Invasive Plant Species – Noxious Weeds

Introduction

Invasive, non-native plants species can inhabit and negatively alter native plant communities. A number of invasive species are recognized as noxious, meaning laws have been developed to restrict their spread and effect on the environment. Dry vegetation types and areas affected by road development, grazing, logging, fire, or other disturbances are most susceptible to weed invasion. Typically, invasive species have the ability to spread rapidly and reproduce in high numbers, which enables them to effectively crowd out native plant populations. Some can pose serious threats to the composition, structure, and function of native plant communities. Field observations, road surveys, and weed treatment records indicate that the presence and extent of invasive plant populations is established and has a high potential to spread within the Hemlock Elk Project Area.

Analysis Area

The analysis area(s) for forest vegetation are varied spatially and temporally based on the forest attribute being analyzed. The scale of the analysis areas were chosen to allow sufficient size and time to illustrate the potential effects of the alternatives, without those effects diminishing to unnoticeable levels. The following descriptions identify the analysis areas for this project.

Spatial Bounds

The spatial bounds of the analysis area for noxious weeds is based on the area of the project's influence/impacts on the potential introduction and spread of noxious weeds within the project area. Because ground disturbance increases the potential for weed establishment and spread, the analysis area includes all treatment units and road systems with activity related to this proposed project.

Temporal Bounds

The temporal bounds are up to 50 years after the decision is signed. Following project implementation, vegetation conditions would take approximately 10 to 50 years to return to closed overstory. Then, overstory and understory tree and shrub canopy cover conditions would exist to shade out and compete with potentially occurring shade-intolerant noxious weeds establishing after proposed activities. During this recovery time, ground activities, opening of the canopy, and increased soil disturbance from treatments would increase the potential for weed establishment. Shade tolerant weeds, such as hawkweed, may persist indefinitely even after the canopy closes. It is unknown, but expected that after a 50-year period, the rate of new infestations due to the disturbance would be at a minimum; therefore, the temporal bounds considering both shade-tolerant and intolerant weed species is up to 50 years.

Data Sources, Methods, and Assumptions Used

The Montana State noxious weed list was consulted and invasive species of concern were identified**.** In addition, a recent weed risk assessment (WRA) project in the Northern Region of the USDA Forest Service (USDA Forest Service 2003) identified additional species that pose a threat to native vegetation**.** Noxious weed surveys have been conducted along major road corridors and within the

project area as part of this and other projects on the forest**.** A summary of the current noxious weed inventory for the project area is found in Table 3-22.

Weed inventories are documented in a USDA Forest Service National Weeds Database, NRIS TERRA Invasive Plants Database (Natural Resource Inventory System)**.** Population of the database began in 2005. Weed inventories from the 2007 field season are not yet documented in the database**.** A summary is available in the Existing Conditions Section and copies of the survey forms are found in Project File Exhibit H-6.

This assessment of non-native and noxious weeds incorporates by reference the NIWC Decision Notice and EA (USDA 2001b). The objective of the Forest-wide project is to implement an adaptive integrated pest management strategy to control and reduce the presence of noxious and invasive weeds on NFS lands.

Measurement Indicators

Measurement indicators considered in this analysis are acres of existing noxious weed infestations, miles of temporary roads and haul routes proposed for the project, and acres of ground disturbance from the proposed project. Other more qualitative measurement indicators are invasiveness of the noxious weed species, invadability of habitat, and trends of infestation of noxious weed species.

Affected Environment

Historic Conditions

In the late 1800s, exotic plant species rapidly became established in North America due to the introduction of species for agricultural and experimental purposes. This introduction rate dropped in the mid-1900s because of the depression, wars, and decreased travel abroad. A dramatic increase in global travel and trade introduced many more species, and they are rapidly expanding in aerial distribution. Some of these species are growing at an exponential rate. Locally, establishment and rate of spread may have been influenced by timber harvest, road building, and to some degree grazing; all vectors for the spread of weeds. Most of these activities began in the 1960s on the Flathead National Forest. Some roadless areas remain relatively weed free because of healthy undisturbed native plant communities where few vectors exist for the spread of weeds.

The Flathead National Forest has been less affected than many other public lands because most invaders are best adapted to grasslands, shrublands, and warmer/drier forest types than exist here. Regardless, exotics have significantly altered species composition locally. Areas of high risk, severely impacted by noxious invaders adapted to our climate do occur, and have altered native plant communities.

Existing Conditions

In the project area, there is a concern that invasive plants may spread into treatment areas and undisturbed native habitats, especially where susceptible conditions exist. Weed invasion and expansion has been observed in areas of past timber management projects. Noxious weeds may alter organic matter distribution and nutrient flux such as spotted knapweed’s greater ability to uptake phosphorus over some native species in grasslands (Thorpe et al. 2006). In addition, noxious weeds may influence species richness and displacement of resident species by reducing native seedling establishment (Yurkonis et al. 2005).

Invasive species considered for this analysis are those listed as noxious by the State of Montana, as well as other exotic species determined to be highly invasive. They are displayed below in Table 3-22. Of the 1062 vascular plant species known on the Flathead National Forest, about 110 are classified

as exotic. Of these, over 42 species are classified as invasive. Within the project and adjacent areas, 11 noxious weed species and 8 undesirable weed species of concern have been observed as shown in Table 3-22.

TABLE 3-22.
NOXIOUS WEED SPECIES OF CONCERN WITHIN VICINITY OF THE HEMLOCK ELK PROJECT AREA

Scientific Name	Common Name	Known from the Project Area	Potential Invader to the Project Area
Category 1 – Widespread Established[b]			
Acroptilon repens (C. repens)	Russian knapweed		X
Cardaria draba	hoary cress		X
Centaurea biebersteinii (C. maculosa)	spotted knapweed	X	
Centaurea diffusa	diffuse knapweed		X
Cirsium arvense	Canadian thistle	X	
Convolvulus arvensis	field bindweed		X
Cynoglossum officinale	hound's-tongue	X	
Euphorbia esula	leafy spurge		X
Hypericum perforatum	St. John's-wort	X	
Leucanthemum vulgare	ox-eye daisy	X	
Linaria dalmatica	Dalmatian toadflax		X
Linaria vulgaris	yellow toadflax	X	
Potentilla recta	sulphur cinquefoil	X	
Tanacetum vulgare	common tansy	X	
Category 2 – Recently Established, Rapidly Spreading[b]			
Hieracium aurantiacum	orange hawkweed	X	
Hieracium caespitosum, H. floribundum, H. piloselloides, H. pretense	yellow hawkweed complex	X	
Lepidium latifolium	perennial pepperweed		X
Lythrum salicaria	purple loosestrife		X
Lythrum virgatum	wandlike loosestrife		X
Ranunculus acris	tall buttercup	X	
Senecio jacobaea	tansy ragwort		X
Tamarix spp.	salt cedar or tamarisk		X
Category 3 – Not Yet Detected or Small Occurrenceb			
Centaurea solstitialis	yellow starthistle		X
Chondrilla juncea	rush skeletonweed		X
Crupina vulgaris	common crupina		X
Iris pseudacorus	yellowflag iris		X
Isatis tinctoria	dyer's woad		X
Myriophyllum spicatum	Eurasian water milfoil		X
Additional Invasives of Concern for the Flathead National Forest			
Achillea nobilis	noble yarrow	X	
Artemisia absinthium	absinthium	X	
Bromus tectorum	cheatgrass		X
Campanula rapunculoides (undesirable)	creeping bellflower		X
Carduus nutans	musk thistle		X
Chorispora tenella	purple mustard		X

TABLE 3-22.
NOXIOUS WEED SPECIES OF CONCERN WITHIN VICINITY OF THE HEMLOCK ELK PROJECT AREA

Scientific Name	Common Name	Known from the Project Area	Potential Invader to the Project Area
Cirsium vulgare	bull thistle	X	
Elymus repens	quackgrass		X
Euphorbia species (cautionary)	spurge (all)		X
Onopordum acanthium	Scotch thistle	X	
Phalaris arundinacea	reed canarygrass	X	
Potentilla argentea	silvery cinquefoil	X	
Sonchus spp.	perennial sowthistle	X	
Tragopogon dubius	goat's bear/salsify	X	
Tripleurospermum perforata (Matricaria inodora, M. perforata) (undesirable)	scentless chamomile		X
Veronica officinalis	common speedwell		X

a Nomenclature follows the USDA Plants Database: USDA, NRCS 1999. The PLANTS database (http://plants.usda.gov/plants). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

b Montana Department of Agriculture Noxious weed categories.

Category 1 is defined as noxious weeds that are currently established in the State and generally widespread in many counties of the state. Management criteria include awareness and education, containment and suppression of existing infestations, and prevention of new infestations. These weeds are capable of rapid spread and render land unfit or greatly limit beneficial uses.

Category 2 is defined as noxious weeds that have recently been introduced into the state or are rapidly spreading from their current infestation sites. These weeds are capable of rapid spread and invasion of lands, rendering lands unfit for beneficial uses. Management criteria include awareness and education, monitoring and containment of known infestations and eradication where possible.

Category 3 is defined as noxious weeds that have not been detected in the state or may be found only in small, scattered, localized infestations. Management criteria include awareness and education, early detection and immediate action to eradicate infestations. These weeds are known pests in nearby states and are capable of rapid spread and render land unfit for beneficial uses.

Surveys

Project specific surveys for weeds are partially completed from 2007 surveys. The 2007 surveys have not been included in the TERRA database. However, inventories for various projects (e.g., timber stand exams, sensitive plant surveys) within the project area have occurred throughout the years (Project File Exhibit H-8). Approximately 839 acres were surveyed for noxious weeds in 2004, 2005, and 2006 within the project area and vicinity. Additional, project specific surveys along haul routes and within treatment units will be conducted during the summer of 2008.

TABLE 3-23.
ACRES INFESTED WITH WEED SPECIES OF CONCERN ALONG 839 ACRES IN VICINITY OF HEMLOCK ELK PROJECT AREA

State Category	Species	Common Name	Acres Occupied within Surveyed Areas
State Noxious Weed Species			
1	*Cirsium arvense*	Canada thistle	70.78
1	*Centaurea biebersteinii*	spotted knapweed	50.23
1	*Leucanthemum vulgare*	oxeye daisy	41.08
1	*Potentilla recta*	sulphur cinquefoil	26.22
1	*Hypericum perforatum*	common St. John' s wort	17.16
2	*Hieracium aurantiacum*	orange hawkweed	6.03
2	*Hieracium spp.*	yellow hawkweed complex	2.41
1	*Linaria vulgaris*	common toadflax	1.10

TABLE 3-23.
ACRES INFESTED WITH WEED SPECIES OF CONCERN ALONG 839 ACRES IN VICINITY OF HEMLOCK ELK PROJECT AREA

State Category	Species	Common Name	Acres Occupied within Surveyed Areas
1	*Tanacetum vulgare*	common tansy	0.19
2	*Ranunculus acris*	tall buttercup	0.02
Other Exotic Species of Concern			
NA	*Cirsium vulgare*	bull thistle	50.95
NA	*Phalaris arundinacea*	reed canarygrass	4.82

* surveys from in vicinity from other projects – does not include 2007 data.

Eleven invasive species were mapped in recent surveys (2004 to 2006). The most abundant and widely-distributed noxious weed species near the project area are Canada thistle (*Cirsium arvense*), spotted knapweed (*Centaurea biebersteinii*), oxeye daisy (*Leucanthemum vulgare*), sulphur cinquefoil (*Potentilla recta*), St. John's wort (*Hypericum perforatum*), orange hawkweed (*Hieracium aurantiacum*), bull thistle (*Cirsium vulgare*) and reed canary grass (*Phalaris arundinacea*) as shown in Table 3-23.

The 2007 surveys found similar noxious weed species and infestation rates as the 2004 to 2006 data, with the addition of noble yarrow (*Achillea nobilis*), absinthium (*Artemesia abisinthium*), and Scotch thistle (*Onopordum acanthium*). These species are considered other exotic species of concern. Scotch thistle is widely distributed in the Flathead Valley, but this is the first documented occurrence close to NFS lands. Table 3-24 summarizes the 2007 Survey Data.

TABLE 3-24.
WEED SPECIES OF CONCERN FOUND IN THE 2007 HEMLOCK ELK PROJECT AREA SURVEYS

Unit or Haul Route	Species	Comments
Adjacent to Unit #10	absinthium, spotted knapweed, oxeye daisy, Canada thistle	In previously harvested area adjacent to Unit 10.
Unit #12	oxeye daisy, Canada thistle	In seasonally wet meadow
Unit #13	oxeye daisy, Canada thistle	In seasonally wet meadow
Unit #14	Canada thistle	In seasonally wet meadow
Adjacent to Unit #14	Scotch thistle	PCTC land adjacent to Unit #14 on roads and landing.
Road #10291	spotted knapweed, oxeye daisy, Canada thistle, St. John's wort, orange hawkweed, yellow hawkweed	
Road #9586	spotted knapweed, oxeye daisy, Canada thistle, St. John's wort, orange hawkweed, sulphur cinquefoil	Weeds extend into previously harvested areas.
Road #9591	spotted knapweed, oxeye daisy, Canada thistle, St. John's wort, orange hawkweed, sulphur cinquefoil, noble yarrow, tall buttercup, reed canarygrass, bull thistle	Weeds also extend far from road into cleared areas on PCTC land.

Spotted knapweed, sulphur cinquefoil, common tansy, and ox-eye daisy are roadside species and generally have not invaded into understory forested habitats. These species do, however, have potential for expansion into open canopies and naturally occurring forest openings, such as grasslands, open rock outcrops, and other open areas created by fire. Canada thistle is a generalist and can invade in almost any habitat from dry to wet disturbed areas with canopy openings (personal observation).

State-listed Category 2 noxious weed species yellow and orange hawkweed are of greatest concern in the area. These species are recently established (within the last 5 to 10 years) and are rapidly expanding in established areas. They can invade undisturbed areas where native plant communities are intact. These species can persist in shaded conditions and often grow underneath shrubs making eradication very difficult. Their stoloniferous (growing at the surface or below ground) habit can create dense mats that can persist for 30 years and spread to densities of 3500 plants per square mile (Thomas and Dale 1975).

The amount and distribution of the above invasive plants is variable within the project area, ranging from scattered isolated individuals to small dense groups. These species occur along portions of many of the roads, gravel pits, and other disturbed sites. Invader weed species tend to be shade intolerant, with the exception of orange and yellow hawkweed (personal observation). Invasive plants usually establish in disturbed areas where other plants are slow to establish and recover. These areas are mostly associated with road right-of-ways, landing sites for timber harvesting, gravel pits, mechanically-piled slash burn piles, skid roads, mechanical site preparation treatment on well drained or shallow soils, power line and railroad corridors, and mines. Most of the area outside of these more heavily disturbed sites has experienced limited invasive plant establishment.

Special Habitats of Concern for Weed Introduction

Vegetation habitat type can influence susceptibility to weed invasion. Surveys and aerial imagery have detected many wetland features in the project area. Wetland areas are often more susceptible to infestations from weeds adapted to mesic habitats than upland forest. Additionally, once noxious weeds are established in wetland areas, they are difficult to eradicate with herbicide due to regulations of herbicide use near water. Chemical treatments in such situations are limited to a more limited set of herbicides which can be applied near water. Many vegetation treatment units in the Hemlock Elk Project Area contain or are adjacent to wetland areas. These areas may be riparian, fens and fen margins, forested wetlands, or marshes, seeps, and wet meadows.

Weed Management

The Flathead National Forest completed the NIWC EA (Project File Exhibit Q-5) evaluating the effects of treating noxious and invasive plants. A Forest-Wide Weed Management Plan is currently under development to outline methodology in prioritizing treatment and inventory and monitoring protocols. In addition, this plan would outline a method for minimizing the establishment and spread of invaders in all projects and special use permits, such as grazing allotments and timber management areas. Currently, treatment and inventory is prioritized at quarterly meetings of the Flathead National Forest Weed Advisory Group. Factors for prioritization include:

- **Weed invasive category** as outlined in the NIWC EA (Project File Exhibit Q-5) and shown in Table 3-25 below.
- **Level of invasive risk** to a potential vegetation group.
    - The Western Montana Planning Zone Weed Risk Assessment is used as a tool to ascertain the level of invasiveness for weed species within potential vegetation groups (Project File Exhibit H-7).
- **Special areas** that are threatened by weed invasion.
    - Particular areas of greater conservation concern need additional protection from weed invasion. Examples would be designated wilderness, sensitive plant habitat, and pristine native plant communities.
- **Potential for increased off-site movement** of weeds that could increase the spread to new areas.

- Weed infestations that are located along roads, at trailheads, in grazing allotments, or at high use recreation sites are higher priority for treatment because of the increased vectors of spread in these areas.

TABLE 3-25.
WEED TREATMENT PRIORITIZATION ON THE FLATHEAD NATIONAL FOREST

Forest Priority	State Category	Objectives	Prioritization Factors
1	3 (Potential Invaders)	Currently absent on Flathead National Forest; goal is prevention, then eradication, if possible	▪ detection ▪ available funds
2	2 (New Invaders)	Localized containment and strong emphasis on overall population reduction	▪ available funds ▪ relative invasive nature of the species and its potential to displace native vegetation ▪ potential for off-site movement of seeds ▪ relative ecological importance of rarity of the site that could be damaged by the presence of the invader species
3	1 (Widespread Invaders)	Containment and localized reduction of populations	▪ available funds ▪ relative invasive nature of the species and its potential to displace native vegetation ▪ potential for off-site movement of seeds ▪ relative ecological importance of rarity of the site that could be damaged by the presence of the invader

Control and Containment

Efforts to control the spread of noxious weeds include prevention, containment, and eradication methods. Eradication is generally limited to localized areas and Category 2 and 3 Species. Methods used for eradication include hand pulling and herbicide applications.

Containment methods are used to prevent weeds from spreading into new areas and reducing the coverage, if possible, in existing infestations. Containment methods include closing infested areas to travel, washing vehicles and equipment upon entering or leaving an infested area, using weed free seed and straw mulch for revegetation, hand pulling, and herbicide application around the perimeter of the infestation. Prevention uses similar techniques as containment, with the objective of preventing a new weed infestation rather than limiting spread of an existing one.

For a number of years, noxious weeds in the Hemlock Elk Project Area have been sprayed with herbicides along major roads. Minor roads, especially those that crossed lands previously owned by PCTC, have not been targeted for weed control. Roads #561 and #9591 have been the focus of weed control efforts, although these roads have not been sprayed every year.

Environmental Consequences

Alternative A - No Action
Direct and Indirect Effects

Alternative A provides the least opportunity for creating weed habitat since there would be no new areas of ground disturbance. However, invasive species currently known to the analysis area would have potential for expansion. Roads currently open could continue to serve as corridors for weed spread. Invasive species considered in the analysis area could potentially expand by using roads as vector corridors. Once seeds are dispersed to a new site, habitat type and disturbance patterns influence the establishment potential of invasive plant species. Because Alternative A proposes no

ground disturbance related to this project, the potential for noxious weed species to establish in undisturbed areas would be low. With the exception of orange and yellow hawkweeds, noxious weed species commonly require disturbance, bare ground openings, and reduced competition (early successional habitat conditions) for initial establishment. However, if established, the ability for weed species to out-compete existing native vegetation, to sustain its occurrence, and potentially alter native habitat functions is largely dependent on the habitat conditions and the life history, morphology, phenology, ecology, and reproductive biology of the individual weed species.

Orange and yellow hawkweeds are Category 2 species (recent invaders to Montana). Life history and reproductive biology of these two invasive hawkweeds allow for rapid spread, once established, not only on open areas, but also under forested conditions. Unlike the other known weeds in the project area that remain primarily within open disturbed areas, orange and yellow hawkweeds can spread into forested habitats beneath the forest canopy despite reduced understory light levels.

Alternative A would also not expose the wetland habitats to opening up adjacent forested vegetation that currently insulate these areas from weed establishment. Bull thistle, Canada thistle, common tansy, oxeye daisy, reed canarygrass, tall buttercup, and orange and yellow hawkweeds are all found within the project area and are common wetland invaders.

Alternative A – No Action
Cumulative Effects

The project area is highly susceptible to weed invasion due to its proximity and inclusions in portions of the WUI and proximity to adjacent ownership. Weed establishment is opportunistic in disturbed soils and open bare ground, common in development of urban areas. This may result in a higher risk level of spread from adjacent urban areas to disturbed areas in the project area. Additionally, patchwork sections of ownership with PCTC sections adjacent to NFS land have created an additional risk of invasion, as much of the adjacent PCTC land is currently cleared and infested with noxious weeds.

Past ground-disturbing activities such as timber harvest, road construction, trail construction, and road maintenance have contributed to the establishment and spread of noxious and invasive plants in the area. Recreational and economic land uses (hunting, hiking, fishing, logging, firewood gathering, etc.) have also promoted the spread of weed seeds, because users and their vehicles become vectors for weed seed spread. Wildlife have likely contributed to weed spread in the past by transporting weed seeds across the landscape. All these activities are likely to continue into the future to some degree.

The No Action Alternative would be less likely to address existing weed populations within the project area than the action alternatives would (that provide for treatment of haul routes within the project area). The No Action Alternative would create the least amount of new ground-disturbed areas for potential new weed establishment and spread. Nevertheless, the total existing condition of infested weed acres is expected to continue to increase with existing uses and conditions in the No Action Alternative, although not as great of extent as with the Action Alternatives.

For all alternatives, there is the potential for wildland fire. A wildland fire within the project area could potentially increase and spread noxious weeds into new areas. Wildland fire would increase exposed bare ground that may be susceptible to new weed establishment. However, areas currently free of weeds would be more resistant to weed establishment due to the ability of the existing native component to compete with new invaders. Areas most at risk of weed encroachment following a wildland fire are areas adjacent to roads and areas where suppression activities have occurred with nearby existing weed populations.

Alternatives B, C, and D
Direct and Indirect Effects

Vegetation treatments and temporary road construction are proposed for this project. General effects on the risk to weed establishment and spread are discussed below by activity. Areas with more acres of ground disturbance or open roads are expected to have greater vulnerability to weed colonization and spread, especially where disturbance occurs next to existing weed populations.

Timber Harvest and Other Vegetation Treatments

The effects of logging are variable depending on the amount of ground disturbed during the activity. The more bare soil exposed, the more germination substrate is available for colonizing weed seeds. Logging systems can impact the amount of ground disturbance. The action alternatives propose the same logging systems, with the majority of the treatment acreage using tractor systems and small acreage of mechanical and hand treatment. The differences in these logging systems and prescriptions by alternative are displayed in Table 3-26 below.

The amount of area disturbed may vary by prescription planned. Prescriptions with more volume removed, more canopy cover (shade) removed, and more soil disturbed would have more potential for weed invasion and persistence. Clearcut with Reserves, Patch Clearcut with Reserves, and Seed Tree with Reserves would pose the greatest risk for weed invasion and persistence compared to the other prescriptions. Alternatives B and C propose similar acreage for these prescriptions. Alternative D has the least number of harvest acres and the least acreage of the most impactive prescriptions. Alternative D would pose the least risk of noxious weed spread considering prescription type.

TABLE 3-26.
PRESCRIPTION AND LOGGING SYSTEM BY ALTERNATIVE

	Alternative B	Alternative C	Alternative D
Commercial Harvest Treatment Acres			
Clearcut with Reserves	58 acres	58 acres	0 acres
Patch Clearcut with Reserves	16 acres	16 acres	0 acres
Seed Tree with Reserves	129 acres	129 acres	0 acres
Thin From Below – Commercial	404 acres	404 acres	511 acres
Sanitation	51 acres	51 acres	51 acres
Salvage	10 acres	10 acres	30 acres
Total Harvest Acres	**668 acres**	**668 acres**	**592 acres**
Non Commercial Treatment Acres			
Thin From Below	10 acres	10 acres	10 acres
Pre-Commercial Thinning	61 acres	61 acres	61 acres
Total Acres of Commercial and Non-Commercial Treatments	**739 acres**	**739 acres**	**663 acres**
Logging System Acres			
Tractor	668 acres	668 acres	592 acres
Mechanical Treatment in Thin From Below Non-Commercial Unit	10 acres	10 acres	10 acres
Hand Treatment in PCT Units	61 acres	61 acres	61 acres

TABLE 3-26.
PRESCRIPTION AND LOGGING SYSTEM BY ALTERNATIVE

	Alternative B	Alternative C	Alternative D
Total Logging System Acres	**739 acres**	**739 acres**	**663 acres**
Seasonality of Treatment			
Acres Required for Winter Logging	0 acres	281 acres	0 acres

Vegetation habitat type can influence susceptibility to weed invasion. Surveys and aerial imagery have detected many wetland features in the project area. Wetland areas are often more susceptible to infestations from weeds adapted to mesic habitats than upland forest. The weeds currently known to exist in or near the project area that are adapted to mesic habitats are bull thistle, Canada thistle, common tansy, oxeye daisy, reed canarygrass, tall buttercup, and orange and yellow hawkweeds. Many vegetation treatment units in the Hemlock Elk Project Area contain or are adjacent to wetland areas. These areas may be riparian, fens and fen margins, forested wetlands, or marshes, seeps, and wet meadows. Although no treatments are proposed in wetland areas, the potential for weed expansion into adjacent wetlands or wetlands within treatment units exists. Design Criteria would include buffering of wetland features, which would offer some protection from noxious weed invasion (Refer to Table 2-15). However, as many weed species reproduce by aerially disseminated seed, these buffers may not be large enough to eliminate the potential spread of noxious weeds when compared to the protection offered by many acres of undisturbed forest. In addition, some crossings of streams and other wetland features could occur in and adjacent to treatment units, creating an establishment corridor. The associated soil disturbance and machinery vectors could increase the potential for noxious weed establishment in wetland areas.

Another consideration is the time of year vegetation treatments would occur. Winter logging could reduce the potential of weed spread. Although winter logging does not eliminate all soil impacts, this logging method would reduce the total equipment contact with soil substrates when compared to non-winter operations. Substrate that is protected by a layer of snow during harvest and skidding would have fewer disturbances to the native plant community and soil. Less disturbed native plant communities are more resistant to weed invasions than disturbed communities (Dukes 2002). Additionally, the potential of bringing in weed seeds to the units is reduced in the winter, as most weed seed would be under snow. Alternatives B and D do not propose any winter logging. Alternative C proposes 281 acres of winter logging. Winter logging would reduce soil disturbance and opportunity for weed establishment and dispersal. Winter logging is proposed in large areas that are currently weed free and contain a large number of wetland features (Refer to Table 2-8 which designates treatment units proposed for winter logging). Alternative C would decrease the risk of noxious weed infestation in upland forest and in wetland features susceptible to noxious weed invasion. Exposed substrate poses a higher risk for weed colonization than removal of overstory alone. Five of the units proposed as Seed Tree with Reserves or Clearcut with Reserves for winter logging in Alternative C have a less impactive prescription in Alternative D; nevertheless, winter logging in Alternative C would provide more protection from noxious weeds than Alternative D, which would retain more shade but have increased ground disturbance.

The effect of weeds on native plant communities from proposed fuels treatments also depends on the amount of ground disturbed during the activity. As with logging systems and prescriptions, the more bare soil exposed from the fuels treatment method, the more germination substrate is available for colonizing weed seeds. Whole tree yarding may create some ground disturbance moving the material to the landing, but then there is less subsequent ground disturbance treating the fuels in the unit, as disturbance is concentrated to the landing. Using excavators to pile fuels could cause ground disturbance and expose bare soil. Burning the piles reduces competing native vegetation and exposes bare mineral soil to create a favorable environment for noxious weeds. Burn piles often have

high incidence of noxious weed presence and persistence (personal observation). Chipping or lopping and scattering fuel material creates less potential for noxious weeds than burning in slash piles. As the prescription for acres of fuel treatment for these methods allows flexibility (whole tree yard or excavator pile and/or chip or burn etc.), there is no discernable difference between alternatives for potential noxious weed effects from fuels treatment prescriptions (Table 3-27).

TABLE 3-27.
FUELS TREATMENT METHOD ACRES

	Alternative B	Alternative C	Alternative D
Fuels Treatment Acres			
Whole Tree Yard/Excavator Pile/Chip/Burn	465 acres	465 acres	592 acres
Whole Tree Yard/Excavator Pile/Chip/Lop and Scatter	10 acres	10 acres	10 acres
Hand Piling and Pile Burning	61 acres	61 acres	61 acres
Whole Tree Yard/Excavator Pile/Burn	203 acres	203 acres	0 acres
Total Acres of Fuel Treatment	**739 acres**	**739 acres**	**663 acres**

Machinery can also spread weed seeds if not washed prior to use; therefore, Design Criteria include cleaning all off-road equipment before entering the area. Use of dedicated skid trails would also minimize spread across units. Other criteria designed to minimize soil impacts would also aid in reducing noxious weed spread. (Please refer to Table 2-15 for specific Design Criteria that would be implemented to control the spread of weeds.

Tree planting occurring throughout the area may also contribute to weed expansion. Vehicles and personnel could act as vectors for weed spread. However, planting activities would be of short duration with minimal impact to the soil. In addition, planting conifers would assist in regeneration of natural vegetation and reduce the potential for exotic weed establishment of shade intolerant species when conifers establish a canopy cover.

Temporary Road Construction and Haul Routes

Portions of the existing road network would be used to implement this project. Use of existing roads facilitates weed establishment because cars and trucks, along with mountain bikes and horses, are among the main vectors of weed spread. All alternatives propose similar miles of roads for hauling, with Alternative D having the least amount of miles (Table 3-28). Road maintenance to implement BMPs on haul routes would occur for all action alternatives. This activity could create new ground disturbance for potential new weed establishment.

TABLE 3-28.
ROAD MANAGEMENT BY ALTERNATIVE

	Alternative B	Alternative C	Alternative D
Road Management			
Haul Routes (BMPs to be applied to meet Timber Sale Requirements)	21.4 miles	21.4 miles	21.1 miles
Permit Haul Routes	1.5 miles	2.2 miles	1.5 miles
Temporary Road Construction	4.8 miles	4.7 miles	4.5 miles

Temporary road construction to access some units is also proposed for all action alternatives. All action alternatives propose similar mileage of temporary roads. Temporary road construction activities would expose bare soil and parent material, creating suitable substrates for weed germination. In addition, use of these temporary roads could also contribute to the dispersal and spread of weed seeds. Proposed weed control prevention methods and revegetation would lessen the establishment and spread of weeds (Refer to Design Criteria, Table 2-15 in Chapter 2).

Seeding and planting of forbs/shrubs would create competition with non-native invaders on the newly disturbed soils of the temporary roads. This may be effective short-term mitigation for weeds. However, over the long-term, temporary roads would remain on the landscape as these roads are not completely returned to their natural condition. Soil compaction and native vegetation removal still occurs despite Design Criteria for road reclamation. Over the long-term, the temporary roads would most likely have a mix of the planted revegetation species, new colonizers from the surrounding vegetation, and potentially some weed species.

The seeding of temporary roads as a conservation measure to reduce weed invasion has been occurring on the Flathead National Forest for past 30 to 40 years. Non-native mixes of grasses and forbs have primarily been used. Native grasses and forbs have only been applied on the Flathead National Forest for the last couple of years. Observations of some of the temporary roads constructed in the last 30 to 40 years indicate some success with prevention of weed invasion on these temporary roads. Shade-intolerant weed species, such as knapweed, are not as abundant as the native and non-native grass and forb seed mixes on these old roads. However, shade-tolerant species such as hawkweed (and sometimes Canada thistle and oxeye daisy) are often abundant along these old temporary roads (personal observations). There is no information on the circumstances of how these old roads were built or rehabilitated to make inferences on how or why the weeds established in these old road beds.

It is unknown how long the effects of the temporary road construction would persist on the landscape to act as corridors for weed establishment and invasion. Observations of old forest roads on the Flathead National Forest from over 50 years ago indicate that some roads may recover, with the surrounding forest vegetation inhabiting the old road template. Weed prevention measures were most likely not implemented during these older harvest operations. However, conditions during those times are unlike current existing conditions, which now have adjacent weed populations near proposed units.

Alternatives B, C, and D
Cumulative Effects

The Cumulative Effects Worksheet (Project File Exhibit H-4) considers and describes proposed activities in addition to the past, current, and reasonably foreseeable activities listed at the beginning of this chapter in Tables 3-1 and 3-2. Those activities that have cumulatively contributed indiscernible effects are not included in this section. Those activities that cumulatively affect the species or habitat are discussed below.

In addition to the cumulative effects described for Alternative A, the Action Alternatives (B, C, and D) would also contribute to cumulative effects to the degree described above for each proposed activity. Past, present, and foreseeable actions within the Hemlock Elk Project Area (Federal, State, and private) that may have affected or may affect noxious weeds include timber harvesting, road construction, maintenance, and reclamation, recreation and forest product gathering, noxious weed control, PCTC land sales, and stream habitat restoration. These actions may have historically affected noxious weed populations and may continue to have effects.

People, vehicles, domestic animals, wildlife, and wind are all vectors contributing to the transport of weeds within the project area. Once seeds are dispersed to a new site, habitat type, and disturbance patterns influence the establishment of potential invasive plant species. The potential for each

species to establish is also dependent on life history, morphology, phenology, ecology, and reproductive biology of the individual weed species. Activities that create ground disturbance provide a substrate for colonization of noxious weeds when propagules are present. In general, past, present, and future activities with the greatest amount of ground disturbance accompanied by a vector source of noxious weed seeds have the greatest potential for noxious weed establishment and spread.

Timber Harvesting and Prescribed Fire

Timber harvesting opens up the canopy and creates new substrate from ground disturbance for noxious weed colonization where propagules are present. Logging equipment may carry noxious weed seeds into the harvest area. Currently, there are are no data on the quantitative increase in weed infestations from past timber harvests in the Hemlock Elk Project Area, although weed invasion and expansion has been observed in other areas of past timber management projects. Past, present, and future timber harvests cumulatively contribute to increases in noxious weed distribution and populations.

Prescribed burning activities within the analysis area cumulatively contribute to increases to noxious weed distribution and populations. However, prescribed fire is generally of cool, low to moderate intensity. Although there is potential for weed establishment, the potential for establishment and spread into the burned areas is low due to the low intensity burns. Low-intensity burning, mimicking the natural fire, may invigorate native species germination, as native plants are adapted to natural disturbance such as fire. Should weeds become established, potential for spread of weeds would be lower than that of the ground disturbance of timber harvest. The prescribed burns would have short-term low-intensity disturbance that would promote understory native vegetation to compete with potentially establishing weeds.

Wildland Fire and Fire Suppression

The project area includes portions of the Crazy Horse Fire Area, which created conditions favorable for noxious weed establishment. As a disturbance process, fire has the potential to greatly exacerbate infestations of certain noxious weed species, depending on burn severity and habitat type (Fire Effects Information System 2004). Soil disturbance, such as that resulting from low and moderate burn severities from a wildfire and fire suppression related disturbances (dozer lines, fire camps, drop spots, etc.), provide optimum conditions for noxious weed invasion. Dry site vegetation types and road corridors are also extremely vulnerable, especially where recent ground disturbance has occurred.

Non-native invasive plants have a high potential to establish and spread into the burned areas within the project area, especially where optimum conditions exist as above. Inventory of historic fires on the Flathead National Forest [e.g., Moose (2001), Little Wolf (1994)] indicate that fire and related suppression efforts may favor weed invasions and population expansion. The Crazy Horse Fire cumulatively contributed to increasing weed distribution and populations. Fire suppression is likely to continue to occur in the project area.

Potential for future wildland fires would increase the risk and susceptibility for new weed invasion. For all action alternatives, ground disturbance would increase the potential for new weed establishment as discussed above. These areas would be more susceptible and less resistant to new invaders following a wildland fire due the the potential change in native community assemblages from weed established during previous ground disturbing activities.

Road Construction, Maintenance, Closure, and Reclamation

Road construction and maintenance creates ground disturbance, which contributes to the potential spread of noxious weeds. Road closures limit use of road and amount of new weed propagules spread into area. However, road closures may have also created conditions (overgrown with brush or

closed with berms) that prevented established weed populations from being treated by spraying of noxious weeds from a vehicle.

Road reclamation also limits the road use and amount of new propagules spread into an area. However, road reclamation also involves ground disturbance that can increase the spread of weeds. The areas are usually revegetated using seed where ground disturbance from water bar and culvert removals occurs. Revegetation using native species can compete with noxious weed establishment. Usually the remaining road surface not disturbed by machinery is not seeded or revegetated. Thus, the existing substrate could be colonized by existing noxious weed populations on the roadside not eradicated prior to reclamation. Treatment of noxious weeds may occur before reclamation, but reclamation of the road may prevent further treatment of weeds by spraying due to the closure of the road to vehicular traffic. In the short term, reclamation could increase the spread of weeds. In the long term, road reclamation could decrease amounts of weeds in the area for shade intolerant species, but could increase weeds that are shade tolerant, such as hawkweed, as they may persist and spread untreated into adjacent areas.

Stream Habitat Restoration

Stream habitat restoration projects have occurred, are proposed for resource enhancement projects, and could continue to occur. Culvert installation and replacement, placement of log structures, and equipment associated with these activities could cause ground disturbance and increase the potential spread of weeds. However, the small scope of these activities would have minimal additional contributions to overall weed infestations.

Special Use Permits

Special uses within the Hemlock Elk Project Area cumulatively contribute to moderate increases to weed distribution and populations due to road use and powerlines acting as corridors for weed distribution into new areas. Noxious weed control provisions are put in place where it is expected that special use activities could contribute to unwanted increases in noxious weed populations or distribution.

Land Acquisition

Land previously owned by PCTC and acquired by the Forest Service may be more likely to be treated for weeds than land owned by PCTC. Depending on treatment priorities, this could occur in conjunction with the goals to protect and restore important wildlife, fish, and wetlands habitat. Land acquisition could cumulatively decrease the potential spread of noxious weeds.

PCTC Land Sales

Land sale parcels that were harvested with associated road building could be highly infested with noxious weeds. Land sold would likely increase use and have increased potential for noxious weed spread. Current and future land sales would contribute cumulative effects of increasing weed distribution and populations.

Recreation and Forest Product Gathering

Hiking, horseback riding, camping, motorcycle and ATV riding, snowmobiling, boating, fishing, guiding/outfitting, driving, sightseeing, and forest product gathering are past, present, and reasonably foreseeable activities. People and associated activities can be vectors contributing to the transport of weeds within the project area. Trail and campground building and maintenance could create ground disturbance and increase the potential spread of weeds. Recreation has likely increased and would continue to increase noxious weeds in the project area, although the scope compared to large-scale

disturbance is minimal and likely limited to established roads, trails, campgrounds, and a few dispersed locations.

Noxious Weed Control

Future spraying of haul routes and other roads in the Hemlock Elk Project Area may temporarily decrease noxious weeds establishment and spread on a short-term basis. Populations of orange and yellow hawkweed (Category 2 species) have recently increased in the Swan Valley, shifting priorities in the project area so that treatment of more roads and more areas are expected in the future. While hawkweeds would be the primary target, all noxious weeds in a given area would be sprayed when that area is treated to control hawkweed. However, to maintain the gains accomplished by these treatments, more intensive long-term integrated management is needed. Ongoing and reasonably foreseeable noxious weed control within the project area would cumulatively contribute to maintaining or increasing total noxious weed distribution and populations due to the high levels of infestations and priorities for treatments.

Alternatives B, C, and D
Summary of Direct, Indirect, and Cumulative Effects

Cumulatively, the Hemlock Elk Project, in combination with past, present, and reasonably foreseeable actions, would contribute to increases in weed distribution and populations. Additional acres, outside and adjacent to the treatment units, would become more susceptible to weed invasion because of the action alternatives. Areas with greater miles of open roads, road use, and bare ground exposure would increase facilitation of weed spread, especially where adjacent noxious weed populations exist. This contribution to cumulative effects would be moderated, however, by Design Criteria (See Table 2-15) that would reduce the potential for new weed introduction and spread into existing un-infested areas, specifically:

- Weed treatments,
- Washing of equipment,
- Soil stabilization measures,
- Revegetation of disturbed sites,
- Restoration of constructed temporary roads, and
- Post implementation monitoring/treatment of areas with new weed establishment resulting from the vegetation treatments (See Appendix A of this document).

The objectives of the weed treatments associated with the action alternatives are to reduce the short-term potential for new establishment into the newly disturbed areas created by this project, not to reduce the total infested acres of the project area.

In summary, action alternatives would increase the infested noxious weed acres from existing conditions, more so than the No Action Alternative, even with the lack of weed treatments for the No Action Alternative. For all action alternatives, the risk of weed establishment is greater than the No Action Alternative, even with the risk of wildland fire effects on noxious weed establishment. This is due to the ground disturbance proposed for all action alternatives that would create new areas for potential new establishment of weeds and the decrease resistance to weed invasion following a wildland fire in areas with previous ground disturbance. Two alternatives propose prescription elements that combined would provide the lowest risk of noxious weed spread and persistence. Alternative C (acreage of required winter logging) combined with Alternative D (with the least amount of treatment acreage and least acreage of the most impactive prescriptions) would provide the least potential for noxious weeds.

Regulatory Framework and Consistency

Management direction for noxious and invasive weed control on the Flathead National Forest is set at the National and Forest levels. Forest Service policies were developed in response to Federal laws guiding implementation of noxious weed control actions. These policies are set forth in Amendment 2000-95-5 of the FSM, Chapter 2080, Noxious Weed Management, and have been incorporated into the Forest Plan. Treatment and monitoring of known weed populations in the project area would be implemented under the authority and guidance of the NIWC Decision Notice and EA (Project File Exhibit Q-5). These were designed to meet legal requirements and Forest Service policies for noxious weed control. The proposed project incorporates and is consistent with the NIWC Decision Notice. Design criteria and management requirements for actions proposed under this project follow requirements documented in the FSM amendment for noxious weed management, road, and timber management projects.