5 Environmental Consequences

The environmental consequences, or impacts, displayed here are the potential effects on a resource as a result of carrying out the actions of an alternative.

For a better understanding of why these effects may occur, refer to the descriptions of resource conditions and interactions in chapter 3 (affected environment). Even more detail for some resources may be found in appendix A.

Chapter 4 (alternatives) presents the management scenario—objectives and strategies—for each alternative, which could create the consequences described here.

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Sunset at the refuge.

This chapter presents the following:

- summary of environmental consequences (table 16)
- environmental justice
- consequences common to all alternatives
- range of environmental consequences

Table 16. Summary matrix of environmental consequences for the draft CCP and EA, Lost Trail National Wildlife Refuge, Montana

	Alternative A (proposed action) –Biological potential emphasis –Compatible public use opportunities	*Alternative B* –Habitat and species protection –Maximum compatible, public use opportunities	*Alternative C* –Habitat restoration and natural processes –Minimum public use opportunities	*Alternative D* (no action) –Custodial management –Limited public use opportunities
HABITAT MANAGEMENT ISSUES Loss of water downstream due to restoration projects Eradication of invasive plants Loss of grazing opportunities	*Soils* Negligible effects on soil conditions.	*same as alternative A*		
	Air Quality Minimal temporary impact ameliorated by conservation easements. Road use and maintenance may temporarily lessen air quality.	*same as alternative A*		Minimal temporary impacts from increased public use and invasive plant control.
	Hydrology Wetland and riparian habitats would benefit as well as local and migratory wildlife. Increased public use would require additional water allocations. Use and maintenance of public roads could increase siltation of streams and wetlands.	*same as alternative A*		*except* effects from unmonitored public uses would be more severe.

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HABITAT MANAGEMENT ISSUES Loss of water downstream due to restoration projects Eradication of invasive plants Loss of grazing opportunities	**Riparian Habitat Goal**	Restore, enhance, and maintain a mixed deciduous and coniferous riparian habitat to support indigenous wildlife species and perpetuate the ecological integrity of the Fisher River watershed..		
	Riparian corridor function benefits with protection from browsing, invasive plant control, prescribed fire, riparian vegetation plantings, and natural streamflow reestablishment. Fisheries and fishing would be positively impacted as well as water quality.	*same as alternative A* *except* some benefits would be ameliorated by increased foot traffic and other public use impacts.		*except* restoration would be accomplished at a slower pace and with the help of volunteers.
	Wetland Habitat Goal	Provide breeding, resting, and feeding habitat for wetland-dependent species of northwestern Montana by restoring, maintaining, and enhancing a mosaic of lake, semipermanent, seasonal, temporary, and saturated wetlands.		
	Wetland basins would be expanded and reinvigorated through water management. A mosaic of wetland types benefit a wide variety of native and migratory plants and animals throughout their life cycles. Increased size of wetland basins could have adverse effects on undocumented and unprotected cultural resources.	*same as alternative A* *except* some benefits ameliorated from increased public use.		*except* wetland restoration is not as extensive and benefits to wildlife take longer to be realized.
	Grassland Habitat Goal	Restore, enhance, and maintain intermountain grasslands, with an emphasis on native bunchgrass prairie to provide habitat for migratory birds, species of concern, and associated wildlife species.		
	Grasslands and their associated wildlife benefit and indigenous species would be reestablished through invasive plant control, prescribed fire, grazing regime modifications, and tree thinning.	*same as alternative A* *except* increased public uses may contribute to invasive plant infestation and may delay habitat restoration.		*except* habitat restoration would be hampered by lack of personnel to accomplish invasive plant management as well as by adverse impacts from unmonitored public use.

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HABITAT MANAGEMENT ISSUES	**Forest Habitat Goal**	Enhance and maintain Douglas-fir, ponderosa pine, aspen, and cottonwood forested habitats within the context of the Fisher River watershed for migratory birds, species of concern, and other associated wildlife.		
Loss of water downstream due to restoration projects Eradication of invasive plants Loss of grazing opportunities	Forests benefit from thinning and spacing of trees, prescribed fire, invasive plant control, increasing vigor, and insect resistance as well as wildlife value. All public uses in forests would be improved through improved habitat conditions.			*same as alternative A* → *except* habitat restoration would be hampered by lack of personnel to accomplish tree thinning and prescribed fire as well as by impacts from unmonitored public use.
	Invasive Plant Goal	Native plant communities, composition, occurrence, and density exist without degradation by invasive plants, and support associated wildlife.		
	Invasive plant control would be aggressively pursued through integrated pest management causing minimal and temporary air quality degradation, but benefiting habitats and wildlife. Native vegetation would be increased, precluding invasive plants from spreading to neighboring lands.	*same as alternative A* →		*except* that invasive plant control would be only sporadic and accomplished through partnerships and, rather than controlling spread, invasive plants would be only contained.

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WILDLIFE MANAGEMENT ISSUES	**Migratory Bird Goal**	Preserve, restore, and enhance the ecological diversity and abundance of migratory birds of the intermountain west forest, wetland complexes, riparian habitat, and bunchgrass prairie.		
Foremost consideration for wildlife and habitats Potential for the refuge to be an important habitat corridor Biological potential may be greater for deer, elk, and upland birds than for waterfowl Potential conflict between humans and presence of the gray wolf and grizzly bear Biological potential for reintroduction of trumpeter swan and Columbian sharp-tailed grouse Determination of management techniques and expected effects	Migratory birds benefit from improved habitat conditions and invasive plant control. Richness and abundance of migratory birds increases with habitats being more diverse and providing for life cycle needs of birds. Public uses benefit from increased migratory bird presence. Minor negative impacts to migratory birds would occur during invasive plant control.	*same as alternative A* *except* that increased public use levels may have negative impacts on migratory birds due to encroachment and disturbance.		*except* that benefits to migratory birds would be realized over a longer period of time and may be hampered by a smaller area being manipulated to achieve habitat goals, and by adverse impacts from unmonitored public use.
	Other Wildlife Goal	Restore and maintain resident and endemic wildlife populations of northwestern Montana to maintain and enhance species diversity of Lost Trail National Wildlife Refuge and Pleasant Valley.		
	Mammals, birds, amphibians, reptiles, and fish would benefit from improved and diversified habitats. Natural cycles of wetlands, riparian corridors, grasslands, and forests would be reestablished, meeting life cycle needs. Negative impacts to amphibians and reptiles could occur during habitat and water manipulation, causing impact to their richness and short-term displacement.	*same as alternative A*		*except* benefits to wildlife are realized over a longer period of time and may be hampered by unmonitored public use.

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	Species of Concern Goal	Contribute to the conservation, enhancement, and recovery of endangered, threatened, and species of concern populations in Lost Trail National Wildlife Refuge and Fisher River watershed.		
	Habitats would contribute to the conservation and recovery of species of concern. Visitors would be protected and harmful interaction between humans and listed species would be minimized through modifications of public use, when needed.	*same as alternative A*	*in addition*, some species of concern may be reintroduced to the refuge.	*except* minimal staffing hampers efforts to protect species of concern from inadvertent or unintended adverse effects from public use and activities outside the refuge.
TRADITIONAL USE ISSUES Protection of cultural sites Loss of a working ranch	**Cultural Resource Goal**	Protect, manage, and interpret archaeological, cultural, and historical resources present at Lost Trail National Wildlife Refuge for the benefit of present and future generations.		
	Surveying and documenting many resources and sites with partners would help protect and maintain them. Educated public supports protection. Documented resources would minimize project delays. Impacts to resources may occur from outreach programs that generate increased use.	*same as alternative A* *in addition*, restoration of historic resources could provide facilities for refuge operations. Increased interpretation and education with the museum. Major increase in funding and staffing needs directed towards development of museum may decrease availability for other priority public use. Minimum refuge staffing would provide public use and law enforcement personnel.		Cultural resources would be maintained, protected, and documented when found. Documented resources help plan projects. Undocumented resources may delay, change, or stop projects. Resources could be inadvertently damaged. Minimum refuge staffing provides public use and law enforcement personnel.
	Sites protected through closures due to wetland restoration and endangered and threatened species concerns. Hydrological restoration may negatively impact historic sites.	*same as alternative A*		

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PUBLIC USE ISSUES Use that does not degrade wildlife habitat Desire to hunt on the refuge and access to hunt on neighboring lands Desire to trap Desire for nature trails, fishing, horseback riding, snowmobiling, and cross-country skiing Need to prohibit recreational use Impacts to refuge habitats by timber company crews	**Public Use Goal**	Provide quality wildlife-dependent recreational and educational opportunities for persons of all abilities to learn, understand, and enjoy the Intermountain ecosystem of northwestern Montana; its associated fish, wildlife, and plants of Lost Trail National Wildlife Refuge; and the National Wildlife Refuge System in a safe and compatible manner.		
	Hunting Allowing refuge access for hunting of deer, elk, turkey, grouse, and special hunts organized for youth, persons with disabilities, and archery would develops appreciation for public use and help manage wildlife and habitats.	Allowing refuge access for hunting of large mammals, grouse, and turkey develops appreciation for public use and helps manage wildlife and habitats.	Limiting hunting to special-permit hunts only for deer, elk, grouse, and turkey develops appreciation for public use and helps manage wildlife and habitats.	*same as alternative A*
	Fishing Improved fisheries with fishing allowed if fish populations warrant.	Improved fisheries with fishing allowed regardless of population size; may have negative impacts on fisheries and eventually on public use.	Fisheries restored with no fishing permitted; may have negative impact on public perception and lack of recreational opportunities.	*same as alternative A* *except* fisheries would take longer to develop and fishing experience may be lessened.
	Wildlife Observation and Photography, Environmental Education, and Interpretation An involved and educated public understands and supports resource conservation efforts and Service goals.	*same as alternative A*		Minimally involved and educated public due to limits of existing infrastructure.
	Public information needs and service are met through contact station open at least 5 days a week and weekends during busy season.	*same as alternative A* *except* contact station service provides 7 days a week.		

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ADMINISTRATION ISSUES Retention of existing, and location of new, facilities Access to easements from the MPC Commitment of the Service to maximize potential for use of additional property	**Administration Goal**	Provide staffing, funding, and facilities to maintain the long-term integrity of habitats and wildlife resources of Lost Trail National Wildlife Refuge in supporting the achievement of ecosystem and National Wildlife Refuge System goals.		
	Staff of seven full-time employees makes progress toward habitat restoration and management. Brochure and facilities upgrades improve public perception of refuge, leading to increased use. Public expenditures on wildlife-related recreation and refuge staff income boost the local economy. Livestock losses from predator recolonization could impact relations with neighbors despite monetary compensations.	*same as alternative A*	*except* staff of 6	Staff of less than two full-time employees, with the help of volunteers, achieves custodial management. Minimal progress in habitat restoration would be achieved over a long period of time. Facilities would remain the same. No changes to the current socioeconomic situation.
	Partnership Goal	Promote and develop partnerships with adjacent landowners, public and private organizations, and other interested individuals to preserve, restore, and enhance a diverse and productive ecosystem of which Lost Trail National Wildlife Refuge is an integral part.		
	Partnership RMEF would assist with elk management. New partnerships assist with refuge management including restoration of habitats, survey of cultural resources, control of invasive plants, environmental education, and law enforcement.	*same as alternative A*		*except* to a lesser degree, due to limited personnel and facilities.

ENVIRONMENTAL JUSTICE

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations, 1994) directs federal agencies to incorporate environmental justice in their decision-making process. Federal agencies must identify and address any disproportionately high and adverse environmental effects of their programs, policies, and activities on minority or low-income populations.

Alternatives A and D would not have a disproportionately high or adverse environmental effect on minority or low-income populations. Public use and access to the refuge does not require a fee and is open to all the visiting public.

Alternative B may require some fee programs to help support the increase in public use and the infrastructure needed for a quality program. Any fees would need to be made equitable, so as not to exclude certain groups. However, the remoteness of the refuge may be a deterrent to certain populations.

The outreach programs in alternative C would reach into schools—many of which would be in urban areas and could expand to reach reservation schools. Environmental education programs would target youth and provide them with refuge experiences.

Consequences Common to All Alternatives

All alternatives would have the same impacts related to soils, as described below.

Much of the road on the refuge follows Pleasant Valley Creek. At high water, roads can become inundated and cause increased sediment loads to the creek. Increased visitation may increase the need for road maintenance. Some types of roadwork and use, and grazing practices at or near the refuge could increase sediment runoff into aquatic habitats and accelerate siltation.

The Pleasant Valley Creek restoration project would likely contribute very little sediment during or after construction. Erosion would be minimized through the use of sod mats, root wads, and woody vegetation, as necessary. The drainage channel from Dahl Lake would be filled—the lake would fill to a normal level each year, and seepage and evaporation would maintain that level without any overflow. No increased erosion or sedimentation is expected from this activity.

The organic soils around Dahl Lake are not subject to compaction; however, the sodium-affected soils on the lake terraces would be affected by compaction from increased foot traffic.

Uplands, where the slope is less than 8 percent, have few limitations relative to pesticide applications. Upland soils are generally deep with moderate permeability. Cobbles and stones in the surface layer may limit farming equipment in some areas.

Where there is native vegetation in the uplands, it is generally sufficient to protect against erosion. Runoff and erosion may occur where slopes are greater than 8 percent, particularly where the surface is disturbed or vegetative cover is lacking. Although the loamy surface layers are generally not susceptible to compaction from heavy equipment or foot traffic, the heavy equipment restrictions would reduce the likelihood of compaction.

Flooding and water tables are the main limitations for flood plain soils, relative to pesticide applications

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Upper Moose Pond

and farming operations. Bottomland soils are quite variable in their properties and limitations—permeability ranges from rapid on stream terraces to moderately slow on lake terraces. Floodplains have seasonal water tables at or near the surface and some areas are "ponded" for long periods in the spring.

Limited use of equipment and foot traffic on lake terraces would reduce the likelihood of compaction. The organic soils around Dahl Lake are wet all year. The high pH values in these soils severely limit reestablishment of vegetation.

Range of Environmental Consequences

Environmental consequences of the alternatives are described for each major component of the environment.

Direct impacts on the environment from management actions are detailed, as well as indirect impacts. Some consequences, from various management actions on and off the refuge, may combine to create the potential for greater impacts, i.e., cumulative impacts.

AIR QUALITY

No adverse effects on air quality are expected.

DIRECT IMPACTS

Of the seven criteria pollutants under the NAAQS, carbon monoxide and particulate matter are the only two that may experience minor short-term changes with implementation of any of the alternatives.

Carbon Monoxide

Carbon monoxide is a gas that is released when carbon in fuels is not completely burned. In this area of western Montana, vehicle emissions and house furnaces would be the greatest contributors to carbon monoxide. Any alternative that increases vehicular traffic or housing would have the potential to affect carbon monoxide.

Most public use is expected to occur in the spring, summer, and fall Alternative B, which proposes the greatest increase to public use, and hence the largest increase in vehicle travel, is not expected to have any impact on air quality. Even with a 10 percent increase in public use, no adverse affect in air quality is expected. Alternatives A and D propose smaller increases in public use. Alternative C would maintain or decrease public use.

Alternatives A, B, and C all support seeking conservation easements with willing neighbors. Conservation easements would decrease housing growth and decrease potential carbon monoxide emissions associated with heating.

Particulate Pollution

Carbon in the form of particulate matter would not have an adverse affect on air quality under any of the alternatives, using the same reasoning as was set forth under carbon monoxide. In the area of the refuge, carbon from automobiles and diesel engines; soot from slash burning, wildland fires, fireplaces, and wood stoves; and dust associated with wind-blown sand and dirt from roadways, fields, and construction sites can all contribute to particulate matter.

Vehicle Travel and Construction

Agricultural practices that disturb the soil and the use of the Pleasant Valley Road by recreationists and logging crews would increase particulate matter in the air. Gravel roads would likely be responsible for the largest portion of particulate pollution (PM_{10}) on the refuge. All alternatives permit hunting, which would lead to the greatest concentration of use during hunting season weekends.

Air quality would be affected by logging activity adjacent to the refuge. Particulate pollution (respirable into the lungs) would increase when logging trucks are operating and during slash pile burning.

Alternative B—with provisions for fishing, camping, day use, environmental education, and nonmotorized boating—would have the most vehicle use, and is the only alternative that may decrease air quality. Alternative C, with minimal public use and administrative traffic, would have the least impact on air quality.

The implementation of the habitat development plan would occur in all alternatives. The use of heavy equipment may lead to local, short-term effects associated with dust from earthwork and engine exhaust. Alternative B provides for the most additional construction and would have the greatest short-term impact on air quality. Public use areas would be constructed to a lesser degree in alternative A. Alternatives C and D would have the least impact to air quality.

Prescribed Fire

The effects on air quality from prescribed fire should not vary significantly between any of the alternatives, although the number of acres burned and timing may vary. Prescribed burns would have minor, short-term impacts on air quality. The NAAQS for particulate matter may be approached for short periods of time in the area immediately adjacent to the burn, and for only 1–2 days. Air quality on a regional scale would be affected only when many acres were burned on the same day.

The greatest amount of prescribed fire may be seen with alternative C, where it is the only management tool to manipulate grasslands. Management of grasslands and forests would strive to mimic historic conditions with the use of fire and prescribed fire would be used more frequently than in the recent past. Alternative D would use prescribed fire least; it is the only alternative in which fire is not described as a management tool to maintain ponderosa pine uplands.

Wildland Fires

Wildland fire would be aggressively suppressed with the help of the Montana DNRC in Alternatives A, B, and D.

Since alternative C calls for the greatest amount of prescribed fire, the expected reduction of fuels may decrease the intensity and acreage of wildland fires. The impact of smoke from wildland fires could still be greatest under Alternative C, which does not include suppression support from DNRC, resulting in greater amounts of smoke for longer periods; even so, emissions should only affect the local area and be of short duration.

Indirect Impacts

Releases from any nearby facilities would likely have minimal impact on the refuge under all alternatives, as transport pathways are limited to aerial transport.

Two local facilities are listed on the toxic release inventory of the Environmental Protection Agency, for air emissions of toxic chemicals. An aluminum smelter (Columbia Falls Aluminum Company) and a fiberboard plant (Plum Creek Manufacturing) are located in Columbia Falls, and their emissions are not likely to reach the refuge in significant quantities.

Several other facilities in the airshed are monitored for emissions such as particulate pollution and volatile organic compounds, but these sources are typically more than 18 miles away and are separated from the refuge by mountains.

Cumulative Impacts

Cumulative impacts would be the same for all alternatives. Smoke and dust may be trapped in mountain valleys by temperature inversions.

Wildland fires could be larger, and produce more emissions, under a suppression strategy that uses natural and constructed barriers as control lines, compared to fires that are suppressed with an aggressive, direct-attack strategy. The relative size of fires is still expected to be so small as to have little overall impact.

Hydrology

No adverse impacts on refuge hydrology are expected.

Direct Impacts

Hydrologic restoration called for in alternatives A–D would result in various combinations of the following:

- recharge and maintenance of wetland complexes
- maintenance of or increase in open water on Dahl Lake
- restoration of temporary wetlands to seasonal and semipermanent conditions

One-third of drained wetlands would be recharged to 75–100 percent of their capacity under alternatives A, B, and D. Maximum water management under alternative B would occur in all refuge basins and increase open water in Dahl Lake to 260 acres. In contrast, under alternative D, Meadow Creek would be restored to a series of wetland complexes, and wetlands in the Dahl Lake complex would be restored from temporary to seasonal and semipermanent conditions. In alternative C, drained wetlands would recharge and function naturally after removal of structures, resulting in restoration of Dahl Lake and semipermanent and temporary wetlands.

Indirect Impacts

Hydrologic restoration would create larger and more diverse wetland and grassland habitats under all alternatives. It is expected that implementation of all alternatives, with their associated hydrological changes, would have varying degrees of beneficial effects on wildlife that inhabits or migrates through the refuge.

Additional allocations of water may be required for the hydrologic restoration called for in all alternatives. A doubling of wetland acres would require a water right change application and possibly a request for additional water. The largest component of the additional water would be to offset evaporation of the new surface water that would be impounded. It is unknown whether there is a reliable source of water to accomplish this.

Logging and road building on adjacent PCTC lands would likely increase sediment loads to several streams flowing into the refuge, as well as to Pleasant Valley Creek. The groundwater-fed system of Dahl Lake should be immune to sedimentation, as all streams terminate before reaching the lake, except in high runoff years. Sedimentation may impact the existing fishery or impair attempts to improve the fishery on the refuge.

Water temperatures in Pleasant Valley Creek should be decreased in alternatives A and D, as a result of revegetated channel sections along the creek that would provide bank stabilization and cover.

Invasive plant control is likely to have minimal impacts in all alternatives. The avoidance of herbicide application during rain events and to areas with a shallow groundwater table or near streams or lakes, would reduce the risk of the water-soluble clorpyralid methyl and picloram being entrained in runoff or leached into groundwater. The refuge may sustain impacts from contaminants resulting from activities on adjacent lands and nearby facilities.

Cumulative Impacts

Increased public use under all alternatives would increase the demand for public toilets by visitors and domestic water by employees. Additional water and permits to accommodate the expanded needs would need to be obtained. This is not expected to be a problem, as the state of Montana is known to support applications for domestic well use.

HABITAT

Habitat restoration in alternative C would occur over a longer period of time in comparison with alternatives A, B and D; recolonization of certain wildlife species might also take longer.

The control of invasive plants is a major factor in the restoration and maintenance of wildlife habitats. Alternative A would restore native species without herbicide use, and may release sedges and other native species. As native plants recolonize the area, plant species diversity would increase and provide more diverse food sources. Subsequent wildlife diversity, as well as abundance, could increase with the increase in food. The impacts of invasive plant control under alternative B would have greater benefits to native species than alternative A.

There is not nearly as much public use in alternative C as in the other alternatives. This should lead to a decrease in ground disturbance from parking areas, trails, and vehicle use, with much less dispersal of invasive plants.

In alternatives A and D, public access points (for fishing, observation, and photography) could restrict impacts to soil and vegetation to limited areas (Douglas et al. 1999).

With limited staffing on site under alternative A, staff from the National Bison Range would continue to provide collateral effort for control of invasive plants, until a maintenance worker and biologist are added at the refuge. This would limit control efforts to the stated average of 200–400 acres. The refuge would garner funding and recruit volunteers to continue and expand control efforts.

Impacts of management actions on specific habitats, as described in the alternatives, are displayed below.

DIRECT IMPACTS

Although habitats are arranged in complex mosaics of different-sized components, consequences are described below for these general habitat types: riparian and wetland habitats, grassland habitat, and forest habitat.

Riparian and Wetland Habitats

Alternative A promotes a more natural vegetative composition and structure, and would increase riparian shrubs varying in cover densities. Bare ground would be a short-term impact associated with stream restoration, when there may be some risk of invasive plant establishment. Increased riparian shrub cover would lead to a long-term decrease in nonnative foxtail occurrence on streambanks.

In alternative A, the wetland restoration program with the NRCS to restore Pleasant Valley Creek would increase riparian vegetation along the creek's southern end before it turns west and just north of Lower Moose Pond. Plantings of willows and alders would provide understory and midlevel understory in an area currently devoid of healthy, native, riparian vegetation. Spacing and protection from ungulate browsing would increase the success of riparian vegetation restoration.

Natural, diverse, wetland vegetation (cattail, bulrush, sedge, and other rushes) would be restored in areas previously dominated by reed canarygrass, under alternative A. This increase in native vegetation would provide greater biological integrity than the monoculture of reed canarygrass.

Sections along the Pleasant Valley Creek channel would be revegetated with herbaceous and woody wetland plant species, under alternatives A and D.

Riparian area and wetland impacts are mostly the same for alternatives B and D as those described for alternative A. In alternative D, however, willow, birch, and alder would likely die out on the north end of Pleasant Valley Creek, where vegetation plantings would not occur. Alternative B's greater manipulation of water levels would provide control of flooding and drawdown regimes and lead to more control of wetland vegetation.

As wetlands return to a normal seasonal fluctuation under alternative C, wetland vegetation would reestablish without further manipulation.

The wetlands recharged in alternatives B and C would provide emergent vegetation and invertebrate foods for foraging habitat and nesting/brood cover. The variety of wetlands would provide enough interspersion of open water to emergent vegetation to meet the needs of many species.

Grassland Habitat

Alternatives A–C would restore upland grasslands to native species. Native, upland grasslands would not be restored under Alternative D; however, vegetative structure beneficial to wildlife would be maintained.

In all alternatives, upland, grass communities would be maintained through prescribed burns. The net loss of prairie to Douglas-fir and ponderosa pine encroachment would be halted, and grasses and other forage favored by wildlife would be enhanced. In some cases, thicker duff layers and dense, dry crowns resulting from fire exclusion could allow heat to penetrate deeper and kill vegetation; however, risk of a severe fire would be less where past grazing practices have reduced vegetative build-up.

- Idaho fescue has been reported to be more sensitive to fire than bluebunch wheatgrass (Conrad and Poulton 1966). Rough fescue seems to be well adapted to periodic burning. Spring and late fall burns on Idaho and rough fescue sites—

with good soil moisture, during plant dormancy, and with favorable Idaho fescue root reserves—are thought to injure plants less, yet late-season burning results are varied for both fescues (USDA Forest Service, fire database). Drastic reductions in rough fescue seed production may occur following spring burning (Bailey and Anderson 1978).

- Western wheatgrass increases in abundance and density after a fire. Spring burns, after new growth on western wheatgrass, can severely injure this species (Volland and Dell 1981).
- Vigor has been seen to return 2–5 years after a fire for Idaho and rough fescue and western wheatgrass, with an increase in protein content for Idaho fescue (Launchbaugh 1964, Phillips 1973, Stubbendieck et al. 1986, Singer and Harter 1996).

Periodic burning would not occur as frequently in alternative D as in the other alternatives due to staffing constraints. With little use of fire Douglas-fir would encroach into prairie grasslands, woody shrubs would increase, and this ecosystem would gradually degrade.

In alternative A, the occasional grazing of native, upland, bunchgrass prairie is expected to stimulate plant vitality and play a beneficial role in community stability, through timely grazing of plants and moderate use of the community.

- Bunchgrasses in general can tolerate light grazing after seed formation (Miller 1986). Idaho fescue is sensitive to the amount of grazing, dependent on soil type, competition, existing vigor condition, and moisture regime (Pond 1960, Johnson 1994). Idaho fescue is most sensitive to defoliation from flowering to seed ripening (Mueggler 1967, Miller 1986, Johnson 1994). Pond (1960) found the vigor of Idaho fescue significantly reduced on areas where 50 percent or more of the current year's height growth was used. An interesting note is that Jones (1965) found fescue decreased with cattle grazing, but remained relatively unchanged by elk grazing.
- Repeated grazing may reduce the ability of Idaho fescue to compete with spotted knapweed when both are grazed (Olson and Wallander 1997). Grass defoliation in spring increases spotted knapweed cover compared to summer defoliations (Jacobs and Sheley 1999).
- Rough fescue is a highly palatable species and is extremely susceptible to grazing and trampling damage; however, light grazing does not reduce overall plant vigor (Johnston 1961, Mueggler and Stewart 1980).
- Western wheatgrass can tolerate moderate grazing, but is damaged from close spring grazing (Wasser 1982). Proper grazing can help prevent plants from becoming too coarse as a forage species for wildlife or livestock (Rogler 1973). Allowing carryover of 40–50 percent of the current year's growth would maintain these bunchgrasses and not result in resource damage.

Without grazing, under alternative C, upland grass growth may become decadent. For plants without light or moderate grazing for several years, growth would be slower and plants would not grow as tall, and would have less weight and numbers of seed stalks than comparable plants that were grazed (Ganskopp and Bedell 1981).

More native grasses in bottomland grasslands would be maintained in alternative A, providing the healthiest system of native grasses. This may lead to more residual vegetation than normally maintained for these types of grasses, but would not have much effect on vegetative structure.

Alternative B would maintain more tame grasses in bottomland grasslands; however, good vegetation structure would exist and have no detrimental effect on waterfowl nesting cover.

A vigorous medium-tall grassland around Dahl Lake would be provided under alternatives A and B. Vegetation would be maintained in a vigorous state in alternatives A and B.

Alternative A would restore a large portion (85 percent) of the foxtail infestations to native grasses and sedges. This would increase plant diversity, which would foster maintenance of the biological integrity of the system. Results would occur quicker and with greater cost efficiency within the WRP easement, through collaboration with the NRCS. More acres of foxtail reduction would occur in alternative D than alternative A.

Foxtail restoration would not be as extensive in alternative B as in alternatives A and D. Some acreage of tame grasses would be maintained rather than bare ground, which should decrease the risk of increasing invasive plants in these areas.

All foxtail areas would be restored in alternative C, which should result in a greater benefit for maintaining native grass communities. Spotted knapweed would be reduced to less than 10 percent by 2007. With careful herbicide application, reduction of knapweed should release native species for a quicker response and over a much larger area.

Forest Habitat

Alternatives A and C would promote, through prescribed fire, a more natural forest composition and structure, with increased tree vigor and spacing to combat insect infestations. Thick second-growth would be reduced for an altered age-class structure in the forest. Some snags could be lost during the extensive prescribed fire program. Prescribed burning would be conducted in a much more patchy nature in alternative A than in alternative C.

- A healthy ponderosa pine-dominated forest (south-facing slopes) and Douglas-fir-dominated forest (north-facing slopes) would be maintained.
- Forests would contain large trees, abundant snags, and a dense herbaceous layer.
- Trees and shrubs of varied sized and age classes would have increased robustness.
- Shrub thickets would occur in increased density and be more continuous.
- Recruitment of young trees and shrubs would create more complex vertical structure.
- Forests would be at low risk to severe damage by wildland fire and epidemics of insects and disease.

The lack of fire in the ecosystem under alternative D would continue the trend away from fire-adapted species. Forest health would decline. The increase in fire-intolerant species would shift composition toward the more shade-tolerant Douglas-fir, and contribute to the loss of wildlife forage (Gruell et al. 1982). The increase of Douglas-fir would more likely be heavily infested with dwarf mistletoe, which would increase ladder fuels that contribute to catastrophic (stand-replacing) wildland fires.

Alternative A would maintain or increase the coverage of aspen groves. Regeneration would provide the recruitment necessary to replace older trees as they die. Aspen stands regenerate naturally in a fragmented or linear nature with a mix of age structures, which would increase the habitat structure complexity and diversity.

Unmanaged aspen and midstory riparian vegetation, under alternatives C and D, may result in degraded habitat conditions and reduce the quality of habitat for wildlife and plant species. Aspen groves would continue to age, remain simpler in structure, and have insufficient regeneration to establish new age classes. Without management intervention, these habitats would likely die out.

Indirect Impacts

The hydrologic restoration in alternative A would result in the slow fill of Dahl Lake (for greater surface acreage) with naturally occurring runoff and collection, with no increase in turbidity nor reduction of seed stocks for establishing emergent vegetation (Weller et al. 1991). Water levels should increase gradually to avoid scouring turbidity and plant mortality (Weller 1981). Wildlife would benefit from an increase in temporary, seasonal, and semipermanent wetlands (i.e., foraging and nesting habitat) with restoration of natural functioning in the Dahl Lake wetland complex.

An increase in temporary wetlands, due to hydrologic restoration, would likely increase emergent vegetation coverage (cattail, bulrush, and reed canarygrass), in alternative A. Existing emergent vegetation may be flooded out as water capacity increases. Rewatering of saline areas may alter the vegetation composition, since salinity has a strong influence on the dominant plants.

Alternative C would facilitate natural succession toward a climax state for refuge habitats. This would be beneficial to grassland- and riparian-dependent wildlife species, but may discourage use by wetland- and forest-dependent species as wetland and forest habitats decrease in size and composition.

Under alternatives A, B, and D, ground disturbance from parking areas, trails, vehicles, and seeds carried on clothing and shoes could increase the amount of invasive plants or bring in new invaders.

Biocontrol of invasive plants under alternative A could potentially have the negative effect of altering native insect communities. This could lead to reduced numbers of pollinators, which would subsequently impact the maintenance and dispersal of certain flowering plants.

In alternative A, herbicide use for control of invasive plants is expected to have no detrimental effects resulting from too much herbicide in one location. Because of great care in application, there would be negligible risk of an aerial spray such as Tordon drifting into forested areas and killing young trees, and negligible impacts from herbicide in water systems.

In alternative C, there may be more risk of herbicide-spraying impacts occurring in one area or drift problems associated with more aerial applications, due to treatment of most areas of spotted knapweed by 2007.

Cumulative Impacts

There may be cumulative impacts resulting from livestock grazing under alternative A. Grazing impacts may be increased in grazed areas by aboveground herbivore grazing, facilitating grazing by below-ground herbivores (Ingham and Detling 1984).

Wildlife

Limited manipulation of habitats, coupled with decreased human impacts, in alternative C would have positive effects on wildlife composition and use of the refuge. Habitat restoration would occur over a longer period in comparison with alternatives A, B and D; recolonization of certain wildlife species might also take longer.

By developing specific areas for wildlife observation and photography and restricting recreation to predictable patterns in alternative A, wildlife disturbance would be limited. Trails, wildlife-viewing areas, and platforms would offer quality viewing opportunities and draw users away from

sensitive areas, minimizing the negative effects (Youmans 1999, Canfield et al. 1999, Hamann et al. 1999).

In alternatives A and B, limiting the public's movement through use of designated viewing and photographic sites would restrict users from following wildlife. Wildlife are mobile, may range a large distance, and may find sanctuary in closed areas if there is too much use at designated sites. However, these restrictions may also encourage more wildlife to use the refuge, particularly for sensitive activities such as bearing and raising young and wintering.

Under alternative B, disturbance from the public would be increased over all other alternatives where floating devices would be allowed on Dahl Lake and access into the closed area would be permitted.

Education and development of awareness and appreciation for wildlife and the Refuge System would be greatest under alternative B. There would be a positive influence on the acceptance of threatened and endangered species in alternatives A and B, by increasing awareness and providing accurate information through the interpretive program. This would not occur in alternatives C and D.

Environmental education in Alternatives A–C is expected to result in limited disturbance to natural resources.

In alternative A, habitat would be protected through the use of conservation easements. Conservation easements can be vital to the preservation of wildlife habitat, habitat integrity, and maintenance of open space. Conservation easements would also benefit all wildlife by decreasing habitat fragmentation and decreasing human–wildlife conflicts.

Specific impacts of management actions on species groups, as described below, are described in the following section.

- migratory birds
- large mammals
- small mammals
- resident birds
- amphibians, reptiles, and fish
- species of concern–grizzly bear, gray wolf, Canada lynx
- species of concern–bald eagle, trumpeter swan, black tern
- species of concern–boreal toad, bull trout
- species of concern–Spalding's catchfly

Migratory Birds

Estimated effects of the alternatives on migratory birds are described below.

Direct Impacts

Migratory waterfowl would benefit from larger and more diverse wetland and grassland habitats in all alternatives.

In alternatives A, C, and D, enhancing riparian habitats by replanting alders, willow, and hawthorn would provide much additional stream vegetation, benefiting habitat for Neotropical migratory birds such as the willow flycatcher. Restoration of wetlands to historic conditions and functions should result in a mosaic of wetland types with healthy, robust, emergent plant communities and varying degrees and depths of open water, providing habitat for a diversity of water birds.

Dahl Lake would be increased slowly under alternative A, so there would be no net decrease in vegetation types important to waterfowl and other water birds. A short-term negative impact is expected as restoration efforts change water levels and shoreline vegetation. For instance, increasing Dahl Lake by 200 acres in one year may eliminate both shoreline vegetation and submergent vegetation. After restoration is complete, natural wetland function and protection from livestock grazing would encourage the establishment of wetland vegetation. Reduction in grazing and management for robust wetland vegetation may have a negative impact on shorebirds.

Providing a mosaic of wetland types, as proposed in alternatives A and C, with a healthy, robust emergent plant community well-interspersed with open water would provide habitat for a diversity of waterfowl and other water birds such as American bittern and grebe species. There would be some decrease in waterfowl habitat under alternative C, as water control structures are removed; however, restoration of drained wetlands would result in a net increase in wetland habitat in the bottomlands. In alternative D, restored wetlands would occur only on the NRCS easement.

Restored native plant diversity in the grasslands would result in expanded food and nesting habitat for a variety of water birds in alternatives A, C, and D. A mosaic of native grasses in various stages of succession would cover the landscape, providing habitat for a diversity of birds. Rested grasslands would be in a vigorous state for waterfowl nesting habitat. Vigorous medium-tall grassland around Dahl Lake would provide waterfowl-nesting habitat, along with benefits to species such as the short-eared owl, savannah sparrow, meadowlark, and northern harrier.

There would be less native grassland restored under alternative B. Grassland habitat management would be similar to alternative A with similar impacts. Foxtail restoration would not be as extensive in alternative B as in alternatives A and D (only 35

percent of the creeping meadow foxtail would be restored). Although not a native, and monotypic in nature, foxtail can be nesting cover and may provide for more migratory bird and waterfowl use of the area than under alternatives A or D. Maintaining the areas in tame grasses rather than bare ground should decrease the risk of increasing invasive plant coverage in these areas.

Alternative B would have the greatest positive impact on water bird numbers. Increased constructed nesting habitat may increase waterfowl production. Wild rice plantings for forage would maximize local waterfowl production (alternative B). Wild rice has been shown to attract and concentrate large numbers of breeding waterfowl and may increase nest success and duckling survival (Peden 1977, Huseby et al. 2001). Increased invertebrate food sources and emergent vegetation for foraging and nesting habitat would be available in alternative B, which would restore all ponds and install water control structures.

The use of habitat improvement tools such as prescribed fire and mowing in all alternatives would have minimal impact on ground-nesting migratory birds, including ducklings and molting birds. Prescribed burns and mowing would be timed to reduce impacts on nesting birds (burn after nesting and molting seasons).

Species such as mountain bluebird, loggerhead shrike, killdeer, and rock wren would respond positively to the occasional use of grazing to restore vigor to grasslands, as used in alternatives A, B, and D. Species such as willow flycatcher, savannah sparrow, short-eared owl, orange-crowned warbler, and lazuli bunting would be negatively affected by grazing (Saab et al. 1995).

Authorized waterfowl hunting (when fall populations average more than 1,000 ducks) would result in a reduction in waterfowl numbers from direct take as well as displacement due to disturbance, under alternatives A, B, and D.

The revegetated channel of Pleasant Valley Creek under alternatives A and D would provide plants such as alder, willow, and hawthorn, which would provide habitat for passerine birds such as the willow flycatcher, a MPIF species of concern.

Indirect Impacts

Designated access for fishing and wildlife observation and photography, under alternatives A and C, would have a positive impact on waterfowl, by providing localized and somewhat predictable disturbance to waterfowl. Birds react less negatively to predictable use, and waterfowl are less disturbed by predictable shoreline activity than overwater use (such as boats, both motorized and nonmotorized) (Hamann et al. 1999). Studies have shown that unpredictable and erratic disturbances by humans have the greatest negative impacts on wildlife (Canfield et al. 1999).

Restricting the public to designated trails in alternatives A, B, and C would minimize disturbance to waterfowl and Neotropical migratory birds during critical periods of the annual biological cycle. Neotropical migratory respond to human disturbance by altering their behavior, spatial distribution, and use of habitats (Hamann et al. 1999). Miller et al. (1998) found lower nest success and density adjacent to, rather than removed from, trails in Colorado.

Early waterfowl nesters may be subject to disturbance prior to May 15, especially with the open spring turkey-hunting season. Disturbance from public use in alternative A may lead to a decline in waterfowl populations by:

- decreasing the number of pairs using the area;
- increasing the nest-desertion rate;
- reducing hatching success;
- decreasing duckling survival.

The potential for impacts on nesting waterfowl and other water birds from disturbance is greatest in alternative D, which would allow unrestricted access for authorized public use except in the designated area from September 1 to December 15.

If a viable sport fishery is established in alternatives A and B, this use would increase disturbance to water birds by attracting the public to wetland areas. Impacts from public use would be the highest in alternative B, where public use is promoted and a substantial increase in user days is predicted.

In all alternatives, fence removal (to meet large mammal objectives) would benefit migratory birds by reducing the chance of collision and death. In addition, cowbird parasitism may be reduced. Fences provide perches from which cowbirds can search for host nests (Johnson and Temple 1990). A reduction in grazing should also reduce cowbird numbers.

Although bald eagles prey on waterfowl, increased numbers of eagles under all alternatives are not expected to impact waterfowl populations.

Depredation of ducklings by bullfrogs would be minimal in alternative A; bullfrogs are known to occur in Pleasant Valley; monitoring of bullfrog habitat and subsequent control of bullfrogs would be done. There may be impacts to ducklings in alternatives B, C, and D, where no monitoring for bullfrogs would be done.

Species diversity of Neotropical migratory birds would be maximized in alternative C, which manages habitats from a landscape level. Since migratory birds are so diverse, management of

habitat to benefit one guild would ultimately harm other species.

Cumulative Impacts

[None expected for all alternatives.]

LARGE MAMMALS

Estimated effects of the alternatives on large mammals are described below.

Direct Impacts

Vigorous, native grasslands, with reduced invasive plants in alternatives A and C would provide not only palatable, but nutritious, forage for deer, elk, and moose. Native grasslands support a diversity of plants that are critical to herd health. Although a plant may be desirable at a specific time of year and may supply some crucial nutrients, variety is necessary to provide the complexity of nutrients needed such as proteins, fats, carbohydrates, minerals, and vitamins. There may be a short-term negative effect on large mammals as grasslands are restored to native plants. Alternative C would have short-term negative effects on large mammals during the restoration process, as invasive plants are eliminated and desirable forage is established.

Although a slight positive impact on large mammals would occur as forage vigor is restored through rest from livestock grazing, restoration to native habitat would not occur in alternative D.

Removal of fences in all alternatives would have a beneficial impact on deer, elk, and moose. Fences can be harmful to wildlife by: impeding movement away from predators, restricting access to forage, and causing entanglement.

Hunting would impact deer and elk through direct take and disturbance, in all alternatives. Hunting pressure has always been high on private and public land surrounding the refuge, yet local wildlife populations remain healthy. Hunting would keep wildlife populations in balance with available habitat. Since the refuge has never been open to public hunting, implementing this program may lead to elk movement and redistribution with corresponding overpopulation problems in localized areas, including private lands.

In alternatives A and C, disturbance and stress to deer and elk would be decreased in winter and early spring, as a result of public use restrictions. Public use objectives are more restricted in alternative C, with access confined to designated roads and trails, except during the hunting season. Impacts to large mammals from disturbance should be minimal.

- Opening the refuge to other public uses such as wildlife observation may affect large mammal populations through disturbance. Disturbance may cause flight responses that result in young becoming separated from adults, leaving them more vulnerable to the elements and predation.
- Disturbance could force animals off highly nutritious summer and fall range, onto less productive range. This may result in poorer body condition going into winter, which has been linked to lower reproductive performance and even death (Geist 1978).
- Early fall movements may also leave nutritious summer forage uneaten at the cost of overgrazing winter range. In winter, deer, elk, and moose may be restricted by disturbance to smaller areas with less nutritious forage. They would expend additional energy to remain warm and to travel through deep snow. Elk require almost 40 percent more food in winter to generate energy for daily metabolic activities (Nelson and Leege 1982).
- Deer, elk, and moose are in their lowest physical condition in the spring. Until they can regain weight, these animals may succumb to stresses that would be considered minor at other times of the year. Constant disturbance may keep animals off important forage resulting in lower weight gains and lower birth rates.

With maximum public use in alternative B, an educated public understands the importance of winter range to deer and elk and the effects of disturbance, but there are no access restrictions. Disturbance may be greater, however public use would continue unless serious population decreases are recognized. Directing the public to sites of high animal use may cause increased stress to animals in important habitats or may cause the sites to be abandoned completely. Impacts may be offset by directing the public use to specific areas, limiting overall disturbance.

Unrestricted access under alternative D, except for a fall closure in the designated area, may increase widespread disturbance to wildlife throughout the year; however, current levels of public use are low and public use would not be promoted.

Since Lost Trail is a new refuge, management practices may result in large mammal populations increasing beyond the carrying capacity of the refuge. Animals may concentrate in areas of high use, resulting in vegetation damage. Harassment by hunters and other public users may cause large mammals to overuse areas with less disturbance. Large mammal populations move freely across refuge boundaries and it would be difficult to manage for a specific number of individuals given the size of their range and seasonality of refuge use.

Indirect Impacts

Forage and cover would be enhanced with accomplishment of riparian vegetation restoration in alternatives A and B—with increased aspen groves and potentially increased willow, birch, and alder.

Restoration of Dahl Lake may negatively impact large mammals as the lake rises and riparian vegetation is flooded, but should ultimately increase forage as the lake stabilizes at a higher level with more edge for willow, aspen, and birch.

The conversion of large areas to wild rice in alternative B would be beneficial to moose, but it is not preferred forage for other large mammals. Conversion to wild rice may impact large mammals by reducing winter forage.

Public use restrictions associated with species of concern may indirectly benefit deer, elk, and moose by reducing disturbance, for all alternatives.

Reestablishment of a pack of wolves to Pleasant Valley in all alternatives may have a negative impact on deer, elk, and moose—all of which are prey of the gray wolf. Wolves in the Greater Yellowstone area are shown to have a kill rate of 12–15 ungulates per wolf per year. Improvement in deer, elk, and moose habitat may be enough to offset any decrease in their populations from increased predation.

Conservation easements established to enhance other species (alternative C) would benefit large mammals by limiting subdivisions and maintaining a rural environment.

Cumulative Impacts

Although fostering predator populations such as the gray wolf and grizzly bear and eliminating livestock grazing from the refuge may increase predation on large mammals, predation alone should not have a major impact on populations. Predation coupled with other detrimental factors such as increased hunter harvest or severe weather patterns may have a negative impact on large mammal species. For example, when a higher than normal number of female deer die in any given year from things such as hunting or a severe winter, local conditions could exist where wolves and other predators may keep deer numbers suppressed or slow population growth.

Small Mammals

Estimated effects of the alternatives on small mammals are described below.

Direct Impacts

Restoration to native habitat and improvement in vigor in alternatives A and B should have positive affects on most small mammals, providing more cover and forage. Reduction in livestock grazing and improvement in vigor of grasslands may have a negative impact on ground squirrels. Restoration efforts in alternatives C and D would have short-term negative impacts on small mammals as habitat is eliminated. As restoration is accomplished and healthy native vegetation is reestablished, mammal populations should rebound.

Ground squirrels would benefit from restrictions against sport shooting of this species in alternatives A, B, and D. Ground squirrel numbers would be kept in check by the improved health and density of native vegetation, as well as by a diverse predator base.

Restoration of wetlands in alternative A would benefit semi-aquatic mammals such as beaver, river otter, mink, and muskrat. Planting and encouraging shoreline vegetation (willow, cottonwood, and aspen preferred by beaver; cattail, bulrush, and sedge preferred by muskrat) would benefit these species by providing forage and bank stabilization.

Restoration efforts in alternatives A and D would also help stabilize water levels and benefit semi-aquatic mammals. These animals are sensitive to fluctuating water levels that may cause flooding of dens or expose dens to predators. Manipulation of water levels through the use of water control structures in alternative B may have adverse impacts on these species.

Semi-aquatic mammals may be impacted by disturbance in the uplands in alternative A. The elusive behavior of these species and the importance of secure den sites, indicates they have a low tolerance for human presence. Disturbance would be minimized during spring, early summer, and fall in alternatives A and C. The immediate postnatal period is critical to these mammals, and fall is also a critical time as they are often out of the water and more susceptible to disturbance while they build houses and cut stems for caches.

Increased public use around wetlands and riparian areas in alternative B may impact semi-aquatic mammals. Unrestricted public access for most of the year in alternative D may have a negative impact on these species.

If a sport fishery is established in alternative A, disturbance may increase as more people use the water's edge. Abandoned fishing line may cause a hazard by trapping and entangling. These animals would not be impacted by the effects of boating (disturbance and bank erosion from wave action) as public boating would be restricted. Minimal, short-term impacts could occur from administrative use of boats.

Indirect Impacts

In alternative A, an increase in predators due to management for gray wolf, grizzly bear, and Canada lynx and prohibition of trapping may have a slight negative impact on small mammals.

A substantial reduction in ground squirrel numbers would adversely affect those species that prey on them. Ground-nesting birds may also be negatively affected as predators switch to alternate prey sources.

Small mammals would not be impacted by recreation in alternative A, except possibly in sensitive habitats. There may be localized, minimal impacts on small mammals from the construction of facilities such as the wildlife-viewing areas and trail. Fens (bogs) and subnivian (i.e., beneath snow) areas are sensitive habitats. Compaction of snow due to snowmobiles and other off-highway vehicle use would inhibit small mammal movement beneath the snow, reduce the insulative character of snow, and increase mammal mortality. There may be a slight increase in snow compaction from administrative activities.

Designated access for fishing and wildlife observation, under alternatives A and D, would have a positive impact on semi-aquatic mammals, by providing localized and somewhat predictable disturbance. Studies have shown that unpredictable and erratic disturbances by humans have the greatest negative impacts on wildlife (Canfield et al. 1999). Waller et al. (1999) found that beaver, muskrat, river otter, and mink may habituate to recreational activities if they occur in predictable areas.

Controversy exists over whether there are indirect effects of biological control (to reduce invasive plants) on nontarget species.

- Pearson et al. (2000) demonstrated the establishment of a biological control agent (*Urophora* spp.) that altered deer mouse diets and habitat selection by effecting changes in foraging strategies. This could result in spiraling changes to the food web.
- For example, a small mammal population increase could be followed by an increase in predators such as raptors, fox, and skunk, which also prey on ground-nesting migratory birds.
- On the other hand, increases in small mammals have been shown to result in less nest predation because predators are using small mammals as alternative prey.
- In addition, high populations of small mammals could result in increases in ground disturbance from tunneling, which often provides perfect sites for invasive plant dispersal.

Cumulative Impacts

[None expected for all alternatives.]

Resident Birds

Estimated effects of the alternatives on resident birds are described below.

Direct Impacts

Alternative A would maintain viable populations of cavity nesters. In forest habitats, retention of all large snags and broken-top trees, and management for adequate numbers over the landscape, would benefit species such as woodpeckers, sapsuckers, nuthatches, and flammulated and western screech-owls.

Indirect Impacts

Biotic transport of contaminants is a possibility, especially if nearby cattle ranches use Famphur to control parasites. This insecticide can be applied as a pour-on to the backs of cattle, and at recommended doses, can result in magpie die-offs (Eisler 1994). Magpies can pick up lethal doses of Famphur by ingesting cattle hair from rubs or directly from the backs of cattle. Food chain poisonings from Famphur can include eagles, hawks, and owls (Eisler 1994).

Cumulative Impacts

[None expected for all alternatives.]

Amphibians, Reptiles, and Fish

Estimated effects of the alternatives on amphibians, reptiles, and fish are described below.

Direct Impacts

Reduced water temperatures in alternative A, and to a lesser extent in alternative D, would enhance amphibians and the native fisheries. Enhancing riparian habitats by replanting alders, willow, and hawthorn would provide much additional stream vegetation, which would foster a reduction in water temperature.

Breeding, wintering, and foraging habitat for many amphibians would be increased through enhancement and restoration of streams, lakes, ponds, and wetlands in alternative A and to a lesser extent in alternative D; however, results may be positive to one species and negative to another.

The complexity of habitat and life history requirements of amphibians and their susceptibility to environmental change makes protection of these species difficult under any alternative. Data gathered in alternatives A, C, and D would enable protection of identified populations, as well as help identify appropriate management.

In alternative A, amphibians and small aquatic reptiles would be protected from bullfrog predation and displacement, as bullfrog populations are identified and controlled. Bullfrogs would not be monitored in alternatives B and D, and may become established.

Fish habitat would be enhanced in all alternatives—improved stream pool-to-riffle ratios, restored stream meander, increased water for emergent vegetation, and raised stream grade to raise the groundwater table. The Pleasant Valley Creek restoration in alternative A would benefit native fish. If determined feasible, improved fish passage on and off the refuge would lead to restoration of native fisheries.

Indirect Impacts

Any change in water manipulation or water levels could result in the loss of key breeding, overwintering, and foraging habitats for amphibians and reptiles.

Water impoundments that are developed for waterfowl production, as in alternative B, may lead to a decline in amphibians and reptiles through increased depredation from a high concentration of waterfowl. High waterfowl numbers could lead to a decrease in water quality. Adult amphibians are very sensitive to environmental conditions due to their permeable skin, which they use to breathe and absorb water. Risk from slightly increased numbers of waterfowl would occur in alternative C.

In alternative B, manipulation of water levels in impoundments may cause mortality to amphibian eggs and larvae through exposure and increased risk of predation. Increased water levels may decrease water temperature, stopping the development of eggs or slowing development, and preventing maturation.

Restoration of habitat in alternative C may have a short-term negative effect, as reptiles and amphibians are highly sensitive to changes in environment. The removal of dikes and wetland structures may eliminate habitat. Restoration of drained wetlands would mitigate this loss for species that are adaptable or pioneering. Philopatric species may be lost.

Amphibians and reptiles would benefit from control of invasive plants in alternatives A–C. Invasive plants may impact terrestrial amphibians and reptiles by forming dense stands and changing microhabitats, blocking migration routes, and eliminating critical habitat. Conversely, management of invasive plants with chemical herbicides may have major negative impacts on these animals. Although the assumption is that toxicity criteria developed for mammals, birds, and fish would protect amphibians and reptiles, the permeable skin of amphibians and reptiles readily absorbs toxicants.

Eggs of amphibians, as well as larval stages and adults, would be subject to greater predation by fish because of fisheries development in alternatives A and B. Predatory fish may keep amphibians from important foraging habitat. Fish may also act as vectors for pathogens of amphibians.

Fish passage restoration in Pleasant Valley Creek, if determined feasible, may negatively impact amphibian populations (all alternatives).

Risk of habitat degradation and direct mortality of amphibians and reptiles may be increased in alternatives A and B, where traffic on existing roads may increase. Soil disturbance and increase in settling of airborne dust may affect water temperature and sedimentation in aquatic habitats. As some amphibians undergo mass migrations to and from breeding habitats, they may be killed in mass while crossing roads. One study of frogs and toads (Fahrig et al. 1995) showed that the proportion of dead to live animals increased, and the total density of animals decreased, with increasing traffic intensity (Maxell and Hokit 1999).

Amphibians and reptiles would be at higher risk of mortality from handling and killing by humans in alternatives A and B, where public use and the development of recreational facilities along streams, lakes, and ponds would occur. These animals may become stressed by human handling. In addition, humans often transport animals, releasing them in unfamiliar or unfitting microhabitats, which can result in death to the animal.

Alternative B, where public use would be increased in critical amphibian habitat during spring and summer, would have a broader negative impact on amphibians and reptiles—through greater access to Dahl Lake and other wetlands, unrestricted access on designated trails and roads, increased access for fishing, and occurrence of nonmotorized floating devices on Dahl Lake. Risks associated with public use would be the least in alternative C.

Allowing fishing in alternative B, prior to restoration and recovery of native fish populations, may impact future recovery by depleting nursery stock or impacting the water's edge.

Adverse impacts on aquatic habitats of the refuge, affecting the fisheries food base, could occur from use of herbicides by neighboring landowners for control of invasive plants.

Cumulative Impacts

Traffic on the county road that runs through the refuge would multiply with increased public use under alternatives A and B, increasing disturbance to wildlife and the chance of wildlife–vehicle collisions.

Species of Concern—*Grizzly Bear, Gray Wolf, Canada Lynx*

Estimated effects of the alternatives on the grizzly bear, gray wolf, and Canada lynx are described below.

Direct Impacts

Restoration and management of riparian areas and aspen communities in all alternatives would benefit grizzly bears and Canada lynx. Grizzly bears prefer riparian areas because they are rich in forage and provide more security than other cover types. At lower elevations, aspens become important emergency food for snowshoe hare, an important lynx food.

Alternatives A and C would promote refuge habitats as part of larger corridors for the grizzly bear and

gray wolf, allowing movement of individuals between distinct populations. Island populations cut off from one another by lack of suitable habitat are subject to high rates of extinction. Preserving linkages between populations may be more important to long-term conservation of a species than attempting to manage separate populations.

Deer and elk populations would be at levels to provide adequate prey for large predators, under all alternatives. Alternatives A and B would maintain adequate ground squirrel populations by prohibiting hunting. Ground squirrels are an important source of protein for grizzly bears and may also be taken by lynx and wolves.

Any grizzly bears would likely have access to early spring browse in all alternatives, because potential competition with livestock would not be a major factor. Livestock can affect grizzly bears through direct competition for early spring browse, by degradation of habitat from trampling and grazing, and displacement of bears from quality habitat as they avoid areas of human activity. In addition, there would be less likelihood of depredation of livestock by grizzlies.

Restoration of a free-ranging, nondepredating gray wolf pack would be facilitated in all alternatives, through removal of livestock, provision of abundant natural prey, and protection from disturbance.

Restrictions of public use while grizzly bears may occur on the refuge, in all alternatives, would reduce disturbance to and displacement of bears. Removal of carrion from roadsides would decrease the chance of scavenging grizzly bears and wolves being hit by cars. Alternative D would provide the most protection from disturbance for grizzlies, wolves, and Canada lynx due to little promotion of public use.

Public use restrictions in alternative B would protect gray wolves from disturbance at den and rendezvous sites. Since this alternative does not require public users to remain on designated trails or roads during winter, disturbance could occur to wolves while on deer and elk winter range.

Problem wolves would be controlled on surrounding federal, state, and private lands. Without wolf control in place, there would likely be more illegal killings of wolves than the present average of one per year (Interim Wolf Control Plan 1999).

Indirect Impacts

The maintenance or increase of deer and elk populations in alternative A would benefit grizzly bears, gray wolves, and Canada lynx, all of which feed on deer and elk.

Modification of the fences should have a positive impact on deer and elk populations in alternative A, which would increase native prey availability. Conversely, predators use fences to help capture prey and creating fences that are more conducive to deer and elk movement may make the capture of prey more difficult.

In alternative A, the hunt program may be modified if it were found to be in conflict with restoration of these species. Alternatives B and C, which call for increased public use facilities (day use or campground facilities), would have increased potential for conflict with grizzly bears. Public use, including camping and hunting, may have periodic restrictions when grizzly bears or gray wolves are in the area, under alternative B. Although alternative D offers the most unrestricted access, public use would not be not promoted, as it would be in alternatives A and B. The result is that there may not be as many people using the refuge, but they would be permitted wider access for a longer time.

Some effects of disturbance on the grizzly bear and gray wolf follow.

- Disturbance and displacement can result in reduced reproduction, higher mortality rates due to food stress or lower security, and smaller bear populations due to reduced carrying capacity.
- Bears habituated to humans often sustain mortality through greater vulnerability to hunters and poachers, collisions with motor vehicles (Claar et al. 1999), or becoming nuisance bears that must be controlled. Bears that habitually feed on human food and garbage often lose their normal wariness of people, become nuisance bears, and may become aggressive towards humans (Herrero 1985).
- Disturbance during wolf denning, around rendezvous sites, and in winter habitat has the potential to adversely affect the survival of wolves in the area.
- During wolf use of a den site, the pups are extremely vulnerable to disturbance that may keep the female away. The pups may be abandoned or exposed hazards such as inclement weather, predation, and physical barriers such as rivers. Rendezvous sites are safe areas where the adults leave the pups and return with food.

Restrictions during hunting seasons under alternative A would benefit the grizzly bear, gray wolf, and Canada lynx if they are located on or near the refuge. In addition, the restriction of coyote and black bear hunting in alternative A would benefit the grizzly bear and gray wolf. Wolves may be misidentified as coyotes or dogs and be killed by mistake. Grizzly bears can be confused with black bears. There would be some risk that grizzly bears and wolves would be shot intentionally by hunters who perceive them as threats to future hunting opportunities.

Wolves and lynx would not be subject to incidental injury or mortality from traps, as all alternatives restrict all trapping. These predators may both be caught in traps set for other species such as coyote, wolverine, or bobcat.

The presence of livestock at any time of the year that wolves are in the area may contribute to depredation or habituation of bears and wolves to livestock as a food source. Alternative C, which would not use grazing as a management tool, would benefit wolves and grizzly bears by decreasing competition between deer, elk, and livestock to increase survival and reproduction of these prey species. In the NCDE, livestock depredation was the most common reason for relocating grizzly bears. These relocations were significantly less successful than relocations for other offences. Wolf–livestock conflicts cause negative public perceptions of wolves, decreasing the acceptance of wolves by the public.

Environmental education, open communication, and development of trust between the public and managers under alternative A would ensure the success of recovery of the grizzly bear and gray wolf. Tolerance of wolves by the local public would reduces illegal killing, and allow opportunity for the public and biologists to investigate innovative ways to reduce wolf–livestock conflicts without killing wolves (such as aversive conditioning).

Cumulative Impacts

[None expected for all alternatives.]

Species of Concern—*Bald Eagle, Trumpeter Swan, Black Tern*

Estimated effects of the alternatives on the bald eagle, trumpeter swan, and black tern are described below.

Direct Impacts

Restoration and management of riparian areas and aspen communities in alternative A would benefit bald eagles. Nesting habitat would be maintained near Dahl Lake in alternatives A and B. Aspen groves provide nest sites and roosting areas for bald eagles.

Alternative B would provide increased fish, an important food source for the bald eagle; however, sport fishing could increase disturbance to eagles and decrease the availability of fish. Increased numbers of waterfowl in alternatives A and B would provide an important source of food for bald eagles. Alternatives A and B would maintain adequate ground squirrel prey by prohibiting hunting.

In all alternatives, restrictions of public use near bald eagle nest sites would reduce disturbance to bald eagles. Removal of carrion from refuge roadsides would decrease the chance of scavenging eagles being hit by cars. Alternative D would provide the most protection from disturbance for bald eagles due to little promotion of public use.

If waterfowl numbers increase as expected in alternatives B and D, additional prey would be available for eagles. High waterfowl numbers may result in a waterfowl hunting season under alternative B. This may affect bald eagles by increasing disturbance, causing accidental wounding of eagles by shot, and decreasing waterfowl numbers during hunting season.

Bald eagles would not be subject to incidental injury or mortality from traps, as all alternatives restrict trapping.

In alternative B, trumpeter swans would be protected through minimizing disturbance.

The black tern could be displaced from the Dahl Lake area as water levels would be slowly increased under alternative A, causing a short-term negative impact on shoreline vegetation.

Indirect Impacts

In alternatives A and D, restoration and improvement of habitat and reduction in grazing may have a negative effect on ground squirrel populations, with a subsequent decrease in bald eagle prey.

In alternative B, an interpretive display located within 0.5 mile of the eagle nest may affect production. For a blind to be effective, it must be located close to the bald eagle nest or perch trees, but use would be strictly regulated as to not jeopardize eagle recovery.

In all alternatives, the bald eagle, trumpeter swan, and black tern would benefit from water management that enhanced fisheries, and the subsequent availability of fish.

In alternative C, an educated public would be aware and accepting of management actions for bald eagles.

Cumulative Impacts

[None expected for all alternatives.]

Species of Concern—*Boreal Toad, Bull Trout*

Estimated effects of the alternatives on the boreal toad and bull trout are described below.

Direct Impacts

Wetland restoration in alternative A would benefit boreal toads. These toads use the same sites for breeding year after year. They lay their eggs in shallow water where higher temperatures are found. Warm water is crucial to the development of their eggs.

Indirect Impacts

The removal of the water manipulation structures at Lower Moose Pond, as called for in alternative C, would adversely impact one of the largest reproductive sites for boreal toads in the Rocky Mountains. It is likely that this population of boreal toads would be eliminated. Research has shown that boreal toads have very limited dispersal (Olson 1992). They are also philopatric, i.e., laying their eggs in the same site every year.

Restoration of stream channels and riparian vegetation restoration on portions of the refuge (alternatives A, B, and C) would decrease water temperatures and improve water quality, to support the successful restoration of bull trout in the downstream Fisher River. Restoration of fish passage in Pleasant Valley Creek would benefit bull trout and other cold-water fishes.

If a viable sport fishery becomes established under alternatives A, B, or C, the refuge may be opened to fishing. In the case that bull trout also become established in refuge waters, the fishing program would be designed as to have minimal impact on bull trout.

Cumulative Impacts

[None expected for all alternatives.]

Species of Concern—*Spalding's Catchfly*

Estimated effects of the alternatives on Spalding's catchfly are described below.

Direct Impacts

Increased numbers of deer and elk in alternatives A and B has the potential to increase grazing and trampling of Spalding's catchfly plants.

In alternatives A and B, Spalding's catchfly (threatened plant) populations would be protected through identification of sites, protection of sites from trampling and grazing, control of invasive plants, and protection and restoration of native Palouse prairie. In addition, all suitable sites for Spalding's catchfly would be restored to up to 90 percent of available habitat in alternative C.

Alternative D would provide protection of catchfly populations found during inventory of suitable habitat prior to implementation of management actions. Catchfly populations would be further protected through control of invasive plants around known locations of the plants.

Public use may be restricted in uplands in alternatives A and B to reduce potential impacts. Any increase in public use of uplands, as may occur during hunting season, may have a negative impact on Spalding's catchfly recovery through unintentional trampling. Although the public has more off-trail access in alternative B than in alternative A, the additional use either occurs in the bottomlands or during the winter so additional impact on Spalding's catchfly from trampling should not be a factor.

Alternative D may not have as many people using the refuge as in alternatives A or B, but they would be permitted wider access for a longer time period. There may be a threat to Spalding's catchfly from trampling by public users since the uplands would be open all year.

Conservation easements, obtained through coordination with partners, would protect habitat for Spalding's catchfly in alternatives A–C.

Indirect Impacts

Spalding's catchfly populations would likely increase in alternatives A and B. Catchfly habitat would be greatly benefited through decreased coverage of invasive plants, along with increased native grasses and forbs.

Prescribed burning of Palouse prairie (alternatives A and B) should have positive benefits for reinvigorating catchfly habitat. Removal of invasive plants would be conducted at least 2 years prior to prescribed burning to prevent seed production and dispersal (Goodwin 2001). Fire can have a positive impact on Spalding's catchfly by removing litter and duff and inhibiting the establishment of woody plants.

Healthy Palouse prairie, which benefits Spalding's catchfly, may be maintained by livestock grazing in alternatives A, B, and D. Grazing in these areas would be restricted to late fall or winter to protect plants from grazing and trampling.

Cumulative Impacts

With no use of fire under alternative D, Douglas-fir would encroach into the prairie grasslands and contribute to the gradual loss of that ecosystem essential for Spalding's catchfly. There would be increased woody shrubs in grasslands, which could have a cumulative impact with invasive plant encroachment by reducing the potential habitat for Spalding's catchfly, as well as outcompete current catchfly plants.

Cultural Resources

Estimated effects of the alternatives on cultural resources are described below.

Direct Impacts

Cultural resources, including known and previously unknown resources, would be documented, protected, and maintained under all alternatives, as required by law. An educated and compliant public would not have adverse effects on cultural resources. Sensitive and fragile sites would be protected through

restricted access and law enforcement presence. Fundamental documentation, protection, and maintenance of sites and resources found on this new refuge may not be adequate where resources are diverted to restoration (alternatives B and C) or to a museum (alternative B).

In alternatives A–C, documenting as many sites as possible would allow planning of refuge projects to avoid or mitigate impacts to sites and objects.

The restoration of a cultural site (alternatives B and C) and development of a museum (alternative B) would be a source of information for researchers and scholars and provide for extensive interpretation and environmental education. Any historic buildings restored through this alternative could be used for refuge office space, housing, or the museum.

Maintaining resources to the extent they do not deteriorate would be difficult with refuge staffing for alternative D. This alternative would not adequately protect currently known or undocumented resources. Not only could this result in damage to the resource, but could increase costs as projects are delayed, changed, or stopped due to discovering previously-undocumented sites during a project.

There may be some damage to resources in alternative D, due to delays associated with reliance on off-site, qualified personnel to provide evaluation and documentation.

Indirect Impacts

In all alternatives, the presence of a cultural resource could impose restrictions on use of an area, including closures to public use, cessation of wetland restoration efforts, or modification in management projects. However, closures or restricted access to a site could allow for additional protection of sensitive, threatened, and endangered wildlife and plants. Conversely, closures or restrictions of access due to needs of sensitive, threatened, and endangered species would protect cultural resources in those areas.

Restoring Dahl Lake to its natural condition (as found during pre-European contact) would occur in alternatives A–C. This could have the effect of restoring the camas once found in this area and used by the Kootenai people (Wakefield 1998, Schwab et al. 2000). From another perspective, restoration of any aspect of the refuge to pre-European-contact conditions would eliminate historical traces of the homesteading era along the lake.

In alternatives A–C, documentation of cultural resources would provide opportunities to forge partnerships, which would furnish the expertise needed to do a thorough survey using up-to-date methods.

Increased access to sites would allow for more public education and interpretation in alternative B. While increasing support and compliance with rules and regulations to protect cultural resources, there would also be potential for increased disturbance and impacts.

Cumulative Impacts

[None expected for all alternatives.]

Public Use

High-quality environmental education programs establish community support that will increase interest and understanding of the refuge and the Refuge System.

General Public Use

Estimated effects of the alternatives on general public use are described below.

Direct Impacts

Wildlife-dependent recreational uses can foster understanding and instill appreciation of native fish, wildlife, and plants as well as promote support for their restoration and conservation and support of the refuge as part of the Refuge System.

Restricting public use to designated trails would allow access to the public with minimal disturbance to wildlife in alternative C. Viewing opportunities may even improve as animals become habituated to predictable disturbance in a given area. Protection from disturbance, in conjunction with habitat restoration, should boost wildlife populations increasing public use opportunities.

Ethical wildlife viewing and photographic behavior, promoted in alternatives A–C, includes being considerate of other users and would reduce user conflicts.

Promoting a youth fishing program (alternatives A–C), even if provided off-refuge through partnerships, could provide support for management programs, as the public is made aware of current conditions and efforts to restore the natural water regime and native fisheries.

Indirect Impacts

All alternatives would support protection and conservation of natural resources and provide for better public use opportunities through development of a visitor services requirement evaluation and plan. Public use would be directed to those activities most compatible with resources.

Alternatives A and B would provide high-quality experiences—ones the public would want, use, and be attracted by; and which would complement opportunities provided by the private sector and other agencies.

Information gathered from a demographic survey would help plan refuge needs in hiring staff and developing facilities to support public use in alternatives A, B, and C. While saving much in the way of time and money by not conducting a demographic survey in alternative D, the refuge would not have basic information needed to provide the most appropriate public use that resources could support. This may contribute to resource damage by not anticipating how, where, and when visitors visit the refuge.

The introduction of trumpeter swans to Dahl Lake in alternative B may impact public uses such as hiking, bird watching, fishing, and hunting during reintroduction efforts.

Skilled staff would lead quality interpretive and environmental education programs in adequate facilities in alternatives A, B, and C. These resources would be available for other aspects of public use, e.g., contact station staffing and volunteer coordination.

Having refuge-specific environmental education materials available for classroom use may encourage students to visit and experience the refuge on their own, as provided in all alternatives. However, limited staff in alternative D would limit development and distribution of materials. The environmental education lessons would address ways to reduce and eliminate impacts to natural resources, thus protecting the refuge environment and increasing compliance to rules and regulations.

All alternatives would develop and maintain good relationships with refuge neighbors, as their children are exposed to environmental education programs, although this effort is extremely limited in alternative D.

Volunteer and partnership programs, to assist in all aspects of the public use and restoration programs, would flourish under alternative B, with increased partnerships facilitated by a volunteer coordinator. Limited staffing in alternative A would result in a smaller partnership and volunteer program.

Cumulative Impacts

[None expected for all alternatives.]

HUNTING

More details on the impacts of hunting can be found in the hunting EA, at http://bisonrange.fws.gov /losttrail/lastea.pdf

Estimated effects of the alternatives on hunting are described below.

Direct Impacts

Allowing hunting on portions of the refuge would allow for an expansion of hunting and provide quality opportunities.

Pulling staff from the National Bison Range to support the hunting program may limit other public use, although all could use hunting resources such as a good public use handout.

Indirect Impacts

Removal of some elk on the refuge would facilitate adequate harvest levels and assist MFWP in optimum management of the local elk population.

Restoration of wetlands and planting wild rice (alternative B) should increase the number of waterfowl using the refuge, which may lead to being able to open a quality waterfowl hunt.

[None for alternatives A, C, and D.]

Cumulative Impacts

[None for all alternatives.]

FISHING

Estimated effects of the alternatives on fishing are described below.

Direct Impacts

The natural water regimes and their corresponding fisheries and plant communities have been greatly modified in Pleasant Valley and do not support a quality fishing program at this time. A sport-fishing program at this time could hinder recovery and disturb habitat and other wildlife.

Alternatives A and B would provide the best possibility to establish a successful sport-fishing program. Since there is currently no viable fishery on the refuge, recovery and restoration must first be completed. If a sport fishery were established, access points and trails would be developed to direct anglers, including those with disabilities, to areas that would provide quality experiences and reasonable harvest opportunities. Partnerships would provide resources, personnel, and expertise in this effort. With restoration of natural water regimes and native fisheries, the refuge may provide a nursery for off-refuge fishing opportunities. Habitat would be provided for redband and westslope cutthroat trout.

While a native fish restoration program would be established in alternative C, even if fisheries were restored, fishing would not be allowed.

Fishing would be promoted to youth in alternatives A, B, and C. This would introduce future generations to the pleasure and excitement of fishing. Those involved would not only learn how to fish successfully, but ethically as well. In alternative C, more effort would be needed to find appropriate sites and partners to hold fishing events off-refuge. Supporting existing programs such as the MFWP's "Hooked on Fishing, Not on Drugs" would not only make them more successful, but could provide the

refuge a strong base to start its own on-site fishing program for youth if a sport fishery were restored.

Indirect Impacts

The wetland restoration program would have to be successfully completed before a fishery could be restored. The cost, personnel, and time needed to restore the fisheries may be large enough to make restoration to a level that could support a fishing program for alternatives A, B, and D within the time frame of this CCP (10–15 years) unrealistic or even prohibitive.

Support from partners in the watershed may be difficult to attain if sport fishing were never to be allowed under alternative C. Support for the program may be raised if, by restoring the hydrology on the refuge, downstream fisheries would be improved.

In alternative D, while a great deal of funding and staffing would be saved by not actively pursuing a native fish restoration program, the overall health of the refuge may suffer. Fish are an important part of the ecosystem, playing roles as predator and prey. Recovery of native fish should occur as the hydrology is restored in partnership with the NRCS, but could take a very long time. During this time, anglers as well as other wildlife-dependent recreation users such as wildlife photographers and bird watchers would not be able to experience aspects of a healthy stream ecology.

Cumulative Impacts

[None for all alternatives.]

Wildlife Observation and Photography

Estimated effects of the alternatives on wildlife observation and photography are described below.

Direct Impacts

Visitors would have access to information about types of plants and animals on the refuge, as well as the best locations, times, and seasons to view them (alternatives A, B, and C). This would result in quality wildlife observation and photographic opportunities and experiences. Interpretive displays and handouts at viewing sites, as well as personal contacts, would inform users of opportunities and introduce them to the least disruptive ways to photograph and observe wildlife. With minimal staffing in alternative D, there would be limited personal contact with visitors. Information would need to be posted in accessible areas where it would be easily available to all.

In alternatives A–C, the refuge would offer a unique opportunity to observe and photograph Intermontane plants and animal in a native setting. The refuge would provide habitat for rarer species such as wolves, eagles, and bears, which are highly sought-after species for viewing and photography. Trails, wildlife-viewing areas, and platforms would offer quality viewing opportunities and may increase chances of photographic success. Wildlife viewing and photographic opportunities would be limited in alternative D for those visitors who do not have the capability, or are reluctant, to travel off-trail and cross-country, reducing the quality of their experience.

Allowing visitors foot access to a large portion of the refuge in alternative B and the majority of the refuge in alternative D would provide opportunities for following and locating animals, however, this could cause wildlife to avoid areas easiest to access and reduce viewing and photographic opportunities.

Alternative B would allow access by permit to areas normally closed to the public, and could provide unique opportunities for wildlife observation and photography. Providing limited access to closed areas could expose the public to the need to protect and conserve natural resources, while limiting impacts to these areas. Adequate staff and office resources would result in a fair and equitable means to dispense permits.

Restoration of habitat and minimization of disturbance in alternative C should enhance public viewing opportunities by fostering wildlife populations. Access to most of the refuge would be restricted under this alternative, so opportunities for wildlife observation and photography would be limited. Limited access may make it difficult for the public to support resources with which they do not have direct contact. Outreach contacts would provide background for the closed areas.

Indirect Impacts

Wildlife photographers and bird watchers would be able to enjoy the aspects of a healthy stream ecology and receive quality, wildlife-dependent experiences, as a result of restoration of natural hydrology and associated fish, wildlife, and plants in alternatives A, B, and C.

Wetlands restoration in alternative B would increase numbers of water birds such as the black tern, American bittern, and grebes, along with mammals such as moose and mink. This would provide maximum wildlife viewing and photographic opportunities.

Wildlife photography and observation in alternatives A–C would foster appreciation for native fish, wildlife, and plants and their conservation, by providing the public with safe, quality, and compatible experiences.

Conflicts between users would be minimized in alternative A, by developing some areas for wildlife photography and observation that are away from other users. Visitors would be informed of where particular recreational uses may be taking place to give them choices.

The high levels of public use promoted in alternative B would provide facilities and opportunities that would benefit a variety of visitors, but user conflicts may also be increased. A recreational fee could help defray costs of implementing the permit program (for access to closed areas) in this alternative. The permit program, or any associated fee, may be disliked by visitors and result in less visitation.

Restricting wildlife viewers and photographers mainly to areas along roads in alternative C would concentrate users into a small area, with potential for conflicts with other recreationists and traffic. By restricting use to designated areas, not only can impacts to wildlife be minimized, but viewing and photographic opportunities may increase as animals habituate to human presence (Youmans 1999). Disturbance to the natural environment would be minimal, which may encourage wildlife to use the refuge and promote better viewing and photography of wildlife.

With limited information and facilities available for wildlife viewers and photographers in alternative D, conflicts with other users could increase. There would be no opportunity to instill ethical behavior under this alternative.

Cumulative Impacts

[None expected for all alternatives.]

INTERPRETATION

Interpretation would impart the unique stories of the refuge—wetland restoration; restoration of native plants, fish, and wildlife; threatened and endangered species; Native American inhabitants, homesteaders, and the railroad.

Interpretive materials and activities would help users develop appropriate expectations and make informed choices about recreational opportunities available at the refuge. This would result in quality experiences and minimal resource impacts. Estimated effects of the alternatives on interpretation are described below.

Direct Impacts

Interpretive activities would tie together public use with the biology, management, and rules of the refuge, in alternatives A–C. Interpretation would foster understanding and instill appreciation for fish, wildlife, and plants and their conservation. Support of the refuge as part of the Refuge System would be promoted. Alternative A would provide a balance between personal contact (large funding and staffing needs) with less expensive and timesaving self-guided services.

All alternatives would provide some level of self-guided services (brochures, exhibits, kiosks, and audiovisual media). While these can have high, initial costs, subsequent maintenance and staffing would be minimal. This form of interpretation does not appeal to all users. The different alternatives provide varying levels of personal contact with refuge visitors.

An increase in personal interpretive services in alternative B should increase understanding of and compliance with rules and regulations, to reduce resource impacts in this high public use alternative.

Development of the contact station in all alternatives would provide support to visitors, especially during peak public use times such as weekends, spring bird watching, summer vacation, and fall hunting season. Partnerships and volunteer programs would be developed to assist with the interpretive program. Alternative B would provide for contacting more visitors, due to the station being open more hours (7 days per week). There would be less chance for personal contact with visitors in alternative D, because the contact station would be open limited hours.

Alternative B would providing guided walks and talks that would attract visitors to the refuge, especially those coming for the first time and in need of orientation. By providing variety and different skill levels, the refuge would promote return users.

Under alternative C, much of the refuge would be closed to public use and restrictions would apply to most areas. Visitors would be informed of the reasoning and rationale behind this management decision to encourage compliance. Interpretive messages would emphasize that even nonconsumptive recreational uses such as observation and photography cause wildlife disturbance and alter behavior.

Alternative D would have no cohesive interpretive program. This may reduce the time spent at the refuge as well as reduce the quality of visitor experiences.

Indirect Impacts

Alternative C would provide little opportunity for direct public experience with, or interpretation of, the refuge's natural resources.

Limited access to the contact station in alternative D would reduce the availability of getting needed information (safety, rules, and regulations) to visitors. This could correspond to an increase conflicts between users, noncompliance of rules, and damage to natural resources.

Cumulative Impacts

[None expected for all alternatives.]

ENVIRONMENTAL EDUCATION

Estimated effects of the alternatives on environmental education are described below.

Direct Impacts

Environmental education programs would promote understanding and appreciation of natural and cultural resources. Children that are resident of the Pleasant Valley would be able to further their appreciation for the surrounding environment. In addition, community support could be established, which would increase interest and understanding of the refuge as part of the Refuge System.

Alternative A would provide a good, basic environmental education program (appendix A) to build on as future needs demand. The program would complement what is currently being offered by Glacier Institute, MFWP, and Flathead Valley Community College.

Since the local schools (Marion, Pleasant Valley, Lost Prairie, and Montana Academy) are small (Pleasant Valley School had five students at the start of the 2001–2002 school year), the program should reach to at least Kalispell and Libby, especially for use of the lending library (all alternatives). The lending library would be a very effective means of spreading the environmental education message to schools who find the distance to the refuge a deterrent.

The environmental education site developed in alternatives A and B would involve underserved populations such as urban or rural schools, Native Americans, non-English speaking populations, senior citizens, people with disabilities, and colleges and universities. This type of environmental education would be tied to pre- and postsite activities to prepare students for the experience and to reinforce messages.

Alternatives A, B, and C would provide an extensive environmental education program (appendix A). Because of the large distance to most schools, day trips may not be feasible for the majority of educational facilities. Overnight facilities would be developed. Benefits would include attracting school groups from a wide area, opportunities for long-term contact and interaction, and the availability of students and educators to help with monitoring, research, and restoration efforts.

With staff and facilities being extremely limited in alternative D, the refuge would only be able to accommodate a few requests from schools for environmental education services. Opportunities for pre- and postfield trip programs would be limited, which could limit the effectiveness of field trips.

Indirect Impacts

Partnerships could be critical in providing funding, materials, staff, and volunteers to develop and provide basic environmental education program in alternative A.

The extensive environmental education program in alternative B would promote stewardship in youth, who are our future caretakers.

Alternative C's environmental education program would help foster stewardship among our future caretakers, however, it would be hard to inspire appreciation and establish ties to natural resources if students do not get to experience the resources on-site.

Cumulative Impacts

[None for all alternatives.]

SOCIOECONOMICS

None of the alternatives considered is expected to have disproportionately high adverse impacts to the health of any human beings (especially to Native American tribal members, and minority or low-income populations) or to the environment.

While the refuge is located near Native American tribal lands, the refuge is not within the boundaries of any Indian reservation. The local area is not comprised of either a predominantly minority population nor a predominantly low-income population. Estimated effects of the alternatives on the socioeconomic situation are described below.

DIRECT IMPACTS

For all alternatives, it is estimated that employment of refuge staff would have a positive effect on local employment, income, and housing conditions in the communities surrounding the refuge or in the Kalispell area. It is not expected that implementation of any alternative would result in increased housing construction in the area of the refuge.

Projected staffing levels for the alternatives range between seven full-time employees in alternative A to one full-time and one part-time employee in alternative D. Staffing income is estimated to range from $390,000 in alternative A to $98,000 in alternative D. Additionally, temporary jobs and indirect employment could be generated during annual work and maintenance as well as one-time projects.

Volunteer and youth programs would provide opportunities for people to gain job experiences in a wide variety of natural resource management and visitor services, which could provide for better future job opportunities.

INDIRECT IMPACTS

The open, rural, visual character of the refuge in all the alternatives considered, against the backdrop of the Rocky Mountains, would benefit adjacent landowners and nearby communities.

All alternatives would have, in the long term, a positive impact on public perception of refuge programs, particularly by the local ranchers and timber industry personnel. While it is believed that current public perception is dominated by the refuge's history of ranching, future perceptions may associate the refuge as restored, ecologically sound wildlife habitat and a valuable part of the Refuge System. Such a change would benefit the refuge and the surrounding communities.

Securing additional water rights related to the Meadow Creek restoration (all alternatives) would be done through the state court system. The Service expects that the issue of expanding the refuge's water rights would have a neutral effect on socioeconomic conditions in the area. Past water rights' adjudications and water issues generated few conflicts for the previous owners of Lost Trail Ranch.

Any of the alternatives would help to restore refuge habitat as a place where the gray wolf and grizzly bear could meet all or most of their life cycle needs. If these species were once again to make the refuge part of their home range, there could be beneficial effects on the local tourism industry.

Wolves and grizzlies are not only a source of wonderment to wildlife enthusiasts, but also a source of concern for some landowners near the refuge, especially those whose livelihood is intrinsically tied to domestic cattle and sheep ranching. Even with implementation of protective measures including a livestock compensation program, there may be deleterious effects on the local public's perceptions, as well as on their support for, the existence and management of the refuge.

Cumulative Impacts

While meeting refuge goals through any of the alternatives may make development of adjacent lands more attractive, it would not directly affect any land use, employment, or income conditions outside the refuge.

Partnerships

Existing partnerships would be maintained and new partnerships would be fostered to meet refuge purposes, in all alternatives. In alternatives A, B, and C, additional partnerships would provide volunteers to assist with habitat management projects.

For example, the mission of the MCC is to bring together Montana's commitment to its people and its natural resources—by enhancing citizenship and employability through stewardship of our lands and community service.

Their model is "young people + hard work + meaningful projects = quality citizens and a better environment."

In partnership with MCC, the refuge would help fulfill the MCC mission along with refuge objectives through community service projects that provide habitat benefits. High-priority refuge projects such as removal of fencing and facility maintenance would be accomplished.