Effects Determination Criteria Instructions for
Bald Eagle

Each proposed action should first be compared to all the conditional statements within the Activity Type All. More than one conditional statement may apply to a single proposed action, so be sure to review all conditional statements. For those conditional statements that describe the project, apply the associated criteria. The criteria in all the remaining Activity Types assume that the project meets any applicable criteria in the All Activity Type. In other words, criteria in the All Activity Type are in addition to any other applicable criteria in the remaining Activity Types.

Once you have reviewed the All Activity Type conditional statements and have applied the associated criteria, each proposed action should be compared to the individual Activity Types, Activity Components and Work Elements for additional criteria specific to elements of the proposed action.

Many criteria are based on disturbance of critical life stages and behaviors during specific seasons or within particularly sensitive portions of bald eagle habitat. For the purposes of these criteria, we have defined the following seasons and habitat terms:

Nesting territory: 400 m. radius around nest tree or as defined by a wildlife biologist based on known bald eagle use of the territory.

Nesting season: January 1 through August 15, inclusive.

Winter roosting area or winter roosting site: Site used by multiple eagles on a regular basis during the wintering eagle season. The site boundaries are delineated by local biologists.

Winter roosting season: November 1 through March 1, inclusive.

Perching habitat: Trees >18" dbh that are either within a riparian zone or within 50 m of fishbearing water or waterfowl concentration area (Stalmaster 1987). In addition, perching habitat also includes an area as defined by a wildlife biologist based on known bald eagle use.

Potential habitat: Habitat that is suitable for nesting or winter roosting by bald eagles, but is not known to be used by bald eagles.

The following terms are used in some of the conditional statements or criteria.

Potential perch tree: Snags or green trees that extend above the general level of the forest canopy. For green trees, this would include emergent trees and may include some dominant trees (see Overstory definition below for description of emergent and dominant trees).

Overstory: This includes the upper continuous canopy and the emergent trees (those individuals whose crowns fully extend above the upper continuous canopy, receiving full light from above and from the sides of the tree crown). This description is adapted from Oliver and Larson

(1996:Figure 5.3). Unlike Oliver and Larson (1996), for the purposes of this document the overstory only includes the dominant and codominant trees of the upper continuous canopy. Dominant trees are those trees with crowns extending partially above the general level of the upper canopy and receiving full light from above and partly from the side; they tend to be larger than the average trees in the stand, with well-developed crowns though possibly somewhat crowded on the sides (Smith et al 1997). Codominant trees have crowns that make up the general layer of the upper continuous canopy and receive full light from above but relatively little light from the side; the crowns tend to be medium-sized and relatively crowded on the sides (Smith et al 1997).

Because of the sensitivity of bald eagles to disturbance during particularly critical times of their life stages, the conditional statements generally focus on whether or not habitat loss occurs, how far the activity is from a nest tree or the perimeter of a winter roost site (usually at 1/4 mile, ½ mile and, in the case of blasting, 1 mile), and whether the activity is within line of sight of the roost or nest tree.

References:

Arnett, E.B., R.J. Anderson, C. Sokol, F.B. Isaacs, R.G. Anthony, and W.P. Erickson. 2001. Relationships between nesting bald eagles and selective logging in south-central Oregon. Wildlife Society Bulletin. 29:795-803.

Montana Bald Eagle Recovery Plan. 1986. Montana Bald Eagle Working Group. Montana Fish, Wildlife and Parks, Helena, Montana.

Oliver, C.D. and B.C. Larson. 1996. Forest Stand Dynamics. John Wiley & Sons, Inc. 520 pp.

Smith, D.M., B.C. Larson, M.J. Kelty, and P.M.S. Ashton. 1997. The Practice of Silviculture: Applied Forest Ecology. John Wiley & Sons, Inc. 537 pp.

Stalmaster, M. 1987. The bald eagle. Universe books, New York, NY. 227 pp.

Steenhof, K. 1978. Management of wintering bald eagles. U.S. Fish and Wildlife Service, FWS/OBS-79/79, 55 pp.

U.S. Fish and Wildlife Service. 1986. Pacific bald eagle recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 160 pp.

Species Code:	Bald Eagle
Activity Type:	**Abandoned Mine Restoration**
Activity Component:	**Mine Site/Abandoned Mine Reclamation**
Work Element:	**Close mine opeinings, adits, and stopes - gates, foam sealant, backfilling, blasting**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Blasting >1 mile from a nest tree or winter roost site and within potential habitat (see bald eagle instructions for definition).	Loss or change in habitat		See criteria under Trails and Trail Maintenance Activity Type, Construction/Reconstruction/Heavy Maintenance Activity Component, Blasting surface, subsurface, aerial Work Element		
Blasting <=1 mile from a nest tree or winter roost site, and habitat modification.	Loss or change in habitat		See criteria under Trails and Trail Maintenance Activity Type, Construction/Reconstruction/Heavy Maintenance Activity Component, Blasting surface, subsurface, aerial Work Element		
Blasting <=1 mile from a nest tree or winter roost site, and no habitat modification.	Disturbance		See criteria under Trails and Trail Maintenance Activity Type, Construction/Reconstruction/Heavy Maintenance Activity Component, Blasting surface, subsurface, aerial Work Element		

Species Code:	Bald Eagle
Activity Type:	**Access and Equipment Maintenance**
Activity Component:	**Access to work site**
Work Element:	**Access by helicopter/aircraft**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Helicopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance		See criteria under Activity Type All		

Species Code:	Bald Eagle
Activity Type:	**All**
Activity Component:	**All**
Work Element:	**All**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Project Activity Type is NOT Prescribed Fire, habitat modification occurs AND the activity meets one of the two following conditions: 1) <=1/2 mile within line of sight from a nest tree; OR 2) <=1/4 mile from a nest tree.	Loss or change in habitat	Potentially Adverse	Activity involves treatment of only the understory, no treatment of overstory.	Saving sufficient structure for future habitat.	Not Likely To Adversely Affect
Project Activity Type is NOT Prescribed Fire, habitat modification occurs AND the activity meets one of the two following conditions: 1) >1/2 mile from any (active or inactive) nest tree/winter roost site; OR 2) <=1/2 mile, but >1/4 mile and not within line of sight of a nest tree/winter roost site.	Loss or change in habitat	Potentially Adverse	Meet one of the following: 1) Project is not within a riparian zone; 2) project is within a riparian zone not used by bald eagles for foraging; OR 3) project is within a riparian zone used by bald eagles (within 1 mile of a major river/fishable water or within 0.5 mile of a major tributary containing fish, and the area contains trees >18" dbh or suitable habitat to be defined by local biologists from land management and regulatory agencies) and overstory is not removed and the prey base is maintained for foraging.	Maintain prey base and hunting perches in bald eagle habitat	Not Likely To Adversely Affect
Project Activity Type is NOT Prescribed Fire, habitat modification occurs AND the activity meets one of the two following conditions: 1) <=1/2 mile within line of sight from a winter roost site; OR 2) <=1/4 mile from a winter roost site.	Loss or change in habitat	Potentially Adverse	Only understory is treated.	Saving sufficient structure for future habitat.	Not Likely To Adversely Affect

Habitat modification occurs AND the activity meets one of the two following conditions: 1) <=1/2 mile and within line of sight from a nest tree/winter roost site; OR 2) <=1/4 mile from a nest tree/winter roost site.	Loss or change in habitat	Potentially Adverse	Create a defensible space around individual roost trees or nest trees, or around the nesting territory or winter roost site. Creating a defensible space means modifying primarily the understory, with only an occasional removal of overstory trees to reduce the risk of losing the site from fire, insect, disease, etc. If the occasional overstory tree is removed, it must not be a known roost, nest or perch tree, or have the potential for use by nesting, perching or roosting eagles. Meet ALL of the following: 1) Activity occurs outside of nesting season (January 1 - August 15) at a nest site; 2) Activity occurs outside of winter roosting season (November 1 - March 1) at a winter roost site; 3) Activity meets all other relevant criteria within this Bald Eagle Effects Determination Criteria Table	Protect functioning habitat	Not Likely To Adversely Affect
Habitat modification does NOT occur, the activity does NOT involve blasting, AND the activity meets one of the two following conditions: 1) >1/2 mile from an active nest tree/winter roost site; OR 2) <=1/2 mile, but >1/4 mile and not within line of sight of a nest tree/winter roost site.	Disturbance	No Effect	No additional criteria needed	nest tree/winter roost site is beyond affected area	No Effect
Habitat modification does NOT occur AND the activity meets one of the two following conditions: 1) <=1/2 mile within line of sight from a nest tree; OR 2) <=1/4 mile from a nest tree.	Disturbance	Potentially Adverse	Activity occurs outside of nesting season (January 1 - August 15) and project does not change the duration or level of human use during the nesting season (e.g. establishing permanent structures or upgrading existing ones: trails, roads, campgrounds, or administrative changes)	Outside of nesting season and the project will not create future disturbance during the nesting seasons.	No Effect

Habitat modification does NOT occur AND the activity meets one of the two following conditions: 1) <=1/2 mile within line of sight from a winter roost site; OR 2) <=1/4 mile from a winter roost site.	Disturbance	Potentially Adverse	Activity occurs only between 9 am and 3 pm during winter roosting season (November 1 - March 1) and project will not change the duration or level of human use during the winter roosting season (e.g. establishing permanent structures or upgrading existing ones: trails, roads, campgrounds, or administrative changes)	With daily restrictions, disturbance will be minimized and the project will not create future disturbance during the winter roosting seasons.	Not Likely To Adversely Affect
Helicoptor/aircraft <=1/2 mile from a nest tree/winter roost site	Disturbance	Potentially Adverse	Activity occurs outside of nesting season (January 1 - August 15) or winter roosting season (November 1 - March 1) and project doesn't change the duration or level of human use during the nesting/roosting season (e.g. establishing permanent structures or upgrading existing ones: trails, roads, campgrounds, or administrative changes)	Outside of nesting/roosting season	No Effect
Helicopter/aircraft >1/2 mile from a nest tree/winter roost site.	Disturbance	No Effect	No additional criteria needed	Nest tree/winter roost site is beyond affected area.	No Effect
Habitat modification does NOT occur AND the activity meets one of the two following conditions: 1) <=1/2 mile within line of sight from a winter roost site; OR 2) <=1/4 mile from a winter roost site.	Disturbance	Potentially Adverse	Activity occurs outside of winter roosting season (November 1 - March 1) and project will not change the duration or level of human use during the winter roosting season (e.g. establishing permanent structures or upgrading existing ones: trails, roads, campgrounds, or administrative changes)	Outside of winter roosting season and the project will not create future disturbance during the winter roosting seasons.	No Effect

Conditional Statement	*Effects Pathway*	*Conservation Recommendation*	*Rationale*
Activity <=1/2 mile within line of sight from a nest tree/winter roost site, or activity <=1/4 mile from a nest tree/winter roost site.	Disturbance	Close roads/trails/travel routes to all use within nest treeing habitat during the nest treeing season (January 1 - August 15) and winter roosting habitat during winter roosting season (November 1 - March 1); OR reduce or eliminate roads/trails/travel routes within nest treeing or winter roosting habitat.	Future disturbance is reduced or eliminated.
Within potential but unoccupied habitat (commonly within 1 mile of a major river/fishable water or within 0.5 mile of a major tributary containing fish) or areas defined by local biologists from land management and regulatory agencies.	Change in habitat	Create future habitat (e.g. planting nest/roost/perch tree species)	Creating habitat

Species Code:	Bald Eagle
Activity Type:	**Insect and Disease Suppression**
Activity Component:	**Aerial survey and application of insecticides and pesticides**
Work Element:	**Fixed wing/helicopter flights and application more than 1500 feet above ground**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Helocopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance	Potentially Adverse	Activity occurs outside of nesting season (January 1 - August 15) or winter roosting season (November 1 - March 1). Pesticide applied within nesting territory or winter roost site will not affect forest overstory or bald eagle prey base.	Activity occurs outside of nesting or roosting season to avoid effects during critical life history stages.	Not Likely To Adversely Affect
Helocopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance	Potentially Adverse	Pesticides are not applied (e.g. it is a survey flight only).	Aircraft is high enough above tree canopy to minimize disturbance during critical life stages. Pesticides are not applied in nesting or roosting areas, avoiding potential exposure by eagles.	No Effect

Species Code:	Bald Eagle
Activity Type:	**Insect and Disease Suppression**
Activity Component:	**Aerial survey and application of insecticides and pesticides**
Work Element:	**Fixed wing/helicopter flights and appliction less than 1500 feet above ground**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Helocopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance	Potentially Adverse	Activity occurs outside of nesting season (January 1 - August 15) or winter roosting season (November 1 - March 1). Pesticide will not affect forest overstory or bald eagle prey base.	Activity occurs outside of nesting or roosing season to avoid effects during critical life history stages.	No Effect

Species Code:	Bald Eagle
Activity Type:	**Mechanical Treatments**
Activity Component:	**Logging Systems and Operations**
Work Element:	**Helicopter**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Helicopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance		See criteria under Activity Type All		

Species Code:	Bald Eagle
Activity Type:	**Prescribed Fire**
Activity Component:	**All except where otherwise noted**
Work Element:	**All except where otherwise noted**

This Work Element does NOT include Fireline Construction/Holding Actions Activity Component, Explosive built fireline Work Element

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Within nesting territory (See bald eagle instructions for definition)	Change in habitat	Potentially Adverse	Overstory trees are not lost as a result of activities associated with the following Activity Components: Fire Support; Fireline Construction / Holding Actions; Helicopter Landing Sites and other Operational Facilities; and Mop-up. Loss of overstory trees as a result of the burning itself is allowed if it meets ALL of the following: 1) Protect all nest trees, as well as adjacent trees whose crowns touch the nest tree, from fire and mechanical damage; 2) Protect known and potential perch trees from fire and mechanical damage; 3) Retain patches of young trees (generally in unburnt or low-intensity burn areas) as a recruitment source of future overstory trees; 4) Minimize mortality to trees of desired species, size, and structure, with no more than 20% mortality of the basal area of overstory trees; AND 5) activity occurs outside of nesting season (January 1 - August 15).	1) Protect nest tree and adjacent trees that may influence nest tree characteristics; 2) Retain adequate perch trees within the nesting territory; 3) Provide for recruitment into overstory; 4) Retain forest canopy characteristics conducive to use by nesting bald eagles (Arnett et al. 2001); 5) Outside of nesting season to minimize disturbance during critical life history stage.	Not Likely To Adversely Affect
Within winter roosting area (See bald eagle instructions for definition)	Change in habitat	Potentially Adverse	Overstory trees are not lost as a result of activities associated with the following Activity Components:	1) Provide for recruitment into overstory; 2) Retain the characteristics of	Not Likely To Adversely Affect

			Fire Support; Fireline Construction / Holding Actions; Helicopter Landing Sites and other Operational Facilities; and Mop-up. Loss of overstory trees as a result of the burning itself is allowed if it meets ALL of the following: 1) Retain patches of young trees (generally in unburnt or low-intensity burn areas) as a recruitment source of future overstory trees; 2) Minimize mortality to trees of desired species, size, and structure, with no more than 20% mortality of the basal area of overstory trees; AND 3) activity occurs outside of winter roosting season (November 1 - March 1).	the forest canopy, especially thermal characteristics of the roost stand; 3) Outside of winter roosting season to minimize disturbance during critical life history stage.	
Within perching habitat (See bald eagle instructions for definition)	Change in habitat	Potentially Adverse	Overstory trees are not lost as a result of activities associated with the following Activity Components: Fire Support; Fireline Construction / Holding Actions; Helicopter Landing Sites and other Operational Facilities; and Mop-up. Loss of overstory trees as a result of the burning itself is allowed if it meets ALL of the following: 1) Where a local biologist has identified known or suspected perch trees, protect these trees from fire and mechanical damage; 2) Retain patches of young trees (generally in unburnt or low-intensity burn areas) as a recruitment source of future overstory trees; 3) Minimize mortality to trees of desired species, size, and structure, with no more than 25% mortality of the basal area of overstory	1) Protect perch trees used by bald eagles; 2) Provide for recruitment into overstory; 3) Retain adequate perch trees from which foraging is likely to occur; 4) Outside of time of year when eagles may use area during a critical life history stage.	Not Likely To Adversely Affect

			trees;AND 4) activity occurs outside of nesting season (January 1 - August 15) if used by nesting eagles, or outside of winter roosting season (November 1 - March 1) if used by winter roosting eagles.		
Potential for smoke >1/2 mile from a nest tree or winter roost site.	Disturbance	No Effect	No additional criteria needed	Nest tree or roost site is beyond the affected area.	No Effect
Potential for smoke <=1/2 mile from a nest tree or winter roost site.	Disturbance	Potentially Adverse	Burn occurs outside of nesting season (January 1 - August 15) in nest habitat or outside of winter roosting season (November 1 - March 1) in winter roost habitat.	Outside of nesting/roosting season, species is not present or will not affect critical life history.	No Effect
Helicopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance		See criteria under Activity Type All		
Potential for smoke <=1/2 mile from a nest tree or winter roost site	Disturbance	Potentially Adverse	If burn occurs between January 1 and August 15 in nesting habitat or between November 1 and March 1 in winter roost habitat, then meet ALL of the following: 1) Smoke management guidelines are followed; 2) nest tree or edge of winter roost site is not within 1/4 mile of the fire edge; 3) wind direction is not towards nest or roost site; AND 4) nest or roost site is not located where evening inversions will be severe and smoke concentration intense.	Smoke movement and dispersion patterns are considered to minimize effects to species.	Not Likely To Adversely Affect

Species Code:	Bald Eagle
Activity Type:	**Prescribed Fire**
Activity Component:	**Fireline Construction/Holding Actions**
Work Element:	**Explosive built fireline**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Blasting <=1 mile from a nest tree or winter roost site, and habitat modification.	Loss or change in habitat		See criteria under Trails and Trail Maintenance Activity Type, Construction/Reconstruction/Heavy Maintenance Activity Component, Blasting surface, subsurface, aerial Work Element		
Blasting <=1 mile from a nest tree or winter roost site, and no habitat modification.	Disturbance		See criteria under Trails and Trail Maintenance Activity Type, Construction/Reconstruction/Heavy Maintenance Activity Component, Blasting surface, subsurface, aerial Work Element		
Blasting >1 mile from a nest tree or winter roost site and within potential habitat (see bald eagle instructions for definition).	Loss or change in habitat		See criteria under Trails and Trail Maintenance Activity Type, Construction/Reconstruction/Heavy Maintenance Activity Component, Blasting surface, subsurface, aerial Work Element		

Species Code:	Bald Eagle
Activity Type:	**Range Infrastructure**
Activity Component:	**Rangeland Restoration**
Work Element:	**Seeding - aerial**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Helicopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance		See criteria under Activity Type All		

Species Code:	Bald Eagle
Activity Type:	**Threatened, Endangered Species Habitat Restoration**
Activity Component:	**Monitoring Fish and Wildlife**
Work Element:	**Aerial Wildlife Counts**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Helicopter/aircraft <=1/2 mile from a nest tree or winter roost site	Disturbance		See criteria uner Activity Type All		

Species Code:	Bald Eagle
Activity Type:	**Trails & Trail Maintenance**
Activity Component:	**Construction/Reconstruction/Heavy Maintenance**
Work Element:	**Blasting - surface, subsurface, and aerial**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Blasting >1 mile from a nest tree or winter roost site and within potential habitat (see bald eagle instructions for definition).	Loss or change in habitat	Potentially Adverse	Activity does not remove or degrade potential nesting or roosting habitat or does not remove overstory.	Maintain prey base and hunting perches in potential eagle habitat.	Not Likely To Adversely Affect
Blasting <=1 mile from a nest tree or winter roost site, and habitat modification does NOT occur.	Disturbance	Potentially Adverse	Activity occurs outside of nesting season (January 1 - August 15) if in nesting habitat, or outside of winter roosting season (November 1 - March 1) if in winter roosting habitat and project does not change the duration or level of human use during the nesting/winter roosting season (e.g, establishing permanent structures or upgrading existing ones: trails, roads, campgrounds, or administrative changes)	Outside of nesting/roosting season and the project will not create future disturbance during the nesting or roosting seasons. While eagles may still occur in the area, activity is not occurring during their critical life history stages.	Not Likely To Adversely Affect
Blasting >1 mile from a nest tree or winter roost site and not within potential habitat (see bald eagle instructions for definition)	Disturbance	No Effect	No additional criteria needed.	nest tree / winter roost site is beyond area affected by the blast.	No Effect
Blasting <=1 mile from a nest tree or winter roost site, and habitat modification DOES occur.	Loss or change in habitat	Potentially Adverse	Blasting occurs between January 1 and August 15 in nesting habitat or between November 1 and March 1 in winter roost habitat. Cannot develop criteria at this scale; neet to develop criteria at the local level.	Cannot develop criteria at the regional scale	Potentially Adverse

Species Code:	Bald Eagle
Activity Type:	**Weeds and Chemical Treatments**
Activity Component:	**Herbicide Control**
Work Element:	**Aerial application by fixed wing or helicopter**

Conditional Statement	*Effects Pathway*	*Potential Effect*	*Project Criteria*	*Rationale*	*Final Effect*
Helicopter/aircraft <=1/2 mile from a nest tree or winter roost site.	Disturbance and habitat alteration.	Potentially Adverse	Activity occurs outside of nesting season (January 1 - August 15) or winter roosting season (November 1 - March 1). Herbicide applied within nesting territory or winter roost site will not affect forest overstory or bald eagle prey base.	Activity occurs outside of nesting or roosting season to avoid effects during critical life history stages.	Not Likely To Adversely Affect
Helicopter/aircraft >1/2 mile from a nest tree/winter roost site.	Disturbance		See criteria under Activity Type All		

ACTIVITY TYPE

Abandoned Mine Restoration

Restoration requires implementation of work activities and elements that will render an abandoned mine safe for human health and environmental function. Hard rock abandoned mines and mills typically have several features that pose a risk to human health, safety, and the environment. These include waste rock dumps and tailings that contain and release hazardous substances such as lead, arsenic, copper, zinc and other metals. Mine and mill sites may also have abandoned hazardous chemicals that were used to extract metals. Safety problems include hazardous mine openings (shafts and adits), unstable slopes on open pits, unstable buildings and other abandoned mining equipment. Dredge piles and tailings from abandoned placer mines can be major sources sediment and have the potential to have mercury contamination.

Pre-construction activities include assessments, inventories and site investigations to determine if mine features such as waste rock dumps and tailings have a release or threat of a release of a hazardous substance. If there is a release or threat of release of a hazardous substance, the Forest Service uses the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, as defined in the National Contingency Plan, for documenting, designing and reclamation of sites. Reclamation of Non-CERCLA sites follow the NEPA process. Mine and mill wastes containing CERCLA hazardous materials are typically removed and placed in an engineered on-site repository or are treated and reclaimed in place. Non-CERCLA mine features, such as placer tailings, are typically stabilized to prevent erosion. Mine openings are closed in a variety of ways depending on the site's location, environmental features, and concerns for other resources. Other actions may include restoring hydrological function and stream channels, and re-vegetating areas.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Related work elements may be found in **Access and Equipment Maintenance Activity Type** regarding access and heavy equipment use and maintenance. Almost all of the work elements associated with abandoned restoration requires the use of heavy and mechanized equipment. Related work elements may be found in **Roads and Roads Maintenance Activity Type** regarding Roads and Roads maintenance that may be needed for abandoned mine restoration. Related work elements may be found in **Prescribed Fire Activity Type** regarding camping that may be needed for abandoned mine restoration.

Mining Waste Cleanup

Abandoned mines features, such as waste rock dumps or mill tailings may contain hazardous substances as defined by CERCLA. Leachate produced from waste rock and tailings may contaminate soils and streams. Waste rock dumps, mill tailings and contaminated soils are typically excavated and removed to an on-site engineered repository. Repositories are typically excavated in a geologically suitable area and may or may not have a bottom liner. The repositories are typically capped using a geosynthetic clay liner and soil cover to minimize

rainwater and snow melt infiltration. Restoration consists of standardized practices that include the following activity components and their associated work elements:

Junk Removal - Mining waste cleanup may require removal of non-hazardous wastes in the form of wood, metals, household junk, and other trash left at the site after the mining operations ceased. These wastes can be collected and transported to a landfill.

Preliminary Assessments, Inventories, Analyses (e.g., Site Investigations, Engineering Evaluation/Cost Analysis and Design) - Assessments, inventories, and site investigations of abandoned mines are performed to characterize and identify hazardous substances that may be present in the mining wastes and other abandoned mine features. If the site is identified as a CERCLA site, an *Engineering Evaluation/Cost Analysis and Design* is performed to determine the appropriate reclamation alternative.

Contaminated Soil Removal – Soils contaminated from leachate from mine wastes such as waste rock dumps or tailings, are typically excavated and removed to an on-site engineered repository. Repositories are typically excavated in a geologically suitable area and may or may not have a bottom liner. The repositories are typically capped using a geosynthetic clay liner and soil cover to minimize rainwater and snow melt infiltration.

Barrel Removal - Sampling may be required to determine the presence and identify of hazardous substances within abandoned barrels/drums. If hazardous substances are present, removal typically involves over-packing the barrel in a larger, plastic drum. Barrels are then removed from the site to an appropriate disposal site.

Reclamation Plan Implementation – This includes the implementation of the prepared reclamation plan and design. It may require all of a combination of all of the work elements included within this activity type.

Mine Site/Abandoned Mine Reclamation

Abandoned mines may have mill tailings (crushed ore waste piles) left over from the extraction of desired economic minerals. Prior to regulation, tailings were typically disposed into streams or drainage ways adjacent to the mill. Typical reclamation includes excavation of tailings and contaminated soil and placed in an engineered repository. The stream is then reconstructed to as near as natural conditions as feasible.

Related work elements may be found in **Roads and Roads Maintenance Activity Type** regarding Roads and Roads maintenance that may be needed for abandoned mine sites.

Restore Surface Flow/Floodplain Reclamation - Reclamation includes excavation of tailings or waste rock possible reestablishment of water flow into historic floodplains, replacing cover soils, and re-vegetation with appropriate native species.

Mine Shaft Backfilling – If bat habitat is not an issue, mine shafts are typically backfilled using non-contaminated local materials. Use of polyurethane foam is commonly used in remote areas.

If the shaft cannot be effectively backfilled, an engineered plug is often used to close the opening.

Removal Of Hazardous Waste (Hazmat) – The removal of Hazmat materials and garbage removal is consistent with **Mining Waste Clean-Up Activity Component** described above. Typical reclamation includes excavation of tailings and contaminated soil and placement in an engineered repository.

Close Mine Openings, Adits, and Stopes - Gates, Foam Sealant, Backfilling, Blasting – This is the process of physically blocking an opening used for mining operations leading underground. Mine openings may be closed with bat-friendly gates if the mine has bat habitat, or the closure can be completely blocked with the use of a *foam sealant*, or *backfill* (see *Mine Shaft Backfilling* above). Explosives may be used to *blast* surrounding rock to create a rock fall in front of the opening.

Wetlands Reclamation - Remove Contaminated Soil - Soils that are contaminated from leachate from mine wastes, such as waste rock dumps or tailings, are typically excavated and removed to an on-site engineered repository. Repositories are typically excavated in a geologically suitable area and may or may not have a bottom liner. The repositories are typically capped using a geosynthetic clay liner and soil cover to minimize rainwater and snow melt infiltration. Reclamation also includes re-vegetation with appropriate native species.

Wetlands Reclamation - Restore Stream Channel –Large surface mining operations, placer mining activities, and the dumping of waste rock or tailings from hardrock mining can alter stream channels. To restore proper channel flow, mining wastes are typically excavated and removed from the stream channel. Wastes that contain hazardous substances are placed in an engineered repository. Non-hazardous wastes are typically reshaped and used for stream reconstruction. The stream channel is reconstructed with design features to ensure a properly functioning stream system.

Wetlands Reclamation – Construct Repository - Repositories are typically not located in wetlands. Repositories are typically excavated in a geologically suitable area and may or may not have a bottom liner. The repositories are typically capped using a geosynthetic clay liner and soil cover to minimize rainwater and snow melt infiltration.

Tailings Impoundment Rehabilitation - Water Management **-** Rehabilitation by *s*tabilization of large, constructed tailings piles that were formed like a reservoir; a dam is placed at the lower end, with tailings flowing out in the form of slurry behind the dam.
Reclamation of tailings dams includes stabilizing existing dam features or replacing features to within acceptable risk factors, reshaping , stabilizing and capping the tailings in place, and complete excavation of tailings to and engineered repository.

Tailings Impoundment Rehabilitation - Cap Impoundment – This typically includes reshaping piles, installation of water management system, and placing a cap that includes cover soil and may include an impermeable liner.

Dredge Tailings Restoration - Aerial surveys (including Photography and Hydrologic Analysis) – Determination of the extent of dredge tailings piles from placer mining and analysis of the original stream functions.

Dredge Tailings Restoration - Tailings Redistribution - Redistribution of dredge tailings from placer mining, according to plans, is a major activity associated with this type of restoration. This activity is used to stabilize large, undulating piles of unsorted cobbles, gravels, and rocks usually found in, and adjacent to old stream channels left from large floating dredges used for gold mining.

Dredge Tailings Restoration - Restore Channel Flow – Large surface mining operations, placer mining activities, and the dumping of waste rock or tailings from hardrock mining can alter stream channels. To restore proper channel flow, placer tailings are typically excavated and removed from the stream channel and may be reshaped and used for stream reconstruction. The stream channel is reconstructed with design features to ensure a properly functioning stream system

Groundwater Control - Reroute - Rerouting contaminated surface waters through a water treatment facility, either active or passive, can mitigate further groundwater contamination, or prevent possible contamination if none currently exists.

Groundwater Control - Treat - Treatment can include capturing the contaminated ground water through trenching or drilling and then installing above ground facilities to treat the contaminated water. Another method includes the installation of reactive barriers to remediate contaminated ground water by removing the toxic materials. This usually involves construction of a trench in the path of the groundwater and filling it with reactive materials (e.g., carbon-based materials, such as horse manure, that extract toxic metals).

Groundwater Control - Test - Groundwater must be *investigated* that includes sampling and chemical analysis and geohydrologic analysis to determine extent of any contamination.

Mine Waste Dump Removal - Treat – Perform a site investigation of the waste rock to characterize and identify hazardous substances that may be present. If the site is identified as a CERCLA site, an *Engineering Evaluation/Cost Analysis and Design* is performed to determine the appropriate reclamation alternative. Reclamation alternatives include removal of waste rock and associated contaminated soils to an engineered repository and reclaiming in place by stabilizing waste piles, treating waste rock, placing cover soil, and re-vegetating using appropriate native species. Non-CERCLA waste rock dumps are typically reclaimed to prevent erosion of the material.

Mine Waste Dump Removal – Test – Removal involves first testing materials to determine if contents are hazardous.

Mine Waste Dump Removal - Inventory and Monitor (including Preliminary Assessments) – Abandoned mine site inventories and preliminary assessments provide information to begin

prioritization of projects. Where advantageous, AML watershed characterizations are performed to assess the AML impacts to a watershed, to determine each mines contribution to the impacts, and to assess and perform monitoring activities. Monitoring activities begin prior to abandoned mine reclamation and continue for several years after reclamation.

Mine Waste Dump Removal - Re-vegetation – GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** *Seeding – aerial Work Element* for a description of aerial seeding. GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** *Seeding – disking, drilling, fertilizing, plowing Work Element* for a description of non-aerial seeding. GO TO **Reforestation Activity Type, Hand plant upland/riparian Activity Component,** *Plant trees and shrubs with hoe, bar, auger Work Element* for a description of planting trees and shrubs. Other activities covered by this Work Element are described as follows: Re-vegetation is a component for most reclamation activities. Typically, cover soil is placed over excavated areas or placed or mixed in with treated wastes/soils. These areas are seeded and/or planted with appropriate native species. See **Weeds and Chemical Treatments Activity Type** for additional information concerning re-vegetation activities.

ACTIVITY TYPE: Access and Equipment Maintenance

ACTIVTY COMPONENTS AND WORK ELEMENTS

Access to Work Site

All activity types require some form of access to the work site and travel within the site. Access refers to mobilizing work crews, and the delivery and hauling of equipment, materials, and supplies needed to carry out the activity components and their associated work elements.

Access by Foot or Pack Animal - Access and mobilization to reach and maneuver around the work site would be accomplished on foot, or with pack animals (e.g., horses, mules, llamas and even goats). Pack animals or travel by foot may be needed to access areas that cannot physically be accessed by a road system or by mechanized vehicles. These areas may include but are not limited to, wilderness and roadless areas, areas with seasonal or year round access restrictions (e.g., wildlife concerns), or watersheds with erosive or unstable soils. Roads often have seasonal closures to protect lambing and calving, or during wet periods when roads are subject to damage by erosion. Pack animals and travel by foot can only be used, however, when the work activity does not require the use of heavy equipment or large quantities of material (e.g., fencing supplies, gravel, soil, or large structures).

Access by Vehicle on Roads, within Normal Use Patterns – Access by vehicles within normal use patterns may include travel with passenger vehicles (for crews); all terrain vehicles (ATVs); snowmobiles and other over-the-snow machinery; large and small sized trucks; and trucks hauling heavy machinery, logs, or other materials that require the use of a dump truck (e.g., soil, gravel, poles, or any number of other supplies). Vehicular use on system roads and designated off road areas would generate expected and more predictable levels of disturbance or risk to

other resources.

Access by Vehicle or ATV Off Roads or Outside of Normal Use Patterns – All of the mechanized vehicles mentioned in the previous Work Element may be used under this activity as well. This type of travel includes travel on closed roads, travel off of designated roads and trails, and use of roads and trails outside of normal restrictions. The frequency, duration and level of disturbance generated from mechanized vehicle, heavy equipment and power tools outside of what is considered normal, may cause erratic, continuous, or higher levels of disturbance and increased damage to certain resources. For example, travel off-roads and onto undesignated trails or areas with no trails, may alter normal wildlife use patterns, increase soil erosion and compaction in susceptible areas (e.g., wet meadows, streams, or sensitive plant communities), or spread weeds into previously unoccupied areas.

Work activities during fire suppression, prescribed fire, or any other work activity related to rehabilitation may need to occur outside of normal use patterns. In some cases, salvage efforts post fire may require access and associated road or off road use for long periods of time, may require higher numbers of log hauling trucks, larger crews, or road maintenance (e.g., grading and dust management) at high frequency intervals.

Rangeland rehabilitation efforts may require off-road access, larger crews and the hauling of materials to rebuild fences or water developments.

Access by helicopter/aircraft – Some work sites or distribution points may need to be accessed by helicopter or aircraft for transporting crews, aircraft equipment, materials and supplies. Aerial access may occur for any number of reasons including emergency situations and the immediacy of work needed, or the sites location relative to roads or trails. No construction of new landing strips for fixed-wing aircraft would occur.

Fueling/Maintenance

Vehicles used to travel to worksites, and heavy equipment and power tools used at worksites may need re-fueling and maintenance throughout the duration of the work activities. It is not always practical or possible to re-fuel and conduct maintenance at a development such as a warehouse.

Fueling/maintenance of Light Equipment on Site - Chain saws, augers, and other lighter power tools can be refueled and serviced at the site with little to no risk to other resources.

Fueling/maintenance of Heavy Equipment on Site – Bulldozers, graders, backhoes and other heavy machinery and equipment will need re-fueling and maintenance during work activities, and it may not always be practical to do this at a development such as a warehouse. Heavy equipment may require the use of high volumes of fuel, and repair and maintenance may be frequent. The risk of spilling substantial amounts of fuel or cleaning substances, and/or accidental release of other toxic substances, may increase.

Normally, a site is designated where these activities can safely occur. Sometimes it may not

always be possible to reach these sites if equipment runs out of fuel or if equipment fails and needs immediate repair. In all circumstances certain habitats should be avoided, including wetlands, streamside riparian areas and habitats with sensitive plants, to name a few.

ACTIVITY TYPE: **Defensible Space**

Defensible space is an area, typically 30 to 120 feet wide that lies between improved property with human structures, and potential wildland fire areas. It is within this space that combustible materials are removed or modified making them safer for fire operations to defend and protect the structures.

The threat to life and property from wildfire is a significant issue for federal, state, and local fire planning agencies responsible for protecting residential areas (and their associated structures) in close proximity to wildlands. This issue is currently at the forefront of fire management and protection policies at national and local levels. Areas determined susceptible to threat of wildland fire are called wildland-urban interfaces (WUI).

The WUI consists of areas with human populations and structures, as well as other areas of special significance that lie within or adjacent to wildland areas. Developed areas on private, state and federal lands that may need fuel reduction treatments include but are **not** limited to: private residences, recreation and business centers, campgrounds, communication towers, high voltage transmission lines, church camps, scout camps, research facilities, summer homes or ranger stations, ranches, outbuildings, and municipal watersheds.

Treatments that may be used to reduce the risk of wildland fire or create defensible space are not limited in application to communities, private residences, or other private structures. These treatment applications may be implemented for any public facility or structure, or area of special significance that occurs on state or federal lands.

Related work elements may be found in: **Mechanical Treatments Activity Type** regarding tree felling, hazard tree removal, thinning, and piling; **Prescribed Fire Activity Type** regarding fire and camping; **Reforestation Activity Type** regarding planting; **Weeds and Chemical Treatments Activity Type** regarding weeds; and **Access and Equipment Maintenance Activity Type** regarding access and fueling issues.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Fuels Reduction

Remove Plants or Plant Parts – The removal and/or reduction of flammable plants and plant parts such as dead trees, branches, flammable brush, grasses and leaves is a common practice. Fuels reduction treatments may include under or overstory thinning, selective tree harvest or complete removal of dense forest stands. Other important treatments include pruning dead wood from shrubs, removing low tree branches, mowing dried grass, and/or piling brush and down trees for removal or subsequent burning under safe conditions.

Replace Flammable Plants with Less Flammable Plants – An example of this work element is replacing highly flammable shrubs with irrigated and well-maintained flowerbeds and lawns.

Structure Modifications

Structures would include homes and their associated buildings, developments and structures within administrative sites, or any others that may or may not be listed above.

Replace Flammable Roof Materials – Replace flammable roof materials (e.g., cedar shingles) with "Class C" fire resistant roofing (metal or asphalt) or better.

Remove Ignitable Materials Surrounding Structures – Some examples include: removing ignitable materials from around chimneys, within gutters, off sidewalks or any other home, lawn, or structural features and attachments that may collect ignitable materials.

ACTIVITY TYPE: Forest Products

Activities include collection and gathering of products other than those related to mineral or saw-timber removal operations. All activities require collection permits whether for personal or commercial uses. Activity levels vary from minimal, to potentially disturbing, depending on the density and collection locations across a unit. Activities may require the use of heavy equipment and power tools as well as off-road travel and/or increased access to previously undisturbed sites. These activities will not require new road construction or reconstruction, but in rare circumstances, opening a closed road may be needed. Related Work Elements may be found in **Mechanical Treatments Activity Type** regarding felling, thinning and hazard trees, **Access and Equipment Maintenance Activity Type** regarding access and fueling, **Prescribed Fire Activity Type** regarding fire and camping, and **Defensible Space Activity Type**.

To manage activities of potentially high densities of people and to minimize resource damage, appropriate campsites and sanitation facilities must be provided. Soil and plant compaction, and/or road closure violations may occur. Campers located near water sources should be kept from having an impact on riparian areas, fish and efforts made to minimize potential effects to listed species such as bald eagles. Proper camp location, law enforcement involvement, and education should help avoid any adverse effects.

ACTIVITY TYPES AND WORK COMPONENTS

Firewood Collection

Collect Firewood from Already Downed Sources (e.g., hazard tree removal, road maintenance, etc.) - Firewood collection may require the use of heavy equipment. Access and hauling activities may pose concerns. Firewood collection for both personal and commercial use will require a permit. Although commercial operations are managed, personal collection may or may not be managed, depending on the geographic area. Personal firewood permits allow for the collection of ten cords of wood per year / per person. These cords may be sold under one or

more permits. The number of cords of wood allowed for collection under a commercial permit will vary by administering unit. The amount of woody material taken from a site should not exceed amounts required by the administering units' standards and guidelines for dead and down material. See the **Access and Equipment Maintenance** and **Roads and Roads Maintenance Activity Types** for additional information

Fruits, Berries and Nut Harvest

Hand Picking and Raking of Edible Berries - Post-disturbance there may be an increase in the availability of fruits, berries, and nuts, depending upon the site, habitat type, and extent of a burn. The scope of activity is similar to that identified under mushroom harvest relative to campsites, human densities and potential resource damage apply (see **Mushroom Harvesting Activity Component** below).

Greenery Harvest – Total Removal

Digging of Species for Complete Removal **–** Collection of boughs, ferns, or any other plants used in ornamental commodities is allowed under permit for personal and commercial operators. No significant increase in any additional management is expected. In burned areas, no harvest is expected.

Moss Harvesting

Moss Removal **–** Moss collection is not expected to increase above normal levels or to occur in burned areas.

Mushroom Harvesting

Removal of Fungi – Large numbers of people can be expected, under permit, to personally or commercially harvest mushrooms such as morels, *Morchella esculenta,* in burned areas. Morels come in after disturbance and usually last three to four years each spring for approximately a three-week period.

Raking of Soil Substrate/Mycelium - Harvest techniques do not require raking for detection or collection. Therefore, soil substrate disturbance will be minimal.

Seed Collection

GO TO **Reforestation Activity Type, Collection of Plant Propagation Materials Activity Component** for a description of work elements related to collecting seed or other plant propagation materials.

Tree and Shrub Removal

Complete or Partial Removal of Trees or Shrubs **-** Collection of whole or partial plant parts used in ornamental commodities (e.g., scorched bark, root wads, picture frames, fence posts,

landscape design) is allowed under permit for personal and commercial operators in areas previously impacted by wildland fires. The amount of trees or shrubs removed would be small and scattered in nature. See the **Mechanical Treatments Activity Type** for additional information.

Public Access

Public Access **-** See the **Access and Equipment Maintenance Activity Type** for implementation information

ACTIVITY TYPE: Insect and Disease Suppression

ACTIVITY COMPONENTS AND WORK ELEMENTS

These projects cover a wide variety of insect and disease prevention and suppression activities. Insects and diseases can increase stand flammability by causing mortality and increasing slash. In addition to increased mortality, dwarf mistletoe infestations increase stand flammability by creating ladder fuels. Some of the work elements that have primary objectives covered by other activity types and components are not detailed here (e.g., reforestation; thinning of forested stands; prescribed fire).

Related Work Elements may be found in: **Mechanical Treatments Activity Type** for felling, thinning, and hazard trees; **Roads and Roads Maintenance Activity Type** for snowplowing; **Prescribed Fire Activity Type** for fire and camping; **Reforestation Activity Type** for planting; and **Access and Equipment Maintenance Activity Type** for access and fueling activities**.**

Aerial Survey and Application of Insecticides and Pesticides

Aerial surveys are used to determine status, extent, and intensity of defoliation or mortality from insects, diseases, or other agents (i.e. bear damage). .

Fixed Wing/Helicopter Flights and Application less than 1500 feet above ground – Special surveys that require close inspection by helicopters are typically conducted 100 to 500 feet above treetops. Fixed wing aircraft or helicopters flying within 50 feet of the treetops and in swaths of about 150 feet apply insecticide. Only Environmental Protection Agency (EPA) approved insecticides are used and all applications follow label directions and precautions. Mitigating actions required by an Environmental Assessment (NEPA document), or Record of Decision (ROD), are included in the contract. Bulk tankers transport insecticide over forest roads. Water, if needed, is pumped from rivers or streams (see the Prescribed Fire Type for water drafting and water pumping).

Fixed Wing/Helicopter Flights and Application greater than 1500 feet above ground - Fixed wing flights are typically conducted about 1,500 feet above treetops, traversing the area in a grid with 4-mile wide swaths, or by contour flying in deeply dissected terrain.

Fertilization

Hand Application of N-Frells - Fertilization can enhance stand vigor and promote resistance to insect and disease-related mortality, and subsequent risk of fire. Nitrogenous compounds in the form of pellets *(N Pellets)* or frells *(N Frells)* can be applied by hand using a hand-crank fertilizer spreader.

Ground Applications of Pesticides

Back-pack Spraying or Inoculation of Individual Trees with Insecticide – Insecticide is applied to protect individual high-value trees using backpack or hydraulic sprayers. Only EPA registered insecticides are used and all applications follow label directions and precautions. Mitigating actions required by the NEPA document or Record of Decision (ROD), are included in the contract. Insecticide in small quantities (less than 50 gallons) is transported by small truck to the treatment sites. Occasionally, implants of a systemic insecticide are placed by hand into individual trees.

Borax Treatment of Freshly Cut Stumps - To prevent the spread of annosus root disease, large freshly cut stumps are covered with a thin film of borax powder to prevent germination of *Heterobasidion annosum* spores. Borax may be applied manually or mechanically, using an attachment to the felling equipment.

Ground Survey

Walking Survey - Walking surveys are used to determine status of insects and diseases, or to "hazard rate" stands to identify those susceptible to insects or diseases before and after fire. A survey of stands is conducted in a manner similar to a forest inventory. One or two people traverse stands and take non-destructive measurements of the vegetation and site. Occasionally roots or boles are chopped to detect or verify insects or diseases. Some surveys establish semi-permanent plots. These surveys are conducted where areas are fully accessible on foot. See the **Access and Equipment Maintenance Activity Type, Access to work site Activity Component** for additional information.

Manual Treatments

Manual and mechanical treatments (see **Mechanical Treatments Activity Component** below) reduce stand susceptibility to insect and disease-caused mortality and consequently reduce fire risk. Treatments reduce stand density, remove infested trees, remove trees at high risk of becoming infected (for example scorched trees), alter stand structure, or convert stands to less susceptible species. Slash disposal prevents bark beetle build-up in downed material. For treatment to be effective against bark beetles, most of the material larger than about 4" in diameter must be physically removed from the site, debarked, cut into smaller pieces, chipped, or burned, before beetle flight.

Thin, Selecting Against Species/Conditions – Manually thinning involves a crew using chainsaws to cut undesirable trees close to the ground. Susceptible species and trees infected with dwarf

mistletoe, western gall rust, or other insects or diseases are selected against. GO TO the **Mechanical Treatments Activity Type, Harvest Prescription/Implementation Activity Component,** *Understory / single story treatments: thinning Work Element* for the description of this Work Element.

Burning Infested Tree - Individually infested trees can be burned in place. Slash can also be burned in place, or pushed into piles with large rubber-tired or tracked tractors, and burned (*machine pile and burning*). See **Mechanical Treatments Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component,** and **Prescribed Fire Activity Type** for additional work elements used to accomplish these objectives.

Topping or Otherwise Killing, and Removing Infested Trees - Individual trees can be burned in place, or the tops may be removed to kill the tree. Treetops are removed with a chain saw, or by setting an explosive charge below the live crown. Girdling, cutting off the bark and cambium in a strip 4 inches wide all the way around the tree, is less reliable.

Slash Disposal, Lop and Scatter, Pile or Cover Hand Pile and Burn - Disposing of slash helps prevent bark beetle build-up in downed material. Manual slash disposal requires cutting slash into smaller pieces and scattering them on the ground (lop and scatter), or putting the pieces in piles not more than approximately 6 feet high. Piles may be placed in the sun and covered with transparent plastic to kill any bark beetles (pile and cover), or burned (pile and burn). Slash can also be broadcast burned in place. See the **Prescribed Fire Activity Type** and **Mechanical Treatments Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for additional work elements used to conduct these activities.

Pruning - In some cases, dwarf mistletoe brooms can be pruned from the lower crown to increase tree vigor and/or reduce a safety hazard. Pruning also reduces white pine blister rust infection and mortality. Pruning is usually done with a chain saw or pole-pruner and pruned branches are lopped and scattered on the ground.

Mechanical Treatments

*A*lso, see general description in **Manual Treatments Activity Component**, above.

Slash Disposal Debark/Chip/ or Fragment, Machine Pile, and Burn - Disposing of slash helps prevent bark beetle build-up in downed material. For treatments to be effective against bark beetle outbreaks, most of the material must be reduced to less than about 4 inches in diameter. Slash can be chipped and spread around the site. Slash can also be burned in place, or pushed into piles with large rubber-tired or tracked tractors, and burned. Large logs can be debarked by machine. See **Prescribed Fire Activity Type** and **Mechanical Treatments Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for additional work elements used to conduct these activities

Young Stand Destruction, Chaining, Roller Chopping – Where a young stand has become heavily infected and stand management objectives will not be met, stand destruction can be accomplished by chaining, roller chopping, or manual whip felling. Chaining and roller

chopping require the use and transportation of heavy equipment. Chaining requires two bulldozers moving together over the stand with a heavy chain stretched between them; the chain knocks down and pulls up the young trees. Roller chopping is done with a bulldozer pulling a large rolling drum over the stand. The drum has protruding flanges to aid in cutting and crushing the young trees. For added weight, the drum is filled with water (often drafted from a stream - see **Prescribed Fire Activity Type, Fireline Construction/Holding Actions Activity Component,** *Pumping from streams/ponds using portable pumps Work Element* and *Drafting to fill engines/tenders Work Element* for this activity) from a water tender or engine, and drained on site. Under freezing conditions, the drums may be filled with antifreeze. Slash may be lopped and scattered or burned in place. Manual whip felling involves crews using chainsaws to cut the infested trees as close to the ground as possible.

Overstory Removal – When previous partial cutting has left an overstory heavily infected with dwarf mistletoe, timely overstory removal prevents infestation of the young understory. Overstory removal can be accomplished mechanically. Felled trees can be removed or left on site with appropriate slash disposal. GO TO **Mechanical Treatments Activity Type, Harvest Prescription/Implementation Activity Component,** *Overstory treatments: Overstory removal, partial overstory removal, sanitation Work Element* for the description of this work element.

Harvest/Removal of Fire Damaged or Other High Risk Trees – Fire killed or heavily damaged trees, trees infected with mistletoe, or trees with extensive decay may be a safety hazard to vehicles on roads, to a campsite, parking area, or building. Such trees are typically felled by chainsaw, and subsequently removed or left on site with appropriate slash disposal. An old dense, heavily damaged or heavily infested stand may not be capable of meeting management objectives, or it may be a fire risk. Regeneration harvest can return a forest stand to dominance by seral species that are less susceptible to some insects and diseases. Regeneration harvest is designed to completely replace a stand by clearcut, seed tree or shelterwood cut. Seed tree and shelterwood cuts require multiple entries before the old stand is completely removed from the newly regenerated stand. See the **Mechanical Treatments Activity Type, Harvest Prescription/Implementation Activity Component** for additional details and work element descriptions.

Thin, Selecting Against Species/Conditions - Thinning from below and thinning with selection against certain species or conditions, reduces stand density and alters stand structure and composition. This reduces the stands susceptibility to insects and disease. Mechanical thinning requires the use of heavy equipment and power tools. GO TO **Mechanical Treatments Activity Type, Harvest Prescription/Implementation Activity Component,** *Understory/single story treatments: thinning Work Element* for the description of this Work Element.

Plant Less-Susceptible Species

Many insects and diseases are host specific or preferentially attack certain kinds of trees. The dwarf mistletoes and some bark beetles have limited host ranges. Climax species tend to be more susceptible to root diseases. Planting less-susceptible species can ensure continuous forest vegetation conditions while other tree species are under decline. GO TO **Reforestation Activity Type, Hand Plant Upland/Riparian Activity Component** for the description of this work

element.

Population Assessment and Trapping

In some instances, population assessments are conducted prior to the roads being passable because of snow. In these cases, roads must be plowed to gain access to remote areas requiring analyses. For some insects, the placement of bubble caps (see below), may be done over snow. In these situations, roads may need to be plowed or travel with snow machines may be necessary. See the **Access and Equipment Maintenance, Roads and Roads Maintenance,** and **Mechanical Treatments Activity Types** for work elements related to snowplowing, over the snow travel or other associated activities.

Sampling and Trapping **-** Population assessment of defoliators is sometimes done over a large landscape to determine if populations warrant suppression. Larval populations are sampled prior to application of pesticides. This usually consists of clipping 18-inch branch tips and counting larvae. Larvae can also be sampled by beating the lower branches of a crown; this dislodges the larvae onto a canvas where they are counted. For cocoon and/or egg mass sampling, visual observations are made of the lower crown of trees, or lower branches are cut and examined. Adult populations of defoliating insects are sampled using pheromone-baited traps placed in accessible areas to catch flying males.

Use of Fire

Prescribed underburning can accomplish some of the same objectives as thinning from below, thinning with selection against certain species, and young stand destruction. See the **Prescribed Fire Activity Type** for related work elements.

Pulling back duff from legacy trees - Large legacy trees may be protected from bark beetle attack by removing competing vegetation and pulling back duff from the base of the tree. Thick duff at the base of large trees is pulled away by hand crews using rakes or shovels. The duff is then redistributed well away from the large trees.

Use of Pheromones

Pheromone treatments may be used to collect massive numbers of beetles in baited traps or trap trees, or to disrupt the behavior of beetles to prevent their infestation of other susceptible stands.

Anti-aggregate Bubble Caps - Anti-aggregate pheromones are used to disrupt the behavior of beetles to prevent infesting susceptible stands. Pheromone bubble caps (packets containing an EPA-registered pheromone) are stapled to trees in a 10 x 10 meter grid pattern over the treatment area. After the flight period, the bubble caps are removed from the trees.

Trap Tree Baiting and Removal- Attracting and collecting massive numbers of beetles in pheromones-baited “trap trees” can reduce bark beetle populations. Trap trees are removed from the area before the next beetle flight period. When removing trap trees is infeasible, pheromone-baited traps might be effective in some instances.

ACTIVITY TYPE: Mechanical Treatments

Work elements are typical of timber harvest operations, however, implementation of certain work elements may be needed for reasons other than timber production. For example, thinning forested areas may be used to reduce fuels in the wildland-urban interface (WUI) and create "defensible space" near human developments or agency administrative sites. Most work elements in this activity type require the use of power tools, heavy equipment, and crews.

Related Work Elements may be found in: **Roads and Roads Maintenance Activity Type** regarding snow removal, opening closed roads, and road work; **Access and Equipment Maintenance Activity Type** regarding access, the use of heavy equipment, and mechanized tools; **Prescribed Fire Activity Type** regarding fire and camping; and **Weeds and Chemical Treatments Activity Type** regarding weed prevention actions.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Dust Abatement

Chemical Palliatives **–**GO TO **Roads and Roads Maintenance Activity Type, Road Maintenance Activity Component,** *Dust abatement – water or chemical Work Element* for the description of this Work Element.

Water Drafting – For salmonids, criteria will be found under this Work Element; for all other species, criteria will be found under **Prescribed Fire Activity Type, Fireline Construction/Holding Actions Activity Component,** *Drafting to fill engines/tenders Work Element.* GO TO **Prescribed Fire Activity Type, Fireline Construction/Holding Actions Activity Component,** *Drafting to fill engines/tenders Work Element* for the description of this Work Element.

Harvest Prescriptions/Implementation

Prescriptions contain rationale (or need) for treating forested habitats and identify implementation tactics needed in advance of harvest activity. For assessing potential effects of harvest treatments on certain species, activities include both the description of the treatment to be enacted and actual implementation procedures. Harvest units are either marked as leave or cut trees, designated by a diameter limit, or designated by a species for harvest in the timber sale contract.

Regeneration Harvest: Clearcut, Seed Tree, Shelterwood - Treatments are used to create a forest stand with one or two age classes in an exposed microclimate. Treatments are most suited for shade intolerant species. *Clearcutting* removes all trees in a single harvest thereby preparing the site for planting or natural regeneration. *Seed tree* harvest removes all except a small number of seed trees to provide for regeneration. *Shelterwood* operations remove most of the trees except those needed to provide shade and/or seed for establishing a new stand.

Traditionally the shelterwood and seed trees that remain are removed once the new stand is established. However, it is now common to leave seed trees, shelterwood trees, and other designated trees as "reserve" trees, to promote forest stand diversity, and meet other resource needs. Reserve trees may comprise 40 % of a forest stand following harvest, occurring in groups or uniformly throughout the stand. Trees are managed with the developing young stand to produce a two-aged stand. During shelterwood and seed tree harvest treatments, the majority of undesirable small trees are typically slashed so they do not compete with establishing trees.

Understory/Single Story Treatments: Thinning – Thinning may occur in any age or structure of stand and involve removal of various components of the stand, depending on the purpose of the thinning. It may be applied in single-story or multi-storied stands. Thinning is a common tool for decreasing fuel in stands that are considered overstocked or as a pre-treatment for prescribed fire. In these cases, thinning often targets understory trees. Thinning is also used to break the continuity of the tree canopy to limit fire spread in the canopy. In other cases, thinning may remove some of the overstory trees to reduce competition and increase growth or to remove larger trees when they overtopped, malformed, or otherwise are undesirable dominants.

Overstory Treatments: Overstory Removal, Partial Overstory Removal, Sanitation - In uneven-aged forest stands, all or some portion of the larger, dominant trees in the overstory may be removed leaving the understory trees intact. This is referred to as partial or complete overstory removal. This can be accomplished by selective tree and group harvest procedures. Sanitation cutting removes dead, diseased and damaged trees, or those live trees susceptible to the actual or anticipated spread of pests and/or pathogens. This treatment is used to promote forest growth and health. The liberation method removes trees that are overtopping young trees in the sapling stage. The improvement method is similar to commercial thinning where less desirable trees are removed to improve stand composition and quality. A timber sale contract refers to these systems as commercial thin and overstory removals.

Dead Trees: Salvage, Hazard Tree Removal – Salvaging dead and dying trees or deteriorating stands typically occurs before the wood becomes economically unfeasible to harvest. When all or nearly all of the trees in a stand are dead, a regeneration system is prescribed. When a small portion of the stand is dead, a salvage operation is prescribed that leaves residual live trees. Salvage operations are the most common treatments used in areas to remove dying and damaged trees following fire, insect or pathogen outbreaks, or weather related events such as winterkill. Hazard trees occur in a variety of situations and result from several disturbances, such as fire, insects, pathogens, age, or human-caused injuries. Hazard trees are removed when they pose a risk to campsites, administrative sites, along roadways or other areas where the trees pose a danger to the public. Hazard trees also pose a danger to the health and welfare of people at the sites. These trees may be obstacles to safely working equipment, or they may be snags or

weakened trees with the potential to topple during work operations. Such trees are typically felled by chainsaw, and subsequently removed or left on site with appropriate slash disposal. Removing hazard trees following fires, insect, or disease outbreaks is often done through the timber sale process or by contract.

Selection Harvest - All Stand Layers - Selection harvest is used to "regenerate", create and retain at least three distinct age classes. Several harvest entries are made over the rotation period of the stand. Traditionally, treatments have been designed to maximize timber yield and establish a new crop of trees with an irregular species and structure constitution. Selection treatments may be designed to remove individually dispersed, and/or groups of trees. Individual tree selection is limited to the removal of shade tolerant species and no distinct openings are created.

Forest stand opening are established where groups of trees are removed. Group selection harvesting can be used on any forest type. The size of the opening is dependent on whether the primary re-vegetation species is seral (shade intolerant or semi-shade tolerant) or climax (shade tolerant). For example, openings can range from one-fourth to four acres. New trees become established in the openings and this promotes the development and maintenance of a structurally diverse forest stand. This type of treatment is suitable for both shade intolerant and shade intolerant species. Harvest entries may occur at intervals of twenty years or longer depending on the rotation life of the stand.

Killing Sub-merchantable Trees

For salmonids, criteria will be found under this Activity Component; for all other species, criteria will be found under **Tree Felling Activity Component** (below in this Activity Type) for killing trees by falling or **Prescribed Fire Activity Type** for killing trees by burning. GO TO **Tree Felling Activity Component** (below in this Activity Type) for killing trees by falling. GO TO **Prescribed Fire Activity Type** for killing trees by burning.

Logging Systems and Operations

These are mechanical methods of getting the tree/log from the harvest unit to the landing. The logging system used for stand treatment depends on harvest objectives, terrain, and concerns for other resources.

G*round Based Logging*– Ground based logging systems use tractors, feller-bunchers, forwarders, and some types of cable systems. During this operation, logs are moved (skidded) more or less wholly along the ground. This type of system usually involves the creation of skid trails from the individual trees to the landing. Depending on the stand conditions and contract specifications, skid trails may occur throughout the logging unit or may be designated to specific areas. Soil disturbance along skid trails and within the stand varies from high to low depending on condition, time of operation, equipment, etc.

Helicopter – An aerial yarding operation lifts and flies logs to a landing, resulting in minimal soil disturbance. Aerial operations are used where access is limited, yarding distances are one-half mile or less, or other resource concerns must be met.

High Lead – Powered cable logging consists of main-line blocks, fastened high on a spar tree or equivalent, that enable the front end of logs to be lifted clear of the ground. Generally this system is powered by a 3-drum power-unit carrying main haul-back and straw lines. Although this logging system requires the use of heavy equipment, ground disturbance is relatively low.

Skyline – Powered cable logging is where a heavy cable, "the skyline", is stretched between two spar-trees (or their equivalents): the head-spar, close to the landing and power unit, and the tail-spar**.** Spar trees function as an overhead track for a load-carrying trolley, or skyline carriage. The carriage traverses along the skyline under the control of a main-line and a haul-back line. Under some operations, logs travel clear of the ground for minimal impacts on soils. Most skyline operations do not provide for full suspension and therefore the logs would be trailed on the ground

Hauling – This is a general term for the transport of loads from one point to another, (e.g., logs from stump to landing or from landing to mill or shipping point). Logs are loaded onto a logging truck and transported on a main road designated as the haul road. Log truck travel along haul routes may have short-term impacts in the area by generating dust or creating disturbances.

Loading - Process of moving the log from a deck onto a truck (usually). The process involves heavy equipment.

Landing Construction and Location – A landing is a place where timber is assembled for further transport. Landings are generally "constructed" by clearing away existing vegetation (trees and brush), however, no soil is removed or plowed up. Logging activities often center around landings and most heavy equipment is used there. Landings must be constructed to complement the yarding system; comply with safety codes and other environmental standards; accommodate the size and type of machinery needed; and, the amount of material to be yarded.

Reducing Soil Compaction

Subsoiling **–** This requires the use of a machine attached to a small bulldozer to dig into the ground and uplift soil to reduce subsoil compaction caused by logging or other mechanized equipment. While this is a surface disturbing action, it provides soil that is better suited for tree establishment and water penetration.

Refueling

GO TO **Access and Equipment Maintenance Activity Type, Fueling/Maintenance Activity Component** for the description of this activity.

Rehabilitation, Removal of Excess Vegetation and Slash

After harvest, fire, or other disturbance, treatments are needed to prepare the affected site for regeneration and reduce high fuel loads. Operations should be conducted in a manner to minimize topsoil disturbance, and still maintain the desired level of woody debris on the site.

Furrowing - A dozer with a blade at an angle is used to create a furrow oriented on the horizontal. Furrowing is done to accomplish scarification on steeper slopes, and used to minimize erosion.

Patch Scarification, Mechanically or by Hand – GO TO **Reforestation Activity Type, Site Preparation Activity Component,** *Hand scalp/Grubbing WorkElement* for the description of hand scarification. Other activities covered by this Work Element are described as follows. Scarification is achieved with attachments to dozers which scrape the ground surface to expose mineral soil at specified distances to create planting spots. Generally, patch scarification is only used where competing vegetation is very dense. See **Reforestation Activity Type, Site Preparation Activity Component** for additional information on mechanical scarification activities.

Dozer Scarification - A bulldozer with a brush blade or similar attachment is used to rip topsoil pulling out bunch grasses or similar competing vegetation in various patterns on 20 to 40% of the unit.

Dozer Piling - Bulldozer is used to collect and pile woody material throughout the unit for later burning. Piling may also utilize rubber-tired equipment.

Grapple Piling - The grapple piler lifts fuels up and lays it in a pile. Less topsoil is disturbed in grapple piling, as opposed to dozer piling.

Hand Piling – Excess slash from a harvest or thinning operation may be piled to reduce. This process does not scarify and no soil disturbance occurs.

Piling at landings – If a cutting unit is tree-length yarded, tops and limbs are piled for later treatment, usually by burning.

Road Construction

GO TO **Roads and Roads Maintenance Activity Type, New Construction/Reconstruction Activity Component** for the description of this activity.

Road Maintenance

GO TO **Roads and Roads Maintenance Activity Type, Road Maintenance Activity Component** for the description of this activity.

Skid Trail/Landing Rehab

Waterbars – Shallow channels (cross-drains) or raised barriers (e.g., a ridge of packed earth or a thin pole), are laid diagonally across the road surface to direct water (particularly storm water) from roads and trails. This will reduce potential sediment from reaching streams, wet meadows or other moist areas of areas of concern.

Tree Felling

Hand – Standing trees are primarily cut down with hand tools such as a chainsaw (see *Mechanical* below). In wilderness areas, however, a cross cut saw is used.

Mechanical – This involves cutting down a tree with a chain saw and/or feller-buncher. A feller-buncher is a tracked vehicle with a boom and chainsaw or clippers attached to the end of the boom for cutting trees. A feller-buncher lays down a slash mat on which to operate for minimal soil disturbance. Skidding equipment also moves over slash mats built by the feller-buncher to reduce soil movement.

Additional Information for Harvest Treatments –

These are not "stand alone" work components or work elements. They are included here to help further describe the harvest prescriptions described above. These are common treatments used for the management of forested areas for timber productions.

Intermediate/Commercial Treatments **-** Intermediate harvest (or sometimes known as commercial thinning) is the harvest of trees in an immature stand to reduce tree numbers, and/or select for favored tree qualities. Trees are generally removed in a dispersed manner and regeneration is not the goal. These treatments promote the growth and vigor of the remaining trees, or may be used to alter the species composition of the stand. Sanitation harvest may be the goal of these operations as well. A manageable stand remains following harvest. Post and pole sales (the harvest of trees from 4 – 7 inches at diameter breast height) are generally considered intermediate operations. These treatments are also common in lodgepole pine stands and where the demand is high for fence material and other uses.

Pre-commercial Thinning/Commercial and Non-Commercial – Pre-commercial thinning generally refers to the harvest of trees ranging in diameter breast height from 1 – 4 inches. Generally, the purpose of this activity is to reduce competition among the trees in the target forest stand. Tree densities in pre-commercially thinned stands will vary from 150 to 400 trees per acre; this depends on species growth patterns and management objectives. Release thinning is similar, although generally involves the felling of trees overtopping young regeneration in a non-commercial operation. Pre-commercial thinning is typically conducted with a service contract. During periods of poor market conditions or treatments involving species with little or no market value, trees larger than 4 inches in diameter may be cut and not sold.

ACTIVITY TYPE: Prescribed Fire

Prescribed fire projects are part of vegetation manipulation projects that reduce hazardous fuels and restore natural ecosystems. Prescribed fire projects are often a combination of numerous activity types. The actual application of fire is often only a small part of the total project. Prior to ignition of the prescribed fire, other work activities must occur to prepare the project area for the fire. For example, in remote locations, camps will be established and supplied. Following

wildland and prescribed fires, rehabilitation work may be needed to mitigate impacts caused by implementation. Each project has its own special set of conditions, and its own combination of activities.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Fire Support

See the **Roads and Roads Maintenance Activity Type** for information related to road use and maintenance associated with prescribed fire activities.

Fire/Spike Camps- Some prescribed fire projects are conducted at remote locations. Personnel conducting the project must camp near the project area. The size of any particular campsite, and the complexity of the logistic support operations are determined by the magnitude of the project.

Large prescribed fire projects in remote locations may require that personnel camp near the project site. This helps to increase the amount of time spent on site, and reduces potential hazards to personnel traveling to and from the project area. This can be especially important when crews are working long hours and driving prior to sunrise and after sunset. There will be areas for tents, cooking and dining, restrooms, parking for vehicles, and sometimes for helibase/helispot activities. Logistical support of large camps often requires daily shuttles of supplies and resources. Large camps will often be placed in accessible areas with good road access.

Spike camps are often set up on less complex prescribed fire projects, or in the early stages of the project. These camps require less logistical support and will occupy a smaller total area. Small camps will have similar components to large camps but total number of personnel will be less. These camps are also set up in less accessible areas, are more self-contained and daily supply is not necessary.

Fireline Construction/Holding Actions

There are numerous techniques used to build fireline. The overall goal of fireline construction is to remove living and dead vegetation (fuel), or to create a break in the continuity of the fuel. Fuel breaks help stop fire spread. Flame lengths and fuel type are used to determine the width of a fireline.

Machine Built Fireline – This type of fireline is created using mechanized equipment. Bulldozers, tractors with plows, road graders, or even four-wheelers can be used for line construction. Machine built firelines are typically constructed on level terrain having less than a 15 % slope and relatively free of surface rocks. Machine built fireline is used when a fuel break needs to be wide and/or lengthy, or when smaller fires have the potential to rapidly grow. The ground must also be relatively free of large surface rocks. Plows, dozers, blades, or other implements are pulled or pushed just below the soil surface and mineral soil is exposed. On ground that is fairly level and has few surface rocks, a brush beater (heavy duty mower) can be

used to create a fireline. Brush-beat lines do not expose mineral soil and must be supported by other activities. The width of the line is dependent on the potential flame length.

"Wet" Line/Foam Line – Water, water with surfactants, or aqueous firefighting foam (AFFF, or A Triple F) are used to create a fireline. These substances are sprayed on vegetation to increase moisture content and limit fire spread. Wet lines are most often used in short vegetation or fuel (i.e. grass, pine needles) and where flame lengths are short. Wet lines are also used in conjunction with burnout (burning of fuels between fire and fireline) or black lining operations (See "*Black" Line Work Element* below). Vegetation and dead fuel will be sprayed with water or foam. Wet lines have the lowest impact of any human constructed fireline. The line will only be effective as long as the vegetation remains wet. Once the vegetation dries, fire will easily cross the line. Aqueous firefighting foam (AFFF) helps to stretch water and keep vegetation wet longer, but its effects are also temporary. Use of wet lines and foam lines require large amounts of water; a reliable water source must be in the area to support these operations.

Pumping from Streams/Ponds Using Portable Pumps – Water from ponds and streams may be drawn using portable pumps. A two-inch suction hose with a screen on the end is placed in the water source. The water is then pumped to hose lays on the fireline, into large portable storage tanks or bladders, and into fire engines and/or water tenders. Under some circumstances, a dam is constructed in a stream to create a pool deep enough from which to pull water. Portable pumps are often used in areas where fire engines or water tenders cannot access the water source.

Drafting to Fill Engines / Tenders – Water from ponds and streams is used to fill water tanks on fire engines and water tenders. Pumps mounted to the engines or tenders are used to pull water from the pond or stream. The water source must be located in an area where vehicles can drive to within 10 to 15 feet of the water's edge. Water sources are often found next to roads or near bridges. A hard suction hose, with a screen over the end, is placed in the water. Water is used by the engine, transported to a portable tank, or pumped through hose lays. Under some circumstances, the water source must be improved to gain adequate depth for the end of the suction hose to be completely submerged.

Natural Barriers and Riparian Wetlands – Natural breaks in vegetation and fuel are used when available to help contain prescribed fires. Natural barriers require little if any improvement to stop fire spread. These areas are often rocky ridges or scab flats where the arrangement of vegetation is such that fire cannot move through the plant community. Riparian areas or wetlands are also used as firelines. The vegetation in these areas is too wet to support combustion and is very effective at limiting fire spread. Prescribed fires that use these areas for firelines must conduct activities while these areas are wet. Once they dry for the season, riparian areas or wetlands are no longer effective at limiting fire spread.

Helicopter Dipping – Buckets suspended beneath helicopters may be used for prescribed fires to strengthen the fireline, or to quickly treat hot spots. The pilot controls the bucket remotely. These buckets will most often carry from 100 to 250 gallons of water. Water is obtained from nearby water sources. The helicopter will hover close to the water surface and allow the bucket to fill. This type of operation requires a large water source sufficient to supply the needed water.

Lakes, ponds, larger streams, and rivers are the most frequent sites used to dip water. Helicopter operations require that a helibase or helispot be located close to the project for support.

Hand Built Fireline – The most common form of fireline is constructed using hand tools. The goal is the same as with the other types of fireline: remove the burnable material from the fire. All plant material and downed dead material are removed and mineral soil is exposed. In some instances, chainsaws are used to help remove shrubs and trees and/or branches. Hand built fireline will often be used in conjunction with other activities, such as black lining, wet lining, and brush beating. The width of the line is dependent on the type of fuel in the area and the current or expected flame length. Where lines greater than 2 - 3 feet in width are needed, machinery is often used. Crews of up to 20 people are used to create these lines.

Explosive Built Fireline – In some areas explosives are used to create fireline. This technique is used only under special circumstances and is uncommon. An explosive device, similar to a small diameter hose or small rope, is laid across the ground or used to fall trees. Long runs can be done very quickly. The explosion will expose mineral soils and stop fire spread by removing the burnable fuel.

"Black" Line **-** Black lines are pre-burned areas that are used as firelines. Black lines are often used in conjunction with another type of fireline. The other type of fireline is constructed and the vegetation is ignited on the inside of the fireline. The hand built, machine built or other fireline is used to keep the fire within the boundaries of the prescribed fire unit. In some cases, a second fireline is constructed and all the burnable material between the two lines is burned. This gives the fire managers the greatest control of the black line operation. In other cases, there is no second fireline and the fire is allowed to burn into the unit. Ignition is often done later in the day to take advantage of cooler night conditions and increases in relative humidity. Black lining can provide a wide fireline without the disturbance that occurs with other methods.

Helicopter Landing Sites and Other Operational Facilities

Many prescribed fires use helicopters for some portion of the operation.

Helicopter Support Sites; refuel, alumigel mix sites, etc. - In remote areas, a temporary facility may be needed to manage the helicopter operations. The size of the helispot will be based on the type of the helicopter, equipment needed, and number of aircraft being used. The helispot will often be located next to a road for ground transport of supplies. The helispot must also have a firm, level surface, and a free line of travel that is clear of obstacles in and out for takeoffs and landings.

A helicopter is used to transport personnel and equipment when an area is remote and inaccessible. The personnel and equipment may be loaded at the helibase or on site helispot. Landing areas require a firm level surface free of obstructions. The size of the landing area will be dependent on the type of helicopter used. In areas where landing is not possible, equipment will be delivered via a long-line. Equipment is attached to a line suspended from beneath the helicopter, then transported and placed in a designated area. Long-line operations have a

minimal impact because the area needed to drop equipment is much smaller than that needed to land a helicopter.

- Helicopter Refuel – Helicopter refueling is often done at the helispot. The fuel truck is driven to the helispot and fuel is pumped from the truck's fuel tank to the helicopter. Fuel trucks meet all Department of Transportation (DOT), and Federal Aviation Administration (FAA) regulations regarding fuel transport and transfer.

- Alumigel Mix Sites – If a helitorch is used on the project, an area to mix alumigel will be established near the helispot. The alumigel is the fuel for the helitorch. Transport and mixing is done under regulations designated by DOT and FAA. The mixing requires a level area in close proximity of the helispot.

Ignition

The actual application of fire to the landscape can be done using a variety of different techniques and equipment. Fire can be applied using drip torches, from a mechanized piece of equipment with an ignition device, or by a firefighter walking through the prescribed fire unit. Fire can also be applied from the air using a helitorch or a device that drops ping-pong ball sized spheres filled with a flammable chemical. These spheres ignite after contact with the ground.

Hand Ignition – Ignition by ground personnel using drip torches is one of the most common methods. Fire personnel will walk through the unit using drip torches to ignite the area in a set pattern. The torches contain a mixture of gasoline and diesel fuel. Activities associated with this type of ignition would be minimal. Hand ignition gives the fire managers the highest level of control over the ignition pattern.

Mechanized Ignition – In relatively flat terrain, or along roads, mechanized equipment may be used to ignite fuel within the prescribed fire unit. Larger versions of drip torches are mounted to 4-wheelers, pickup trucks, or other vehicles and driven along a road or through the unit igniting the vegetation in a preset pattern. Mechanized ignition allows large areas to be covered in a shorter time period. This is important in larger prescribed fire units. Tera-torches (drip torch capable of applying limited amounts of fire to a unit) are also mounted on vehicles and can be used in prescribed fire operations.

Aerial Ignition – Helicopters are the principle platform for aerial application of fire. Application of fire using helicopters allows large, inaccessible areas to be treated with minimal impacts outside of the fire on the ground. These operations require support at the airport or helispot.

- Helitorch – Helicopters can carry a large version of a drip torch capable of applying large amounts of fire to a unit. Helitorch operations are most frequently conducted in areas with large fuels (logs, trees, slash); more recently, this tool is being used in lighter fuel types. The helitorch allows fire managers to ignite a large area relatively short amount of time. The mobility and lack of ground impact is making its use more common. These operations are supported by an alumigel mixing operation at the helispot or landing area.

- Ping-pong Balls – Another device commonly used with helicopters is a “ping-pong” ball dispenser. These ping-pong ball sized spheres are filled with potassium permanganate. Just before the balls are dropped from the helicopter, the balls are injected with ethylene glycol. The chemical reaction generates heat and the balls will ignite after they hit the ground. Balls may be dispensed in a pre-determined pattern. This technique allows the fire manager to treat a large area in a short time. This technique is used in lighter fuels, in both forest and shrub-steppe habitats.

Mop-Up

Once objectives have been achieved and ignition is no longer taking place, fire managers must extinguish hot spots within the prescribed fire unit. This is the mop-up phase of the fire. Hot spots are often stumps, downed logs, or other accumulations of dead material that continue to burn after the majority of the fire in the unit has gone out. Firefighters will use a combination of hand tools, fire engines, and hose lays to make sure the fire is contained within the unit before it is abandoned. Standards of mop-up will vary from unit to unit. In most cases, the burning material is exposed and cooled with water and/or soil.

Engine – Fire engines will be used on flat terrain to bring water to the hot spots. Areas must also be free of rocks, or downed material that would limit access by fire engines. Firefighters will use water and hand tools to cool the hot spot. Engines will drive up to the hot spot, or use hose lays to bring water from the engine to the hot spot.

Hand Tools – Firefighters will use hand tools to cool hotspots. Shovels, backpack pumps, and other hand-carried tools (e.g., the Pulaski), are used in areas inaccessible to vehicles, and laying hose. Firefighters will use water from backpack pumps, and moisture in the soil, to cool hot spots. In some circumstances, firefighters will only use soil to cool hot spots.

Hose Lays – In areas where vehicles cannot travel, hose will be placed along the ground and supplied by portable pumps, fire engines or water tenders. Firefighters will use the water and hand tools to cool the remaining hot spots. Long runs of hose can be laid, but once down it is difficult to move. In most cases hose lays are limited to the perimeter of the prescribed fire unit.

Introduction to the Prescribed Fire EffectsTables

For any prescribed fire, both the effects of the activities associated with support and implementation of the fire and the effects of the actual burn must be analyzed. Support and implementation activities have been described above (e.g. fireline construction, mop up, and ignition). The **Activity Components** and *Work Elements* that describe the effects of an actual fire are organized in a slightly different manner than elsewhere in this process.

These activities and effects analysis are defined according to fire regime, existing vegetation type, treatment type, and treatment intensity. In describing the effects of prescribed fire in this process, treatment intensity does NOT mean fire intensity. Rather, it is a qualitative description of the magnitude of the applied fire treatment. It does not refer to any pre-fire treatment levels. Five combinations of fire regime, expressed as fire return interval and fire severity, are defined.

Fire Regime Group	Frequency (Fire Return Interval)	Severity
I	0-35 years	Low severity
II	0-35 years	Stand replacement severity
III	35-100+ years	Mixed severity
IV	35-100+ years	Stand replacement severity
V	>200 years	Stand replacement severity

The **Activity Component** is defined by fire regime (e.g., Fire Regime III) and existing vegetation type (e.g., Aspen). The *Work Element* is defined according to treatment type (e.g., thin, pile and broadcast burn) and treatment intensity (e.g., low intensity). For each treatment intensity, a "post-treatment vegetation description" is provided that describes the predicted condition of the site after that particular treatment. This information is provided in the tables below. If a proposed prescribed fire activity does not fall within a given **Activity Component** and *Work Element*, then consultation for that proposed activity would have to occur outside the National Fire Plan Project Design and Consultation Process.

Aspen Prescribed Fire Effects – General Description and Trends

Quaking aspen (*Populus tremuloidies*) constitutes a relatively small proportion of the total land area in the western United States, but contributes significantly to the biodiversity of wildlife and plant communities. Quaking aspen stands can be found in a wide variety of sites ranging from gentle slopes with deep soils to valley bottoms, riparian areas, and steep high talus ridges. The Intermountain region contains over 2.5 million acres of aspen forests. Quaking aspen is associated with montane and subalpine vegetation types along broad elevational and moisture gradients. The elevational distribution of quaking aspen is between 2,500 to over 10,000 feet. The stands most affected by the National Fire Plan projects are, for the most part, located on north slopes, or in areas where snow accumulates and is held for extended periods of time. These stands are surrounded by drier woodland, shrublands or forest types. Their size ranges from a few acres to over 1,000 acres. Stands are, for the most part, dominated by mature aspen stems. The understory may or may not have suckers present in varying quantities. There is a paucity of middle-aged stems or mid level structure to these communities. Stands are composed of large and small individuals.

In the Rocky Mountain region there has been an approximate 60% decline in aspen dominated landscapes due to conifer encroachment. Conifers are replacing quaking aspen throughout much of its range. The loss of quaking aspen is resulting in a decrease in water, forage, and biodiversity. In some areas the conifers have caused a type conversion from hardwood to conifer.

Fire is a natural event in quaking aspen communities and it plays a role in the perpetuation of the stands. Fire stimulates suckers by nullifying apical dominance through the removal of the main stems. The paradox in the system, quaking aspen stands do not readily burn. Certain conditions are required for quaking aspen stands to burn. A dense understory of conifers or shrubs combined with dry conditions favor hot fire with rapid spread. Prior to European settlement, fire occurred on a fairly regular basis. Fires that burned through these stands were typically stand replacing with mixed intensity. The period between fires varied based on inherent site conditions and general climatic patterns. Following settlement conifers and shrubs increased in quaking aspen stands. However, past management practices and public policy did not permit fires to burn through these stands. Today, conifers or old, decadent quaking aspen trees dominate many quaking aspen stands.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Aspen**	Quaking aspen stands with multiple age-class structure. Large aspen trees dominate the stand with subdominant trees present below the canopy of the dominant trees. Numerous saplings and smaller suckers can be found in the understory. On mesic sites the entire understory may have a dense cover of saplings and suckers. Drier sites would have a more open understory with a diverse plant community comprised of grasses and forbs. Shrubs may be present in the understory, but are usually not a major component of the plant community. Some dead aspen trunks may be found standing or dead on the ground. Conifers may be present in varying densities. Quaking aspen stands are often isolated islands within other plant communities. The size of the islands varies and can be less than an acre to several hundred acres.	**Broadcast Burn**	**Common to all treatment intensities:** Aboveground stems of quaking aspen are killed by burning. Fencing the quaking aspen stand following treatments may help to protect aspen suckers from all large, wild and domestic herbivores. **Low Treatment Intensity:** Fire has burned through the stand consuming the upper layer of duff. Small aspen sucker and conifer saplings, if present, are killed. Shrubs, herbaceous vegetation and small downed woody debris is also consumed. Larger standing snags and downed woody debris is charred, but not consumed in the fire. Little to no bare ground is exposed. Suckering is patchy following the fire. The greatest response of the understory vegetation occurs in open areas of the stand. **Moderate Treatment Intensity:** Fire has burned smaller vegetation in the stand, but has not killed large dominant trees. All but the largest down woody debris has been consumed. Over half of the duff has been consumed and in areas of high fuel concentrations bare ground occurs. Suckering occurs vigorously in larger open areas and around the perimeter of the stand. Herbaceous vegetation is also dense in areas where bare ground has been exposed. Areas where large down woody debris was consumed may remain unvegetated for 3-5 years. **High Treatment Intensity:** Fire has killed all to most of the standing trees (aspen and conifer). Most woody debris on the ground has been consumed and mineral soil has been exposed throughout the majority of the stand. Suckering occurs vigorously throughout most of the stand. Herbaceous vegetation also responds vigorously to burning. Areas of high fuel concentrations may remain unvegetated for a few years. Some large quaking aspen stems will fall, while others will remain standing for a number of yers. In most cases stems with the greatest amount of rot will fall before the more solid stemmed individuals.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Aspen**	Quaking aspen stands have been encroached by conifers. Encroachment is significant enough to suppress quaking aspen. Numbers of conifer saplings and seedlings may outnumber quaking aspen suckers. The stand may be composed of a dominant quaking aspen layer with a subdominant layer of conifers. Conifers may also dominate the stand with few live quaking aspen stems left standing. In some stands where the conifer encroachment has been significant, only a few isolated quaking aspen may be present and a large number of dead aspen trunks may be on the ground. Understory vegetation is also much reduced in these stands. The litter layer is comprised of a combination of quaking aspen leaves and conifer needles.	**Thinning** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	Common to all treatment intensities: Above-ground stems of aspen are killed by burning. Fencing the quaking aspen stand following treatments may help to protect aspen suckers from all large, wild and domestic herbivores Quaking aspen stands are thinned by removing the associated conifer species. Few to no quaking aspen are cut in the thinning operation. Cut trees are felled and left in place to provide protection quaking aspen suckers. Some soil disturbance may occur due to the cutting activity. However, these are usually isolated areas where mineral soil is exposed. Herbaceous and associated shrubby vegetation may also respond to the removal of the conifer overstory. This is most likely to occur in the open areas of the stand where quaking aspen density is low. In stands where the conifer encroachment was severe and there was a low number of larger quaking aspen, suckering will be reduced in the first few years following cutting. Fencing the stand from all herbivores, wild and domestic, will provide additional protection for aspen suckers.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Aspen**	Quaking aspen stands have been encroached by conifers. Encroachment is significant enough to suppress quaking aspen. Numbers of conifer saplings and seedlings may outnumber quaking aspen suckers. The stand may be composed of a dominant quaking aspen layer with a subdominant layer of conifers. Conifers may also dominate the stand with few live quaking aspen stems left standing. In some stands where the conifer encroachment has been significant, only a few isolated quaking aspen may be present and a large number of dead aspen trunks may be on the ground. Understory vegetation is also much reduced in these stands. The litter layer is comprised of a combination of quaking aspen leaves and conifer needles.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Common to all treatment intensities:** Above-ground stems of aspen are killed by burning. Fencing the quaking aspen stand following treatments may help to protect aspen suckers from all large, wild and domestic herbivores **Low Treatment Intensity, Moderate Treatment Intensity and High Treatment Intensity:** Conditions will be similar to broadcast burning. Intensity will be related to the amount of slash left following the thinning operation. The greater the number of trees removed and amount of slash left on site, the higher the intensity of treatment.

Cedar, Hemlock, Fir Prescribed Fire Effects

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III Mixed severity, Lethal & Nonlethal, creates mosaic of patterns	**Cedar, Hemlock, Fir, Condition Class 1** Ranges from north of Clearwater basin in Idaho to Canadian border, W. Montana, NE. & W. Washington, NW. Oregon & along OR. Coast, mainly wet areas (covers 25% of area). Highly productive sites w/ more to pile & burn, more duff & litter to reduce sediment delivery, faster regeneration	Condition Class 1 - Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large trees are common in the following order of dominance: white pine, western larch, Douglas-fir, cedar, spruce, true fir, western hemlock, with minor amounts of ponderosa pine, lodgepole pine and hardwoods. All stands have been previously thinned to encourage seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Small amount of understory, shade tolerant conifers scattered throughout unit. Other understory vegetation includes high diversity of grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. **Low Treatment Intensity** = Scorch damage on up to 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** = Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** = **Not likely to occur** (at mid to upper elevations) since piles are normally covered and burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (low chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 1**	Condition Class 1 – Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large trees are common in the following order of dominance: white pine, western larch, Douglas-fir, cedar, spruce, true fir, western hemlock, with minor amounts of ponderosa pine, lodgepole pine and hardwoods. All have been previously thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Small amount of understory, shade tolerant conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** = Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs partially consumed or consumed. Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** = 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs partially consumed or consumed. **High Treatment Intensity** = 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 50% of snags and up to 75% of large downed logs partially consumed or consumed.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 1**	Condition Class 1 – Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large trees are common in the following order of dominance: white pine, western larch, Douglas-fir, cedar, spruce, true fir, western hemlock, with minor amounts of ponderosa pine, lodgepole pine and hardwoods. Small amount of understory conifers (true fir, spruce, cedar, hemlock) scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Broadcast Burn**	**Low Treatment Intensity** = Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 20% of snags and up to 30% of large downed logs partially consumed or consumed. Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** = 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 30% of snags and up to 50% of large downed logs partially consumed or consumed. **High Treatment Intensity** = 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 50% of snags and up to 75% of large downed logs partially consumed or consumed.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and if last fire was stand replacing, shade-tolerant species are increasing. If last fire severity was non-lethal, large diameter, over- mature white pine, western larch, Douglas fir dominate with some true fir, cedar and western hemlock. Otherwise, cedar and shade tolerant species dominate. Stand may be single or multi-aged depending on past fire regime intensity. Stand has been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Most smaller diameter, understory true fir, spruce and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by shade-tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present (depending on safety factors). Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Thin, Machine pile, burn piles.** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. **Low Treatment Intensity** = Scorch damage on 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity (from fire creeping outside the pile boundaries) total of 20% of treatment area burned. **Moderate Treatment Intensity** = Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** = **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (low chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and if last fire was stand replacing, shade-tolerant species are increasing. If last fire severity was non-lethal, large diameter, over- mature white pine, western larch, Douglas fir dominate with some true fir, cedar and western hemlock. Otherwise, cedar and shade tolerant species dominate. Stand may be single or multi-aged depending on past fire regime intensity. Stand has been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Most small diameter, understory true fir, spruce, and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by tolerant, Other understory vegetation includes grasses, forbs, and shrubs. Up to 20 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** = Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs partially consumed or consumed. **Moderate Treatment Intensity** = 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs partially consumed or consumed. **High Treatment Intensity** = 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs partially consumed or consumed.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and if last fire was stand replacing, shade-tolerant species are increasing. If last fire severity was non-lethal, large diameter, over- mature white pine, western larch, Douglas fir dominate with some true fir, cedar and western hemlock. Otherwise, cedar and shade tolerant species dominate. Stand may be single or multi-aged depending on past fire regime intensity. Many small diameter, understory true fir, spruce, cedar and hemlock trees are scattered throughout the treatment area. Other understory vegetation includes grasses, forbs, and shrubs. Up to 20 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Broadcast Burn**	**Low Treatment Intensity** = Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs partially consumed or consumed. **Moderate Treatment Intensity** = 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs partially consumed or consumed. **High Treatment Intensity** = 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs partially consumed or consumed.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and may have converted to cedar, true fir, western hemlock and shade-tolerant species if last fire was stand replacing (late seral species that are more sensitive to fire). Stand may be single or multi-aged depending on past fire regime intensity. If last fire severity was lethal, all-aged, large-diameter, over- mature cedar, western hemlock and true fir dominate with very little white pine, western larch or Douglas fir. Stand has been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Many understory trees have been cut and remaining understory trees are scattered throughout the treatment area and dominated by true fir, spruce and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Duff and litter are thicker than other condition classes and cover types. Over 20 snags per acre present depending on safety concerns. Not all sites have cedar. Duff and litter are thicker than other cover types and condition classes.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities** - 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. **Low Treatment Intensity** = Scorch damage on 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned. **Moderate Treatment Intensity** = Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** = **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (low chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and may have converted to cedar, true fir, western hemlock and shade-tolerant species if last fire was stand replacing (late seral species that are more sensitive to fire). Stand may be single or multi-aged depending on past fire regime intensity. If last fire severity was lethal, all-aged, large-diameter, over- mature cedar, western hemlock and true fir dominate with very little white pine, western larch or Douglas fir. Stand has been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Many understory trees have been cut and remaining understory trees are scattered throughout the treatment area and dominated by true fir and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Duff and litter are thicker than other condition classes and cover types. Over 20 snags per acre present depending on safety concerns. Not all sites have cedar. Duff and litter are thicker than other cover types and condition classes.	**Thin, Broadcast Burn**	**Low Treatment Intensity** = Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 40% of large downed logs partially consumed or consumed. **Moderate Treatment Intensity** = 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 40% of snags and up to 60% of large downed logs partially consumed or consumed. **High Treatment Intensity** = 40-60% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60%+ of snags and up to 80%+ of large downed logs partially consumed or consumed.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Cedar, Hemlock, Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and may have converted to cedar, true fir, western hemlock and shade-tolerant species if last fire was stand replacing (late seral species that are more sensitive to fire). Stand may be single or multi-aged depending on past fire regime intensity. If last fire severity was lethal, all-aged, large-diameter, over- mature cedar, western hemlock and true fir dominate with very little white pine, western larch or Douglas fir. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Understory trees are heavy and scattered throughout the treatment area and dominated by true fir, spruce, cedar and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Duff and litter are thicker than other condition classes and cover types. Over 20 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types and condition classes.	**Broadcast Burn**	**Low Treatment Intensity** = Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 40% of large downed logs partially consumed or consumed. **Moderate Treatment Intensity** = 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 40% of snags and up to 60% of large downed logs partially consumed or consumed. **High Treatment Intensity** = 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs partially consumed or consumed.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V Fire intervals long - 200 yrs (longer & episodic in regime V). Often stand replacing	**Cedar, Hemlock, Fir, Condition Class 1** Ranges from north of Clearwater basin in Idaho to Canadian border, W. Montana, NE. & W. Washington, NW. Oregon & along OR. Coast, mainly wet areas (covers 25% or area). Highly productive sites w/ more to pile & burn, more duff & litter to reduce sediment delivery, & faster regeneration	Condition Class 1 - Stand has not missed any past fire disturbance cycles but is nearing or at maturity. Large trees are common in the following order of dominance: white pine, western larch, Douglas-fir, spruce, true fir, western hemlock, cedar, with minor amounts of ponderosa pine, lodgepole pine and hardwoods. More seral species than higher condition classes. All have been previously thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Small amount of understory, shade tolerant conifers scattered throughout unit. Other understory vegetation includes high diversity of grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. **Low Treatment Intensity** - Scorch damage on up to 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (low chance unless large & close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 1**	Condition Class 1 – Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large trees are common in the following order of dominance: white pine, western larch, Douglas-fir, spruce, true fir, western hemlock, cedar, with minor amounts of ponderosa pine, lodgepole pine and hardwoods. All have been previously thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Small amount of understory, shade tolerant conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. . Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Thin, Broadcast Burn** (underburn/ jackpot burn) See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs heavily damaged or burned up. Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 50% of snags and up to 75% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 1**	Condition Class 1 – Stand has not missed any past fire disturbance cycles but is nearing or at maturity. Large trees are common in the following order of dominance: white pine, western larch, Douglas fir, spruce, true fir, western hemlock, cedar, with minor amounts of ponderosa pine, lodgepole pine and hardwoods. More seral species than higher condition classes. Small amount of understory conifers (true fir, spruce, cedar, hemlock) scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types, but not as thick as higher condition classes.	**Broadcast burn** (underburn/ jackpot burn)	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs heavily damaged or burned up. Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 50% of snags and up to 75% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over-mature white pine, western larch, Douglas fir dominate with some true fir, cedar and western hemlock all of which have been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Most smaller diameter, understory true fir, spruce and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by shade-tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present (depending on safety factors). Not all sites have cedar. Duff and litter are thicker than other cover types but not as thick as Condition Class 3.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. **Low Treatment Intensity** - Scorch damage on 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (low chance unless large & close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over-mature white pine, western larch, Douglas fir dominate with some true fir, cedar and western hemlock all of which have been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Most small diameter, understory true fir, spruce, and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present (depending on safety factors). Not all sites have cedar. Duff and litter are thicker than other cover types but not as thick as Condition Class 3.	**Thin, Broadcast Burn** (underburn/ jackpot burn) See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over-mature white pine, western larch, Douglas fir dominate with some true fir, cedar and western hemlock. Many small diameter, understory true fir, spruce, cedar and hemlock trees are scattered throughout the treatment area. Other understory vegetation includes grasses, forbs, and shrubs. Up to 20 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other cover types but not as thick as Condition Class 3.	**Broadcast Burn** (underburn/ jackpot burn)	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 20% of snags and up to 30% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 30% of snags and up to 50% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 60% of snags and up to 80% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and has converted to cedar, true firs, western hemlock, shade-tolerant species (late seral species that are more sensitive to fire). All aged, large diameter, over-mature cedar, western hemlock and true fir dominate with very little white pine, western larch or Douglas fir. Stand has **been thinned** to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Many understory trees have been cut and remaining understory trees are scattered throughout the treatment area and dominated by true fir, spruce and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Over 20 snags per acre present depending on safety concerns. Not all sites have cedar. Duff and litter are thicker than other condition classes and cover types.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. **Low Treatment Intensity** - Scorch damage on 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (low chance unless large & close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and has converted to cedar, true fir, western hemlock and shade-tolerant species (late seral species that are more sensitive to fire). All aged, large diameter, over-mature cedar, western hemlock and true fir dominate with very little white pine, western larch or Douglas fir. Stand has **been thinned to favor seral species**. Some tree limbing may be part of treatment in Wildland Urban Interface. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Many understory trees have been cut and remaining understory trees are scattered throughout the treatment area and dominated by true fir and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Over 20 snags per acre present depending on safety concerns. Not all sites have cedar. . Duff and litter are thicker than other condition classes and cover types.	**Thin, Broadcast Burn** (underburn/ jackpot burn) See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring. Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring. Up to 40% of snags and up to 60% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 40-60% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 60%+ of snags and up to 80%+ of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Cedar, Hemlock, Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and has converted to cedar, true fir, western hemlock and shade-tolerant species (late seral species that are more sensitive to fire). All aged, large diameter, over-mature cedar, western hemlock and true fir dominate with very little white pine, western larch or Douglas-fir. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Understory trees are heavy and scattered throughout the treatment area and dominated by true fir, spruce, cedar and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Over 20 snags per acre present. Not all sites have cedar. Duff and litter are thicker than other condition classes and cover types.	**Broadcast Burn** (underburn/ jackpot burn)	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring. Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 40% of snags and up to 60% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 60% of snags and up to 80% of large downed logs heavily damaged or burned up.

Lodgepole Pine, Douglas Fir, True Fir Prescribed Fire Effects

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 1** Occurs in southern Utah to Canada; Rockies to crest of Cascades. Across 90% of the footprint of this process. Mid to higher elevations. Higher moisture available than lower ponderosa pine sites.	Condition Class 1 - Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large pole to mature size lodgepole pine alone or mixed w/ Douglas fir, western larch, white pine, hardwoods with small amounts of spruce, western hemlock or true fir. Stand may be single or multi-aged depending on past fire regime intensity. All have been previously thinned to favor seral species. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Small amount of understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope.	**Common to all treatment intensities**: 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas Fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Low Treatment Intensity** - Scorch damage on up to 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles.. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 1**	Condition Class 1 - Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large pole to mature size lodgepole pine alone or mixed w/ Douglas fir, western larch, white pine, hardwoods with smaller amounts of spruce, true fir or western hemlock. Stand may be single or multi-aged depending on past fire regime intensity. All have been previously thinned to favor seral species. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Small amount of understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs partially consumed or consumed. Most likely scenario at mid to upper elevations. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs partially consumed or consumed. Western larch, Douglas-fir and ponderosa pine will be favored to survive where present. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 50% of snags and up to 70% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 1**	Condition Class 1 – Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large pole to mature size lodgepole pine alone or mixed with Douglas fir, western larch, white pine, hardwoods with smaller amounts of spruce, western hemlock or true fir. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Stand may be single or multi-aged depending on past fire regime intensity. Small amount of understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Broadcast Burn**	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs partially consumed or consumed. Most likely scenario at mid to upper elevations. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 50% of snags and up to 70% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 2**	Condition Class – 2 Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Stand has been thinned to favor Douglas fir, western larch, lodgepole pine, or western white pine with minimal true fir, spruce or western hemlock scattered. Some tree limbing may be part of treatment in Wildland Urban Interface. Stand may be single or multi-aged depending on past fire regime intensity. Most smaller diameter, understory true fir, spruce and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present (depending on safety factors). Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**All Treatment Intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Low Treatment Intensity** - Scorch damage on 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Stand has been thinned to favor Douglas fir, western larch, lodgepole pine, or western white pine with minimal true fir, spruce or western hemlock scattered. Some tree limbing may be part of treatment in Wildland Urban Interface. Stand may be single or multi-aged depending on past fire regime intensity. Most small diameter, understory true fir, spruce and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present (depending on safety factors). Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring. Up to 30% of snags and up to 40% of large downed logs partially consumed or consumed. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring. Up to 40% of snags and up to 60% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring. Up to 60% of snags and up to 80% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and if last fire was stand replacing, has shade-tolerant species increasing. Stand may be single or multi-aged depending on past fire regime intensity. If past fire severity was non-lethal, large diameter Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Douglas fir, western larch, lodgepole pine, or western white pine dominate with true fir, spruce or western hemlock scattered. Many small diameter, understory true fir, spruce and hemlock trees are scattered throughout the treatment area and dominated by shade-tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 20 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Broadcast Burn**	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 30% of snags and up to 40% of large downed logs partially consumed or consumed. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 40% of snags and up to 60% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 60% of snags and up to 80% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and may have converted to true firs, western hemlock and shade-tolerant species if last fire was stand replacing. More late seral species without disturbance that are more sensitive to fire. Stand may be single or multi-aged depending on past fire regime intensity. Stand has been thinned to favor Douglas fir, western larch, lodgepole pine, or western white pine with minimal true fir, spruce or western hemlock scattered. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Pathogens, insects and possibly past fires have increased some damage to trees and created excessive fuels. Understory trees are scattered throughout the treatment area and are dominated by true fir, spruce and western hemlock. Understory plants also include grasses, forbs, and shrubs. Over 20 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Low Intensity** - Scorch damage on up to 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and may have converted to true firs, western hemlock and shade-tolerant species if last fire was stand replacing. More late seral species without disturbance that are more sensitive to fire. Stand may be single or multi-aged depending on past fire regime intensity. Stand has been thinned to favor Douglas fir, western larch, lodgepole pine, or western white pine with minimal true fir, spruce or western hemlock scattered. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Pathogens, insects and possibly past fires have increased some damage to trees and created excessive fuels. Understory trees are scattered throughout the treatment area and are dominated by true fir, spruce and western hemlock. Understory plants also include grasses, forbs, and shrubs. Over 20 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 40% of large downed logs partially consumed or consumed. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks soil moisture and temperature conditions are favorable for plant growth. Up to 40% of snags and up to 60% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present. **High Treatment Intensity** - 40-60% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60%+ of snags and up to 80%+ of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 3**	Condition Class 3--Stand has missed many past fire disturbance cycles and may have converted to true firs, western hemlock and shade-tolerant species if last fire was stand replacing. More late seral species present without disturbance that are more sensitive to fire. Stand may be single or multi-aged depending on past fire regime intensity. If past fire severity was non-lethal, large diameter Douglas fir, western larch, lodgepole pine, or western white pine dominate with true fir, spruce or western hemlock scattered. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Pathogens, insects and possibly past fires have increased some damage to trees and created excessive fuels. Understory trees are scattered throughout the treatment area and are dominated by true fir, spruce and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Over 20 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Broadcast Burn**	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 40% of large downed logs partially consumed or consumed. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 40% of snags and up to 60% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs partially consumed or consumed. Western larch, Douglas fir and ponderosa pine will be favored to survive where present.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V Lethal, stand replacing fires at intervals of 100 or 200+ years	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 1** Occurs in southern Utah to Canada, Rockies to crest of Cascades. Across 90% of footprint of this process. Mid to higher elevations. Higher moisture available than lower ponderosa pine sites.	Condition Class 1 - Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes large pole to mature size lodgepole pine alone or mixed with Douglas fir, western larch, white pine, hardwoods with small amounts of spruce, western hemlock or true fir. All have been previously thinned to favor seral species. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Small amount of understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive to heating by fire and most likely to die. Lodgepole pine regenerates easily after disturbance. **Low Treatment Intensity** - Scorch damage on up to 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V Lethal, stand replacing fires at intervals of 100 or 200+ years	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 1** Occurs in southern Utah to Canada, Rockies to crest of Cascades. Across 90% of footprint of this process. Mid to higher elevations. Higher moisture available than lower ponderosa pine sites.	Condition Class 1 – Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes Large pole to mature size lodgepole pine alone or mixed w/ Douglas fir, western larch, white pine, hardwoods with smaller amounts of spruce, true fir or western hemlock. All have been previously thinned to favor seral species Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Small amount of understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Broadcast Burn**	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs heavily damaged or burned up. Most likely scenario at mid to upper elevations. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, climax species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 50% of snags and up to 70% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 1**	Condition Class 1 – Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes Large pole to mature size lodgepole pine alone or mixed with Douglas fir, western larch, white pine, hardwoods with smaller amounts of spruce, western hemlock or true fir. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Small amount of understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Broadcast Burn**	**Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 20% of snags and up to 30% of large downed logs heavily damaged or burned up. Most likely scenario at mid to upper elevations. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, climax species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 50% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 50% of snags and up to 70% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over-mature lodgepole pine mixed with Douglas fir, western larch, white pine, with smaller amounts of spruce, western hemlock or true fir all of which have been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Smaller diameter, understory true fir, spruce and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by shade-tolerant, late serial species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present (depending on safety factors). Restoration treatments would reduce true fir/spruce in favor western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**All Treatment Intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, climax species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Low Treatment Intensity** - Scorch damage on 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - Not likely (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over- mature lodgepole pine mixed with Douglas fir, western larch, white pine, with smaller amounts of spruce, western hemlock or true fir all of which have been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Most small diameter, understory true fir, spruce and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present (depending on safety factors). Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 40% of snags and up to 60% of large downed logs may be partially or totally consumed. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 2**	Condition Class 2 – Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over- mature lodgepole pine mixed with Douglas fir, western larch, white pine, with smaller amounts of spruce, western hemlock or true fir Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Many small diameter, understory true fir, spruce and hemlock trees are scattered throughout the treatment area and dominated by shade-tolerant, climax species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 20 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Broadcast Burn**	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, climax species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 40% of snags and up to 60% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and has converted to true firs, western hemlock, and shade-tolerant species. More late seral species present without disturbance that are more sensitive to fire. Large diameter true fir, spruce or western hemlock dominates with remnant Douglas fir, western larch, lodgepole pine, or western white pine scattered. Stand has been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Many understory trees have been cut and piled with remaining understory trees scattered throughout the treatment area and dominated by true fir, spruce and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Over 20 snags per acre present depending on safety concerns. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Machine pile, burn piles** Machine piling preferred on slopes <35-40% slope. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. **Low Treatment Intensity** - Scorch damage on up to 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and has converted to true firs, western hemlock and shade-tolerant species. More late seral species present without disturbance that are more sensitive to fire. Large diameter true fir, spruce or western hemlock dominates with remnant Douglas fir, western larch, lodgepole pine, or western white pine scattered. Stand has been thinned to favor seral species. Some tree limbing may be part of treatment in Wildland Urban Interface. Pathogens and insects have increased damage to trees and have created excessive fuels and many accumulations. Many understory trees have been cut and remaining understory trees are scattered throughout the treatment area and are dominated by true fir, spruce and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Over 20 snals per acre present, depending on safety concerns. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Thin, Broadcast Burn** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring. Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring. Up to 40% of snags and up to 60% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 40-60% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if burned in spring or late summer/early fall. Up to 60%+ of snags and up to 80%+ of large downed logs heavily damaged or burned up.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV & V	**Lodgepole Pine, Douglas Fir, True Fir, Condition Class 3**	Condition Class 3 – Stand has missed many past fire disturbance cycles and has converted to true firs, western hemlock and shade-tolerant species. More climax species present without disturbance that are more sensitive to fire. Large diameter true fir, spruce or western hemlock dominates with remnant Douglas fir, western larch, lodgepole pine, or western white pine scattered. Some tree limbing and understory slashing may be part of treatment in Wildland Urban Interface. Pathogens and insects have increased damage to trees and have created excessive fuels. Understory trees are heavily scattered throughout the treatment area and are dominated by true fir, spruce and western hemlock. Other understory vegetation includes grasses, forbs, and shrubs. Over 20 snags per acre present. Restoration treatments would reduce true fir/spruce in favor of western larch, Douglas fir, lodgepole pine or ponderosa pine. Wildland Urban Interface treatments would reduce fuels in addition to above.	**Broadcast Burn**	**Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 40% of snags and up to 60% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperature conditions are favorable for plant growth. Up to 60% of snags and up to 80% of large downed logs heavily damaged or burned up.

Pinyon-Juniper and Juniper Woodlands - General Descriptions and Trends

Pinyon-juniper and juniper woodlands are found throughout the area covered by this process. Juniper (lacking pinyon) is found in Oregon, Nevada, Montana, Washington, Idaho, and northern portions of Nevada. Pinyon-juniper woodlands are found in Nevada, Utah, Wyoming, and Idaho. Some current pinyon-juniper or juniper woodlands may be vegetatively classified as sagebrush because pinyon-juniper and juniper woodlands have been colonizing sites that were formerly dominated by shrubs. Of the current pinyon-juniper and juniper woodlands, less than 20% can be considered "historic" woodlands. About 80% of current pinyon-juniper and juniper cover was formerly dominated by shrubs. The younger (established within the last 150 years) pinyon-juniper and juniper woodlands generally surround the older woodlands. Most fuels projects would be focused on the pinyon-juniper and juniper woodlands that established within the last 120 to 150 years.

In some locations, pinyon-juniper and juniper densities have increased to the point that understory vegetation density and cover have been severely reduced. In these instances, broadcast burning may not be the most effective tool for treatment because only very intense fires may carry. Where there is very little to no understory vegetation, mechanical treatments are likely to be the preferred treatment types. In the Wildland Urban Interface, mechanical treatments may also be the preferred treatment type because of the extreme conditions required to burn mature woodlands.

In areas with sufficient understory, broadcast burns are usually fast moving in the shrub and grass fuels and pinyon and juniper trees may be easily killed if fires are intense enough to cause torching in the trees. In activity fuels, broadcast burning is likely to be of a longer duration possibly resulting in more soil impacts. One soil impact of concern is soil hydrophobicity following burning. This may occur in longer duration burns. Depending on the location, broadcast burning can be accomplished during most parts of the year, with spring and fall being the most common. Mechanical treatments can take place almost year-round if areas are free of snow. However, high soil moisture conditions may limit activity of machinery during the spring, winter and fall. Pile burning generally occurs in the fall or winter, after rain or snow events.

Some anecdotal evidence indicates that fuel treatment in pinyon-juniper and juniper woodlands results in increased water yields in springs and drainages near where trees were removed. If trees are removed and the native understory is allowed to regenerate, there would likely be less erosion into the streams due to increased ground cover. Invasive annuals may be a large component of this vegetation type. Site with understorys dominated by invasive annuals are not be covered by this process.

Pinyon-juniper and Juniper Woodlands Prescribed Fire Effects

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
II	**Pinyon-juniper and juniper woodlands**	Young pinyon-juniper or juniper invasion into historical sagebrush-steppe ecosystem. Only natural fuels are on-site; few to no activity fuels are on-site. Some scattered old-growth pinyon and/or juniper trees may be present on shallow soil sites or rocky sites. Understory vegetation is sufficient to carry fire from tree to tree. Annual invasive species may occur in the treatment area, but do not dominate the understory.	**Broadcast Burn**	**Common to all treatment Intensities**: Grass and forb (and some sprouting shrub) species will begin to sprout shortly following the burn if soil temperature and moisture conditions are conducive to plant growth. Sagebrush seedlings will be evident one to five years following burning. Seeding of grasses, forbs and/or shrubs may be necessary following the broadcast burn treatment. The amount of heat transferred to the soil surface will be directly proportional to the pre-burn fuel loadings. **Low Treatment Intensity** - Broadcast burning will create patches of burned and unburned areas (less than 50% of the area burned). In the burned areas, woody plants are killed and above-ground portions of the herbaceous plants are consumed. Mortality will occur in 10 to 50% of small, young pinyon and/or juniper trees across the treatment area. In patches where burning occurs, there will be low to moderate ground scorch severity. **Moderate Treatment Intensity** - Broadcast burning will create patches of burned and unburned areas, with more burned patches (up to 75% of the area burned). In the burned areas, woody plants are killed and aboveground portions of the herbaceous plants are consumed. Mortality will occur in up to 75% of small, young pinyon and/or juniper trees across the treatment area. In patches where burning occurs, there will be low to high ground scorch severity. **High Treatment Intensity** - Broadcast burning will occur over all of the landscape. Woody plants are killed and aboveground portions of the herbaceous plants are consumed across the entire area. Mortality will occur in up to 100% of small, young pinyon and/or juniper trees. Depending on the size of the burn, it may take several years for sagebrush seedlings to recolonize the interior areas of the burn. Where burning occurs, there will be moderate to high ground scorch severity.

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
II	**Pinyon-juniper and juniper woodlands**	Clumps of widely spaced individuals of young pinyon-juniper or juniper invasion into historical sagebrush-steppe ecosystem. Clumps or widely spaced individuals are interspersed with hand or machined-piled pinyon and/or juniper boles, branches and/or needles. Piled vegetation resulted from previous hand or mechanical pinyon and/or juniper removal treatment. Some scattered old-growth pinyon and/or juniper trees may be standing on shallow soil sites or rocky sites. Understory grass, forb and shrub vegetation is sparse to moderate and may or may not be sufficient to carry fire from pile to pile. Annual invasive species may occur in the treatment area, but do not dominate the understory.	**Activity fuels piled, then piles burned** See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: Piles cover up to 40% of the treatment area. Remaining clumps of trees and shrubs will have some additional mortality from heat and flames resulting from pile burning (up to 20% of remaining trees and/or shrubs) if piles are constructed close to residual trees and shrubs. Following pile burning, there will be severe ground heating below piles (up to 40% of the area). The amount of heat transferred to the soil surface will be directly proportional to the amount of fuel in the piles. Sprouting or seedling establishment may be reduced beneath the piles for several years. **Low Treatment Intensity** - Up to 10% of the area may also be burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of the treatment area burned). Tree and shrub mortality may occur from creeping piles. Some larger branch wood and boles in the piles will not be completely consumed and will remain on the site. **Moderate Treatment Intensity** - 10-40% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 80% of total treatment area burned). Tree and shrub mortality may occur from creeping piles. Most larger branch wood and boles in the piles will be completely consumed. **High Treatment Intensity** - more than 40% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (80 to 100% of total treatment area burned). Tree and shrub mortality may occur from creeping piles. All piled vegetation will be completely consumed.

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
II	**Pinyon-juniper and juniper woodlands**	Clumps or widely spaced individuals of young pinyon-juniper or juniper invasion into historical sagebrush-steppe ecosystem. Clumps or widely spaced individuals are interspersed with scattered hand or machined-cut pinyon and/or juniper boles, branches and/or needles. Some dispersed old-growth pinyon and/or juniper trees may be standing on shallow soil sites or rocky sites. The scattered material will be the main fuel carrying the broadcast burn because understory grass, forb and shrub vegetation is sparse. Annual invasive species may occur in the treatment area, but do not dominate the understory.	**Activity fuels scattered, then broadcast burned** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: Grass, forb, and some sprouting shrub species will begin to sprout shortly following the burn if soil moisture and temperature conditions are conducive for plant growth. Sagebrush seedlings will be evident one to five years following burning. Seeding of grasses, forbs and/or shrubs may be necessary following the broadcast burn treatment in areas where residual vegetation is insufficient to re-vegetate the site. The amount of heat transferred to the soil surface will be directly proportional to the pre-burn fuel loadings. **Low Treatment Intensity** - Broadcast burning will create patches of burned and unburned areas (less than 50% of the area burned). In the burned areas, some woody plants are killed and aboveground portions of the other sprouting shrubs and herbaceous plants are consumed. Mortality will occur in 10 to 50% of small, young pinyon and/or juniper trees across the treatment area. In burned patches there will be low to moderate ground scorch severity. Some scattered larger branch wood and boles will not be completely consumed and will remain on the site. **Moderate Treatment Intensity** - Broadcast burning will create patches of burned and unburned areas, with more burned patches (up to 75% of the area burned). In the burned areas, some woody plants are killed and aboveground portions of the sprouting shrubs and herbaceous plants are consumed. Mortality will occur in up to 75% of small, young pinyon and/or juniper trees across the treatment area. In burned patches there will be low to high ground scorch severity. Most scattered larger branch wood and boles will be completely consumed. **High Treatment Intensity** - Broadcast burning will occur over all of the landscape. Some woody plants are killed and aboveground portions of the sprouting shrubs and herbaceous plants are consumed across the entire area. Mortality will occur in up to 100% of small, young pinyon and/or juniper trees. Depending on the size of the burn, it may take several years for sagebrush seedlings to recolonize the interior areas of the burn. Where burning occurs, there will be moderate to high ground scorch severity. Most scattered vegetation is completely consumed.

Oak Woodland / Oak-maple / Interior Chaparral / Mountain Brush Prescribed Fire Effects

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
II	**Oak woodland/oak-maple/ interior chaparral/ mountain brush**	Clumps of dense, homogenous woodland or shrub interspersed with hand or machine-piled woodland or shrub. Piled vegetation resulted from hand or mechanical treatment. Dominant species of woodland and shrub may include: Gambel's oak, bigtooth maple, mountain mahogany, serviceberry, snowberry, bitterbrush, manzanita, ceanothus, silk tassle, madrone or other evergreen oaks.	**Activity fuels piled, then piles burned** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: Piles cover up to 30% of the treatment area. Remaining clumps of woodlands and shrubs will have some additional mortality from heat and flames resulting from pile burning (up to 20% of remaining woodland or shrubs) if piles are located close. Following pile burning, there will be severe ground heating below piles (up to 30% of the area). Prolific sprouting can be expected, except in areas where piles were constructed. Sprouting below piles ranges from minimal to no sprouting. If objectives are to reduce woodland or shrub densities over time, successive years of cutting and piling, and/or burning may be needed to deplete vegetative reserves and reduce future sprouting. Almost all large woody debris and snags are absent since they likely did not occur in the overstory. **Low Treatment Intensity** - Up to 20% of the area may also be burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of the treatment area burned). Woodland and shrub mortality may occur in areas burned by creeping piles. Most piled vegetation is completely consumed – only larger branch wood may remain. **Moderate Treatment Intensity** - 20-50% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 80% of total treatment area burned). Woodland and shrub mortality may occur in areas burned by creeping piles. Most piled vegetation is completely consumed. **High Treatment Intensity** - more than 50% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (80 to 100% of total treatment area burned). Woodland and shrub mortality may occur in areas burned by creeping piles. All piled vegetation is completely consumed.

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
II	**Oak woodland/oak-maple/ interior chaparral/ mountain brush**	Dense homogenous stands of woodland or shrub with very little to no understory or overstory tree vegetation. Only natural fuels are on-site; few to no activity fuels are on-site. Dominant species of woodland and shrub may include: Gambel's oak, bigtooth maple, mountain mahogany, serviceberry, snowberry, bitterbrush, manzanita, ceanothus, silk tassle, madrone or other evergreen oaks.	**Broadcast burn**	**Common to all treatment intensities**: If objectives are to reduce woodland or shrub densities over time, successive years of burning may be needed to deplete vegetative reserves and reduce future sprouting. Almost all large woody debris and snags are absent since they likely did not occur in the overstory. **Low Treatment Intensity** - Broadcast burning will create patches of burned and unburned areas (less than 50% of the area burned). Partial to complete vegetative consumption will occur in burned patches. Soil heating will be of relatively short duration; where burning occurs, there will be low to moderate ground scorch severity. Prolific and vigorous woodland/shrub sprouting will occur in the burned patches shortly following burning. **Moderate Treatment Intensity** - Broadcast burning will create patches of burned and unburned areas, with more burned patches (up to 75% of the area burned). Partial to complete vegetative consumption will occur in burned patches. Soil heating will be of moderate duration; where burning occurs, there will be low to moderate ground scorch severity. Prolific and vigorous woodland/shrub sprouting will occur in the burned patches shortly following burning. **High Treatment Intensity** - Broadcast burning will occur over all of the landscape. Complete vegetative consumption will occur across the entire treated area. Soil heating will be of moderate duration; where burning occurs, there will be moderate to high ground scorch severity. Prolific and vigorous woodland/shrub sprouting will occur across the burned area shortly following burning.

Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, and lodgepole pine cover types occupying historical Fire Regime Group I and III

Tree species distribution:

- Ponderosa pine (*Pinus ponderosa var. ponderosa* and/or *var. scopulorum)* and Douglas-fir (*Pseudotsuga menziesii* mostly var*. glauca*, but some var. *menziesii* on the western edge) occur in all seven states involved in this process.
- Western Larch (*Larix occidentalis*) occurs in Western Montana, Northern Idaho, Eastern Washington and Oregon.
- Jeffrey pine (*Pinus Jefferyi*) may occur in Southwestern Oregon and Western Nevada.
- Lodgepole pine (*Pinus contorta var. latifolia*) occurs in all seven states involved in this process.

Fire regimes:

Fire regimes used in these tables are the same fire regime groups as those used in Restoring Fire-Adapted Ecosystems on Federal Lands, A Cohesive Fuel Treatment Strategy for Protecting People and Sustaining Natural Resources (USDI and USDA Forest Service, August 2, 2002). Fire regime is the natural historical frequency and severity of fire within an ecosystem.

Fire-Prone Areas Targeted:

"The cohesive Strategy places a greater emphasis on restoration and fuel maintenance treatments within these areas most prone to fire occurrence, specifically within Fire Regime Groups I, II, and III. These areas have experienced the greatest change from historical conditions due to fire exclusion. Thus, they are most likely to respond favorably to treatments designed to reduce hazardous fuels, thereby improving ecosystem resiliency to wildland fire" (Restoring Fire-Adapted Ecosystems on Federal Lands, A Cohesive Fuel Treatment Strategy for Protecting People and Sustaining Natural Resources, USDI and USDA Forest Service, August 2, 2002, pg 28). Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, and lodgepole pine are common forest overstory species in Fire Regime Groups I and III, and will likely comprise a majority of the restoration project proposals in conifer ecosystems.

Restoration activities will vary greatly depending on landscapes and site specific conditions. Some treatment proposals may seek to restore forest structure in one treatment, and other proposals may plan for multiple activities spread over 5 to 20 years, depending on other resource values involved.

Lodgepole pine or grand fir were not historically the dominant cover type in these fire regimes, but due to past management actions, they may now be the dominant overstory on some Fire Regime Group I or III areas. These coniferous forests types may merge into Sagebrush plant communities, especially in fire regime I and sometimes in fire regime III.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
I	**Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, lodgepole pine** *Due to fire exclusion, timber harvesting, or insect and disease, lodgepole pine or grand fir may now be the *primary* (overstory and understory) tree species on these sites.	Overstory of ponderosa pine, or western larch, Jeffrey pine, or Douglas-fir (or in combinations). In this treatment most of the smaller diameter, understory trees are thinned and piled. Due to past timber harvest or insect and disease activity, large diameter trees may no longer be present on the areas. Due to their higher value, ponderosa pine, western larch, or Douglas-fir may have been selectively harvested, leaving lodgepole pine (or grand fir) as the current primary overstory tree species.	**Thin, pile, and burn piles –** This includes machine thinning and machine piling, hand thinning and hand piling, and combinations of the above treatments. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: Native understory plants that have the ability to sprout and will begin to sprout shortly following spring and early fall burns if soil moisture and temperature conditions are conducive to plant growth. In burned areas, 95% of the fine and small diameter fuels (one hour [0 to 0.25" diameter], 10 hour [0.25 to 1.0"], and 100 hour [1 to 3"]) will be consumed. Large diameter fuels (1,000 hour [3"+]) will be consumed in relation to their diameter and moisture content. The lower the moisture content of the larger fuels the greater the mass consumed. Up to 20% of the treatment area (area under the piles) may have severe soil heating (up to several inches into the soil profile). **Low Treatment Intensity**: Scorch damage on 20% of the trees in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 40% of treatment area burned). Immediate post fire mortality of the overstory will be less than 10% of the basal area per acre. **Moderate Treatment Intensity:** Scorch damage on 20-50% of the trees in the immediate vicinity of the burned piles. 20-50% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (Up to 70% of total treatment area burned). Immediate post fire mortality of the overstory will be less than 20% of the basal area per acre. **High Treatment Intensity**: Scorch damage on more than 50% of the trees in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch. More than 50% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (More than 70% of total treatment area is burned). Immediate post fire mortality of the overstory will be less than 25% of the basal area per acre. **Riparian areas:** Most riparian areas will be treated with low intensity treatment, but due to thick duff accumulations or other fuel arrangements, some portions (generally less than 20%) of the riparian area may experience effects equivalent to moderate treatment intensity. Some variation in fire effects is natural and healthy for producing functioning ecosystems.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
I	**Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, lodgepole pine** *Due to fire exclusion, timber harvesting, or insect and disease, lodgepole pine or grand fir may now be the *primary* (overstory and understory) tree species on these sites.	Overstory of ponderosa pine, or western larch, Jeffrey pine, or Douglas-fir (or in combinations). In this treatment most of the smaller diameter, understory trees are thinned and left where they fall, or the thinned trees may be scattered to avoid concentrations of thinning slash. Due to past timber harvest or insect and disease activity, large diameter trees may no longer be present on the areas. Due to their higher value, ponderosa pine, western larch, or Douglas-fir may have been selectively harvested, leaving lodgepole pine as the *current* primary overstory tree species.	**Thin, scatter, and broadcast burn -** This includes machine thinning, and hand thinning and combinations there-of. In some cases, fuels may be pulled away from the designated leave trees or other important resources. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	**Common to all treatment intensities**: Native understory plants that have the ability to sprout, will begin to sprout shortly following spring and early fall burns. In burned areas, 90% of the fine fuels (one hour [0 to 0.25”] and 10 hour [0.25 to 1.0” diameter]) will be consumed. Large diameter fuels (100 hour [1 to 3”] and 1,000 hour [3”+]) will be consumed in relation to their diameter and moisture content. The lower the moisture content of the larger fuels the greater the mass consumed. **Low Treatment Intensity**: Scorch damage on up to 40% of the trees. Up to 50% of the area has been burned (low to moderate severity). Immediate post fire mortality of the overstory will be less than 10% of the basal area per acre. **Moderate Treatment Intensity**: Scorch damage on 20-50% of the trees. Up to 70% of the area has been burned (mostly low to moderate, but some high severity). Immediate post fire mortality of the overstory will be less than 20% of the basal area per acre. **High Treatment Intensity**: Scorch damage on more than 50% of the trees. More than 80% of the area has been burned (low, moderate, and some high severity). Immediate post fire mortality of the overstory will be less than 25% of the basal area per acre. **Riparian areas:** Most riparian areas will be treated with low intensity treatment, but due to thick duff accumulations or other fuel arrangements, some portions (generally less than 20%) of the riparian area may experience effects equivalent to moderate treatment intensity. Some variation in fire effects is natural and healthy for producing functioning ecosystems.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
I	**Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, lodgepole pine** Due to fire exclusion, timber harvesting, or insect and disease, lodgepole pine or grand fir may now be the *primary* (overstory and understory) tree species on these sites.	Overstory of ponderosa pine, Jeffrey pine, or western larch, or Douglas-fir (or in combinations). Due to past timber harvest or insect and disease activity, large diameter trees may no longer be present on the areas. In many cases, the *current* tree biomass may far exceed the biomass that would have been maintained on these sites naturally. Therefore, treatments may be designed to kill much of the understory trees and even significant portions of the overstory trees.	**Broadcast burn** In some cases, this may include fuels being pulled away from the designated leave trees or other important resources.	**Common to all treatment intensities**: Native understory plants that have the ability to sprout, will begin to sprout shortly following spring and early fall burns. In burned areas, 90% of the fine fuels (one hour [0 to 0.25"] and 10 hour [0.25 to 1.0" diameter]) will be consumed. Large diameter fuels (100 hour [1 to 3"] and 1,000 hour [3"+]) will be consumed in relation to their diameter and moisture content. The lower the moisture content of the larger fuels the greater the mass consumed. **Low Treatment Intensity**: Scorch damage on up to 40% of the overstory trees. Up to 50% of the area has been burned (low to moderate severity). Immediate post fire mortality of the overstory will be less 20% of the basal area per acre. **Moderate Treatment Intensity**: Scorch damage on 20-50% of the overstory trees. Up to 70% of the area has been burned (mostly low to moderate, but some high severity). Immediate post fire mortality of the overstory will be less than 30% of the basal area per acre. **High Treatment Intensity**: Scorch damage on more than 50% of the trees. More than 80% of the area has been burned (low, moderate, and some high severity). Immediate post fire mortality of the overstory will be less than 40% of the basal area per acre. **Riparian areas**: Most riparian areas will be treated with low intensity treatment, but due to thick duff accumulations or other fuel arrangements, some portions (generally less than 20%) of the riparian area may experience effects equivalent to moderate treatment intensity. Some variation in fire effects is natural and healthy for producing functioning ecosystems.

Ponderosa pine, Douglas-fir, Western Larch, Jeffrey Pine, Lodgepole pine – Open Forest Objective Prescribed Fire Effects

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, lodgepole pine – Open Forest Objective** Mosaics of different forest structure are part of the landscape patterns for this regime. Much of this regime had surface fires frequent enough to result in open forests with trees of medium and large diameter. Closed and multi-story forest and seedling/sapling structures were also represented in this regime. ***** Due to fire exclusion, timber harvesting, or insect and disease, lodgepole pine or grand fir may now be the primary (overstory and understory) tree species on these sites.	Overstory of ponderosa pine, Jeffrey pine, or western larch, or Douglas-fir (or in combinations). Most of the smaller diameter, understory trees and piled or scattered. Due to past timber harvest or insect and disease activity, large diameter trees may no longer be present on the areas. Due to their higher value, ponderosa pine, western larch, or Douglas-fir may have been selectively harvested, leaving lodgepole pine (or grand fir) as the *current* primary overstory tree species.	**Thin, pile and burn piles** to achieve open forest structure as a result of a non-lethal or mixed lethal severity disturbance. Treatment type and size should be based on landscape objectives considering the natural mosaic of patches of forest structure and within stand variation. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	After reviewing the forest structure of a landscape, it may be necessary to restore an open large tree forest structure component in that landscape. This would be accomplished with prescribed fire with an end result of non-lethal or mixed lethal fire effects. **Common to all treatment intensities**: Native understory plants that have the ability to sprout, will sprout following spring and early fall burns. In burned areas, 95% of the fine and small diameter fuels (one hour [0 to 0.25“ diameter], 10 hour [0.25 to 1.0”], and 100 hour [1 to 3”]) will be consumed. Large diameter fuels (1,000 hour [3”+]) will be consumed in relation to their diameter and moisture content. The lower the moisture content of the larger fuels the greater the mass consumed. Up to 20% of the treatment area (area under the piles) may have severe soil heating (up to several inches into the soil profile). **Low Treatment Intensity**: Scorch damage on 20% of the trees in the immediate vicinity of the burned piles. Up to 20% of the area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 40% of treatment area burned). Immediate post fire mortality of the overstory will be less than 10% of the basal area per acre. **Moderate Treatment Intensity**: Scorch damage on 20-50% of the trees in the immediate vicinity of the burned piles. 20-50% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (Up to 70% of total treatment area burned). Immediate post fire mortality of the overstory will be less than 20% of the basal area per acre. **High Treatment Intensity**: Scorch damage on more than 50% of the trees in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch. More than 50% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (More than 70% of total treatment area is burned). Immediate post fire mortality of the overstory will be less than 25% of the basal area per acre. **Riparian areas:** Most riparian areas will be treated with low intensity treatment, but due to thick duff accumulations or other fuel arrangements, some portions (generally less than 20%) of the riparian area may experience effects equivalent to moderate treatment intensity.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, lodgepole pine – Open Forest Objective** Due to fire exclusion, timber harvesting, or insect and disease, lodgepole pine or grand fir may now be the primary (overstory and understory) tree species on these sites.	Overstory of ponderosa pine, Jeffrey pine, or western larch, or Douglas-fir (or in combinations). Due to past timber harvest or insect and disease activity, large diameter trees may no longer be present on the areas. Due to their higher value, ponderosa pine, western larch, or Douglas-fir may have been selectively harvested, leaving lodgepole pine (or grand fir) as the *current* primary overstory tree species.	**Broadcast burn** - to achieve open forest structure (as a result of a non-lethal or mixed lethal severity disturbance). In some cases, this may include fuels being pulled away from the designated leave trees or other important resources.	**Common to all treatment intensities**: Native understory plants that have the ability to sprout, will begin to sprout shortly following spring and early fall burns. In burned areas, 90% of the fine fuels (one hour [0 to 0.25"] and 10 hour [0.25 to 1.0" diameter]) will be consumed. Large diameter fuels (100 hour [1 to 3 "] and 1,000 hour [3+"]) will be consumed in relation to their diameter and moisture content. The lower the moisture content of the larger fuels the greater the mass consumed. **Low Treatment Intensity**: Scorch damage on up to 40% of the overstory trees. Up to 50% of area has been burned (low to moderate severity). Immediate post fire mortality of the overstory will be less 20% of the basal area per acre. **Moderate Treatment Intensity**: Scorch damage on 20-50% of the overstory trees. Up to 70% of the area has been burned (mostly low to moderate, but some high severity). Immediate post fire mortality of the overstory will be less than 30% of the basal area per acre. **High Treatment Intensity**: Scorch damage on more than 50% of the trees. More than 80% of the area has been burned (low, moderate, and some high severity). Immediate post fire mortality of the overstory will be less than 40% of the basal area per acre. **Riparian areas**: Most riparian areas will be treated with low intensity treatment, but due to thick duff accumulations or other fuel arrangements, some portions (generally less than 20%) of the riparian area may experience effects equivalent to moderate treatment intensity.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, lodgepole pine – Open Forest Objective** Mosaics of different forest structure are part of the landscape patterns for this regime. Much of this regime had surface fires frequent enough to result in open forests with trees of medium and large diameter. Closed and multi-story forest and seedling/sapling structures were also represented in this regime. ***** Due to fire exclusion, timber harvesting, or insect and disease, lodgepole pine or grand fir may now be the *primary* (overstory and understory) tree species on these sites.	Overstory of ponderosa pine, Jeffrey pine, or western larch, or Douglas-fir (or in combinations). Most of the smaller diameter, understory trees have been cut and piled or scattered. Due to past timber harvest or insect and disease activity, large diameter trees may no longer be present on the areas. Due to their higher value, ponderosa pine, western larch, or Douglas-fir may have been selectively harvested, leaving lodgepole pine (or grand fir) as the *current* primary overstory tree species.	**Thin, scatter and burn** to achieve open forest structure as a result of a non-lethal or mixed lethal severity disturbance. Treatment type and size should be based on landscape objectives considering the natural mosaic of patches of forest structure and within stand variation. See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	After reviewing the forest structure of a landscape, it may be necessary to restore an open large tree forest structure component in that landscape. This would be accomplished with prescribed fire with an end result of non-lethal or mixed lethal fire effects. **Common to all treatment intensities:** Native understory plants that have the ability to sprout, will begin to sprout shortly following spring and early fall burns. In burned areas, 90% of the fine fuels (one hour [0 to 0.25”] and 10 hour [0.25 to 1.0” diameter]) will be consumed. Large diameter fuels (100 hour [1 to 3 “] and 1,000 hour [3+”]) will be consumed in relation to their diameter and moisture content. The lower the moisture content of the larger fuels the greater the mass consumed. **Low Treatment Intensity :** Scorch damage on up to 40% of the trees. Up to 50% of area has been burned (low to moderate severity). Immediate post fire mortality of the overstory will be less than 10% of the basal area per acre. **Moderate Treatment Intensity**: Scorch damage on 20-50% of the trees. Up to 70% of the area has been burned (mostly low to moderate, but some high severity). Immediate post fire mortality of the overstory will be less than 20% of the basal area per acre. **High Treatment Intensity:** Scorch damage on more than 50% of the trees. More than 80% of the area has been burned (low, moderate, and some high severity). Immediate post fire mortality of the overstory will be less than 25% of the basal area per acre. **Riparian areas**: Most riparian areas will be treated with low intensity treatment, but due to thick duff accumulations or other fuel arrangements, some portions (generally less than 20%) of the riparian area may experience effects equivalent to moderate treatment intensity. Some variation in fire effects is natural and healthy for producing functioning ecosystems.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Ponderosa pine, Douglas-fir, western larch, Jeffrey pine, lodgepole pine – Seedling/Sapling Objective** Mosaics of different forest structure are part of the landscape patterns for this regime. Much of this regime had surface fires frequent enough to result in open forests of medium and large diameter trees. Closed and multi-story forest and seedling/sapling structures were also represented in this regime.	Includes a wide range of fuel and forest stand conditions. May include areas which have had trees cut down to generate dry fuels to burn to produce enough heat to kill most of the trees in both the overstory and understory. Stands may typically be well stocked, having dense canopy cover of single or multistory trees.	**Broadcast burn** - to achieve seedling/sapling forests (as a result of a stand replacing disturbance). It may be necessary to restore seedling and sapling patches and pole size patches across the landscape to restore a natural mosaic pattern. This would be accomplished with prescribed fire with an end result of lethal fire effects. Treatment type and size should be based on landscape objectives considering the natural mosaic of patches of forest structure and within stand variation.	**High Treatment Intensity**: Scorch damage or basal injury on more than 90% of the trees. More than 80% of the area has been burned (moderate and high severity). Immediate post fire mortality of the overstory will be 85% or more of the basal area per acre. Treatments of low or moderate intensity would generally not be planned with a stand replacing disturbance objective. **Riparian areas:** Most riparian areas will be treated with moderate intensity treatment, but due to thick duff accumulations or other fuel arrangements, some portions (generally less than 20%) of the riparian area may experience effects equivalent to moderate treatment intensity.

Riparian Mid/Upper Elevations Prescribed Fire Effects

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
III, IV & V Highly variable but generally longer intervals and high severity	**Riparian Mid/Upper Elevations, Condition Class 1** Exist throughout lodgepole pine, cedar, spruce, fir type in the area	Condition Class 1 – Area includes only riparian vegetation – not entire RHCA. Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large pole to mature size lodgepole pine, Douglas-fir, western larch, white pine, hardwoods, spruce, western hemlock, cedar or true fir. Understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are up to 5 snags per acre present.	**Thin small diameter trees, Hand pile, burn piles** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	Piling is the treatment most likely to have effects in riparian due to higher fuel moistures. Piling and pile covers facilitate drying of fuels and help to increase consumption. **Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, climax species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. Consumption of duff will be dependent on moisture content. Movement of fire outside of the perimeter of the pile may occur during "creeping." Total consumption of the duff layer will only occur under extremely dry forest floor conditions, or in areas where heating is great. **Low Treatment Intensity** - Scorch damage on up to 10% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). Most likely to occur in areas where fuel moistures, dead and live, are high **Moderate Treatment Intensity** - Scorch damage on 10-20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 20% of the trees in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
III, IV & V	**Riparian Mid/Upper Elevations, Condition Class 1**	Condition Class 1 **–** Area includes only riparian vegetation – not entire RHCA. Stand has not missed any past fire disturbance cycles but is nearing or at maturity. More seral species than higher condition classes. Large pole to mature size lodgepole pine, Douglas fir, western larch, white pine, hardwoods, spruce, true fir, cedar or western hemlock. Understory conifers scattered throughout unit. Other understory vegetation includes grasses, forbs, and shrubs. Snags are low in number - up to 5 snags per acre present.	**Broadcast Burn (thinned or not)** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	Intentional burning in riparian areas is often not an objective. However, fire can creep into riparian area from upland burns. Often this creeping does not result in the same degree of impacts as in the upland area due to higher fuel moistures. **Low Treatment Intensity** - Up to 10% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees are likely killed through cambial heating or scorching. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperatures are conducive to plant growth. Up to 20% of snags and up to 30% of large downed logs heavily damaged or burned up. Most likely scenario at mid to upper elevations. **Moderate Treatment Intensity** - 10-30% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorching damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorching. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moisture and temperatures are conducive for plant growth. Up to 30% of snags and up to 50% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorching. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moisture and temperatures are conducive for plant growth. Up to 50% of snags and up to 70% of large downed logs heavily damaged or burned up.

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
III, IV & V	**Riparian Mid/Upper Elevations, Condition Class 2**	Condition Class 2 – Area includes only riparian vegetation – not entire RHCA. Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over- mature spruce, cedar, western hemlock, true fir, lodgepole pine, Douglas fir, western larch or white pine. Most small diameter, understory true fir, spruce and hemlock trees have been cut and piled. Remaining understory trees are scattered throughout the treatment area and dominated by shade-tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present.	**Thin small diameter trees, hand pile, burn piles** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	Piling is the treatment most likely to have effects in riparian due to higher fuel moistures. Piling and pile covers facilitate drying of fuels and increases consumption. **Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, late seral species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance due to serotinous cones and bare soil. Consumption of duff will be dependent on moisture content. Movement of fire outside of the perimeter of the pile may occur during "creeping." Total consumption of the duff layer will only occur under extremely dry forest floor conditions, or in areas where heating is great. **Low Treatment Intensity** - Scorch damage on 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned. **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered and burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless large and close). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 60% of total treatment area burned).

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
III, IV & V	**Riparian Mid/Upper Elevations, Condition Class 2**	Condition Class 2 – Area includes only riparian vegetation – not entire RHCA. Stand has missed 1 or more past fire disturbance cycles and is past maturity with shade-tolerant species increasing. Large diameter, over- mature spruce, cedar, western hemlock, true fir, lodgepole pine, Douglas fir, western larch or white pine. Most small diameter, understory true fir, spruce and hemlock trees have been cut and scattered. Remaining understory trees are scattered throughout the treatment area and dominated by tolerant, late seral species. Other understory vegetation includes grasses, forbs, and shrubs. Up to 15-20 snags per acre present.	**Broadcast Burn** **(thinned or not)** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	Intentional burning in riparian areas is often not an objective. However, fire can creep into riparian area from upland burns. Often this creeping does not result in the same degree of impacts as in the upland area due to higher fuel moistures, etc. **Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moistures and temperatures are conducive for plant growth. Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks if soil moistures and temperatures are conducive for plant growth. Up to 40% of snags and up to 60% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 30-50% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but sprouting evident within a few days to up to 3 weeks soil moisture and temperatures are conducive for plant growth. Up to 60% of snags and up to 80% of large downed logs heavily damaged or burned up.

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
III, IV & V	**Riparian Mid/Upper Elevations, Condition Class 3**	Condition Class 3 – Area includes only riparian vegetation – not entire RHCA. Stand has missed many past fire disturbance cycles and has converted to true firs, western hemlock, and shade-tolerant species. More late seral species present without disturbance that are more sensitive to fire. Large diameter true fir, spruce, cedar or western hemlock dominates with remnant Douglas fir, western larch, lodgepole pine, or western white pine scattered. Pathogens and insects have increased damage to trees and have created excessive fuels and many piles. Most understory trees have been cut and piled with remaining understory trees scattered throughout the treatment area and dominated by true fir, spruce and western hemlock. Other understory vegetation includes native grasses, forbs, and shrubs. Over 20 snags per acre.	**Thin small diameter trees, Hand pile, burn piles** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning. See **Mechanical Treatment Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for information related to piling.	Piling is the treatment most likely to have effects in riparian due to higher fuel moistures. Piling and pile covers enable fuels to dry out and be more completely consumed than fuels scattered on ground. **Common to all treatment intensities:** 95% of piles are completely consumed. Up to 20% of the treatment area (area directly under the piles) will have severe soil heating up to several inches into the soil profile. Western larch, ponderosa pine & Douglas fir less sensitive to fire than lodgepole pine, climax species are most sensitive & most likely to die. Lodgepole pine regenerates easily after disturbance. Consumption of duff will be dependent on moisture content. Movement of fire outside of the perimeter of the pile may occur during "creeping." Total consumption of the duff layer will only occur under extremely dry forest floor conditions, or in areas where heating is great. **Low Treatment Intensity** - Scorch damage on up to 20% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. Up to 20% of area has been burned (low to moderate severity) from fire creeping outside the pile boundaries (total of 20% of treatment area burned). **Moderate Treatment Intensity** - Scorch damage on 20-30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles. 20-30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 40% of total treatment area burned). **High Treatment Intensity** - **Not likely** (at mid to upper elevations) since piles are normally covered & burned late in the season before winter or early spring. Scorch damage on more than 30% of the trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) in the immediate vicinity of the burned piles with limited immediate mortality from 100% scorch depending on where and how large piles are (less chance unless piles are large and close to one another). More than 30% of the area beyond the piles burned (low to moderate severity) from fire creeping outside of pile boundaries (up to 50% of total treatment area burned).

Activity Component			Work Element	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-treatment Vegetation Description**
III, IV & V	**Riparian Mid/Upper Elevations, Condition Class 3**	Condition Class 3 – Area includes only riparian vegetation – not entire RHCA. Stand has missed many past fire disturbance cycles and has converted to true firs, western hemlock and shade-tolerant species. More climax species present without disturbance that are more sensitive to fire. Large diameter true fir, spruce, cedar or western hemlock dominates with remnant Douglas fir, western larch, lodgepole pine, or western white pine scattered. Pathogens and insects have increased damage to trees and created excessive fuels and accumulations. Most understory trees have been cut, remaining understory trees are scattered throughout treatment area & are dominated by true fir, spruce & western hemlock. Other understory vegetation includes native grasses, forbs & shrubs. Over 20 snags per acre present.	**Broadcast Burn (thinned or not)** See **Mechanical Treatment Activity Type, Harvest Prescription / Implementation Activity Component** for information related to thinning.	Intentional burning in riparian areas is often not an objective. However, fire can creep into riparian area from upland burns. Often this creeping does not result in the same degree of impacts as in the upland area due to higher fuel moistures. **Low Treatment Intensity** - Up to 20% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating, but relatively little scorch damage on other overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moistures and temperatures are conducive to plant growth . Up to 30% of snags and up to 40% of large downed logs heavily damaged or burned up. **Moderate Treatment Intensity** - 20-40% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate scorch damage on most of remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moistures and temperatures are conducive for growth. Up to 40% of snags & up to 60% of large downed logs heavily damaged or burned up. **High Treatment Intensity** - 40-60% of remaining overstory trees (primarily fire sensitive species such as true firs, hemlock, spruce and other species when younger) killed by crown scorch damage or cambial heating with moderate-high scorch damage on almost all remaining overstory trees. Remaining fire sensitive understory trees likely killed through cambial heating or scorch. Other understory vegetation top-killed but resprouting evident within a few days to up to 3 weeks if soil moistures and temperatures are conducive for growth. Up to 60%+ of snags and up to 80%+ of large downed logs heavily damaged or burned up.

Sagebrush Prescribed Fire Effects – General Descriptions and Trends

Sagebrush is usually the dominant shrub in drier ecosystems of the Intermountain Region and the Great Basin. Elevation of sagebrush communities varies from 300 ft above sea level in the Columbia Basin to over 10,000 ft in the mountains of the Great Basin. Sagebrush plant communities occupy just over 155 million acres in the western United States. These shrub-steppe plant communities are characterized by an overstory of sagebrush (*Artemisia* sp.) and an understory of perennial grasses and forbs. As effective precipitation decreases, the herbaceous plants total a smaller percentage of the total plant cover. Vegetal cover is usually not continuous and large areas of bare ground can occur. Potential composition of the associated vegetation is dependent on the local and regional climate as well as soil type. A large number of herbaceous species are present throughout the sagebrush biome, but relatively few species form the bulk of the biomass.

Fire regimes of these plant communities are variable. However, there are some general patterns. In all cases fires would be classified as stand replacing based on the accepted definition. Fires are either mixed or high severity. The average number of years between fire events will increase as the site conditions becomes drier. Higher elevation mountain big sagebrush plant communities may experience a fire once every 15 to 25 years and a lower elevation Wyoming big sagebrush plant community may not experience a fire event once in 100 years. Over the last 150 years, most big sagebrush plant communities within the range of consideration have missed at least one fire cycle. Higher elevation sagebrush plant communities may have missed as many as 3-4 cycles. The exception to this is where annual grasses, primarily cheatgrass, have come to dominate the site. These areas have shifted to a fire regime with very frequent fires. In some cases these annual grass dominated sites burn once every 3-5 years.

Eleven species and 14 subspecies of sagebrush have been identified in the western United States. Three subspecies of big sagebrush (*Artemisia tridentata*) are described in the text and table below.

> Wyoming Big Sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) occurs throughout the area under consideration. Site productivity affects species composition and stature. Highly productive sites have greater plant density and more biomass than drier areas. Wyoming big sagebrush is the least flammable of the three big sagebrush species described. Soils are often shallow, well drained with a fine texture. The invasive annual, cheatgrass (*Bromus tectorum*) has made the most significant inroads into these big sagebrush plant communities.
>
> Basin Big Sagebrush (*Artemisia tridentata* ssp. *tridentata*) occurs on sites that are more productive than Wyoming big sagebrush. Basin big sagebrush is considered to be intermediate in flammability to Wyoming big and mountain big sagebrush. Soils are often deep and well drained. However, in the Great Basin, basin big sagebrush can be found on areas with shallow soils. The shrub will have similar physical and plant community structural characteristics to Wyoming big sagebrush under these conditions.

Mountain Big Sagebrush (*Artemisia tridentata* ssp. *vaseyana*) is often found on productive, higher elevation sites. Mountain big sagebrush is the most flammable of the three subspecies. Soils are deep and well drained. Herbaceous plants comprise a larger proportion of the late seral plant communities than in the Wyoming or basin big sagebrush plant communities.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
II	**Mountain Big Sagebrush** (*Artemisia tridentata* ssp. *vaseyana*)	Mountain big sagebrush is either dominant or co-dominant with other understory grasses and forbs. Sagebrush, and associated woody vegetation cover, varies from less than 10% to over 60%. At higher elevations, mountain big sagebrush exists with other mountain shrubs; bitterbrush, horsebrush, rabbitbrush, ceanothus, and snowberry. Sagebrush forms a relatively homogonous stand of woody vegetation of similar sized shrubs. As woody vegetation approaches the maximum allowable on site, understory vegetation cover and density is reduced with a corresponding increase in bare ground. Understory cover at this stage will be less than 10%.	**Broadcast Burn**	Mountain big sagebrush plants are killed by fire. However, most associated woody vegetation is capable of sprouting following top removal. Sprouting ability varies across and within individual shrub species. Sprouting of antelope bitterbrush would represent a species with sporadic ability to sprout, and green rabbitbrush and snowberry would be classified as vigorous sprouters. Most shrubs found in these plant communities fall in the continuum between these species. Deep rooted perennial forbs and grasses also sprout vigorously following burning. Shallower rooted grasses and mat-forming forbs can be suppressed following burning. Small amounts of plant litter are present in these communities and are found beneath the canopies of shrubs or larger grasses and forbs. Cheatgrass does occur in disturbed areas of some these plant communities. However, areas where cheatgrass is a major component, or dominates the plant community is discussed elsewhere.. **Low Treatment Intensity** – Fire has removed most of the leaves on the shrubs and the smaller branches. Numerous blackened shrub skeletons are left standing. Aboveground portions of forbs and grasses are consumed. Plants with heavier leaves may have portions left intact. Large perennial grasses have blackened crowns. Green plant material may or may not have been consumed, especially within dense grass crowns. Litter on the soil surface, most commonly found beneath shrub canopies, is scorched to partially consumed. **Moderate Treatment Intensity** – Fire has removed all leaves and branches of shrubs. Only main stems and larger branches of dominant individuals in the stand remain. Aboveground portions of grasses and forbs are burned, but large plants may have recognizable parts blackened, but intact. Litter on soil surface (mostly beneath shrub canopies) is blackened and may be totally consumed in some areas. **High Treatment Intensity** – Fire has removed most of the above-ground portion of all shrubs grasses and forbs. Part of the shrub main stem may be present immediately following the fire. Most of the litter has been consumed by the fire and ash remains in the areas beneath shrubs. Crowns of grasses may be visible, but all live and dead plant material has been removed.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
II	**Mountain Big Sagebrush** (*Artemisia tridentata* ssp. *vaseyana*)	Mountain big sagebrush is either dominant or co-dominant with other understory grasses and forbs. Sagebrush, and associated woody vegetation cover, varies from less than 10% to over 60%. At higher elevations, mountain big sagebrush exists with other mountain shrubs; bitterbrush, horsebrush, rabbitbrush, ceanothus, and snowberry. Sagebrush forms a relatively homogonous stand of woody vegetation of similar sized shrubs. As woody vegetation approaches the maximum allowable on site, understory vegetation cover and density is reduced with a corresponding increase in bare ground. Understory cover at this stage will be less than 10%.	**Brushbeating / mowing**	Brushbeating results in the severing/shredding of the upper portions of the shrubs. Big sagebrush does not sprout following removal of the aerial portions of the plant. However, associated shrubs sprout to varying degrees. Low growing herbaceous and woody plants can be missed by cutting blades. Treatment is often done in late fall when fire danger is low and the majority of plants are dormant. Brushbeating can also be done in winter or early spring if weather permits, or during other times when risk of fire is low. Cheatgrass does occur in disturbed areas of some these plant communities. However, areas where cheatgrass is a major component, or dominates these areas are discussed elsewhere. **Low Treatment Intensity** – Brushbeating occurs across less than 25% of the plant community. Cutting equipment is held at 18" above the soil surface. Only tops of larger shrubs are removed by cutters. Lower branches of larger shrubs and smaller shrubs are left intact. Minimal disturbance occurs to herbaceous plants. Some mechanical damage to herbaceous plants can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter is increased in interspace areas by cutting. **Moderate Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held at 12-18" above the soil surface. The majority of larger shrubs have the tops removed. Sprouting of may be stimulated in shrubs other than mountain big sagebrush. Woody plants less than 12" tall are not damaged by the cutting blades. Most herbaceous plants are dormant during the treatment. Only aerial portions of herbaceous plants are removed by cutters, minimally impacting these plants. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter increases following treatment. Moderate amounts of woody litter are added to the soil surface. Some mechanical damage to herbaceous plants can be done by passage of tractor. Soi ls are usually dry and/or frozen during this treatment, reducing compaction. **High Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held below 12" above the soil surface. Most shrubs have tops removed leaving a plant community. Sprouting shrubs will begin to send up shoots in the next growing season. Sagebrush is killed by treatments and will not sprout following top removal. Cutting blades remove aboveground herbaceous plant material at the level of the cutting blades. Some soil disturbance may occur due to cutting blades contacting the soils surface. Some mechanical damage can be done to herbaceous plants by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Large amounts of woody and herbaceous plant litter is added to the soil surface.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Mountain Big Sagebrush** (*Artemisia tridentata* ssp. *vaseyana*)	These plant communities are at the warmer/drier end of the mountain big sagebrush distribution and may integrate into Wyoming big sagebrush plant communities as elevation and/or soil depth decreases. Mountain big sagebrush dominates in these drier plant communities. Rabbitbrush, horsebrush, and bitterbrush are commonly founding various levels in the plant community. Sagebrush cover and density have reached a point that understory herbaceous plants are being suppressed. Cover of herbaceous plants is less than 10%. Introduced annual plants may be present at various quantities. These plants may dominate the understory vegetation in areas with severe disturbance history.	**Broadcast Burn**	Mountain big sagebrush plants are killed by fire. However, most associated woody vegetation is capable of sprouting following top removal. Sprouting ability varies across and within individual shrub species. Sprouting of antelope bitterbrush would represent a species with sporadic ability to sprout, and green rabbitbrush and snowberry would be classified as vigorous sprouters. Most shrub species fall in the continuum between these species. Deep rooted perennial forbs and grasses also sprout vigorously following burning. Shallower rooted grasses and mat-forming forbs can be suppressed following burning. Small amounts of plant litter are present in these communities. What is present is found beneath the canopies of shrubs or larger grasses and forbs. Cheatgrass does occur in disturbed areas of some these plant communities. However, areas where cheatgrass is a major component, or dominates these areas are discussed elsewhere. **Low Treatment Intensity** – Fire has removed most of the leaves on the shrubs and the smaller branches. Numerous blackened shrub skeletons are left standing. Aboveground portions of forbs and grasses are consumed. Plants with heavier leaves may have portions left intact. Large perennial grasses have blackened crowns. Green plant material may or may not have been consumed, especially within dense grass crowns. Litter on the soil surface, most commonly found beneath shrub canopies is scorched to partially consumed. If annual plants are present in significant quantities prior to burning they will potentially dominate the post treatment plant community. **Moderate Treatment Intensity** – Fire has removed all leaves and branches of shrubs. Only main stems and larger branches of dominant individuals in the stand remain. Aboveground portions of grasses and forbs are burned, but large plants may have recognizable parts blackened, but intact. Litter on soil surface (mostly beneath shrub canopies) is blackened and may be totally consumed in some areas. If annual plants are present in significant quantities prior to burning they will potentially dominate the post treatment plant community.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Mountain Big Sagebrush** (*Artemisia tridentata* ssp. *vaseyana*)	These plant communities are at the warmer/drier end of the mountain big sagebrush distribution and may integrate into Wyoming big sagebrush plant communities as elevation and/or soil depth decreases. Mountain big sagebrush dominates in these drier plant communities. Rabbitbrush, horsebrush, and bitterbrush are commonly founding various levels in the plant community. Sagebrush cover and density have reached a point that understory herbaceous plants are being suppressed. Cover of herbaceous plants is less than 10%. Introduced annual plants may be present at various quantities. These plants may dominate the understory vegetation in areas with severe disturbance history.	**Brushbeating / mowing**	Brushbeating results in the severing/shredding of the upper portions of the shrubs. Big sagebrush does not sprout following removal of the aerial portions of the plant. However, associated shrubs sprout to varying degrees. Low growing herbaceous and woody plants can be missed by cutting blades. Treatment is often done in late fall when fire danger is low and the majority of plants are dormant. Brushbeating can also be done in winter or early spring if weather permits. Cheatgrass does occur in disturbed areas of some these plant communities. However, areas where cheatgrass is a major component, or dominates these areas are discussed elsewhere. **Low Treatment Intensity** – Brushbeating occurs across less than 25% of the plant community. Cutting equipment is held at 18" above the soil surface. Only tops of larger shrubs are removed by cutters. Lower branches of larger shrubs and smaller shrubs are left intact. Minimal disturbance occurs to herbaceous plants. Some mechanical damage can be done to herbaceous plants by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter is increased in interspace areas by cutting. Annual plant density and cover will initially increase following treatment. **Moderate Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held at 12-18" above the soil surface. The majority of larger shrubs have the tops removed. Sprouting of may be stimulated in shrubs other than mountain big sagebrush. Woody plants less than 12" tall are not damaged by the cutting blades. Most herbaceous plants are dormant during the treatment. Only aerial portions of herbaceous plants are removed by cutters, minimally impacting these plants. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter increases following treatment. Moderate amounts of woody litter are added to the soil surface. Some mechanical damage can be done to herbaceous plants by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. **High Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held below 12" above the soil surface. Most shrubs have tops removed leaving a plant community. Sprouting shrubs will begin to send up shoots in the next growing season. Sagebrush is killed by treatments and will not sprout following top removal. Cutting blades remove aboveground herbaceous plant material at the level of the cutting blades. Some soil disturbance may occur due to cutting blades contacting the soils surface. Some mechanical damage can be done to herbaceous plants by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*) – Intermountain West	Wyoming big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, bitterbrush and horsebrush are commonly found in association with Wyoming big sagebrush. Sagebrush and associated shrub cover and density will increase to the point where associated understory plant become suppressed. At maximum shrub cover and density, understory herbaceous plant cover would be less than 10% and bare ground would be greater than 65% of the total cover. Communities would have considerable diversity and are generally resilient to disturbance. Little to no invasive plant species present.	**Broadcast Burn**	Wyoming big sagebrush plants are killed by fire. Associated woody vegetation is capable of sprouting following top removal. Sprouting ability varies across and within individual shrub species. Sprouting of antelope bitterbrush would represent a species with sporadic ability to sprout, and green rabbitbrush and horsebrush would be classified as vigorous sprouters. Most shrub species fall in the continuum between these species. Deep rooted perennial forbs and grasses also sprout vigorously following burning. Shallower rooted grasses and mat-forming forbs can be suppressed following burning. Small amounts of plant litter are present in these communities. What is present is found beneath the canopies of shrubs or larger grasses and forbs. Cheatgrass does occur in disturbed areas of some these plant communities. However, areas where cheatgrass is a major component, or dominates these areas are discussed elsewhere. **Low Treatment Intensity** – Fire has removed most of the leaves on the shrubs and the smaller branches. Numerous blackened shrub skeletons are left standing. Aboveground portions of forbs and grasses are consumed. Plants with heavier leaves may have portions left intact. Large perennial grasses have blackened crowns. Green plant material may or may not have been consumed, especially within dense grass crowns. Litter on the soil surface, most commonly found beneath shrub canopies is scorched to partially consumed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **Moderate Treatment Intensity** – Fire has removed all leaves and branches of shrubs. Only main stems and larger branches of dominant individuals in the stand remain. Aboveground portions of grasses and forbs are burned, but large plants may have recognizable parts blackened, but intact. Litter on soil surface (mostly beneath shrub canopies) is blackened and may be totally consumed in some areas. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **High Treatment Intensity** – Fire has removed most of the aboveground portion of all shrubs grasses and forbs. Part of the shrub main stem may be present immediately following the fire. Most of the litter has been consumed by the fire and ash remain in the areas beneath shrubs. Crowns of grasses may be visible, but all live and dead plant material has been removed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*) – Intermountain West	These plant communities are at the warmer/drier end of the mountain big sagebrush distribution and may integrate into Wyoming big sagebrush plant communities as elevation and/or soil depth decreases. Mountain big sagebrush dominates in these drier plant communities. Rabbitbrush, horsebrush, and bitterbrush are commonly founding various levels in the plant community. Sagebrush cover and density have reached a point that understory herbaceous plants are being suppressed. Cover of herbaceous plants is less than 10%. Introduced annual plants may be present at various quantities. These plants may dominate the understory vegetation in areas with severe disturbance history.	**Brushbeating / Mowing**	Brushbeating results in the severing/shredding of the upper portions of the shrubs. Big sagebrush does not sprout following removal of the aerial portions of the plant. However, associated shrubs sprout to varying degrees. Low growing herbaceous and woody plants can be missed by cutting blades. Treatment is often done in late fall when fire danger is low and the majority of plants are dormant. Brushbeating can also be done in winter or early spring if weather permits. Cheatgrass does occur in disturbed areas of some these plant communities. However, areas where cheatgrass is a major component, or dominates these areas are discussed elsewhere. **Low Treatment Intensity** – Brushbeating occurs across less than 25% of the plant community. Cutting equipment is held at 18" above the soil surface. Only tops of larger shrubs are removed by cutters. Lower branches of larger shrubs and smaller shrubs are left intact. Minimal disturbance occurs to herbaceous plants. Some mechanical damage can be done by passage of tractor. Soi ls are usually dry and/or frozen during this treatment, reducing compaction. Plant litter is increased in interspace areas by cutting. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. **Moderate Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held at 12-18" above the soil surface. The majority of larger shrubs have the tops removed. Sprouting of may be stimulated in shrubs other than mountain big sagebrush. Woody plants less than 12" tall are not damaged by the cutting blades. Most herbaceous plants are dormant during the treatment. Only aerial portions of herbaceous plants are removed by cutters, minimally impacting these plants. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter increases following treatment. Moderate amounts of woody litter are added to the soil surface. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. **High Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held below 12" above the soil surface. Most shrubs have tops removed leaving a plant community. Sprouting shrubs will begin to send up shoots in the next growing season. Sagebrush is killed by treatments and will not sprout following top removal. Cutting blades remove aboveground herbaceous plant material at the level of the cutting blades. Some soil disturbance may occur due to cutting blades contacting the soils surface. Some mechanical damage can be done to herbaceous plants by passage of the tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Large amounts of woody and herbaceous plant litter is added to the soil surface. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*) – Intermountain West	These plant communities are at the warmer/drier end of the mountain big sagebrush distribution and may integrate into Wyoming big sagebrush plant communities as elevation and/or soil depth decreases. Mountain big sagebrush dominates in these drier plant communities. Rabbitbrush, horsebrush, and bitterbrush are commonly founding various levels in the plant community. Sagebrush cover and density have reached a point that understory herbaceous plants are being suppressed. Cover of herbaceous plants is less than 10%. Introduced annual plants may be present at various quantities. These plants may dominate the understory vegetation in areas with severe disturbance history.	**Herbicide**	Herbicide is used to kill sagebrush in patches to reduce cover and density of sagebrush. Herbicide is applied a low rates where the objective is to thin the stand. Higher application rates will result in greater sagebrush kill. Post treatment plant community would have varying levels of dead and or dying sagebrush in the plant community. Associated herbaceous plants would increase density and cover in response to reduction in competition from sagebrush. **Low Treatment Intensity** – Low rates of the herbicide are applied resulting in isolated death of Wyoming big sagebrush plants. Chlorolysis of other plants that received lower levels of the herbicide will be common. Sagebrush skeletons will be left on plants killed by the herbicide. An increase in understory grasses and forbs will occur following sagebrush death. Associated shrubs will also increase leaf area and reproductive effort following death of sagebrush. **Moderate Treatment Intensity** – A greater number of dead sagebrush will occur in this due to the higher rates of herbicide application. Dead sagebrush may occur in patches. Increase in associated understory plants will be greatest in these patches of dead sagebrush. Leafless sagebrush skeletons will be obvious in the plant community. **High Treatment Intensity** – The greatest level of sagebrush death will occur in this treatment. Large patches of sagebrush skeletons will be obvious in the plant community. Individual sagebrush and small patches of live sagebrush will be scattered across the plant community. Associated woody and herbaceous plants will increase cover following death of sagebrush.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*)– Intermountain West	Wyoming big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, and horsebrush are commonly found in association with Wyoming big sagebrush. Bareground, or a combination of bareground and microbiotic soil crusts is usually greater than 65% in these dry communities. Communities would have considerable diversity and are generally resilient to disturbance. Little to no invasive weed species present. However, disturbance results in a period dominated by annual plants.	**Broadcast Burn**	Wyoming big sagebrush plants are killed by fire. Associated woody vegetation is capable of sprouting following top removal. Sprouting ability varies across and within individual shrub species. Deep rooted perennial forbs and grasses also sprout vigorously following burning. Shallower rooted grasses and mat-forming forbs can be suppressed following burning. Small amounts of plant litter are present in these communities. What is present is found beneath the canopies of shrubs or larger grasses and forbs. **Low Treatment Intensity** – Fire has removed most of the leaves on the shrubs and the smaller branches. Numerous blackened shrub skeletons are left standing. Aboveground portions of forbs and grasses are consumed. Plants with heavier leaves may have portions left intact. Large perennial grasses have blackened crowns. Green plant material may or may not have been consumed, especially within dense grass crowns. Litter on the soil surface, most commonly found beneath shrub canopies is scorched to partially consumed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **Moderate Treatment Intensity** – Fire has removed all leaves and branches of shrubs. Only main stems and larger branches of dominant individuals in the stand remain. Aboveground portions of grasses and forbs are burned, but large plants may have recognizable parts blackened, but intact. Litter on soil surface (mostly beneath shrub canopies) is blackened and may be totally consumed in some areas. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **High Treatment Intensity** – Fire has removed most of the aboveground portion of all shrubs grasses and forbs. Part of the shrub main stem may be present immediately following the fire. Most of the litter has been consumed by the fire and ash remain in the areas beneath shrubs. Crowns of grasses may be visible, but all live and dead plant material has been removed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV	**Wyoming Big Sagebrush** *(Artemisia tridentata ssp. Wyomingensis)*- Intermountain West	Wyoming big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, bitterbrush and horsebrush are commonly found in association with Wyoming big sagebrush. Bareground, or a combination of bareground and microbiotic soil crusts is usually greater than 65% in these dry communities. Communities would have considerable diversity and are generally resilient to disturbance. Little to no invasive weed species present. However, disturbance results in a period dominated by annual plants.	**Brushbeating / Mowing**	Brushbeating results in the severing/shredding of the upper portions of the shrubs. Big sagebrush does not sprout following removal of the aerial portions of the plant. However, associated shrubs sprout to varying degrees. Low growing herbaceous and woody plants can be missed by cutting blades. Treatment is often done in late fall when fire danger is low and the majority of plants are dormant. Brushbeating can also be done in winter or early spring if weather permits. **Low Treatment Intensity** – Brushbeating occurs across less than 25% of the plant community. Cutting equipment is held at 18" above the soil surface. Only tops of larger shrubs are removed by cutters. Lower branches of larger shrubs and smaller shrubs are left intact. Minimal disturbance occurs to herbaceous plants. Some mechanical damage can be done to herbaceous plants by passage of the tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter is increased in interspace areas by cutting. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. **Moderate Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held at 12-18" above the soil surface. The majority of larger shrubs have the tops removed. Sprouting of may be stimulated in shrubs other than mountain big sagebrush. Woody plants less than 12" tall are not damaged by the cutting blades. Most herbaceous plants are dormant during the treatment. Only aerial portions of herbaceous plants are removed by cutters, minimally impacting these plants. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter increases following treatment. Moderate amounts of woody litter are added to the soil surface. Some mechanical damage can be done to herbaceous plants by passage of the tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. **High Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held below 12" above the soil surface. Most shrubs have tops removed leaving a plant community. Sprouting shrubs will begin to send up shoots in the next growing season. Sagebrush is killed by treatments and will not sprout following top removal. Cutting blades remove aboveground herbaceous plant material at the level of the cutting blades. Some soil disturbance may occur due to cutting blades contacting the soils surface. Some mechanical damage can be done to herbaceous plants by passage of the tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Large amounts of woody and herbaceous plant litter is added to the soil surface. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*)– Intermountain West	Wyoming big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, bitterbrush and horsebrush are commonly found in association with Wyoming big sagebrush. Bare ground, or a combination of bare ground and microbiotic soil crusts is usually greater than 65% in these dry communities. Communities would have considerable diversity and are generally resilient to disturbance. Little to no invasive weed species present. However, disturbance results in a period dominated by annual plants.	**Herbicide**	Herbicide is used to kill sagebrush in patches to reduce cover and density of sagebrush. Herbicide is applied a low rates where the objective is to thin the stand. Higher application rates will result in greater sagebrush kill. Post treatment plant community would have varying levels of dead and or dying sagebrush in the plant community. Associated herbaceous plants would increase density and cover in response to reduction in competition from sagebrush. **Low Treatment Intensity** – Low rates of the herbicide are applied resulting in isolated death of Wyoming big sagebrush plants. Chlorolysis of other plants that received lower levels of the herbicide will be common. Sagebrush skeletons will be left on plants killed by the herbicide. An increase in understory grasses and forbs will occur following sagebrush death. Associated shrubs will also increase leaf area and reproductive effort following death of sagebrush. **Moderate Treatment Intensity** – A greater number of dead sagebrush will occur in this due to the higher rates of herbicide application. Dead sagebrush may occur in patches. Increase in associated understory plants will be greatest in these patches of dead sagebrush. Leafless sagebrush skeletons will be obvious in the plant community. **High Treatment Intensity** – The greatest level of sagebrush death will occur in this treatment. Large patches of sagebrush skeletons will be obvious in the plant community. Individual sagebrush and small patches of live sagebrush will be scattered across the plant community. Associated woody and herbaceous plants will increase cover following death of sagebrush.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*) – Great Basin	Wyoming big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, and horsebrush are commonly found in association with Wyoming big sagebrush. These Wyoming big sagebrush plant communities are often found adjacent or intermixed with salt desert plant communities. Salt Desert plant species may be found at low to moderate levels in these big sagebrush plant communities at the drier end of its distribution. Annual plants commonly dominate disturbed areas. Introduced annual and perennial plants have made significant encroachments into these plant communities. Bareground, or a combination of bareground and microbiotic soil crusts is usually greater than 75% in these dry communities. Total shrub cover would be between 10-15%. Introduced annual and perennial plants have made significant encroachments into these plant communities.	**Broadcast Burn**	Wyoming big sagebrush plants are killed by fire. Associated woody vegetation is capable of sprouting following top removal. Sprouting ability varies across and within individual shrub species. Deep rooted perennial forbs and grasses also sprout vigorously following burning. Shallower rooted grasses and mat-forming forbs can be suppressed following burning. Small amounts of plant litter are present in these communities. Plant litter is often found concentrated beneath the canopies of larger grasses, forbs and shrubs. **Low Treatment Intensity** – Fire has removed most of the leaves on the shrubs and the smaller branches. Numerous blackened shrub skeletons are left standing. Aboveground portions of forbs and grasses are consumed. Plants with heavier leaves may have portions left intact. Large perennial grasses have blackened crowns. Green plant material may or may not have been consumed, especially within dense grass crowns. Litter on the soil surface, most commonly found beneath shrub canopies is scorched to partially consumed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **Moderate Treatment Intensity** – Fire has removed all leaves and branches of shrubs. Only main stems and larger branches of dominant individuals in the stand remain. Aboveground portions of grasses and forbs are burned, but large plants may have recognizable parts blackened, but intact. Litter on soil surface (mostly beneath shrub canopies) is blackened and may be totally consumed in some areas. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **High Treatment Intensity** – Fire has removed most of the aboveground portion of all shrubs grasses and forbs. Part of the shrub main stem may be present immediately following the fire. Most of the litter has been consumed by the fire and ash remain in the areas beneath shrubs. Crowns of grasses may be visible, but all live and dead plant material has been removed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*) – Great Basin	Wyoming big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, and horsebrush are commonly found in association with Wyoming big sagebrush. These Wyoming big sagebrush plant communities are often found adjacent or intermixed with salt desert plant communities. Salt Desert plant species may be found at low to moderate levels in these big sagebrush plant communities at the drier end of its distribution. Annual plants commonly dominate disturbed areas. Introduced annual and perennial plants have made significant encroachments into these plant communities. Bareground, or a combination of bareground and microbiotic soil crusts is usually greater than 75% in these dry communities. Total shrub cover would be between 10-15%. Introduced annual and perennial plants have made significant encroachments into these plant communities.	**Brushbeating / Mowing**	Brushbeating results in the severing/shredding of the upper portions of the shrubs. Big sagebrush does not sprout following removal of the aerial portions of the plant. However, associated shrubs sprout to varying degrees. Low growing herbaceous and woody plants can be missed by cutting blades. Treatment is often done in late fall when fire danger is low and the majority of plants are dormant. Brushbeating can also be done in winter or early spring if weather permits. **Low Treatment Intensity** – Brushbeating occurs across less than 25% of the plant community. Cutting equipment is held at 18" above the soil surface. Only tops of larger shrubs are removed by cutters. Lower branches of larger shrubs and smaller shrubs are left intact. Minimal disturbance occurs to herbaceous plants. Some mechanical damage can be done to herbaceous plants by passage of the tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter is increased in interspace areas by cutting. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. **Moderate Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held at 12-18" above the soil surface. The majority of larger shrubs have the tops removed. Sprouting of may be stimulated in shrubs other than mountain big sagebrush. Woody plants less than 12" tall are not damaged by the cutting blades. Most herbaceous plants are dormant during the treatment. Only aerial portions of herbaceous plants are removed by cutters, minimally impacting these plants. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter increases following treatment. Moderate amounts of woody litter are added to the soil surface. Some mechanical damage can be done to herbaceous plants by passage of the tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. **High Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held below 12" above the soil surface. Most shrubs have tops removed leaving a plant community. Sprouting shrubs will begin to send up shoots in the next growing season. Sagebrush is killed by treatments and will not sprout following top removal. Cutting blades remove aboveground herbaceous plant material at the level of the cutting blades. Some soil disturbance may occur due to cutting blades contacting the soils surface. Some mechanical damage can be done to herbaceous plants by passage of the tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Large amounts of woody and herbaceous plant litter is added to the soil surface. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
IV	**Wyoming Big Sagebrush** (*Artemisia tridentata* ssp. *wyomingensis*) – Great Basin	Wyoming big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, and horsebrush are commonly found in association with Wyoming big sagebrush. These Wyoming big sagebrush plant communities are often found adjacent or intermixed with salt desert plant communities. Salt Desert plant species may be found at low to moderate levels in these big sagebrush plant communities at the drier end of its distribution. Annual plants commonly dominate disturbed areas. Introduced annual and perennial plants have made significant encroachments into these plant communities. Bareground, or a combination of bareground and microbiotic soil crusts is usually greater than 75% in these dry communities. Total shrub cover would be between 10-15%. Introduced annual and perennial plants have made significant encroachments into these plant communities.	**Herbicide**	Herbicide is used to kill sagebrush in patches to reduce cover and density of sagebrush. Herbicide is applied a low rates where the objective is to thin the stand. Higher application rates will result in greater sagebrush kill. Post treatment plant community would have varying levels of dead and or dying sagebrush in the plant community. Associated herbaceous plants would increase density and cover in response to reduction in competition from sagebrush. **Low Treatment Intensity** – Low rates of the herbicide are applied resulting in isolated death of Wyoming big sagebrush plants. Chlorolysis of other plants that received lower levels of the herbicide will be common. Sagebrush skeletons will be left on plants killed by the herbicide. An increase in understory grasses and forbs will occur following sagebrush death. Associated shrubs will also increase leaf area and reproductive effort following death of sagebrush. **Moderate Treatment Intensity** – A greater number of dead sagebrush will occur in this due to the higher rates of herbicide application. Dead sagebrush may occur in patches. Increase in associated understory plants will be greatest in these patches of dead sagebrush. Leafless sagebrush skeletons will be obvious in the plant community. **High Treatment Intensity** – The greatest level of sagebrush death will occur in this treatment. Large patches of sagebrush skeletons will be obvious in the plant community. Individual sagebrush and small patches of live sagebrush will be scattered across the plant community. Associated woody and herbaceous plants will increase cover following death of sagebrush.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Basin Big Sagebrush** (*Artemisia tridentata* ssp. *tridentata*)	Basin big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, and horsebrush are commonly found in association with basin big sagebrush. Bas in wild rye or similar larger perennial bunchgrasses are common. Rhizomatous grasses and forbs may be present in the understory of more mesic sites, forming a sod in portions of the understory. Bare ground, or a combination of bare ground and microbiotic soil crusts is usually greater than 50% in these communities. Much of this land has been converted to cropland and has reverted back to a combination of basin big sagebrush, rabbitbrush and perennial/annual plant communities. Basin big sagebrush has a large morphological amplitude. Plants may grow to over 6ft in height or be morphologically similar to Wyoming big sagebrush. Soil depth and effective moisture/climate appear to be the key factors. Deeper soils, with adequate available moisture, will produce large plants. Shallow soils on drier sites will produce shorter plants that resemble Wyoming big sagebrush. Shorter varieties of basin big sagebrush, and associated vegetation, probably respond similarly to Wyoming big sagebrush.	**Broadcast Burn**	Basin big sagebrush is readily killed by fire. However, associated shrub species, such as rabbitbrush sprout vigorously following top removal. **Low Treatment Intensity** – Plant communities with large basin big sagebrush plants may experience an condition similar to an under burn in forested systems. Tall sagebrush plants (> 3ft) may retain leaf canopy and experience charred stems near the soil surface. Shorter herbaceous and woody vegetation (< 3ft) will be burned by the fire. Fire has removed most of the leaves on the shrubs and the smaller branches of the shorter vegetation. Aboveground portions of forbs and grasses are consumed. Plants with heavier leaves may have portions left intact. Large perennial grasses have blackened crowns. Green plant material may or may not have been consumed, especially within dense grass crowns. Litter on the soil surface, most commonly found beneath shrub canopies, is scorched to partially consumed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **Moderate Treatment Intensity** – Fire may remove some taller individuals as well as all leaves and branches of smaller shrubs. Aboveground portions of grasses and forbs are burned, but large plants may have recognizable parts blackened, but intact. Litter on soil surface, mostly beneath shrub canopies, is blackened and may be totally consumed in some areas. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants. **High Treatment Intensity** – Fire has removed most of the aboveground portion of all shrubs grasses and forbs. Part of the shrub main stem may be present immediately following the fire. Most of the litter has been consumed by the fire and ash remain in the areas beneath shrubs. Crowns of grasses may be visible, but all live and dead plant material has been removed. Annuals may dominate immediate post-fire plant community. The magnitude of the post-fire annual flush will be dependent on the pre-burn annual composition. Areas with strong annual plant component prior to burning will have a strong flush of annual plants.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Basin Big Sagebrush** (*Artemisia tridentata* ssp. *tridentata*)	Basin big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, and horsebrush are commonly found in association with basin big sagebrush. Basin wild rye or similar larger perennial bunchgrasses are common. Rhizomatous grasses and forbs may be present in the understory of more mesic sites, forming a sod in portions of the understory. Bareground, or a combination of bareground and microbiotic soil crusts is usually greater than 50% in these communities. Much of this land has been converted to cropland and has reverted back to a combination of basin big sagebrush, rabbitbrush and perennial/annual plant communities. Basin big sagebrush has a large morphological amplitude. Plants may grow to over 6ft in height or be morphologically similar to Wyoming big sagebrush. Soil depth and effective moisture/climate appear to be the key factors. Deeper soils, with adequate available moisture, will produce large plants. Shallow soils on drier sites will produce shorter plants that resemble Wyoming big sagebrush. Shorter varieties of basin big sagebrush, and associated vegetation, probably respond similarly to Wyoming big sagebrush.	**Brushbeating / Mowing**	More appropriate treatment for shorter varieties of basin wild rye. Response will be similar to Wyoming big sagebrush

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
III	**Basin Big Sagebrush** (*Artemisia tridentata* ssp. *tridentata*)	Basin big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation is a mixture of perennial grasses and forbs. Green and gray rabbitbrush, and horsebrush are commonly found in association with basin big sagebrush. Basin wild rye or similar larger perennial bunchgrasses are common. Rhizomatous grasses and forbs may be present in the understory of more mesic sites, forming a sod in portions of the understory. Bareground, or a combination of bareground and microbiotic soil crusts is usually greater than 50% in these communities. Much of this land has been converted to cropland and has reverted back to a combination of basin big sagebrush, rabbitbrush and perennial/annual plant communities. Basin big sagebrush has a large morphological amplitude. Plants may grow to over 6ft in height or be morphologically similar to Wyoming big sagebrush. Soil depth and effective moisture/climate appear to be the key factors. Deeper soils, with adequate available moisture, will produce large plants. Shallow soils on drier sites will produce shorter plants that resemble Wyoming big sagebrush. Shorter varieties of basin big sagebrush, and associated vegetation, probably respond similarly to Wyoming big sagebrush.	**Herbicide**	More appropriate treatment for shorter varieties of basin wild rye. Response will be similar to Wyoming big sagebrush.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
II, III, IV	**Sagebrush / cheatgrass** (and other introduced annual plants) understory	Big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation varies from a mixture of perennial and annual grasses and forbs and to an understory dominated by introduced annual plants. The annual plant most commonly found is cheatgrass, however medusahead wild rye and other non-*Bromus* species are also a problem in certain areas. Perennial plants may be found beneath shrubs in stands dominated by annuals. Herbaceous plants form a continuous layer beneath the shrub canopy. Green and gray rabbitbrush, and horsebrush are commonly found in association with big sagebrush. Total shrub cover would fall between 15 – 25 %.	**Broadcast Burn / Seed (drill)**	Burning treatments would kill big sagebrush. Most associated shrubs would sprout following top removal and become the dominant woody plant in the post-fire plant community. A follow-up seeding treatment would be required to reestablish a perennial plant dominated understory. Without seeding the plant community may revert to an annual dominated community. **Low Treatment Intensity** – Most sagebrush plants are killed by the fire. Leaves and small branches are consumed in the fire. Patches of unburned area exists throughout the treatment area. The fire removes the aboveground portions of herbaceous plants and partially consumes litter on the soil surface. Greatest amount of heat is experience and thus litter consumed occurs beneath shrub canopies. Seeding occurs in burned areas. Soi l is disturbed to approximately 4". Standing sagebrush skeletons are broken down by passage of the tractor and drill. **Moderate Treatment Intensity** – Most sagebrush in plant community are killed by fire. Isolated main stem and branches of sagebrush are left standing following burning. Isolated of islands of unburned sagebrush can be found in areas where herbaceous vegetation is insufficient to carry the fire. The fire removes the aboveground portions of herbaceous plants and partially consumes litter on the soil surface. Greatest amount of heat is experience and thus litter consumed occurs beneath shrub canopies. Soil is disturbed to approximately 4". Perennial plants are seeded across treatment areas. Standing sagebrush skeletons are broken down by passage of the tractor and drill. **High Treatment Intensity** – All sagebrush are killed by burning and few to no standing shrub skeletons exist. Greatest amount of heat is experience and thus litter consumed occurs beneath shrub canopies. However, the fire consumes all litter on soil surface. Perennial plant seeding occurs across the treatment area. The soil is disturbed to approximately 4". Any standing shrub skeletons are broken down by the passage of the tractor and drill.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
II, III, IV	**Sagebrush / cheatgrass** (and other introduced annual plants) understory	Big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation varies from a mixture of perennial and annual grasses and forbs and to an understory dominated by introduced annual plants. The annual plant most commonly found is cheatgrass, however medusahead wild rye and other non-*Bromus* species are also a problem in certain areas. Perennial plants may be found beneath shrubs is stands dominated by annuals. Herbaceous plants form a continuous layer beneath the shrub canopy. Green and gray rabbitbrush, and horsebrush are commonly found in association with big sagebrush. Total shrub cover would fall between 15 – 25 %.	**Broadcast Burn / Seed (aerial)**	Conditions would be similar to above broadcast burning/seeding (drilling) however there would be little to no surface soil disturbance attributed to tractor and drill. Success of seeding will be more variable than if a drill was used.

ACTIVITY COMPONENT			WORK ELEMENT	
Fire Regime	**Existing Vegetation Type**	**Pre-Treatment Vegetation Description**	**Treatment Type**	**Post-Treatment Vegetation Description**
II, III, IV	**Sagebrush / cheatgrass** (and other introduced annual plants) understory	Big sagebrush dominates the plant community and is the most obvious woody plant. Herbaceous understory vegetation varies from a mixture of perennial and annual grasses and forbs and to an understory dominated by introduced annual plants. The annual plant most commonly found may be cheatgrass, however medusahead wild rye and other non-*Bromus* species are also a problem in certain areas. Perennial plants may be found beneath shrubs is stands dominated by annuals. Annual plants are scattered across the interspace areas. Bare ground may account for over 75% of the total cover. Green and gray rabbitbrush, and horsebrush are commonly found in association with big sagebrush. Total shrub cover would fall between 20 – >30 %.	**Brushbeating / Mowing / Seeding (drilling)**	Brushbeating results in the severing/shredding of the upper portions of the shrubs. Big sagebrush does not sprout following removal of the aerial portions of the plant. However, associated shrubs sprout to varying degrees. Low growing herbaceous and woody plants can be missed by cutting blades. Treatment is often done in late fall when fire danger is low and the majority of plants are dormant. Brushbeating can also be done in winter or early spring if weather permits. **Low Treatment Intensity** – Brushbeating occurs across less than 25% of the plant community. Cutting equipment is held at 18" above the soil surface. Only tops of larger shrubs are removed by cutters. Lower branches of larger shrubs and smaller shrubs are left intact. Minimal disturbance occurs to herbaceous plants. Some mechanical damage can be done by passage of tractor. Soi ls are usually dry and/or frozen during this treatment, reducing compaction. Plant litter is increased in interspace areas by cutting. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. Tractor and drill disturb the soil to approximately 4". Shredded plant material is incorporated into the soil by drilling. **Moderate Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held at 12-18" above the soil surface. The majority of larger shrubs have the tops removed. Sprouting of may be stimulated in shrubs other than mountain big sagebrush. Woody plants less than 12" tall are not damaged by the cutting blades. Most herbaceous plants are dormant during the treatment. Only aerial portions of herbaceous plants are removed by cutters, minimally impacting these plants. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Plant litter increases following treatment. Moderate amounts of woody litter are added to the soil surface. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. Tractor and drill disturb the soil to approximately 4". Shredded plant material is incorporated into the soil by drilling. **High Treatment Intensity** – Brushbeating occurs across 25-50% of the plant community. Cutting equipment is held below 12" above the soil surface. Most shrubs have tops removed leaving a plant community. Sprouting shrubs will begin to send up shoots in the next growing season. Sagebrush is killed by treatments and will not sprout following top removal. Cutting blades remove above-ground herbaceous plant material at the level of the cutting blades. Some soil disturbance may occur due to cutting blades contacting the soils surface. Some mechanical damage can be done by passage of tractor. Soils are usually dry and/or frozen during this treatment, reducing compaction. Large amounts of woody and herbaceous plant litter is added to the soil surface. Annual plant density and cover will initially increase following treatment. The magnitude of the increase is directly proportional to the level of annual plants in the pre-treatment plant community. Tractor and drill disturb the soil to approximately 4". Shredded plant material is incorporated into the soil by drilling.

ACTIVITY TYPE: Range Infrastructure

Fire prevention actions and post fire activities in rangelands may require rehabilitation of native ranges and construction, repair or replacement of range improvement structures. Fences and water developments are common structures used for livestock management and/or protection of rangeland resources. The construction, reconstruction, and maintenance of fences and water developments and rangeland restoration activities may require the use and hauling of heavy equipment, and the hauling and storage of materials.

Related Work Elements may be found in: **Weeds and Chemical Treatments Activity Type** regarding weeds; **Prescribed Fire Activity Type** regarding fire and camping; and **Access and Equipment Maintenance Activity Type** regarding access, fueling and transportation.

ACTIVITY COMPONENTS WORK ELEMENTS

Fence Construction / Reconstruction / Maintenance

These activities normally require material transport, ground disturbance, and the use of power tools or large equipment. Materials for wooden fences may be gathered and prepared on or near the construction site. This work generally is accomplished with power tools. Standing trees may be used where available and incorporated into the fence design for strength and cost savings.

Stringing Wire - Wire is strung and attached to fence posts with clips. ATV's and pickups trucks are commonly used to string wire.

Digging Post Holes – manual / mechanical - Posts may be set at times using a tractor with an auger or pounder and tractors. Posts are wooden or metal. Fence repair or reconstruction may require any or all of the above types of work related to fence construction

Clearing Right of Way –This is accomplished in timber or brush with minimum clearing widths commonly four to five feet on either side of fence. Clearing methods are comprised of hand tools, or with mechanized equipment such as chain saws, brush hogs, road graders and bulldozers. Hazard tree removal may be necessary to protect fencing and work sites.

Building Rock Jacks – Rock jacks and rock cribs are used to anchor a fence. Both are built with rock, wood, or metal posts. Rock drills may be used to create anchor points where solid rock is available.

Onsite Material Cutting, Gathering Rocks, etc – Cutting trees for fence posts will generally require the use of chainsaws, or hand saws depending on the need. Rocks are gathered at the site or hauled in when they are not available to build rock jacks and cribs.

Pre-project Weed Control – GO TO **Weeds and Chemical Treatments Activity Type** for Work Elements describing this activity.

Spike/Work Camps – GO TO **Prescribed Fire Activity Type, Fire Support Activity Component,** *Fire/Spike Camp Work Element* for the description of this Work Element.

Rangeland Restoration

Restoration of native vegetation and natural site conditions may be needed following both wild and prescribed fires, particularly in previously degraded sites or where invasive species are likely to establish. Restoration activities are generally designed to facilitate immediate or eventual re-establishment of native vegetation (grasses, forbs and shrubs), and site conditions that will promote native vegetation establishment).

Depending on disturbance level, seeding may be necessary. If seeding is necessary, seeding activities should use native seeds or non-native sterile annuals (e.g., Regreen, native hybrids) to provide ground cover for the first year following ground disturbing activities. These species will not out-compete native vegetation that would re-establish on the site naturally. The establishment of certain native species that are less susceptible to fire is necessary to restore the natural function of native vegetative communities. An example would be cheat grass infested sites that tend to burn every few years, not allowing native species to get established, which are less susceptible to frequent fires and allow shrubs to establish

Preparing the seedbed for seeds and/or seedlings is a necessary step in most cases. Mechanical methods such as chaining, rangeland plowing, and disking are commonly used to prepare a seedbed for planting by roughening soil surfaces, damaging or killing existing unwanted vegetation, and facilitating the planting process. Roughening the soil surface loosens soils, reduces soil crusts, allows for water retention, and reduces wind speed and temperature extremes. These conditions are desirable for successful seed germination and plant survival.

Seeding - aerial - Aerial application by fixed wing or helicopter is used to seed vast areas or to facilitate the success in establishment of a specific species.

Seeding – disking, drilling, fertilizing, plowing

- Disking - Disks are attached to tractors and are generally used to temporarily break surface crusts and kill shallow rooted plants (weeds). These are typically used on sites with lower shrub densities dominated by grasses and forbs.
- Drilling – Rangeland drills are used to plant seeds when uniform seed distribution and proper seed depth are required for plant establishment. Rangeland drills are attached to back of a tractor and requires a firm seedbed and uniform terrain without obstructions to operate effectively.
- Fertilization – Fertilizer may be used to enhance the seedling germination and increase seedling survival. Fertilizer can increase the potential of noxious weed establishment if a seed source is present. Fertilizers can be broadcasted or aerially applied.
- Rangeland Plows - Plows attached to tractors are used to improve crusted or compacted soil, at least temporarily, and kill or damage competing vegetation. These are used on sites where grasses dominate.

Chaining - Chaining is used to remove and or destroy vegetation. Chain-dikers have disks welded to the links of an anchor chain. This is pulled behind a crawler tractor and as the chain rotates it improves tillage, land smoothing and basin formation, in a single pass. This is the most effective method for preparing seedbeds on sites with relatively large amounts brush and other woody debris.

Prescribed Fire – GO TO **Prescribed Fire Activity Type** for the description of work elements associated with this activity.

Water Development Construction/Reconstruction (springs, guzzlers, tanks, ponds, reservoirs, wells)

Several types of water developments may be needed to implement livestock allotment plans, or enhance and protect an area's other resource values.

Rock Haul/Material Haul - Transporting materials to the site can be done by human-power, pack animals, all-terrain-vehicles, pickup truck, or helicopter. Material transport may create disturbance along transport routes and at the site. Disturbance potential is dependent on the time of year, duration, frequency, and habitat through which the transport occurs.

Earthwork - Cat, Dragline, Scraper – Ponds and/or dams are always constructed with heavy equipment (e.g., dozers, backhoes or scrapers). Material for dam construction is usually excavated from the catchment area, and heavy equipment repeatedly hauls material to heighten the dam. Likewise, for dam maintenance, silt must be excavated from the catchment area, sometimes using a dragline to pull material from the catchment area. Sometimes material must be hauled in for dam construction or for a water holding basin.

Pipelines - Trenching - Pipelines are used to transport water from a water source (i.e. creek, developed spring, or well) to another location. Pipeline construction includes transporting materials, trenching (usually with a backhoe or trencher), and installing troughs.

All Water Developments – Clearing - Clearing an area for the installation of a water development may be accomplished by any number of methods, manual or mechanical. Vegetation may be cleared with a dozer, weed-whacker, brushbuster, rake, hoe, or chainsaw. See **Reforestation, Mechanical Treatments, or Weeds and Chemical Treatments Activity Types** for additional information and descriptions regarding this Work Element.

All Water Developments – Transporting Materials – Material transport for water developments may be by truck or helicopter. Repair, construction or reconstruction of any water holding device (be it natural or artificial), requires transport of materials by person, on and/or off-road vehicles, helicopter, or by pack animal. Transport may occur off designated roads or trails, at times requiring lengthy cross-country travel. Generally, transportation of large water catchments with high storage capabilities utilized for livestock guzzlers is not practical.

All Water Developments – Installing Troughs, Storage Tanks, or Pits - Spring development generally requires excavation of the water source by hand, or with heavy equipment (e.g.,

backhoes or trenchers) to install a head box or perforated pipe. Normally trenching buries pipe from the head box to the trough and from the trough to the overflow pipe. A *trough or troughs* are installed and the water source is fenced to exclude livestock. *Guzzlers or trick tanks* are water storage containers catch and store water for wildlife and livestock use and generally are built where no natural water sources such as streams, springs or ponds exist. They may also be built to draw livestock away from natural water sources or decrease their use.

Storage containers, made of fiberglass, metal, or a bladder-lined pit, can hold up to 10,000 gallons for livestock use. Storage containers for wildlife guzzlers are much smaller (1,000 gallons) and containing two or three polyurethane or metal tanks per site. Containers are plumbed to aprons and then water is piped to a trough or troughs where livestock drink. Typically, areas around catchments are fenced to exclude livestock. Smaller storage tanks used for wildlife guzzlers often require *earthwork* for burial and a small dozer typically is used for removal and backfill of soil. These tanks may be repeatedly checked four or more times a year to ensure proper functioning.

All Water Developments - Installing/Building Fence Around Development – GO TO **Fence Construction/Reconstruction/Maintenance Activity Component,** contained within this Activity Type, for the description of this Work Element.

All Water Developments - Constructing Apron - Rubber, Meta, Asphalt - Guzzler catchments (often called aprons), catch and store precipitation and generally are made of rubber, sheet metal or asphalt; varying in size depending on size of the storage container.

ACTIVITY TYPE: Recreation Facilities and Operations

This activity includes obliteration, rehabilitation, reconstruction, and new construction of recreation facilities. Work elements will vary widely in response to the effects a recreation site may receive from fire or suppression activities. The acquisition of materials (e.g., gravel, riprap, boulders, borrow) for construction or reconstruction may occur on lands not adjacent to the recreation facility, and impacts may be associated with operations at these material sources. Activities associated with recreation facilities and operations may be needed where fire may have caused damage, during suppression activities, or for the development of defensible space) around the facility. Related Work Elements may be found in: **Access and Equipment Maintenance Activity Type** regarding access and fueling; **Defensible Space Activity Type;** and **Range Infrastructure Activity Type** regarding water development.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Existing Facilities Developed and Dispersed

Install Site Furniture – Installing site furniture such as tables and grills requires some ground disturbance, vegetation removal, and excavation for sinking table legs, fire rings, or pedestal grill supports. Ground hardening around site furniture can be done with gravel, asphalt, or concrete.

Remove Trees and Ground Vegetation, Blade to Create Smooth Surface, Apply gravel, Asphalt or Concrete to Harden Surface – Removing trees, shrubs and other site vegetation may be accomplished with a variety of methods. See the **Mechanical Treatments and Reforestation Activity Types** for additional information associated with these activities. Blading and smoothing the surface (or adding topsoil) would occur before applying gravel, asphalt, or concrete. Materials would be hauled to the site and applied by the use of heavy equipment and hand tools.

Install/Remove Toilets

Toilet installation may require clearing trees and other vegetation, excavation for vaults, backfill around vaults, and transport and installation of buildings. Large cranes may be necessary for building placement. The ground around the structure may need to be re-contoured, and topsoil added to prepare the area for seeding or planting.

Harden Entry to Building – Areas in front of buildings are typically hardened with gravel, asphalt, or concrete to withstand expected wear.

Remove Trees, Excavate, Construct Building – Removing trees, shrubs and other site vegetation may be accomplished by variety of methods. Tools such as chainsaws, weed whackers, or other power tools and equipment may be used. Slash would be piled for subsequent removal. See the **Mechanical Treatments and Reforestation Activity Types** for additional information associated with these activities. Excavation of an area would be required to place the foundation and vault. This can be done with a small backhoe and/or other digging device. The building may be hauled to or constructed at the site.

Collapse Building into Vaults or Haul Structures Off-Site – Components such as toilet vaults and foundations are sometimes capped and buried at the site. The site is then rehabilitated. The old structure may also be properly contained, and hauled away from the site for disposal. These activities require the use of heavy machinery, and vehicles for hauling such as dump trucks or trucks with trailers.

Installation of Other Site Amenities

Other site amenities such as interpretive signs, garbage containers, water developments, or other structures may be installed. As with installing a toilet, some of this work will require excavation, clearing vegetation, and rehabilitation of the area with grading and leveling for the application of gravel, asphalt, or concrete. Installation of culverts, ditches, and other types of drainage devices may also be required.

Remove Trees and Vegetation, Excavate, Backfill - These activities generally require the use of power tools and other mechanized machinery, depending on the location and magnitude of the job. Vegetation clearing can be done with hand tools, small dozers, backhoes, brush whackers, or other tools appropriate for the work.

Obliteration/Rehabilitation of Recreation Sites

Obliteration or rehabilitation may be needed for developed or dispersed sites, and this may affect an entire recreation facility (campground, picnic area or trailhead), or simply occur within a portion of the developed site. Rehabilitation is common where resource concerns warrant action such as moving campsites away from river banks/riparian areas. Hardening roads and/or spurs may help reduce sedimentation.

Related Work Elements may be found in **Roads and Roads Maintenance Activity Type** regarding activities associated with hardening roads. Regarding rehabilitation, related Work Elements may be found in **Watershed Restoration Activity Type, Reforestation Activity Type,** and **Range Infrastructure, Rangeland Restoration Activity Component.**

Remove any Existing Site Furniture – Rehabilitation may be complete or partial, and include permanent removal of damaged or old site components, or replacement with new amenities. Removal of facility components such as toilet buildings, tables, grills, fire rings, fire hydrants, and signs may be necessary.

Install Barriers (Boulders, Fencing, Signs, etc) – GO TO **Range Infrastructure Activity Type, Fence Construction/Reconstruction/Maintenance Activity Component** for the description of fencing only. All other activities covered by this Work Element are described as follows. Ground disturbance needed for post installation depends on the type of fence (free-standing verses post/pole). Other than where posts are placed, ground vegetation can remain in tact. Tree removal can usually be avoided. However, in places of extremely dense forest, individual tree removal may be necessary. Boulders may be placed as barriers and are usually attained from public lands, close to the facility. Heavy equipment is necessary for digging up native boulders, transporting, and placing them in the developed site. Placement includes digging a hole (typically 1-2 feet deep) and placing the boulder in it. Backfill may be necessary.

Rip Surface, Re-contour, Topsoil, Seed, Mulch - GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component** for the description of seeding. GO TO **Reforestation Activity Type, Hand plant riparian/upland** for the description of tree or shrub planning. Other activities covered by this Work Element are described as follows. These activities may be implemented on roads and/or spurs, trailheads, parking areas and other compacted areas. Some sites may need surface ripping, re-contouring or scarification for seedbed preparation. Native seeds or seedlings, or an annual fast rooting species, may be used to stabilize the site until native vegetation re-establishes. Where seeds are slow to establish and native forbs and grasses have long-lived roots systems, the introduction of root-rich soil from the local area helps re-establishing ground cover. In some areas, topsoil may be hauled to the site and spread before seeding. See **Watershed Restoration Activity Type** for additional information related to this Work Element. Mulch application helps prevent soil erosion, retain soil moisture, and protect seeds and seedlings from extreme temperature changes, wind, or damage from trampling.

Recreation Site Maintenance

Road Grading, Spot Graveling - This may occur in both dispersed and developed sites and on roads and road spurs. GO TO **Roads and Roads Maintenance Activity Type, Road Maintenance Activity Component,** *Blading and grading Work Element* and *Surface rocking (rock replacement) Work Element* for the description of this Work Element.

Water Development

Related Work Elements may be found in **Range Infrastructure Activity Type, Water Development Construction/Reconstruction (springs, guzzlers, tanks, ponds, reservoirs, wells) Activity Component.**

Excavate Hole, Pump Installation – Installing a water structure may require the development of a well. The well is generally capped with a hand pump and concrete pad (typically 5 foot radius); distribution lines are then placed to various locations within the developed site.

Trenching for Distribution Line – Distribution lines are placed in trenches approximately 30 inches to six feet deep; disturbance widths will vary from two to three feet. The trench is filled with gravel (or loose rock), pipe is placed, and the trench is backfilled. The surface is then leveled, top soil added and seeded. Trenching typically requires the use of hand and power tools as well as heavy equipment. See **Range Infrastructure Activity Type, Water Development Construction/Reconstruction (springs, guzzlers, tanks, ponds, reservoirs, wells) Activity Component,** *Pipelines – trenching Work Element* for more information on this activity.

Additional Information on Recreational Facilities

Dispersed camping and boating sites are typically accessed from two-track or narrow graveled roads. Dispersed camping sites are typically undeveloped (i.e., absence of tables, restrooms, or grills) and user-constructed rock fire circles are often present. Sites typically have native surfacing with sparse vegetation and compacted soils from concentrated use. Many dispersed sites occur near water, often within riparian zones found around lakes and along streams and rivers. Boating sites (where users launch and remove boats) commonly have user-defined pedestrian trails and user-developed motorized trails that extend directly to the water's edge.

Developed campgrounds have defined interior roads and camping spurs, typically surfaced with gravel or asphalt. Each site generally includes a table and fire ring, a pedestal grill, hydrant, and electrical hook-up. Within developed campgrounds, toilet buildings, signage, fee stations, garbage receptacles, and additional water hydrants are present.

Trailheads have defined parking areas (usually surfaced with gravel or asphalt), informational signing and/or kiosks, corrals, hitch rails, toilet buildings, potable water, water trough, and a horse unloading ramp.

Picnic Sites generally have parking areas (usually surfaced with gravel or asphalt), picnic tables, and toilet buildings. Sites are managed for day use only and may have interpretive signs, linkages to day-use trails, garbage receptacles, fire rings, pedestal grills, and play areas.

ACTIVITY TYPE: Reforestation

Reforestation activity components primarily address treatments needed to replant and seed forested habitats. Several of these activity components include activities that overlap with other activity types. Identified overlaps direct the user to location of additional pertinent information.

Related Work Elements may be found in the following Activity Types: **Access and Equipment Maintenance** regarding access and fueling; **Range Infrastructure** regarding fencing; **Prescribed Fire** regarding site preparation, fire and fuels reduction, and camping; **Roads and Roads Maintenance** regarding road work; and **Weeds And Chemical Treatments** regarding weed control.

ACTIVITY COMPONENT AND WORK ELEMENTS

Access for Reforestation Activities

Opening Closed Roads Including Snowplowing - Access for reforestation activities (e.g., tree planting, surveys, animal protection) may result in repeat visits after initial planting. Although motorized vehicle access (i.e. truck) is preferred, when vehicle travel is restricted or in unroaded areas, the transport of trees, equipment, and crews may be done with ATV's, foot, pack animal or helicopters, depending on the travel plan regulations.

Snow plowing is commonly required to access spring planting units. Although snow caches are not common, when they are used snow plowing to the cache area is required as early as January. Commonly, drifts are plowed and the road is allowed to dry before the crews access the units for planting. In very high snow areas, the majority of the snow is plowed leaving several inches to melt and the road to dry before vehicle use. Road maintenance practices to minimize sediment transport should be used.

See **Access and Equipment Maintenance Activity Type, Access to work site Activity Component,** and **Roads and Roads Maintenance Activity Type, Road Maintenance Activity Component,** *Opening closed roads, including logging out, snow plowing Work Element* for additional information.

Animal Damage Control

Chemicals, traps, netting and fencing may all be used to protect planted seedlings from animals.

See the **Range Infrastructure Activity Type, Fence Construction/Reconstruction/Maintenance Activity Component** for fence construction and reconstruction work elements.

Chemical Application Above and Below Ground - Direct gopher control includes baiting with rodenticides (generally strychnine treated grains); and elk and deer damage control includes the application of animal repellants such as Big Game Repellent (putrescent egg solids chemical) or similar commercially available chemicals to seedlings.

Netting and Associated Device for Protection - Seedlings can be protected from some damage by slipping vexar tubing or netting over the seedling. In addition, fencing is used to protect plantations from cattle although altered pasture systems are generally as effective and less costly. Fencing plantations to protect trees from big game is generally done only on high value plantations such as aspen clones. See the **Range Infrastructure Activity Type, Fence Construction/Reconstruction/Maintenance Activity Component** for fence construction and reconstruction work elements.

Use of Snap Traps for animal Removal – These traps kill the target species and may be placed in gopher runs or other areas where small rodents are threatening regeneration areas.

Artificial Shade

Where there is inadequate natural shade provided by stumps, logs and other structures, artificial materials are used to protect planted seedlings from mid-day sun or high solarization.

Shade Cards - For protection, artificial shade materials, such as styremen cards or mesh shade cloth, can be secured next to the seedlings with wire pins.

Aspen Regeneration/Protection Fencing

GO TO **Range Infrastructure Activity Type, Fence Construction/Reconstruction/Maintenance Activity Component** for the description of fencing. GO TO **Threatened, Endangered Species Habitat Restoration, Aspen Restoration Activity Component** for a description of aspen restoration activities. Related Work Elements may be found in the **Reforestation Activity Type**.

Camping

Tree planting crews may camp near planting sites to reduce travel time. Site selection and maintenance of the camp (trash, clean-up, waste water) is controlled with the planting contract. Crews are generally not allowed in improved campgrounds or areas commonly used by the public. GO TO **Prescribed Fire Activity Type, Fire Support Activity Component,** *Fire/spike camp Work Element* for the description of this Work Element.

Collection of Plant Propagation Materials

Climb to Access or Mechanically Pick Cones - Cone collection requires access to the upper 1/3 of the tree crown when the cones are ripe. Cones may be collected by mechanical means, or by climbing a tree to reach the tree crown. Climbing trees does not cause damage, although spurs should not be used on some species (western white pine). In level terrain, such as seed orchards, cherry pickers and other machines can be used to access the cones directly in the tree crown. Collection for most species begins in August although testing for cone ripeness occurs earlier in the season.

Firearm Use - Branches may be shot off with guns when small amounts of material are needed.

Pollen, Scion Material - Material necessary for genetic work is collected as described for cone collection. Scions are tree branches brought to nurseries for sprouting or grafting to other trees. Cages are sometimes placed over cones attached to trees to protect them from damage or consumption by various wildlife species. For example, white bark pinecones are caged in some areas for protection from Clark's Nutcrackers.

Collection of Seeds or other Vegetation Material – Seeds and other vegetative material are collected for propagation from their native setting. Most collection occurs by hand.

Tree Felling to Access Cones - Occasionally, trees are felled and cones are picked directly from the crowns. These trees cannot be used for future cone collections and they may be sold in a small sale or left on the ground as large woody debris. This may be done in timber sale units prior to harvest operations. GO TO **Mechanical Treatments Activity Type, Tree Falling Activity Component** for the description of this Work Element.

Fuels Reduction

Burning Slashed Material, including Broadcast Burning – GO TO **Prescribed Fire Activity Type** for the description of Work Elements associated with this activity.

Hand Plant Upland/Riparian

Plant Trees and Shrubs with Hoe, Bar, Auger - Tree planting occurs primarily in spring, with some summer and fall planting. Non-conifer trees and shrubs may be planted in conjunction with traditional conifer planting operations, or as a separate activity. Competing vegetation may be removed as part of the planting operation (refer to following Activity Component – "Site Preparation"). A hole is opened and a single seedling planted. Planting units may be concentrated in small geographic areas for logistical purposes. Crews range in size from 4 to 30 people depending on the size of the planting program. Hoe dads, augers, bars, and shovels are used to plant trees. The auger is the only mechanized tool.

See the **Access and Equipment Maintenance Activity Type** for related work elements.

Natural Regeneration Surveys

Generally, on timber suitable lands or previously harvested lands, surveys are conducted within one year of harvest or wildfire, and subsequently at years three and five. Survey intensity is dependent on the agency's land management objectives. On unmanaged lands, an initial post fire assessment should be conducted to determine regeneration potential. Many forested areas naturally regenerate and periodic monitoring occurs to assure regeneration.

See the **Access and Equipment Maintenance Activity Type, Access to Work Site ActivityComponent** for related work elements.

On-Site Tree Storage

In the absence of a cooler, tree storage may be necessary at or near the planting site to prevent trees from breaking dormancy before planting. Road plowing may be necessary to access the site where the cache will be constructed and maintained. See access for reforestation activities (above) for additional information.

Building and Maintaining Snow Cache - Although not a common practice, caches may be placed in isolated higher elevation areas to store seedlings for spring planting. Caches are built as early as January by pushing snow over a simple frame by a small bulldozer (D6) and allowed to freeze in place. Structures may be covered with straw or sawdust to maintain snow. Boxes of tree seedlings are stored in the cache until needed for out planting. Access roads must be snowplowed for cache construction and maintenance.

Pre-Activity Surveys

GO TO **Access and Equipment Maintenance Activity Type, Access to Work Site Activity Component** for the description of Work Elements associated with this activity.

Return Visits after Planting

Return visits are typically conducted to inventory, monitor and conduct maintenance activities in areas planted or naturally regenerating. Netting and shade cards are maintained at least annually. Maintenance generally involves walking through the unit straightening or replacing shade cards knocked down or destroyed by animals, and/or re-installing netting and putting in new nets.

After tree planting, surveys are conducted after the first and third growing seasons, and sometimes during the fifth year as described for natural regeneration surveys. The entire acreage planted will be surveyed.

Related Work Elements may be found in **Access and Equipment Maintenance Activity Type, Access to Work Site Activity Component.**

Seed Production Development

Forested areas, from 5- 30 acres, are selected as seed tree production areas and are located where trees are phenotypically superior, and where cones and seeds will be collected over long time periods (10 + years).

Commercial Thin to Remove Undesirable Trees, Cone Crop Enhancement - To enhance the genetic quality of seed collected from certain stands, areas are typically commercially thinned and the material sold in commercial timber sales. GO TO **Mechanical Treatments Activity Type, Harvest Prescription/Implementation Activity Component,** *Understory / Single Story Treatments: Thinning Work Element,* for the description thinning. To enhance pollen and cone crop production, fertilizers are applied semi-annually. GO TO **Insect and Disease Suppression Activity Type, Fertilization Activity Component**, *Hand application of N frells* for hand fertilization. GO TO **Weeds and Chemical Treatments Activity Type, Cultural Control Activity Component**, *Fertilize by hand, machine or aerial Work Element* for other fertilization applications.

Treat Slash Mechanically or by Hand – After commercial thinning treatments, excess slash may be hand or dozer piled. Piles may be left, removed or burned. GO TO **Mechanical Treatments Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component,** for the description of this Work Element.

Site Preparation

Prior to planting or natural regeneration, site preparation is conducted to reduce fuels and competing vegetation, and further ensure seedling establishment and survival.

Related activity components and work elements that describe activities needed to prepare a site for planting using fire can be found in the **Prescribed Fire Activity Type**. Fire removes the woody debris and herbaceous litter that interferes with seedbed preparation. The effectiveness of using fire to remove debris varies with environmental conditions and the amount and distribution of fuel.

In some cases, mechanical site preparation is done in conjunction with a timber sale or a separate activity. See the **Mechanical Treatments Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for related information.

Mechanical Scarification - Mechanical methods of site preparation include the use of a small bulldozer such as a D3 with a brush rake, salmon blade, or similar tool to remove plants, roots, and rip topsoil and sod, exposing mineral soil. Some machines are designed to scarify patches (breaking up the organic mat on the ground layer so seeds can easily send roots into the mineral soil below), while other machines do more intensive soil disturbance. See **Mechanical Treatment Activity Type, Rehabilitation, Removal of Excess Vegetation and Slash Activity Component** for additional information.

Chaining is another mechanical treatment used to remove and/or destroy vegetation in areas with dense shrubs or small trees. For this procedure, a heavy chain is extended between two tractors; brush and other small trees are destroyed or pulled up as the tractors proceed through a treatment area. Chain-dikers have disks welded to the links of an anchor chain. This is pulled behind a crawler tractor and as the chain rotates it improves tillage, land smoothing and basin formation, in a single pass. This is the most effective method for preparing seedbeds on sites with relatively large amounts brush and other woody debris.

Hand Scalp/Grubbing – Alternatives to machine scarification include hand scalping (grubbing) during tree planting operations. A hand scalper is used to prepare spots for planting. When sod is not heavy, vegetation may be scraped and removed from an area with a radius of up to 12 inches. Grubbing is done using a heavy hoe (a grubbing hoe), to remove plant roots.

Hand Mechanized Scarifier – This is a brush blade with a head on it that rips the topsoil and sod at each planting area. See **Mechanical Treatments Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for additional applicable Work Elements.

Spot Application of Herbicides - Spot applications of herbicides such as Pronone (hexazinone) or Roundup (glyphosate) may also be used. GO TO **Weeds and Chemical Treatments Activity Type, Herbicide Control Activity Component**, for the description of Work Elements used to apply herbicides.

ACTIVITY TYPE: Roads and Roads Maintenance

Roads are constructed and operated to provide access and mobility. Road construction, re-construction, operations, and maintenance consist of standardized practices that include many different activity components and work elements. Where appropriate, agency and commercial users are required to remove mud and other debris from vehicles and other equipment. This helps to reduce the likelihood of transporting noxious weeds, non-native plants, and plant diseases to a site. Related Work Elements may be found in **Access and Equipment Maintenance Activity Type** regarding access and fueling.

ADDITIONAL ROAD NARRATIVE INFORMATION

Road Maintenance Levels

Level 1 – Level 1 roads are physically closed for long periods and may be opened only for selected activities. These roads are probably not surfaced other than with native materials. When these roads are open, only vehicles with high clearance may be used on these roads, and passenger cars are not given consideration.

Level 2 – Level 2 roads are usually open, but may be seasonally closed. These roads are probably not surfaced other than with native materials. These roads are maintained for high clearance vehicles. Passenger cars are permitted, however, these roads are not maintained for such. These roads receive minor average daily traffic (ADT).

Level 3 - Level 3 roads are opened and maintained for the prudent driving of passenger cars. These roads meet Highway Safety Act standards. These roads are single land roads with turnouts and are used at typically low speeds. Road user comfort and convenience is not given priority. The surface of these of roads may be composed of native or aggregate material.

Level 4 – Level 4 roads are opened, maintained and provide a moderate degree of user comfort and convenience. These roads are traveled at moderate speeds and they meet Highway Safety Act standards. The majority of these roads are double lane, although, some may be single lane with turnouts. The surface of these of roads is composed of aggregate material or pavement.

Level 5 - Level 5 roads are open, maintained, and provide a high degree of user comfort and convenience. These roads meet Highway Safety Act standards, are normally paved and have double lanes. Some of these roads may have aggregate and dust abated.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Decommissioning Roads

Decommissioning roads will involve different combinations of activities, such as closing open roads and road obliteration. Roads chosen for decommissioning are those no longer needed for transportation purposes. Such roads may be in poor locations or causing unacceptable sediment loads or disturbance to wildlife or plants. Decommissioning may require the construction of *earth berms,* or work elements such as *re-vegetation, roadbed ripping, side cast pullback, re-contouring, erosion control, water barring,* and *culvert removal.* These work elements may require use of bulldozers or other heavy machinery. The most important activity associated with road decommissioning is the restoration of hydrological function.

Re-vegetation – GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component**, for a description of Work Elements related to seeding**.** GO TO **Reforestation Activity Type, Hand plant upland/riparian Activity Component**, ***Plant trees and shrubs with hoe, bar, auger Work Element*** for a description of planting trees and shrubs. Other activities covered by this Work Element are described as follows. Re-vegetating areas for road decommissioning, or for areas left bare after construction, reconstruction and/or restoration is important for re-establishing soil and slope stability. Re-vegetating activities may be accomplished by mechanical or manual means. Seeding, mulching seedling planting, and fertilizing are common practices. Seed mixes, seedlings, vegetation mats, and sediment filters may all be used during re-vegetation. In most cases, native species are used to re-vegetate and stabilize exposed slopes to the extent possible. Invasive species are not used in seed mixes. Native seed mixes may be spread over the disturbed area or the area may be replanted with saved native or nursery stock plants.

Re-contouring – Decommissioning may involve re-contouring the road surface to approximate the pre-road condition. Obliteration involves placing sidecast material back onto the road surface using a large backhoe. Full re-contouring means the replacement of sidecast or replacement materials back onto the roadcut to restore the original slope angle. Re-contouring

normally requires the use of heavy equipment such as excavators. Re-vegetation measures are implemented as appropriate for the site.

Water Barring – Water barring is accomplished by using a bulldozer or excavator to dig a trench across the road surface. Water bars forcibly interrupt water flow to prevent erosion and decrease sediment distribution. They are generally placed at a 30 - 40 degree angle to the road surface, and more are installed where road grades increase.

Roadbed Ripping - Roadbed ripping can be accomplished with a bulldozer pulling a bar with teeth, or by using an excavator to scarify the roadbed with a toothed bucket. Ripping helps restore water infiltration and facilitates vegetative growth.

Culvert Removal – In most cases, culverts and their associated fills are completely removed to return the stream channel to its original width and function. Culvert removal requires the use of mechanical equipment. Small culverts can be removed with rubber-tired backhoes but large culverts may require the use of larger backhoes with metal tracks. Culverts are removed from the site for salvage or disposal. Culvert removal can temporarily increase sediment loads. Appropriate re-vegetation and temporary erosion control measures are generally needed at culvert removal sites.

Berm/barrier construction – A berm is a barricade placed to restrict road access and is generally composed of natural material such as a soil berm, combination of soil berm and ditch, logs, rocks, or vegetation. Excess soil from side cast, or excavated from the road template, creating a berm in combination with a ditch, may be available for its construction. Berm construction is generally done with a small bulldozer, excavator, or backhoe, if needed a dump truck may be used to haul material to the site. Other items such as boulders, logs, root wads, gates, guard rail barriers, or other constructed barriers are used to restrict access. Construction may require excavation, digging post-holes, clearing vegetation, and rehabilitation of the area with re-vegetation.

Side Cast Pullback – This is an operation accomplished by using an excavator to pull the material away from a fill slope. The material is then piled against a slope or loaded into a dump truck for removal to a waste area. This activity is implemented during road decommissioning.

Road Maintenance

Road maintenance is needed to protect water quality and aquatic resources, to meet access needs and to provide safe and efficient road operations. Road maintenance consists of a variety of activity components and work elements and these will vary by objective and concerns for other resource. Work elements include surface rock replacement including small quantities of spot surfacing, roadside brushing, erosion control, logging out, road surface blading, ditch cleanout, slide removal, dust abatement, and other items that contribute to the preservation of the existing road.

Traffic control – Controlling traffic use and patterns may require the use of permanent signs, special event signs, temporary signs, and/or use of flaggers, special closures, or closures for

specific uses. Traffic control can use portions of traffic management such as discouragement techniques to control the volume of use, type of use, or type of vehicle. Signing is needed for special conditions such as log hauling or fire management situations. Road signs may be directional, issue warnings, designate speeds or used for a number of other purposes. Ongoing sign management requires maintenance, installation, removal, and/or repair.

Blading and grading - Blading restores the shape of the road and redistributes aggregate evenly on the roadbed. Blading eliminates potholes, tire wear ruts, and other features that tend to concentrate water and accelerate erosion. This activity helps to make the surface of the roadbed more even, and the substrate more drainable. Graders are used to redistribute rock/gravel by pulling it back to the middle of the road, and then spreading it back over the road to eliminate oversize. On roads with ditches, the grader may be used to clear or clean ditches to allow water to runoff more efficiently. This helps prevent "ponding" in ditches, and/or accumulated water from spilling onto the roadbed. Blading can be implemented so that road materials do not get too far off the roadbed which otherwise can widen the road surface. A roller may be used to compact the road surface following the final blading passes to prevent further sedimentation. Surface blading can temporarily increase sediment production during intense rains and through dusting.

Disposal Site Use – Disposal sites are approved areas where disposal material is placed or held until a later date. Disposal material may be buried or piled and may consist of soil, tree stumps, slash, brush or other items such as old culverts. These sites must be located on stable ground, free of sensitive plants and animals, usually out of view of recreation areas, and suitable for the purpose.

Hazard Tree Removal – GO TO **Mechanical Treatments Activity Type, Harvest prescription/implementation Activity Component,** *Dead trees: salvage, hazard tree removal Work Element* for the description of this Work Element.

Adding Cross Drain Culverts – Cross drain culverts are added to areas where water must travel through excessively long ditches. Depending on the size of the culvert, a backhoe with rubber tires or metal tracks may be used for installation. Depending on the topography and site characteristics, catch basins may also need to be installed. Culverts are installed with a minimum of 1 foot of fill placed over the top of the culvert.

Bridge Maintenance – riprap, deck cleaning, guardrail repair, abutment repair – This may occur on decks and guardrails, abutments and sills, protecting riprap, bridge approaches, ramps, and wing walls when needed. The need for maintenance is often exacerbated by fire and fire activity when they are damaged, weakened, or destroyed. Many of these activities will require the use of mechanical tools and heavy equipment; some of these activities may result in minor increased erosion for a given time period. Heavy equipment operation could contribute to disturbances in an area of concern for wildlife. Newer diesel engines are much quieter than they have been in the past.

Dust Abatement - Water or Chemical – Dust abatement is sometimes necessary on roads not having a hardened or paved surface. This is especially needed when the volume and frequency of use keeps the surface stirred and fines become separated and airborne in the form of dust.

- Water dust abatement is generally accomplished by spreading water on roads with a truck carrying a water tank and a spreader bar attached to the back of the truck. Only approved sources of water can be used for abatement, and sometimes this may require water source development. Water source development must consider volume, time of use, water rights, drain back prevention, sub-grade pad reinforcement, and protection for fish and other resources.
- Chemical dust abatement involves the use of chemicals that help bind the fines and reduce dust and sediment production. These agents are used when the volume and duration of use make water use too expensive. Common chemical agents used for dust abatement are Calcium Chloride Flake, Lignin Sulfonate, Sodium Chloride, Dust Oils (water based), and other soil stabilizing agents made for that purpose. Volatile cut back dust oils are seldom used. Most common dust abatement agents used today are quite non-toxic to fish and animals in normal concentrations. To be most effective the road surface is prepared by blading, applying water, and then applying dust palliative. Traffic is not allowed on the road until the road has cured. Blotter material is used to soak up excessive dust palliative. Measures are taken to prevent splattering in streams and adjacent vegetation. Pump chance areas and water quality are protected from drain back with berms and aggregate pads constructed prior to use.

Surface Rocking (rock replacement) – This is commonly needed for road maintenance. Over time and from a multitude of uses, original surface rock becomes washed, bladed, worn off, and pushed into muddy sub-grade soil. Eventually surface rock needs to be replaced. This is accomplished by loading a dump truck at a commercial source or agency stockpile with surface rock, hauling the rock to a designated site, then dumping the rock out of the truck onto the road. Moving the truck forward distributes the rock over the road, and a grader used to further spread the rock. Subsequently, a roller may be used to compact and harden the road surface. When the aggregate is dry, it is particularly important to add water prior to blading to prevent segregation and facilitate compaction. Spot surfacing may also be implemented under this work element. Spot surfacing is a type of surface rocking and is limited to the dump truck spreading the rock at specific spots and grading.

Slide Removal – This can be accomplished with a grader, loader or bulldozer. On aggregate surfaced roads, the waste material is loaded into a dump truck and hauled to a designated waste area. Large slide removal generally requires the construction of some type of structure to re-stabilize the roadway. Re-vegetation or other erosion control measures are often taken to reduce erosion from the site.

Roadside Brushing – This is done to prevent vegetative growth in the roadbed, and to improve sight distance. Most roadside brushing is done by mechanical removal of trees, branches, and brush. Occasionally, hand tools such as chain saws with regular bars or brushing bars are used. Mechanical brushing is generally done with a road brushing machine that may use a bar or rotating brush head. A number of passes may be made on each side of the road and generally the uphill side takes more passes. Sometimes a pole saw may be needed to reach limbs on the lower

side of the road. Chainsaws are used to cut and remove fallen logs from the roadway and roadsides.

Opening Closed Roads, including logging out, snowplowing - This occurs for special situations such as commercial thinning, prescribed fire activities, fire suppression or fire rehabilitation activity. During emergency situations, closed roads may be opened to allow emergency vehicles and personnel access. Opening closed roads may require removing barriers, knocking down water bars, clearing vegetation in the travel way, snowplowing, and/or reconditioning other roadway features. Temporary culvert crossings of streams may be installed with bedding and clean backfill. Closed roads that have been opened may then need to be closed after use.

- Logging Out - Logging out refers to the removal of downed trees from the roadbed or roadsides; GO TO **Mechanical Treatments Activity Type** for the description of Work Elements to describe logging operations.
- Snowplowing - Snowplowing may be used to open a closed road for emergency purposes. GO TO **Reforestation Activity Type, Access for reforestation Activities Activity Component,** *Opening closed roads, including snowplowing Work Element* for the description of snowplowing.

Ditch Cleanout - Ditch cleaning is necessary when ditches no longer meet the objective of transporting water to the next cross drain or away from a road or culvert. Water running down the road can increase road surface generated sedimentation, and may overload the next drainage structure, causing a fill failure. Grass, brush, and minor debris is left in place to stabilize the surface, trap sediment, and slow the velocity of water, as long as the ditch adequately handles the expected flow without scour damage to other facilities. Excess material generated through these actions is loaded on a dump truck and hauled to pre-approved disposal sites. Sometimes suitable fines are used to replace lost ones in the aggregate surface of the road. A bulldozer or grader cleans ditches by dropping a corner of the blade into the ditch pushing material along. Occasionally an excavator is used to cleanout ditches that have been filled in by large amounts material and/or vegetation. This re-establishes designed road drainages.

Culvert Maintenance - Cleaning culvert inlets or upgrading is done when they no longer effectively handle expected water and storm events. Culverts are also upgraded to better facilitate the passage of fish. *Upgrading* can require replacing a culvert that is too small, changing the inlet structure to better handle flows and debris, or adding more culverts to reduce existing impacts on roadside ditches. Sometime when replacing a temporary culvert in a live stream, backfill such as drain rock is used. This allows for culvert installation directly in the water with no additional compaction needed for the backfill. No additional sedimentation of the stream will result.

Road Restoration

This is a relatively new term and often involves components used for both maintenance and reconstruction. Generally, the function of road restoration is to improve road drainage capacity and to add a margin of safety for increased flow. Restoration can reduce the need for recurrent road maintenance. Additional cross drains, rolling dips and/or enlarging culverts are common restoration measures.

Environmental consequences from fires can put additional pressure on structures and other road features needed for proper functioning. Vegetation can be burned off stabilized slopes and banks, increasing the probability of erosion and mass sliding; very hot burns can cause soils to become hydrophobic. Water yield can be magnified several times over putting increased stress on culverts and drainage capacity. Woody debris becomes mobilized making drainage plugging a problem.

Stormproofing – This involves the implementation of management practices that substantially reduce the potential for erosion, sedimentation, and mass wasting, while still allowing road use. Stormproofing for road restoration may require constructing dips or waterbars, installing additional culverts, and/or upgrading existing culverts with larger, newer, or with special inlet sections and/or debris racks. It may also involve reshaping the roadway, disconnecting ditches (diverting flow – not relying on ditch flow) and surfacing the roadway. Slope stability can be restored with re-vegetating efforts such as seeding, fertilizing, mulching, vegetation mats, or sediment filters. See the Reforestation and Range Infrastructure Activity Types for additional re-vegetation information. Vegetative re-growth and forest litter, now allowed to accumulate on the roadbed, enables the road surface to regain its hydrological function.

Bridge Replacement – Bridges are replaced when they are destroyed by fire or have become too old to function safely. Bridges are also replaced when they cannot provide access and mobility as needed (e.g., updating from single to double lane), and/or when the original design cannot pass anticipated flood flow events. Bridge replacement can range from replacing the decking, deck or the entire bridge including the abutments. Bridge replacement procedures will vary according to the design, size, type and configuration of the bridge. Large cranes and other heavy equipment are used to remove and install bridges. Minor short-term impacts to water quality are likely to occur.

Installation of Drainage Dips and Waterbars - Roadbed drainage features, such as dips and waterbars, are preferred to facilitate roadbed drainage. Dips or waterbars are not "maintenance dependent" like their counterparts, and work almost indefinitely even with minor slumping of cut banks into the roadbed. They have the added benefit of helping to stormproof the road, or providing an added measure of safety for storm events in the event of overtopping. Installing water bars and dips usually requires the use of mechanical and heavy equipment.

Culvert Installation and Upgrade – Culverts are installed where they are needed to reduce soil erosion and run-off. Installation requires procedures be implemented that will minimize sedimentation and turbidity during the installation of in-channel structures, properly accommodate stream discharge, bedload and debris to reduce road failure risk, provide for stream function (by installing a buffering device that intercepts road surface erosion), and provide a fish passage if fish are present. All culverts must be sized to accommodate 100-year flood events. Culvert installation usually requires the use of mechanical tools and heavy equipment such as backhoes, bulldozers, and dump trucks. After a trench to accommodate a culvert is dug, rock may be placed where the culvert will lie in the trench. Fill is placed on top of the culvert in layers that are compacted.

Surface Shaping and Draining – On high traffic roads, surface shaping and drainage are needed to keep the road dry. Simply grading the road usually completes shaping the surface, this allows for proper drainage. See *road blading* (found above) for additional information.

Surface Material Processing – in place rock crushing – Processing surface material can be accomplished many different ways. From crushing operations to blading and re-distributing rock on the road will "process" material. Binder may be added to an aggregate being used to surface the road, and this can be re-mixed while it is being graded on the road surface. Rock pit plans are designed to minimize adverse effects of excavation and processing of rock materials. The plans will cover erosion control measures needed during and after pit preparation.

New Construction/Reconstruction

Locating stable slopes, avoiding wetlands, and choosing areas where proper drainage can be accomplished are necessary for any new road construction or reconstruction. New construction or reconstruction may include clearing, excavation, embankment, installation of drainage features and structures, and sometimes surfacing and re-alignment.

Vegetation Clearing – pioneering activities – Trees, brush and all other vegetative materials are cleared from the area so that roadbed construction can begin. Bulldozers, graders, backhoes, and power tools such as chainsaws and roadside brushers may all be used. Vegetation is seldom cleared beyond the top of a cut, or fill toe. Sometimes vegetation is left in the lower section of the fill area on temporary roads.

Installation of Drainage Features – includes bridge construction - Under fill drainage refers to installing culverts and bridges. These structures may be permanent or temporary, and are designed to allow for fish passage when needed. They help reduce sedimentation in streams during construction, as well as avoid erosion after construction. Culverts used on fish-bearing streams are all designed for 100-year flood events. The diversion of water around the culvert installation site is done to protect water quality. De-watering occurs when working in the stream channel. Sediment fencing, other erosion control measures, or the use of clean "drain rock" bedding and backfill (at least halfway up on culvert) is used during culvert installation.

Earthwork - Excavation and embankment refers to building a road out of the slope of the ground. This requires excavation, hauling of material, and filling across drainages and depressions.

Finish – Many different types of "finishes" may be used to complete the surface of a road. Some roads may only need a "dozer finish" and other roads may need an asphalt finish. The majority of roads on Forest Service and Bureau of Land Management lands have a grader finish.

Surfacing - Surfacing is designed to meet anticipated road use. Native surfacing is generally used on low volume roads. On occasion, aggregate is used to help stabilize moisture-sensitive sub-grades and protect against erosion on erosive surfaces.

ACTIVITY TYPE: Threatened, Endangered Species Habitat Restoration

These projects cover a wide variety of habitat restoration and enhancement activities for wildlife, fisheries, and plant species. Activity components with primary objectives covered by other activity components are not detailed here. These include road re-location, road decommissioning, road maintenance, road restoration/storm-proofing, thinning of forested stands, prescribed fire, and watershed restoration techniques such as in-channel erosion control structures.

Heavy equipment, including helicopter operations, and the use of power tools are often needed for many instream and aquatic restoration projects and their operation. Access sites and provisions must be made to haul and use heavy machinery. All of these activities would require the presence of crews at a site during the time required to accomplish the work. Most instream restoration activities and some streamside activities would create additional temporary sediment loading.

Related Work Elements may be found in the following Activity Types: **Range Infrastructure** regarding fencing, water source/spring construction, and reseeding; **Roads and Roads Maintenance** regarding decommissioning and obliteration; **Prescribed Fire** regarding fire; **Mechanical Treatments** regarding tree removal; **Trails and Trail Maintenance** regarding trail construction; **Reforestation** regarding seed collection; and **Access and Equipment Maintenance** regarding access and fueling.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Instream Restoration

Helicopter Operations – GO TO **Prescribed Fire Activity Type, Helicopter landing sites and other operational facilities Activity Component,** *Helicopter support sites: refuel, alumigel mix sites,etc. Work Element* for the description of ground support and helicopter maintenance operations. GO TO **Access and Equipment Maintenance Activity Type, Access to Work Site Activity Component**, *Access by helicopter/aircraft Work Element* for the description of helicopter flights.

Hilti Drill Operation – This drill is used to install instream structures.

Mulching for Erosion Control – Localized mulching may be used at disturbed sites, and larger areas of erosion control may be needed if there are large areas of bare soil (e.g., as a result of major channel reconstruction or bank disturbance). Within the **Watershed Restoration Activity Type,** GO TO **Revegetation Activity Component**, *Mulch Application Work Element* and **Hillslope Erosion Control Activity Component**, *Erosion control mulch or blankets Work Element* for the description of this Work Element.

Placement of Boulders or Large Woody Material – GO TO **Watershed Restoration Activity Type, Sediment Control Activity Component,** *Instream log structure* for the description of this work element.

Power Saw Operation – The operation of hand-held power saws. See the **Access and Equipment Maintenance Activity Type, Fueling/Maintenance Activity Component,** ***Fueling/maintenance of light equipment on site*** for additional information regarding fueling.

Seeding For Erosion Control – GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** for Work Elements describing this activity.

Meadow Restoration

Fence Construction – GO TO **Range Infrastructure Activity Type, Fence Construction/reconstruction/maintenance Activity Component** for Work Elements describing this activity.

Mowing - Tractors with mowing implements may be used to mow vegetation along roadsides, and in rangelands with dense shrubs or grasses. Although mowing does not remove roots, it helps eliminate undesired plant species by giving desired plants a competitive advantage. If mowing or brushbeating occurs in Sage Brush, GO TO **Prescribed Fire Activity Type, the appropriate Sage Brush Activity Component (e.g. Mountain big sagebrush fire regime II)**, *Mowing/Brushbeating Work Element* for a description of this Work Element.

Riparian Improvement

The objectives of riparian restoration are to provide vegetative cover, protect soils, provide wildlife habitat including forage and browse, reduce stream temperatures, provide bank shade/cover, and improve local site hydrologic characteristics (e.g. water table depths).

Typical work elements include planting native shrub and tree seedlings, tall tree planting, and forb/grass seeding. Native plant sources are desired and are usually used, but in circumstances where soil profiles are highly modified, non-native plants may be used. Typical implementation consists of hand planting, localized site preparation, use of power tools, and sometimes machinery for seed drilling or tall tree planting. See the **Range Infrastructure Activity Types** for activity components and work elements used to re-seed and replant areas.

Native Plant seeding – GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** for Work Elements describing this activity.

Non-native plant seeding - GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** for Work Elements describing this activity.

Placement of small trees, shrubs, seedling - Woody plant material is placed in riparian zones to increase vegetation diversity. It has benefits to both fish and wildlife through providing a food source, a cover source or reducing stream temperatures. Placement of small trees, shrubs, and

seedlings can occur by various methods. This activity ranges from small projects to large projects. A small project may consist of one or two persons walking along a stream course placing willow cuttings by hand without machinery. A larger project may involve a crew of up to 14 people hand operating power equipment and using a truck mounted auger to bore holes to place large material, such as tree stems up to 6" in diameter. This work generally occurs in early spring (sometimes late fall) and people are present on a given acre for a very short time period (less than one day).

Snag Creation

Tree Climbing – GO TO **Reforestation Activity Type, Collection of Plant propagation materials Activity Component,** *Climb to access or mechanically pick cones Work Element* for the description of this Work Element.

Inoculation – GO TO **Insect and Disease Suppression Activity Type, Ground application of pesticides Activity Component,** *Back-pack spraying or inoculation of individual trees with insecticide* for the description of this Work Element.

Girdling Trees – Trees are girdled by carving a ring around the tree bole interrupting the cambium function.

Tree Topping – GO TO **Insect and Disease Suppression Activity Type, Manual Treatments Activity Component,** *Topping or otherwise killing and removing infested trees Work Element* for the description of this Work Element.

Brush Pile Construction

GO TO **Mechanical Treatments Activity Type, Rehabilitation, removal of excess vegetation and slash Activity Component** for the description of Work Elements related to piling. GO TO **Mechanical Treatments Activity Type, Tree Felling Activity Component** for the description of Work Elements related to tree felling.

Contour Felling

GO TO **Watershed Restoration Activity Type, Hillslope erosion control Activity Component,** *Contour felling Work Element* for the description of this Work Elements.

Exclosure Construction and Maintenance

GO TO **Range Infrastructure Activity Type, Fence construction/reconstruction/maintenance Activity Component** for Work Elements describing fencing activities. GO TO **Access and Equipment Maintenance Activity Type** for Work Elements describing equipment operation.

Fish Population Recovery/Enhancement

Improving and protecting fish habitat is part of the fisheries programs of most administrative units. When areas have been burned, work may be required to repair structures that have been damaged or destroyed and protective measures may need to be taken to prevent further damage to fisheries habitats.

Fish Barrier Installation or Removal - The addition of large woody material and placement of instream boulders may be needed for cover, channel complexity, bedload collection and sorting (e.g., improve spawning habitat). Replacement and/or upgrading of existing culverts may be needed to provide fish passage and for potential 100-year flood events. In some cases, the reduction of instream wood loading is required to allow for fish passage. The installation of barriers to prevent movement of undesired non-native fish may be necessary.

Exotic Species Removal - Trapping - Exotic Species Removal – Trapping (fish) – A primary method for removing fish by mechanical means is electroshocking (see below, *Fish electroshocking).* Trapping and netting fish are alternative methods that produce variable results. Both traps and nets are labor intensive and the specific gear type depends on habitat (e.g., seines require smooth bottoms and trap, or net, types may differ if used in lakes rather than streams). Gear types may include minnow traps, trammel nets, gill nets, fyke nets, weirs and seines. Traps usually result in little to no bank disturbance (e.g., a location to tie down the trap), although a temporary weir may result in bank disturbance. Different fish species and sizes have differing vulnerabilities to any given net or trap. Injury to fish depends on mesh sizes, length of time the net or trap is set, increased risk of animal predation (e.g., river otter or larger fishes), and human handling. Mesh sizes may be used to attempt to not catch certain species or age classes, but, depending on the size of fishes in a given community, non-target fishes may be caught. Nets and traps must be tended in a manner that reduces risk of fish being exposed to predation. Fishes that are not a target for removal, but that swim into a trap and cannot escape, sometimes require human handling that increases stress on the fish. The number of non-target fish that may be released with little to no handling depends on the gear type.

Exotic Species Removal - Rotenone and antimycin A (Fintrol)- These two chemicals are EPA registered restricted use pesticides. Proper use is done according to the labels. Use depends on estimating stream flow so that a proper dosage can be added to the water in drip stations or by backpack sprayer. Both chemicals are neutralized by potassium permanganate. Fish cellular systems (e.g., oxygen uptake) are interrupted resulting in death. Both rotenone and antimycin have other ingredients so that they may be water soluble (i.e. naphthalene for rotenone and acetone for antimycin A). Dead fish must be removed and disposed of. Two or three treatments are sometimes needed. At concentrations used for fish eradication, both chemicals are toxic only to gill breathing animals.

Interpretation/Conservation Education

Many projects have a component that interprets the ecological recovery of severely burned areas. Work components include signing, viewpoint and trail access, and associated parking and restrooms (the infrastructure development). Generally, these actions will be adjacent to already developed roads. See the **Recreation Facilities and Operation, Access and Equipment**

Maintenance, and Trail and Trail Maintenance Activity Types for additional information on related activities.

Signing - Complexity of sign placement varies from simply placing paper signs on tree trunks with a staple gun to potentially constructing a kiosk with display panels. The placement of small signs on tree trunks may be to inform or direct visitors that are in the area already. Larger display signs may require a small construction crew for up to 5 days. These larger displays are meant to draw visitors, possibly all year long. After the construction human presence may increase dramatically.

Viewpoint Construction
Within the **Recreation Facilities and Operations Activity Type,** GO TO **Existing facilities developed and dispersed** and **Installation of other site amenities Activity Components** for the description of this Work Element.

Trail Access / building
GO TO **Trails and Trail Maintenance Activity Types, Construction/reconstruction/heavy maintenance Activity component** for the description of trail building. GO TO **Access and Equipment Maintenance Activity Type, Access to Work Site Activity Component** for the description of trail access.

Monitoring Fish and Wildlife

Fish snorkeling or underwater video - Snorkeling consists of one or more persons outfitted to conduct underwater counts of fish. Fish may leave their territory or station within the water column depending on the proximity of the person. Underwater video would be similar in disturbance, but less often used due to needs for special equipment. Both methods would be limited to streams with proper visibility.

Channel condition surveys, fish habitat inventory - These methods primarily consist of two to three people walking a stream on both the banks and in the stream. Measurements or estimates obtained include channel unit lengths, widths, depths, number of pieces of wood, and special features such as culverts and waterfalls. Disturbance to fish eggs and amphibians can occur, depending on the season of fish reproduction. Surveys are primarily done in low water conditions, such as summer and early fall.

Use of snowmobiles - GO TO **Access and Equipment Maintenance Activity Type, Access to work site Activity Component**, *Access by vehicle or ATV off roads or outside of normal use patterns Work Element* for the description of this Work Element.

Wildlife and fish telemetry - This activity involves the placement of a small radio transmitter on a particular animal and then periodically re-locating that animal to gain information on movements, survival, habitat selection and other desired parameters. The act of re-locating the animal can be done several ways. Most commonly the re-location is gained using a portable radio receiver and hiking in an area where the animal is likely to be located. Locations can also

be gained remotely through the placement of fixed antennas, the use of aircraft, and though the use of satellite receivers. This activity can occur year-round.

Wildlife denning/nesting surveys - Determining the location of animal dens or nests is accomplished through many methods, depending on the species of interest. Commonly the searches are conducted on foot or by vehicle (e.g., ATV, snowmobile or aircraft). The search would cover an area suspected of containing a den or nest of interest. These surveys are normally conducted late winter through summer.

Direct wildlife observation - Direct wildlife observations are those conducted to determine the presence or absence of a species, and sometimes its relative abundance. Observation is most commonly conducted by foot, but occasionally vehicles or aircraft may be used. This activity is conducted year-round depending on the species in question.

Aerial wildlife counts - Aerial wildlife counts are usually conducted to gain an index of animal population numbers and distribution. Most methods used to look at estimating population require counts to be done in the winter or early spring. Helicopters and fixed wing aircraft that are used to conduct these counts usually use low flight levels.

Redd counts - Redd counts are usually conducted by walking a stream to note the number of nests that a female salmonid has excavated and laid eggs in. The surveyor may walk on the bank, or may have to walk in the stream, but redds are often visible enough to avoid disturbing them. Helicopters and boats have also been used to conduct redd surveys.

Fish electroshocking - Electroshocking consists of stunning fish with electric current (alternating or direct). Non-target species would be susceptible to electroshocking, including small mammals that may be in the stream (e.g., vole, mouse, beaver). Given proper knowledge and training, very little mortality is associated with electroshocking, however injury can occur (especially to larger fishes). Injury might consist of bruising of the muscle or breakage of the spinal column. Monitoring with electroshocking may entail three passes through a stream reach to obtain statistically valid estimates of fish populations. Minimum monitoring (e.g., presence/absence or size structure) may entail only one-pass. During three-pass electroshocking, fish are removed from the stream reach with each successive effort (and the reach is blocked with nets to provide a closed population). Fish must thus be kept streamside (usually in buckets) until weighed and/or measured and until the final pass is complete. If fish are weighed and/or measured (as opposed to a numerical count and size estimate) further stress can occur from human handling. Non-target species of fishes may be left in the water under a one-pass or three-pass method. Fish that are being monitored and removed from the stream under either system are put back into the water after they have been weighed and/or measured.

Quarry Restoration

Waste Storage – General waste created in quarrying is usually either topsoil (dirt), which is stockpiled, or tailings (rock, gravel), which are usually stored separately. Toxic waste generated from a quarry site is required to be stored in containers that prevent it from escaping into the environment. In older quarry sites, toxic chemicals were used to extract the object mineral (e.g.,

cinnabar). These older quarries may contain toxic materials such as mercury and cyanide. During restoration, contaminated soil is removed prior to contouring and re-vegetation. These activities may require hand tools and/or large machinery, depending on the size of the quarry.

Seeding – GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** for Work Elements describing this activity.

Road Decommissioning

GO TO **Roads and Roads Maintenance Activity Type, Decommissioning Roads Activity Component** for Work Elements describing this activity**.**

Road Obliteration

GO TO **Roads and Roads Maintenance Activity Type, Decommissioning Roads Activity Component** for Work Elements describing this activity**.**

Spring Restoration and Repair

GO TO **Range Infrastructure Activity Type, Water development construction/reconstruction (springs, guzzlers, tanks, ponds, reservoirs, wells) Activity Component** for Work Elements describing this activity.

Thinning

GO TO **Mechanical Treatments Activity Type, Harvest prescription/implementation Activity Component,** *Understory/single story treatments: thinning Work Element* for the description of this Work Element.

Water Source Construction

GO TO **Range Infrastructure Activity Type, Water development construction/reconstruction (springs, guzzlers, tanks, ponds, reservoirs, wells) Activity Component** for Work Elements describing this activity.

Aspen Restoration

If this project involves fencing, GO TO **Range Infrastructure Activity Type, Fence construction/reconstruction/maintenance Activity Component** for Work Elements describing fencing activities.

See the **Reforestation, Prescribed Fire and Rangeland Infrastructure Activity Types** for additional activity components and work elements that may be used to implement aspen restoration.

Mechanical Root Shearing – Mechanical root shearing is used to remove large numbers of trees and stumps over four inches in diameter. Modified bulldozer blades are normally used for this activity to sever stumps and standing trees at ground-line. This treatment can clear as much as a 12-foot corridor in one pass.

Prescribed Fire – GO TO **Prescribed Fire Activity Type** for Work Elements describing this activity.

ACTIVITY TYPE: Trails and Trail Maintenance

ACTIVITY COMPONENTS AND WORK ELEMENTS

Construction/Reconstruction/Heavy Maintenance

Trail construction could involve a number of activity components and work elements depending on the type of trail needed to meet the recreation objective and constraints involving soils, terrain, and other resource concerns. Trail development could range from merely mowing the trail, to the use of a trail builder machine (trail dozer) and compacter. Construction activities typically include clearing and grubbing, trailbed excavation and building turnpikes, puncheons and switchbacks. Structures such as bridges and rock retaining walls may be constructed, and depending on the site's drainage abilities, the work may require the installation of water bars, grade dips, and/or culverts.

Trail reconstruction could require the use of power and/or hand tools as well as heavy equipment. The most common reconstruction activities include adding drainage dips, check dams, or rock spillways; or removing sloughs or berms. Tread relocation may be needed to avoid bogs, slumps, or other moist areas. This requires establishment of new trail and the closure/restoration of old trail. The tools needed to construct trail may include heavy equipment, power or hand tools, or both.

Access to the site and the movement of personnel and equipment and supplies will also vary among trail types. The time required to construct or reconstruct a trail will depend on the crew size, the intensity of the work and the location. For example, because only hand tools can be used in wilderness areas, this may increase the amount of time that crews would be present in an area. Hand-held tools include anything that can be carried to the site and held in the hand to operate including a chainsaw, crosscut saw, Pulaski, and/or a hoe dad. Machinery also requires an operator and such examples include backhoes, small tractors, ATVs, and other vehicles designed for trail tread construction and repair.

Related Work Elements may be found in the following Activity Types: **Access and Equipment Maintenance** regarding access and fueling; **Mechanical Treatments Activity Type** regarding tree falling.

Horses/Weed Free Hay – If stock is used to pack in material for building trail, the agency is required to use certified weed free feed. On almost all public lands in the west, the public and agencies are required to use certified weed free hay or pellets for livestock.

Camping – The selection of camping sites may be needed for crews that remain on or near the work site while conducting trail maintenance, construction or reconstruction. Effects may include: temporary disturbance, prolonged disturbance, and soil erosion, compaction or sedimentation. Usually agency crews are familiar with minimum-impact camping techniques and will choose a campsite that is already established or a site that is resistant to vegetation loss and soil compaction. GO TO **Prescribed Fire Activity Type, Fire support Activity Component,** *Fire/spike camp Work Element* for the description of this Work Element.

Trail Decommissioning – Decommissioning may require obliterating the trail so that no sign of the trail remains. This may require scarifying, ripping, and seeding, bringing in brush, or the construction of barriers. The objective would be to allow the area encompassed by the trail to become part of the native surface and terrain. This may require the use of hand and/or power tools as well as heavy equipment. Most frequently, backcountry trails are closed to prevent use and allowed to re-vegetate naturally, unless there is a high degree of concern about erosion or weeds.

Ford Maintenance/Construction – This typically involves stabilizing streambanks to prevent erosion and sedimentation. This may be accomplished with native materials (usually rock) or concrete slabs. See **Watershed Restoration Activity Type, In-Channel Erosion Control Activity Component** for additional information.

Gravel Borrowing/Borrow Pit – This involves the removal of small amounts of gravel from sources that are either established for that purpose, or can that be easily restored. Where soil types are favorable the borrow material often comes from the immediate site – if it is removed for ditching and drains it can be placed as turnpike material. Tools needed may include heavy equipment, power or hand tools, or both, depending on location and type of trail.

Reseeding Edges/Bank – Edges and banks along the trail may need reseeding because of wear. Areas may require some scarification of the seedbed. Native seeds or seedlings may be used or an annual fast rooting species may be used to stabilize the bank until native vegetation re-establishes itself. In most mountain applications, where seeds are slow to establish and native forbs and grasses have long-lived roots systems, introduction of root-rich soil from the local area is successful at re-establishing ground cover. This treatment, at least in backcountry settings, is labor-intensive and therefore only used for small areas so the disturbance is slight and hand tools are usually the most appropriate. See the **Watershed Restoration Activity Type, Re-vegetation Activity Component,** and **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** for additional information.

Tread Construction – Tread is the area over which most direct travel occurs. Tread may consist only of native material or may consist of non-native surface (such as gravel). Trail tread may extend to the entire width of the trail or some other width depending on the composition of the tread.

Bridge Building – Bridges are designed to support the maximum snow load, snow grooming equipment, or pack and saddle stock. Materials such as gabions, lumber, or steel for beams and other heavy items are often flown into the backcountry by helicopter if they are too large or too heavy to pack. In areas near roads, heavy equipment is more likely to be used to set gabions, excavate, pour concrete, and set beams.

Trail Relocation away from Meadows – Relocating a trail out of a wet area, or sensitive dry meadow, may require all activities related to building new trail and decommissioning old trail.

Puncheon/Turnpike Construction – Puncheons and turnpikes are used to stabilize trailbeds in areas with high water tables and relatively good soils. Ditches are excavated on each side of the trailbed and the excavated material is placed on the trailbed to raise the trail grade above the surrounding water table. It is often necessary to bring borrow material to complete turnpike construction. If the ground is wet, turnpike sections will be allowed to sit through the winter and spring seasons to permit full consolidation before use. Geotextiles may be used in turnpike construction to improve the turnpike's effectiveness.

Culvert Installation – This consists of furnishing and installing culverts made of non-native material and/or rock culverts. The work includes backfilling and constructing of catch basins and headwalls. Pipe is laid in a stable foundation of undisturbed or compacted soil and headwalls are constructed at the inlets and outlet ends of pipe. In all locations except where turnpikes are laid, culverts are extended from stream bank to stream bank and are horizontal on top.

Blasting – surface, subsurface and aerial – The extent and implementation of blasting depends on the amount of material to be removed and the location of the trail. Typically, in backcountry settings a protruding outcrop or boulder will be removed with relatively small charges. Few trails are being constructed these days that require full-bench cuts in bedrock. In wilderness areas, hand drills are used; outside of wilderness areas hand and power equipment can be used.

Major Tread Reconstruction (blowout repair, large cribbing projects) – Tread is the area over which most direct travel occurs. If significant damage to tread has been incurred, material may have to be hauled to the site to repair the tread; corresponding drainage features may also need to be repaired or reconstructed. Large cribbing projects or retaining wall installation will require the use of fill. The fill may be obtained from a nearby borrow pit, or it may need to hauled to the site.

Light Maintenance

Light maintenance is needed to preserve trails and their related facilities. This may involve a number of activities including but not limited to: installation, clean out and repair of drainage features, removing trees and stumps, protruding rocks, roots, berms and sloughs. Filling ruts and troughs, reshaping backslopes, constructing drainage ditches, finishing treads, and spot filling may also be needed along the trail. These activities could include use of either non-mechanical or light mechanical equipment (e.g., bobcat-sized dozers, post-hole diggers, hand-held

machinery). Activity occurs within trail prism and all materials are left on site.

Hazard Tree Removal – GO TO **Mechanical Treatment Activity Type, Harvest prescription/implementation Activity Component,** *Dead trees: salvage, hazard tree removal Work element* for the description of this Work Element.

Installation, Cleanout and Repair of Drainage Features (waterbars, dips, etc.) – When debris and other unwanted material build up in dips, cross-check culverts, or waterbars, improper water run-off and soil erosion can occur. Debris and other material are removed during maintenance activities to allow for proper hydrological function along trails. See the **Watershed Restoration Activity Type** for additional information.

Signing (blazes, rock cairns, sign posts) – Signs are used for trail operations and are installed or replaced as needed. Blazes are typically chiseled into a tree bole in a standard heel-and-toe style and may be painted to indicate trail routes. The practice of marking trails with blazes is rarely used anymore. Cairns consist of rocks placed in layers that slope to the center of the structure so that it forms a rough pyramid that can be seen from some distance. Some are built to support signposts and others are used as barriers. Generally, rocks used to construct cairns are gathered near the site. Sometimes they are hauled to the site. Posts for signs may be hauled to a site or they may be produced from nearby trees. This activity may require the use of a chainsaw, posthole digger, auger, and/or pounder.

Repair of Structures Near Water (bridges, stream fords) – Repairing trail structures near water may require the implementation of measures to prevent erosion and sedimentation during and after the work activity. This work would likely require the use of machinery, depending on the type of repair work to be done, and the location of the bridge.

Repair of Land Structures (puncheons, turnpikes, steps) – This work may require the use of hand and/or mechanical tools as well as heavy equipment such as a trail machine.

Minor tread reconstruction – Sections along a trail may need surface repair. Wet areas may need to be hardened with gravel and/or puncheon and turnpikes may need to be installed. Tread reconstruction may be done with manual and/or mechanized tools. Constructing trail tread may require hauling non-native material such as gravel or soil, or by using a Pulaski to expose bare soil. Sometimes a protective aggregate may be applied to the trail surface.

Log Clearing and Brushing - Non Mechanical – This could require the use of non-powered hand tools such as the Pulaski, saws, and sickles to remove vegetation and commonly used in remote settings and wilderness.

Log Clearing and Brushing - Mechanical – Chain saws and motorized brush cutters may be used to conduct this maintenance activity outside of wilderness areas.

Excavating Material Near Water (gravel bar) – Material may be excavated adjacent to water sources, or within riparian zones, when fords are constructed or repaired or bridges and other structures are installed for the trail.

Excavating Material (borrow pits, trenches) – Material will be excavated from borrow pits, or trenches and used to "spot repair" tread, or other features in need of maintenance or repair along a trail.

Debris Removal – Debris can be removed with rakes, or any other tools that will facilitate the removal of leaves, twigs, loose soil, rock or other gathered material on a trail, or within structures related to the proper function of the trail.

ACTIVITY TYPE: Watershed Restoration

Watershed restoration activities are intended to repair and monitor fire impacts and restoration treatment effectiveness. Work activities include control of hill slope or channel erosion, watershed stability enhancement, and monitoring of fire impacts and effectiveness of restoration treatments. Treatments are primarily designed to reduce soil loss in burned watersheds and minimize adverse impacts on water quality and aquatic and terrestrial habitats. Techniques described here can be used in watersheds with forest, shrub and grassland habitats to control both storm runoff and erosion.

Mobilizing crews and equipment transportation would typically occur on existing roads. Equipment may require off-road travel to access work areas. Remote work sites may require crew camping near work areas. Related Work Elements may be found in the following Activity Types: **Access and Equipment Maintenance** regarding access and fueling; **Roads and Roads Maintenance Activity Type** regarding road obliteration; **Prescribed Fire** regarding camping.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Hill slope Erosion Control (Erosion control for slopes)

Erosion control treatments are implemented to reduce or slow surface runoff and soil erosion. Some are specifically designed to reduce soil compaction, increase water infiltration, and recover site productivity. These include activities in upland areas or riparian areas.

Gully check structures: install straw bales, logs, silt fences - Material is placed in existing gullies, or areas of high potential for gully formation (coalescing rills), to impede further downcutting or initiation. On-site or nearby material (logs, limbs, brush) may be used when available; if not, generally biodegradable material is brought in (straw bales; silt fencing). This is normally hand placed with log ends sometimes secured into the gully or hillside, although machinery may be used if operationally feasible.

Trenching - Hand or machine work to create a surface slope break to intercept overland flow (and effectively shorten slope length) by a contour trench. Trench width and depth typically depends on the tool used. Hand shovels, or the digging side of a Pulaski, are the most common trenching tools and dictate the width and depth of the trench. In some cases, a backhoe may be

employed and the trench sized according the bucket size. Waste soil/material is placed on the downhill side as a terrace.

Terracing - Hand tools or machinery is used to move soil into contour rows to break slope length, slow velocity of overland flow, and provide some sediment storage. Size of terraces depends on slope length and steepness and soil type. Terrace height in wildland situations typically ranges from 4 to 18 inches with similar base widths. Terraces may sometimes be constructed with sandbagged soil. Soil is usually shoveled from the immediate area into sandbags to form a terrace. This is usually only undertaken in areas with coarse-textured soils.

Slope ripping, sub-soiling - GO TO **Mechanical Treatments Activity Type, Reducing soil compaction Activity Component,** *Subsoiling Work Element* for the description of this Work Element.

Erosion Control Mulch or Blankets - Applying mulch helps prevent soil erosion, retain soil moisture, and protect seeds and seedlings from extreme temperature changes, wind, or damage from trampling. Mulch can be applied by manual or mechanical means depending on the need.

Contour felling - Trees (usually fire-killed) are cut and dropped on-site and placed on the contour to impede overland flow and provide some sediment storage. Construction may involve limbing of fallen trees and trenching to provide a bed for the logs to ensure soil contact and avoid undercutting.

Road / landing ripping - Heavily compacted road or landing areas are mechanically tilled or fractured with a rock ripper, chisel, or subsoiler mounted on a tractor. May be done by hand if treatment is limited in extent and depth of compaction. Subsoilers are designed to fracture compacted layers with minimal surface plowing or mixing.

Install wattles - Straw wattles are long mesh tubes filled with straw, or occasionally hay, that are laid on the contour of slopes to detain overland flow and collect sediment. They are typically installed by hand after being carried on-site by hand, and are usually anchored in place with wooden stakes. Rarely involves mechanized transportation off-road. Transportation may be by helicopter in slings.

In-Channel Erosion Control

Log, Root Wad or Willow Bundle Revetments - These are installed as gradient control measures. A revetment is an armoring wall or barrier protecting stream channel walls from erosion or (further) scouring. Although 'Riprap' made of rocks is a classic example, this activity uses vegetation (i.e. logs, root wads and/or willow bundles) as a bioengineering technique.

Reshape Streambanks and Incised Channels - Treatments designed to reduce streambank erosion and enhance channel stability may be implemented in active channels and floodplains. This activity typically involves machinery (typically an excavator) to reconfigure stream channels or merely shape the banks (see below, *Lay Back Vertical Banks,*). This activity ranges

from use of handwork with shovels on small channels to use of heavy machinery to implement large meander adjustments based on 'Rosgen-style' calculations.

Lay Back Vertical Banks – Laying back the bank is needed when the bank slope is too vertical and sloughs into the stream. These procedures help reduce the bank's vertical slope, thus reducing erosion and channel undercutting. Hand tools or machinery (tracked backhoe/excavator) are used to pull material away from the channel to limit additional calving of banks. The banks are smoothed back from the channel to allow gradual rising of water levels and reduction of water velocity that otherwise would erode vertical or overhanging banks.

Install Barbs - Installing barbs also helps to reshape banks and incised channels. Barbs are generally logs anchored to the streambanks. They extend into the stream channel and slow down or redirect water flow helping to create such features as pools.

Structural Bank Controls (riprap, etc.) - Structural bank control or shaping can be treated with the placement of riprap.

Re-vegetation

Re-vegetation treatments are designed to establish ground cover, improve infiltration, and restore site productivity. The activities may be implemented on upland slopes, riparian areas and along streambanks.

Seeding – Aerial or Hand Application – Seeding techniques include hand and aerial broadcast. GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** *Seeding – aerial Work Element* for a description of aerial seeding. GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** *Seeding – disking, drilling, fertilizing, plowing Work Element* for a description of non-aerial seeding.

Site Prep - Surface Scarification, Tilling, Ripping – These activities are implemented for seedbed preparation. For salmonids, criteria will be found under this Work Element; for all other species, criteria will be found under: **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** *Seeding – disking, drilling, fertilizing, plowing Work Element* for tilling; **Reforestation Activity Type, Site Preparation Activity Component** for Work Elements for scarification; **Mechanical Treatments Activity Type, Reducing Soil Compaction Activity Component**, *Subsoiling Work Element* for ripping.
GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** *Seeding – disking, drilling, fertilizing, plowing Work Element* for a description of tilling. GO TO **Reforestation Activity Type, Site Preparation Activity Component** for Work Elements describing scarification. GO TO **Mechanical Treatments Activity Type, Reducing Soil Compaction Activity Component**, *Subsoiling Work Element* for a description of ripping.

Planting Upland and Riparian – Grass, forb, shrub, tree - GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component** for Work Elements describing seeding. Other activities covered by this Work Element are described as follows. Riparian and

upland areas (with grasses, forbs, shrubs and/or trees) may be planted with transplanted nursery stock and/or local plant materials. Normally, species used for seeding or seedlings are native to the area, however, non-persistent, non-native species may be used where objectives require rapid ground cover establishment. Plantings may be done by hand or with machinery. See the **Reforestation Activity Type** for additional information related to planting.

Mulch Application - Applying mulch helps prevent soil erosion, retain soil moisture, and protect seeds and seedlings from extreme temperature changes, wind, or damage from trampling. Mulch can be applied by manual or mechanical means depending on the need.

Hanson Dibble – This non-mechanized tool is used by an individual to plant tree and shrub seedlings in all types of soils and on all slopes. It is often used in rangelands.

Road Obliteration

Obliteration treatments for watershed restoration purposes include re-contouring. Full re-contouring means replacement of sidecast, or replacement material back onto the roadcut to restore the original slope angle. Re-contouring normally requires heavy equipment such as excavators.

GO TO **Roads and Roads Maintenance Activity Type, Decommissioning roads Activity Component** for Work Elements describing this activity.

Sediment Control

Structures (e.g., instream log structures) are designed to detain, control, or remove increased sediment in highly impacted burned watersheds. Rebuilding and maintaining instream structures helps protect and maintain instream basins. Structures are constructed and placed by crews using equipment and/or hand crews. Maintaining structures requires sediment removal and disposal by equipment and/or hand crews depending on size and location of structures.

Maintain instream basin - Tracked backhoe (excavator) or other machinery is used to remove collected sediment and debris from constructed basin. Small structures may be cleaned by hand. Structural maintenance may be by machine or with shovels patching or shoring weak spots, damage or leaks.

Construct instream basin (impoundment) - Catchment basins are constructed to collect mobilized sediment and debris. They are often made with tracked backhoes (excavator) or, less often, bulldozer or by hand using on-site soil and rock material. Occasionally involves dump trucks to transport in material

Instream log structure - Instream structures using logs (usually from on-site). Log structures vary from single log or multiple logs. They may be simply felled into the stream (typically intermittent channels) or may be cabled to rocks or standing trees nearby. Log ends may be dug

into channel sides to anchor in place. Some installations may involve using machinery in the channel for short periods of time. Many installations will be in dry channels and done by hand.

Watershed Monitoring

Work activities designed to measure vegetation recovery, soil condition, stream channel condition, and water quality may be needed to monitor watershed conditions, and recovery following environmental events such as fire.

Establish/monitor erosion plots – Installation of erosion monitoring plots for sediment collection typically involves use of hand shovels or other tools to anchor silt fencing or collection boxes. Visual observation plots may only require driving a locating monument (stake) or temporary flagging.

Install gage – Gage installation for post-fire monitoring typically means simple placement of a water depth measure rod near the stream channel or the installation of weather station(s). These usually involve simple hand digging in to secure placement of a measuring rod or small weather monitoring station including precipitation gages and electronic warning devices. Occasionally, water flow and depth gages are installed which may involve trenching and securing of gage and housing in or adjacent to stream channels.

Instream water/sediment collection – This may be occasional hand collection of water samples or involve installation of an automated water/sediment/temp sampling device. These are typically housed in metal barrels or small wooded houses and require some trenching and anchoring of the housing and sampling lines.

Manual instream measurements – Typically involves measuring water flow or stream morphology by cross-section characterization. Water flow measures typically require wading of the stream and insertion of flow measurement rod into the stream channel. Stream channel measurements require rod and level measurements across the stream channel from bank to bank with the rod person wading the stream to take readings at regular intervals.

Monument Plots – Typically requires digging or driving of stakes or other locating devices to ensure long-term identification of specific spots on the landscape for monitoring purposes or land-line location.

ACTIVITY TYPE : Weeds and Chemical Treatments

Noxious weed management includes the use of herbicides, manual, mechanical, biological, and cultural treatments. Rehabilitating a site following treatment is also a part of noxious weed management. Weed treatment may be necessary on rangelands, in timber harvest areas, along roads and road rights-of-way, along trail routes, at dispersed and developed recreation sites, and on other disturbed sites (i.e. fires, flood events). Many treatments are needed during post fire conditions; some are used to reduce the risk and severity of wildland fires. The type of treatment

used depends on site characteristics, weed species present, and management objectives ranging from containment, to control, and eradication. Containment is used to prevent weed spread to beyond the existing infestation perimeter. Control objectives strive to reduce the extent and density of a target weed. Eradication focuses on complete elimination of the weed species including reproductive propagules.

All vegetation treatments conducted for control of noxious weeds are done in accordance with the corresponding agencies' policies, regulations, and product label requirements. Federal agency policy requires the use of specific design features, when in close proximity to sensitive areas, to insure vegetation treatments do not have an adverse impact on non- target plants or animals. Treatments methods include: herbicide, manual, mechanical, biological, prescribed burning, seeding, or any combination of treatment methods.

Ground based application may include the use of backpack sprayers or vehicle-mounted or ATV sprayers (boom or spot gun) to treat noxious weed infestations. Aerial applications require the use of helicopters or fixed wing aircraft mounted with sprayers to treat noxious weed infestations.

Related Work Elements may be found in the following Activity Types: **Access and Equipment Maintenance** regarding access and fueling; **Prescribed Fire** regarding fire and camping.

ACTIVITY COMPONENTS AND WORK ELEMENTS

Biological Control

Biological methods require the use of living organisms to selectively suppress, inhibit, or control herbaceous and woody vegetation. This method requires the proper management of plant-eating organisms and precludes the use of mechanical devices, chemical treatments, or burning of undesired vegetation. Biological weed control activities typically include release of parasitic and `host specific" insects to target weeds. Presently, insects are the primary biological control agent in use. Mites, nematodes, and pathogens are occasionally used. Treatments do not eradicate the target species but rather reduce target plant densities and competition with desired plant species for space, water, and nutrients. Bio-control agents are typically used where the target weed has dominated the plant community across large areas.

Collection / Release of Insects or Other Biological Controls – Biological control activities include collection of insects, development of colonies for collection, transplanting parasitic insects, and supplemental stocking of populations. In most situations, a complex of biological control agents is needed to reduce weed density to a desirable level. For example, a mixture of five or more biological control agents may be needed to attack flower or seed heads, foliage, stems, crowns and roots all at the same time or during the plant's life cycle. Typically 15 to 20 years are needed to bring about an economic control level.

Monitoring by Sweep Netting – This involves inventory and monitoring of released bio-control agents to determine treatment success. Repeat visits may need to be made several times a season, and over a series of years.

Competitive Seeding - Noxious weeds commonly invade areas with disturbed or exposed soil or areas where native plants cannot compete with aggressive exotic plants. Consequently, after control of weeds, it is beneficial to establish native/desirable plants, restrict or prevent additional infestations, and help prevent soil erosion and soil nutrient loss. Treatments may require ground and/or aerial application of seeds and fertilizers.

Transport of Bio-control Agent by Vehicle – Bio-control agents are transported in containers that safely enclose the agent until release.

Cultural Control

Cultural control treatments require management changes associated with prevention, livestock or wildlife habitat manipulation, competitive plantings, and a change of public land use.

Chaining - Chaining is used to remove and or destroy vegetation. Chain-dikers have disks welded to the links of an anchor chain. This is pulled behind a crawler tractor and as the chain rotates it improves tillage, land smoothing and basin formation, in a single pass. This is the most effective method for preparing seedbeds on sites with relatively large amounts of brush and other woody debris.

Provide Shade - Shade (i.e. shade cards or mulch) may be necessary to protect seeds and seedlings from high solar rays. GO TO **Reforestation Activity Type, Artificial Shade Activity Component,** *Shade Cards Work Element* for the description of this Work Element.

Fertilize by Hand, Machine, or Aerial – Fertilizer application by aerial or ground method depending on the sites locations and treatment objectives. For hand application of fertilizer, also see **Insect and Disease Suppression Activity Type, Fertilization Activity Component,** *Hand application of N frells Work Element* for additional information.

Injection/Cut Stump – Herbicides may be injected into stumps, using a hatchet injector or other type of instrument to inhibit re-sprouting.

Grubbing – GO TO **Reforestation Activity Type, Site preparation Activity Component,** *Hand scalp/grubbing Work Element* for the description of this Work Element.

Prescribed Fire – Fire removes the woody debris and herbaceous litter that interferes with seedbed preparation. The effectiveness of using fire to remove debris varies with environmental conditions and the amount and distribution of fuel. GO TO **Prescribed Fire Activity Type** for work elements that describe this activity.

Use Grazing to Control Weeds, Fencing, or Herding – Domestic animals such as sheep or goats can be a valuable control method at reduced costs. The following considerations will be made before using livestock or herding: 1) size of infestation, 2) plant species, 3) timing of consumption for best control, 4) availability of water sources for stock, 5) stock management to insure beneficial effects, (e.g., when stock presence does not encourage spread of noxious weeds

into non-infested areas). Some combinations of livestock or other bio-control agents such as insects may be the most effective.

Plant Native Vegetation – Planting native vegetation in areas following fire will help prevent invasion and spread of noxious weeds. In areas where a good establishment of native species exists prior to fire, there is a high probability that natives would re-establish and occupy the site. In certain habitats, native species lower the frequency, intensity, and occurrence of wildland fire. GO TO **Reforestation Activity Type, Hand plant upland/riparian Activity Component,** *Plant trees and shrubs with hoe, bar, auger Work Element* for a description of planting trees and shrubs. GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component** for Work Elements that describe seeding activities.

On and Off Road Vehicle Use – GO TO **Access and Equipment Maintenance Activity Type, Access to Work Site Activity Component** for work elements that describe this activity.

Mulch – By Hand or Machine –Applying mulch helps prevent soil erosion, retain soil moisture, and protect seeds and seedlings from extreme temperature changes, wind, or damage from trampling. Mulch can be applied by manual or mechanical means depending on the need. Mulch may be applied using mulch mats, shovels, and rakes. Within the **Watershed Restorations Activity Type,** see **Hillslope Erosion Control Activity Component**, *Erosion control mulch or blankets Work Element*, and **Re-vegetation Activity Component**, *Mulch Application Work Element* for additional information.

Herbicide Control

The herbicide application method and selected technique depends on a number of variables such as treatment objective (contain versus eradicate), accessibility, topography, and size of treatment area, characteristics of target plant and desired vegetation, location of sensitive areas in immediate vicinity, anticipated costs and equipment limitations, and meteorological and vegetative conditions at time of treatment.

Applications are scheduled and designed to minimize potential impacts to non-target plants and animals, while remaining consistent with vegetation treatment program objectives. Application rates depend on the presence of the target species, condition of non-target vegetation, soil type, depth to the water table, and distance to open water sources, riparian areas, special status plants, and requirements of the herbicide label. See the **Insect and Disease Suppression Activity Type** for additional chemical application descriptions.

Hand Crank Granular Spreader – Some herbicides are applied in solid form and are placed on the soil surface to be absorbed by plant roots.

Liquid Application - Carriers (gases, solids, or liquids) are used to dilute or suspend herbicides during application and allow for proper herbicide placement. Liquid carriers include water, liquid fertilizers, diesel, and other similar low-viscosity oils. Water is the most widely used carrier because it is available, cheap, and most herbicides are formulated to be applied with water.

Spray solution additives, adjuvant, are mixed with herbicide solutions to improve spray mixture performance. Adjuvant can either enhance activity of a herbicide's active ingredient or offset any problems associated with spray application such as adverse water quality or wind. Adjuvant may contain surfactants, antifoaming agents, crop oil or crop oil concentrates, drift retardants, compatibility agents (mixing two or more herbicides in a common solution), and spray buffers (change the spray solution PH).

Spray from ATV – A sprayer attached to an ATV allows for treatments of patches of weeds on hillsides, or other areas not easily accessible by road.

Granular Application – Some herbicides are applied in solid form and are placed on the soil surface to be absorbed by plant roots.

Back Pack Sprayer with Spray Wand – The use of pressurized container with an agitation devise carried with backpacking equipment, allows the operator to target specific or individual plants.

Aerial Application by Fixed Wing or Helicopter – Aerial application of herbicides from a helicopter or fixed wing aircraft do not disturb soil or protective organic layers and are not limited by inaccessibility or rugged terrain. Applications allow for treatment of large areas quickly with a smaller workforce. However, drift management and off-site effects may be more difficult to manage and predict.

Spray from Truck Mounted Boom or Spray – Truck mounted mechanical spray equipment is primarily limited to treatment of accessible roadsides and flat areas. This allows large area coverage, and is faster and less expensive than manual or hand applications.

Hand Controlled Wand with Soaked Wick – This technique allows user to target individual unwanted plants reducing risk to non-target organisms and other resources.

Manual Control

Manually treating noxious weeds may disturb soil surfaces and can be labor intensive and costly when compared to herbicide applications. Manual treatments are typically used to treat selected plants, small infestations, and in sensitive areas to avoid adverse effects to non-target species or water quality.

Hand Clip Seed Heads or Pull Weeds - Crews may use power or hand tools to cut, clear or prune vegetation; pull, grub, or dig out plant root systems to prevent subsequent sprouting and re-growth; scalp vegetation at ground level or remove competing plants around desired vegetation; or place mulch around desired vegetation to limit the growth of competing vegetation. All noxious weed disposals will be in accord with proper disposal methods. Noxious weeds with developed flowers are generally bagged and burned. This method is most effective on new infestations of annual, biennial, or simple perennial exotic plant species.

Handsaws, axes, shovel, rakes, machetes, grubbing hoes, mattocks, brush hooks, and hand clippers may all be used to treat weeds. Axes, shovels, grubbing hoes, and mattocks are also used to dig up and cut below the surface to remove the main root of plants. This is especially effective on plants that quickly re-sprout in response cutting and clearing.

Mechanical Control/Restoration

Activities include the use of wheel tractors, crawler-type tractors, or specially designed vehicles with attached implements for mechanical vegetation treatments (e.g., plows, harrows, rangeland drills and mowers). Choosing the appropriate treatment depends on the characteristics of undesired species present (for example, density, stem size, brittleness, and sprouting ability); the need for seedbed preparation and revegetation; topography and soil characteristics of the site (e.g., type, depth, amount and size of rocks, erosive conditions, and susceptibility to compaction). It also depends on climatic conditions and potential cost of improvement as compared to expected productivity. Activities typically occur on old agricultural areas, industrial sites, and roadsides.

Weed-Whacker Use – This is a motorized brush cutter with a saw-like blade used to remove herbaceous or woody plant materials. This may be used in conjunction with other power tools to (such as a brush buster), to remove noxious weeds or clear dense areas of trees or brush preparing the area for replanting or reseeding. Slash busters may be used to mow down heavy slash or unwanted vegetation in densely vegetated areas.

Plowing – transport of heavy equipment – Tractors with attached discs (disking), chains (chaining) or other types of plows may be used to clear and de-root plants, furrow (plowing a strip) or contour a site, or completely remove vegetation (scarification) from an area. The transport of tractors and their associated implements may require the use of trucks with low bed trailers or other types hauling vehicles.

Mowing of Weeds – Tractors with mowing implements may be used to mow vegetation along roadsides, and in rangelands with dense shrubs or grasses. Although mowing may not remove roots, it helps eliminate undesired plant species by giving desired plants a competitive advantage. For mowing in Sage Brush, GO TO **Prescribed Fire Activity Type, Sage Brush Activity Component(s)**, *Mowing/Brushbeating Work Element* for a description of this activity. For all other mowing, GO TO **Threatened, Endangered Species Habitat Restoration Activity Type, Meadow Restoration Activity Component,** *Mowing Work Element* for a description of this activity.

Drill Seeding - On areas with moderate slopes, the use of rangeland drills attached to tractors, may be the most effective method reseed an area.

Aerial Application of Seed – Seed may be applied aerially using helicopters or fixed wing aircraft when appropriate. GO TO **Range Infrastructure Activity Type, Rangeland Restoration Activity Component,** *Seeding - aerial Work Element* for the description of this Work Element.

Weed Prevention

Wash Vehicles, Water Drafting - Washing vehicles used to access and maneuver around treatment sites should occur before and after work is accomplished. Washing would occur at designated areas and may require water drafting from a nearby water source such as a pond, lake, stream, or spring. Water hauled in by truck is an alternative to using natural water sources. Within the **Prescribed Fire Activity Type, Fireline Construction/Holding Actions Activity Component,** see the *Pumping from streams/ponds using portable pumps* and *Drafting to fill engines/tenders Work Elements* for additional information.

Information

Education/Outreach – Informational materials, seminars, and workshops may be provided to assist agency personnel and the public in understanding the effects of noxious weed invasion. Providing information and education to assist with prevention, control, and eradication of noxious weeds is the primary objective of these efforts.

Federal land management agencies that conduct noxious weed treatments must closely coordinate with federal and state agencies, county weed control programs. Herbicides used on federal lands must be registered by the U.S. Environmental Protection Agency.

References

A Risk Assessment for Herbicide Use: A USDA Forest Service Publication of Forest Service Regions 1, 2, 3, 4, and 10, and the Bonneville Power Administration (1992). This has been prepared to address applicable risks of herbicides to human health and non-target species including wildlife and aquatic species.

Noxious Weeds Home Page at www.fs.fed.us/r6/weeds: A USFS Region 6 Natural Resource Home Page. This is an excellent resource with detailed information about noxious weeds, treatments, chemical uses, and the legal aspects treatments related to chemicals uses.