PESTICIDE OR HERBICIDE?

The term "pesticide" is an umbrella term that includes herbicides, rodenticides, insecticides, etc. In short, it applies to any chemical used to control a living organism.

"Pesticide" and "herbicide" are both used in this document. Herbicides, a type of pesticide, are used to chemically treat nonnative plants. Some herbicides are selective, in that they control certain target plants while allowing non-target (desired) plants to survive.

EPA REGISTRATION

Pesticide registration is the process through which the Environmental Protection Agency (EPA) examines the ingredients of a pesticide, the site or crop on which it is to be used, the amount, frequency and timing of its use and storage and disposal practices.

The EPA evaluates the pesticide to ensure that it will not have unreasonably adverse effects on humans, the environment, and non-target species. Except for a small number of low-toxicity active ingredients that have been exempted, a pesticide cannot be legally used if it has not been registered with EPA's Office of Pesticide Programs (EPA 2003 in NGP EPMP).

After registration, a label is developed for each pesticide. Pesticide labels include directions for the protection of workers who apply the pesticide, directions for reducing exposure to non-applicators, and ways to reduce potential impacts to the environment. Labels also identify the types of species that the pesticide may be used on.

Violations of pesticide label directions constitute a violation of FIFRA, which regulates the storage and disposal of most pesticides.

Because labels contain important application, safety, and storage and disposal information, labels are required to be kept with the product. The label is the law.

4) Chemical Treatments

Under Alternative 1, the partner parks would continue to use chemical treatments consisting of applying herbicides to part or all of a plant as prescribed by the herbicide label using a variety of application methods. Application methods that have been used by some or all of the parks include portable hand-held and backpack sprayers, OHVs equipped with sprayers, aerial spraying, and painting, etc. (see "Commonly Used Herbicide Treatment Methods" below). Although ATV use is currently prohibited in NPS Intermountain Region parks, if such use was reinstated, this method of application would be used again. Currently UTVs with seatbelts and other driver protection devices are being substituted for ATVs where possible.

Application rates depend upon the target species, the presence and condition of non-target vegetation, soil type, depth to the water table, presence of other water sources, and the label requirements. The selected application method depends upon the treatment objective (such as eradication or suppression); accessibility, topography, and the size of the treatment area. Characteristics of the target species and the desired vegetation; location of sensitive areas and potential environmental impacts in the immediate vicinity; anticipated costs; equipment limitations; and meteorological and vegetative conditions of the treatment area at the time of treatment are often other factors considered.

Application of herbicide treatments by broadcast spraying is most effective for pure stands of single species in areas where desirable plants are scarce or absent. Spot spraying is effective in treating individuals or small infestations where ground disturbance or cutting is not recommended (such as on rhizomatous species) or in archeological or other cultural resources sites (where chemical use has been determined to have no or negligible effects).

In addition to different application methods for herbicides, different herbicides have different modes of action in affecting target plants. Contact herbicides kill the parts of the plant they touch, while translocating pesticides move through the circulation system of the plant. Some herbicides provide long-term treatment by remaining active in the soil around the plant for a period of days, weeks or months.

In Alternative 1, chemical pesticide use by the NPS would continue to be approved through the centralized NPS IPM program, including the annual submission of formal PUPs and reporting requirements that accompany these (see section 6. *Recordkeeping*). All pesticides used in the parks are EPA registered and approved. Most are also non-restricted use pesticides, although restricted use pesticides are occasionally approved on a limited basis. Parks also must obtain approval

from the regional and/or national IPM coordinator before purchasing or using a pesticide.

Herbicides vary in terms of their chemical and biological behavior in the environment. Factors that affect herbicide behavior in the environment include herbicide properties, soil characteristics, and climatic conditions. Factors that influence the behavior of herbicides in the environment are summarized below. This summary is based on information provided by Miller and Westra (1998) in "*Colorado State University Fact Sheet: Herbicide Behavior in Soils.*"

- *Acid or Base Strength* - refers to whether an herbicide has basic, acidic, or non-ionizable properties. This factor determines the ability of an herbicide to exist in soil water or be retained onto soil solids. In general, herbicides whose pH is close to the pH of soil are strongly retained and are not subject to runoff, erosion, and/or leaching. In contrast, herbicides whose pH is not close to that of the soil are less strongly retained and are subject to runoff, erosion, and/or leaching. These herbicides are also more available for plant uptake than those herbicides that are strongly retained onto soil solids.
- *Water Solubility* - refers to how readily an herbicide dissolves in water and determines the extent to which an herbicide is in the solution (water) phase or the solid phase. An herbicide that is water soluble generally is not retained by soil.
- *Volatility* - refers to the tendency of an herbicide molecule to become a vapor. Herbicides with high vapor pressures are likely to escape from the soil and volatilize in the atmosphere.
- *Soil Retention* - is an index of the binding capacity of the herbicide molecule to soil organic matter and clay. In general, herbicides with high soil retention are strongly bound to soil and are not subject to leaching. Those not exhibiting high soil retention are not strongly bound and are subject to leaching. This is typically expressed as the coefficient of adsorption or sorption coefficient (Koc) that describes the tendency of a pesticide to bind to soil particles. Sorption reduces movement, but in some cases it may also increase persistence because the pesticide is protected from degradation. The higher the Koc value, the greater the sorption potential.
- *Soil Persistence* - refers the longevity of an herbicide molecule, typically expressed in terms of a half-life, as determined under normal conditions in the region where the herbicide would be used.

These factors influence the environmental fate and effects of an herbicide, including its residual soil activity, persistence, volatilization, water solubility, and potential for leaching into groundwater. Table 37: *Environmental Effects of Current and Proposed Herbicides* in Chapter V: *Environmental Consequences*, which summarizes the potential environmental fate and effects of herbicides that may be used under this plan.

Once an herbicide has been selected, the resource manager submits a PUP request using the Intranet-based IPM System. In general, the Regional IPM Coordinator would be responsible for reviewing and approving proposed herbicide uses. Review and approval from a National IPM Coordinator is required for herbicide uses that involve:

- Aquatic applications or situations in which the applied herbicide could reasonably be expected to get into waters or wetlands;
- Herbicide uses that may affect rare, threatened, or endangered species or associated critical habitat;
- Herbicide use involving aerial application;
- Herbicide use on 400 or more contiguous acres; and
- Use of a restricted-use herbicide as defined by the EPA.

Table 16 shows the herbicide active ingredients that have been approved for use on target plants in the Northern Rocky Mountains parks in the last five years.

Herbicides are classified according to their mode of action, which is determined by the active ingredients. Active ingredients that have been used and would continue to be used are summarized in Table 16. Common trade names are provided after the active ingredient. This is not a comprehensive list of trade names, nor an endorsement of the trade names listed. Under this plan, any registered herbicide trade name that contains the active ingredients listed in Table 16 would likely continue to be used.

Herbicides containing active ingredients that are not listed in Table 16 may also be used under this plan. The use of any herbicide not listed, however, must meet all conditions outlined in this document and must also be approved by a Regional and/or National IPM Coordinator.

An adjuvant is a substance added to an herbicide to aid its action, but has no herbicide action by itself. Some herbicides require the addition of an adjuvant to work effectively. Surfactants are adjuvants used in conjunction with herbicides to increase absorption. A surfactant is a surface active ingredient that lowers surface tension of the solvent in which it is dissolved or the tension between two immiscible liquids (such as oil and water). Safety procedures and MSDS's must be kept on site for all adjuvants used under the plan.

The only restricted use herbicide currently being used by the parks is picloram. All formulations that contain picloram and that may be broadcast on soil or foliage are classified as "Restricted Use" herbicides. Sale and use of these herbicides are limited to licensed herbicide applicators or their employees, and only for uses covered by the applicator's certification. In addition to approval by an NPS regional IPM coordinator, a National IPM Coordinator must approve the use of restricted use herbicides, such as picloram, prior to purchase and use by the parks. Pesticide use in the NPS is also tracked and annually summarized [see Appendix H: *Northern Rocky Mountains Parks' Use of Herbicides (2005-2009)*].

Commonly Used Herbicide Treatment Methods

The following methods are among the most commonly implemented means of chemical treatment, although others, such as aerial spraying from helicopters or fixed wing aircraft have also been used by some parks.

Foliar Spray: Leaves are sprayed with a mixture of herbicide, water (or other carrier), and surfactant from a backpack or other sprayer. Precise mixes vary depending on the species being treated, the life cycle of the species, and other factors. In some cases, perennial plants may be cut first and then allowed to resprout before being sprayed – this can reduce the amount of herbicide needed.

Wiper: Herbicides are wiped onto the leaves of plants using a wick, sponge, paintbrush, or similar tool.

Cut Stump: Herbicides are applied to the stump of a woody species (tree, shrub, or vine) immediately (within one minute) after cutting down the tree or shrub. The herbicide penetrates into the plant's vascular system and translocates (moves throughout the plant) to the remaining belowground portions of the plant to kill roots and prevent resprouting.

Frill: Similar to cut stump, but the tree or shrub is left standing. Instead, multiple smaller cuts are made into the cambium of the tree and herbicides are applied immediately. The herbicide translocates throughout the plant.

Stem injection: A hand-held device is used to puncture the stem and inject a precise amount of herbicide inside the stem. While not currently used in the parks, it may be used in the future, for example for some plants in the knotweed complex, such as Japanese knotweed.

Aerial Spray: The use of helicopters or fixed wing aircraft to apply herbicides over a large, homogenous area.

Table 16: NPS Approved Herbicide Use in Northern Rocky Mountains Parks 2004-2009[3]
(See also Appendix H: Northern Rocky Mountains Parks' Herbicide Use 2005-2009)

Pesticide Active Ingredient	Pesticide Common Name(s)	Target Plant(s)	Park Units
2,4-D	2,4-D	Field bindweed	LIBI 2005-2006
	2, 4-D Amine	Rush skeletonweed Leafy spurge Knapweed	CRMO 2005-2006
		Scotch thistle Annual grass Exotic vegetation	GOSP 2005
		Whitetop Babysbreath	GRKO 2005-2006
	HiDep	Broadleaf weeds	LIBI 2008-2009
	LV6	Broadleaf weeds	LIBI 2005-2008
		Scotch thistle Annual grass Exotic vegetation	GOSP 2006, 2008-2009
	Salvo	Sweetclover Exotic vegetation	FOBU 2005-2006
2,4-D + Clopyralid	Curtail	Canada thistle Knapweed	LIBI 2005-2007
Aminopyralid	Milestone	Spotted knapweed Canada thistle Common tansy	BIHO 2006-2007
		Canada thistle	CIRO 2005, 2007
		Canada thistle Knapweed	CRMO 2005-2006
		Spotted knapweed Canada thistle Russian knapweed Kochia Babysbreath	GRKO 2004-2007
		Spotted knapweed Canada thistle Russian knapweed Broadleaf weeds	HAFO 2005-2006, 2009
		Spotted knapweed Canada thistle Common tansy	BIHO 2006-2009
		Canada thistle Bull thistle Spotted knapweed Hoary cress Field bindweed	CIRO 2006-2009 CIRO 2006-2008 CIRO 2006-2008 CIRO 2007-2008 CIRO 2008
		Spotted knapweed Russian knapweed Diffuse knapweed Canada thistle Scotch thistle Common burdock Rush skeletonweed	CRMO 2006-2009
		Thistles Knapweed Whitetop Curley dock	FOBU 2006-2007, 2009
		Black henbane	FOBU 2008
		Scotch thistle Canada thistle Mullein	GOSP 2006-2009
		Canada thistle	GRKO 2006-2009

		Spotted knapweed Russian knapweed	
		Thistle Knapweed Broadleaf weeds	HAFO 2006-2007, 2009
		Canada thistle Spotted knapweed Russian knapweed	LIBI 2006-2009
		Knapweed Rush skeletonweed Thistle Common mullein Broadleaf weeds	MIIN 2006-2009
Chlorosulfuron	Telar	Scotch thistle Dalmatian toadflax	CRMO 2007
	Telar DF	Dyers Woad Scotch thistle Canada thistle Dalmatian toadflax	CRMO 2007-2009
	Telar XP	Whitetop	FOBU 2009
		Yellow toadflax Canada thistle	GRKO 2008-2009
Chlorosulfuron plus Metsulfuron methyl	Telar + Escort	Dyers woad	GOSP 2009
Clopyralid	Transline	Knapweed Scotch Thistle Rush skeletonweed	CRMO 2005-2006
		Spotted knapweed Whitetop Canada thistle Bull thistle Musk thistle	CIRO 2007, 2009
		Canada thistle Sweetclover Sow thistle	FOBU 2005-2006
		Scotch thistle Exotic vegetation	GOSP 2005-2008
		Spotted knapweed Canada thistle Russian knapweed	GRKO 2005, 2009
		Rush skeletonweed Thistle Knapweed Broadleaf weeds	HAFO 2006-2007
		Spotted knapweed Russian knapweed Canada thistle Curly dock	LIBI 2008
Clopyralid + Triclopyr	Redeem R&P	Babysbreath Canada thistle Spotted knapweed	GRKO 2004-2006
		Canada thistle Knapweed	LIBI 2005-2008
	Confront	Canada thistle	LIBI 2005-2009
Copper Sulfate Pentahydrate	Zep Root Kill	Roots	LIBI 2008-2009
	Root Out	Roots	LIBI 2008
Glyphosate	Cornerstone	Broadleaf weeds Grasses	LIBI 2005-2009
	Gly Star Pro	Cheatgrass	GRKO 2009
	Roundup	Broadleaf weeds Grasses	LIBI 2005, 2008
	Roundup Pro	Rush skeletonweed Thistle Broadleaf weeds Grasses	HAFO 2005-2009
		Knapweed	CRMO 2007

		Thistle Mullein	
		Annual weeds Scotch thistle	GOSP 2005
		Cheatgrass	GRKO 2007-2008
	Roundup Power Max	Thistle Broadleaf weeds Grasses	HAFO 2009
	Roundup Ready to Use	Broadleaf weeds Grasses	LIBI 2008
	Roundup Ultra	Canada thistle Field bindweed Perennial grass Exotic vegetation	FOBU 2005-2007, 2009
		Cheatgrass	GRKO 2006
		Canada thistle Knapweed	CRMO 2005
	Rodeo or Aquaneat	Fountaingrass Canada thistle Sow thistle Bindweed Perennial grass	FOBU 2005-2007, 2009
		Purple loosestrife Thistle Broadleaf weeds	HAFO 2005-2009
		Canada thistle Musk thistle Field bindweed	CIRO 2005, 2007-2009
		Canada thistle Knapweed	CRMO 2005
		White bryony Purple loosestrife Thistle Rush skeletonweed Common mullein Broadleaf weeds	MIIN 2007-2009
Imazapic	Cadre	Riparian corridor Leafy spurge	GRKO 2006-2008 GRKO 2009
	Plateau	Cheatgrass	LIBI 2005-2006, 2009
		Cheatgrass	CRMO 2005-2006,2008-2009
		Leafy Spurge Cheatgrass	CRMO 2008
		Leafy spurge Yellow Toadflax Cheatgrass Perennial pepperweed Field bindweed	GRKO 2006-2009
Imazapyr	Habitat	Canada thistle Tamarisk Russian olive	CRMO
		Tamarisk Russian olive Broadleaf weeds	HAFO 2006-2009
Metsulfuron methyl	Escort	Tamarisk Scotch thistle Exotic vegetation	GOSP 2005-2008
		Whitetop Yellow toadflax Field bindweed Babysbreath Black henbane Common mullein Perennial pepperweed Houndstongue	GRKO 2005-2009
		Tamarisk Whitetop Broadleaf weeds	HAFO 2006-2009

		Hoary cress Field bindweed Houndstongue	CIRO 2006-2009
		Scotch thistle Whitetop	CRMO 2005-2009
		Whitetop Sweetclover Pepper grass	FOBU 2006-2007, 2009
		Whitetop Broadleaf weeds	MIIN 2006, 2008-2009
Picloram	Tordon 22K	Mullein Leafy spurge Rush skeletonweed Field bindweed Black henbane	CRMO 2005-2009
		Hoary cress	FOBU 2009
		Dyers woad Hoary cress Field bindweed Scotch thistle Moth mullein	GOSP 2007-2008 GOSP 2006-2008 GOSP 2006, 2009 GOSP 2008 GOSP 2007-2008
		Broadleaf weeds Whitetop Field bindweed St. Johnswort	LIBI 2005-2009 LIBI 2006-2008
		Rush skeletonweed Knapweed Leafy spurge Broadleaf weeds	HAFO 2005, 2007-2008
		Leafy spurge	BIHO 2004
		Spotted knapweed Yellow toadflax Leafy spurge Babysbreath	GRKO 2004-2008
Picloram plus 2,4-D	Grazon P+D	Canada thistle	GRKO 2009
Quinclorac	Drive	Field bindweed	LIBI 2006-2009
	Paramount	Field bindweed Annual weeds	LIBI 2007-2009
Rimsulfuron	Matrix	Cheatgrass	GRKO 2009
Triclopyr	Garlon 3A	Tamarisk Russian olive	LIBI 2007, 2009
		Tamarisk Russian olive Broadleaf weeds	HAFO 2006-2009
	Garlon 4	Tamarisk Russian olive Field bindweed Canada thistle	LIBI 2005-2009
		Tamarisk Russian olive Broadleaf weeds	HAFO 2006-2009

[3] Listing of trade names for herbicides is for convenience and is not an endorsement of these products nor is this a comprehensive listing of the products that include the named active ingredient(s).

Table 17: Herbicides: Active Ingredients, Target Plants, Mode of Action and Methods of Application[4] [5]

Active Ingredients	Registered Use	Target Plants	Mode of Action	Method of Application
Aminopyralid (Milestone)	General Use	Annual, biennial and perennial broadleaf weeds and woody plants.	Translocates throughout the entire plant and accumulating in meristematic tissues, including the roots. It disrupts plant growth metabolic pathways affecting the growth process of the plant.	Aerial spraying, spraying from a truck, backpack or handheld sprayer, foliar spray, spot treatments.
Clopyralid (Curtail, Transline, Reclaim, Lontrel, Redeem)	General Use	Annual and perennial broadleaf herbs, especially knapweeds, thistles, and other members of the sunflower, legume, and knotweed families.	Absorbed by the leaves and roots of the exotic plant and moves rapidly through the plant. It affects plant cell respiration and growth.	Aerial spraying, spraying from ground equipment.
Glyphosate Products (Roundup Pro, Roundup Ultra, Rodeo, GlyPro, Accord, Glyphomax, Touchdown)	General Use	Grasses, herbaceous plants including deep rooted perennial exotic plants, brush, some broadleaf trees and shrubs, and some conifers. Does not control all broadleaf woody plants.	Absorbed by leaves and rapidly moves through the plant. It acts by preventing the plant from producing an essential amino acid. This reduces the production of protein in the plant, and inhibits plant growth.	Aerial spraying, spraying from a truck, backpack or handheld sprayer, wipe application, frill treatment, and cut stump treatment.
Imazapic (Plateau, Cadre, Plateau Eco-Paks)	General Use	Annual and perennial broadleaves and grasses	Inhibits the production of some amino acids, which are necessary for protein synthesis and growth.	Aerial spraying, spraying from ground equipment or a handgun sprayer.
Imazapyr (Arsenal, Habitat)	General Use	Annual and perennial grass, broad-leaved weeds, brush, vines, and deciduous trees.	Absorbed by leaves and roots, moves rapidly through plants. Disrupts photosynthesis and interferes with cell growth and DNA synthesis.	Ground or aerial foliage spray, basal bark and stem treatment, cut stump treatment, tree injection.
Picloram (Tordon, Grazon PC, Tordon K, Tordon 22K)	Restricted Use*	Broadleaf herbs, vines, and woody plants (especially leafy spurge).	Absorbed through plant roots, leaves and bark. It moves both up and down within the plant, and accumulates in new growth. It acts by interfering with the plant's ability to make proteins and nucleic acids.	Broadcast or spot treatment as foliar (leaf) or soil spray, basal spot treatment, tree injection, frill treatment, stump treatment, basal bark treatment, low volume dormant stem spray, by air as broadcast or low volume dormant spray.
Triclopyr (Garlon products)	General Use	Woody plants and broadleaf plants.	Disturbs plant growth. It is absorbed by green bark, leaves and roots and moves throughout the plant. Accumulates in the meristem (growth region) of the plant.	Ground or aerial foliage spray, basal bark and stem treatment, cut surface treatment, tree injection.

Based on NPS SEUG 2009 (Table 2-4)

* Restricted use herbicides are only occasionally approved for use by the NPS.

[4] Listing of trade names for herbicides is for convenience and is not an endorsement of these products nor is this a comprehensive listing of the products that include the named active ingredient(s).

[5] All formulations that may be broadcast on soil or foliage are classified as "restricted use" herbicides. Sale and use of these herbicides are limited to licensed herbicide applicators or their employees, and are only for uses covered by the applicator's certification. The restricted use classification is due to picloram's mobility in water, combined with the extreme sensitivity of many important crop plants to damage.

5) Prescribed Fire Treatments

Prescribed fire treatment consists of burning vegetation in a predetermined area to reduce the growth of nonnative plants and to increase the growth of native plants. Prescribed fire is effective when native plants tolerate fire well and nonnative species do not. Treatment with fire can also include the use of flaming (using torches to burn small plants or parts of plants). The use of both flaming and prescribed fire treatments requires parks to have a currently approved FMP that specifically addresses the use of these techniques.

Fire is sometimes necessary to prompt germination of some plants, but it can also reduce the abundance of some species. The most successful uses of fire for invasive species control result from burns that try to mimic or restore historical (natural) fire regimes, which have been disrupted by land use changes, suppression practices, fire breaks, or development (Tu *et al.* 2001 in NPS DINO 2005). Generally, prescribed fire is not being used in the Northern Rocky Mountains to reduce invasive plants. Instead this technique, in this region, often promotes the growth of nonnative invasive cheatgrass.

The following park FMPs currently allow the use of prescribed fire as a nonnative invasive plant or vegetation management tool: Fossil Butte, Golden Spike, and Grant-Kohrs. Grant-Kohrs uses fire to remove vegetation from irrigation ditch banks to promote efficient delivery of water to hayfields. Fossil Butte used fire to remove decadent sagebrush and to increase the predominance of grasses and mixed forbs. At Golden Spike fire has been used to control sagebrush understory vegetation and to restore native vegetation part of the historic scene. For parks that have approved Fire Management Plans, the use of prescribed fire and/or flaming could continue under Alternative 1.

The following parks would continue no use of prescribed fire treatment under Alternative 1: City of Rocks, Craters of the Moon, Hagerman Fossil Beds, Little Bighorn, Minidoka, and Nez Perce (Bear Paw and Big Hole).

c) Summary of NRM-EPMT Treatment

Table 14: *NRM-EPMT Treatment of Northern Rocky Mountains Parks 2004-2009* shows weed species that have been treated in the 10 parks over the past few years. Treatment methods vary per species and sometimes based on the park. Methods have primarily included chemical treatment, seed-head bagging, hand-pulling and digging.

d) Summary of Current and Past Treatment of Nonnative Invasive Plants at Partner Parks

This summary provides an introduction to the kinds of nonnative invasive plant management that would continue to occur in the parks under Alternative 1, by illustrating treatments that have occurred over the between 2005 and 2009. Sources for the following information come from the NPS EPMT reports (2004-2009) (NPS 2004a, 2005a, 2006a, 2007a, 2008a, and 2009a) and from park staff involved in the preparation of this plan.

1) City of Rocks

City of Rocks treatment is currently focused on eradicating, houndstongue, black henbane, spotted and diffuse knapweed, hoary cress, and bull and musk thistle. Canada thistle is the most widespread invasive species in the park, eradication is not likely but the park is having success in controlling it. Most of the efforts have been focused on riparian corridors and roadsides. All of these species are listed as noxious weeds by the State of Idaho, which requires their treatment. The park intends to start focusing on non-noxious invasive weeds, such as mullein and burdock as well.

City of Rocks staff currently treats most weeds. City of Rocks continues to maintain certification for at least one certified pesticide applicator. The NRM-EPMT usually visits twice (five days each) per year and conducts approximately 3.5 days of treatment (primarily pesticide application). City of Rocks relies on the Idaho Noxious Weeds booklet (Idaho Department of Agriculture 2005) to identify potential new invaders.

In addition to work being done by the NRM-EPMT, City of Rocks has designated several weed management zones, wherein invasive plants are monitored to determine efficacy of treatment methods. The 2005 Weed Management Plan (refined to become the 2006-2010 plans) identified zones to study weed management problems, including dispersal, and also identified management objectives for each primary weed species found at City of Rocks.

City of Rocks contains a wide array of site conditions, including varying elevations, water table levels and types of, accompanied by high and low visitor use within several native plant communities. To help manage this diverse landscape, weed management zones were designated to correspond to drainage basins. Drainage basins were used because of the propensity of weeds to disperse along water courses. The zones are used to identify weed dispersal areas, to develop site specific weed eradication schemes, and to assist in analyzing data collected (NPS CIRO 2005:49) (see section 7. *Monitoring*).

The protocol for data collection used at City of Rocks was developed to meet the necessary NPS inventory and monitoring program data management standards as well as to meet those core elements outlined by the NPS Intermountain Region Weed Mapping Committee and the North American Weed Management Association (NAWMA) (see section 7. Monitoring). A variety of park partners contributed information to developing this program (see section 8. *Partnerships*) (NPS CIRO 2005:53)

NAWMA has created minimum mapping standards in collaboration with Canada, the United States and Mexico that are used at City of Rocks. The NAWMA describes three basic elements of weed inventorying:

- What is the weed?
- Where is it located? and
- How large is the infestation?

According to its Weed Management Plan (NPS CIRO 2006), the reserve currently treats species listed by the State of Idaho as noxious. Combined, City of Rocks and Castle Rocks State Park have nine noxious weed species designated by the State of Idaho, three that are listed as species of concern, and five nonnative weed species that are not on the Idaho list but are of concern to City of Rocks and Castle Rocks.

Priorities are assigned based on the acres covered by the species and the ability of the species to dominate and cause imminent threat to the surrounding natural resources. Higher priority is assigned to those species that have a relatively small infestation, because control of those species can be easier to achieve.

City of Rocks NRM-EPMT Treatment 2005-2009

Black henbane: This plant was removed in 2005 near the entrance by hand-pulling.

Canada, musk and bull thistle: Curtail was used in 2005 to treat Canada thistle. Rodeo was also used for Canada and musk thistle. Between 2006 and 2008, Milestone was used to treat populations of bull and Canada thistle. In 2008, the NRM-EPMT reported that there had been major reduction in the size and density of thistle infestations treated over the last two years. The improvement in these areas allowed the crew to treat different infestations of Canada, musk, and bull thistle in City of Rocks and Castle Rocks State Park. Two new infestation areas that were treated were part of the City of Rocks Backcountry Byway that excluded these wetland areas from cattle and other impacts. Most of the NRM-EPMT effort in 2009 was focused on treating Canada thistle with Milestone. The 2009 report noted that treatments in 2008 had decreased the size and density of this infestation by 80 percent.

Spotted knapweed: This plant was removed in 2005 by hand-pulling. It was chemically treated with Milestone in the campground area between 2006 and 2008. The 2009 report noted that a spotted knapweed infestation that has been treated since 2004 appeared to have been completely eradicated; however a new population was later found (NPS 2009a).

Common mullein: This plant was dug or hand-pulled between 2005 and 2007 from the campground area.

Houndstongue: This plant was dug or hand-pulled in 2006 and 2007 from the campground area.

Hoary cress: Milestone was used to treat this species near the visitor center in 2007 and 2008.

Field Bindweed: Milestone was used to treat this species near the visitor center in 2008.

Castle Rocks State Park: In 2006 and 2007 near the visitor center, spotted knapweed was chemically treated early in the season and hand-pulled late in the season and Escort was used to treat hoary cress. (*Note*: While treatment of Castle Rocks State Park has occurred it is not currently part of this plan but would continue to be treated by NRM-EPMT resources as time and funding allowed and as desired by the combined management of the two parks.)

2) Craters of the Moon

Prior to the mid-1990s, weed treatment at Craters of the Moon was informal, completed as resource management staff became familiar and able. Initially, it was also thought that weed invasion would be limited by the area's harsh environment. Currently, Craters of the Moon weed treatment is focused on a variety of species, including rush skeletonweed, leafy spurge, dyers woad and spotted and diffuse knapweed, which are found in and around lava flows. Rush skeletonweed is of critical concern because it is transported via windborne seeds into remote areas of the preserve. The current program is comprised of mostly walk-in treatment using backpack sprayers through the use of park staff, NRM-EPMT and park base project money, financial assistance provided by the IDAG, and through Student Conservation Association (SCA) and other internship programs. In the future, the park may need to expand treatment tools to include biological control and other means of access, such as helicopters and/or potential use of these or fixed wing aircraft for aerial spraying.

The following is a description of the park's treatment programs based on specific areas, including highways; park roads, park facilities, and backcountry / off-road areas.

Highways: Park technicians survey, map, and treat primarily spotted knapweed, diffuse knapweed, rush skeletonweed, and Canada thistle along the Highway 20/26/93 right-of-way through the north end of the park. This 25-mile stretch of highway is surveyed and treated at least once each summer. Technicians have used manual removal (for isolated plants) and chemicals (primarily Transline and Milestone and rarely Tordon) for larger patches. These areas have been treated annually since 1998. Of the known sites visited in 2009, most patches had far fewer plants than in 2008 and over 60 percent of them had no plants to treat. Only one new site was located in 2009. The potential for new introductions remains high due to the volume of highway vehicle traffic including a large number of trucks transporting hay, which may include knapweed seed and which occasionally overturn.

Loop Road/Spur Roads/Two-Track Roads: Park technicians survey, map, and treat primarily spotted knapweed, diffuse knapweed, rush skeletonweed, field bindweed, Scotch thistle, and Canada thistle along the park's five-mile loop road and various spur roads across the monument. Technicians have used manual removal (for rare and isolated plants) and chemicals (Transline, Milestone, and rarely Tordon) to treat larger roadside patches. These areas have been treated annually since 1996. Similar to the highway, 2009 surveys found many patches in decline and/or with no plants at all. Only three new sites were located. Park staff also cooperates with local land owner Lava Lake Land and Livestock, LLC (an organic sheep ranch) to hand-pull knapweed and thistles from both monument and private road corridors adjacent to NPS lands. This work is done on several work days throughout the season (see *Partnerships* below).

Park Facilities: To reduce water use most lawns and formerly irrigated landscaped areas around the visitor center and housing area have eliminated irrigation and have been converted to native plants. In the late

spring, park staff manually removes cheatgrass from around the park visitor center, housing and nearby kiosks. In the fall, technicians also use Plateau to chemically treat emerging cheatgrass seedlings around park housing and parking areas. The park has also hand-pulled or chemically treated spot infestations of diffuse knapweed, spotted knapweed, and Canada thistle around the park visitor center, kiosks, and housing areas. Cheatgrass continues to be a problem in open spaces around park facilities. Although cheatgrass declines have been observed within individual years, these have not been sustained. Park staff has been testing management alternatives (i.e. sugar applications to reduce soil nitrogen, planting native species, and inclusion of surplus lava rock as a physical hindrance) and hope to expand on these techniques in future years.

Backcountry/"Off-Road" Areas: *Wapi Lava Field*: Since it was first found in 2007, park staff has been aggressively treating dyers woad across the southern one-third of the Wapi Lava Field. In 2007, park staff (with assistance from NRM-EPMT and an SCA crew) attempted mechanical removal and bagging of seed heads. This method was tried initially due to the small size of the originally discovered infestation and because herbicides would have been ineffective since most plants had already gone to seed. As additional infestations were discovered this approach was found impractical and park staff has since been applying the chemical Telar XP to all plants. Four sites were found, mapped and treated in 2007, 95 sites in 2008, and 150 sites in 2009. A BLM helicopter aerial survey across the preserve in 2009 found an additional 35 sites. NPS received state funds in 2009 through the Blaine County CWMA to treat several dozen dyers woad sites by horse-mounted sprayer (see 8. *Partnerships* below).

Carey Flow: Park staff has been aggressively treating leafy spurge along the southern Carey Flow since 2003. Since that time, 138 sites have been mapped and treated by park and BLM staff. BLM staff grid search the entire lava flow by helicopter each year and then treat sites and relay weed location data to monument staff. The largest site ever recorded has numbered 250 plants. Two chemical treatments are presently being used: Tordon is used in the spring and, beginning in 2007, Plateau application is used in the fall. In 2009, of the 90 sites surveyed and treated, 60 were found dead and all the remaining sites, save one, had 30 or fewer plants.

Paddelford Flat and Laidlaw Park: Beginning in 2006, park staff has been aggressively treating rush skeletonweed in these two predominantly BLM monument areas. In 2006 and 2007, NPS received state funds through the Blaine County CWMA to treat this weed by horse-mounted sprayer using the chemical Tordon. Thirty-five sites were treated in 2006 and 121 sites in 2007. In 2007, NPS (NRM-EPMT) also funded a five-person crew of SCA interns to survey and chemically treat rush skeletonweed in portions of Laidlaw Park. This crew located and treated 200 additional rush skeletonweed sites with Tordon; 75 percent of these sites had fewer than 10 plants. In 2009, park staff treated only 63 rush skeletonweed locations. With over 840 locations on adjoining BLM lands now known, Craters of the Moon is currently reevaluating when and where control efforts are feasible given that BLM has no active control measures in place on its lands.

Little Cottonwood and Leech Creeks: As with other areas, Craters of the Moon has been intensively surveying and treating these riparian areas since about 1995. Craters of the Moon technicians use mechanical removal (for mullein, burdock, and other isolated nonnative plants as well as for those in the stream course) and the chemicals Transline or Milestone for larger, drier patches. Other weeds treated include bull thistle, Canada thistle, and a small number of knapweeds. Most weeds are in decline but Canada thistle is difficult to control and is expanding.

Craters of the Moon NRM-EPMT Treatment 2005-2009

In 2005, the NRM-EPMT focused on spotted knapweed, Canada thistle, cheatgrass, leafy spurge, Scotch thistle, and diffuse knapweed. In 2007, the NRM-EPMT focused on leafy spurge, rush skeletonweed, dyers woad, Canada and bull thistle and spotted, diffuse and Russian knapweeds. In 2009, the team focused predominantly on dyers woad with a few days spent on leafy spurge and Rush skeletonweed (NPS 2004a, 2005a, 2006a, 2007a, 2008a, 2009a).

Herbicide treatment: NRM-EPMT work has focused on herbicide treatment of Canada thistle (Milestone and Aquaneat), spotted knapweed (Curtail and Milestone), rush skeletonweed (Tordon), leafy spurge (Tordon and Plateau), and Scotch thistle (Transline and Milestone). Cheatgrass, spotted and diffuse knapweed, Scotch thistle, and wooly mullein have also been manually removed by hand-pulling or digging (NPS 2005a). In 2007, knapweeds and thistles were also treated with Milestone, dyers woad with Telar XP, rush skeletonweed with Tordon, and leafy spurge with Tordon, then 2 4-D. In the late season, the knapweeds and dyers woad were manually removed by hand-pulling or digging and seedhead bagging.

Rush skeletonweed: Based on recent NRM-EPMT reports (NPS 2007a, 2009a), the wind-dispersed rush skeletonweed is increasing in the southwest part of the monument, especially near Laidlaw and has overwhelmed adjacent private landowners and BLM land managers. Despite concentrated efforts to contain this invasive species, the magnitude of the skeletonweed problem in this area is possibly beyond the present weed control resources of the BLM, Craters of the Moon, and NRM-EPMT, combined (NPS 2007a).

Leafy spurge: The BLM and Craters of the Moon have also been cooperating to contain a major leafy spurge infestation in the Raven's Eye Wilderness Study Area. In 2007, control efforts shifted from full containment using herbicides, to containment at the northern end of the front to protect the Carey Flow (Raven's Eye Wilderness Study Area) and to study the release of biocontrol agents elsewhere. Leafy spurge is a notoriously persistent plant; however the herbicide treatments have been very effective. The buffer area would likely need to be expanded southward in future years, to hold back the leafy spurge infestations on BLM land, since that area is no longer being treated with herbicides (NPS 2007a).

3) Fossil Butte

Fossil Butte treatment is focused on eradicating knapweed, creeping foxtail, thistles, and henbane. Tamarisk has been eradicated. High risk areas include the railroad and road, fences, and legislated livestock trails through the park (trailing of cattle twice a year and sheep twice a year).

From 1998 until spring 2007 Fossil Butte used a park staff certified pesticide applicator to treat invasive plants. The primary herbicides used were Roundup and 2,4D. Since this staff member retired in 2007, the park has primarily relied on the NRM-EPMT to manage invasive plants, especially associated with herbicide application. In addition to herbicide treatment, mechanical methods have been used to control yellow sweet clover, musk thistle, henbane, and other weeds controllable through mechanical means. Other permanent and seasonal park staff has periodically treated plants using manual/mechanical control (mowing, pulaskis, shovels, hand-pulling, and a shop vacuum).

Because of recent staff limitations, the park has concentrated efforts on areas frequently visited by the public such as trails, parking areas, roads, and picnic areas. In some of these areas it appears the weeds are being contained. In other areas of the park, some weed populations (especially musk thistle) are expanding.

Fossil Butte NRM-EPMT Treatment 2005-2009

Between 2005 and 2009, the NRM-EPMT focused on treatment of Canada, bull and musk thistle, spotted knapweed and black henbane.

Canada, bull and musk thistle: In 2005 and 2006, Canada thistle was treated chemically with Transline and bull thistle was removed by hand-pulling or digging. Musk thistle was hand-pulled in the southern part of the park. In 2006, Milestone was also used to treat 3.15 acres of Canada thistle. In 2007, musk and bull thistle were manually controlled along roadsides. The 2007 report noted that Canada and bull thistle treatments at Murder Hill and Millet Canyon had been quite effective considering the disturbance in these areas, including beaver induced water table changes and trespass cattle grazing. That report also noted that musk thistle had increased as a result of a recent fire. Milestone was used in 2007 and 2008 to treat thistles. By 2009, coverage by Canada thistle in these canyons had declined by an estimated 50-90 percent. The NRM-EPMT, therefore, had time to treat additional stands of Canada thistle in the upper

Chicken Creek drainage. Treatment of thistles with Milestone in 2009 was carried out in Millet Canyon, Chicken Creek, and on a road through the park. No treatment occurred, however, in Murder Canyon.

Spotted knapweed: Between 2005 and 2007 this species was removed by hand-pulling or digging, including from along roadsides in 2007. Between 2007 and 2009, a localized patch was also treated with Milestone.

Black henbane: In 2007, this species was hand-pulled from along roadsides. In 2007, the NRM-EPMT reported that a recent fire had increased the prevalence of this species. The 2008 NRM-EPMT report noted that soil salvaged from roadside ditches that was contaminated with henbane seed was used for fill during the construction of a new boardwalk to the Chicken Creek picnic area. Henbane along the boardwalk was treated with Milestone in 2009, and could require additional treatment in the future.

Cheatgrass: In 2007, the NRM-EPMT reported that a recent fire had increased the prevalence of this species. The park has experimented with seasonal mowing (and bagging) to reduce cheatgrass in areas accessible to a mower.

Hoary cress: This species was treated with Escort in 2009.

Fountaingrass: This species was treated with Rodeo in 2009.

4) Golden Spike

Golden Spike treatment is focused on the Big Fill area. Of the 133 plants known from the park, 41 are nonnative. The park has treated Scotch thistle and followed-up on recommendations from the NRM-EPMT for treatment of field bindweed and hoary cress. Some aerial spraying for dyers woad, leafy spurge, medusa head rye, and Russian and diffuse knapweed occurs adjacent to the park in spring and fall by Box Elder County on surrounding private lands.

Golden Spike NRM-EPMT Treatment 2005-2009

The 2005 NRM-EPMT report noted that the monument is relatively free of noxious weeds and there is good opportunity to reduce or perhaps even eliminate the relatively small noxious weed infestations identified at this park. NRM-EPMT treatment has focused on dyers woad, moth and common mullein, tamarisk (saltcedar), hoary cress, field bindweed and Scotch thistle.

Dyers woad: In 2005, due to an extremely wet spring, the park experienced a tremendous flush of dyers woad. Dyers woad infestations were found growing in locations where it had not previously been reported. The NRM-EPMT hand-pulled and removed the plant to eliminate seed production of this invasive annual. Additional hand-pulling of dyers woad was conducted in 2006. In 2007, the NRM-EPMT focused on hand-pulling and spraying. Several previously unknown infestations were discovered on the southeast side of the park. Large new infestations of dyers woad were also discovered in some canyon areas, as were new plants growing on recently graveled roads. It is likely that the gravel brought in for the road was contaminated with exotic plant seed and therefore did not meet weed-free specifications. Once dyers woad is established, it requires annual treatments for many years. Escort was used to treat large patches of dyers woad in 2007 and 2008. In 2009, previously untreated infestations were targeted within a canyon in the central area of the park with a combined treatment of Telar and Escort.

Common mullein: Incidental plants have been manually removed by pulling or digging.

Hoary cress: New patches of this plant were found in 2006. Due to the late season, arrangements were made for park staff to treat hoary cress when the timing was optimal for an Escort herbicide application. In 2007 and 2008, Escort was again sprayed. No hoary cress was observed in 2009.

Field bindweed: New patches of this plant were found in 2006. Similar to hoary cress, arrangements were made for park staff to treat the infestation during a more optimal time. In 2009, an initial treatment was performed on large patch of field bindweed using Escort.

Scotch thistle: This plant was treated in 2006 with Transline and hand-pulled in the bolting stage in 2007. In 2007, Milestone was sprayed to control large numbers of seedlings. In 2008, Escort and Milestone were used and Milestone again in 2009.

Moth mullein and common mullein: Moth mullein was found as a new invader in 2006, when over 700 rosettes were hand-pulled. Plants were also found and hand-pulled in the bolting stage in 2007. In addition, Escort was sprayed on many large infestations of moth mullein rosettes that were too large to control mechanically in 2007 and 2008. In 2009, only a few moth mullein plants were found and these were hand-pulled. No common mullein was observed in 2009.

Tamarisk (Saltcedar): Habitat was used as a cut-stump treatment to inhibit resprouting saltcedar along Blue Creek in 2007 and 2008.

5) Grant-Kohrs Ranch

Noxious weed management has been implemented through an IPM approach at Grant-Kohrs Ranch, beginning in 1985. Initially, spotted knapweed and Canada thistle were considered the primary pests; as of 2010, there are 12 Montana listed noxious weeds present and managed for at Grant-Kohrs Ranch including leafy spurge and yellow toadflax. IPM strategies implemented at Grant-Kohrs Ranch have included mapping and monitoring, hand-pulling, mowing, biocontrol, livestock grazing, herbicide application, and cooperation in the Gold Creek CWMA.

In 2003, Peter Rice from the University of Montana (UM) prepared a 10 year time line of recommendations for treatment of invasive plants at Grant-Kohrs Ranch (GRKO Rice 2003). Many of these recommendations have since been implemented by the NRM-EPMT.

Hand-pulling: Records indicate that hand-pulling was one of the first weed control practices completed in 1985 and that 14 worker hours were devoted to pulling 6,750 square feet of spotted knapweed in 1996. Hand-pulling/clipping approximately 0.01 acres of leafy spurge was completed in 2009 along irrigation ditch banks to prevent seeds from spreading downstream.

Mowing: Mowing was begun in 2000 to limit seed production of common annual weeds in sprinkler irrigated pastures. Mowing was used in 2008 and 2009 to remove litter from approximately two acres of cheatgrass to improve herbicide efficacy.

Biocontrol: Records indicate that biocontrol agents were released as early as 1985 on spotted knapweed at Grant-Kohrs Ranch. Additional releases on spotted knapweed occurred within the park during the 1990's. A presence/absence survey for biocontrol insects was conducted by an entomologist in 2009. Sampling results of leafy spurge along the river indicated the presence (in sizable numbers) of the flea beetles *Aphthona lacertosa* and *Aphthona nigriscutis*. Also found were sizable populations of the spurge stem borer, *Oberea erythrocephala*, and the leafy spurge hawk moth, *Hyles euphorbia*. A spotted knapweed infestation near the southern park boundary was evaluated and each of the blooms examined had multiple knapweed flower weevils, *Larinus sp*. and roots were loaded with robust *Cyphocleonus achates* larvae. Even though the knapweed seedhead flies, *Urophora sp*., were not sampled, a high level of confidence of their presence in the park exists because they are widespread throughout western Montana. The park's yellow toadflax infestations along the river were sampled and revealed the presence of two introduced beetles; the flower feeding beetle, *Brachypterolus pulicarius* and the toadflax seed capsule weevil, *Gymnetron antirrhini*. Although the sampling was for presence/absence, there appears to be a good complex of biocontrol insects feeding on the leafy spurge, spotted knapweed, and yellow toadflax in Grant-Kohrs Ranch. The Powell County Weed District and MSU Powell County Extension office have been active in making biocontrol releases on spotted knapweed, leafy spurge, and yellow toadflax in areas

surrounding Grant-Kohrs Ranch over the last 20 years and it appears that the populations have established, multiplied, and expanded their range into Grant-Kohrs Ranch.

Livestock Grazing: Grant-Kohrs Ranch successfully collaborated with Utah State University in 2004 and 2005 to train park livestock (cattle) to eat weeds. A growing body of research along with demonstrated successes on the ground indicates that behavior of livestock can be effectively modified and managed as an economical alternative to 1) enhance and maintain biodiversity of rangelands, 2) restore pastures and rangelands dominated by invasive species and 3) improve wildlife habitat. The training period lasted for one month and had immediate success. The cattle assisted with controlling spotted knapweed, Canada thistle, and some leafy spurge on more than 300 acres in 2004. In 2009, a Cooperative Ecosystem Studies Unit (CESU) project with MSU was initiated to further study the preference the previously trained cattle have for the target weeds and to determine if their learned behavior was passed onto their offspring and other untrained animals in the herd. Approximately 20 cattle and their offspring remain part of the herd from the training program.

Herbicide Application: Prior to 2003, herbicide treatment was implemented through contract commercial applicators including ground and aerial application as well as appropriately licensed resource staff. In 1998, 260 acres of Canada thistle were treated utilizing helicopter application. Another 150 acres of Canada thistle was treated with helicopter application in 2002. Since 2003, the NRM-EPMT has served as the primary herbicide applicators at Grant-Kohrs Ranch. Resource staff spot sprayed one acre of Canada thistle with Milestone in 2009 utilizing county rental spray equipment. Currently, there is one Grant-Kohrs Ranch staff member that is a licensed applicator. In 2009, Peter Rice (UM) treated approximately 0.1 acres of cheatgrass as part of a study to develop a cheatgrass prescription for Grant-Kohrs Ranch.

Cooperative Weed Management Area: See *Partnerships* below.

Grant-Kohrs Ranch NRM-EPMT Treatment 2005-2009

The NRM-EPMT has focused on treatment of spotted knapweed, Canada thistle, hoary cress, field bindweed, leafy spurge, yellow toadflax and perennial pepperweed.

Corrals and Roads: In 2005 and 2006, hoary cress was treated to prevent further spread by livestock. In 2007, the NRM-EPMT noted that hoary cress infestations had been reduced by 25 percent. In 2008, that same population was noted as having been reduced by upwards of 90 percent.

Grazing Fields: Perennial pepperweed was mapped and treated in 2005. Spotted knapweed was treated in 2005 using Tordon, applied to fields using an OHV sprayer and truck-mounted tank sprayer. Spotted knapweed treatments by the NRM-EPMT in 2006 were very effective. Extremely well established and dense spotted knapweed populations were noted by the 2007 NRM-EPMT to have been reduced by more than 48 percent. In 2008, that same population was noted as having been reduced by upwards of 90 percent.

Irrigation Canals: In 2005 and 2006, perennial pepperweed was mapped and treated along irrigation canals throughout the park.

Western Park Boundary: In 2005 and 2006, babysbreath was treated with Redeem in an attempt to prevent it from spreading further into the ranch. In 2007 and 2008, the NRM-EPMT noted that the babysbreath infestations on the foothills had been reduced by 98 percent.

Clark Fork River Riparian Corridor: The Grant-Kohrs riparian area is a haven for white-tailed deer, sand hill cranes and many other animals as a result, this area has been a focus for restoration. The primary goal of this project is to contain and control leafy spurge and yellow toadflax; facilitate recovery of willows and other trees, sedges, grasses and other native plants. Photo point monitoring during the first year indicates some positive results; with initial treatment efforts beginning to control some leafy spurge along the riparian corridor (NPS 2007a). In 2005, small outlying populations of leafy spurge were treated to prevent

spread by livestock. Large, dense infestations of leafy spurge and yellow toadflax were identified for treatment in 2006. As a result, in 2006, the riparian corridor (80.5 acres) was treated with Plateau. In 2007, 115 acres of this same heavily infested riparian area were treated with Plateau. This was a 40 percent increase in the number of acres treated over 2006. The increase in acres treated was due to an expansion of the project scope, including adding treatment of Russian knapweed and Canada thistle to the original leafy spurge and yellow toadflax targets. In 2008, 54 acres in this area were retreated with Plateau and in 2009 6.7 acres of leafy spurge were treated with Plateau. In 2008, test plots were set up to measure the effectiveness of Telar on yellow toadflax. In 2009, these were noted as so successful that Telar was used to treat all yellow toadflax. The proposed focus in 2010 is likely to be on Canada thistle because yellow toadflax and leafy spurge reductions have been so successful.

Field Bindweed and Cheatgrass: Small infestations of both species were treated in 2008. The 2008 report noted that the NRM-EPMT would be assisting the park with cheatgrass eradication and native bunchgrass restoration beginning in 2009.

6) Hagerman Fossil Beds

Hagerman currently relies on the NRM-EPMT for treatment of invasive plants.

Hagerman Fossil Beds NRM-EPMT Treatment 2005-2009

Between 2005 and 2009, the NRM-EPMT focused on Canada thistle, diffuse knapweed, purple loosestrife, rush skeletonweed, and saltcedar. In 2009, houndstongue was also treated.

In 2005, treatment included rush skeletonweed (Tordon), Canada thistle (Round-up Pro), and purple loosestrife (Rodeo). Diffuse knapweed, rush skeletonweed, and purple loosestrife were manually removed by pulling or digging. Canada thistle, diffuse knapweed, rush skeletonweed, purple loosestrife, and saltcedar locations were inventoried and/or monitored.

Although 2005 reports noted little presence of noxious weeds, further exploration in 2006 found several large infestations of saltcedar – one of which covers 20-30 percent of a 12.35 acre canyon. Purple loosestrife infestations, especially younger plants, continued to be found along the riverbank in larger abundance than had previously been thought because the plants are in amongst thickets of 10-foot-tall rushes.

In 2006 treatment included rush skeletonweed (Transline in May and Rodeo in July), Canada thistle (Transline in May and Milestone in July), and purple loosestrife (Rodeo). Generally, diffuse knapweed, was manually removed by pulling or digging. Saltcedar locations were inventoried with a few trees drilled and filled with undiluted Rodeo – 10 ccs per 5/8" drill-hole. Common teasel was also found to heavily infest the riverbank and Canada thistle was found in great numbers from along the riverbank up through the canyons and along private property lines.

Treatment in 2007 included diffuse knapweed and Scotch thistle (Milestone), rush skeletonweed (Tordon), saltcedar (Habitat cut-stump), purple loosestrife (Rodeo). 2008 treatment focused on controlling 4.8 acres of saltcedar in the main drainage and purple loosestrife.

Purple loosestrife: This plant is abundant along the Snake River. Major infestations are located upstream outside the boundary. Large infestations were treated using a boat between 2006 and 2007. Small, non-blooming plants were undetected in the early season because they grow amongst dense vegetation. The 2007 NRM-EPMT report noted that while purple loosestrife is still widespread, all solid stands had been treated and contained. This resulted in an overall reduction in the volume of herbicide needed to treat purple loosestrife in 2007. Removal of widespread scattered small plants, however, continues to be a slow process. Detection of these small plants, by wading through mud banks of dense, 10-foot tall rush thickets is difficult. In many locations, the riparian areas are so wide and dense that plants growing just a short distance inside the riparian zone are not visible from the boat, requiring detailed and intensive surveys on foot (NPS 2007a). In 2008, purple loosestrife treatment from the boat was delayed by a late

winter and boat trouble. Some new infestations were found and treated on foot. In 2009, treatments were again hampered, this time by low water levels and high winds. This team noted that the riparian area continues to need methodical monitoring and multiple treatments for purple loosestrife each season.

7) Little Bighorn Battlefield

The roads, trails, building network, and Custer National Cemetery, collectively the developed zone, has long been managed for nonnative invasive species. Nonnative invasive species within the natural prairie, undeveloped zone, did not become a concern until the early 1990s. Facility management crews, with BIA and assistance from the Crow Tribe, managed weeds in both zones including St. Johnswort, spotted knapweed, and Dalmatian toadflax until the mid 1990s.

Under the formal guidance of the Natural Resource Challenge issued in 1999, Yellowstone National Park, Bighorn Canyon National Recreation Area (NRA) and NRM-EPMT aided Little Bighorn staff in sporadic treatments using chemicals, mechanical tools, and by hand-pulling. Efforts focused on treatment and restoration as well as prevention. Seed (species unknown) and matting were laid at the Tour Road pullouts when curbing was established in the mid 1980s. Throughout the 1980s and 1990s the Superintendent periodically closed unimproved trails to protect resources. Visitor access was restricted to roads and improved trails in 2000, when improved trails opened permanently. While this protected the resource, a notable, consequent benefit was that it helped to prevent the spread of nonnative species. Unfortunately, when the Indian Memorial was constructed in 2003, soil brought in from outside the park carried Russian knapweed, a species which had not previously been seen in the park. Although native seed was planted in the areas disturbed by the Indian Memorial construction, other sites are believed to have been cultivated with nonnative crested wheatgrass. In the mid-1980s crested wheatgrass most likely was planted after facility work southeast of the visitor center and the removal/abandonment of the old drainfield south of the administration building. The vegetation map shows only one crested wheatgrass infestation, which occurs over the old drainfield.

The natural resources program was initiated in 2004 funded by visitor use fees under the Federal Lands Recreation Enhancement Act (FLREA). The natural resources staff adopted nonnative species management by targeting state-listed species (noxious weeds) throughout the park's road and trail system, building network, and disturbed sites. During the program's first year, MSU completed a baseline survey inventorying several other nonnative plants including Japanese brome, cheatgrass, field bindweed, houndstongue, hoary cress / whitetop, and thistles. These plants tend to occur along roadsides and in previously disturbed areas. Because there is limited visitor use disturbance (i.e. trampling) away from roads and trails due to visitor restrictions from overland foot or vehicle travel, the park lands remain relatively weed free. Weeds across the park, like yellow sweetclover and smooth brome, most likely have been present since the late 1800s, and western salsify (*Tragopogon dubius*) since the early 1900s. Other nonnatives include ornamental trees planted in the cemetery and bush honeysuckle, Canada thistle, Russian olive, and salt cedar in the riparian area of the park.

A brochure educating the public on park weed management and preventing the spread of exotic species is available at the visitor center. Seasonal staff is briefed on exotic species and the Natural Resources program before the summer visitor use season. Treatment methods include mechanical (tools and hand-pulling) and chemical (herbicide use). Little Bighorn also plans future use of biological controls to treat sizeable infestations. Native seed collected inside the park is cultivated in disturbed areas. Species collected include green needlegrass (*Nassella viridula*), bluebunch wheatgrass (*Pseudoroegneria spicata*), blue grama (*Bouteloua gracilis*), and sideoats grama (*Bouteloua curtipendula*). The NRCS has produced large quantities of native seed from seed collected within the park for restoration.

Bighorn Canyon NRA assists Little Bighorn staff in maintaining roadside vegetation by mechanical mowing to ensure safe, functional, and healthy (attractive) roadsides. Little Bighorn staff also maintains roadside vegetation by chemical treatments to control or prevent the growth of vegetation such as noxious weeds, brush or other vegetation. Chemical spraying is done by or under the supervision of a licensed chemical applicator. Chemical spraying may also occasionally be contracted.

Little Bighorn Battlefield NRM-EPMT Treatment 2005-2009

The NRM-EPMT currently supplements the Little Bighorn program for treatment of invasive plants. Typically, a team of three biotechs from the NRM-EPMT visits once annually to monitor and treat infestations as well as to provide recommendations to park management. In 2005 there were three site visits to Little Bighorn to monitor and treat infestations. The park continually works with NRM-EPMT to refine methods for environmental soundness, effectiveness, and efficiency.

Between 2005 and 2009, the NRM-EPMT focused on field bindweed, houndstongue, hoary cress, yellow sweetclover, bull thistle, Canada thistle, Russian olive, saltcedar, St. Johnswort, spotted knapweed and bush honeysuckle.

Field Bindweed and Houndstongue: In 2005 and 2006, most NRM-EPMT work was concentrated on heavy infestations of field bindweed growing along the battlefield road. It is likely that infestations of field bindweed along the roadsides were brought into the battlefield in the soil used for road reconstruction. Mitigation measures have been identified to prevent this in the future. Trace amounts of houndstongue along the battlefield road were treated in 2005 during the field bindweed treatment. The 2006 report noted that despite three successive years of field bindweed treatment, no major decrease in the infested acreage has been evident. The area had been chemically treated with either Tordon or 2,4D. This report proposed switching to Paramount pending PUPs approval. In 2007, the team continued to focus on field bindweed along the road and in the gravel pit area and the report for that year noted that three successive years of field bindweed treatments have finally yielded a small decrease in the infested acreage. It attributed this decrease to an early-season treatment with 2,4-D herbicide by Little Bighorn staff prior to the arrival of the NRM-EPMT crew that had a positive effect in slowing vegetative and seed production.

Hoary Cress and Yellow Sweetclover: In 2005 hoary cress and yellow sweetclover were treated chemically along roads and trails. Yellow sweetclover blooms on a noticeable three-year cycle. The plants encroached on trails and road turnouts in 2005.

Bull Thistle and Canada Thistle: In 2005, the NRM-EPMT chemically treated some of the Canada thistle infestations at Little Bighorn. Trace amounts of bull thistle were also simultaneously treated. Park staff chemically treated the remaining infestations. Canada thistle was also chemically treated in 2005 in the National Cemetery.

Russian Olive and Saltcedar: Only minimal treatment of Russian olive along the Little Bighorn River corridor occurred in 2007 due to high flows. Treatment of both species along the Little Bighorn River occurred in 2008. Most of the trees were treated with cut stump and basal spray techniques. Some larger trees overhanging the river were girdled and sprayed. Retreatment of Russian olive resprouts occurred in 2009. Also in 2009, the last Russian olive in the housing area was removed.

St. Johnswort: In 2009, the NRM-EPMT focused on treating this species throughout the battlefield prairie. Extensive inventory work performed beforehand by park staff saved time in both treating and mapping the infestations. The infested area totaled 0.23 acres in an inventoried gross infested area of 25 acres. Trace amounts of hoary cress and spotted knapweed were also treated as St. Johnswort was treated.

Bush Honeysuckle: Approximately 0.25 acres along the Little Bighorn River corridor containing this species was treated with cut stump and basal spray techniques in 2009.

8) Minidoka

Minidoka currently relies on the NRM-EPMT for treatment of invasive plants. Minidoka currently has only isolated patches of native vegetation. Historic landscape plants are also sporadically located throughout the park. Elsewhere, the park is dominated by cheatgrass, crested wheatgrass, and other nonnative invasive species.

Minidoka NRM-EPMT Treatment 2005-2009
NRM-EPMT treatment over the past few years has focused on treatment of yellow starthistle, Russian knapweed, thistles (Canada, musk, and Scotch), white bryony, rush skeletonweed and common mullein.

Horse Corral: Russian knapweed is now confined to the horse corral area, but within the corral it is still a serious problem and continues to require aggressive management. Curtail was initially used to control it. In 2007 and 2008, Milestone was used to treat it. The 2009 monitoring showed control of this species and it was not retreated.

Canal: White bryony, a relatively new nonnative vine, added to Idaho's noxious weed list in 2007, was detected in 2005 in Russian olive trees along the canal. In 2007, the NRM-EPMT set up herbicide treatment plots to determine which treatment was the most effective at controlling this weed. Later in the season, these test plots were evaluated and it was found that the Rodeo treatment worked most effectively; therefore the team applied Rodeo to the remaining white bryony infestations (NPS 2007a). In 2008, the white bryony that was treated in 2007 was much less abundant, but still present next to the canal. Follow-up treatments are needed to eliminate the infestation. In 2009, the white bryony infestation that was monitored was found to be greatly reduced in size and density. Much of the remaining infestation is growing as an understory in an area containing Russian olive. To more effectively treat the bryony infestation, the team recommended removal of the olive trees in 2010, a plan Minidoka staff are pursuing.

Two other noxious weeds, Canada thistle and rush skeletonweed were also treated with Rodeo beginning in 2007 along the canal. Rush skeletonweed and thistles were also treated with Milestone in 2008. In 2006 musk thistle and some mullein were hand-pulled, then new Canada thistle infestations were mapped. Between 2007 and 2009, Canada, musk, and Scotch thistle and some common mullein infestations were mapped and treated with either Rodeo or Milestone.

Yellow starthistle was manually removed and monitored in 2005, but was not found in 2006. The area has been monitored since 2005.

9) Nez Perce: Bear Paw
Bear Paw treatment is currently focused on a 7-8 acre parking / picnic area adjacent to the battlefield and an interpretive trail that traverses the battlefield. The site is remarkably intact and contains only small invasions of Canada thistle and field bindweed, with less than 0.1 acre affected. The park has begun to consider treatment for alfalfa encroaching from adjacent ranches.

Bear Paw NRM-EPMT Treatment 2005-2009
The Bear Paw site is in very good condition and noxious weeds infestations are somewhat limited. The NRM-EPMT conducted Canada thistle treatment at Bear Paw in 2010. In past years, the EPMT has contributed funding to some treatment of Canada thistle and spotted knapweed conducted by Blaine County road crews.

10) Nez Perce: Big Hole
Big Hole treatment is currently focused on approximately two acres of spotted knapweed and Canada thistle. Park staff and cooperative partners treat approximately 1.5 acres yearly, the same general area that the NRM-EPMT treats on their biannual visits to Big Hole.

Most nonnative species are treated chemically with Milestone, distributed with backpack sprayers. Mechanical treatment of spotted knapweed (pulling or cutting flowering heads off) is used as appropriate during the growing season.

Nez Perce: Big Hole NRM-EPMT Treatment 2005-2009
In 2009, the team focused on spotted knapweed, Canada thistle, and common tansy.

Housing Complex and Visitor Center area: Spotted knapweed occurs primarily in these and other park developed areas. This plant is perhaps the most tenacious invasive weed in the park due to its persistent seed bank (NPS 2007a). Since 2005, it has been reduced by 96 percent (NPS 2009a). Infestations are mainly limited to developed areas including the housing complex and areas around the visitor center. The crew initially concentrated on these areas, applying Milestone. Unfortunately, the knapweed rebounded due to unknown environmental reasons. Fortunately, the park was able to secure volunteers to hand-pull the plants and prevent seed drop. In August 2005, park employees discovered and treated a newly discovered acre of spotted knapweed. In addition to NRM-EPMT work in 2005, the park conducted an additional 10 days of treatment of targeted weed species.

Battlefield Road and Parking Lot: Field bindweed and common tansy occur along the edge of the road and parking lot. These infestations have been reduced by 95 percent, and with continued treatment may be completely eradicated from the Battlefield in the near future (NPS 2007a). A single leafy spurge plant was discovered in 2004 along the road edge. It was treated with Tordon herbicide and showed no signs of regrowth in 2005. In 2009, the NRM-EPMT also treated small populations of common tansy, and hoary alyssum along the edge of the battlefield road and parking lot. These infestations have been reduced by 95 percent, and with continued treatment may be completely eradicated from the battlefield.

Irrigation Canals: The five irrigation canals that cross the park have provided an artificially wet environment conducive to Canada thistle growth and spread. Canada thistle is considered the most abundant and widespread invasive plant at Big Hole. Beginning in 2006, a polymer was added to the irrigation water system to seal the bed of each canal. Annual polymer treatments have decreased water seepage below each of the canals and combined with annual NRM-EPMT herbicide treatments beginning in 2003 appear to be limiting re-growth of Canada thistle populations (NPS 2007a). By 2005, Canada thistle was reduced by 75 percent. By 2007, Canada thistle had been reduced by 95 percent.

5. Monitoring

a. NRM-EPMT

In Alternative 1, most of the parks would primarily continue to depend on the NRM-EPMT inventory and monitoring efforts for invasive plants, and as they occurred or were revised depending on development of park vegetation maps.

In general, the NRM-EPMT site visits and treatments are documented using GPS. The team also monitors known infestations, documents new locations of invasive exotic plants and assists with park restoration efforts, as needed (NPS 2005a).

NRM-EPMT monitoring currently consists of identifying and mapping a polygon of the invasive plant population. NRM-EPMT staff then conducts an inventory of this area to record target nonnative species by making a visual estimate of the target species cover (based on cover classes) within the polygon. The NRM-EPMT also makes a visual estimate of the target species distribution (patchy, dispersed, isolated, uniform, etc). In addition, information about the phenology of the plants is noted (young, blooming, gone to seed, etc.) and notes about the site (proximity to water, etc.) and the weather are made.

Each time initial monitoring or treatment occurs, information about the population is noted on a data form. Treatment data forms are similar to the inventory forms (Appendix I: *Forms*); however, do not require the observer to conduct the inventory.

b. Park Specific Monitoring

In addition to monitoring conducted in cooperation with the NRM-EPMT, some parks including City of Rocks, Craters of the Moon, Grant-Kohrs, Little Bighorn, Minidoka, and Nez Perce (Big Hole) have used or developed monitoring programs or actions. Following are some examples that would continue to occur in Alternative 1.

1. City of Rocks

Reserve field personnel collect data to effectively evaluate the status of weed populations. Data collection is the basis for determining the extent of weed infestations and is used to analyze progress in meeting treatment objectives. Data collection at the reserve is according to a set of minimum standards that have been developed so that information being collected is compatible each year and with other partners (NPS CIRO 2006:53).

A variety of information is collected while conducting weed inventories at City of Rocks and Castle Rocks. Spread sheets and data dictionaries document the inventories.

2. Craters of the Moon

Craters of the Moon has recorded and is presently tracking nearly 2,300 weed locations, including 760 locations on NPS lands and over 1,500 on BLM Monument lands directly adjacent to NPS lands.

Since 2000, Craters of the Moon has employed a local weed crew to survey and treat nonnative plants throughout the monument. Inventory and treatment of the recently expanded portion of the monument and preserve's harsh terrain of lava flows occurs for noxious weed species, with special emphasis on invaders such as rush skeletonweed, leafy spurge, diffuse knapweed and spotted knapweed is occurring. Annually, for each target species in a small population, staff identifies a point and counts the number of plants. For large populations, park monitoring is the same as NRM-EPMT monitoring, with visual estimates of plant density and cover and mapped edges.

In 2007, an EPMT-funded SCA Native Plant Corps team focused on mapping rush skeletonweed and completed inventory on nearly 2,758 acres and walked more than 822 miles to treat 2.8 acres of this highly dispersed priority weed. They produced a detailed spatial map of all noxious weeds identified and located (NPS 2007a).

The UCBN completed a vegetation inventory and map for the monument in September of 2009 which would aid in identifying susceptible and high priority plant communities for weed invasion. In particular this indicates areas in which cheat grass already occurs in high densities.

3. Grant-Kohrs Ranch

In 2003, a contractor from MSU (in cooperation with resource management staff and the UM mapped 75 percent of the park for noxious weeds and completed a GIS map. In 2009, 25 variable size monitoring plots were established in the riparian zone with assistance from the UM (Peter Rice) to monitor the effectiveness of control strategies on leafy spurge, yellow toadflax and Canada thistle. The 2009 individual species cover data from the plots is currently being compared to the 2003 inventory data. The ROMN has also developed and implemented a vegetation monitoring protocol for the park, and a 2006-2007 Grant-Kohrs Ranch Vegetation Map is nearing completion.

As noted above, in 2008, the NRM-EPMT set up herbicide treatment test plots to determine the most effective herbicide to use in treating yellow toadflax.

4. Little Bighorn

There are abundant weeds in the developed zone and a wide variety of species compared to the undeveloped zone. Weeds in the developed zone are easily located and treated annually, so monitoring consists of evaluation of annual treatment time and cost (salary, materials, and equipment). Little Bighorn employs a simple GPS method to monitor the spread/invasiveness of a species in the undeveloped zone.

The GPS unit currently used at Little Bighorn has a margin of error of more than one meter. Therefore, at the rate that most populations (patches) spread, it would take a minimum of four to five years to be certain that the area of a patch was actually increasing, even at a consistent maximum spread per year (LIBI Wood and Rew 2005). In 2004 and 2010, MSU completed nonnative plant surveys using GPS.

Although it had been only two years since the MSU 2004 baseline weed inventory, infestations were mapped in 2006 to evaluate the success of and close out a park project.

Little Bighorn uses an IPM approach including various monitoring and treatment methods. The ROMN employs a simple presence/absence technique park wide and may develop an Early Detection monitoring protocol. The park is developing a park-specific monitoring protocol for two of the highest priority exotic species, St. Johnswort and Canada thistle. The 2004 and 2010 surveys completed by MSU will be analyzed to evaluate the success of the park weed program.

5. Minidoka

As noted above, in 2007, the NRM-EPMT set up test plots to determine the most effective herbicide to use in treating a new noxious weed – white bryony. No other monitoring has occurred at the park.

6. Nez Perce: Big Hole

Of the park's 655 acres, approximately 70 acres are monitored annually. Monitoring has shown increases in current populations of invasive species, combined with a decrease in spread to new areas of the park.

6. Recordkeeping

The 10 parks would continue to keep a variety of records associated with nonnative invasive plant treatment in Alternative 1.

The following are among the requirements for monitoring and recordkeeping strategies that the parks employ to ensure that they are complying with existing NPS and state requirements:

- Pesticide Use Proposals (PUPs): PUPs are submitted annually for each pesticide intended to be used for each plant. For example, if a pesticide is intended to treat three different plants, each of those would be identified on the proposal. The proposals are submitted to the Regional IPM Coordinator and are individually approved or disapproved per pesticide per plant. These pesticide use proposals document the use of all EPA registered chemicals. Required information includes the type of pesticide, the amount and concentration planned to be used, the size of the total treatment area, and the target plant(s). Later, after use, information is submitted against these proposals to document actual use of the pesticides.
- Pesticide Use Logs: Pesticide use logs are needed each time a pesticide is used. Information recorded includes amount of active ingredient used, whether or not it was mixed with another ingredient, date of use, and target plants.
- Material Safety Data Sheets (MSDS): For each pesticide used, parks are required to keep MSDS on hand, both in the office and with the team in the field where the pesticide is being used.
- Pesticide Container Labels: For each pesticide used, parks are required to keep a copy of the label on hand, both in the office and with the team in the field where the pesticide is being used and to follow manufacturer's specifications regarding use of the chemical.
- GPRA goals and Superintendent's Annual Reports: Reports of areas treated and treatment success are included in these park annual activity summaries.

By law, pesticide recordkeeping requirements are:

- Pesticide application data must be recorded within 30 days of the application;
- Records must be maintained for a minimum of three years;
- Applicator must notify applicants of hazards (worker protection standards);
- Date of application;
- Brand or product name;
- EPA registration number;
- Specific crop or commodity/target plant area;

- Amount applied;
- Size of area;
- Location of application;
- Name and number of certified applicator;
- Temperature; and
- Wind speed.

The following NRM-EPMT records are also kept:

- Number of acres treated (by any method) (what? where? how?);
- Annual mapping of some major infested areas (using GIS layers);
- NRM-EPMT Site Visit Reports;
- NRM-EPMT use of chemical pesticide treatment per species; and
- NRM-EPMT Annual Reports.

Parks that conduct additional monitoring (City of Rocks, Craters of the Moon, Grant-Kohrs, Little Bighorn and Big Hole) would also continue to keep monitoring records.

7. Interpretation and Education

Under Alternative 1, existing visitor awareness or public education activities, which vary widely among parks, would continue. For some parks, these programs currently provide general information on nonnative plant management issues, and information about and strategies for controlling individual nonnative invasive plants to increase staff and visitor awareness. Many parks would also continue to offer seasonal training to staff and volunteers on prevention or early detection and eradication of nonnative invasive plants.

Among the interpretive and educational programs currently employed at the parks, include the following:

- Nearly all of the parks conduct some formal seasonal training that is used to, among other objectives, introduce seasonal staff to the presence of nonnative invasive plants, and create awareness that supplements park invasive plant control efforts.

- Craters of the Moon has hosted an annual *Weed Awareness Week*, which has been a very successful week-long public education and community outreach effort. In 2007, the program included over 600 public contacts (NRM-EPMT 2007). Special events included six poster presentations; two four-person interactive evening interpretive programs, two power point presentations on nonnative plant management partnerships, and two junior ranger activities.

- Grant-Kohrs Ranch has cooperated with the Montana Department of Agriculture to set up a certified weed free forage informational booth at Ranch Days in July.

- Little Bighorn conducts seasonal training, has developed brochures and hung posters for *Weed Awareness Week*, and special interpretive / educational programs, including a demonstration plant plot highlighting native and nonnative species.

8. Partnerships

Existing partnerships for each of the parks would continue under Alternative 1. Each of the 10 parks participates in one of the following Natural Resource Inventory and Monitoring Networks:

- Upper Columbia Basin (UCBN) (City of Rocks, Craters of the Moon, Hagerman Fossil Beds, Minidoka, Big Hole and Bear Paw),

- Rocky Mountain (ROMN) (Big Hole, Grant-Kohrs Ranch and Little Bighorn), or
- Upper Colorado Plateau (UCPN) (Golden Spike and Fossil Butte).

As a result, the parks collaborate on a variety of network activities or are the recipients of network activities, such as the development of inventory and monitoring protocols and NRM-EPMT work. The parks also currently collaborate with one another on a limited basis as part of nonnative plant management planning. These latter cooperative efforts occur primarily through the NRM-EPMT. This team usually employs approximately nine seasonal employees (three for each satellite crew) who travel to the parks to conduct invasive plant treatment (primarily manual/mechanical and chemical treatments). The NRM-EPMT has been an active resource for the 10 parks for approximately the past six years. Each year the parks submit requests through the NRM-EPMT coordinator, based at Yellowstone, to address park nonnative plant mapping and management needs. The NRM-EPMT then compiles and prioritizes these requests as a guide for the coming season. The NRM-EPMT Advisory Committee (comprised of representatives from parks served by the NRM-EPMT) holds meetings twice a year (at the beginning and end of the season) to define work schedules, budgets, and to summarize annual accomplishments, etc.

Some of the parks have also developed partnerships with members of various groups to prevent invasive plant spread; share information and knowledge about weeds on NPS and adjacent lands; acquire help to treat invasive plants; educate each other and visitors about weeds; participate in cooperative conservation efforts; and to obtain money and labor for treating weed infestations. Table 18: *Northern Rocky Mountains Parks Current Partnerships* below identifies the existing partnerships at each of the 10 partner parks. The parks would also continue to collaborate routinely with state, county, private, tribal and federal officials as well as with private landowners when undertaking planning.

a. City of Rocks

Brenda Waters, former NRM-EPMT coordinator, Tim Prather of the University of Idaho, Steven Dewey of Utah State University, Shana Wood of MSU, and inventory and monitoring program colleagues from the UCBN and elsewhere assisted the reserve in developing its Weed Management Plan monitoring program.

b. Craters of the Moon

Craters of the Moon works closely with two CWMAs (Blaine County and Lost River) to collaborate on weed management activities. Park staff work with the Lost River CWMA weed crew for two work days each year to treat noxious weeds along a northern boundary. Crews have mapped and treated spotted and diffuse knapweed, Scotch thistle, and field bindweed. With the Blaine County CWMA, consistent work days have not been established, but this CWMA has provided funds to support removal of dyers woad across the Wapi Lava Field.

Craters of the Moon staff also work closely with an adjacent private landowner northwest of the park boundary. Lava Lake Land and Livestock, LLC maintains an organic lamb operation and works with park staff to manually and mechanically remove weeds from private and BLM Monument lands. Two work days are accomplished each year and because of the organic lamb status no chemical treatments are used.

c. Big Hole

The current program relies on the NRM-EPMT, and a few cooperative days with the USFS and Beaverhead County. Big Hole also uses USFS and Beaverhead County spray equipment, and their staff in exchange for providing staff from the park, to participate in county wide weed spray days. These partners have worked with park staff for several years to eradicate nonnative species from the park and its boundary areas. Because of contributions from NRM-EPMT and park neighbors, there has been a decrease in the spread of invasive plants to new areas in the park.

The park's certified pesticide applicator also periodically works with Beaverhead County to treat highway corridors leading into the battlefield. In 2005, this led to a donation of herbicide that allowed Big Hole to conduct additional treatment and re-treatment of targeted species.

d. Grant-Kohrs Ranch

Grant-Kohrs Ranch has participated in the Gold Creek CWMA initiated by the Powell County Weed District in 2000. Grant-Kohrs has provided letters of support for grants that have provided funding to assist weed management on neighboring properties. The Montana Department of Transportation (MDOT) also participates in the CWMA. The MDOT, through Powell County, implements weed management along MDOT rights of way located along the east and south Grant-Kohrs Ranch borders. Grant-Kohrs Ranch also participates in an annual public agency weed meeting facilitated by the Powell County Weed District.

e. Little Bighorn

Little Bighorn staff currently works with NRM-EPMT and Bighorn Canyon NRA staff to treat weeds annually. NRM-EPMT visits once or twice annually to monitor and treat infestations as well as to provide recommendations to park management. The park continually works with the NRM-EPMT to refine methods for environmental soundness, effectiveness, and efficiency. Bighorn Canyon NRA maintains Little Bighorn roadside vegetation by mechanical mowing.

ROMN and MSU assist with monitoring and Little Bighorn cooperates with BIA land managers regarding weeds in the area of the park and Little Bighorn River corridor.

Under a NPS service-wide agreement, Little Bighorn works with the Rocky Mountain CESU to identify potential park projects and partners. The CESU facilitated a park agreement with MSU for a student research project to assist park staff in weed control and research and report biological control options for high-priority species.

The NRCS has propagated large quantities of seed collected within the park for Little Bighorn for use in restoration.

f. Exotic Plant Management Teams

NPS EPMTs are partnering with communities, groups, land managers, and other public land agencies to prevent the introduction and spread of invasive species in and around national parks. Invasive species outreach programs include school curriculum materials, such as *Aliens in your Neighborhood*, support for local CWMAs, partnerships with CESUs, and financial support through grants. CWMA's are locally based organizations that help landowners, land managers, and invasive plant experts pool resources to manage invasive plants within a local area.

Table 18: Northern Rocky Mountains Parks Current Partnerships

Park Unit	Currently Active Partnerships
City of Rocks	NRM-EPMT (NPS) Cassia County Weed Supervisor Youth Conservation Corps
Craters of the Moon	NRM-EPMT (NPS) Lost River Cooperative Weed Management Area Blaine County Cooperative Weed Management Area Adjacent Landowners Idaho Weed Coordinating Committee Youth Conservation Corps Student Conservation Association Lava Lake Land and Livestock, LLC Bureau of Land Management
Fossil Butte	NRM-EPMT (NPS) Lincoln County Adjacent Landowners Railroads Stocktrailing

Park Unit	Currently Active Partnerships
Golden Spike	NRM-EPMT (NPS) Box Elder County (road spraying) Utah Conservation Corps
Grant-Kohrs	NRM-EPMT (NPS) Adjacent Landowners Inholding with NPS Scenic Easement (Treated by NPS) Inholding (City Sewage Lagoons) (no treatment) Inholding (Railroad) (no treatment) Gold Creek Cooperative Weed Management Area Powell County Weed District
Hagerman Fossil Beds	NRM-EPMT (NPS)
Little Bighorn	NRM-EPMT (NPS) ROMN (NPS) Bighorn Canyon National Recreation Area (NPS) Rocky Mountain CESU Montana State University BIA NRCS
Minidoka	NRM-EPMT (NPS)
Nez Perce: Bear Paw	NRM-EPMT (NPS) Blaine County Highway Department (road spraying) Boy Scouts
Nez Perce: Big Hole	NRM-EPMT (NPS) Adjacent USFS (collaborative spraying) Beaverhead County Adjacent ranchers

9. Measures to Avoid, Minimize or Mitigate Impacts

There are currently few specific measures that partner parks use to avoid, minimize or mitigate impacts from nonnative invasive plants aside from those mentioned in section 1. *Prevention and Early Detection.* Those measures that are used by the parks primarily have to do with avoiding impacts from construction and are applied individually as the parks undertake construction projects. These measures include importation of clean fill, reseeding and other revegetation of areas disturbed by construction, etc. As park invasive plant management programs and standards continued to develop, it is likely that additional measures to avoid, minimize or mitigate impacts would be employed more routinely by the parks in Alternative 1.

B. Alternative 2: Implement Comprehensive Invasive Plant Management Program (Preferred)

Introduction: Unlike Alternative 1, this alternative is a comprehensive proposal that includes the following elements for the management of invasive plants that would be systematically implemented by the 10 partner parks:

1) Prevention and Early Detection;
2) Implement Seven Step Decision-Making Tool;
3) Recordkeeping;
4) Interpretation / Education;
5) Partnerships;
6) Adaptive Management;
7) Measures to Avoid, Minimize or Mitigate Impacts; and
8) Consistency Analysis for Site Specific Plans.