Chapter II
Proposed Action

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PROPOSED ACTION

Description

The proposed action is to control, contain, or eradicate invasive plants on existing or newly discovered infestations. Various types of treatments would be used including the use of herbicides, physical, and biological methods. Treatments are proposed for existing or new infestations including new plant species that currently are not found on the Forest. Current inventory indicates there are approximately 47,500 acres of invasive plant infestations on the two Forests (Table II - 1).

Potential treatment types based on existing mapped sites (see maps of treatment sites in Appendix H and I of this BA) are chemical, physical and biological. Any use of chemicals would be done in accordance with USDA Forest Service policies, regulations and Forest Plan Standards as well as product label requirements. Chemicals approved for use, within or outside riparian areas, are listed in tables II-8, II-9, and II-10 of this document and further elaborated in the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS (USDA 2005), and ROD (USDA 2005a).

Table II - 1. Acres and type of treatment type by forest.

Forest	Upland and Riparian Biological or Physical Treatments	Upland Chemical, Physical, or Biological	Riparian Chemical, Physical, or Biological	Physical only	Aerial	Total
Umatilla	3,958	14,456	5,560	50	675	24,699
Wallowa-Whitman	2,066	13,556	6,345	0	875	22,842

Monitoring of treated sites would determine if follow-up treatments would be needed. For sites treated with herbicides, follow-up treatment could include herbicide application and or manual treatments. However, the goal is to become progressively less dependent on herbicides and to use more of the alternative control methods for continued treatment if a site requires it.

TREATMENT METHODS, PRIORITIES AND STRATEGIES

The appropriate treatment method for each site is determined by applying site information to the Treatment Decision Tree (Figure II - 1). Given adequate funding, approximately 4,000 acres on each forest could receive treatment with herbicide, manual, mechanical, and/or cultural methods annually. Biological control methods are ongoing, once started the control method is maintained by residual populations and acres managed using this type of control would vary across the forest over time. On-going monitoring of the site would provide the information needed to decide if follow-up treatment methods are required. The following treatment methods provide specific information related to effectiveness.

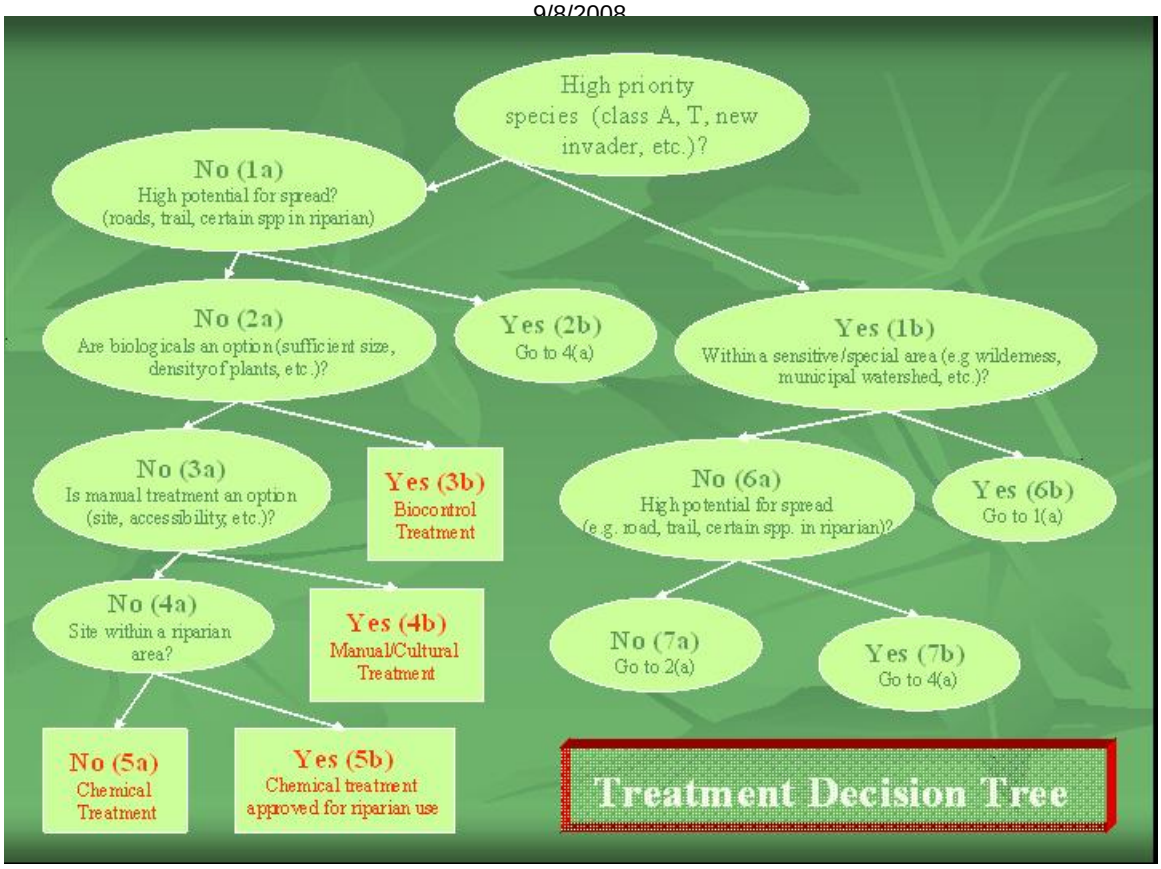

Figure II - 1– Treatment Decision Tree

Manual and Mechanical Treatments

Manual and mechanical treatments physically remove and destroy, disrupt the growth of, or interfere with the reproduction of invasive plants. These treatments can be accomplished by hand, hand tool (manual), or power tools (mechanical); and include pulling, grubbing, digging, hoeing, tilling, cutting, mowing, and mulching of the target plants. Thermal techniques such as steaming, super heated water and hot foam are also considered as viable treatments.

Manual Methods - Manual methods can be effective on small infestations if the entire root is removed. With new, small infestations, hand pulling can be the easiest and quickest method. Even larger populations, though, can be controlled with hand pulling if the workforce is available. The Bradley Method is one sensible approach to manual control of invasive plants (Fuller and Barbe 1985). This method consists of hand weeding selected small areas of infestation in a specific sequence, starting with the best stands of native vegetation (those with the least extent of infestation) and working towards stands with the worst infestation.

Manual methods are usually not as effective for deep-rooted or rhizomatous perennials such as leafy spurge where hand-pulling and hoeing often leave root fragments that can generate new plants. Hand-pulling or hoeing also disturbs the soil surface, which may increase susceptibility of a site to reinvasion by weeds (Brown et al., 2001). Manual methods are labor-intensive and usually ineffective for the treatment of large, well-established infestations of perennial invasive plants with long term viable seed such as knapweeds (Brown et al., 2001). A local effort where larger community support or funding for hand crews exists does show promise, if efforts can be sustained. Manual and mechanical methods as primary methods prior to the use of herbicides

were shown to be only 25 percent effective on the Umatilla National Forest located adjacent to the Wallowa Whitman National Forest (Erickson, 2006).

The Nature Conservancy reported success with the use of manual control (Tu et al., 2001). Hand pulling by volunteers has successfully controlled diffuse knapweed (*Centaurea diffusa*) in the Tom McCall Preserve in northeast Oregon. Yellow bush lupine (*Lupinus arboreus*) was also controlled in coastal dunes in California by pulling small shrubs by hand. Larger shrubs were cut down with an ax, and re-sprouting was uncommon (Pickart and Sawyer, 1998). Hand pulling has also been fairly successful in the control of small infestations of thistles (*Centaurea spp.*), white and yellow clover (*Melilotus officinalis*), and purple loosestrife (*Lythrum salicaria*) at TNC preserves scattered across the country.

Manual tools such as the Weed Wrench (www.weedwrench.com) can be used on herbaceous plants that have a stem or bundle of stems strong enough to withstand the crush of the jaws. It has been used successfully to pull acacia *(Acacia melanoxylon*), buckthorn (*Rhamnus cathartica*), Russian olive (*Elaeagnus angustifolia*), multiflora rose (*Rosa multiflora*), willow (*Salix spp*.), tamarisk (*Tamarix spp.*), bush honeysuckles (*Lonicera spp.*), Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulanus*), and Brazilian pepper (*Schinus terebinthifolius*) at preserves across the mainland U.S. In Hawaii, the Weed Wrench has been used to pull Strawberry guava (*Psidium cattleianum*) and small saplings of Karaka nut (*Corynocarpus laevigatus*) from the Kamakou preserve on Molokai (Hawaii) (Tu et al, 2001).

Mechanical Methods - Mowing or cutting is more effective on tap-rooted perennials such as spotted knapweed compared to rhizomatous perennials (Brown et al., 2001). Cutting or mowing plants can reduce seed production if conducted at the right growth stage. For example, a single mowing at late bud growth stage can reduce the number of seeds produced on spotted knapweed (Watson and Renny, 1974). Mowing can also weaken an invasive plant's competitive advantage by depleting root carbohydrate reserves, but mowing must be conducted several times a year for consecutive years to reduce the competitive ability of the plant.

Oregon Department of Agriculture staff compared mowing and pulling mature plants to no treatment in two western Oregon spotted knapweed infestations. They applied one treatment annually at the optimum time for each of four consecutive years, and concluded that neither method was effective in reducing population density or cover. They recommend consideration of pulling and mowing only where the goal is to contain spotted knapweed infestations or to suppress seed production (Isaacson et al., 1997 in USDA 2005b Appendix J).

Because invasive plants flower throughout the summer, it is difficult to time mechanical treatments to prevent flowering and seed production. Repeated mechanical treatment too early in the growing season can result in a low growth form that is still capable of producing flowers and seed (Benefield et al., 1999; Goodwin and Sheley, 2001). Mechanical treatments on some rhizomatous weeds, such as leafy spurge, can encourage sprouting and result in an increase in stem density (Goodwin and Sheley, 2001).

Mulching - Mulching with plastic or organic materials can be used on relatively small areas (less than 0.25 acre), but will also stunt or stop growth of desirable native species. Mulching prevents seeds and seedlings from receiving sunlight necessary to survive and grow, and can smother some established invasive plants. Hay mulch was used in Idaho to reduce flowering of Canada thistle (Tu et al., 2001), but most rhizomatous perennial invasive plants cannot be controlled by this method or by shading because extensive root reserves allow regrowth through and around mulch or shade materials.

Thermal Techniques - Thermal techniques are being tested or used with some success throughout Region Six by such agencies as Oregon Department of Transportation (ODOT), the Nature Conservancy and the Bureau of Land Management (BLM). The Nature Conservancy (Tu et al, 2002) tested the Eco-Weeder, an infrared technology device that uses the combustion of liquid gas to reach extremely high temperatures that place intense radiation directly on weeds to explode plant cells. The tool could be useful for small area treatments, especially on sidewalks, but the effectiveness on deep-rooted plants, sedges or rhizomatous grasses may not be as high. The Nature Conservancy also tested hot water pressure washers. The brand tested could apply hot water through a pressure nozzle with a wide spray or intense stream which would act as an injection device for below ground portions of plants. They found it effective on seedlings and annual plants within reach of the washer, but the effectiveness on plants with extensive underground roots or rhizomes would be less. Hot foam has been tested by the Nature Conservancy and used by the BLM effectively on puncturevine and slender false brome. Again, this technique is limited to the reach of the foam generator, but is an excellent non-chemical method. It is effective on seedlings and annuals and can be applied under weather conditions including wind and light rain.

Herbicide Treatments

The objectives of herbicide treatments are often twofold: 1) to more efficiently reduce the size of moderate to large infestations of invasive plants to a point at which they can be hand-pulled or manual or mechanical methods are ineffective due to invasive plant growth morphology, or, 2) more efficiently treat large expansive areas where invasive plants thrive due to the nature of the site. Different herbicides vary in effectiveness and length of control on different invasive plants, and herbicide techniques can vary in effectiveness, environmental effects, and costs.

Herbicides vary in selectivity of control for various plant groups. Those differences in selectivity are the basis for developing effective plant control treatments while minimizing adverse effects and facilitating native plant community maintenance or restoration.

Physical forms of herbicide vary. Some may be oil- or water-soluble molecules dissolved in liquid, or attached to granules for dry application to soil surface. Herbicides may move from their location of application through leaching, volatilization, or adsorption. For a complete review of all physical properties and risk assessments of herbicides approved for use and discussed in this BA, see Regional Invasive Plant Herbicide Information http://www.fs.fed.us/r6/invasiveplant-eis/Region-6-Inv-Plant-Toolbox/ (accessed 4/2007). Herbicides can also be applied with a variety of equipment and techniques. The techniques vary in effectiveness, environmental effects and costs. Aerial application of sprays or granules can be used for rapid broadcast coverage of large or inaccessible areas. In general, herbicides provide and effective method of controlling invasive plants and is projected to be 80 percent effective at controlling invasive plants when used with other methods of treatment in the region (R6 2005 FEIS).

Just as changes in plant diversity or species composition can occur due to invasive plants, changes can also occur due to treatments. Short-term changes in species dominance can lead to long-term shifts in plant community composition and structure. Repeated treatments over time could favor tolerant species, which in turn could shift pollinators available to a community. DiTomaso (2001) points out that continuous broadcast use of one or a combination of herbicides will often select for herbicide tolerant plant species. When broadleaf selective herbicides are used, noxious annual grasses such as medusahead, cheatgrass or barbed goatgrass may become dominant. Population shifts through repeated use of a single herbicide may also reduce plant diversity and cause nutrient changes. Alternatively, plant diversity is reported to be maintained

on sites with repeated applications of Picloram and Chopyralid for control of spotted knapweed in Montana (Rice 2000). Additionally, analyses based on 60 published studies of terrestrial plants and animals in temperate zone forests and agro-ecosystems indicate species richness and diversity of vascular plants was either unaffected or increased (particularly herbaceous species) in response to glyphosate (Sullivan and Sullivan 2003).

It is obvious there are still unanswered questions related to recovery of native vegetation after herbicide treatment. Project design features such as the development of a long-term site strategy, monitoring, and restoration would be directed towards sites that could experience repeated herbicide applications (i.e. areas where recovery to native vegetation may not be possible such as campgrounds, highly disturbed areas). It is likely that due to the nature of repeated disturbance activities in some areas on the forest, long-term site objectives may be focused on containment of these areas to prevent future spread into other areas of the forest and a fully restored native plant component is not attainable. In these cases, desirable vegetation that reduces the potential for invasive plant re-establishment and protects other resources such as soil and water is likely.

Biological Control

Biological control can be defined as the use of natural enemies to reduce the damage caused by invasive plant populations. Bio-control is often viewed as a progressive and environmentally friendly way to control pest organisms because it leaves behind no chemical residues that might have harmful impacts on humans or other organisms, and when successful, it can provide essentially permanent, widespread control with a very favorable cost-benefit ratio. Biological control is potentially useful where: eradication is not possible, sites are too large to be sprayed with herbicides, the invasive plant species is so abundant that other methods would not be practical, or the biological control agent is effective on the target plant species and reduces or eliminates the need to use herbicides. The time frame for controlling invasives using bio-controls is very long, and agents would likely spread throughout the forest where food sources are available.

Stem weevil bio-control agents have proven very successful for Dalmation toadflax control on infested forest and adjacent landownership sites on the forest (Dawson 2007). Several bio-control agents are available for yellow starthistle and diffuse knapweed and effectiveness appears to be higher when bio-control agents work in concert. However, where fire has entered into yellow starthistle sites, bio-control agents appear to be less effective, likely a result of bio-control population dynamics, impacts from fire and available food source. Bio-control agents for control of purple loosestrife have been released on the Idaho side of the Snake River, however, the fluctuating water levels have negatively affected the establishment of a productive bio-control population and effectiveness is minimal (Dawson, 2007).

Bio-control agents previously released on private lands and established on the Forest will continue to spread to other nearby invasive sites providing a potential long-term control treatment.

Cultural Treatments

No cultural treatment sites are presently identified within the analysis area. Ground disturbing activities that would include disking or use of heavy equipment for revegetation will require separate NEPA analysis.

Surfactants

Inerts, Adjuvants and Impurities - Inert compounds are those that are intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicidal activity. Inerts are added to the formulation to facilitate its handling, stability, or mixing. Adjuvants are compounds added to the formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers).

Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant, for example: Inerts and adjuvants, including surfactants, are not under the same registration guidelines as are pesticides. The classifies these compounds into four lists based on the available toxicity information. If the compounds are not classified as toxic, then all information on them is considered proprietary and the manufacturer need not disclose their identity. Therefore, inerts and adjuvants generally do not have the same amount of research conducted on their effects compared to active ingredients (See Appendix G of this EIS) for a detailed discussion of surfactants). Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process.

HERBICIDE APPLICATION METHODS

The risk to non-target vegetation also varies with the herbicide application method. Spot and hand application methods substantially reduce the potential for impacts to non-target vegetation because there is reduced chance for drift.

Drift is associated primarily with broadcast treatments and can be mitigated to some extent by the applicator.

Drift can also be minimized by adjustment of numerous factors such as spray particle size, release height, spray pressure, nozzle size/type in addition to climatic variables such as wind speed, air temperature, and relative humidity.

Impacts on these factors related to drift are summarized in Table II - 2.

Table II - 2- Summary of the influence of various factors on spray drift

Factor	More Drift	Less Drift
Spray particle size	Smaller	Larger
Release height	Higher	Lower
Wind speed	Higher	Lower
Spray pressure	Higher	Lower
Nozzle size	Smaller	Larger
Nozzle orientation (aircraft)	Forward	Backward
Nozzle location (aircraft)	Beyond 2/3 wing span	2/3 or less wing span
Air temperature	Higher	Lower
Relative humidity	Lower	Higher
Nozzle type	Produce small droplets	Produce larger droplets
Air stability	Vertical stable air	Vertical movement of air
Herbicide volatility	Volatile	Non-volatile

Droplet size in herbicide application is a key factor in minimizing drift as larger droplets are heavier and, therefore, less affected by wind and evaporation. The largest particles, being the heaviest, will fall to the ground quickly upon exiting the sprayer. Medium size particles can be carried beyond the sprayer swath (the fan shape spray under a nozzle), but virtually all of the particles fall within a short distance of the release point. The smallest, and therefore the lightest particles have the potential to travel the farthest. For this reason if the droplet size forced out of the nozzle can be limited to larger particle sizes, the potential for herbicide to drift beyond the target vegetation can be controlled.

As droplet size increases (VMD in microns), the distance herbicide may travel in concentrations sufficient to harm plants decreases. Factors affecting droplet size are nozzle type, orifice size and spray angle, as well as spray pressure, and the physical properties of the spray mixture. By simply changing the type of nozzle (diameter of pore size) used during broadcast treatments, the drift potential of herbicide can be effectively and significantly decreased as the droplet size forced out the nozzle is increased in size (R6 2005 FEIS). Vegetation on the ground, including the target invasive plants, acts as a barrier to herbicide droplet drift.

Spray nozzle diameter, pressure, the amount of water applied with the herbicide, and herbicide release height are important controllable determinants of drift potential by virtue of their effect on the spectrum of droplet sizes emitted from the nozzles. Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants previously described. These products create larger and more cohesive droplets that are less apt to break into small particles as they fall through the air.

They reduce the percentage of smaller, lighter particles that are the size most apt to drift (See Appendix G of this BA for surfactants and adjuvants approved for use).

Marrs et al. (1989) in the study, “Assessment of the Effects of Herbicide Spray Drift on a Range of Plant Species of Conservation Interest”, examined the distances in which drift affected non-target vascular plants using ground based broadcast treatment methods.

Their observations are consistent with drift-deposition models in which the fallout of herbicide droplets has been measured. Most of the severe impacts (death of the plants and severe growth suppression) were confined to a very short distance (about 2 meters, 6 meters maximum). Symptoms of plant damage and flower suppression were found at slightly greater distances, but most damage occurred near the sprayer. The maximum safe distance at which no lethal effects were found was 20 feet, but for most of the herbicides tested, the distance was 7 feet. In most cases, there was rapid recovery by the end of the growing season.

They concluded: “In summary, the effects of severe damage by herbicide-droplet drift from simulation experiments set up to cover a range of high-risk herbicides under realistic application conditions, with standard hydraulic sprayers, suggest that buffer zones surrounding nature reserves and other sensitive vegetation could be quite narrow, in the order of c. 5-10m” (~16-33 feet).

The maximum safe distance at which no impacts are found obviously is greater with aerial application due to the distance above the ground at which the herbicide is sprayed. Aerial herbicide treatments using helicopters is proposed for all herbicide application sites on the Wallowa-Whitman National Forest due to terrain and access issues (Pope 2006). Helicopters would likely apply herbicides at heights of 10 to 20 feet above the ground in most cases. In steep terrain, the pilot would attempt to fly up and down the slope in order to maintain an equal

distance of the boom to the ground, typical distances above the ground in steep terrain can vary but generally range to 10-50 feet.

New applicator technology also exists for more precise application with minimal drift of herbicide to very small areas from helicopters (spray balls). These small applicator tools are lowered via a boom from the helicopter and the pilot applies herbicide (by a trigger mechanism and pump) to approximately a 4 foot radius area two to four feet above the ground (Pope 2006).

Because distances above the ground and boom widths are similar to ground based herbicide application the same buffer distances will be applied in these special case scenarios.

All aerial applications of herbicides will comply with EPA label restrictions and advisories, adhere to all PNW Regional Standards, and implement buffer distances described in project design features for the protection of SOLI and riparian areas. Buffer widths were determined by monitoring results and modeling herbicide drift (AGDISP 2007) using worst case scenario application situations. Factors such as release height, wind speed/direction, droplet size, ground terrain, weather conditions, and nozzle type/orientation/droplet size were model input factors. See Appendix F for model output, monitoring studies and spray guidelines for aerial applications of herbicides.

Previous aerial herbicide applications in the area indicate sensitive areas were fully protected using a 300 foot buffer (no aerial deposition) in a study using three commonly used helicopters, with various nozzle types applying picloram at a rate of 2 gallons/acre (USDA 2006c). Additionally, helicopter application of clopyralid and picloram to control yellow starthistle in Hells Canyon area in Idaho reported greater than 90 percent control and no apparent damage to the native grasslands following treatment (TNC 2006). This application method was reported to be very accurate and negligible drift was observed (Talsma 2006). Some temporary set-back of some arrowleaf balsamroot (*Balsamorhiza sagittata*) was observed, however, most plants recovered. Additional aerial drift tests conducted near sensitive areas (stream side and threatened plant species) in northern Idaho indicated that these areas were fully protected with a 50-100 foot buffer (J. Laufman personal communication with D. Huibregtse, 2007).

Table II - 3 and Table II - 4 display the number of acres by treatment type on each of the forests. Once treatment methods have been determined, prioritization of infestation treatments should be based on the following decision pathway. Highest priority treatments should be focused on new invaders and early treatment of new infestations, followed in priority by containment, then control of larger established infestations. The higher priority sites would likely be treated first unless special funding is acquired for specific areas. New detections would be considered a high priority for treatment if it is a new species, or a small infestation in an area that did not contain invasive plants in the past. Priorities would change over time based on treatment success and changes occurring on invasive sites.

Target species within each treatment site were also assigned a treatment strategy.

- **Eradicate -** Totally eliminate an invasive plant species from a site. This objective generally applies to small infestations of aggressive species such as yellow starthistle, spotted knapweed, leafy spurge, and hawkweed; and/or higher priority treatment areas. At some point, larger infestations can become impossible to eradicate.
- **Control -** Reduce the size of the infestation over time; some level of infestation would be acceptable. This objective applies to target species such as Russian knapweed and whitetop.

- **Contain -** Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories.

- **Early Detection Rapid Response (EDRR) -** EDRR refers to newly inventoried invasive plant infestations, including previously undiscovered invasive plant infestations or new infestations that would occur over the life of this project. Ongoing inventory and monitoring would look for infestations of new invasive plant species or new locations of existing weeds. Newly discovered infestations or sites would likely receive a high priority for treatment to eradicate the invasive plants while the infestation is small and easily treatable (See Treatment Decision Tree, Figure II - 1).

Table II - 3- Acres by treatment method by Ranger District on the Umatilla National Forest.

Treatment Method	Umatilla National Forest Ranger District				
	Heppner	Pomeroy	North Fork John Day	Walla Walla	Total
Biological or Physical	89	46	47	3736	3917
Chemical Physical or Biological	4699	3138	3933	5531	17301
Chemical/Riparian Physical or Biological	839	1130	621	802	3392
Physical	2	6	24	6	39
Total	**5629**	**4320**	**4625**	**10075**	**24649**

Table II - 4. Acres by treatment method by Ranger District on the Wallowa-Whitman National Forest.

Treatment Method	Wallowa-Whitman National Forest Ranger Districts							
	Whitman RD (Baker)	Whitman RD (Pine)	Whitman RD (Unity)	Wallowa Valley RD	HCNRA RD	Eagle Cap RD	La Grande RD	Total
Biological and/or Physical	90	30	1,297	186	86	123	143	1,955
Chemical Physical and/or Biological	951	1,762	1,269	1,596	6,232	436	1,128	13,376
Chemical/Riparian Physical and/or Biological	628	725	403	555	4,031	300	758	7,400
Physical only	1	18	7	10	70	2	3	111
Total	**1,670**	**2,535**	**2,976**	**2,347**	**10,419**	**861**	**2,032**	**22,842**

Note: The Baker, Pine, and Unity Ranger Districts have been consolidated into the Whitman Ranger District; however, to increase site-specificity, this separation was maintained in this table.

RIPARIAN TREATMENTS

Many of the treatment areas are on or near roads that cross either perennial or intermittent streams on WNF. For the purpose of analyzing close proximity of treatment areas to listed fish, streams containing listed fish that flow through treatment areas were identified, and a width of 100ft from the stream up into the riparian area was used to identify treatment areas that may be located immediately adjacent to a stream (i.e., up to bankfull) with listed fish**.** There are a total of 167

treatment on 6,345 acres identified that include areas within RHCAs of streams with ESA-listed fish (Table II - 5 and Table II - 6).

Table II - 5- Fifth Field Watersheds within Umatilla National Forest Proposed for Treatment

Fifth Field Watershed Name	HUC	Acres	Acres of Invasive Plants	Percent Watershed to Treat	Treated Acres in RHCAs*	T&E Fish Present*
Asotin Creek	1706010302	208,532	2105	1.0%	380	SRS, SRC,BT,
Upper Grande Ronde River	1706010401	133,777	98	0.07%	0	NF
Meadow Creek	1706010402	116,100	44	0.04%	7	NF
Grande Ronde River/Five Points	1706010404	87,630	78	0.008%	13	NF
Willow Creek	1706010408	53,565	162	0.3%	73	NF
Lookingglass Creek	1706010410	60,527	1153	1.9%	132	SRS, SRC, BT
Grande Ronde River/Cabin Creek	1706010411	108,389	1018	0.9%	447	SRS
Grande Ronde River/Grossman Creek	1706010601	114,787	1108	1.0%	129	SRS, SRC, BT
Wenaha River	1706010603	189,224	958	0.5%	155	SRS, SRC, BT
Lower Grande Ronde River	1706010607	160,794	370	0.2%	69	SRS, SRC
Pataha Creek	1706010705	118,434	176	0.1%	28	NF
Upper Tucannon River	1706010706	140,811	762	0.5%	199	SRS, SRC, BT
Upper Walla Walla River	1707010201	101,385	234	0.2%	22	MCS, BT
Mill Creek	1707010202	76,051	906	1.2%	141	MCS, BT
Upper Touchet River	1706010203	146,115	1128	0.8%	104	MCS, BT
Upper Umatilla River	1707010301	86,765	1410	1.6%	239	MCS, MCC, BT
Meacham Creek	1707010302	114,158	2820	2.5%	367	MCS, MCC, BT
Birch Creek	1707010306	182,206	505	0.3%	176	MCS
Upper Butter Creek	1707010309	206,658	199	0.1%	21	NF
Upper Willow Creek	1707010401	94,088	340	0.04%	176	NF
Rhea Creek	1707010403	145,967	2	0.001%	0	NF
Upper North Fork John Day River	1707020201	71,525	17	0.02%	9	MCS
Granite Creek	1707020202	94,513	277	0.3%	169	MCS, BT
North Fork John Day River/Big Creek	1707020203	105,881	344	0.3%	277	MCS
Desolation Creek	1707020204	69,675	126	0.2%	21	MCS, BT
Upper Camas	1707020205	104,623	539	0.5%	297	MCS, BT
Lower Camas Creek	1707020206	157,015	815	0.5%	158	MCS
North Fork John Day River/Potamus Creek	1707020207	185,288	1772	1.0%	388	MCS

Fifth Field Watershed Name	HUC	Acres	Acres of Invasive Plants	Percent Watershed to Treat	Treated Acres in RHCAs*	T&E Fish Present*
Wall Creek	1707020208	128,327	1756	1.4%	606	MCS
Lower North Fork John Day River	1707020210	117,016	12	0.01%	1	NF
Camp Creek	1707020302	125,940	1166	0.9%	344	NF
Lower Middle Fork John Day River	1707020305	60,635	2	0.003%	0	NF
Lower John Day River/Kahler Creek	1707020401	197,919	1676	0.8%	339	NF
Upper Rock Creek	1707020411	177,121	567	0.3%	74	NF
Total			**24,643****		**5560**	
Snake River Steelhead =SRS, Snake River Chinook Salmon =SRC, Columbia River Bull Trout =BT, Mid-Columbia Steelhead =MCS, Mid-Columbia Chinook Salmon =MCC, No Listed Fish = NF						

Table II - 6 - Fifth-field watersheds proposed for treatment in the Wallowa-Whitman National Forest

Fifth Field Watershed	HUC	Acres	Treatment Acres	Percent Watershed	Acres Proposed for Treatment in RHCAs	T&E Fish Present**
Bear Creek	1706010504	46,300	400	0.86	115	SRC, SRS, BT
Big Creek	1705020307	54,896	92	0.17	51	NF
Birch Creek	1707010306	182,205	6	0.00	0	MCS
Burnt River/Auburn Creek	1705020205	60,006	295	0.49	164	NF
Burnt River/Big Creek	1705020204	94,102	20	0.02	1	NF
Burnt River/Canyon	1705020206	54,081	63	0.12	4	NF
Camp Creek	1705020203	51,954	275	0.53	65	NF
Chesnimnus Creek	1706010604	122,764	398	0.32	66	SRS
Eagle Creek	1705020310	123,643	846	0.68	164	NF
Grande Ronde River/Beaver Creek	1706010403	131,648	338	0.26	91	SRC, SRS, BT
Grande Ronde River/Five Points Creek	1706010404	87,632	49	0.06	6	SRC, SRS
Grande Ronde River/Indian Creek	1706010409	96,033	26	0.03	13	SRC, SRS
Grande Ronde River/Mud Creek	1706010602	154,202	653	0.42	49	SRC, SRS
Granite Creek	1707020202	94,513	411	0.43	156	MCS, , BT
Ladd Creek	1706010406	83,953	53	0.06	34	SRS
Little Malheur River	1705011612	86,434	3	0.00	0	NF
Lostine River	1706010502	58,035	142	0.24	28	SRC, SRS, BT
Lower Big Sheep Creek	1706010204	129,726	182	0.14	125	SRC, SRS, BT

Fifth Field Watershed	HUC	Acres	Treatment Acres	Percent Watershed	Acres Proposed for Treatment in RHCAs	T&E Fish Present**
Lower Catherine Creek	1706010407	83,128	419	0.50	42	SRC, SRS, BT
Lower Imnaha River	1706010205	147,024	436	0.30	156	SRC, SRS, BT
Lower Joseph Creek	1706010606	104,789	450	0.43	75	SRS
Lower Powder River	1705020311	61,488	16	0.03	0	NF
Lower Wallowa River	1706010506	110,421	198	0.18	85	SRC, SRS, BT
Mckay Creek	1707010305	127,200	62	0.05	0	NF
Meadow Creek	1706010402	116,100	459	0.40	225	SRC, SRS
Middle Imnaha River	1706010202	87,982	5879	6.68	1250	SRC, SRS, BT
Middle Wallowa River	1706010503	85,060	9	0.01	4	SRC, SRS
Minam River	1706010505	152,909	115	0.08	60	SRC, SRS, BT
North Fork Burnt River	1705020201	124,147	1171	0.94	229	NF
North Powder River	1705020305	74,553	144	0.19	38	BT
Pine Creek	1705020106	193,640	794	0.41	339	BT
Powder River/Baldock Slough	1705020303	72,489	50	0.07	22	NF
Powder River/Rock Creek	1705020304	120,776	75	0.06	25	BT
Powder River/Ruckles Creek	1705020308	166,729	1327	0.80	497	NF
Powder River/Sutton Creek	1705020302	115,885	274	0.24	92	NF
Powder River/Wolf Creek	1705020306	109,371	58	0.05	11	NF
Snake River/Cherry Creek	1706010301	88,100	333	0.38	117	SRC, SRS, BT
Snake River/Granite Creek	1706010101	127,509	100	0.08	25	SRC, SRS, BT
Snake River/Indian Creek	1705020107	117,760	50	0.04	7	BT
Snake River/Temperance Creek	1706010102	115,289	2142	1.86	740	SRC, SRS, BT
Snake River/Wolf Creek	1706010103	103723	365	0.35	116	SRC, SRS
South Fork Burnt River	1705020202	75,183	1281	1.70	75	NF
South Willow Creek	1705011901	65,950	49	0.07	4	NF
Upper Big Sheep Creek	1706010203	89,358	341	0.38	174	SRC, SRS, BT
Upper Camas Creek	1707020205	104,623	32	0.03	0	MCS, RT
Upper Catherine Creek	1706010405	9,2520	19	0.02	4	SRC, SRS, BT
Upper Grande Ronde River	1706010401	133,776	330	0.25	187	SRC, SRS, BT

Fifth Field Watershed	HUC	Acres	Treatment Acres	Percent Watershed	Acres Proposed for Treatment in RHCAs	T&E Fish Present**
Upper Imnaha River	1706010201	90,349	686	0.76	332	SRC, SRS, BT
Upper Joseph Creek	1706010605	125,191	421	0.34	120	SRS
Upper North Fork John Day River	1707020201	71,525	30	0.04	2	MCS, BT,
Upper Powder River	1705020301	105,509	461	0.44	154	BT
Upper Wallowa River	1706010501	157,943	7	0.00	6	SRC, SRS, BT
Willow Creek	1706010408	53,565	5	0.01	0	SRS
Grand Total			**22,840**		**6345**	
Snake River Steelhead =SRS, Snake River Chinook Salmon =SRC, Columbia River Bull Trout =BT, Mid-Columbia Steelhead =MCS, Mid-Columbia Chinook Salmon =MCC, No Listed Fish = NF						

Table II - 5 and Table II - 6 do not include any miles of RHCA that might be chemically treated under Early Detection Rapid Response (EDRR). Table III-9 and III-10 (see Chapter III) predict acres and where additional invasive plant populations might occur based on current population locations.

EARLY DETECTION RAPID RESPONSE (EDRR)

Using the Early Detection/Rapid Response approach, new or previously undiscovered infestations would be treated according to approved methods and Project Design Features. Treatments may occur anywhere on the forests where invasive plant treatment is allowed and may include invasive species that are not listed in Tables I-1 and I-2 (see Chapter I). A treatment plan would be developed for new infestations, based on the process outlined in the R6 FEIS. The Forest's considered the kinds of site conditions encountered throughout the treatment areas and analyzed the effects of applying a range of treatments to these situations. The Implementation Planning process would ensure that treatments of currently undetected invasive plants would have effects within the scope of those disclosed in this BA, because the Project Design Features were developed considering a wide range of conditions that occur throughout the Forests. The Project Design Features serve to eliminate or minimize the risk of significant effects to such a degree that even though precise treatment locations may not be known, the effects of treatment are known. Uncertainty is addressed through monitoring and adaptive management.

The intent of Early Detection/Rapid Response is to treat new infestations when they are small so that the likelihood of adverse treatment effects is minimized.

In addition, the precise location of individual target plants, including those mapped in the current inventory is subject to rapid change. The typical NEPA process does not allow for rapid response; infestations spread during the analysis window.

Thus, the Early Detection/Rapid Response approach included in proposed action allows the Forest Service to treat anywhere on the Forests that the need exists. The Implementation Planning process is intended to ensure that effects are within the scope of those disclosed in this document. New situations that may have different effects would be subject to further analysis.

COMMON CONTROL MEASURES

Common Control Measures for the Forests are developed in Table II - 7. The table includes summary prescriptions that would be used as a starting point for all action alternatives. It is adapted from the Regional FEIS Treatment Restoration Standards to target species known or suspected to occur on Umatilla and Wallowa-Whitman National Forest system lands. Aerial application of herbicides follow the Regional FEIS Standards 16, 21, and 22 in addition to Project Design Features listed in this section. PDFs are additional protective measures designed to minimize potential impacts from treating invasive plants. The common control measures reflect current information and are subject to change depending on new research and adaptive management.

Table II - 7- Common Control Measures

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
Bugloss (ANAR in database should be ANOF the perennial species) (*Anchusa officinalis*) *Perennial*	-Manual, small populations can be pulled prior to seed set -Mechanical, hoeing and cutting the root below the crown. Continuous mowing will prevent seed production, but will not eradicate the weed.	Upland: 1. 1.Metsulfuron methyl 2. Picloram 3. 3.Clopyralid 4. 4.Clorsulfuron + Metsulfuron Use surfactants for herbicide use to penetrate the hairy leaves on the plant. High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table Follow PDFs	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom broadcast spray in dense cover, where dominant plant community is non-native invasives. Spot spray whenever possible, especially in areas with good native plant cover. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application with manual follow-up treatments to target individual plants. Follow PDF's they may require a less impacting choice Timing: Apply to actively growing plants prior to bud set. Notes: Regardless of what method is used to control, regrowth may occur within the same growing season and follow up is key. If rosettes are found in the fall, spraying or cutting can help reduce spring populations.
Bull thistle (CIVU) (Cirsium vulgare)	-Manual and mechanical: Repeated mowing or clipping will reduce thistle infestations. Remove plant that are in the early bud growth stage to prevent seed-set. Several mowings/clippings per year are required to address varying plant maturity periods. Mow as close to the surface as possible. If plants are cut above the terminal bud before the stems elongate, they likely will regrow. It is important to mow before the flowers start showing color because plants mowed after that will likely produce some viable seed. Clipping and mowing should be combined with a chemical control program for best results.	Upland: Clopyralid, Picloram, Redeem (triclopyr plus clopyralid) is labeled for thistle control in non-cropland and CRP. Metsulfuron will control biennial thistles in the spring and will eliminate seed production when applied in the bolting to bud growth stages High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives.. • Spot or hand broadcast with backpack sprayer whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing: Fall is the preferred time for applying herbicides for biennial thistle control. Fall applications allow for more time to apply herbicides than in the spring and correspond to the most effective time for thistle control. Seedlings that emerge in summer after tillage or previous herbicide applications will not bolt but

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
			remain in the rosette stage. Biennial thistles are most susceptible to herbicides in the rosette form. Herbicides should be applied as late as possible in the fall but prior to a killing frost to allow for maximum seedling emergence and rosette size. Seedlings that emerge after spraying will remain vegetative until the following spring and can be treated then. Long-term eradication of biennial thistles is difficult because of the large number of seeds each plant can produce. Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used
Canadian thistle (CIAR4) (*Cirsium arvense*) *Perennial-rhizomatous*	- The only manual technique would be hand cutting of flower heads, which only suppresses seed production. • Mowing may be effective in rare cases if done monthly (this intensity would damage native species). - Covering with plastic tarp may also work for small infestations. - Herbicide treatment is most effective. - Re-vegetate with desirable species.	Upland: Clopyralid, Picloram, Glyphosate or Chlorsulfuron High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives.. • Spot or hand broadcast with backpack sprayer whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing: Apply in spring before to rosettes and prior to flowering. • Or apply in fall to rosettes; season is dependent upon herbicide used. Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Clary Sage (SASC2) and Mediterrenean sage (SAAE) *Salvia aethiopis* *Biennial*	Manual or mechanical removal of individual plants can be effective. When the plant begins to bolt, cut or dig up the taproot two to three inches below the crown. This prevents re-sprouting of Mediterranean sage. Mowing several times during the growing season will prevent seed production, but the rosettes are low enough to the ground to escape most damage. Mowing, however, will spread the seeds if it is done too late in the year. Bio-control available, but would require reapproval, therefore not available through the Regional FEIS (USDA 2005),	Upland: Metsulfuron methyl Chlorsulfuron Picloram Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot or hand broadcast with backpack sprayer whenever possible. • Boom spray larger areas of dense cover, where dominant plant community is non-native invasives. • Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDF's they may require a less impacting choice. Timing: Apply before plant bolts. Notes: Clary sage is used as a medicinal plant and used as a flavoring agent in beverages.

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
Common burdock (ARMI2) (Arctium minus) Biennial	Hand pulling and mechanical control may prove to be successful since common burdock cannot tolerate cultivation. When cut down or uprooted, any root fragment that is left behind can grow into an entirely new plant and can contribute to spread. An effective control is to cut off emerging flower buds. The plants will have to be monitored throughout the summer as buds can reform after cutting. If herbicides are used, revisits to the site may be necessary in subsequent years to exhaust the seedbank.	Upland: Metsulfuron methyl Clopyralid+Triclopyr Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Timing: Apply during active growth, Notes: Seeds remain viable for 2 and reported up to 10-20 years.
Common crupina (CRVU) (*Crupina vulgaris*)	- Manual and mechanical can be effective on this annual however yearly visits to sites would be necessary to address seeds present in seedbank	Upland: 1. Picloram, Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives.. • Spot or hand broadcast with backpack sprayer whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing: Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Dalmation Toadflax (LIDA) *(Linaria. dalmatica)* Butter 'n' Eggs or Yellow toadflax (LIVU) *(Linaria vulgaris)* Toadflax species (LINAR) *Rhizomatous Perennials*	-Hand pull or dig small, easily accessible populations. Multiple entries per year are required. Plants can be left on site, but may reduce germination of desirable species due to mulching effect. Success will depend on consistent labor for each growing season until plants are eradicated. -Mowing stands in spring or early summer will eliminate plant reproduction, but not the infestation. - These treatments may take up to ten years due to long term seed viability. -Bio-controls available (See Appendix E) - If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time.	Upland: Picloram Chlorsulfuron Imazapic (Use in native grass stands; fall application only) High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom broadcast spray in dense cover,where dominant plant community is non-native invasives.. However, this species tends to be scattered, so spot spraying (Spot or hand broadcast with backpack sprayer or on OHV) is usually more appropriate. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray to target individual plants. Follow PDF's they may require a less impacting choice Timing: Apply during active growth in spring before bloom or in late summer or fall during re-growth. Notes: Revisits will be necessary; the number of which is dependent on the chemical used and the seedbank. This control could vary by site. Even after three years of consecutive treatments, control may range widely. Bio-control agents

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
	- Revegetate with desirable species at high priority sites when possible. Plant communities in good condition may recover without replanting.		have been shown to be very successful on lands in and around the Wallowa Whitman National Forest
Dodder (CUSC, CUCA) (*Cuscuta* sp.) *Parasitic annual*	Manual and mechanical methods have not been extremely successful. Host plants need to be totally removed to ensure this species cannot continue to thrive. Planting nonhost plants can be an effective means of managing a dodder infestation. Plants that are not hosts of dodder include grasses and other monocots. Also plants that grow primarily during winter as well as transplanted trees and shrubs that have bark. Dodder seedlings are difficult to find, but if they are observed before they attach to a host, remove them by cultivation or by hand-pulling. Dodder seed has been observed to survive soil solarization. Foaming or steaming may be successful for control of this species.	Upland: Picloram, Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives.. • Spot or hand broadcast with backpack sprayer whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing: Notes: Yearly revisits will be necessary; host plant must be removed.
Everlasting peavine (LALA4) (*Lathyrus latifoliis*) Perennial vine	Hand pulling is most effective if the entire plant is pulled. Care must be taken not to pull desirable vegetation which is often intermingled. If herbicides are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time	Upland: Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Backpack spray whenever possible. • Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice Timing: Yearly revisits will be necessary.
Field bindweed (COAR2) (*Convolvulus arvensis*) *Perennial*	-Manual pulling in small areas can be effective Mechanical tilling or mowing not suggested, promotes production of additional buds near the ground.	Upland: Metsulfuron, Glyphosate or Picloram High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives.. • Spot or hand broadcast with backpack sprayer whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing:

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
			Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Himalayan blackberry Rubus discolor RUDI	Manual: Best if the massive root crown is fully dug out. This method works best where native vegetation is an issue and/or where a large workforce of volunteers is available. After digging out root crowns, return in a year and remove new plants. Typically about ¼ of the original amount should remain. This method can be effective over several years, especially if desirable vegetation that provides shade is planted. For plants up to 4 meters tall, a claw mattock is effective for removing root crowns. Mechanical: Mowing may have limited use where ground is flat and free of obstacles. Mowing or cutting of canes may have advantages over herbicides since these techniques will not stimulate adventitious root growth. Mechanical removal is best used as a first step to reduce above ground biomass before root crown removal. Biological: none available	Upland: Glyphosate, Picloram or Triclopyr High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot or hand broadcast with backpack sprayer whenever possible. • Boom spray larger areas of dense cover, where dominant plant community is non-native invasives. • Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDF's they may require a less impacting choice. Timing: For Glyphosate and Triclopyr: most effective in fall when canes are actively growing and after berries have formed. For Picloram: apply in late spring after leaves are fully developed. Could stimulate development of adventitious roots.. Notes: Triclopyr is Selective, systemic for woody and broadleaf species. Will remain in plants until they die.
Hounds tongue (CYOF) (*Cynoglossum officinale*) Biennial	Hand pull or dig for small populations. Entire root system must be removed. Plants could be left on site if no seed pods are present (seed can remain viable for more than one year). These treatments may take up to five years. Re-vegetate with desirable species.	Upland: 1. Metsulfuron methyl 2. Chlorsulfuron 3. Picloram 4. Imazapic 5. Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native. • Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Timing: Apply during active growth, preferably basal rosette stage. • Notes: Revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Japanese knotweed (POCU6)	Manual: Digging out the rhizomes of this species is effective for small infestations or in environmentally sensitive area where herbicides	Upland: 1. Glyphosate Triclopyr	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Broadcast spray in dense cover, where dominant plant community is non-native invasives. Spot spray whenever possible,

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
Polygonum cuspidatum *Perennial*	cannot be used. It is extremely labor intensive and tends to spread the rhizome fragments and promote disturbance so it is not highly recommended. All plant parts should be removed from the site. Mechanical: Cutting may be effective if done repeatedly. Every 2-3 weeks from April through August will reduce rhizome reserves. It does not come highly recommended. Hand cutting or weed-eater/mowing have been used. Covering, particularly in conjunction with cutting, may be useful in smaller stands. Several layers of black plastic or shade cloth weighted down by blocks, mulch or stones may work. This should be done either after cutting or when plants are fully grown for the season since this species is capable of emerging up through asphalt. No reports of successful long term control using covering have been found. Biological: none available Cutting or pulling in combination with herbicide is most effective since the manual/mechanical treatments will encourage the plant to send up new shoots. The more shoots per linear foot of root, the more likely you will be able to physically pull them out, exhaust their reserves or kill them with herbicide..	High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	especially in areas with good native plant cover Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting treatment method Timing:Cutting and injection is most effective in fall when leaves are translocating to rhizomes. Could also follow a prior cut in late spring or early summer. Foliar spray when plants are 1 -2 meters tall. Best if following a prior cut in spring. Triclopyr: Most effective in fall when leaves are translocating to rhizomes. Notes: Cut and paint stems. Cut between first and second internode then deliver into 'well' created. 2. Stem injection (check label)** below first or second node
Leafy Spurge (EUES) *Euphorbia esula* *Rhizomatous perennial*	- Requires combination of techniques for successful control. Multiple entries per year are required. - Repeated mowing or hand cutting can control seed production but must be used with herbicides for adequate control of the site. - Repeated mowing could reduce competitive ability of desirable species. -Bio-controls available (See Appendix E) - Some success has been found with	Upland: Picloram Glyphosate or Imazapic High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot spray whenever possible. Boom broadcast spray in dense cover, where dominant plant community is non-native invasives. and leafy spurge population is large. Sensitive Sites or Special Management Areas where more selective treatment is desired: Wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing: Notes:

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
	using biological control (flea beetle) with fall herbicide treatments.		
Medusahead (TACA8) (*Taeniatherum caputmedusae*) Annual grass	Repeated cutting/mowing with herbicide treatment is effective. • Manual removal can be effective with small populations. A combination of prescribed fire (in June), herbicide application, and reseeding with native grasses is considered highly effective. Repeated treatments may be needed Active restoration (seeding of a competitive desirable species) is important.	Upland: Imazapic Sulfometuron methyl + Chlorosulfuron Sulfometuron methyl Sethoxydim Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Backpack spray whenever possible. • Boom spray in dense cover, where dominant plant community is non-native. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Timing: Treatment should be done before seed formation or during the fall through early winter. Notes: Off-site drift of 100' or more reported with aerial application.
Musk thistle (CANU4) (*Carduus nutans*) Biennial	Use manual, mechanical or herbicide control or a combination. Any manual method that severs the root below the soil surface will kill these plants. Effective control requires cutting at the onset of blooming. Treatment before plants are fully bolted results in re-growth. Repeated visits at weekly intervals over the 4 to 7 week blooming period provide most effective control. • Mowing should be specifically conducted close to full flower stage (within 2 days). Biological controls may be helpful to suppress populations in combination with other methods (see Appendix B).	Upland: Picloram or Clopyralid Metsulfuron methyl Glyphosate Chlorosulfuron High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native. • Backpack spray whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Timing: Apply in spring before to rosettes and prior to flowering. • Or apply in fall to rosettes; season is dependent upon herbicide used. • Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. .
Pepper weed (LELA2) (*Lepedium latifolium)* *Perennial*	-Manual and mechanical control of perennial pepperweed is not recommended. Digging, mowing and tilling will only encourage new plants to sprout from the root crown and creeping roots.	Upland: Chlorsulfuron, Metsulfuron, Glyphosate Imazipic 5. Tyiclopy rmay only kill top plant and capable of resprouting use after mowing to increase efficacy	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot or hand broadcast with backpack sprayer whenever possible. • Boom spray larger areas of dense cover, where dominant plant community is non-native invasives.. • Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
			pulling or wick application to target individual plants. Follow PDF's they may require a less impacting choice. Timing: Spray during flowering or early bud stage Notes:
Poison hemlock (COMA2) (*Conium maculatum*) *Biennial*	- Manual hand pulling or grubbing: works easiest with wet soils and with small infestations. When grubbing, it is not necessary to remove the entire root system since the plant is not perennial. It is best to pull or grub out the plant prior to flowering. Follow-up cultivation is necessary to deal with any seedlings and if possible a vigorous pasture should be established to compete with any further seedling growth. Poison hemlock remains toxic for several years after being pulled, and it is wise not to leave the dead plants where they might be eaten by wildlife or children. -Mechanical multiple mowing close to the ground may eventually kill plants. Mowing or slashing of the plants just before flowering is often effective, but sometimes new growth which requires re-treatment is produced from the base"	Upland: Chlorsulfuron, Glyphosate, or Metsulfuron methyl High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives.. • Spot or hand broadcast with backpack sprayer whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing: Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Puncture vine (TRTE) (*Tribulus terrestris*) *Annual*	Manual and Mechanical control effective if collected prior to seed set	Upland: Chlorsulfuron Sulfometuron methyl Metsulfuron methyl Glyphosate or Picloram High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot or hand broadcast with backpack sprayer whenever possible. • Boom spray in dense cover, where dominant plant community is non-native invasives. • Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDF's they may require a less impacting choice. Timing: . Notes:
Purple loosestrife (LYSA2) (*Lythrum salicaria*)	Hand-removal is recommended for small populations and isolated stems. Ideally, the plants should be pulled out before they have set seed. The entire rootstock must be pulled out since regeneration from root fragments is possible. Be sure to	Upland: Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Not normally found in these habitats. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray to target individual plants. Broadcast

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
Perennial	minimize disturbances to the soil and native vegetative cover. Remove uprooted plants and broken stems from the area since the broken stems can resprout - Manual cutting combined with replanting or supplemental fertilization presently in research phase. -Bio-Controls available See Appendix H PNW RFEIS	table: Aquatic use Glyphosate	spraying of non-selective herbicides kills all of the vegetation and may result in an increase in loosestrife density because of seed germination following the removal of competing perennial vegetation. Spot application directly to plants would ensure that no large holes would appear in the marsh vegetation and that competition would be unaffected. The safest method of applying glyphosate herbicide is to cut off all stems at about 6 inches and then paint or drip onto the cut surface. Alternatively, spray no more than 25-50% of a plant's foliage to protect against overspraying which might damage adjacent vegetation. Timing: Spraying should be done after the period of peak bloom, usually late August. . It is critical that any control effort be followed up the same growing season and for several years afterwards since some plants will be missed, new seedlings may sprout from the extensive seed bank, and a few plants will survive the low-dosage treatment Higher dosage and careless application, however, inevitably kills more surrounding vegetation and leads to establishment of loosestrife Notes:
Reed canarygrass (PHAR3) (*Phalaris arundiacea*)	Use a combination of herbicides and manual, mechanical, cultural or prescribed fire treatments. Manual treatments or mowing are only practical for small stands when multiple entries per year can be made. The entire population must be removed 2 to 3 times per year for at least five years. • Disking or plowing can be effective especially after herbicide treatment. Prescribed burning several weeks after herbicide treatment or in the late fall could also be effective. • Covering populations with black plastic may be effective if shoots are not allowed to grow beyond tarps. This technique could take over two years to be effective.	Upland: Sulfometuron methyl or Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Backpack spray whenever possible. • Boom spray in dense cover, where dominant plant community is non-native. Unlikely area will be in an upland site Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Timing: Apply in early spring when just sprouting before other wetland species have emerged Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank..
Rush skeletonweed (CHJU) (*Chondrilla juncea*) *Perennial*	- No manual techniques recommended. A 1-cm section of the extensive and deep tap and lateral root system can resprout aerial parts if damaged - Frequent mowing of plants infested with gall mites may decrease the rate of spread. •	Upland: Clopyralid (late fall or early spring only) or Picloram Metsulfuron methyl High risk of aquatic delivery /High Water Table/Porous	- Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives. Spot or hand broadcast with backpack sprayer whenever possible. • Sensitive Sites or Special Management Areas where more selective treatment is desired:

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
	-Bio-controls available (See Appendix E). -Herbicides can be effective, especially with repeat follow-up -Re-vegetate with desirable species.	Soils over a shallow water table: Follow PDF's	Apply to rosette in late fall or up to early bolting stage in spring. • Application may be difficult due to lack of leaf surface. • Plants less than 5 years old respond best. • Aggressive repeated treatments will be necessary. • The number will be dependent on the herbicide used and the seed bank. Follow PDF's they may require a less impacting choice. Timing: late fall or early spring only Notes: The pappus on each seed allows the seed to be carried up to 20 miles by wind currents. A healthy plant can produce 1500 flower heads with the capability of producing 20000 viable seeds. Where sexual reproduction is prevented, the plant can regrow from root fragments. Some seeds may remain viable up to 5 years in the seed bank.
Russian Knapweed (ACRE3) (*Acroptilon repens)* *Perennial with adventitious shoots*	Hand-pulling is very difficult, but can be effective for small infestations during the establishment year only. Pull plants when soil is wet and before seeds have formed. Remove all plant parts from site. Cutting or mowing reduces the current year growth and will eliminate seed production, but will not kill the roots of this species. Cut/mow several times annually (at least 3 times/year) to control existing top growth; re-emerging plants will be smaller in size and lower in vigor. Discing or plowing produces broken root fragments that spread quickly and resprout. Russian knapweed is poisonous to horses. Livestock will graze, but it is usually avoided. In most situations, Russian knapweed cannot be effectively managed by herbicides alone. Lasting control requires an integration of techniques (mechanical, manual, chemical, and possibly biological control), proper land management, and revegetation	Upland: Chlorosulfuron Clopyralid Clopyralid + Triclopyr (Redeem) Glyphosate, Imazapic, or Metsulfuron High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table Aquatic labeled Glyphosate	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application with manual follow-up treatments to target individual plants. Follow PDFs they may require a less impacting choice Notes: Late fall/early winter application is critical for Picloram and Clopyralid

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
	to out compete the thistle. Bio-control available, however not effective in region (See appendix B). Competitive plantings are usually necessary.		
Russian thistle (SATR12 or SAIB) (*Salsola tragus*) *Annual*	-Manual or mechanical removal of plant prior to seed set can be effective in small populations. Repeat visits to areas previously infested likely required.	Upland: Chlorsulfuron Metsulfuron methyl Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot or hand broadcast with backpack sprayer whenever possible. • Boom spray larger areas of dense cover, where dominant plant community is non-native invasives. • Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDF's they may require a less impacting choice. Timing: Notes: Species may have developed resistance in the Northwest to Chlorsulfuron & Metsulfuron methyl
Scotch Broom (CYSC4) (*Cytisus scoparius*) Perennial woody shrub	Hand pull, cutting, weed wrenching or digging small populations or when regular volunteers are available. Hand pulling or weed wrenching is most effective in moist soils. Plants can be left on site if no seed pods are present (seed can remain viable for more than one year). Cutting will require multiple visits in one year. • These treatments may take up to ten years due to long term seed viability. • Bio-controls available (Appendix B), yet only moderate effects noted. Re-vegetate with desirable species.	Upland: Triclopyr Picloram Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Smaller plants: Backpack spray where hand pulling or weed wrenching is not feasible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Timing Apply during active growth preferably in the spring to young plants. • Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Mowing prior to fruiting and follow up with spot spray to individual plants will reduce herbicide use.
Scotch Thistle (ONAC) *Onopordum acanthium* *Biennial*	Cutting and mowing can be effective when combined with revegetation of native species. Repeated mowing, in combination with other management methods, often is necessary for long-term	Upland: Picloram or Clopyralid Chlorsulfuron Metsulfuron	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom broadcast spray in dense cover, where dominant plant community is non-native. Spot spray whenever possible, especially in areas with good native plant cover.

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
	control. Manual removal is effective when entire aboveground plant growth is removed. Herbicide treatment is the most effective control.	High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table Aquatic labeled Glyphosate	Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDFs they may require a less impacting choice Timing: Spray in the spring before plants bolt or during the fall on the rosettes.
Senecio species (SENEC)	Identify specific species, contact regional weed specialist for most current research related to treatment and control.		
Slender meadow foxtail (ALMY) (*Alopercurus myosuroides*) *Annual*	- Manual control for small infestations prior to seed set - Mechanical control useful to remove seed heads prior to dispersal	Upland: Glyphosate and Sethoxydim High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDFs	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom broadcast spray in dense cover, where dominant plant community is non-native invasives. Spot spray whenever possible, especially in areas with good native plant cover. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application with manual follow-up treatments to target individual plants. Follow PDF's they may require a less impacting choice Timing: Apply herbicides in early stages of growth Notes:: This is a very prolific seeder, so monitoring of area should be considered a high priority
Slenderleaf nightshade (SOEL) (*Solanum elaeagnifolium*) *Perennial*	-Manual control can be effective in small areas. - Mechanical control methods by mowing not recommended, removing plant tops by mowing results in a loss of apical dominance that causes multiple shoots to re-sprout. Continual mowing above-ground parts every 2 weeks can prevent seed production . - Cultural control methods: Cultivation will not readily kill, only frequent, thorough cultivation can be effective. Shade from crop canopies (60-90% cover) or mulching may also be an effective control tool.	Upland: Picloram Triclorpyr or Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native invasives. Spot application in patchy areas. Sensitive Sites or Special Management Areas where more selective treatment is desired: Follow PDF's they may require a less impacting choice Timing: During active growth, up through flowering stage. Notes: Revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Usually required multiple applications.
Spotted knapweed	Hand pull or dig small populations or when regular volunteers are	Upland: Clopyralid, or Picloram	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom or hand broadcast

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
(CEBI2) (*Centaurea biebersteinii*) Diffuse knapweed (CEDI) (*Centaurea diffusa*) Meadow knapweed (CEDE5) (*Centaurea debeauxii*) *Tap rooted Biennials or Perennials*	available. Multiple entries per year are required. Manual Disposal: Remove entire root system from the site, as re-growth can occur. Mowing is possible, but timing is critical. These treatments may take up to ten years due to long term seed viability. If chemicals are used, manual treatments could be used for follow-up. Relative amounts of herbicide to manual treatments would decline over time. Bio-controls available (see Appendix B) Revegetate with desirable species, at high priority sites when possible.	Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Aquatic labeled Glyphosate (will require the most repeated treatments)	spray in dense cover, where dominant plant community is non-native invasives. Spot spray whenever possible, especially in areas with good native plant cover. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray to target individual plants. Follow PDFs they may require a less impacting choice Timing: Preferred treatment is spring before bud stage or early summer so use less herbicide. Notes: Yearly revisits will be necessary; the number of which is dependent on the chemical used and the seedbank.
St John's wort (HYPE) *(Hypericum perforatum)* perennial	Hand removal of small populations or isolated stems is possible, but repeated treatments will be necessary as lateral roots give rise to new plants. Pulled or dug plants must be removed from the area and burned. • These treatments may take up to ten years due to long term seed viability. Bio-controls available (Appendix B). Biological controls will most likely not be effective in damp, cool climates. Re-vegetate with desirable species.	Upland: Metsulfuron methyl Picloram Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Backpack spray whenever possible. Boom spray larger areas of dense cover, where dominant plant community is non-native. Apply metsulfuron methyl when plants are fully emerged and in active growth. • Apply picloram in early growth stages before bloom. • Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Timing Apply during active growth preferably in the spring to young plants. Notes: Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank.
Sulphur cinquefoil (PORE5) (*Potentilla recta*)	-Hand-pulling is effective on small infested provided the entire root is removed. -Mechanical control by discing	Upland: Picloram Metsulfuron methyl (by itself not a particularly effective	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot or hand broadcast with backpack sprayer whenever possible. • Boom spray larger areas of dense cover, where

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
Perennial	shown to be effective if reseeded. Mowing is not effective -Make post emergent herbicide application to actively growing plants and in the rosette to flower stage of growth. Seeds remain viable in the seedbank for 1 to 5 years	treatment) High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	dominant plant community is non-native invasives. • Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDF's they may require a less impacting choice. Timing: Apply to actively growing plants or during the rosette to flower stage of growth. Notes: Repeated applications are needed to for the first couple of years ensure re-establishment does not occur.
Tansy ragwort (SEJA) (*Senecio jacobaea*) Biennial or short-lived perennial	Hand pulling is effective if done in moist soils. This is most effective after the population has been brought under control. Mowing is the most common technique and is effective if done prior to flowering. • These treatments may take up to ten years due to long term seed viability. Bio-controls available (Appendix B). Ensure biological controls are present nearby or request their introduction. Re-vegetate with desirable species. Is toxic to horses and cattle and causes severe liver damage.	Upland: Clopyralid Chlorosulfuron Picloram Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	• Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom spray in dense cover, where dominant plant community is non-native. Spot application in patchy areas. Sensitive Sites or Special Management Areas where more selective treatment is desired: Follow PDFs they may require a less impacting choice Timing: During active growth, up through flowering stage. Notes: Revisits will be necessary; the number of which is dependent on the herbicide used and the se
Teasel (DIFU2 or DISY) (Dipsascus fullonum) *Biennial*	- Manual and Mechanical: Cutting,and digging, are recommended as the best solutions for control in natural areas. In small areas, rosettes can be dug (whole root must be removed to prevent resprouting). Cutting with a sharp spade or shovel below the surface of the soil can be helpful, but the area should be checked later for resprouts. Stalks of flowering plants can be cut just before flowering. The plant should not reflower, but instead die at the end of the growing season. Cut flowering stalks should be removed from the area if the flowers have opened, because seeds	Upland: Metsulfuron methyl Chlorsulfuron Chloropyralid or Triclorpyr High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
	can mature on the stem even after cutting. Cutting the flowering stalk before the full bud stage should be avoided because the plant will usually send up new flowering stalks.		
Whitetop (CADR (*Cardaria draba)* *Perennia*l	Diligent hand pulling or digging can control small infestations, but plants must be completely removed within 10 days after emergence throughout growing season for two to four years Mowing followed a month later by herbicide may be effective. Mowing must be done during full flowering. In general, manual and mechanical methods are not recommended. Re-vegetate with desirable species.	Upland: Metsulfuron methyl or Chlorsulfuron or Sulfometuron methyl, or Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Backpack spray whenever possible. • Boom spray in dense cover, where dominant plant community is non-native. • Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual plants. Follow PDFs they may require a less impacting choice. Notes: Multiple applications are probably necessary for control. Handing pulling will stimulate plant growth if all plant parts are not removed.
Wild carrot (DACA6) (*Daucus carota*) Perennial	Hand-pulling or mowing close to the ground in the first year of growth (7-10 inches high) in mid-to-late summer before seed set can be effective on small patches. It is particularly troublesome when it occurs on railroad and highway rights-of-way with heavy soils where incorrectly timed mowing scatters viable seed for re-establishment. This perennial herb persists in recovering grasslands and prairies, but has been shown to decline on its own.	Upland: Metsulfuron methyl or Chlorsulfuron High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Aquatic labeled Glyphosate (not found as effective in the literature	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Spot spray whenever possible. Sensitive Sites or Special Management Areas where more selective treatment is desired: Follow PDFs they may require a less impacting choice. Timing: Wide range of application times from spring treatments of over-wintered plants or seedlings to established plants in the fall. Yearly revisits will be necessary; the number of which is dependent on the chemical used and the seedbank Notes: Abundance in sandy soil generally declines on its own as natives become reestablished. It is more persistent in soils with a good clay content, and active management may be necessary in such areas
Yellow Hawkweed (HICA10) (*Hieracium pratense*) Tall Hawkweed (HIPI2) (*Hieracium aurantiacum*)	Manual treatments are difficult since hawkweeds have stolons and will re-sprout from any fragments. Therefore, pulling must be done during moist soil conditions to get as much of the root as possible. Remove seed heads if control is attempted later in the season to reduce seed spread. Mowing of plants can cause plants to respond by sending up shorter	Upland: Picloram or Clopyralid High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Backpack spray whenever possible. • Boom spray larger areas of dense cover, where dominant plant community is non-native.Yearly revisits will be necessary; the number of which is dependent on the herbicide used and the seed bank. Sensitive Sites or Special Management Areas where more selective treatment is desired: Hand pulling or wick application to target individual

Target Species - Common Name and Growth Habit	General Prescription	Documented Effective Herbicides1,2	When/How to treat with Herbicides
Perennial	stems and quickly flowering again.		plants. Follow PDFs they may require a less impacting choice. Notes: No indication of a long-lived seed bank, yet yearly visits may be warranted to ensure no resprouting. Herbicides have been shown to be more effective when combined with fertilizer for grass species.
Yellow starthistle (CESO3) *(Centaurea solstitialis)* *Annual*	- Hand-pull small patches or maintenance programs where plants are sporadically located. Remove all above ground material and get well below the root crown. Pull after bolted but before it produces viable seed. - On relatively large populations of < 40 acres, start removing plants at outward edge of population and work toward interior (Bradley Method). - Mowing can be useful but timing is critical (before viable seed production, but too early can result in rapid regrowth), - In areas with many non-target species, early summer tillage will control yellow starthistle provided roots are detached from the shoots; repeated cultivation will be necessary in same season when rainfall stimulates germination. -Bio-control available (see Appendix E). Two biological control insects have reduced seed production by up to 76% in California. Variable success results reported from eastern Oregon releases. - Revegetate high priority sites if needed with desirable species if possible.	Upland: Clopyralid or Picloram Glyphosate High risk of aquatic delivery /High Water Table/Porous Soils over a shallow water table: Follow PDF's	Drier upland sites (Road, Quarries & Upland Forest/Rangeland): Boom broadcast spray in dense cover, where dominant plant community is non-native invasives. Spot spray whenever possible, especially in areas with good native plant cover. Sensitive Sites or Special Management Areas where more selective treatment is desired: Spot spray or wick application to target individual plants. Follow PDF's they may require a less impacting choice Timing: Notes: Yearly revisits will be necessary; the number of which is dependent on the chemical used and the seedbank.

1Herbicides listed in numerical order represent a preferential order; no numerical listing indicates no preference for control, no chemical listed indicates no information available. If future research indicates that one of our listed chemicals is effective on an invasive species that it is not listed for now, then they could be used. If a new chemical label gets approved that is effective, it can be used after review of the risk assessment and any additional design features incorporated by supplementing this EIS analysis.

2Currently, the available herbicides for use in or near surface water is glyphosate, triclopyr and imazapyr

AERIAL APPLICATION

STD 16: Cannot use: Chlorosulfuron, metsulfuron methyl, sulfometuron methyl or triclopyr

STD 21: Minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land unless otherwise authorized by adjacent private landowners. For this consultation, all buffer widths will be measured slope distance.

STD 22: Prohibit aerial application of herbicides within legally designated municipal watersheds

PROJECT DESIGN FEATURES

The following Project Design Features (PDFs) minimizes the potential impacts of invasive plant treatment. For the purposes of this of this Biological Assessment, these PDFs are considered conservation measures. These PDFs are specific Forest-level measures designed to minimize project effects and provide sideboards for Early Detection/Rapid Response in accordance with R6 2005 ROD Standards 19 and 20. The PDF were developed to respond to the site-specific resource conditions within the treatment areas, including (but not limited to) the current invasive plant inventory, the presence of special interest species and their habitats, potential for herbicide delivery to water, and the social environment. Implementation of the PDFs would be mandatory to ensure that treatments would have effects within the scope of those disclosed in Chapter 3. The analysis assumes buffers approximate horizontal (map) distances. Project Design Features are summarized below.

A-Pre-Project Planning

A-1: Prior to treatment, confirm species/habitats of local interest, watershed and aquatic resources of concern (e.g. hydric soils, streams, lakes, roadside treatment areas with higher potential to deliver herbicide to water, municipal watersheds, domestic water sources), places where people gather, and range allotment conditions. Apply appropriate PDFs described below.

For EDRR sites follow the decision tree (see Figure 1) to determine the type and method of treatment and apply applicable PDFs.

- Purpose: Ensure project is implemented appropriately.
- Source: This approach follows several previous NEPA documents. Pre-project planning also discussed in the previous section.

B-Coordination with Other Landowners and Agencies

B-1: Work with owners and managers of neighboring lands to respond to invasive plants that straddle multiple ownerships. Coordinate treatments within appropriate distances based on invasive plant species reproductive characteristics, and current use of area.

- Purpose: To ensure that neighbors are fully informed about nearby herbicide use and to increase the effectiveness of treatments on multiple ownerships
- Source: A variable distance based on site and species specific characteristics was chosen because it adjusts for various conditions that exist in these areas. All PDFs related to riparian areas and buffer distances will be followed.

C-To Prevent the Spread of Invasive Plants during Treatment Activities

C-1: Ensure vehicles and equipment (including personal protective clothing) does not transport invasive plant materials.

- Purpose: To prevent the spread of invasive plants during treatment activities
- Source: Common Measure

D-Wilderness Areas[1]

D-1: For EDRR in wilderness, invasive plants could be treated using non-mechanical hand methods or herbicides. Herbicide treatments may use application methods such as wicking, stem injection, spray bottle, hand pressurized pumps, battery or solar powered pumps and propellant based systems such as those that use pressurized carbon dioxide.

- Purpose: To reduce the effects of invasive plant treatments on the untrammeled quality of wilderness character

E-Non-herbicide Treatment Methods

E-1: Limit the numbers of workers on any one site at any one time while treating areas within 150 feet of creeks.

- Purpose: To minimize trampling, protect riparian and aquatic habitats, and prevent potential invasive plant spread via waterway dispersal
- Source: The distance of 150 feet was selected because it incorporates the Aquatic Influence Zone for fish bearing streams

E-2: Fueling of gas-powered equipment with tanks larger than 5 gallons would not occur inside the RHCA unless there is no other alternative.

- Purpose: To protect riparian and aquatic habitats
- Source: The distance of 150 feet was selected because it incorporates the Aquatic Influence Zone for fish bearing streams

F-Herbicide Application

F-1: Herbicides would be used in accordance with label instructions, except where more restrictive measures are required as described below. Herbicide applications would only treat the minimum area necessary to meet site objectives. Herbicide formulations would be limited to those containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Herbicide application methods include wicking, wiping, injection, spot, and broadcast, as permitted by the product label and these Project Design Features. The use of triclopyr is limited to spot and hand/selective methods. Herbicide carriers (solvents) are limited to water and/or specifically labeled vegetable oil.

- Purpose: To limit potential adverse effects on people and the environment
- Source: Forest Plans as amended by the R6 2005 ROD Standard 16, Pesticide Use Handbook 2109.14

[1] Invasive plant eradication within Wilderness meets the “no impact” intent of the Wilderness Act and associated land use policies

F-2: Herbicide use would comply with standards in the Forest Plans as amended by the R6 2005 ROD, including standards on herbicide selection, restrictions on broadcast use, tank mixing, licensed applicators, and use of adjuvants, surfactants and other additives.

- Purpose: To limit potential adverse effects on people and the environment
- Source: Forest Plans as amended by the R6 2005 ROD Treatment Standards (see Chapter 1)

F-3: POEA surfactants, urea ammonium nitrate or ammonium sulfate would not be used in applications within 150 feet of surface water, wetlands or on roadside treatment areas, including ditches, having high potential to deliver herbicide.

- Purpose: To protect aquatic organisms
- Source: The distance of 150 feet was selected because it is wider than the largest buffer and incorporates the Aquatic Influence Zone for fish bearing streams.

F4: Lowest effective label rates would be used. No broadcast applications of herbicide or surfactant will exceed typical label rates. NPE surfactant would not be broadcast at a rate greater than 0.5 lbs. a.i./ac (pounds of active ingredient per acre). Favor other classes of surfactants wherever they are expected to be effective.

- Purpose: To eliminate possible herbicide or surfactant exposures of concern to human health, wildlife, and aquatic organisms
- Source: Based on SERA Risk Assessment for imazapyr there would be no exposure concerns

F-5: Herbicide applications would occur when wind velocity is between two and eight miles per hour to reduce the chance of drift. (BA Appendix F) During application, weather conditions would be monitored periodically by trained personnel.

- Purpose: To ensure proper application of herbicide and reduce drift
- Source: These restrictions are typical so that herbicide use is avoided during inversions or windy conditions

F-6: To minimize herbicide application drift during broadcast operations, use low nozzle pressure; apply as a coarse spray, and use nozzles designed for herbicide application that do not produce a fine droplet spray, e.g., nozzle diameter to produce a median droplet diameter of 500-800 microns.

- Purpose: To ensure proper application of herbicide and reduce drift
- Source: These are typical measures to reduce drift. The minimum droplet size of 500 microns was selected because this size is modeled to eliminate adverse effects to non-target vegetation 100 feet or further from broadcast sites (see Chapter 3 for details).

F-7: Use of sulfonylurea herbicides (Chlorsulfuron, Sulfometuron methyl and Metsulfuron methyl), will require soils to be mapped prior to treatment. Treatment of powdery, ashy dry soil, or light sandy soil can only be treated if rainfall is expected within 24 hrs of treatment.

- Purpose: To avoid potential for herbicide drift
- Source: Label advisory

F-8 - Additional design features specific to aerial application corresponding to BA Appendix

F-Aerial Spray Guidelines:

F-8a: Application of herbicide aerially will not be used for treatment of EDRR sites.

- Purpose: To reduce potential adverse effects to non-target species
- Source: Not required for newly discovered small infestations

F-8b: Chlorsulfuron, metsulfuron methyl, sulfometuron methyl and triclopyr will not be applied aerially.

- Purpose: To reduce potential adverse effects to non-target species
- Source: WAW LRMP as amended by the R6 2005 ROD

F-8c: Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners).

- Purpose: To minimize impacts to human health
- Source: WAW LRMP as amended by the R6 2005 ROD

F-8d: Prohibit aerial application of herbicides within congressionally designated municipal watersheds. See B2 for other developed water sources.

- Purpose: To protect water supplies
- Source: WAW LRMP as amended by the R6 2005 ROD

F-8e: Effectiveness Monitoring required for "a representative sample" of the spray area in a project involving aerial application of herbicide to insure impacts to non-target species are within tolerance

- Purpose: To insure impacts to non-target species are within tolerance
- Source: Appendix I, R6 2005 FEIS

F-8f: All aviation activities shall be in accordance with FSM 5700 (Aviation Management), FSH 5709.16 (Flight Operations Handbook)FSM 2150 (Pesticide Use Management and Coordination), FSH 2109.14, 50 (Quality Control Monitoring and Post-Treatment Evaluation),

- Purpose: To ensure all aircraft SS for fleet and contract operators follow all FS safety, training, supervision for natural resource protection activities, and to ensure pesticide-use management and coordination follows NF direction and policies.
- Source: FSM 5700, FSM 2150, FSM 5709.16, FSM 2109.14059

F-8g: Herbicide buffers have been established for perennial and wet intermittent streams, dry streams and lakes and wetlands. These buffers are shown in the tables below.

- Purpose: To reduce the likelihood that herbicides would enter surface water in levels of concern
- Source: Buffers based on SERA risk assessments, label advice., and Berg's 2004 study of broadcast drift and run off to streams; monitoring data from other herbicide application project.

F-8h: Buffer distances for federally listed SOLIs will follow Recovery Plan recommendations. No aerial application would occur within 300 feet of non-federally listed SOLIs. Spray cards to monitor drift can be used in conjunction with monitoring and adaptive management to adjust buffers if needed.

- Purpose: To protect SOLIs and reduce non-target effects. To comply with Forest Plans as amended by the R6 2005 ROD Standards 19 & 20
- Source: Forest Service Manual 2670 and applicable federally listed recovery plans

F-8i: Aerial spraying of invasive species will not occur in areas with 30 percent or more live tree canopy cover. For live tree canopy cover between 10-29 percent an on-site decision whether or not to aerial spray would be based on factors such as target invasive species, herbicides (specificity) proposed for treatment, and potential impacts to non-target tree species present.

- Purpose: To reduce potential adverse effects to non-target species
- Source: Common measure

F-8j: Aerial spray units (and perennial seeps, ponds, springs, and wetlands in proposed aerial units) will be ground-checked, flagged and marked using GPS prior to spraying to ensure only appropriate portions of the unit are aerially treated. A GPS system will be used in spray helicopters and each treatment unit mapped before the flight to ensure that only areas marked for treatment are treated. Plastic spray cards will be placed out to 350 feet from and perpendicular to perennial creeks to monitor herbicide presence.

- Purpose: To reduce potential adverse effects to non-target species
- Source: Common measure

F-8k: Press releases will be submitted to local newspapers indicating potential windows of treatment for specific areas. Signing and on site layout will be performed one to two weeks prior to actual aerial treatment.

- Purpose: To ensure proper public notification

F-8l: Grazing permittees will be notified at annual permittee meeting that aerial application will be conducted. Permittee will also be notified of specific time frames in which treatment would occur to ensure grazing animals are removed from the area.

- Purpose: To ensure grazing animals are not exposed to aerial herbicide applications

F-8m: Enforceable temporary area, trail, and road closures will be used to ensure public safety during aerial spray operations.

- Purpose: To ensure proper public notification

F-8n: Constant communications will be maintained between the helicopter and the project leader during spraying operations. Ground observers will have communication with the project leader. Observers will be located at various locations adjacent to the treatment area to monitor wind direction and speed as well as to visually monitor drift and deposition of herbicide.

- Purpose: To prevent effects to non-target species

F-8o: Aerial swath displacement buffers would be applied as needed as described in BA Appendix F, Table F-2.

- Purpose: To protect resources in the worst case scenario

F-8p: Aerial application rates for Picloram would not exceed (0.25lb/ai/acre), and clopyralid would not exceed typical application rates (0.35lb ai/acre)

G-Herbicide Transportation and Handling Safety/Spill Prevention and Containment

Design Features for G: An Herbicide Transportation and Handling Safety/Spill Response Plan would be the responsibility of the herbicide applicator (Forest Service applicator or contractor as applicable). At a minimum the plan would:

- Address spill prevention and containment.
- Estimate and limit the daily quantity of herbicides to be transported to treatment sites.
- Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling.
- Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent).
- Outline reporting procedures, including reporting spills to the appropriate regulatory agency.
- Ensure applicators are trained in safe handling and transportation procedures and spill cleanup.
- Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition.
- Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible.
- Specify conditions under which guide vehicles would be required.
- Specify mixing and loading locations away from water bodies so that accidental spills do not contaminate surface waters.
- Require that spray tanks be mixed or washed further than 150 feet of surface water.
- Ensure safe disposal of herbicide containers.
- Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft (See H14).
- Purpose: To reduce likelihood of spills and contain any spills.
- Source: FSH 2109.14

H- Soils, Water and Aquatic Ecosystems

H-1: **Herbicide use buffers have been established for perennial and wet intermittent steams; dry streams; and lakes and wetlands. These buffers are depicted in Table II - 8,**

Table II - 9 and Table II - 10 below. Buffers vary by herbicide ingredient and application method. Tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture.

- Purpose: To reduce likelihood that herbicides would enter surface waters in concentrations of concern
- Source: * Treatments within RHCAs are allowed if they meet Riparian Management Objectives (RMOs) including avoiding adverse effects to listed fish; therefore, buffers are based on label advisories, SERA risk assessments and Berg's

2004 study of broadcast drift and run off to streams. Buffers are intended to demonstrate compliance with WAW and UMA LRMP as amended by the R6 2005 ROD Standards 19 and 20.

H-2: No broadcast of high aquatic risk herbicides on roads that have a high risk of delivery to water (generally roads in RHCAs). These herbicides are picloram or non-aquatic triclopyr (Garlon 4), non aquatic glyphosate, and sethoxidim.

- Purpose: To ensure high risk herbicides are not delivered to streams in concentrations that exceed levels of concern
- Source: SERA Risk Assessments, R6 2005 FEIS Fisheries Biological Assessment

H-3: In riparian and aquatic settings, vehicles (including all terrain vehicles) used to access invasive plant sites, apply foam, or for broadcast spraying would remain on roadways, trails, parking areas to prevent damage to riparian vegetation, soil, water quality and aquatic habitat.

- Purpose: To protect riparian and aquatic habitats
- Source: Common measure

H-4: Avoid use of clopyralid on high-porosity soils (coarser than loamy sand).

- Purpose: To avoid leaching/ground water contamination
- Source: Label advisory

H-5: Avoid use of chlorsulfuron on soils with high clay content (finer than loam).

- Purpose: To avoid excessive herbicide runoff
- Source: Label advisory

H-6: Avoid use of picloram on shallow or coarse soils (coarser than loam.) according to herbicide labels. No more than one application of picloram would be made within a two-year period.

- Purpose: To reduce the potential for picloram to enter surface and/or ground water and/or accumulate in the soil. Picloram has the highest potential to impact organisms in soil and water, and tends to be more persistent than the other herbicides.
- Source: SERA Risk Assessment. Based on quantitative estimate of risk from worst-case scenario and uncertainty

H-7: Avoid use of sulfometuron methyl on shallow or coarse soils (coarser than loam.) No more than one application of sulfometuron methyl would be made within a one-year period.

- Purpose: To reduce the potential for sulfometuron methyl accumulation in the soil; sulfometuron methyl has some potential to impact soil and water organisms and is second most persistent.
- Source: SERA Risk Assessments: Based on quantitative estimate of risk from worst-case scenario and uncertainty

H-8: Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover within established buffers or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period. This limits area treated within riparian areas to keep refugia habitat for reptiles and amphibians.

- Purpose: To reduce exposure to herbicides by providing some untreated areas for some organisms to use

- Source: SERA Risk Assessments: Based on quantitative estimate of risk from worst-case scenario and uncertainty regarding effects to reptiles and amphibians

H-9: Wetlands – Wetlands would be treated when soils are driest. If herbicide treatment is necessary when soils are wet, use aquatic labeled herbicides. Favor hand/selective treatment methods where effective and practical. No more than 10 contiguous acres or fifty percent individual wetland areas would be treated in any 30-day period.

- Purpose: To reduce exposure to herbicides by providing some untreated areas for some organisms to use
- Source: SERA Risk Assessments. Based on quantitative estimate of risk from worst-case scenario, uncertainty in effects to some organisms, and label advisories

H-10: Foaming would only be used on invasive plants that are further than 150 feet from streams and other water bodies.

- Purpose: To limit the amount of foam that may be delivered to streams and other water bodies
- Source: No label regulations are associated with this naturally occurring organic compound. The distance of 150 feet was selected because it incorporates the Aquatic Influence Zone for fish bearing streams

H-11: Herbicide use would not occur within 100 feet of wells or 200 feet of spring developments. For stock tanks located outside of riparian areas, use wicking, wiping or spot treatments within 100 feet of the watering source.

- Purpose: Safe drinking water. Also to reduce the potential chance of herbicide delivery to watering systems used for grazing animals
- Source: Label advisories and state drinking water regulations

H-12: When chemicals need to be carried over water by boat, raft or other watercraft, herbicides will be carried in water tight, floatable containers of 1 gallon or less.

- Purpose: Lower the risk of herbicide being delivered to streams in concentrations that exceed levels of concern

H-13: Aerial applications would not exceed typical application rates

- Purpose: Limit herbicide concentrations so that adverse effects are within the scope of analysis
- Source: Analyses based on SERA risk assessment worksheets

H-14: Treatments above bankfull, within the riparian areas, would not exceed 10 acres per year along any 1.6 mile of a stream

- Purpose: Limits the extent of treatment within the riparian areas so that adverse effects are within the scope of analysis
- Source: Analyses based on SERA risk assessment worksheets. Ten acres is based on GLEAM model factors.

I - Vascular and Non-Vascular Plant and Fungi Species of Local Interest (SOLI)

I-1: Botanical surveys may be necessary prior to treatment applications to identify vascular and non-vascular SOLI occurrence in or near areas proposed for invasive plant treatments. Consultation with the district or forest botanist would be done prior to invasive plant treatments to evaluate survey needs. If suitable habitat is present and surveys are needed, they will be conducted by qualified personnel and surveys around proposed invasive plant

treatments will be as follows: 300 to1000 feet of planned aerial treatments (see I7), 100 feet of planned broadcast treatments, 10 feet of planned spot treatments and/or 5 feet of planned hand herbicide treatments.

- Purpose: To ensure SOLI are protected and survey are conducted when appropriate
- Source: Forest Service Manual 2670 and applicable federally listed recovery plans

I-2: In absence of botanical surveys: no aerial herbicide treatment will occur within 300 to 1000 feet of SOLI habitat (see section I6), and no ground based broadcast, spot, or hand treatments will occur within 100 feet of SOLI habitat.

- Purpose: To ensure SOLI are protected and surveys are conducted when appropriate
- Source: Forest Service Manual 2670 and applicable federally listed recovery plans

I-3: Buffer distances for known botanical SOLI's occurrences are:

Greater than 100 feet: All ground based treatments are permitted (see I6 and aerial section for additional buffer restrictions) 100 to 10 feet: Manual and mechancial methods permitted. Broadcast herbicide methods permitted if SOLI's can be completely protected using a protective cover, otherwise use other protective measures such as low-pressure spot-spray, directed spray applications or hand application methods to eliminate any potential for drift.

Less than 10 feet: No broadcast spraying is permitted. Spot treatment using hand application methods is permitted. For saturated or wet soils see I-6. Manual treatment methods are permitted. Precautions must be taken to avoid any contact with individual SOLI.

- Purpose: To ensure SOLI are protected and surveys are conducted when appropriate
- Source: Forest Service Manual 2670 and applicable federally listed recovery plans

I-4: Picloram will not be used within 50 feet of the threatened plant species *Silene spaldingii* and *Mirabilis macfarlanei*.

- Purpose: To ensure protection of emerging seedlings and potential non-target plant root uptake due to herbicide soil persistence
- Source: US FWS Conservation Strategy (2004).

I-5: In the vicinity of *S. spaldingii*, *M. mcfarlaneis* and all other SOLI, restoration and cultural treatments, including seeding and/or use of fertilizer, will be under the direct supervision of the district or forest botanist to ensure that plant communities are restored to their desired condition without negative impacts to existing SOLI populations or individuals. The vicinity areas will be evaluated on a case by case basis.

- Purpose: To ensure soil chemistry/biology is not negatively impacted which can potentially alter the subsequent establishment of resident seedbank species.
- Source: Professional judgement

I-6: When vascular or non-vascular SOLI plant species are within 10 feet of saturated or wet soils at the time of herbicide application, only hand methods (wiping, stem injection, etc.) would be used. Avoid the use of picloram and imazapyr in this situation, and use aquatic triclopyr with caution as typical application rates can result in concentrations greater than estimated or measured “no observable effect concentration” to aquatic plants (R6 2005 FEIS, Table 4-47).

- Purpose: To ensure SOLI are protected and surveys are conducted when appropriate
- Source: Forest Service Manual 2670 and applicable federally listed recovery plans. Aerial drift buffers were derived from various scientific publications (See aerial application methods)

I-7: Aerial herbicide applications will follow Recovery Plan recommendations for listed species (FWS). Presently, two federally listed species (Silene spaldingii and Mirabilis macfarlanei) are documented on the forest. Recovery plan recommend no aerial herbicide within 1000 feet of occurrence for S. spaldingii and not adjacent to M. macfarlanei.. A 1000 foot buffer for aerial application will be used for both species. For non-federally listed SOLI, no aerial herbicide applications would occur within 300 feet of known location of SOLI and spray cards to monitor drift would be used to monitor drift and adjust buffers if needed (See I-7-I-10 and section F-Aerial PDFs).

- Purpose: To ensure SOLI are protected and surveys are conducted when appropriate
- Source: Forest Service Manual 2670 and applicable federally listed recovery plans. Aerial drift buffers were derived from various scientific publications (See aerial application methods Appendix F)

I-8: A USDA Forest Service botanist would use monitoring results to refine buffers in order to adequately protect vascular and nonvascular plant species of local interest

- Purpose: To prevent any repeated effects to SOLI populations, thereby mitigating any long term effects
- Source: Broadcast buffer sizes are based on Marrs, 1989 based on tests on vascular plants. Spot and hand/select buffer distances are based on reports from experienced applicators. Uncertainty about effects on non vascular plants would be addressed through monitoring (See I-9)

I-9: The impacts of herbicide use on plant Species of Local Interest (SOLI) are uncertain, especially regarding lichen and bryophytes. The potential for variances in aerial drift due to uncontrolled weather conditions during treatment may also be uncertain. To manage this uncertainty, representative samples of herbicide treatment sites adjacent to vascular and non-vascular plant SOLI's would be monitored. Non-target vegetation within 1000 feet of aerial treatment sites, 500 feet of herbicide broadcast treatment sites and 20 feet of herbicide spot and hand treatment sites would be evaluated before treatment, immediately after treatment, and two to three months later as appropriate. Treatment buffers would be expanded if damage is found as indicated by: (1) Decrease in the size of the SOLI plant population; (2) Leaf discoloration or chlorophyll change

- Purpose: To prevent any repeated effects to SOLI populations, thereby mitigating any long term effects

I-10: Compliance monitoring would occur before implementation to ensure that prescriptions, contracts and agreements integrate appropriate Project Design Features. This will be done via a pre-work review.

I-11: Implementation monitoring would occur during implementation to ensure Project Design Features are implemented as planned. An implementation monitoring form will be used to document daily field conditions, activities, accomplishments, and/or difficulties. Contract administration mechanisms would be used to correct deficiencies. Herbicide use will be reported as required by the Forest Service Health Pesticide Use Handbook (FSH

2109.14). The reports required by the Forest Service Health Pesticide Use Handbook will be submitted to the Level I teams annually.

I-12: Effectiveness monitoring would occur before, during and after treatment to determine whether invasive plants are being effectively controlled and to ensure non-target vegetation, especially native vascular and non-vascular species of local interest, is adequately protected.

- Source: Tiering to PNW ROD and PNW FEIS Appendix M: Inventory and Monitoring Plan Framework

J - Wildlife Species of Local Interest

J-2: Grey Wolf

J-2a: Treatments within 1 mile of active wolf dens would be timed to occur outside the season of occupancy (April 1 through June 30)

- Purpose: To minimize disturbance and reduce energy demands on denning wolves
- Source: Federal Register, Vol, 68, No, 62 4(d)

J-2b: Treatments within 0.50 mile or 0.50 mile line-of-sight of occupied rendezvous sites would be timed to occur outside the season of occupancy unless treatment activity is within acceptable ambient noise levels and human presence would not cause wolves to abandon the site (as determine by a local specialist)

- Purpose: To minimize disturbance/impacts to wolves at rendezvous sights.
- Source: Buffer is based on expected range of disturbance

J-2c: Consultation with FWS would be reinitiated (unless determined otherwise by FWS) if/when wolf dens or rendezvous sites are discovered in the vicinity of treatment sites.

-

K-Public Notification

K-1: High use areas, including administrative sites, developed campgrounds, visitor centers, and trailheads would be posted in advance of herbicide application or closed. Areas of potential conflict would be marked on the ground or otherwise posted. Postings would indicate the date of treatments, the herbicide used, and when the areas are expected to be clear of herbicide residue. See also F for aerial, L for special products, and M for cultural plants.

- Purpose: To reduce the risk of inadvertent public contact with herbicide
- Source: Common Measure

K-2: The public would be notified about upcoming herbicide treatments via the local newspaper or individual notification, fliers, and posting signs. Forest Service and other websites may also be used for public notification.

- Purpose: To reduce the risk of inadvertent public contact with herbicide
- Source: Forest Plans as amended by the R6 2005 ROD Standard 23

L-Special Forest Products

L-1: Triclopyr would not be applied to foliage in areas of known special forest products or other wild food collection areas.

- Purpose: To reduce the chance that people might be exposed to harmful doses of triclopyr
- Source: Appendix Q of the R6 2005 FEIS

L-2: Special forest product gathering areas may be closed for a period of time to ensure that no inadvertent public contact with herbicide occurs.

- Purpose: To reduce the risk of inadvertent public contact with herbicide
- Source: Forest Plans as amended by the R6 2005 ROD Standard 23

L-3: Popular berry and mushroom picking areas would be posted, marked on the ground or otherwise posted.

- Purpose: To reduce the risk of inadvertent public contact with herbicide
- Source: Forest Plans as amended by the R6 2005 ROD Standard 23

L-4: Special forest product gatherers would be notified about herbicide treatment areas when applying for their permits. Flyers indicating treatment areas may be included with the permits, in multi-lingual formats if necessary. See section K.

- Purpose: To reduce the risk of inadvertent public contact with herbicide
- Source: Forest Plans as amended by the R6 2005 ROD Standard 23

O-Human Health (See R6 2005 FEIS, Appendix Q for more information)

O-1 Worker Health

O-1a: Backpack Application - Triclopyr application rate will not exceed 1.0 lbs a.i./ac

- Purpose: To reduce the potential of adverse effects to human health

O-1b: Backpack Application - Sulfometuron methyl application rate will not exceed 0.2 lb a.i./ac

- Purpose: To reduce the potential of adverse effects to human health

O-1c: Backpack Application - NPE surfactant will not exceed 1.67 lb a.i./ac

- Purpose: To reduce the potential of adverse effects to human health

O-1d: Ground Boom Application - Picloram application rate will not exceed 0.5 lb a.i./ac

- Purpose: To reduce the potential of adverse effects to human health

O-1e: Ground Boom Application - Sulfometuron methyl application rate will not exceed 0.12 lb a.i./ac

- Purpose: To reduce the potential of adverse effects to human health

O-2 Public Health

O-2a: Triclopyr application rate will not exceed 1.0 lbs a.i./ac. Use selective spray techniques to further reduce dermal exposure. Favor other herbicides wherever they are expected to be effective

- Purpose: To reduce the potential for adverse effects to human health from dermal contact or consumption of contaminated vegetation

O-2b: Those PDFs developed for water quality and protection of aquatic organisms will provide reduction in potential doses of herbicides in drinking water

- Purpose: To reduce the potential for adverse effects to human health from drinking water that contains herbicide

P-Restoration

P-1: Long-term site strategy for highly disturbed areas that have high invasibility such as old fields or old homesteads, follow guidelines and techniques outlined in *Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest* (Erickson et al. 2003)

- Purpose: To ensure highly invasible/disturbed sites are successfully restored or revegetated with desirable vegetation
- Source: Treatment Restoration Standard 12 (RFEIS)

P-2: On dry grassland habitat below 3000 feet in the Hells Canyon National Recreation Area and other highly disturbed areas where live vegetative groundcover will be reduced by 70 percent of existing vegetation by herbicide treatment, restoration and/or revegetation would occur following *Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest* (Erickson et al. 2003) and R6 2005 FEIS standards

- Purpose: To ensure highly invasible/disturbed sites are successfully restored or revegetated with desirable vegetation
- Source: Treatment Restoration Standard 3, 12 (RFEIS), *Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest* (Erickson et al. 2003), Water Erosion Prediction Project (WEPP) erosion data, and Goodwin et al. 2002

P-3: In areas where broadcast herbicide is used to treat highly infested areas, evaluation of potential re-infestation by new or nearby invasives would be considered and restoration and/or revegetation measures would be implemented to ensure protection of native vegetation and soils. Also see Treatment Restoration Standard #12 in R6 2005 Feis and ROD.

- Purpose: To ensure highly invasible/disturbed sites are successfully restored or revegetated with desirable vegetation
- Source: Treatment Restoration Standard 3, 12 (RFEIS), and Guidelines for Revegetation for Invasive Weed Sites on National Forests and Grasslands in the Pacific Northwest (Erickson et al. 2003)

HERBICIDE USE BUFFERS

Herbicide treatments would become more restrictive as they occur close to water. PDFs and herbicide use buffers within the riparian areas were developed based on label advisories; SERA risk assessments, and various studies of drift and runoff to streams such as Berg 2004. Table II - 8, Table II - 9, and Table II - 10 specify buffers according to treatment methods, herbicides used, risk, and type of aquatic zone.

Table II - 8 - Herbicide Use Buffers in feet – Perennial and Wet Intermittent Streams - Proposed Action

Herbicide	Perennial and Wet Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100	Water's edge	Water's edge

Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100	Water's edge	Water's edge
Low Risk to Aquatic Organisms				
Imazapic	300	100	15	Bankfull
Clopyralid	300	100	15	Bankfull
Metsulfuron Methyl	None Allowed	100	15	Bankfull
Moderate Risk to Aquatic Organisms				
Imazapyr	300	100	50	Bankfull
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

Table II - 9 - Herbicide Use Buffers in feet – Dry Intermittent Streams - Proposed Action . Buffers that apply while streams are dry. See Table II - 8 for distances when flowing or pools present, but water not flowing.

Herbicide	Dry Intermittent Stream			
	Aerial	Broadcast	Spot	Hand/ Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	100	50	0	0
Aquatic Triclopyr-TEA	None Allowed	None Allowed	0	0
Aquatic Imazapyr*	100	50	0	0
Low Risk to Aquatic Organisms				
Imazapic	100	50	0	0
Clopyralid	100	50	0	0
Metsulfuron Methyl	None Allowed	50	0	0
Moderate Risk to Aquatic Organisms				
Imazapyr	100	50	15	Bankfull
Sulfometuron Methyl	None Allowed	50	15	Bankfull
Chlorsulfuron	None Allowed	50	15	Bankfull
High Risk to Aquatic Organisms				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	100	100	50	50
Sethoxydim	100	100	50	50
Glyphosate	100	100	50	50

Table II - 10 - Herbicide Use Buffers in Feet–Wetlands-Proposed Action

Herbicide	Wetlands			
	Aerial	Broadcast	Spot	Hand/ Select
Aquatic Labeled Herbicides				
Aquatic Glyphosate	300	100**	Water's edge	Water's edge
Aquatic Triclopyr-TEA	None Allowed	None Allowed	15	Water's edge
Aquatic Imazapyr*	300	100**	Water's edge	Water's edge
Low Aquatic Hazard Rating				
Imazapic	300	100	15	high water mark
Clopyralid	300	100	15	high water mark
Metsulfuron Methyl	300	100	15	high water mark
Moderate Aquatic Hazard Rating				
Imazapyr	300	100	50	high water mark
Sulfometuron Methyl	None Allowed	100	50	5
Chlorsulfuron	None Allowed	100	50	high water mark
Greater Aquatic Hazard Rating				
Triclopyr-BEE	None Allowed	None Allowed	150	150
Picloram	300	100	50	50
Sethoxydim	300	100	50	50
Glyphosate	300	100	50	50

*Aquatic Imazapyr (Habitat) may not be used until the risk assessment (currently underway) is completed for inert ingredients and additives.
** If wetland, pond, or lake is dry, there is no buffer.

In addition to the monitoring already required under various Forest Plans, an inventory and monitoring plan framework is part of the Proposed Action. The approach included in the framework was developed via interagency discussions with NOAA Fisheries and FWS personnel. A measure included within the monitoring framework that will improve the Forest's ability to detect, respond rapidly to new infestations is the requirement to maintaining an invasive plant inventory consistent with nationally accepted (e.g., NRIS/Terra) protocols. Additionally, the monitoring framework outlines the agreed-upon criteria for prioritizing monitoring of projects that may pose more risk to federally listed species.

Contents of the Inventory and Monitoring Plan Framework can be found in Appendix J.

STANDARDS

In addition to the DFCs, Goals, Objectives, and the Inventory and Monitoring Framework, the Proposed Action contains a suite of new Forest Plan standards. These standards were designed in cooperation with Forest Service staff, to ensure that long-term multiple use goals and objectives would not be significantly altered through the alternatives developed (Forest Service Manual

1922.51/52). Table II - 11 displays the Forest Plan standards associated with the Proposed Action.

Table II - 11. Standards to be added to existing LRMP's in Region Six by implementing the Proposed Action

Standard Number	Proposed Action
Prevention Standards	
1. (Objectives 1.1, 1.2, 2.3, 2.4, 2.5)	Prevention of invasive plant introduction, establishment and spread will be addressed in watershed analysis; roads analysis; fire and fuels management plans, Burned Area Emergency Recovery Plans; emergency wildfire situation analysis; wildland fire implementation plans; grazing allotment management plans, recreation management plans, vegetation management plans, and other land management assessments.
2. (Objectives 1.1, 1.2, 2.3)	Actions conducted or authorized by written permit by the Forest Service that will operate outside the limits of the road prism (including public works and service contracts), require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands. This standard does not apply to initial attack of wildland fires, and other emergency situations where cleaning would delay response time.
3. (Objectives 1.1, 2.3)	Use weed-free straw and mulch for all projects, conducted or authorized by the Forest Service, on National Forest System Lands. If State certified straw and/or mulch is not available, individual Forests should require sources certified to be weed free using the North American Weed Free Forage Program standards (see Appendix O of EIS) or a similar certification process. This standard may need to be phased in as a certification process is established.
4. (Objectives 1.1, 2.5)	Use only pelletized or certified weed free feed in wilderness and wilderness trailheads. If state certified weed free feed is not available, individual Forests should require feed certified to be weed free using North American Weed Free Forage Program standards or a similar certification process. This standard may need to be phased in as a certification process is established.
5.	From other alternatives in the EIS; no corollary standard for Proposed Action. (Addressed as Objective 2.2 and in the USDA Forest Service Guide to Noxious Weed Prevention Practices)
6. (Objectives 1.1, 5.1, 5.3)	Through annual operating instructions, and the revision of grazing allotment management plans, incorporate invasive plant prevention practices that reduce the spread of invasive plants. Plan and implement practices in cooperation with the grazing permit holder.
7. (Objectives 1.1, 1.2, 1.3)	Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material. Use only gravel, fill, sand, and rock that is judged to be weed free by District or Forest weed specialists.
8. (Objectives 1.1, 1.2, 5.1)	Conduct road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants in consultation with District or Forest-level invasive plant specialists, incorporate invasive plant prevention practices as appropriate.
9.	From other alternatives in the EIS; no corollary standard for Proposed Action. (Addressed as Objectives 1.1 and 2.4)
10. (Objectives 1.1, 2.4, 2.5)	Require the establishment of a system of roads, trails, and areas designated for motor vehicle use; and prohibit the use of motor vehicles off the designated system that is not consistent with the classes of motor vehicles and if applicable, the time of year, designated for use.1
Treatment Standards	
11. (Objectives 1.5, 5.1)	Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale.
12. (Objectives 1.1, 5.1)	Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment.

Standard Number	Proposed Action
13. (Objectives 1.1, 1.4)	Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used when: 1) needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) native plant materials are not available, and 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used.
14. (Objectives 1.4, 4.1, 4.2)	Use only APHIS and State-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released.
15. (Objectives 1.4, 3.1, 4.1, 4.2)	Application of any herbicides to treat invasive plants will be performed or directly supervised by a State or Federally licensed applicator. All treatment projects that involve the use of herbicides will develop and implement an herbicide transportation and handling safety plan.
16. (Objectives 1.4, 3.1, 4.1, 4.2)	Select from herbicide formulations containing one or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0.2 All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.
17. (Objective 3.4)	When herbicide treatments are chosen over other treatment methods, document the rationale for choosing herbicides.
18. (Objectives 3.1, 4.1, 4.2)	Use only adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessment documents such as SERA, 1997a, 1997b; Bakke, 2002.
19. (Objective 4.1)	To reduce or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Only consider those herbicides and herbicide mixtures registered for aquatic use when evaluating herbicide use near streams or surface water.
20. (Objectives 4.1, 4.2, 4.3)	Design invasive plant treatments to reduce or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure.
21. (Objectives 3.1, 4.2)	Provide a minimum buffer of 300 feet for aerial application of herbicides near developed campgrounds, recreation residences and private land (unless otherwise authorized by adjacent private landowners).
22. (Objectives 4.1)	Prohibit aerial application of herbicides within legally designated municipal watersheds.

Standard Number	Proposed Action
23. (Objective 3.1)	Prior to implementation of treatment projects, each Forest will develop a public information plan. The plan will ensure (at a minimum) that timely (normally 15 days) public notification will occur. Warning and information signs will be placed at appropriate locations (defined in the public information plan) to inform the public, and forest workers of herbicide application dates and herbicide used. If requested, individuals may be notified in advance of spray dates and times.

1. Details, conditions, terms, definitions, etc. of this standard parallel those contained in Proposed Rule 36 CFR Parts 212, 251, 261, and 295 Travel Management; Designated Routes and Areas for Motor Vehicle Use, Federal Register Vol. 69, No. 135, July 15, 2004 (See Appendix R of EIS).
2. ATSDR, 2004. Guidance Manual for the Assessment of Joint Toxic Action of Chemical Mixtures. U.S. Department Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.

INVENTORY AND MONITORING PLAN FRAMEWORK

In addition to the monitoring already required under various Forest Plans, an inventory and monitoring plan framework is part of the Proposed Action. The approach included in the framework was developed via interagengy discussions with NOAA Fisheries and FWS personnel. A measure included within the monitoring framework that will improve the Forest's ability to detect, respond rapidly to new infestations is the requirement to maintaining an invasive plant inventory consistent with nationally accepted (e.g., NRIS/Terra) protocols.

Contents of the Inventory and Monitoring Plan Framework are as follows:

- It is assumed every Forest in Region Six has an invasive plants coordinator and is maintaining an up-to-date invasive plant inventory using NRIS/Terra, the nationally accepted protocol. The inventory will be the primary means to plan and prioritize treatments. The inventory will be used as the main vehicle for tracking treatment effectiveness both regionally and on a site-specific basis.
- In addition to the monitoring that is already required under various Forest Plans, this inventory and monitoring plan framework is part of all action alternatives in this EIS. The framework would guide the development of detailed monitoring plans at the site-specific project scale. Invasive plant treatment and restoration actions are likely to be complex, involve multiple land ownerships and will take years to implement, due to the nature of invasive plant problems. It is likely that a site will be treated multiple times over the years. Tracking these efforts and subsequent progress will be crucial to determining success.
- A good monitoring program will be well thought out and have a high probability of detecting change in the resource being monitored (NPS, 2002). The Field Guide to Invasive Plant Inventory, Monitoring and Mapping (USDA FS, 2002) has been developed to guide monitoring efforts in conjunction with NRIS TERRA. It suggests a monitoring regime may start with annual monitoring for the first 3-5 years, decreasing in frequency to every other year for the next 5-10 years and further decreasing monitoring frequency to every 3 years for the next ten years until the seed source has been exhausted (i.e. no new germination taking place).
- Monitoring regimes may vary in time and space depending on the species; for example, those that reproduce vegetatively may require a longer span of annual monitoring. The monitoring categories described in this framework (implementation/compliance, and effectiveness (of treatments in meeting project objectives, and effectiveness of protection measures) can be used to implement a long-term adaptive management strategy. By implementing an adaptive management approach, managers will identify and respond to changing conditions

and new information on an ongoing basis, and assess the need to make changes to treatment and restoration strategies.

IMPLEMENTATION/COMPLIANCE MONITORING

Implementation/compliance monitoring answers the question, "Did we do what we said we would do?" This question needs to be answered on a Regional scale, because adaptive management strategies require determination that actions are taking place as described in the Invasive Plants EIS.

If an action alternative is selected, each Forest Supervisor will be directed to assess compliance with the Invasive Plant Program EIS Record of Decision as a part of Forest Plan Implementation monitoring. Regional Office staff will periodically aggregate this information as a part of program oversight.

An implementation/compliance checklist database, such as the Pacfish/Infish Biological Opinion Implementation Monitoring module database for the eastside, could be used as a template to input and analyze implementation/compliance monitoring data. The use of a consistent reporting format will allow for aggregation of information at various scales. Such a system will be used to determine patterns of compliance.

Listed Species -- An implementation/compliance monitoring database would track invasive plant treatment projects that are the subject of Section 7 consultations under the Endangered Species Act (ESA), generate annual reporting of compliance for use by the Services (NOAA Fisheries, U.S. Fish and Wildlife) and FS, and allow for common reporting of data on individual projects. As a minimum, on each project requiring consultation, reporting will be required on compliance with Standards 16, 18, 19, and 20 in the Invasive Plant EIS. Additional standards could be included, as appropriate, for the individual ecoregions, Forests, or projects.

EFFECTIVENESS MONITORING

Effectiveness monitoring, relative to project objectives, answers the question, "Were treatment and restoration projects effective?" This question could be answered on either a regional or a project-level scale. Invasive plant infestations require pre-project inventories to determine how, when, and where treatments are to be applied, and post-treatment monitoring to assess the effectiveness (treatment) in meeting project objectives (e.g. restoring structure and composition of native vegetation).

A goal of the Effectiveness Monitoring component in the Regional Invasive Plant Program is to answer the following questions:

- Have the number of new invasive plant infestations increased or decreased in the Region or at the project level?
- What changes in distribution, amount and proportion of invasive plant infestations have resulted due to treatment activities in the region or at the project level?
- Has the infestation size for a targeted invasive plant species been reduced regionally or at the project level?
- Which treatment methods, separate or in combination, are most successful for specific invasive species?
- Which treatment methods have not been successful for specific invasive species?

The nation-wide NRIS/Terra and the upcoming FACTS databases provide common reporting formats to input information and provide a mechanism for addressing the above questions. In addition, current long-term ecological monitoring networks will assist the FS in determining trends of invasive plant infestations at the Regional level.

The NRIS/Terra database could be sorted to answer the above questions because it tracks size and species of infestations as well as treatment methods. The Forest Inventory and Analysis Network (FIA) or the Forest Health Monitoring plots associated with the FIA network could be used to follow invasion trends. Such networks could be used to track trends in the spread or reduction in spread of the more dominant invasive plants in the region. Monitoring programs developed at the Forest level would answer more project specific questions.

Listed Species - Monitoring that addresses the effectiveness of various measures designed to reduce potential adverse effects from the project, including standards in the EIS, “project design criteria”, “design features”, and “protection measures” may also need to be conducted. This type of monitoring will only be required for invasive plant treatment projects that pose a “high risk” to federally listed species. “High risk” projects are defined as:

- Any project involving aerial application of herbicide.
- Projects involving the use of heavy equipment or broadcast application of herbicide (e.g. boom spray or backpack spraying that is not limited to spot sprays) that occur in 1) riparian areas (as defined in NWFP, Pacfish, or Infish, as applicable), ditches or water corridors connected to habitat for listed fish; or, 2) proximity to federally listed plants or butterfly habitat.

For the purposes of determining the need for protection measure effectiveness monitoring, invasive plant treatment methods that are not considered “high risk” can include, but are not limited to, the following:

- Broadcast application of herbicide and use of heavy equipment that occurs outside of, 1) riparian areas, ditches or water corridors connected to water bodies, or, 2) areas in proximity to federally listed plants or butterfly habitat.
- Manual methods including hand-pulling, grubbing, stabbing, pruning, cutting, etc.
- Mechanical methods using small equipment like chainsaws, or equipment rarely used and not often in proximity to listed fish habitat, like flamers, foamers, hot steam, etc.
- Prescribed fire used expressly for invasive plant control and which occurs outside of riparian areas or habitat for federally listed plants or butterflies.
- Herbicide applications using spot spray (used with a shield near listed plant locations) with a backpack sprayer, cut stump, injection, wicking wiping, basal bark applications, or other highly selective methods.
- Minor uses of fertilizer to encourage native plant competition or growth.
- Biological controls used in habitat areas for terrestrial wildlife or fish. Use in proximity to listed plants or butterflies should be evaluated on a case-by-case basis.
- Broadcast applications (except aerial) using clopyralid, imazapic, and metsulfuron methyl in proximity to habitat for listed fish or listed terrestrial wildlife.

A collection of several of these low risk projects in close proximity to each other and in proximity to habitat for listed species may constitute a “high risk” project, but this should be evaluated on a case-by-case basis.

Monitoring for “high risk” invasive plant treatments that may affect ESA-listed species or designated critical habitat should determine if standards and/or protection measures were effective at reducing potential effect pathways (e.g. disturbance, sedimentation, exposure to herbicides) and results should be applicable elsewhere. Unique, individual monitoring efforts and protocols have not provided information that is applicable to other areas or projects. Therefore, a Regional, interagency approach is outlined in this framework that will help address the needs for protection measure effectiveness at a broader scale. For example, Japanese knotweed is a serious invader of riparian areas and has the potential to alter ecosystems upon which listed salmon depend. The Region may have several Japanese knotweed treatment projects over the next several years and each one may have the potential to adversely affect listed salmon or designated critical habitat if adequate measures are not part of the treatment plan or are not complied with during implementation. Designing consistent monitoring protocol will allow a more efficient and effective evaluation of the project protection measures.

To meet the objective of being able to evaluate standards and measures applied at the Regional, sub-Regional, and project level for protection of ESA-listed species and/or designated critical habitat in “high risk” projects, an interagency monitoring protocol will be developed by 2007. The expectation being that this protocol would be applied to high risk projects to determine the effectiveness of Regional EIS standards, and additional standards or protection measures applied at finer scales, in reducing potential effect pathways (e.g. disturbance, sedimentation, exposure to herbicides, etc.) for listed species.

In the interim, information obtained from implementation/compliance monitoring reports for “high risk” projects will be reviewed in 2005 and 2006 to inform the development of a consistent monitoring protocol for ensuring that standards and protection measures were effective. This 2-3 year lag time before protocol are developed and effectiveness monitoring is implemented does not apply to aerial application of herbicides. All projects with aerial applied herbicide will include a monitoring plan to assess the effectiveness of measures in protecting ESA-listed species and/or designated critical habitat.

Until a Regional, interagency effectiveness monitoring protocol for ESA-listed species and/or designated critical habitat is developed (2007), the need for effectiveness monitoring on “high risk” projects will be evaluated by Level 1 or other interagency technical teams during Section 7 consultation. Recommendations for additional effectiveness monitoring beyond that described in this framework will require that Level 2 or other appropriate interagency management team agree to the recommendations of the technical or Level 1 team for the project. This process will help lead the Region toward efficient and reliable data collection and allow statistical analysis of the data gathered.

Terminology

The following terms may be found in the text when discussing treatment methods. They may be used as targets or objectives for developing site-specific treatment strategies.

Eradication: Attempt to totally eliminate an invasive plant species from a Forest Service unit, recognizing that this may not actually be achieved in the short term since re-establishment/re-invasion may take place initially.

Control: Reduce the infestation over time; some level of infestation may be acceptable.

Contain: Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories.

Suppress: Prevent seed production throughout the target patch and reduce the area coverage. Prevent the invasive species from dominating the vegetation of the area; low levels may be acceptable.

Tolerate: Accept the continued presence of established infestations and the probable spread to ecological limits for certain species. Try to exclude new infestations through prevention practices. This is for species where other levels of effort have not been successful.

Prioritization of infestation treatments should be based on the following decision pathway. Highest priority treatments should be focused on new invaders and early treatment of new infestations, followed in priority by containment, then control of larger established infestations. Moody and Mack (1988) demonstrated in a simple geometric model that small, new outbreaks of invasive plants eventually would occupy an area larger than the source population. Control efforts that focus on the large, main population rather than the new small satellites reduced the chances of overall success. The ability to detect and destroy the new, small infestation was crucial to control of invasive species and should be combined with efforts to control established populations. Another important point for consideration of treatments is control costs. A maintenance strategy focused on control may be more economically feasible than attempting to eradicate large populations.

Another model being used is to apply the fundamentals of wildfire management to invasive plant control. Thinking of weeds as a slow-moving wildfire can provide a valuable perspective and generate useful ideas when developing and implementing invasive plant strategies (Dewey, 2003). Prevention, early detection, rapid response, contain/control, and site restoration are terminologies that are interchangeable in wildfire management and invasive plant control. Focusing on spot fires (or new infestations), containing the size around the perimeter and mopping up (or returning to ensure all controlled sites are eradicated) may be a means to help focus planning efforts.

The methods and factors for prioritizing invasive plant sites for treatments on the Forests in Region Six generally follow a similar decision-making model. Table II - 12 is based on a Forest Service guide for how to prioritize sites and select treatment methods (USDA Forest Service, 2001).

Table II - 12 - Priorities for Treatment and Selection of Treatment Methods. Priority Description Treatment – choice based on site-specific conditions

Priority	Description	Treatment – choice based on site-specific conditions
Highest Priority for Treatment	* Eradication of new species (focus on aggressive species with potential for significant ecological impact including but not limited to State listed high priority noxious weeds) * New infestations (e.g. populations in areas not yet infested; "spot fires"; any State or Forest priority species). * Areas of concern such as: Areas of high traffic and sources of infestation (e.g. parking lots, trailheads, horse camps, gravel pits) Areas of special concerns: (e.g. botanical areas, wilderness, research natural areas, adjacent boundaries/access with national parks) Riparian corridors where high threat species such as knotweeds occur.	1. Manual/mechanical - isolated plants or small populations. 2. Herbicide treatment if manual/mechanical is known to be ineffective or population too large. 3. Remove seed heads. This is an interim measure if cost/staff is an issue. 4. Seed to restore treated areas; use native species when possible.
Second Priority of Treatment	* Containment of existing large infestations (e.g. focus on State-listed highest priority species or Forest priority species) – focus on boundaries of infestation. * Roadsides – focus first on access points leading to areas of concern.	1. Manual/mechanical - isolated plants or small populations in spread zones. 2. Herbicide treatment for larger populations along perimeter. 3. Seed to restore treated areas to create a buffer from spread; use native species when possible.
Third Priority of Treatment	* Control of existing large infestations (e.g. State-listed and Forest second priority species)	1. Disperse bio-control agents on large infestations 2. Livestock grazing 3. Mechanical 4. Herbicide application
Fourth Priority of Treatment	* Suppression of existing large infestations when eradication/control or containment is not possible.	1. Bio-control on large infestations 2. Livestock grazing 3. Mechanical 4. Herbicide application along perimeters

Table II - 13 displays herbicides proposed for use in the Proposed Action (PA) and a range of application rates for each chemical. Effects analysis assumes that typical rates would be applied; however the actual effective rate would vary depending on application method, target species, and PDF. Broadcast applications would never exceed typical label rates shown in Table II - 13. Non-broadcast methods such as spot, wicking or wiping may be applied at rates greater than typical, but that would happen infrequently and only where necessary to be effective.

Table II - 13 - High, Typical, and Low Application Rates for Herbicides

Herbicide	Highest Application Rate Lbs. a.i./acre	Typical Application Rate Lbs. a.i./acre	Lowest Application Rate Lbs. a.i./acre
Chlorsulfuron	0.25	0.056	0.0059
Clopyralid	0.50	0.35	0.10
Glyphosate	7.00	2.00	0.50
Imazapic	0.19	0.130	0.031
Imazapyr	1.25	0.45	0.03
Metsulfuron Methyl	0.15	0.03	0.013
Picloram	1.00	0.35	0.10
Sethoxydim	0.38	0.30	0.094
Sulfometuron Methyl	0.38	0.045	0.03
Triclopyr	10.00	1.00	0.10

Additives, Inert Ingredients, and Impurities

Adjuvants are compounds added to the formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers). For example, Surfactants are one type of adjuvant that makes the herbicide more effective by increasing plant absorption. PDFs have been developed to reduce potential impacts from adjuvants.

Inert compounds are those that are intentionally added to a formulation, but have no herbicidal activity and do not affect the herbicidal activity. Inert additives facilitate the herbicide's handling, stability, or mixing.

Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process. See Appendix G for more information regarding surfactants commonly used by the Forest Service.