection or cover. Trees might be removed in forested areas along rights-of-way, and in riparian and wetland habitat where trees that were allowed to grow too close to the conductors need to be cut.

An obvious habitat change is where mature trees or snags (standing dead trees) used for nesting or cover need to be cut. Large trees are more likely to provide nesting habitat than saplings growing in the right-of-way.

During maintenance, any large mature trees that we would remove would, in most cases, be those that had become "danger trees" and were next to the right-of-way. These trees might have developed root-rot (their roots weakened and the tree becoming susceptible to falling) and/or might have been struck by lightning and now lean toward the transmission line.

In forested areas, maintaining low-growing plants within a right-of-way maintains an **edge effect,** a place where two differing habitats meet, which was created when the transmission line was built. For some animals that live in the forest, but like to use adjacent open areas such as a right-of-way for foraging and hunting, this edge effect is beneficial.

For some animals, a treeless swath through a forest can divide or fragment their habitat. The animals might be unlikely to cross through the right-of-way to get to the other side, especially in the winter. Without tree cover, winter snow depth can increase (because there is no tree canopy to catch and hold the snow), as can exposure to wind, lessening protective hiding places.

In Québec, white-tailed deer use of a 30-m-wide right-of-way was restricted in winter, presumably due to increased snow depth and exposure to wind (Doucet et al., 1987). Another study (Doucet and Brown, 1997) suggests that a denuded right-of-way might represent a barrier to small animal (hares, red and grey squirrel) movements in winter. However, rights-of-way are rarely, if ever, completely denuded of vegetation. Activity levels were higher when some vegetation was showing through the snow.

Questions have been raised about whether rights-of-way create a clear corridor in which animals are more prone to being shot by hunters. One study on moose found that there were no more moose killed within the right-of-way than off. This nine-year study in Québec (Ricard and Doucet, 1993) showed that the number of moose harvested by recreational hunters in rights-of-way was not statistically different from that in control areas.

As noted under **Vegetation**, noxious weeds tend to invade newly disturbed ground. Noxious weed infestations can cause long-term reductions in wildlife habitat values as native vegetation on which the native wildlife depend for food or cover decreases. Some noxious weeds are palatable but have no nutritional value. When animals eat these plants they become full, but might suffer depletion of necessary vitamins and minerals (akin to humans consuming "junk food").

Threatened and Endangered Species

T&E bird and animal species could potentially be affected, as are the bird and animal species discussed above. The bird species (such as the northern spotted owl, marbled murrelet, peregrine falcon, bald eagle, northern goshawk, Colombian sharp-tailed grouse, and several species of woodpeckers) could be affected by eliminating habitats (cutting of nesting trees) or disturbing during courting or nesting times. The peregrine falcon and bald eagle tend to forage in open areas and have been seen perching on transmission towers within our rights-of-way. The creation of the edge effect in forested areas might be slightly beneficial to these species.

The threatened and endangered animal species include the grizzly bear and gray wolf. Presence of human activity could make these animals temporarily leave the area.

Vegetation maintenance in threatened and endangered species habitats would be scheduled for times that would not disturb these species; Bonneville would consult with the USFWS for timing or action restrictions. Also, Bonneville has standards for conducting tree removal within the range of the northern spotted owl (Beak Consultants, 1993) and for marbled murrelets.

Wildlife species with limited home ranges (i.e. within a right-of-way corridor) are most affected by the habitat changes from vegetation management. Because of the narrow, linear nature of rights-of-way, species whose home ranges are well beyond the managed area would be only temporarily displaced.

The following sections discuss method-specific impacts of vegetation management on wildlife.

Manual Impacts

The main impact directly associated with manual methods of clearing (primarily chainsaw) is noise. Chainsaw noise could disturb animals, causing them to flee the area. Because manual clearing is very selective, with little-to-no long-term impact on non-target vegetation, this method would potentially have less impact on the right-of-way habitat than other methods of clearing.

However, if manual cutting of deciduous trees were used *without* follow-up herbicide applications to kill the trees, the right-of-way would require more frequent maintenance cutting cycles, increasing the human presence and animal disturbance.

Mechanical Impacts

Generally, the impacts from mechanical methods are short-term, so long as soils are not compacted and/or severely disturbed. Mechanical methods (especially blading) can disturb soil, and therefore can disturb and potentially kill soil-dwelling species such as ground squirrels, pocket gophers, moles, and salamanders. Ground nesting birds, such as ruffed grouse, dark-eyed junco, and several species of sparrows, can also be disturbed during mechanical vegetation removal. Seasonal timing can be used to minimize or eliminate impacts on breeding animals.

Because most mechanical techniques are non-selective and can cause losses of non-target vegetation, they also cause losses in wildlife habitat, including reduced or eliminated food sources, cover, and perches within treated areas.

As with manual methods, if mechanical cutting of deciduous trees were used *without* follow-up herbicide applications to kill the trees, the right-of-way would require more frequent maintenance cutting, increasing the human presence and animal disturbance.

Biological Impacts

In some cases, insects brought in to control weeds might provide additional forage for birds and other wildlife, but, in most cases, this effect would be negligible.

Herbicide Impacts

Some herbicides can potentially affect wildlife. The potential for wildlife to be affected depends on whether the animal is exposed, whether the exposure amount is enough to cause effects, and the toxicity of the herbicide to the animal species.

EPA standards for formula registration and application methods are intended to reduce risks in the environment to an acceptable level.

Animals can be exposed to herbicides by the following means:

- being directly sprayed,
- inhaling spray mist or vapors,
- drinking contaminated water,
- feeding on or otherwise coming into contact with treated vegetation or animals that have been contaminated, and
- directly consuming the chemical if it is applied in granular form.

The potential for an animal exposed to herbicide to experience toxic effects depends on the toxicity of the herbicide and the amount of chemical the animal was exposed to. Many of the herbicides proposed for Bonneville use are *low in toxicity* to wildlife. Herbicides are designed to be toxic to plants—not animals—and contain chemicals that target plant physiological processes. *Insecticides,* on the other hand, usually involve chemicals that react with the central nervous system of animals and are therefore potentially much more toxic to animals than herbicides.

Table VI-5 shows the ratings used by scientists in determining the toxicity categories for mammal and bird species. The ratings are based on the amount of herbicide product (in milligrams) that would be needed per kilogram of animal body weight in order create a toxic impact on the animal. Generally, the more herbicide that it takes to kill an animal, the less toxic the herbicide is to that animal. Please see Table VI-6 (page 175) for the toxicity ratings of the proposed specific herbicides on mammals and birds.

Table VI-5: Herbicide Toxic Ratings for Mammals and Birds

Risk Category	Mammals (Acute Oral mg/kg)	Birds (Acute Oral mg/kg)	Birds (Dietary mg/kg)
Very Highly Toxic	<10	<10	<50
Highly Toxic	10 – 50	10 – 50	50 – 500
Moderately Toxic	51 – 500	51 – 500	501 – 1,000
Slightly Toxic	501 – 2,000	501 – 2,000	1,000 – 5,000
Practically Non-toxic	>2,000	>2,000	>5,000

Raptors (e.g., hawks and owls), small herbivorous mammals, medium-sized omnivorous mammals, and birds that feed on insects are more susceptible to herbicide exposure. These animals either feed directly on vegetation that might have been treated or they feed on animals that feed on the vegetation. In general, smaller animals are more at risk because it takes much less substance to affect them.

Generally, wildlife is prevented from entering in electrical and non-electric sites (although birds and small mammals are sometimes able to enter these facilities). Most potential impacts on wildlife from vegetation management in these areas would occur only if herbicides were to move off the treatment area and affect habitat or wildlife in surrounding areas. Those impacts would be the same as those discussed above.

Debris Disposal Impacts

Lopping and scattering vegetation that is cut, including stacking or dragging logs to areas just off the right-of-way, creates woody debris (fallen, rotting logs) used by a variety of wildlife. These include amphibians, reptiles and small mammals, as well as numerous other types of organisms (e.g., plants and fungi).

Burning vegetation debris would have little impact on wildlife. Animals might flee the area while the pile is burning.

Noise from chipping machines would most likely disturb animals, causing them to temporarily leave the immediate area.

Mitigation Measures

The following mitigation measures would apply for wildlife species.

- Determine whether any T&E species or designated T&E critical habitats are potentially present in the project area.
- *If T&E species or designated critical habitats are potentially present in the project area,* determine whether they are likely to be affected. If project is likely to affect but not adversely affect T&E species, obtain concurrence from the USFWS and/or NMFS.
- *If it is determined that the project is likely to adversely affect T&E species or their designated critical habitats (other than marbled murrelet and spotted owl, already formally consulted),* initiate formal consultation with the USFWS and/or NMFS and prepare a Biological Assessment according to 40CFR Part 402.
- Apply mitigation measures (such as timing restrictions, or specific method use) resulting from determinations or consultations.

Table VI-6: Herbicide Ecological Toxicities and Characteristics

Herbicide	Acute Toxicity				Physical Properties[4,5]			Off-site Movement Potential[4,5]	
	Mammals[1]	Avian[1]	Aquatic[1]	Microorganisms[2,3]	Persistence	Solubility (mg/l)	Adsorption (K(oc))	Groundwater Leaching	Surface Water Runoff
2,4-D	Practically Non-Toxic to Slightly Toxic	Practically Non-Toxic to Moderately Toxic Depending on Formulation and Species	Practically Non-Toxic to Highly Toxic, Depending on Formulation and Species	Practically Non-Toxic to Highly Toxic, Depending on Formulation and Species	Low: 10 days	Acid: 890 Salt: 796,000 Ester: 100	80 20 20	Moderate Moderate Moderate	Low Moderate Moderate
Benefin	Practically Non-Toxic	Practically Non-Toxic	Highly Toxic	*data not available*	Moderate: 40 days	0.1	9000	Low	High
Bromacil	Slightly Toxic	Practically Non-Toxic	Slightly Toxic	Bees: Practically Non-Toxic	Moderate: 60 days	700	32	High	Moderate
Chlorsulfuron	Practically Non-Toxic	Practically Non-Toxic	Practically Non-Toxic	*data not available*	Moderate: 40 days	7000	40	High	Low
Clopyralid	Practically Non-Toxic	Slightly Toxic	Practically Non-Toxic	*data not available*	Moderate: 40 days	300,000	6	High	Low
Dicamba	Slightly Toxic	Practically Non-Toxic	Practically Non-Toxic to Aquatic Invertebrates; Slightly Toxic to Fish and Amphibians	Bees: Practically Non-Toxic Earthworm: Low	Low: 14 days	400,000	2	High	Low
Dichlobenil	Slightly Toxic	Slightly to Moderately Toxic	Moderately Toxic	Bees: Practically Non-Toxic	Moderate: 60 days	21	400	Moderate	Moderate
Diuron	*data not available*	Slightly Toxic	Moderately Toxic to Fish and Highly Toxic to Aquatic Invertebrates	Bees: Practically Non-Toxic	Moderate: 90 days	42	480	Moderate	High
Glyphosate	Practically Non-Toxic	Practically Non-Toxic	Moderately Toxic	Bees: Practically Non-Toxic	Moderate: 47 days	900,000	24,000	Low	High
Halosulfuron-Methyl	Slightly Toxic	*data not available*	*data not available*	*data not available*	Moderate: 55 days	*data not available*	*data not available*	High	*data not available*
Hexazinone	Slightly Toxic	Practically Non-Toxic	Practically Non-Toxic to Slightly Toxic Depending on Species	*data not available*	Moderate: 90 days	33,000	54	High	Low
Imazapyr	Practically Non-Toxic	Practically Non-Toxic	*data not available*	*data not available*	Moderate: 90 days	> 11,000	100	High	Low
Isoxaben	Practically Non-Toxic	Practically Non-Toxic	Moderately Toxic	Earthworm: Low	High: 100 days	1	1400	Low	High
Mefluidide	Slightly Toxic	Practically Non-Toxic	Practically Non-Toxic	Earthworm: Low	Low: 4 days	180	200	Low	Moderate
Metsulfuron-Methyl	Practically Non-Toxic	Practically Non-Toxic	Practically Non-Toxic	*data not available*	Moderate: 30 days	9500	35	High	Moderate
Oryzalin	Practically Non-Toxic	Slightly Toxic	Moderately Toxic	Bees: Practically Non-Toxic	Low: 20 days	2.5	600	Low	High
Paclobutrazol	Slightly Toxic	Practically Non-Toxic	Slightly Toxic	*data not available*	High: 200 days	35	400	High	
Pendimethalin	Slightly Toxic	Slightly Toxic	Highly Toxic	Bees: Practically Non-Toxic Earthworm: Low	Moderate: 90 days	0.3	5000	Low	High
Picloram	Practically Non-Toxic	Practically Non-Toxic	Moderately Toxic.	Bees: Practically Non-Toxic	Moderate: 90 days	200,000	16	High	Low
Sulfometuron-Methyl	*data not available*	Practically Non-Toxic	Slightly Toxic	*data not available*	Low: 20 days	70	78	Moderate	Moderate
Tebuthiuron	Moderately Toxic	Slightly Toxic	Slightly Toxic	*data not available*	High: 360 days	2500	80	High	Low
Triclopyr Variety TEA Variety BEE	 Practically Non-Toxic Practically Non-Toxic	 Slightly Toxic Slightly Toxic	 Practically Non-Toxic Highly Toxic	 Bees: Practically Non-Toxic Bees: Practically Non-Toxic	 Moderate: 46 days Moderate: 46 days	 2,100,000 23	 20 780	 High Low	 Low High
Trifluralin	Practically Non-Toxic	Practically Non-Toxic	Very Highly Toxic	Bees: Practically Non-Toxic	Moderate: 60 days	0.3	8000	Low	High
Trinexapac-Ethyl	Practically Non-Toxic	Practically Non-Toxic	Slightly Toxic	*data not available*	*data not available*	*data not available*	*data not available*	Moderate	*data not available*

[1] See individual herbicide references in **References**. [2] Tew, James E, Protecting Honeybees from Pesticides, Alabama Cooperative Extension System, ANR-1088, April 1998 [3] Townsend, Lee, et al., Earthworms: Thatch-Busters, University of Kentucky, January 1994
[4] Mahler, Robert L., et al., Pesticides and Their Movement in Soil and Water, University of Idaho, Quality Water For Idaho CIS 865, September 1998 [5] Vogue, P.A., et al., Oregon State University Extension, Pesticide Properties Database, July 1994

Marbled Murrelet

- *If a tree needing removal is greater than 80 cm (32 in.) diameter at breast height and has suitable nest tree characteristics,* initiate formal consultation with the USFWS.
- *During core breeding season, from April 1- August 5,* do not carry out maintenance activities (e.g., chainsaw work) that produce noise above ambient noise levels, within 0.4 km (0.25 mi.) of known marbled murrelet habitat or occupancy (based on marbled murrelet maps).
- *During the late breeding season, from August 6 - September 15,* do not carry out maintenance activities using motorized equipment within 0.4 km (0.25 mi.) of marbled murrelet habitat or occupancy within two hours after sunrise or within two hours before sunset.

Spotted Owl

- *Where opportunity exists,* suspend vegetation management activities within 0.4 km (0.25 mi.) of spotted owl critical habitat between March 1 and June 30, unless the owls are shown not to be nesting.
- Examine any large trees (greater than 8″ diameter at breast height East of the Cascades or 11″ diameter at breast height West of the Cascades) that need to be removed in spotted-owl habitat for evidence of owls. If a tree has evidence of owl nesting activity, conduct formal consultation with the USFWS.
- *In case of an emergency danger tree removal—a tree suddenly becoming an imminent threat to the line, posing a danger to life and property—*immediately examine the felled tree for evidence of owl nesting. If such evidence is found, start emergency consultation with the USFWS, or, if the situation occurs during off-duty hours, conduct after-the-fact emergency consultation the next business day.

Agriculture

The following section discusses general impacts of vegetation management on agriculture.

General Impacts

Bonneville minimally manages vegetation in crop, range, or orchard areas. Where these land uses are actually within the right-of-way (such as when a transmission line crosses a grass turf field), the farmer is the one who manages the grass or other crop on the right-of-way.

On these farmed lands, the issue is the vegetation that grows around the base of the tower legs. Because tilling and farming close to the tower legs are difficult, and could potentially damage wood-pole transmission structures, these small areas are left unfarmed. The unfarmed areas become a prime spot for noxious weed invasion or growth of other nuisance plants, such as blackberries.

Where agricultural lands are next to the rights-of-way, care needs to be taken so that the agricultural plants are not harmed while vegetation on the right-of-way or access road is controlled. Also, if noxious weeds are allowed to spread on the right-of-way, they might spread into agricultural areas and invade crops.

Other issues, not specific to a method, are the maintenance of Christmas tree farms and orchards within the right-of-way. If the farmer does not keep the Christmas trees harvested or orchard trees trimmed, these trees can grow into or close to the lines, causing safety problems and outages—technically not an environmental problem caused by our maintenance, but a problem caused by failure to maintain. Landowner agreements are very important in these areas to insure that tree height criteria are maintained. (See **Appendix E** for more information on clearance criteria.)

The following sections discuss method-specific impacts of vegetation management on agriculture.

Manual Impacts

Manual techniques would have no additional impact.

Mechanical Impacts

Bonneville would not use mechanical techniques *in* agricultural areas, but might use them *next* to agricultural areas. Impacts would be the potential for increased water runoff or soil movement into agricultural fields from disturbed or compacted soils.

Biological Impacts

Biological methods would not be used *in* areas of agriculture.

Herbicide Impacts

Bonneville minimally manages vegetation in crop, range, or orchard areas, as described above, under **General Impacts**. If herbicides were used near crop- or rangelands, drift or potential herbicide migration through water runoff could kill crop plants or expose range animals (sheep, cows, and horses). In areas of organic farming practices, where often strict testing is carried out to ensure the crops are not exposed or grown with the use of chemicals, potential drift of herbicides from an adjacent right-of-way could severely affect crop fields.

Debris Disposal Impacts

There would be little debris disposal necessary in agricultural lands. Care would need to be taken to ensure that debris from right-of-way maintenance would not be left in an adjacent farmland. On grazing lands, pine needles left on the ground can cause 1) a reduction in grass growth due to their acidic property, and 2) abortion in cows if the cows consume a significant amount of the needles (Gardner, 1996, 1998).

Mitigation Measures

The following mitigation measures would apply to agricultural areas.

- Prevent the spread of noxious weeds by cleaning seeds from equipment before entering cropland.
- *If on grazing lands and there is potential for pine needle poisoning,* do not lop and scatter pine tree vegetative debris—machine-chip or haul debris off-site.
- *If using herbicides on grazing lands*, comply with grazing restrictions as required per herbicide label.
- *For rights-of-way adjacent to agricultural fields*, observe appropriate buffer zones necessary to ensure that no drift will affect crops.
- *If using herbicides near crops for consumption*, comply with pesticide-free buffer zones, if any, as per label instructions.
- *For rights-of-way near organic farms*, observe appropriate buffer zones, or provide for the owner to maintain the right-of-way, by way of a vegetation management agreement.
- *If reseeding*, determine whether any of the adjacent properties are being, or will in the immediate future be, used for growing grass seed, especially high-purity strains.
- *If reseeding near grass seed fields*, consult with the area seed certification and registration authority to determine whether buffer zones are necessary, appropriate grass mixtures allowed, and appropriate modes of seeding used.

Timber Production

The following section discusses general impacts of vegetation management on timber production.

General Impacts

Maintaining the vegetation on a right-of-way that crosses timber-producing lands means that periodically some trees must be cut. Trees next to the corridor that have become danger trees might need to be cut before they are ready for harvest.

The following sections discuss method-specific impacts of vegetation management on timber production.

Manual/ Mechanical/ Biological Impacts

There would be no additional impact on timberlands by using manual, mechanical or biological methods of controlling vegetation on the right-of-way.

Herbicide Impacts

Herbicide use on these lands could potentially affect timber production if any drift, overspray or spills were to move off the right-of-way and affect timber trees. The potential of drift or overspray is greater with broadcast or aerial spraying than with spot or localized application methods. On other electric facilities, herbicides that potentially could run off or leach out of the yard to surrounding timber areas could have an effect.

Debris Disposal Impacts

Debris disposal would cause no additional impacts on timberlands.

Recreation

The following section discusses general impacts of vegetation management on recreation.

General Impacts

Transmission lines often cross rivers or are near developed recreational sites (such as campgrounds and parks). Even rights-of-way and access roads that are not near developed parks are used for recreation: hiking, ATV use, snowmobiling, and cross-country skiing.

Most vegetation management activities take place during the growing season; conflicts with winter recreationists (cross-country skiers and snowmobilers) are therefore unlikely to occur. Summer recreationists, on the other hand, might be displaced or excluded from active or recent work sites, might be annoyed by noise and disturbance associated with vegetation management, and might encounter hazards or nuisances resulting from vegetation management.

The following sections discuss method-specific impacts of vegetation management on recreation.

Manual Impacts

Manual techniques are often the method of choice within or near developed recreation sites. The use of power tools, such as chainsaws, can be noisy and annoying to recreationists and can detract from outdoor experiences. However, manual techniques are generally less intrusive and less intensive than mechanical techniques.

Mechanical Impacts

Heavy equipment also can disturb recreationists through noise and exhaust fumes. There is also some danger of people in the area being hit by rocks or pieces of wood that might be thrown by the equipment. (See also the discussion under **Public Health and Safety**.)

Mechanical cutting or chopping machines cut all vegetation in the vicinity and leave slash cut up in varying sizes, from finely shredded/mulched bits (most often) to long pieces. In a few cases, the remaining debris can be difficult to cross by walking, biking, all terrain vehicles (ATVs), motorcycles, and so on.

Biological Impacts

Biological methods of vegetation management would have little impact on recreation. However, aesthetics might be affected if large numbers of insects were present on noxious weeds.

Herbicide Impacts

The recreational experience of a site might be diminished because the landscape becomes less attractive as the vegetation turns brown after being treated. These impacts are generally temporary, as desired vegetation replaces undesirable vegetation that has been killed. (See **Public Health and Safety** for any potential impacts on people from exposure to herbicides.)

Debris Disposal Impacts

Slash burn piles would generate smoke and unsightly burnt areas. Lopped-and-scattered vegetation is difficult to walk or ride bikes over and might discourage recreational activities until the vegetation debris begins to break down.

Residential, Commercial, and Industrial

General Impacts

The following section discusses general impacts of vegetation management on residential, commercial, and industrial resources.

Visual, health and safety, noise, and landscaping effects are the potential impacts of managing vegetation on rights-of-way in residential, commercial, and industrial areas. (See **Visual** and **Public Health and Safety** for impacts on those resources.)

Noise or presence of maintenance crews can disturb people in homes or businesses. Routine vegetation maintenance work would take place during normal worktime (8am to 5pm). These disturbances would be relatively short-term, one or two days in any specific location.

Bonneville's clearing needs can often conflict with a property owner's landscaping needs or desires. Property owners have powerline easement documents that outline provisions for Bonneville's legal right and obligation to clear "on" right-of-way trees that threaten the lines. Trees that are located "off" the right-of-way might also pose a threat to the power line. Once identified, these "off" the right-of-way danger trees are marked, and we start a process with the property owner to have them removed.

Removing these trees can have varied effects on property owners varies. Some people are happy to have someone else pay to have a tree removed. In other cases, a tree might have personal history or an emotional tie, or might be highly valued for aesthetic or other reasons. The impact on the property owner, in this case, can be great.

To lessen this impact, we are in some cases using herbicides that are growth regulators—they slow the growth of vegetation—on landscape trees so they don't become a threat to the line. Trimming or topping trees is often not very feasible because it is very labor-intensive and might require yearly trimming.

The following sections discuss method-specific impacts of vegetation management on residential, commercial, and industrial resources.

Manual Impacts

Noise generated from chainsaws and other hand tools might temporarily disturb people.

Mechanical Impacts

Mechanical techniques are also noisy, and often generate dust and can disturb people in houses, schools, and businesses.

Biological Impacts

Biological techniques have no effect on land uses, other than potentially reducing noxious weeds on adjacent lands.

Herbicide Impacts

Some land uses that might occur next to Bonneville facilities might preclude the use of herbicides, especially aerial application. For example, we would consider it a major impact if accidental spraying or spray were to drift onto residential areas, schools, recreation sites, and other land uses where people are concentrated—even if the chemicals involved were benign. Because of this, chemical techniques must be very controlled when necessary in or near areas where people are concentrated (for example, spot chemical treatments rather than broadcast).

Debris Disposal Impacts

Most debris in these areas would be removed from and disposed of off-site. Burning would probably not be appropriate in these areas because of the nuisance and potential health and safety effects of the smoke. (Please see **Visual** and **Public Health and Safety** for impacts of burning vegetation debris.)

The following mitigation measures would apply in residential/ commercial or industrial areas.

- Evaluate, generally, existing land uses (e.g., agriculture, residential) along a right-of-way or surrounding a facility needing vegetation control to determine any constraints on vegetation control.
- *To the extent practicable*, identify casual informal use of the right-of-way by non-owner publics to determine any constraints on vegetation control.
- Determine, generally, landowners or land managers (i.e., private residential, timber company, Federal, state) in or around the facility needing vegetation control.
- Determine whether there are any existing landowner agreements with provisions that need to be followed regarding the vegetation maintenance of a specific portion of line.
- Determine appropriate level of public involvement, notification or coordination that may be necessary.
- *If needed*, use public contact to help find out about any special uses of the land, or other issues or concerns that might need consideration when determining or scheduling vegetation control.

- *Where appropriate*, assign responsibility for tall-growing species on the rights-of-way to the underlying property owner (i.e., to owners of orchards or Christmas tree farms).
- *If appropriate*, offer to replace trees (with a low-growing species), or use tree growth regulators instead of removing a tree.

USFS- and BLM-managed Lands

The following section discusses general impacts of vegetation management on USFS- and BLM-managed lands.

General Impacts

The USFS and BLM manage lands for a variety of functions, including habitat, riparian reserve and ecosystem protection. Because much of the management is for protection or enhancement of the environment, these lands are often pristine and contain lots of natural resources and species, including wildlife, protected habitat, threatened, endangered, or protected plant and animal species, and high-quality rivers or streams. The vegetation control impacts on these natural resources would be no different than the impacts discussed under the natural resource sections in this EIS. However, the potential of encountering these resources is greater on these lands.

Management Areas

There are also potential impacts on how an area within a Forest or BLM district is managed.

The USFS and BLM have many plans, guidance, and regulations to help ensure appropriate land and resource management. Other land users (such as Bonneville transmission corridors) are to abide by those plans and guidance. Plans specify how various areas of the Forest or District are to be managed.

For example, a Forest might have a resource management area for grizzly bear habitat. This area will have standards and guidelines specifying acceptable actions in that area to maintain or restore the habitat for grizzly bears.

In some cases, controlling vegetation along a right-of-way may conflict with the management of an area, especially if the management requires that tall-growing vegetation cannot be removed.

In other cases, such as the grizzly bear habitat, vegetation control would be consistent with the management as long as seasonal and timing restrictions were followed so as not to disturb the animals.

Some Forest Plans designate Resource Management Areas for utility corridors, such as one of our rights-of-way. Utility Resource Management Areas have standards and guidelines specific to maintaining a safe reliable right-of-way, including the cutting of trees or brush that might threaten the operation of the line. In these areas, although potential resources in the area still are considered, because there is a common goal for utility corridor management, there is no potential management conflicts or impacts.

Compliance with NEPA

The USFS, BLM and Bonneville all must also comply with NEPA to ensure that the environmental impacts of their actions are considered before taking the action. The differences among the three agencies come in the implementation of NEPA. Each agency has its own NEPA Implementing Regulations that guide the level of environmental analysis for certain activities the agency should conduct.

In general, the decisions on vegetation management of rights-of-way across USFS or BLM managed-lands are Bonneville's and, therefore, Bonneville is responsible for complying with NEPA. The USFS or BLM is responsible for ensuring that the proposed vegetation management is consistent with their plans and regulations. The USFS or BLM usually would not have a decision to make (that would trigger their NEPA process) unless the proposed vegetation management were not consistent with their existing plans and regulations. If the proposed vegetation management were inconsistent, then a new decision by the USFS or BLM would have to be made to allow that action, triggering NEPA processes for those agencies.

Method-specific impacts related to BLM- or USFS-managed lands are listed below.

Manual Impacts

Manual cutting is often the preferred method of vegetation management on National Forests or BLM lands. Because manual methods can be very selective, there is minimal potential to affect non-target resources.

Mechanical Impacts

Mechanical vegetation clearing is an available treatment method on the USFS and BLM land; however, it is to be used primarily on relatively flat terrain, and relatively dry stable soils.

Biological Impacts

Controlling noxious weeds with insects is promoted by the USFS and BLM.

Herbicide Impacts

Herbicide use is also possible on most USFS and BLM lands. Both these agencies have their own list of herbicides approved for use on their lands. The list can vary by region, and even by Forest. Some BLM lands are still under an injunction that does not allow any herbicide use. Both agencies also have additional direction (such as buffer zones, and reporting requirements) regarding the use of herbicides.

Debris Disposal Impacts

Debris disposal depends on the need of the Forest. In some places there is concern about leaving vegetation debris on the right-of-way because of the potential for forest fires—dead vegetation adds fuel to the fire. In other places, leaving large woody debris is promoted for wildlife habitat.

Mitigation Measures

The following mitigation measures would apply to USFS-managed lands.

- Use, update, or develop site-specific vegetation management plans for rights-of-way that cross USFS-managed lands.
- Review existing site-specific vegetation management plans for consistency with USFS-specific mitigation measures identified in **Appendix F**. This EIS does not supercede or revoke any existing agreements or site-specific vegetation management plans. However, if appropriate, work with local Forest Officer in revising existing plans to achieve consistency.
- Develop site-specific vegetation management plans (where they do not exist) using the Planning Steps and mitigation measures in this EIS, including the USFS-specific measures in **Appendix F**. Conduct appropriate NEPA analysis and documentation (see Planning Step #7).
- Contact the local Forest Supervisor's or District Ranger's office, before implementing vegetation management activities on national Forest System lands (or follow direction in site-specific vegetation management plans for notification procedures). Notification should be made as far in advance of the planned date of on-the-ground implementation as is reasonably possible.
- *If expecting the USFS to conduct environmental data collection for evaluation,* allow more than one year for completion, and be prepared to reimburse the USFS for the costs in conducting such activities.

The following mitigation measures would apply to BLM-managed lands.

- Use, update, or develop site-specific vegetation management plans for rights-of-way that cross BLM-managed lands.
- Contact the local BLM office, before implementing vegetation management activities on BLM lands (or follow direction in site-specific vegetation management plans for notification procedures). Notification should be made as far in advance of the planned date of on-the-ground implementation as is reasonably possible.
- *For NEPA compliance on BLM-managed lands,* use the Planning Steps and mitigation measures in this EIS, including the BLM-specific mitigation measures (see **Appendix G**) and appropriate NEPA analysis and documentation (see Planning Step *#7).*
- Consult with appropriate BLM regarding presence of natural resources and features and appropriate buffers or other mitigation measures.

The following mitigation measure would apply to other Federal lands.

- Notify, consult and cooperate with other Federal agencies (such as the Corps) when scheduling right-of-way vegetation control activities on their lands.

Tribal Lands

The following section discusses general impacts of vegetation management on Tribal lands.

General Impacts

On ceded Tribal lands and in usual and accustomed areas, vegetation management could encroach on Tribal rights to traditional use activities. (See the section on **Cultural and Historical Resources** in this chapter for discussion of potential impacts on traditional cultural plants and places.)

Additionally, on Tribal reservations, vegetation management must be consistent with applicable Tribal land-management policies and plans. Tribes might elect to exercise rights to employ Tribal members for work performed on Tribal reservations.

Potential encroachment on Tribal rights could be avoided, and consistency with Tribal policies and plans ensured, by consulting with local Tribal governments and traditional leaders in developing site-specific vegetation management plans.

The following sections discuss method-specific impacts of vegetation management on Tribal lands.

Manual Impacts

The more labor-intensive methods of manual vegetation management would have greater potential for employment of Tribal workers on reservations.

Mechanical Impacts

Except as described in the section on **Cultural and Historical Resources** in this chapter, there are no known impacts unique to Tribal lands.

Biological Impacts

Methods involving natural biological selection might be favored by some Tribes.

Herbicide Impacts

Use of herbicides might be inconsistent with Tribal land management policies, and might encroach on Tribal rights if herbicides should adversely affect traditional use plants.

Debris Disposal Impacts

Except as described in the section on **Cultural and Historical Resources** in this chapter, there are no known impacts unique to Tribal lands.

Mitigation Measures

The following mitigation measures would apply for Tribal Reservations.

- If possible and practical, develop a cooperatively written right-of-way management plan with the Tribe. The plan should address specific land-use or environmental resources along the corridor that need consideration, including appropriate mitigation measures identified in this EIS.
- If possible, consider working with Tribes for replanting of traditional use plants. Low-growing traditional-use plants may include blue camas, bitter root, wild celery, biscuit root, Canby's desert parsley, Indian carrot/false caraway, field mint, blue huckleberries.

City, County, and State Lands

Cities, counties and states might have their own plans or requirements for managing vegetation or for the use of herbicides. If those plans are consistent with the Federal requirements to which

Bonneville would adhere, then there would be no conflict. If they are much more stringent, then there might be conflicts in management.

Letters to these governments when their lands are crossed should elicit potential inconsistencies to be considered.

Most issues or concerns would not be unique to local government-owned lands.

Cultural and Historical Resources

The following section discusses general impacts of vegetation management on cultural and historic resources.

General Impacts

Vegetation management activities could damage or expose Native American or historical archeological sites, could harm plants having traditional cultural value, or could visibly or audibly impose on places of traditional cultural value. Vegetation management methods that could cause erosion have a relatively greater potential to disturb sub-surface cultural and historical resources (see the section on **Soils** for discussion of erosion potential). Similarly, noisy activities could audibly impose on ceremonies or other uses of places with traditional cultural values (please see the section on **Noise** for more information).

Potential adverse impacts on cultural and historical resources could be substantially reduced or avoided by (1) consultation with the State (or Tribal) Historic Preservation Office (SHPO) and local Tribal leaders in developing site-specific vegetation management plans; and (2) adoption of site-specific geographic and/or timing constraints on vegetation management activities.

The following sections discuss method-specific impacts of vegetation management on cultural and historic resources.

Manual Impacts

Pulling vegetation from the soil could lead to erosion and could disturb sub-surface artifacts. Cutting and steaming methods would have less potential for disturbing the sub-surface. The more labor-intensive methods of manual vegetation management would have greater potential for vandalism or inadvertent damage by workers.

Mechanical Impacts

Mechanical vegetation management methods that disturb soils could also erode soils and disturb sub-surface artifacts. Some kinds of heavy machinery might also compact soils and sub-surface cultural and historical resources.

Biological Impacts

Biological methods of vegetation management have little potential to adversely affect cultural or historical resources because those methods target noxious weeds and do not disturb soils.

Herbicide Impacts

Herbicides could harm traditional use plants, or threaten the health of people gathering, handling, or ingesting recently treated plants. The less selective broadcast application methods, especially aerial broadcast, would have greater potential to inadvertently affect non-target traditional use plants.

Debris Disposal Impacts

Lopping and scattering cut vegetation might visually intrude on a traditional-use place. Because it contrasts in color with surrounding live vegetation, the unnatural appearance of large vegetation debris could incrementally increase the visibility of unnatural features from places where nature has traditionally spiritual significance.

Reseeding and Replanting

Reseeding and replanting low-growing vegetation species with traditional cultural value would potentially benefit traditional cultural uses.

Mitigation Measures

The following mitigation measures would apply to cultural resources.

- *When using mechanical ground-disturbing vegetation control methods,* review the right-of-way for potential existence of historic and cultural resources. The State Historic Preservation Officer is to be consulted, as appropriate.
- *On Tribal reservation lands and public lands,* consult (visit) with the appropriate Tribe regarding potential impacts on traditional plants. Restrictions such as seasonal constraints for vegetation control, avoidance of certain areas, or using methods that do not affect non-target plants may be required.

Worker Health and Safety

The following section discusses general impacts of vegetation management on worker health and safety.

General Impacts

This section addresses the potential health and safety impacts on workers managing the vegetation on our facilities. Some of these workers are Bonneville employees; some of them are under contract to do the work for us. The impacts can be divided into physical injury risks and health risks. In general, all techniques carry some degree of physical injury risks. Risks to health include herbicides, exhaust gasses, fuels and smoke from burning.

Indirect impacts on workers include the following: dehydration, heat exhaustion, insect stings, falls, and exposure to poisonous snakes and plants.

The following sections discuss method-specific impacts of vegetation management on worker health and safety.

Manual Impacts

Manual techniques include use of non-powered and powered hand-operated tools. Non-powered tools include axes, brush hooks, hoes, hand girdlers, and hand clippers. Powered tools include chainsaws and motorized brush cutters.

Use of these tools can result in worker injuries such as minor cuts, blisters, sprains, abrasions, bruises, muscle strains, exposure to equipment noise, exposure to exhaust gases and fuel vapors, flying debris, and falling trees.

Minor injuries from use of manual techniques will occur; however, severe injuries are rare when standard safety procedures are followed. From 1993 to 1997, Bonneville employees had 22 recorded injuries while using manual techniques on the rights-of-way. They varied from lower back pain, to poison oak reaction, to cuts requiring stitches. In 1997 there were two separate contractor accidents during manual vegetation management, resulting in one fatality and one electrocution with disability.

Mechanical Impacts

Potential direct impacts on worker health and safety from operating heavy equipment include injuries as a result of equipment malfunctions, equipment overturns, loss of control of the equipment, equipment noise, equipment vibration, exposure to exhaust gases and fuel vapors, flying debris, and falling trees.

Minor injuries are bound to occur when mechanical techniques are employed. On the other hand, according to the USFS (USDA/USFS, 1991a), severe injuries are relatively rare if workers adhere to standard safety procedures associated with heavy machinery operation. From 1993 to 1997, there was one recorded Bonneville employee accident associated with mechanical brush control.

Biological Impacts

There are no specific worker health or safety impacts associated with the use of biological controls. Injury could result from the use of equipment such as trucks or aircraft.

Herbicide Impacts

Herbicide methods may require use of heavy machinery, which could involve the potential impacts described above for mechanical methods. The main potential impact associated with the use of herbicide methods is exposure to the compounds (herbicides, carriers, dyes, and adjuvants).

Twenty-four different herbicide compounds would be used to various degrees to control vegetation. See Table VI-7, pages 197-199.

Carriers used by Bonneville include mineral oil and limonene (Bonneville does not use diesel oil or kerosene, two carriers in relatively common use in the United States).

Appendix H contains fact sheets that provide herbicide human health risk assessment information, plus application and safety guidelines. Some of the facts sheets are from EPA's Reregistration Eligibility Decision (R.E.D.); some were developed from a Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4 and 10 and on Bonneville Power Administration Sites (Labat-Anderson, Inc., 1992); and some were developed specifically for this document.

Information on the carriers' limonene and mineral oil are also provided. Each fact sheet provides an assessment of the general and systemic toxicity (both acute and chronic), including potential effects on reproduction, carcinogenicity, teratogenicity and mutagenicity. Table VI-7 summarizes this data.

These chemicals can all be toxic to workers, to varying degrees. (Any chemical poses a health risk at a sufficient dose.) Most clinical reports of herbicide effects are of skin and eye irritation. Some herbicides, such as dicamba, hexazinone, chlorsulfuron, and triclopyr, can be severe skin irritants; others, such as 2,4-D and metsulfuron methyl, can be severe eye irritants.

Short-term effects of excessive exposure to herbicides include nausea, dizziness, or reversible abnormalities of the nervous system (reversible neuropathy). In extreme cases of prolonged, repeated, and excessive exposure (resulting from careless and/or negligent work habits), longer-term health problems can result, including: organ damage, immune system damage, permanent nervous system damage, production of inheritable mutations, damage to developing offspring, and reduction of reproductive success. It is important to note that EPA evaluates and registers herbicides according to a uniform, health-based standard to ensure a "reasonable certainty of no harm" to consumers. The EPA is responsible for restricting a product's use according to its potential impacts on human health and the environment. Much of that restriction is done through the product label, which states the precautions that must be taken, and how and where to apply a certain herbicide. In most cases, the hazards involved are comparable to or less than the risks associated with other methods.

Herbicides have an added safety advantage over insecticides: since herbicides are designed to be toxic to plants, not animals, most herbicides present little risk to workers when used properly. Few of the herbicides available for use on Bonneville facilities are possible carcinogens (bromacil, and trifluralin).

Occupational exposure to herbicides varies with the method of application. The greatest risk occurs when the worker must directly handle and/or mix chemicals. Spot and localized herbicide applications—including use of backpack sprayers, aerial mixers/loaders, and stem injection—require the most hands-on use of herbicides and, therefore, carry the greatest risk of exposure (and require the greatest amount of worker precaution and use of safety equipment, such as respirators).

Under all application categories, workers can be exposed to herbicides from accidental spills, splashing, leaking equipment, contact with the spray, or by entering treated areas. Exposure can occur either through skin or through inhalation. Adherence to operational safety guidelines, use of protective clothing, equipment checks, and personal hygiene can prevent incidents from occurring. The herbicide label and corresponding material safety data sheets detail these application requirements in addition to safety guidelines.

Debris Disposal Impacts

Risks of lopping and scattering would be due to flying debris from use of machines.

Workers involved in pile-burning of vegetative debris can experience short-term effects, such as minor burns, smoke irritation of the eyes and throat, coughing, and shortness of breath. In extreme cases, workers can experience more severe, long-term effects, such as permanent tissue damage from serious burns, inhalation of toxic agents from poison oak and/or fire starting material, and inhalation of particulates that can have acute irritant effects. The small size of the slash pile burns would help preclude such impacts.

Between 1993 and 1997, three injuries occurred while Bonneville employees were in the process of chipping brush on the right-of-way.

Mitigation Measures

The following mitigation measures would apply for worker health and safety.

- *For safety,* cut all brush stumps flat where possible. (Angular cuts leave a sharp point that could cause injuries if fallen upon.)
- *For cutting trees close to "live" power lines,* use only qualified personnel.
- *If burning vegetation debris piles,* burn off the right-of-way. Do not burn debris close enough to the right-of-way or facility where smoke could provide a conductive path from the transmission lines or electric equipment to the ground.
- Ensure that all herbicide applicators have received training and are licensed in appropriate application categories.
- Follow all herbicide label and material safety data sheet (MSDS) instructions regarding worker safety standards. These include the following:
  - Wear appropriate protective equipment;
  - Do not eat, drink or smoke when handling herbicides;
  - Avoid spilling herbicides on skin or clothing (promptly change any clothing substantially contaminated by a herbicide);
  - Cleaning and wash protective equipment daily;
  - Have ready access to clean water and first aid supplies;
  - Have access to emergency medical facilities; and
  - Observe specified restricted entry intervals.
- Use self-contained herbicide handling equipment when appropriate and available to reduce worker exposure during herbicide mixing and handling.

Public Health and Safety

The following section discusses general impacts of vegetation management on public health and safety.

General Impacts

This section discusses the potential health and safety impacts on the general public from managing vegetation around our facilities. The impacts can be divided into two categories: physical injury risks and exposure risks. In general, all techniques carry some degree of physical injury risks. Risks of exposure include herbicides from chemical techniques and smoke from burning.

The following sections discuss method-specific impacts of vegetation management on public health and safety.

Manual Impacts

People who come near workers clearing a right-of-way can be exposed to exhaust gases and fuel vapors, flying debris, and falling trees.

Impacts on the public's health and safety are negligible because the public has limited access to Bonneville facilities and because manual clearing is closely supervised and would prevent exposure.

Mechanical Impacts

As with manual techniques, people near the right-of-way during clearing operations can be exposed to exhaust gases and fuel vapors, flying debris, and falling trees. However, heavy equipment could also run over people if the operator does not see them. Proper supervision would prevent exposure to the public.

Impacts on the general public's health and safety would be minor because of limited access and remote location of many of the activity sites. However, use of equipment on access roads used by the public presents an increased risk in vehicle accidents.

Biological Impacts

Biological techniques pose little health or safety risk to workers or the general public.

Herbicide Impacts

While most chemical techniques require use of heavy machinery and thus incur similar basic risks, the major concern with herbicide application is accidental exposure to the compounds (herbicides, carriers, dyes, and adjuvants). Exposure can occur from being accidentally sprayed, from entering areas soon after treatment (eating berries or other foods collected from the right-of-way, touching sprayed vegetation), or drinking contaminated water. The general public, both visitors and residents, is less likely to receive repeated exposures than vegetation management workers; the right-of-way locations are remote, a variety of herbicides would be used, and the timing of treatments would be widely spaced.

If the public were exposed to herbicides repeatedly, the impacts would be like those described in **Worker Health and Safety**.

Risks of Accidental Drift/Spraying

Members of the public, both visitors and nearby residents, could potentially be exposed to herbicides from drift or accidental spraying, if they were in the area at the time of application. Since aerial and broadcast applications have a higher *potential* for drift, these application techniques might create a higher potential for public exposure. However, aerial spraying would only be done in more remote unpopulated areas and broadcast herbicide spraying would not be done in highly populated areas or suburbs. Potential public exposure from spot or localized drift is extremely low because the application usually takes place close to the target plant, so the herbicide is airborne for only a very short moment.

Should a person be accidentally sprayed, then the person's skin and/or eyes might be irritated, depending on the particular herbicide formula. Individuals have reported chronic nausea, dizziness, and other symptoms following accidental exposure to herbicides. Laboratory tests on animals have shown that most herbicides are not carcinogenic, even at doses and repeated exposures well above that which could occur accidentally as part of vegetation management activities. As stated under **Worker Health and Safety,** herbicides are designed to act on plants, not animals, so that the toxic effects generally do not affect the central nervous system or other vital functions.

Risks of Contact after Spraying

Regardless of application method, the general public might also be exposed through contact with recently sprayed vegetation, consumption of recently sprayed berries or other plant materials, drinking contaminated water, or through consumption of contaminated fish. The application guidelines are designed to prevent such accidental exposures to water and fish.

Debris Disposal Impacts

There would be little potential impact on public health or safety due to debris disposal. Potential impacts on people from pile burning smoke and decreased air quality is discussed in the **Air Quality** section. Wildfires started by burn piles that escape pose a risk to nearby residents. With close supervision, the potential for vegetation debris pile burns to escape and cause wildfires would be low.

Mitigation Measures

The following mitigation measures would apply for public health and safety:

- Evaluate, generally, existing land uses (e.g., agriculture, residential) along a right-of-way or surrounding a facility needing vegetation control to determine any constraints on vegetation control.

Table VI-7 Human Health Toxicology Assessment

Herbicide	Acute Toxicity								Chronic Toxicity			
	Primary Irritation		Oral		Dermal		Inhalation					
	Eye	Skin	LD50 (mg/kg)	Comments	LD50 (mg/kg)	Comments	LC50 (mg/l)	Comments	Carcinogenicity	Teratogenicity	Reproductive	Mutagenicity
2,4-D												
Acids, Salts	Toxicity Category I: Highly Toxic	Toxicity Category III Slightly Toxic	Rat >1000	Toxicity Category III Slightly Toxic	Rabbit >1000	Toxicity Category II Moderately Toxic	Rat (4-hour) >2.1	Toxicity Category III Slightly Toxic	Group 2B by IARC Possibly carcinogenic to humans	Animal studies indicate limited ability to cause birth defects	Evidence suggests adverse effects at moderate doses	Evidence suggests adverse effects to human chromosomes
Esters and others	Toxicity Category III Slightly Toxic	Toxicity Category III Slightly Toxic	Rat >800	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >0.8	Toxicity Category II Moderately Toxic	Same as above	Same as above	Same as above	Same as above
Benefin	Toxicity Category III Slightly Toxic	Toxicity Category III Slightly Toxic	Rat 2000	Toxicity Category III Slightly Toxic	Rabbit 5000	Toxicity Category III Slightly Toxic	No data due to course granular nature of formulations		Evaluation and determination not complete	No adverse effects	No adverse effects	No adverse effects
Bromacil												
Liquid (lithium salt)	Toxicity Category II Moderately Toxic	Toxicity Category III Slightly Toxic	Rat 1414	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category II Moderately Toxic	Rat (1-hour) >10	Toxicity Category III Slightly Toxic	Group C by EPA-OPP – Possible human carcinogen	Repeated high doses caused fetal abnormalities in rats.	No adverse effects	No adverse effects
Solid	Toxicity Category III Slightly Toxic	Toxicity Category III Slightly Toxic	Rat (female) 1300	Toxicity Category III Slightly Toxic	Rabbit >5000	Toxicity Category III Slightly Toxic	Rat (4-hour) >4.8	Toxicity Category III Slightly Toxic	Same as above	Same as above	No adverse effects	No adverse effects
Chlorsulfuron	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Rat (female) 2341	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) 5.9	Toxicity Category III Slightly Toxic	No adverse effects	No adverse effects	Slightly decreased fertility at doses of 2500 mg/kg in 3-generation study	No adverse effects
Clopyralid-Methyl	Toxicity Category II Moderately Toxic	Toxicity Category IV Practically Non-Toxic	Rat >5000	Toxicity Category III Slightly Toxic	Rabbit >5000	Toxicity Category III Slightly Toxic	Rat >3.0	Toxicity Category III Slightly Toxic	No adverse effects	Caused birth defects in animals at greatly exaggerated doses	No adverse effects	No adverse effects
Dicamba	Toxicity Category I Highly Toxic	Toxicity Category IV Practically Non-Toxic	Rat >757	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >5.3	Toxicity Category III Slightly Toxic	No adverse effects	No adverse effects	No adverse effects	No adverse effects
Dichlobenil	Toxicity Category IV Practically Non-Toxic	Toxicity Category IV Practically Non-Toxic	Rat 4250	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >3.3	Toxicity Category III Slightly Toxic	Group C by EPA-OPP – Possible human carcinogen	No adverse effects	No adverse effects	No adverse effects
Diuron	Toxicity Category III Slightly Toxic	Toxicity Category III Slightly Toxic	Rat (female) 1300 Rat (male) 2300	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >3.5	Toxicity Category III Slightly Toxic	Proposed Revised Guidelines by EPA-OPP as a Known/Likely Carcinogen	Teratogenic in mice and rats at doses of 250 mg/kg/day	Significant decrease in weight of offspring in 2nd and 3rd litters. Unlikely to effect humans at expected doses.	No adverse effects
Glyphosate												
I-Salt	Toxicity Category II Moderately Toxic	Toxicity Category IV Practically Non-Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >5000	Toxicity Category IV Practically Non-Toxic	Rat (4-hour) >1.3	Toxicity Category III Slightly Toxic	Group E by EPA-OPP – evidence of human non-carcinogenicity	Diarrhea, decreased body weight gain, nasal discharge and death in high dose animal studies	Kidney and digestive effects and decreased body weight gain in high dose animal studies	No adverse effects
M-Salt	Toxicity Category IV Practically Non-Toxic	Toxicity Category IV Practically Non-Toxic	Rat 4613	Toxicity Category III Slightly Toxic	Rabbit >5000	Toxicity Category IV Practically Non-Toxic	Rat (4-hour) >1.9	Toxicity Category III Slightly Toxic	Same as above	Same as above	Same as above	Same as above
Halosulfuron-Methyl	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Rat 1287	Toxicity Category III Slightly Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rat (4-hour) >5.7	Toxicity Category IV Practically Non-Toxic	No adverse effects	Rat studies indicate decreases in mean body weight and soft tissue and skeletal variations	No adverse effects	No adverse effects

Herbicide	Acute Toxicity								Chronic Toxicity			
	Eye	Skin	LD50 (mg/kg)	Comments	LD50 (mg/kg)	Comments	LC50 (mg/l)	Comments	Carcinogenicity	Teratogenicity	Reproductive	Mutagenicity
Hexazinone	Toxicity Category I Highly Toxic	Toxicity Category IV Practically Non-Toxic	Rat 1200	Toxicity Category III Slightly Toxic	Rabbit >5278	Toxicity Category IV Practically Non-Toxic	Rat (4-hour) 3.94	Toxicity Category IV Practically Non-Toxic	Group D by EPA-OPP – not classifiable as a human carcinogen	Some effects at high dose levels	Some effects at mid- and high dose levels	Positive in one study and negative in others: suggests slight or nonmutagenic effects
Imazapyr	Toxicity Category I Highly Toxic	Toxicity Category IV Practically Non-Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >1.3	Toxicity Category III Slightly Toxic	Group E by EPA-OPP – evidence of human non-carcinogenicity	No adverse effects	No adverse effects	No adverse effects
Isoxaben	Toxicity Category II Moderately Toxic	Toxicity Category III Slightly Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >2.6	Toxicity Category III Slightly Toxic	Group C by EPA-OPP – Possible human carcinogen	Has caused birth defects in animals at high doses	Has been shown to interfere with reproduction in animals	No information available
Mefluidide	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Mice 1920	Toxicity Category III Slightly Toxic	Rabbit >4000	Toxicity Category III Slightly Toxic	Rat (4-hour) >8.5	Toxicity Category III Slightly Toxic	Possible oncogenic effects in tests on mice	No adverse effects	No adverse effects	No adverse effects
Metsulfuron Methyl	Toxicity Category II Moderately Toxic	Toxicity Category III Slightly Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >5.3	Toxicity Category III Slightly Toxic	No adverse effects	No adverse effects	No adverse effects	No adverse effects
Oryzalin	Toxicity Category III Slightly Toxic	Study requested by EPA	Rat >10,000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat >3.17	Toxicity Category III Slightly Toxic	Group C by EPA-OPP – Possible human carcinogen	Reduced maternal and fetal body weight and increased runts and bone development effects at high dose levels	Increase in liver and kidney weights and decreased food consumption and body weight gain at high dose levels	No adverse effects
Paclobutrazol	Toxicity Category II Moderately Toxic	Toxicity Category III Slightly Toxic	Rat 2150	Toxicity Category III Slightly Toxic	Rabbit >4000	Toxicity Category III Slightly Toxic	Rat (4-hour) >250	Toxicity Category IV Practically Non-Toxic	No adverse effects	Caused birth defects in lab animals at doses toxic to the mother	No adverse effects	No adverse effects
Pendimethalin	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Rat male 1250 Rat (female) 1050	Toxicity Category III Slightly Toxic	Rabbit >5000	Toxicity Category IV Practically Non-Toxic	Rat (4-hour) 5.35	Toxicity Category III Slightly Toxic	Group C by EPA-OPP – Possible human carcinogen	No adverse effects	No adverse effects	No adverse effects
Picloram K-Salt	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Rat (female) 3536	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >1.63	Toxicity Category II Moderately Toxic	Group E by EPA-OPP – Evidence of non-carcinogenicity	Body weight gains/losses, abortions, excess salivation	Effects not reported	No adverse effects
T-Salt	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >0.07	Toxicity Category II Moderately Toxic	Study not required by EPA	Same as above	Effects not reported	No adverse effects
Sulfometuron-Methyl	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >5.1	Toxicity Category III Slightly Toxic	No adverse effects	No adverse effects	Decreased number of off-spring at levels toxic to the mother	No adverse effects
Tebuthiuron	Toxicity Category III Slightly Toxic	Toxicity Category IV Practically Non-Toxic	Rat (male) >2000 Rat (female) >1000	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >2.0	Toxicity Category III Slightly Toxic	Group D by EPA-OPP – not classifiable as a human carcinogen	No adverse effects	No adverse effects	No adverse effects

Herbicide	Acute Toxicity								Chronic Toxicity			
	Eye	Skin	LD50 (mg/kg)	Comments	LD50 (mg/kg)	Comments	LC50 (mg/l)	Comments	Carcinogenicity	Teratogenicity	Reproductive	Mutagenicity
Triclopyr												
TEA	**Toxicity Category I Highly Toxic**	**Toxicity Category IV Practically Non-Toxic**	**Rat 1847**	**Toxicity Category III Slightly Toxic**	**Rabbit >2000**	**Toxicity Category III Slightly Toxic**	**Rat (4-hour) >2.6**	**Toxicity Category IV Practically Non-Toxic**	**Group D by EPA-OPP – not classifiable as a human carcinogen**	**Positive for adverse developmental effects**	**Positive for adverse reproductive effects**	**No adverse effects**
BEE	**Toxicity Category III Slightly Toxic**	**Toxicity Category IV Practically Non-Toxic**	**Rat 803**	**Toxicity Category III Slightly Toxic**	**Rabbit >2000**	**Toxicity Category III Slightly Toxic**	**Rat (4-hour) >4.8**	**Toxicity Category IV Practically Non-Toxic**	**Same as above**	**Same as above**	**Same as above**	**No adverse effects**
Trifluralin												
Liquid	Toxicity Category III Slightly Toxic	Toxicity Category III Slightly Toxic	Rat 3700	Toxicity Category III Slightly Toxic	Rabbit >5000	Toxicity Category III Slightly Toxic	Rat (4-hour) >5.5	Toxicity Category III Slightly Toxic	Group C by EPA-OPP – Possible human carcinogen	No adverse effects	Increased kidney and liver weights, renal lesions, reduced litter sizes in test animals at doses lethal to mother	No adverse effects
Solid	Toxicity Category II Moderately Toxic	Toxicity Category IV Practically Non-Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >4.6	Toxicity Category III Slightly Toxic	Same as above	Same as above	Same as above	Same as above
Trinexapac-Ethyl	**Toxicity Category II Moderately Toxic**	**Toxicity Category III Slightly Toxic**	**Rat >5000**	**Toxicity Category IV Practically Non-Toxic**	**Rabbit >2000**	**Toxicity Category III Slightly Toxic**	**Rat (4-hour) >2.7**	**Toxicity Category III Slightly Toxic**	**Slight increase in stomach tumors in male mice at high doses**	**Effects not reported**	None observed	None observed
Mixtures												
2,4-D + Dicamba	Toxicity Category I Highly Toxic	Toxicity Category III Slightly Toxic	Rat 1150	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >20	Toxicity Category IV Practically Non-Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
2,4-D + Glyphosate	Toxicity Category I Highly Toxic	Toxicity Category III Slightly Toxic	Rat 3860	Toxicity Category III Slightly Toxic	Rabbit >6366	Toxicity Category IV Practically Non-Toxic	Rat (4-hour) >1.8	Toxicity Category II Moderately Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
2,4-D + Picloram	Toxicity Category II Moderately Toxic	Toxicity Category II Moderately Toxic	Rat >2600	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >1.8	Toxicity Category II Moderately Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
2,4-D + Triclopyr	Toxicity Category III Slightly Toxic	Toxicity Category III Slightly Toxic	Rat >2000	Toxicity Category III Slightly Toxic	Rabbit >2000	*Toxicity Category III Slightly Toxic*	Rat (4-hour) >4.9	Toxicity Category III Slightly Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
Benefin + Oryzalin	Toxicity Category II Moderately Toxic	Toxicity Category III Slightly Toxic	Rat 3750	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	No data	No data	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
Bromacil + Diuron	Toxicity Category III Slightly Toxic	Toxicity Category III Slightly Toxic	Rat >1200	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) 4.8	Toxicity Category III Slightly Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
Clopyralid + Triclopyr	Toxicity Category I Highly Toxic	Toxicity Category IV Practically Non-Toxic	Rat >1500	Toxicity Category III Slightly Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >2.6	Toxicity Category III Slightly Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
Chlorsulfuron + Metsulfuron Methyl	Toxicity Category II Moderately Toxic	Toxicity Category III Slightly Toxic	Rat >5000	Toxicity Category IV Practically Non-Toxic	Rabbit >2000	Toxicity Category III Slightly Toxic	Rat (4-hour) >5.3	Toxicity Category III Slightly Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above
Isoxaben + Trifluralin	Toxicity Category II Moderately Toxic	Toxicity Category III Slightly Toxic	Rat >2500	Toxicity Category III Slightly Toxic	Rabbit >5000	Toxicity Category III Slightly Toxic	Rat (4-hour) (female) >0.5 (male) >4.6	Toxicity Category II Moderately Toxic	See individual chemical above	See individual chemical above	See individual chemical above	See individual chemical above

Notes:

Unless otherwise noted, toxicity data are for technical forms of the herbicide (that is, the grade used for toxicology studies), not formulated (brand-name) products; data for specific formulated products might be different than that shown.

LC50 = lethal concentration 50; the concentration of a material in air that on the basis of laboratory tests (respiratory route) is expected to kill 50% of a group of test animals when administered as a single exposure (1 hour or 4 hours as indicated in the table).

LD50 = lethal dose 50; the dose of a substance that causes the death of 50% of an animal population from exposure to the substance by any route (other than inhalation) when given all in one dose. (Source: MSDS Pocket Dictionary, Genium Publishing Corporation 1988)

Toxicity Categories: Category I indicates the highest degree of acute toxicity, Category IV the lowest.

- *To the extent practicable,* identify casual informal use of the right-of-way by non-owner publics to determine any constraints on vegetation control.
- Determine, generally, landowners or land managers (i.e., private residential, timber company, Federal, state) in or around the facility needing vegetation control.
- Determine whether there are any existing landowner agreements with provisions that need to be followed regarding the vegetation maintenance of a specific portion of line.
- Determine appropriate level of public involvement, notification or coordination that may be necessary.
- *If needed,* use public contact to help find out about any special uses of the land, or other issues or concerns that might need consideration when determining or scheduling vegetation control.
- Protect drinking water sources by following all buffer zone restrictions.
- Ensure that all herbicide applicators have received training and are licensed in appropriate application categories.
- Observe restricted entry intervals specified by the herbicide label and post public warning signs where required.
- Follow all herbicide label and MSDS instructions regarding mixing and application standards to reduce exposure to the public through drift and misapplication.
- Ensure the use of EPA-approved herbicides that have been reviewed by Bonneville for effectiveness and environmental considerations.
- *If using herbicides near crops for consumption,* comply with pesticide-free buffer zones, if any, as per label instructions.
- Never leave herbicides or equipment unattended in unrestricted access areas.
- Closely follow all equipment cleaning standards required by the herbicide label.
- In the event of a spill, immediately notify potentially affected parties.

Visual Resources

The following section discusses general impacts of vegetation management on visual resources.

General Impacts

Vegetation management activities can change the appearance of the landscape and introduce visual contrasts, such as contrasts in color and/or vegetation height.

Several factors influence the effect of vegetation management on visual resources, including the setting (e.g., rural, urban, agricultural, mountainous), season, type of vegetation present, landscape color (e.g., soils, vegetation, surface geology), and type and amount of public use. In addition, the technique employed and scope of the project greatly determine the level of potential impact.

The setting can include land use patterns, as well as vegetation structure present (e.g., forested or not). In some urban settings, rights-of-way provide green belts appreciated by residents of the area. Visual impacts can be great in forestlands that are within view of major highways or residential areas.

A loss of tall vegetation can have a sudden temporary visual impact on people who see the view often. Long-term impacts can occur if the vegetation formerly screened either aesthetic or unpleasant views. For example, danger trees cut along a road might reveal a view of a mountain or valley not seen before. Alternatively, the tree cutting might reveal large lattice-steel transmission structures. (What people find aesthetically pleasing is also a matter of taste. Many of our electrical engineers think transmission towers are an aesthetically pleasing sight.)

The scope of the clearing necessary also affects the visual impact. If a right-of-way has not been cleared for some time, and a number of small trees and brush needs cutting, the change—and therefore the visual impact and contrast—would be great.

The season, or time of year, that vegetation management activities take place can also determine potential impact on visual resources. During late-fall and winter, brown colors of treated vegetation might blend naturally with the surrounding colors, while in spring or summer, the same colors might contrast.

Potential impacts on visual resources also depend on the colors of the existing landscape, where areas dominated by green vegetation might show signs of vegetation management more than those areas where browns, grays, and other earth tones dominate.

Managing vegetation at non-electric facilities, landscaping, and parking lots, by keeping weeds removed, mowing lawns and keeping shrubbery healthy, is intended make these facilities look better. There would be no difference in visual quality associated with choice in management method.

The following sections discuss method-specific impacts of vegetation management on visual resources.

Manual Impacts

Manual techniques do not create any visual impacts particularly unique to the method. However, the greater control allowed by manual methods can serve to minimize incidental disturbances to non-target vegetation and associated impacts on visual quality.

Mechanical Impacts

Some mechanical methods such as tilling and mowing have the potential to scarify the landscape, leaving swaths of bare soil or dead vegetation that contrasts with surrounding colors. (Use of walking brush-cutters can reduce this soils impact.) Mowing can also create an uneven, ragged appearance along roadsides. Because of these effects, some mechanical techniques might be considered inappropriate for some sensitive visual quality areas (David Evans and Associates, 1996). These impacts would be temporary (one or two years) until vegetation is re-established.

Biological Impacts

Insects or pathogens do not greatly affect visual quality of the landscape. These techniques are used in large areas or noxious weed areas. The weeds tend to die slowly, so the plant might look ill for some time before other plants could take over and gain dominance. The potential for contrast between the vegetation surrounding the treatment areas and the post-treatment vegetation would exist, though the transition would be less noticeable than with other management techniques.

Herbicide Impacts

The use of chemical techniques to control vegetation can create visually unappealing brownout areas immediately following herbicide applications. This impact can be heightened if applications prevent seasonal vegetation changes (i.e., spring flowers or fall colors). As with herbicide impacts associated with recreation, these impacts on visual quality would be temporary. Vegetation would reestablish itself, and thus lessen the color contrast between treated areas and the adjacent landscape.

Debris Disposal Impacts

Scattering cut branches tends to look unkempt and disturbed.

The burning of slash piles would generate relatively minor amounts of smoke and would leave a residual blackened area of soil. The minor generation of smoke would temporarily affect visual quality. Most pile-burning occurs during fall, when winds can quickly disperse smoke.

Spread-out wood chips can create a visually appealing park-like look.

Mitigation Measures

The following mitigation measures would apply in visually sensitive areas:

- Limit use of broadcast foliar application of herbicide to reduce the creation of large areas of browned vegetation.
- *At road crossings, highways or visual overlooks,* leave sufficient vegetation, where possible, to screen view of right-of-way.
- *If the area is a very sensitive visual resource,* consider (1) planting low-growing tree seedlings adjacent to the right-of-way (or providing low-growing seedlings to landowner for planting); (2) softening the straight line of corridor edge by cutting some additional trees outside the right-of-way; or (3) if possible, leaving some low-growing trees within the right-of-way.

Air Quality

The following section discusses general impacts of vegetation management on air quality.

General Impacts

The primary potential impact on air quality, regardless of the method for clearing, would be a less-than-significant impact on Global Warming. In general, clearing results in the release of carbon dioxide from cleared vegetation into the atmosphere. Additionally, clearing reduces the carbon storage capacity of the affected land because large trees, which store carbon, are not allowed to reach maturity.

The following sections discuss method-specific impacts of vegetation management on air quality.

Manual Impacts

Dust and chainsaw exhaust generated during manual clearing activities would be localized and short-term in nature.

Mechanical Impacts

Dust and offroad-vehicle exhaust generated during mechanical cutting would be localized and short-term in nature. Emissions are expected to be slightly higher than those from manual clearing; however, the impacts on air quality due to mechanical emissions remain less-than-significant.

Biological Impacts

There would be no effect on air quality from biological methods.

Herbicide Impacts

Herbicide use does not affect overall air quality. Please see **Worker Health and Safety** for potential impacts of herbicide vapors on workers located in the immediate area. The use of mechanical means to apply herbicide would have the same impacts on air quality as mechanical methods discussed above.

Debris Disposal Impacts

Woody debris from lop-and-scatter would be left onsite to degrade gradually. Carbon contained in the debris would either be reabsorbed by new growth (approximately 50% - USEPA, 1994) or gradually released to the atmosphere as carbon dioxide. Carbon dioxide is one of the most common greenhouse gasses and is linked to global warming.

Carbon dioxide emissions from line maintenance activities would be partially offset by the regrowth of low-growing vegetation and, if some larger trees are marketed as lumber, the permanent storage of carbon in that lumber.

Burning debris would emit particulate matter, carbon monoxide, carbon dioxide, semi-volatile and volatile organic compounds. The exact amount emitted depends on the quantity and the moisture content of the debris being burned. It is important to note that only *unmarketable* debris is considered for burning (typically, 40% of the mass of a tree is marketable).

Generally, Bonneville avoids burning because soot from fires can cause flashovers from one transmission line to another, resulting in outages. Burning would not be conducted in nonattainment or maintenance areas or in areas that could affect visibility in national parks, wilderness areas, or monuments. In the unlikely event that burning is used, Bonneville will obtain burning permits from the appropriate authorities and, in Montana, join the Smoke Management Plan. If implemented, burning could have a short-term marginal impact on air quality.

Chipping would produce the same air emissions as lop-and-scatter, except that the carbon contained in chips would be released over a shorter period of time than that contained in unchipped debris.

Off-site disposal includes recycling, landfilling, and combustion in a biomass burning facility. In all three cases, carbon would be released to the atmosphere in the form of carbon dioxide. The recycling and landfilling options would release carbon slowly and would have the same impact as lop-and-scatter and chipping. The biomass burning scenario would have the same impact as on-site burning.

Mitigation Measures

The following mitigation measures would apply for public health and safety:

- Avoid removing vegetation where it will not grow up into the safety zones for the transmission line.
- *For all methods using machinery or vehicles (i.e. chainsaws, trucks, graders)* keep the equipment in good operating condition to eliminate excess exhaust.
- *Before pile burning is attempted off the right-of-way,* secure from the applicable fire control agency any required permits for burning.
- *If burning,* do not use oil, diesel, or rubber to start pile burn fires.

Social and Economic Resources

The following section discusses general impacts of vegetation management on social and economic resources.

General Impacts

The maintenance of vegetation near Bonneville facilities provides a major benefit to society and the economy by ensuring safe and reliable power. Bonneville facilities provide much of the electricity within the service area, and the maintenance of vegetation within these facilities allows for their safe and reliable operation, which in turn provides a critical resource to the economic functioning of the region. As stated in Purpose and Need (**Chapter I**), a major electric power outage occurred on August 10, 1996, caused in part by trees that had grown too close to transmission lines. The effects of this outage were widespread and illustrated the importance of reliable electricity for the everyday functioning of the region.

Other than the overall benefit of safe and reliable power, none of the alternatives is expected to significantly influence social and/or economic factors because the facilities and associated vegetation management is ongoing. In the numerous environmental studies reviewed as part of this EIS project, very few impacts on social or economic values were identified. Nevertheless, vegetation management can influence social and economic factors to some degree. For example, Bonneville's vegetation management often involves contract workers. The Program therefore provides a moderate level of employment, although (in relation to the overall economic base of Bonneville's service area) the amount of employment provided is negligible.

Impacts on socioeconomics are tied to impacts on agriculture and timber production (see **Agriculture** and **Timber Production** sections). In some cases, Bonneville vegetation management can affect adjacent commercial production of crop or forestlands. As stated elsewhere, many types of crop production are very compatible with Bonneville rights-of-way, so that those crops can be grown within the maintained corridor with little or no effect on their value or production costs. Occasionally, crops might be damaged during certain management activities. For example, fruit trees might require removal. In such cases, Bonneville compensates the landowners for the lost value. Vegetation management might also increase forage production in forested regions or, conversely, can reduce forage where non-target vegetation is removed incidentally.

Vegetation management can provide some opportunities for minor social and economic benefits associated with vegetation removal. Firewood can be made available where trees have been removed. Other forest products, including landscaping trees, can be made available to commercial and/or private collectors within maintained rights-of-way. In addition, as mentioned under **Recreation/Visual**, rights-of-way are often used by people for recreation. In urban areas, rights-of-way can provide open space and green-belt vegetation.

Noxious weeds affect economics by competing with agriculture. As stated in the **Vegetation** section, Bonneville works with local and state agencies on programs to control noxious weeds.

The following sections discuss method-specific impacts of vegetation management on social and economic resources.

Manual Impacts

As the most selective of the techniques, manual methods tend to have little effect on people, although, as with mechanical techniques, use of chainsaws and other hand tools can temporarily disturb people.

Mechanical Impacts

One of the most common mechanical treatments, mowing of roadsides, has little or no social or economic effect. However, this and other mechanical techniques can be quite noisy, and, as discussed under **Land Use**, can temporarily disturb people in their homes, work places, or while recreating.

Biological Impacts

Because of required precautions associated with biological techniques, and because of the species-specific nature of this technique, little or no adverse effect on social or economic values is anticipated, other than the potential beneficial effect of controlling noxious weeds.

Herbicide Impacts

Impacts from chemical techniques would occur if there were a spill or if spray were to drift and affect crops, grazing grasses, timber production, landscaping, or water resources. The economic impacts would be the loss of production. For example, if herbicide spray on the right-of-way drifted to adjacent timber production land and timber trees were accidentally killed before growing large enough for harvest, money would be lost from the potential sale.

Bonneville once misapplied a herbicide on a maintenance site. The herbicide ran off to a nearby stream, traveled downstream and killed many trees in its path, including some in people's yards. The economic impacts of tree replacement fell on Bonneville. The social impact of this incident on the people in the neighborhood was the anger and fear that the mistake of one person could affect them and their surroundings.

Debris Disposal Impacts

Debris disposal would have little potential social or economic impact. Some revenues and public opportunities might be foregone should wood suitable for commercial or firewood use be burned or chipped.

Consequences of Right-of-way Management Approach Alternatives

This section discusses the impacts specific to the implementation of the management approach alternatives.

Alternative MA1: Time-driven

If rights-of way were managed on a time-driven basis, vegetation would be cut or controlled on a cyclical schedule based on when the tallest trees were a near threat to a line. The maintenance activities would involve the removal of relatively tall trees (about 14 ft).

With this alternative, there is no attempt to change the vegetation structure of the right-of-way. Trees would sprout on the corridor through blown seed or root suckers. If deciduous trees dominated, cutting of those trees without herbicide treatment to stop root growth would create more densely sprouting trees. Sapling-filled corridors could develop, requiring the same or increasingly intensive maintenance with each maintenance cycle. With each cycle, there would be repeated disturbance of the right-of-way.

The environmental impacts of this repeated disturbance include potentially affecting the following: non-target vegetation (crushing, accidental treatment or removal); soils (disturbance and erosion through vegetation removal, maintenance traffic and clearing activities); water (sedimentation through erosion, increased surface runoff until revegetation); fish (temporary sedimentation reduces feeding success in the short-term); wildlife (disturbance or removal of habitats).

Impacts on land uses and land owners/managers (Agriculture, Timber, Recreation, Residential, Commercial, Industrial, USFS- and BLM-managed lands, Tribal, City County, and State) specific to this management approach would come from the repetitive and intensive maintenance disturbance on the rights-of-way (noise, dust, debris disposal, access, coordination efforts). Cultural and Historical Resources would not be specifically affected through this management approach.

Impacts on worker health and safety specific to this approach would be the potential for accidents related to working with dense, tall vegetation. Public health and safety impacts would be the slight potential for accidents to the public (such as being hit by flying vegetative debris, hurt by felling of trees, exposed to herbicide applications) during maintenance of dense tall vegetation.

Impacts of visual resources by this approach would be the drastic visual difference of clearing tall vegetation from a site and the disturbance of the right-of-way until revegetation occurs.

Impacts on air quality would be due to the repetitive maintenance activities (exhaust, dust) and the debris left to decompose, releasing carbon dioxide into the atmosphere.

This approach is not specific to the method(s) that would need to be used. Impacts associated with methods would depend on which methods were used.

Alternative MA2: Promotion of Low-growing Plant Communities

This management approach would promote the establishment of low-growing plant communities within the right-of-way. Maintenance would be conducted in a manner conducive to that establishment, including removing or treating tall-growing vegetation before it is tall enough to shade or out-compete low-growing vegetation, and being careful not to disturb low-growing vegetation during maintenance activities.

The impacts associated with this approach would be similar to those of MA1 during the first few years of implementation: the impacts of removing dense, tall vegetation. During early implementation there would also be more potential maintenance impacts and human presence on the rights-of-way to treat small trees. Once low-growing plants began to establish themselves on the rights-of-way, impacts associated with tree removal would lessen because there would be fewer trees.

The impacts of this approach would be more noticeable in forest areas. In these areas the impacts would be associated with changing the vegetation structure from one that constantly reverts back to a forest, to a structure of low-growing plants—shrubs, grasslands. This change could affect the following: vegetation (vegetation structure is changed by reducing the natural rate of tree regeneration; the area becomes a shrub- or grassland); soils (potential for soil erosion would decrease by decreasing soil exposure and creating root mats that hold soil and water); water (less erosion lessens potential sedimentation and turbidity); fish (decreased erosion-related impacts would decrease impacts on fish); and wildlife (habitat is changed to low-growing and is not in constant disturbance of cutting cycles).

Impacts on land uses and land owners/managers (Agriculture, Timber, Recreation, Residential, Commercial, Industrial, USFS- and BLM-managed lands, Tribal, City County, and State) specific to this management approach would include those associated with MA1 (noise, dust, debris disposal, access, coordination efforts). However, these impacts would decrease over time, as rights-of-way needed less intensive maintenance.

As low-growing plant communities became established, potential impacts on worker and public health and safety would decrease (less maintenance necessary means less potential for impacts).

Impacts on visual resources would be most noticeable in forested areas. The rights-of-way would be changed to low-growing vegetation cover, which might/might not be more appealing-looking than a right-of-way with a large number of saplings growing. With fewer maintenance activities needed, the right-of-way would look less disturbed.

Air quality impacts would decrease over time with the fewer maintenance activities (exhaust, dust) and relatively little debris to decompose and contribute to carbon dioxide release into the atmosphere.

The impacts of this approach associated with methods would depend on the methods used, and would categorically include impacts of herbicide methods. This approach would require, at a minimum, herbicide applications for deciduous species. Without herbicide treatment of these fast-growing species, the roots will resprout creating more dense growth with each cutting (see the **Vegetation** section, **Manual Methods,** in this chapter for details) and the establishment of low-growing plant communities would be very difficult.

As with all the methods, the use of herbicides would decrease over time as low-growing plant communities establish.

Consequences of Right-of-way Methods Package Alternatives

This section discusses the impacts specific to the implementation of the right-of-way methods package alternatives.

Alternative R1: Manual, Mechanical, Biological

Alternative R1 relies heavily on manually controlling tall-growing vegetation, with some use of mechanical methods. Noxious weed control would be done with manual and mechanical methods, and biological agents. No herbicides or growth regulators would be used.

Short-term Impacts

Short-term environmental impacts of this alternative would result from the use of manual (chainsaws) or mechanical (heavy equipment) methods to remove tall-growing vegetation.

Non-target vegetation could be crushed through tree felling, use of mechanical clearing and debris disposal. Soils are usually disturbed only slightly by manual methods (the top duff layer can be rearranged), while soil-scraping mechanical methods can cause erosion. Erosion is also possible through vegetation removal, maintenance traffic, and debris disposal. If erosion occurs, then potential sedimentation could occur if there are water bodies nearby.

Surface runoff could increase until revegetation. Oils or fuel from equipment could also potentially enter waterbodies.

Temporary sedimentation could reduce fish feeding success in the short-term. Wildlife would be disturbed through chainsaw and mechanical equipment noise. Maintenance activities could also potentially remove habitats, and soil-scraping mechanical equipment could affect soil-dwelling species.

Impacts on land uses and land owners/managers (Agriculture, Timber, Recreation, Residential, Commercial, Industrial, USFS- and BLM-managed lands, Tribal, City County, and State) would include noise, dust, debris disposal, access, and coordination efforts.

If soil were disturbed, then subsurface cultural resources might be exposed or damaged (more likely with mechanical methods than manual methods).

Worker health and safety impacts would include those for manual (chainsaw accidents, felling of trees) and mechanical (heavy equipment accidents) methods, and with working in dense vegetation. It is potentially more dangerous to cut trees on steep terrain, compared to spraying a tree with herbicide and leaving it standing. Public health and safety impacts would be the slight potential for accidents to the public (such as being hit by flying vegetative debris, hurt by felling of trees).

Vegetation disturbance (stumps and branch debris) could cause impacts on visual resources until revegetation occurs. Impacts on air quality would include exhaust, dust, and slight carbon dioxide release into the atmosphere due to debris left to decompose.

Since herbicides would not be used, there would not be the potential impacts of herbicide use, such as potential contamination.

Long-term Impacts

The indirect or long-term environmental impacts would occur in areas of deciduous vegetation, similar to the impacts of management approach MA1. When cut, deciduous vegetation would resprout with an increased number of stems, creating more thickly vegetated rights-of-way that would need to be managed even more intensively. The right-of-way would then need more extensive clearing (more vegetation per acre to be cut and removed) each maintenance cycle. When densely vegetated areas were cleared, environmental impacts would be more drastic compared to the selective removal of trees or brush. More habitat would be affected and more soil disturbed; non-target plants that have grown in shade-tolerant situations would suddenly be exposed; maintenance worker presence on the right-of-way would increase; and visual impacts would be more dramatic. Increased deciduous brush densities could also decrease vegetation diversity, and in turn decrease wildlife use of the right-of-way.

Noxious Weeds

Without the use of herbicides with this alternative, noxious weed control would be difficult, especially for weeds that do not have an approved biological control. If such weeds cannot be controlled, and spread, impacts would occur for vegetation (loss of diversity), agriculture (competition with crops), and wildlife (loss of habitat and food sources). Because such weeds are very resilient and capable of resprouting through roots, as well as from seed, mechanical or manual techniques are not very effective.

The use of biological methods (where applicable) tends not to have any adverse environmental impacts. There could be some noise disturbance if helicopters apply biological agents. Insect agents might be a food source for birds or fish. There would be no soil or water disturbance.

Mitigation Measures

With this alternative, all the mitigation measures listed in **Chapter III** would apply, with the exception of the measures for herbicide use (since this alternative does not include herbicide use).

Alternative R2:
Manual, Mechanical, Biological + **Herbicide – *spot and localized application***
(Environmentally preferred alternative)

Alternative R2 would use all methods (manual, mechanical, biological, and herbicide), but would use only spot and localized herbicide applications. Most tall-growing vegetation would be manually removed (cut with chainsaws). Spot and localized herbicide applications would be the next most used method. Mechanical methods would be used very rarely. Noxious weeds would be managed primarily with localized herbicide treatments and some biological treatments.

Short-term Impacts

The short-term manual and mechanical impacts would be similar to those of Alternative R1. However, because those methods would be used less, the impacts associated with those methods would be less.

The difference between R1's and R2's short-term impacts spring from the use of spot and localized herbicide applications. These application treatments can be very selective, so that non-target vegetation is not harmed. The slight potential for an herbicide spill would cause the biggest impact on non-target plants as well as water bodies. Applicators must take care not to apply sloppily to maintain selectivity. Herbicides have a slight potential to affect soil productivity by reducing soil microbes in small areas, but the local and spot treatments would allow the microbes to quickly recolonize from adjacent, unaffected areas. There is the potential for herbicides to wash off sprayed plants through heavy rains or over-applications and reach water bodies and fish. Herbicide movement through water runoff could kill crop plants, expose range animals, or affect timber production. Mitigation measures that include no-spray buffers around water bodies and careful consideration of weather before applying should eliminate this risk. Herbicide use could have a slight potential for wildlife poisoning.

Spot treatments of stumps have no particular visual impacts. Spot injection treatments of large trees and localized applications (i.e., backpack spraying) on clumps of vegetation can leave standing dead plants that are not visually appealing.

Worker impacts include potential repeated exposure to herbicides, especially if appropriate precautions are not taken. Exposure to herbicides could cause short-term nausea, dizziness, or reversible abnormalities of the nervous system. Prolonged, repeated, and excessive exposure can cause organ damage, immune system damage, permanent nervous system damage, production of inheritable mutations, damage to developing offspring, and reduction of reproductive success. The option to use spot or localized herbicide applications in areas of steep terrain or where it may be dangerous to fell a tree near an energized line may lessen potential physical injuries.

The potential for the public to be exposed to herbicide applications on the right-of-way is small. Exposure to herbicides could cause short-term nausea, dizziness, or reversible abnormalities of the nervous system. Herbicide applications on the right-of-way would not cause prolonged or repeated exposure to the public because of the time span between treatment cycles (every 2 – 10 years).

Long-term Impacts

Spot and localized herbicide applications *could* be used to treat deciduous plant species, depending on the Management Approach Alternative and Vegetation Selection Alternative paired with this alternative. If herbicide applications were used to treat deciduous species, then the long-term impacts would be similar to those of the management approach MA1 (Promotion of Low-growing Plant

Communities). As the regrowth of multiple stemmed sprouts is controlled and the right-of-way is converted to a shrub- or grassland, maintenance activities would become less intense and the resulting impacts would lessen over time. Wildlife habitat would also change, as the right-of-way vegetation was converted to shrub- or grassland type habitats.

Noxious Weeds

The amount of use and the impacts of biological methods would be the same with this alternative as with Alternative R1. This alternative would mainly treat noxious weeds with localized herbicide treatments. The ability to control noxious weeds is much greater with herbicides than with manual or mechanical methods; therefore, there would be much less impact due to unchecked growth of noxious weeds

Mitigation Measures

With this alternative, all the mitigation measures listed in **Chapter III** would apply, except those for broadcast and aerial herbicide applications (since these applications are not used in this alternative).

Alternative R3:

Manual, Mechanical, Biological, Herbicide – *spot, localized* + ***broadcast application*** *(current practice)*

Alternative R3 would use all methods (manual, mechanical, biological, and herbicide), with spot, localized, and broadcast herbicide applications. Most tall-growing vegetation would still be manually removed (cut with chainsaws). Spot and localized herbicide applications would be the next most used method. Broadcast herbicide applications would be used very rarely, as would mechanical methods. Noxious weeds would be managed primarily with localized herbicide treatments and some biological treatments.

Short-term Impacts

The short-term manual and mechanical impacts would be similar to those of Alternative R1. However, those methods would be used less with this alternative; therefore the impacts associated with those methods would also be less. Impacts of spot and localized herbicide applications would be the same as under R2.

The impacts specific to this alternative would be due to the additional option to use broadcast herbicide application. The applicability of broadcast is very limited on rights-of-way (the vegetation needing treatment must be close to good truck access), so its use would be small.

Impacts specific to broadcast applications include greater potential to accidentally treat non-targeted plants, because the nature of broadcast is to treat everything in an area. Broadcast applications are usually sprayed from a truck. This application has a greater potential for drift (fine clouds blowing or vaporizing to untargeted areas) than with spot or localized applications. This potential also slightly increases the potential for water contamination, fish mortality, and wildlife poisoning. Mitigation measures that include no-spray buffers around water bodies and careful consideration of weather before applying should eliminate this risk.

Potential worker exposure to herbicides would increase with this alternative because slightly more herbicide would probably be used. However, because broadcast herbicide application is done via a truck (rather than by backpack or hand application), there is actually less potential for worker contact or exposure with the chemical.

There would be a slight increase in possible public exposure, because there is more potential for drift with broadcast herbicide use and a slightly greater potential for accidentally spraying persons on the right-of-way with broadcast (compared to spot or localized herbicide applications). Broadcast treatments can leave large areas of dead standing vegetation that are not visually appealing.

Long-term Impacts

As with R2, the herbicide applications in this alternative *could* be used to treat deciduous plant species, depending on the Management Approach Alternative and Vegetation Selection Alternative paired with this alternative. The long-term impact of treating deciduous species would be similar to the impacts of R2 and of management approach MA2, Promotion of Low-growing Plant Communities (deciduous species controlled, low-growing plant communities developed, and maintenance activity impacts becoming less intense). Broadcast applications would be more likely used for corrective action treatments where large, dense stands of deciduous vegetation need removal.

Noxious Weeds

The use of biological agents and localized herbicide applications would be the same as with Alternative R2. This alternative would make greater use of broadcast treatments for noxious weeds than for tall-growing vegetation, allowing somewhat more flexibility in controlling noxious weeds. The impacts of the herbicide application itself would be as discussed above; however, because noxious weeds tend to be so invasive, there is little chance of accidentally treating non-target vegetation.

Mitigation Measures

With this alternative, all the mitigation measures listed in **Chapter III** would apply, except those for aerial herbicide application (since aerial would not be used in this alternative).

Alternative R4:

Manual, Mechanical, Biological, Herbicide – *spot, localized*, *broadcast* ***+ aerial application*** *(Bonneville Preferred alternative)*

Alternative R4 would use would use all methods (manual, mechanical, biological, and herbicide), and all herbicide application techniques (spot, localized, broadcast, and aerial). Most tall-growing vegetation would still be manually removed (cut with chainsaws). Spot and localized herbicide applications would be the most used herbicide application techniques. Aerial herbicide applications would be the next used option. Broadcast herbicide applications would be used very rarely, as would mechanical methods. Noxious weeds would be managed primarily with localized herbicide treatments, with some broadcast, aerial, and biological agent treatments.

Short-term Impacts

The short-term manual and mechanical impacts would be similar to those of Alternative R1. However, because those methods would be used less with this alternative, the associated impacts would also be less. Impacts of spot and localized herbicide applications would be the same as under R2 (except that this alternative would use localized applications somewhat less, so associated impacts would also be less). Impacts of broadcast applications would be the same as those under Alternative R3.

The impacts specific to this alternative would spring from the additional option to use aerial herbicide application. Because aerial applications are relatively non-selective, there is greater potential to treat non-target vegetation and soils. This application also has a greater potential for drift (fine clouds blowing or vaporizing to untargeted areas) than with spot or localized applications. Potential drift slightly increases the potential for water contamination, fish mortality, and wildlife poisoning. Mitigation measures that include no-spray buffers around water bodies and careful consideration of weather before applying should eliminate this risk. Additional impacts would include short-term helicopter or plane noise disturbance of wildlife and residential areas.

Where aerial spraying is used, ground-base vegetation removal is not needed, reducing *physical* damage to non-target vegetation and soils.

Less erosion would occur, as well as associated impacts such as sedimentation to water bodies and wetland or habitat degradation.

Worker exposure to herbicides is actually slightly decreased with this alternative. In the areas treated aerially, fewer workers would be involved and there would be little contact with the herbicides. There would also be some risk of aircraft accidents when flying over or under transmission lines.

The areas that would be treated aerially would not be heavily populated, so potential for public exposure shouldn't increase. However, there is a slight possibility of direct sprays if persons are on remote rights-of-way and cannot be seen by helicopter pilots. Aerial herbicide applications can leave large areas of dead standing vegetation that are not visually appealing.

Long-term Impacts

As with the other herbicide alternatives, the herbicide applications in this alternative *could* be used to treat deciduous plant species, depending on the Management Approach Alternative and Vegetation Selection Alternative paired with this alternative. The long-term impact of treating deciduous species would be similar to the impacts of R2, R3 and of the management approach MA2 (Promotion of Low-growing Plant Communities). Aerial applications would be more likely used for corrective action treatments where large, dense stands of deciduous vegetation need removal.

Noxious Weeds

The use of biological agents and localized herbicide applications would be the same as with Alternative R2. Broadcast treatments would be the same as with Alternative R3. The addition of aerial applications allows the greatest number of noxious weeds to be treated.

Mitigation Measures

With this alternative, all the mitigation measures listed in **Chapter III** would apply.

Consequences of Right-of-way Vegetation Selection Alternatives

This section discusses the impacts specific to the implementation of the Vegetation Selection Alternatives. These alternatives would be paired with any of the right-of-way methods package alternatives that include herbicide use.

Alternative VS1: Noxious Weeds

With Alternative VS1, herbicides would be used only to treat noxious weeds. The impacts associated with this alternative would be the beneficial impacts of being able to treat noxious weeds, reducing potential infestation impacts on vegetation, agriculture, and wildlife.

Potential impacts of herbicide use would be limited to only those areas of noxious weed treatment. Because herbicides would not be used on deciduous species, there would be environmental impacts associated with the increased maintenance needed to clear densely vegetated areas.

Alternative VS2: Noxious Weeds & Deciduous

The environmental impacts associated with Alternative VS2 include those associated with the use of herbicides in areas with noxious weeds and deciduous species. Impacts would be due to herbicide use, reducing potential noxious weed infestations, and being able to lessen maintenance activities through deciduous species control.

Alternative VS3: Any Vegetation

Alternative VS3 allows herbicide use to be an option to treat any vegetation. This alternative would include the beneficial impacts of reducing potential noxious weed infestations and being able to lessen maintenance activities through deciduous species control. Impacts associated with herbicide use would be greatest with this alternative because herbicides would probably be used more. Worker safety impacts from physical injury could be lessened with this alternative; herbicide treatment could be used where manual cutting might be dangerous (i.e., steep terrain).

Consequences of Electric-yard Alternatives

This section discusses the impacts specific to the implementation of the Electric Yard Program Alternative

Alternative E1: Herbicide Treatment

Under this alternative, pre-emergent herbicides would be used most frequently, with some infrequent use of post-emergent herbicides, weed burners, steamers, and selective hand-pulling.

The main environmental impacts from this alternative would occur if herbicides were to migrate off-site and into surrounding areas or water bodies. Pre-emergents tend to be persistent (remain active for a long time).

If herbicides were to move out of the application area (slight potential for runoff or leaching), non-target vegetation could be affected, water bodies or groundwater could be contaminated, and fish and wildlife could be affected. Mitigation measures, such as following weather restrictions, label instructions and buffer requirements would limit potential off site movement.

Worker exposure during application of herbicides could cause health impacts.

Mitigation Measures

With this alternative, all the mitigation measures for herbicide use listed in **Chapter III** would apply.

Consequences of Non-electric Program Alternatives

This section discusses the impacts specific to the implementation of the Non-electric Program Alternatives. The difference between the alternatives is whether herbicides are used to manage vegetation.

Alternative NE1: Mixed Methods with Herbicides

Under this alternative Bonneville would continue to contract landscaping services, maintain landscaping manually, use herbicides to suppress weeds, and apply fertilizers.

No environmental impacts would occur from hand hoeing, clipping, or weed pulling. If herbicides were to move off-site, through runoff, leaching or drift, vegetation and water resources could be affected. Noise and air pollution could occur from lawn mowers, weed whackers, and leaf blowers. Workers would be exposed to health and safety risks when applying herbicides and operating tools and equipment.

Alternative NE2: Non-herbicide Methods

No herbicides would be used under this alternative. Vegetation would be controlled using only manual methods, mechanical methods where needed, and fertilizer.

Because noxious weeds are difficult to control without the use of herbicides, the potential for noxious weeds to spread would increase under this alternative. Vegetation would have to be managed more frequently under this alternative, and visual quality could be degraded if the management cycle is too long. Noise and pollution could occur from lawn mowers, weed whackers, and leaf blowers. Workers would have some potential to be hurt with sharp objects such as clippers, and to experience back injuries from hoeing or weed pulling.

Cumulative Impacts

Cumulative impacts are defined as the effects on the environment that result from the incremental impact of the proposed action, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7).

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In this EIS, the cumulative impacts are the impacts of a Bonneville vegetation management program, together with impacts of other actions taking place throughout the Northwest.

Forest management, construction, and agricultural activities can cause impacts similar to those of the alternatives in this EIS. Because rights-of-way are linear in nature and spread out over a large geographical area, a vegetation management program would contribute relatively minor impacts when considered together with other actions in the region. For example, soil compaction that may occur where heavy equipment is used may increase erosion and diminish soil productivity. However, compared to erosion and diminished soil productivity caused from construction, farming, or logging activities, impacts caused by the vegetation management would be negligible.

The following is a description of the potential cumulative impacts that could occur from the vegetation management program when added to past, future, and reasonably foreseeable actions.

Cumulative impacts on **vegetation** include decreased plant diversity, colonization of noxious weeds in disturbed sites, the increase of trees prone to windfall along forest edges, and potential herbicide damage on non-targeted plants. **Soils** impacts include increased erosion, increased landslide potential, and reduced soil productivity.

Water bodies could be affected cumulatively through increased surface water runoff and water temperatures, reduced nutrients in water, potential groundwater and surface water contamination, and potential wetland degradation. **Fish and other aquatic species** could be affected through cumulative habitat degradation from decreased water quality (usually less than 300 m [985 ft.] of any stream is typically affected).

Cumulative impacts on **wildlife** include harassment, degraded or modified habitat (most affected in forested areas where habitat can be fragmented and thermal cover lost), and potential wildlife poisoning.

Agriculture could be affected by noxious weed and nuisance plant invasion, and crops could be damaged by potential herbicide movement off target areas. There could be additional impacts on **timber** production from potential herbicide damage on timber trees. **Recreationists** can be temporarily disturbed and displaced, diminishing recreational experiences.

Residential, Commercial, and Industrial resources can be further affected with temporary noise disturbances, conflicts with adjacent property owners' landscaping needs or desires, and increased potential for local herbicide contamination.

Additional impacts on **USFS- and BLM-managed lands** involve including various management needs and conflicts, and making appropriate amendments or changes to existing USFS and BLM resource management plans in order to gain consistency.

Cumulative impacts on **Tribal lands** include encroachment on Tribal rights to traditional use activities on ceded lands and usual and accustomed areas, and potential inconsistency with Tribal land use plans. Impacts on **City, County, and State lands** involve potential conflicts with land use plans.

Cumulative impacts on **cultural and historic resources** include potential damage to or exposure of archeological sites, harm to plants with traditional cultural value, visual intrusions on places of traditional cultural value, and temporary noise impacts in areas of traditional cultural value.

Additional **health and safety impacts** would be due to potential physical injury, and health risks from exposure to exhaust, gases, herbicides, and smoke. **Visual resources** impacts would arise from additional changes in visual contrasts and landscape appearance (most notable in forested areas). Short-term and localized dust and exhaust emissions would temporary increase in particulate emissions, reducing **air quality**.

Social and economic resources are further affected through contribution to employment (benefit), minor impacts on commercial production of crops or forestlands, and contributions to open space and green-belt vegetation in urban areas.

Effects of Short-term Uses of the Environment on Long-term Productivity

NEPA requires that EISs consider the effects of short-term uses on long-term productivity. Short-term uses of the environment are those that occur as discrete events or that can occur on a year-to-year basis. Bonneville's vegetation management program is an assortment of short-term uses: cutting vegetation or treating it to control its growth around facilities.

Long-term productivity refers to the capability of the land to provide resources for future generations. The very existence of the power facilities excludes some land from being used for any other production (in the case of substations or maintenance sites) or certain agricultural production such as timber (on transmission-line rights-of-way). The short-term use of vegetation management on these facilities tends to exclude other uses on the land. Long-term productivity has already been affected with the existing facilities, and the use of the vegetation management program does not enlarge the amount of affected land.

Irreversible and Irretrievable Commitment of Resources

Irreversible commitment of resources refers to the use of non-renewable resources such as minerals and petroleum-based fuels. Bonneville's vegetation management program would use some petroleum-based fuels for vehicles and equipment.

Irretrievable commitment of resources is that commitment that results in the lost production or use of renewable resources, such as timber or rangeland. The vegetation management program would not increase any such commitment beyond what has already occurred through the building of the facilities.

Adverse Effects that Cannot Be Avoided

Alternatives presented in this DEIS for the vegetation management program would have few unavoidable adverse effects. This DEIS has included recommended mitigation measures (see earlier discussions in this Chapter and in **Chapter III**) to avoid or reduce adverse environmental effects. The primary effect that could be considered adverse—limiting the growth of plants within and around the facilities—is intrinsic to the vegetation management program. This is not a choice in this DEIS: it was set forth when the facilities were built. Hand-in-hand with the construction of the facilities came the responsibility that they would have to be maintained, with vegetation kept a certain distance away, with diversity and successional changes affected, and the height of the vegetation controlled.

An adverse effect related to any of the alternatives would be the temporary disturbances of wildlife and their habitat in localized areas from increased human activity during vegetation maintenance activities. The presence of humans in an area is enough to disturb many wildlife species. Any of the methods that would be available for use could potentially disturb wildlife and their habitat in localized areas.

Other possible adverse effects depend on the method used to control the vegetation. With this dependence there is a question of whether or not the effects would be avoidable. For instance, vehicle traffic and some types of mechanical clearing can cause adverse soil compaction in certain soil types. It is possible that the soil compaction could be avoided by using other methods in the areas susceptible to soil compaction or by using equipment such as walking brush-cutters that disturb soils minimally.