CHAPTER 1
PROPOSED ACTION AND ITS PURPOSE AND NEED

INTRODUCTION

The Gallatin National Forest (Forest) of the United States Department of Agriculture (USDA) proposes to implement specific invasive weed treatments on 13,260 of approximately 1.8 million acres of Forest land in support of the Gallatin National Land and Resource Management Plant (Forest Plan), U.S. Forest Service policy, and Executive Order 13112. The proposed weed treatment and management project is located on the Gallatin Forest, which is in parts of Carbon County, Gallatin County, Madison County, Meagher County, Park County, and Sweet Grass County, Montana (Figure 1-1). Proposed methods to control invasive weeds include a combination of ground and aerial application of herbicides, mechanical, biological, and cultural weed treatments. The proposed project area occurs only on National Forest lands. This document follows regulations as defined by the Council of Environmental Quality for implementing procedural provisions of the National Environmental Policy Act of 1969 (NEPA, as amended, 40 CFR1500-1508); US Forest Service Environmental Policy and Procedures Handbook (FSH 1909.15); and US Forest Service Handbook 3409 on Forest Pest Management.

DOCUMENT STRUCTURE

The Forest has prepared this environmental impact statement in compliance with the National Environmental Policy Act and other relevant federal and state laws and regulations. This document is organized into six chapters.

Chapter 1 – Purpose and Need for the Action: This chapter includes information on the history of the project proposal, background information on weeds and weed treatments, purpose of and need for the project, and the agency's proposal for achieving that purposed and need

Chapter 2 – Alternatives Considered: This chapter provides a detailed description of the agency's Proposed Action and Alternatives for achieving the stated purpose. Alternatives are developed based on potential impacts resulting from implementation of the Proposed Action and issues raised by the public and other agencies.

Chapter 3 – Affected Environment: This chapter describes the existing environment that could be affected by the proposed weed treatment program.

Chapter 4 – Environmental Consequences: This chapter describes the direct and indirect impacts, commitment of resources and cumulative effects associated with the Alternatives.

Chapter 5 – Public involvement, References and Glossaries: This chapter identifies the steps taken to involve the public, and lists the preparers and agencies consulted during development of this Environmental Impact Statement. There is also a list of references cited in this document and a glossary of terms.

Chapter 6 – Response to Comments on the Draft Environmental Impact Statement: This chapter will contain responses to substantive comments, and will be completed after comments are received on the Draft Environmental Impact Statement.

Appendices:

Appendix A – Best Management Practices for Invasive Weeds
Appendix B – Herbicide Safety
Appendix C – Wilderness Minimum Tool Guidelines
Appendix D – Surface Water Quality
Appendix E – Ground Water Analysis
Appendix F – Biological Assessment

Additional documentation, including detailed analyses of the project can be found in the project file at the Hebgen Lake Ranger District West Yellowstone, Montana.

BACKGROUND

The Federal Noxious Weed Act of 1974 defines a noxious weed as a "plant which is of foreign origin, is new to or is not widely prevalent in the United States, and can directly or indirectly injure crops or useful plants, livestock or fish and wildlife resources in the United States, or the public health" (P.L. 93-629).

The Montana Noxious Weed Control Act defines a noxious weed as "any exotic plant species established or potentially could be established in the State which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses, and is further designated as either a state-wide or county-wide noxious weed" (MCA 7-22-2101).

Executive Order 13112 (1999) directs all agencies to prevent introduction of invasive species, provide for their control, and to minimize economic, ecological, and human health impacts that invasive species cause.

US Forest Service Manual 2080 defines noxious weeds as "those plant species designated as noxious by the Secretary of Agriculture or by the responsible State official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host to serious insects or disease, and being non-native or new to or not common to the United States or parts thereof." The Forest includes tall larkspur, native to this area, to be treated as a weed on some areas where it causes livestock poisoning.

As a point of clarification, the term "noxious weeds" are those plants listed by the Federal, State or Counties, while "invasive weeds" are exotic or poisonous plants that have been identified as plants of concern on the Gallatin Forest and will be treated in the same manner as noxious weeds. Together these species will be referred to as invasive weeds throughout the rest of this document and assessment. See Table 2-2 for a current list of weed species.

Invasive Weeds On The Forest

Federal and state laws define invasive weeds primarily in terms of interference with commodity use of land. However, impacts of invasive weeds on non-commodity resources such as water quality, wildlife, and natural diversity are also of concern.

Other potential environmental effects of invasive weeds include:

- Adverse influence on rare and sensitive native plant species;

- Detrimental impacts to wildlife, especially big game species that use foothill and mountain slopes as critical winter range;
- Degrade habitat for upland game bird and waterfowl;
- Degradation of water quality through increased soil erosion;
- Reduction on native plant communities and forage for wildlife and livestock; and
- Diminished quality of recreational and wilderness experience.

Existing conditions on the Gallatin Forest vary widely in relation to landform, topography, land management objectives, land use, proximity to population centers, and other public and private land. Historic land management, land use, and natural disturbances (e.g., fire, landslides, floods, insect outbreaks) have resulted in varying severity of invasive weed infestations and potential for new infestations across the Forest.

Weed specialists and botanists have conducted field inventories and mapping of a total of 13,260 acres of invasive weeds throughout the Gallatin Forest. These surveys indicate there are at least 10,600 acres (gross area) of noxious weed species, 1,995 acres of invasive species and some 665 acres of concern tall larkspur. Some of the most prevalent weed species include: houndstongue which infests of 1,723 acres; Canada thistle on 1,774 acres; cheat grass on 1,930 acres; spotted knapweed 1,485 acres; and musk thistle on 903 acres (based on 2002 inventory, all gross area measurement). Other established and widespread weeds include: oxeye daisy on 313 acres; leafy spurge on 208 acres; Dalmatian toadflax on 3,336 acres; yellow toadflax on 570 acres; and common tansy on 103 acres. Smaller patches of the following weeds were also inventoried and mapped: scentless chamomile; yellow chamomiles; white top; plumless thistle; diffuse knapweed; Russian knapweed; bull thistle; field bindweed; poison hemlock; orange hawkweed; black henbane; St. Johnswort; field scabious; sulfur cinquefoil; field pennycress; and meadow knapweed.

There are three additional species of invasive plants not yet detected on the Forest but are established in adjacent areas and could be introduced and spread on the Forest. These species include: yellow hawkweed, perennial pepperweed and tall buttercup. A few plants of dyers woad have been found on the Forest but were eradicated. The best management for these new species is prevention, early detection, and eradication. Smaller patches are more feasible to eradicate than larger infestations.

Ecological Impacts Of Invasive Plants

Invasive plants can alter the structure, organization and function of ecological systems (Olsen, 1999), including soil, plants, and animal relationships (Kurz, 1995; Randal, 1996). Spotted knapweed dominance on many open timber and grassland communities on the Forest may be affecting soil properties such as microbial activity, nutrients and moisture, as well as increasing soil erosion. Native plant composition, diversity, species richness, and litter production are also affected. Changes in plant communities from native to non-native species impact wildlife species that depend on open timber and grassland for forage, and breeding and nesting habitat. Spotted knapweed is prevalent throughout the Forest and extensive research on this species has revealed numerous ecological impacts associated with its presence. A resent study has proven that spotted knapweed releases a phytotoxic chemical that inhibits the growth of Idaho fescue thus giving a competitive advantage to spotted knapweed (Harsh *et al.*, 2003). Other noxious weed species are expected to result in similar impacts to ecosystem processes. Examples of ecological impacts from spotted knapweed will dominate the discussion in this section, but this does not preclude the impacts caused by the presence other species.

Soil: Invasive plants can affect the structure of ecosystems by altering soil properties. Soil in areas dominated by invasive plants may have lower amounts of organic matter and available nitrogen than areas supporting native grasslands (Olson, 1999). Organic matter can be affected in various ways. For example, spotted knapweed has a deep taproot, which tends to decompose more slowly than the fine roots of native grasses, reducing the annual input of organic matter into the soil (Olson, 1999). Biologically active organic matter occurs within the top one to four inches of soil and may be more prone to loss even during minor run-off events. A study conducted by Montana State University (Lace *et al.*, 1989) found that runoff and sediment yield increase 56 percent and 192 percent, respectively, on spotted knapweed sites compared to sites dominated by native bunchgrass.

Soil nutrient levels may be affected by the presence of invasive species. For example, potassium, nitrogen, and phosphorous levels were 44 percent, 62 percent and 88 percent lower on soil from a spotted knapweed-infested site than from adjacent soil with a grass overstory in a study conducted by Harvey and Nowierski (Olson, 1999). Plants that reduce soil nutrient availability to very low levels have a competitive advantage over neighboring plants (Olson, 1999).

Soil microorganisms can either benefit or be impacted by the presence of secondary compounds produced by some weedy species. Most microbial populations adapt to secondary compounds by increasing their populations, thereby increasing the rate of breakdown of secondary compounds. Conversely, these secondary compounds may limit activity and growth of aerobic soil microbial populations, resulting in thick liter layers and slower nutrient cycling (Olsen, 1999).

Soil moisture can also be altered by the presence of tap-rooted weedy species. Tap-rooted forbs may reduce infiltration because they do not have dense, fine root systems of grasses, which contribute organic matter and enhance soil structure. Infested sites may also have more extreme temperature changes because of lower soil water content; poorer soil aggregation; and greater exposure of soil to direct sunlight (Olson, 1999). Water has a high capacity to store heat. By reducing soil water content in surface soil, greater evaporation enhances rapid heating and cooling of near-surface layers. This will increase runoff by lowering infiltration, again reducing thermal conductivity and capacity of the soil to store heat resulting in greater temperature extremes at the soil surface (Olson, 1999).

Native Plant Communities: Invasive plants have a variety of mechanisms giving them a competitive advantage over native species. For example: invasive plants can be alleopathic (contain compounds that suppress other plants); produce abundant seed; establish and spread in a wide range of habitats; grow rapidly; initiate growth earlier in the season and later in the season; exploit water and nutrients better; have no native enemies; and are not palatable to large herbivores. Once established, non-native plants threaten biological diversity of native plant communities and can alter ecosystem processes.

As mentioned above spotted knapweed is prevalent throughout the Gallatin National Forest. It occurs primarily on roadsides, on grasslands and open forest community types. Invasion of knapweed into disturbed and undisturbed native bunchgrass communities is well documented (Myers and Berube, 1983; Tyser and Key, 1988; Bedunah and Carpenter, 1989; Lacey *et al.*, 1990). As spotted knapweed and other invasive plants increase, cover of more desirable but less competitive grasses and forbs is significantly reduced, sometimes as much as 60 to 90 percent (Harris and Cranston, 1979; Bucher, 1984). A study conducted in Glacier National Park reported that spotted knapweed reduced the number and frequency of native species. In addition, seven species classified as “rare” and “uncommon” at the beginning of the study were not present three years later. These results suggested that spotted knapweed alters plant community composition (Tyser and Key, 1988).

Rare plants are particularly vulnerable to invasive plants (Rosentreter, 1994) however there is limited information on the impact of weeds on rare and threatened plant and animals. Sapphire rockcress is endemic to Montana and is listed as sensitive by the Forest Service (Montana Native Heritage Program, 2001). The plant is at risk because of livestock trampling and encroachment of habitat by spotted knapweed (Lesica and Shelly, 1991). Sapphire rockcress is subject to an increase risk of extinction since spotted knapweed reduces space available for seedling establishment (Elzinga, 1997).

Cryptogramic ground crust may also be impacted by spotted knapweed. This crust, which is composed of small lichens and mosses and commonly covers undisturbed soil surfaces, is important for soil stabilization, moisture retention and nitrogen fixation (Rycher and Skujins, 1974; Anderson *et al.*, 1982). Tyser (1992) compared a native fescue grassland site to one invaded by spotted knapweed in Glacier National Park. Study results indicated that the crypotgamic ground cover within spotted knapweed infested sites was 96 percent less than native fescue grassland site.

Cheatgrass is becoming a concern on the Gallatin Forest because of its reputation for altering fire regimes. Cheatgrass is commonly associated with disturbed areas, such as recently burned rangeland and wildlands, roadsides, and eroded areas. However, cheatgrass also invades communities in the absence of any type of disturbance. Cheatgrass seedlings usually germinate with fall moisture, and the root system continues to develop throughout the winter producing an extensive root system by springtime. This well-developed root system is ready to exploit available spring moisture and nutrients before native species are able to germinate. Cheatgrass typically dries out and disperses seed by mid-June. The ability of the plant to dry completely, accumulate litter, and its fine structure makes cheatgrass extremely flammable. Cheatgrass invasion has increased the frequency of fires from one every 60 to 100 years to once every three to five years on millions of acres of rangeland in the Great Basin (Whisenant, 1990). The high frequency of fire has eliminated native shrub communities (Randall, 1996). Rapid growth and vigorous reproduction assure cheatgrass dominance.

Wildlife Habitat: The introduction of exotic plants influences wildlife by displacing forage species, modifying habitat structure (such as changing grassland to a forb-dominated community), or changing species interactions within the ecosystem (Belcher and Wilson, 1992; Bedunah, 1992; Trammell and Butler 1995). Exotic plants on the Gallatin Forest have started to invade important big game winter ranges, reducing forage available for over-wintering animals. On the Lolo National Forest, forage availability was identified as the most limiting factor for over-wintering elk and deer populations. Forage that is low in nutrients also hinders elk and deer because they metabolize fat at an accelerated rate to stay warm in colder temperatures (Thomas, 1979).

Unlike elk and deer, bighorn sheep are relatively non-migratory (USFS, 2001b). They spend most of the year on low elevation big game winter ranges, which are often associated with talus slopes. Additional demands are placed on the forage base because they are non-migratory and forage yearlong on some ranges. Yearlong foraging makes bighorn sheep more dependent on high quality forage on low elevation big game winter ranges than elk and deer (USFS, 2001b).

A study conducted by Thompson (1996) on the Three-Mile Wildlife Management Area suggested that elk are not obligate grazers and may lose foraging efficiency where knapweed dominates native ranges. Although elk can incorporate spotted knapweed into their diets, they have been observed using areas with a low relative abundance of knapweed more frequently than infested areas. Thompson (1996) concluded that management practices affecting vegetation on winter ranges are likely to have profound impacts on ungulate foraging efficiency during the season when energy balance is especially critical.

Elk migration patterns may be altered due to the presence and dominance of spotted knapweed (Thompson, 1996). In general, use of spotted knapweed by wildlife and livestock is highest during the spring and early summer when plants are green and actively growing in the rosette and bolt stages (USFS, 2002). Spotted knapweed can have about 18 percent crude protein early in the season, but nutritional value decreases and fiber content increases later in the season (USFS, 2002a; Fletcher and Renney, 1963). Although spotted knapweed infestations are considered more detrimental to elk than deer, Guenther (1989) found that the plant was not detected in mule deer diet even though it was common on winter ranges.

Spotted knapweed is not considered food forage, even though the plants can contain high amounts of crude protein. The bitter-tasting compounds such as sesquiterpene lactone, and cnicin, found primarily in the leaves reduces palatability (USFS, 2002). Even though animals may ingest spotted knapweed, the secondary compounds in the forage may affect rumen microbial activity (Olson, 1999), thereby reducing forage intake, or may cause general malaise resulting in aversive post-ingestive feedback.

Humans: Spotted knapweed has direct and indirect effects on humans. Beekeepers value spotted knapweed because of the quality of honey produced from its flowers. However, the flowers are also pollen sources, which produce positive allergic skin tests and are a significant allergen causing allergic reactions (Olson, 1999). People residing in knapweed-infested areas are treated for a variety of knapweed allergies ranging from skin hives to knapweed-induced asthma attacks. Some individuals are required to carry artificial adrenalin kits and take weekly allergy shots (Olsen, 1999).

Integrated Weed Management

Integrated weed management as defined by Sheley *et al.* (1999) is the "application of many kinds of technologies in a mutually supportive manner. It involves the deliberate selection, integration and implementation of effective weed control measures with due consideration of economic, ecological, and sociological consequences." The integrated weed management approach developed for this Project does not center on treatment methods but rather on a multi-faceted strategy that includes education, inventory, ecological impact and risk assessment, prioritizing treatment areas, choosing management techniques, evaluating the program through monitoring, and adapting as the program evolves. Sheley *et al.* (1999) described the overall goal of integrated weed management as "maintaining or developing healthy plant communities (restoration) that are relatively weed resistant, while meeting other land-use objectives such as forage production, wildlife habitat development, or recreational land maintenance."

Key components of integrated weed management program include:

- Preventing encroachment into non-infested sites;
- Detecting and eradicating new introductions;
- Eradicating small populations within or adjacent to high valued areas (such as wilderness, sensitive plants, and key wildlife habitat);
- Containing large weed populations;
- Re-vegetating when necessary; and

- Properly managing competitive vegetation (Goodwin and Sheley, 2001).

A successful program consists of a sustained effort, constant evaluation, and adoption of improved strategies as they arise.

The goals of implementing the various element of integrated weed management are to:
- Increase public awareness regarding impacts of noxious weeds to resource values;
- Limit weed seed dispersal from roads and trails:
- Contain neighboring weed infestations; and
- Minimize soil disturbance.

Choosing Management Techniques

Selection of weed management tools is not a choice of one tool over another, but rather selection of a combination of tools that would be most effective on the target species for a particular location. Reliance on one method or restricting the use of one or more weed management tools may prove less effective. Effectiveness and applicability of each tool varies and depends on weed biology and ecology, location and size of the infestation, environmental factors, management objectives, and management costs.

Mechanical Treatment

Mechanical weed management methods can be effective on small infestations. Hand pulling and hoeing are the oldest and most traditional weed management methods. These methods are labor intensive and relatively ineffective for management of large, dense infestations of perennial noxious weeds. Best results are achieved when the entire root is removed. This not always possible when treating deep rooted or rhizomatous, since hand pulling often leaves root fragments that generate new plants. Hand pulling also causes disturbance that may increase susceptibility of the site to reinvasion (Brown *et al.*, 1999; Duncan *et al.*, 2001). While this control method is effective on single plants or relatively small infestations, it is not economically feasible on large, well-established knapweed infestations (Brown *et al.*, 1990). In addition, hand pulling plants that contain toxins or skin allergens can expose individuals to their poisonous effects (DiTomaso, 1999). Hand pulling trials that were constructed near spotted knapweed infestations in western Montana and diffuse knapweed infestations in west-central Colorado found this treatment to be 35 percent to zero percent effective, respectively. The treatments were completed twice per year for two consecutive years and were found to significantly increase bare ground and were also the most expensive (Duncan *et al.*, 2001). European beach grass was hand pulled on the Oregon Dunes National Recreation Area and was found to be labor intensive, costing nearly $3,500 per acre for one treatment (Pickart, 1997).

Test plots established on Blue Mountain (Lolo National Forest) and the Lee Metcalf National Wildlife Refuge near Stevensville, Montana, measured effects of hand pulling on spotted knapweed. On the two sites spotted knapweed covered 76 percent and 53 percent, respectively. Average pulling cost for the two locations was calculated at $8494 per acre per year and is used to estimate and analyze pulling costs (USFS, 2001b). Hand pulling provided 100 percent flower control and 56 percent plant control at Blue Mountain, but increased bare ground from 2.7 percent to 13.7 percent during the first year after treatment (Brown *et al.*, 1999).

Mechanical treatments such as tillage are most applicable to tap-rooted weed species; this method can be used on small acreages, level terrain, and infestations that are "tended' or visited on a regular basis in order to remove new germinant and re-sprouts as they occur. Tillage removes all vegetation and must be combined with seeding or planting of desirable species. Although mechanical treatments can reduce seed production for the treated season, invasive weed seeds may remain viable in the soil for several years (Davis *et al*., 1993; Selleck *et al*., 1962). Re-infestation of a site from residual seed, especially when disturbed, will often occur without continued follow-up treatment.

Mowing or cutting is more effective on tap-rooted perennials such as spotted knapweed compared to rhizomatous perennials (Brown *et al*., 1999; Maxwell *et al*., 1984; Scholes and Clay, 1994). Cutting or mowing plants can reduce seed production if conducted at the right phonological stage. For example, a single mowing at late bud growth stage can reduce the number of seeds produced by spotted knapweed (Watson and Renny, 1974). Mowing can also weaken the competitive advantage of weeds by depleting root carbohydrate reserves. Because of large carbohydrate reserves, mowing must be conducted several times a year for consecutive years to reduce the competitive ability of the weed. Cost of mowing twice a year (on terrain conducive to mowing) is approximately $200 per acre (based on 1998 dollars).

Because invasive weeds 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 with plastic or organic material can be used on relatively small weed infested areas (less than ¼ acres), but will also stunt or stop growth of desirable native species. Mulching prevents weed seeds and seedlings from receiving sunlight necessary for survival, and can smother some established weeds. Although hay mulch was used in Idaho to reduce flowering of Canada thistle (Tu *et al*., 2001), most rhizomatous perennial weeds cannot be controlled by this method because extensive root reserves allow re-growth through or around mulch.

Cultural Treatment

Cultural methods of noxious weed management are generally targeted toward enhancing desirable vegetation to minimize weed invasion. Planting or seeding desirable species to shade or out-compete weeds, applying fertilizer to desirable vegetation, and controlled grazing are common cultural treatments.

In most cases, endemic native species do not appear capable of out-competing invasive weed. On appropriate sites, herbicide application after weeds have emerged, followed by tillage and drill seeding, can be an effective treatment for establishing desirable species (Sheley *et al*., 1999). This process, however, can lead to increased soil compaction (DiTomaso, 1999), and cannot be conducted on steep, remote, and rocky sites characteristic of most sites on the Forest.

When seed is introduced to a site by non-natural means (e.g., seeing by humans), there is a risk of introducing non-native and/or invasive species. Use of certified weed-free seed reduces this risk. The magnitude of the risk varies and may be determined by seed source, cleaning practices, and other factors. Certified weed free seed has tolerances for certain weed species and is only certified free of certain weed species (Montana Weed Act Section 4.12.3010-11).

Invasive weeds are often able to establish and occupy a site relatively quickly after introduction because native species are typically slower to germinate and establish. Seedling establishment of native species depends on proper seeding depths, soil, adequate soil moisture, prior removal of as many invasive weeds as possible, and often exclusion of livestock (Goodwin and Sheley, 2001). Selection of a native versus non-native seed mix depends on management objectives. If the objective is naturalness in a plant community dominated by less competitive species, native mixes would be used. Non-native species may be more appropriate where erosion control and competition with invasive weeds are the objective. A compromise is to include short-lived, non-native, less dominant species mixed with native seeds. On many Forest sites, there is adequate residual native and desirable vegetation under the invasive weed canopy such that re-vegetation is not necessary. Once the invasive weeds are removed, individual vegetation can respond and often results in a dense, competitive, and desirable vegetation communities.

Grazing can be an effective management tool on several weed species. Since grazing animals prefer certain forage, selective use of forage can shift competitive balance of plant communities (Crawley, 1983; Lukan, 1990). For example, goats and sheep have been used in various areas for controlling knapweed and leafy spurge. Controlled, repeated grazing of spotted knapweed by sheep has been found to reduce the number of one and two year old spotted knapweed plants within an infestation (Olsen *et al.*, 1997). Appropriate grazing by animals preferring weeds can shift the plant community toward more desired grasses (Lacey et al., 1989). Conversely, grazing can also selectively reduced grass competitiveness, shifting the community in favor of weeds (Svejcar and Tausch, 1991).

Use of grazing animals as a weed management tool must be based on selecting the appropriate grazer (cattle, sheep, or goats) for the target weed. Managers must also determine when, how much, and how often to graze animals to have maximum impact on the weeds with minimum impact on desirable species (Olsen, 1999). Use of grazing animals as a weed management tool on roadsides, trailheads and larger infestations on the Forest is limited due to factors associated with maintenance and management of the animals. A long-term commitment to small ruminant grazing is necessary for effective weed control and achievement of desired results. Invasive weeds can compensate quickly after the grazing pressure is removed because of their dormant seeds in the soil, and because they can rapidly increase flower stem and seed production once grazing pressure is removed.

Range Management Considerations

It has already been noted that many of the grasslands proposed for weed treatment still have relatively viable native plant communities intermixed with the weed invaders. Grasslands are dynamic plant communities that are constantly being shaped by the process of succession (Sheley et al., 1999). Successful grassland restoration should complement successional processes. Grassland species evolved with grazing, and in many cases, grasses require defoliation every two to four years to remove old stems that shade plants and hinder growth. Defoliation methods, such as grazing, mowing or burning stimulate grass growth and enhance its competitive ability. However, proper grazing management is essential in maintaining long-term objectives for weed management. Most weedy species are well adapted to invade heavily grazed areas, allowing competitive advantage.

Grazing animals can be used to assist in weed control efforts, but in most cases will not eradicate mature infestations when used alone. Sheep and goat grazing is being considered under all alternatives however there are some major concerns. For example small ruminant animals are at risk to predation from wolves and bears, there is the risk of transmitting disease from domestic sheep to bighorn sheep, and there is insufficient experience with these types of grazing operations. Initial use of sheep and goats will require mitigation measures to ensure that predation and disease transfer do not occur. Also, both the animals and the experience will need to be gained from commercial practitioners.

Grazing management considerations are important in assisting with the restoration of native grasslands. Timing and frequency of cattle grazing can be adjusted to minimize impact on grasses (Sheley *et al.,* 1999). Permittees are authorized to graze livestock on National Forest System lands by permit. The General Terms and Conditions of the grazing permit, part 8(b) and (c) allow for annual adjustments as deemed necessary by the Forest, to coincide with resource protection measures. This would include restoration measures essential for achieving long-term effectiveness of weed treatment programs.

Biological Treatment

Biological weed management is the deliberate use of natural enemies (parasites, predators, or pathogens) to reduce weed densities. Natural enemies and competitive vegetation prevent weed species from dominating other species. Non-native invasive weeds are such a problem, in part, due to the lack of natural enemies.

Biological management is self-perpetuating selective, energy self-sufficient, economical, and well suited to integration of an overall weed management program (Wilson and McCaffrey, 1999). Management with biological agents is a slow process that does not achieve eradication. Biological agents may be ineffective if they are not integrated into other strategies. Biological management may also not be appropriate against weeds closely related to beneficial plants because the natural enemy may be unable to discriminate between related plant species (Duncan et al., 2001). About 29 percent of the biological management efforts in the United States have demonstrated some level of success (DeLouch, 1991).

A weed infestation may increase in density and area faster than the newly released biocontrol agent population; therefore, other control methods must be used in conjunction with the release of biocontrol agents. The perimeter of the infestation may be sprayed to keep the weeds from spreading. As biocontrol agents increase in density and begin to occupy more area, herbicides may be used for occasional spot treatments.

Treatment with Herbicides

Use of herbicides for invasive weed treatment involves application of products developed, labeled and produced to treat weed species at certain stages of plant growth. Herbicides considered in this analysis include: 2,4-D, chlorsulfunon, clopyralid, dicamba, glyphosate, hexazinone, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclypyr. Several herbicides are considered because they vary in effectiveness on different invasive weeds.

The length of time each herbicide controls invasive weeds varies with the type of herbicides, environmental conditions, and target weeds. Some herbicides control weeds for a short time, while others can provide several years of control from one application. The U.S. Environmental Protection Agency approved herbicide labels include safe handling practices, application rates, and practices to protect human health and the environment. A description of herbicides including copies of labels, susceptibility of weeds to different herbicides, Material Safety Data sheets, and guidelines proposed for use on the Project are contained in the Project File. More information on herbicide labels can be found at http://www.cdms.net/manuf/manuf.asp.

Weed Prevention

Preventing introduction and spread of weeds is one objective of the integrated weed management program on the Forest. The US Forest Service has prepared a comprehensive Guide to Noxious Weed Prevention Practices (USDA FS 2001d) for use in planning forest and wildland resource management activities and operations. The guide assists manger and cooperators in identifying weed prevention practices that mitigate identified risks of weed introduction and spread for projects and programs. Factors critical in a prevention program include:

- Limiting weed seed dispersal occurring from vehicles and equipment traveling forest roads, and people and livestock traveling forest trails;
- Containing neighboring weed infestations;
- Minimizing soil disturbance;
- Detecting and eradicating newly established weeds;
- Establishing competitive desirable vegetation; and
- Managing forage, including re-vegetation and shade management.

In addition, the Forest depends on public education and weed prevention programs to deter establishment of new weed species such as dyers woad, perennial pepperweed, yellow star thistle, rush skeleton weed, and tall buttercup. Weed education programs have helped raise public awareness about invasive weeds and what steps can be taken to help reduce the spread of existing weeds and establishment of new invaders.

Monitoring

Monitoring is the collection of data to determine effectiveness of management actions in meeting prescribed objectives. Monitoring focuses on:

- The density and rate of spread of invasive exotic plant species and the effect these aggressive plants have on natural resources;
- Effectiveness of herbicides on noxious weed, desirable vegetation and sensitive plants;
- Effectiveness of biological control agents;
- Effectiveness of cultural weed management activities;
- Effectiveness of herbicides on surface water quality; and
- Implementation of environmental protection measures.

Comparison of Weed Management Methods

Table 1-1. Compares the relative limitations, management effectiveness, and approximate costs of the weed management methods used in the analysis.

Methods	Limitations	Management Effectiveness[1]	Approximate Cost/Acre
CULTURAL			
Seeding	Environmental limitations; cannot be conducted on steep, remote, rocky sites; causes ground disturbance which may increase likelihood of re-invasion; most effective after weed populations have been reduced by other control actions.	Not able to estimate	$100 to $300 Average $250
Grazing Animals	Treatment must occur during proper phonological stage; herding required; sometimes nonselective; can reduce forage available for big game; predator predation problems; disease transfer to bighorn sheep	Low cost/low effectiveness	$50
MECHANICAL			
Mowing	Limited to smooth gentle slope; treatment timing critical; impact on non-target vegetation	Low cost / low effectiveness	$200
Hand pulling/ Grubbing	Labor intensive; not effective on deep-rooted or rhizomatous perennial; causes ground disturbance which may increase susceptibility of site; effective on single plants or small low-density infestations.	High cost/ low effectiveness	$400
BIOLOGICAL			
Parasites, Predators and Pathogens	Does not achieve eradication; effective only on one species, only a few weeds with available agent; most agents not effective by themselves need multiple agents	Moderate cost/ moderate effectiveness	$150
HERBICIDES			
Ground Application	Not cost effective on slopes greater than 40 percent; must have accessible sites; potential impacts to non-target vegetation; application timing limited based on plant phenology and weather conditions.	Low cost/ moderate to high effectiveness	$30 – Vehicle. $125 – Backpack, $50 – ATV, $65 – Horse Average $100
Aerial Applications	Potential impacts to no-target resources; application timing limited based on plan phenology and weather conditions.	Low cost/ moderate to high effectiveness	$40
WEED PREVENTION			
All Methods	Not effective on existing infestations; ineffective if not enforced	Not measurable	

Notes: [1]Percent of target species killed in a treatment area: High = 75 to 100 percent; Moderate = 46 to 75 percent; Low = 25 to 45 percent; Very Low = 0 to 24 percent.
Not measurable – means the cost/effectiveness is not measurable or quantifiable.

PURPOSE OF AND NEED FOR ACTION

Invasive weeds are threatening or dominating areas of the Forest with negative impacts on native plant communities, wildlife habitat, soil and watershed resources, recreation, and aesthetic values. A shift from native vegetation to invasive weeds decreases wildlife forage, reduces species diversity, and increases soil erosion due to a decrease in surface cover. For these reasons it is imperative to aggressively manage weeds across the Forest.

The purpose and need of the project is to prevent and reduce loss of native plant communities associated with the spread of weeds. Specifically, the purposes of this project are to treat weeds within the Gallatin National Forest, and to reduce the impact of weeds on other resources.

PROPOSED ACTION

The Forest is proposing to broaden the 1987 Environmental Analysis for control of weeds to:

1. Permit the use of different types of herbicides;
2. Treat 13,2600 acres with a combination of treatment methods such as herbicides, biological control agents, grazing, mechanical and cultural (the actual amount of annual treatment will depend on available funding and monitoring results);
3. Adopt adaptive management tools for assessing new treatments and new sites;
4. Broaden control methods to include the use of aerial application (on 255 acres).

Alternative 1 further describes specific treatment sites for the proposed action, size of treatment, targeted species, and treatment methods in Chapter 2.

Authorizing Acts

Direction and authority for invasive weed management is provided in the National Forest Management Act (PL94-588), Federal Land Policy and Management Act (PL 94-579), Carlson-Foley Act (PL-583), Federal Noxious Weed Control Act (PL-629), and the Montana Weed Management Plan (2001).

General land management and environmental analysis direction is provided by the National Forest Management Act, National Environmental Policy Act, and Federal Land Policy and Management Act. The Carlson-Foley Act allows states to control weeds on federal land provided that: 1) the control program is approved by the federal agency administering the land, 2) control methods are acceptable to the federal agency, and 3) similar procedures are followed as applied to private land. The Carlson-Foley Act authorizes federal agencies to reimburse states for weed control expenses on federal land. The Federal Noxious Weed Act defined noxious weeds and authorized cooperative weed control agreements between federal agencies and other agencies, organizations, or individual.

In Montana, the Montana County Noxious Weed Management Act (MCA 7-22-2101) states that it is unlawful for any person to allow noxious weeds to propagate or go to seed on their land unless they have an approved weed management plan. This act directs counties to develop weed control plans and implement weed control efforts.

The US Forest Service strategy for noxious and non-native invasive plant management (USFS, 1998B) provides the Forest Service with a "roadmap into the future for preventing and controlling the spread of noxious weeds and non-native invasive weed plants." Executive Order 13112 directs all federal agencies to conduct activities that reduce invasive populations.

Permits Required

Prior to implementation of aerial application of herbicides, A Montana Pollutant Discharge and Elimination System permit may be required. Consultations with the Montana Department of

Environmental Quality and US Environmental Protection Agency will determine whether a permit is needed at that time.

SCOPE OF THE ANALYSIS

The scope of this analysis is limited to the effects of weeds, and weed control treatments (as proposed in Alternative 1) on different resources within the Gallatin National Forest boundary.

Impacts

Regulations contained in 40 CFR 1508.25(c) require analysis of direct, indirect, and cumulative impacts. Direct effects are caused by the action and occur at the same time and place as the Proposed Action. Indirect effects are caused by the action and occur later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative impacts are those impacts on the environment that result from incremental impact of the action where added to other past, present, and reasonably foreseeable future action.

Alternatives

In determining the scope of analysis, the agency must consider three types of alternatives (40 CFR 1508.25[b]): no action alternative, other reasonable courses of action, and mitigation measures. Chapter 2 presents a range of alternatives for site-specific treatment of invasive weeds. Alternatives that have a reasonable likelihood of partial success are discussed in detail. Mitigation measures for each alternative have been developed by the Forest and included as Environmental Protection Measures. Impacts of the no-action alternative, which would maintain the current program projects on the forest, are also considered.

Connected, Cumulative And Similar Actions

Regulations in Code of Federal Regulations (CFR) Title 40 1508.25 address the scope of analysis and elements to be considered in a proposed action. The regulations recognize that separate activities can combine and interact to create impacts that may be significantly beyond the effects of individual actions. These actions are considered cumulative, and their additive effects must be addressed in the analysis.

Federal regulations also require a combined analysis of connected actions. Connected actions are those that are closely related and 1) automatically trigger other actions, 2) could not or would not proceed unless other actions are taken previously or simultaneously, and 3) are interdependent parts of a larger action and depend on the larger action for their justification. The effects of connected actions should be analyzed together.

Similar actions are those that share a common timing or geography and therefore can be evaluated together.

SCOPE OF THE DECISION TO BE MADE

Geographic Scope

The geographic scope of this analysis is confined to the treatment areas that would occur within the Gallatin National Forest boundary. For each resource issue an analysis area was determined that could be used to adequately measure cumulative effects of the proposed alternatives. Unless otherwise stated, the cumulative effects area is the same as the project area.

Temporal Scope

The timeframe for project implementation is 5 to 15 years. Direct, indirect, and cumulative effects, if any, would occur during that period. For cumulative effects analysis, an additional 10 years past the final implementation year is included in the analysis. In some cases, longer-term effects are also discussed.

Decision Framework

Based on the environmental analysis in the EIS and consideration of public comments, the Forest Supervisor of the Gallatin Forest is responsible for making the decision concerning this proposal. Given the purpose and need, the deciding official reviews the alternatives, and the environmental consequences in order to make the following decisions:

- Whether to expand current efforts to control invasive weeds;
- What treatment methods would be used;
- What herbicides would be used;
- What mitigation and monitoring measures would be required; and whether to include an adaptive approach to address future spread of invasive weeds.

The EIS is a project level analysis. The scope of the project is confined to issues and potential environmental consequences relevant to the decision. This analysis does not attempt to re-evaluate or alter decisions made at higher levels. The decision is subjected to and would implement direction from higher levels.

National, regional, and Forest Plan rules, policies, and direction require consideration of effects of all projects on weed spread and prescribe mitigation measures where practical to limit those effects. Reconsideration of other existing project level decisions or programmatically prescribing mitigation measures or standards for future Forest management activities (such as travel management, timber harvest, and grazing management) are beyond the scope of this document. Cumulative effects of the Project are addressed where appropriate in Chapter 4, combined with effects of other Forest activities.

Decisions that will not be made based on this analysis are briefly discussed below:

- Changes in land use and Forest Management objectives;
- Changes in the level of wildland suppression, strategies and tactics, and decisions on whether or not to control wildfire;
- Changes in travel, road use and access;
- Road analysis or road management decisions. These decisions will be addressed by the Gallatin Travel Management Plan, which is being revised in a separate.
- Prevention measures that minimize establishment and spread of noxious weeds are already a part of Forest Service policy and recent decisions, and therefore will not be repeated in this analysis. The Gallatin National Forest fully utilizes prevention, education, and non-chemical activities to combat weeds on the forest. Herbicide, cultural, mechanical, and biological methods as addressed in this analysis would be used in

conjunction with these other activities where necessary or appropriate. The following outlines recent prevention and education decisions, policy, and measures for the weed control program occurring within the analysis area.

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(1) Forest Service Policy (FSM2080 R1 Supplement) provides Best Management Practices for weed control. They specify incorporation of weed prevention and control through project layout, design, and alternative evaluation and project decisions to reduce potential sites for weed establishment.

(2) Coordination of weed prevention and control efforts continues at the local, county, state, regional, and national levels.

(3) The Weed Seed Free Feed and Straw program is a Forest and Region-wide requirement.

(4) The Off Highway Vehicle (OHV) amendment for Region One was implemented in January 2001. Off road or trail use by OHV is restricted and will reduce an important vector of weed spread. The first year focused on public education of riders in the field. In 2002 the enforcement phase of the amendment resulted in more enforcement, resulting in citations and warnings.

(5) Timber sales and other activities utilizing mechanical equipment off roads require that off-road equipment be washed prior to entering sites on the Gallatin National Forest.

(6) Each Ranger District Office provides a wide array of information on noxious weed identification, prevention, and control. In addition, most trailheads are posted with information about weed identification and the requirement to use only certified noxious weed seed-free feed for livestock.

(7) Field employees will continue to be trained in identification of invasive weeds.