Chapter 4: Environmental Consequences

Bumblebee pollinating Northern monkshood. Terry Tracy

4.1 Introduction

The actions identified in the EIS are for the protection and restoration of wildlife habitat, with emphasis on endangered species recovery. The consequences of each alternative are evaluated in terms of listed species, refuge expansion, habitat and habitat management, wildlife-dependent recreation, and other rare species. Water quality and soils, economic effects, and cumulative effects are also evaluated in this chapter.

The small size and primarily protective purpose of the Refuge result in relatively minor overall adverse environmental consequences. The primary consequences as they relate to Refuge purposes (reaching recovery and delisting target species) are: Alternatives A and B are not likely to meet sufficient recovery goals for delisting of any of the species; Alternative C would meet multiple recovery goals for delisting of the Iowa Pleistocene snail.

4.2 Issues/Impacts Common to all Action Alternatives

Endangered species habitat remains closed to all public entry. Cultural resources are treated the same as under current management and are fully protected. Some level of habitat restoration would occur under each alternative that would include the use of prescribed fire.

4.2.1 Prescribed Fire

Prescribed fire would be used as a management tool under all alternatives according to the current Refuge fire plan.

4.2.1.1 Social Implications

A prescribed burn on the Refuge will benefit the public by maintaining or increasing recreational opportunities through increased wildlife populations for hunting and observation.

Smoke from a Refuge fire could impair visibility on roads and become a hazard. All efforts will be taken to assure that smoke does not impact smoke sensitive areas such as roads and local residences.

Combustion of fuels during prescribed fire operations may temporarily impact air quality, but the impacts are mitigated by small burn unit size, direction of wind, and distance from population centers.

Any smoke from the Refuge may cause some public concern. This concern will be reduced through a concerted effort by Refuge personnel to inform the local citizens about the prescribed burning program, emphasizing the benefits to wildlife and the safety precautions that are taken. Interpretive programs, explaining the prescribed burning program, may also be conducted on and off the Refuge. The Refuge has a portable fire exhibit designed to inform the public about the benefits of prescribed fire in habitat management.

In general, local public attitude toward fire is positive. In fact, during the spring or fall smoke is a familiar part of the surrounding landscape from brush or road ditch fires initiated by local property owners.

4.2.1.2 Cultural and Archaeological Resources

There may be archaeological sites within prescribed burn units. When these units are burned, it is doubtful that the fire will have any adverse impact on the sites. The fire will be only a temporary disturbance to the vegetation in the area and likely will not destroy or reduce the archaeological value, since artifacts are typically buried beneath the surface. No known sites will be impacted by prescribed burning operations.

Constructing firebreaks usually involves some shallow ground disturbance that could damage or destroy archeological resources. If a firebreak is needed on previously undisturbed ground, the area will be surveyed prior to construction to avoid or protect any cultural or archaeological resources.

4.2.1.3 Flora

The prescribed burning program will have a visible impact on vegetation and the land. Immediately after a fire much of the land will be blackened. There will be few grasses or ground forbs remaining and most of the brush will be scorched. Trees may be scorched. Because of wet ground conditions or discontinuous fuel, there may be areas within the burn unit that are untouched by the fire.

In spring, grasses and forbs will begin to grow within a few days of the burn. The ash enriched soil will promote rapid growth such that after two or three weeks the ground will be covered. In some cases, young trees will re-sprout. Some of the less fire resistant trees will show signs of wilting and may succumb. After one season of regrowth, most signs of the prescribed burn will be difficult to detect without close examination.

Other signs of the burn will remain for longer periods. The firebreaks may still be visible. Vehicle tracks through the burn are visible on the freshly burned ash and may be longer lived if the vehicle created ruts in the ground. The long-term visibility of tracks will be reduced through procedures described in Chapter 2.

4.2.1.4 Listed Species

There will be no impacts to listed species because of precautions described in Chapter 2.

4.2.1.5 Soils

The effect of fire on soil is dependent largely on the fire intensity and duration. On areas with high fuel loads, a slow backing fire is usually required for containment and desirable results. The intense heat generated by a slow backing fire will have a greater effect on the soils than fast, cooler head-fires. The cool, moist soils of wetter areas in the burn units or areas with little fuel will be minimally affected by the fire.

The degree of impact to the soil is a function of the thickness and composition of the organic mantle. In cases where only the top layer of the mantle is scorched or burned, there will be no effect on the soil. This usually occurs in the forested areas.

On open grassland sites, the blackening of the relatively thin mantle will cause greater heat absorption and retention from the sun. This will encourage earlier germination during the spring growing season.

Nutrient release occurs as a result of the normal decomposition process. Fire will speed up the nutrient release process. The rate and amount of nutrients released will be dependent on the fire duration and intensity as well as the amount of humus, duff and other organic materials present in the mantle. The increase, immediately after a burn, of calcium, potash, phosphoric acid and other minerals will give the residual and emergent vegetation a short-term boost.

There is no evidence to show that the direct heating of soil by a fire of low intensity above it has any substantial adverse affect. Fire of this type has little total effect on the soil, and in most cases would be beneficial.

4.2.1.6 Escaped Fire

The possibility exists that prescribed fire may escape to the surrounding area. An escape can be caused by factors that may, or may not, be preventable. Inadequate firebreaks, too few personnel, unpredicted changes in weather conditions, peculiar fuel type, inadequate planning, and insufficient knowledge of fire behavior are factors that can lead to a loss of control. An escaped fire can turn into a very serious situation. On the Refuge's wildlands, an escaped fire would cause less severe damage than on land where buildings, equipment, and land improvements could be damaged. Many of the prescribed burn areas are well within the Refuge and of minimal threat to private or other improved lands. We will exercise extreme care, careful planning, and adherence to the unit prescription when we conduct all prescribed burns.

4.2.2 Environmental Justice

Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was signed by President Bill Clinton on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

None of the alternatives disproportionately place an adverse environmental, economic, social, or health impact on minority or low-income populations.

4.2.3 Cultural Resources

Activities outlined in each alternative have the potential to impact cultural resources, either by direct disturbance during habitat projects or construction of facilities related to public use or administration and operations, or indirectly by exposing cultural and historic artifacts during management actions such as prescribed burning. Although the presence of cultural resources including historic properties cannot stop a federal undertaking, the undertakings are subject to Section 106 of the National Historic Preservation Act, and at times, other laws.

Thus, the Refuge will, during early planning of actions, provide the Regional Historic Preservation Officer a description and location of all projects, activities, routine maintenance and operations that affect ground and structures, details on requests for allowable uses, and the range of alternatives being considered. The regional officer will analyze these undertakings for their potential to affect

historic properties and enter into consultation with the State Historic Preservation Officer and other parties as appropriate. The Refuge will notify the public and local government officials to identify concerns about impacts by the undertaking. This notification will be at least equal to, but preferably with, the public notification accomplished for NEPA compliance and compatibility determinations.

4.2.4 Climate Change

The increase of carbon within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive conservation planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. Department of Energy's "Carbon Sequestration Research and Development" (U.S. DOE, 1999) defines carbon sequestration as A...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon monoxide. The Department of Energy report's conclusions noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere. Conserving natural habitat for wildlife is the heart of any long range plan for national wildlife refuges. The actions considered in this EIS would conserve or restore land and water, and would enhance carbon sequestration. This would contribute positively toward efforts to mitigate human-induced global climate changes.

Conversely, climate change has the potential to negatively affect Refuge resources. Climate change may affect the endangered species habitat we are seeking to conserve on this Refuge. The species the Refuge seeks to conserve depend on cold microclimates that are dependent on outflows of air resulting from underground ice. Global warming may cause this ice to melt more than usual and freeze less in the winter, thereby reducing or eliminating the permanent ice in the system. Loss of this ice would eliminate algific talus slopes and associated species. All three alternatives include monitoring of soil temperatures on a sample of algific slope habitats. Global warming may also cause an increased frequency of high rainfall events that can cause local flooding and erosion of habitats.

4.3 Alternative A: No Action

4.3.1 Impacts on Resources

4.3.1.1 Listed, Proposed, and Candidate Species

Under this alternative, recovery of the target listed species according to current recovery plans would not occur because there would be insufficient protection of current Refuge sites or of additional sites. Other recovery tasks also would not be accomplished. This alternative may also lead to possible listing of species of concern associated with algific talus slopes because of the lack of protection. There may be a greater chance of unauthorized uses that disturb endangered species habitat because of infrequent law enforcement patrol. Private landowner contacts would still occur as staff time allows. This alternative does continue to work towards recovery goals, but they will not be met in the near future with current management.

4.3.1.2 Refuge Expansion

No Refuge expansion would occur under this alternative. Recovery of the target listed species would not occur without further permanent protection of habitat. Although Refuge partners may be able to protect some sites in the next 15 years, their current funding levels suggest that the amount of protection would be insufficient to reach recovery goals. Partners also would not have the personnel or funding to manage endangered species sites to meet other recovery goals to allow delisting.

4.3.1.3 Habitat

Minimal habitat restoration would occur under this alternative which may result in undesirable habitat, such as box elder groves, for other Service trust resources and other wildlife. Desirable habitat would take much longer to develop. Lack of, or reduced, restoration effort could also affect algific talus slopes by shading, sinkhole erosion, and increase of invasive species. Invasive species control would be minimal which could threaten endangered species habitat as well as other wildlife habitat.

4.3.1.4 Wildlife-Dependent Recreation

Current public uses would continue. There would be no change in public support for the Refuge mission and no increase in public opportunities. There may be a slight increase in public use from increased local knowledge and demand of the current opportunities over time. No environmental education would take place except as staff time allows. There may therefore be fewer human impacts to habitat under this alternative, but also static or reduced understanding and support for endangered species protection. The current regulations and level of use create a quality experience for Refuge visitors.

4.3.1.5 Other Rare Species

With no evaluation, investigation, or further protection of algific slopes, the threats to other species associated with this habitat may increase. There may then be the potential for future listing as threatened or endangered. There would also be a loss of general biodiversity and scientific information about other species and possible insights into the geology and cold conditions these species evolved with.

4.4 Alternative B: Habitat Protection Emphasis

4.4.1 Impacts on Resources

4.4.1.1 Listed, Proposed, and Candidate Species

Alternative B would address the permanent protection recovery goal for all three species by maximizing acquisition. Enough sites could be protected to meet Iowa Pleistocene snail recovery goals by increasing land acquisition. More sites would be protected for Northern monkshood than in Alternative C. This alternative would preserve more sites for species of concern than the other alternatives. Although minimizing management activity on algific slopes would ensure protection of the physical environment of endangered species habitat, it would not address the overall biological integrity, diversity and environmental health of algific slopes that includes sinkholes and surrounding habitat, nor would it address threats to algific slopes resulting from adjacent land use.

This alternative does not adequately address multiple recovery goals, such as habitat restoration and invasive species, that would provide permanent habitat protection for delisting. If other threats are not addressed in the next 15 years, they could become more difficult to achieve.

4.4.1.2 Refuge Expansion

Expansion of the Refuge by 3,400 acres would allow significant progress towards the primary recovery goals for permanent protection of endangered species habitat and would likely meet that goal for the Iowa Pleistocene snail. Habitat for species of concern would also be protected. However, additional recovery goals for delisting will not be reached with only land acquisition. With Refuge resources primarily going to land acquisition under Alternative B, it would be difficult to complete habitat management and restoration for other wildlife on the Refuge.

Additional land acquisition or other forms of protection would not only preserve endangered species, but also soils, water quality, aesthetic features, and wildlife habitat. The Driftless region is a

beautiful area with tourism popular in some locations. There has been a recent increase in land sales to private owners solely for recreation. There has been a coinciding increase in land values in recent years.

The Driftless region also contains karst geology that is sensitive to land uses. Groundwater is directly linked to surface water because of subsurface fractures and is easily contaminated. Soils are shallow and erodible. Some of the underground systems associated with karst can have specialized ecosystems that deserve protection in themselves. In short, lands set aside for the Refuge in this region also promote protection of other unique and fragile resources. Refuge lands may promote stewardship of natural resources by others. There may be increased public and local government support in an increased federal land acquisition program in some areas.

4.4.1.3 Habitat

Minimal habitat restoration would occur under Alternative B with just forty acres of grassland actively restored. The result may be undesirable habitat for other Service trust resources and other wildlife. Any desirable habitat would take much longer to develop. This could also affect algific talus slopes by shading, sinkhole erosion, and increase of invasive species. Invasive species control would be minimal which could threaten endangered species habitat as well as other wildlife habitat. Threats from adjacent lands, such as erosion, would not be adequately addressed.

4.4.1.4 Wildlife-Dependent Recreation

There would be no change in public support for the Refuge mission and no increase in public use opportunities for wildlife-dependent recreation. There may be a slight increase in public use from increased demand and increased local knowledge of the current opportunities over time. Public use would be monitored. Newly acquired lands would remain closed to public use.

4.4.1.5 Other Rare Species

There would be some new protection for other glacial relict species by expanding the Refuge boundary. However, with no evaluation or management of lands adjacent to algific slopes, the threats to other species associated with this habitat may increase. There may then be the potential for future listing as threatened or endangered. There would also be a loss of scientific information and insights into the geology and cold conditions these species evolved with because of no additional study.

4.5 Alternative C: Habitat Protection, Increased Management, and Integrated Wildlife-dependent Recreation (Preferred Alternative)

4.5.1 Impacts on Resources

4.5.1.1 Listed, Proposed, and Candidate Species

Delisting of the Iowa Pleistocene snail could occur by addressing multiple recovery goals with this alternative. Increased land acquisition in both Alternative B and Alternative C will be a very important component for reaching delisting. However, delisting will not occur without insurance of permanent protection and management of surrounding habitat. New information and threats since the Iowa Pleistocene snail recovery plan was written increase the need for more active management to meet multiple recovery goals. Because of the resources required to reach delisting, the Refuge cannot meet all recovery goals for all three species in the next 15 years. Therefore, this alternative includes only enough land acquisition to delist the Iowa Pleistocene snail so that Refuge resources can also be used for more active management of habitat. We focused on the snail because less acquisition is needed to reach recovery goals. In addition, there are only 37 total snail sites, making protection more critical than for monkshood where nearly three times as many sites exist. Work will still continue towards meeting recovery goals for the other species. Many of the recovery goals that

are addressed for the snail will also benefit Northern monkshood. Any of the three Leedy's roseroot sites that become available will be protected under Alternative C.

There may be slight increased risk physically to endangered species habitat due to monitoring activities. However, the benefit of the increased information would likely outweigh this. Without sufficient monitoring, information will likely not be available for a delisting decision. Measures would be taken to minimize activity on algific slopes during monitoring or study. The number of personnel would be limited, existing wildlife trails would be used for traversing slopes, monitoring would be only occasional and not on all sites, and sinkhole studies could be done in winter. Not all activities would occur on any one slope.

4.5.1.2 Refuge Expansion

Expansion of the Refuge by 2,275 acres would complete land acquisition needs for the Iowa Pleistocene snail and protect species of concern. Some of this acreage will also benefit Northern monkshood and Leedy's roseroot. Alternative C has less acreage identified for Refuge expansion than Alternative B. Therefore, limited Refuge resources can be used to acquire land as well as to address other recovery goals in order to delist the Iowa Pleistocene snail. If other recovery goals related to permanent protection of habitat are not addressed in the next 15 years, they could become more difficult to achieve. Although meeting the snail recovery goals will also benefit Northern monkshood, less land will be acquired for this species under Alternative C. Land values will likely continue to rise, making additional land acquisition more expensive in the future.

Other benefits of land protection are the same as given in Alternative B.

Sinkhole located on Driftless Area NWR. USFWS

4.5.1.3 Habitat

Habitat restoration surrounding algific talus slopes would benefit endangered species. Restoration can reduce erosion and invasive species impacts, and improve important microclimate factors (i.e. shade helps maintain cool temperatures). Not all impacts from neighboring land uses can be addressed through acquisition. Therefore, this alternative would better address issues such as nonpoint source runoff. This alternative would provide more beneficial habitat for other Service trust species, Resource Conservation Priority species, and other wildlife. Forty acres of grassland and 116 acres of forest would be restored. Additional restoration may occur on newly acquired sites. Alternative C fulfills the Service's policy of ensuring that the biological integrity, diversity, and environmental health of the Refuge System are maintained for Americans.

4.5.1.4 Wildlife-dependent Recreation

There could be increased public support for the Refuge mission under this alternative. There will be some increase in public use opportunities and information. A moderate increase in public use may increase the potential for wildlife impacts. However, the increase of on site activities would be minimal with just a trail added at the Howard Creek unit. Law enforcement patrols would increase. The primary increase in opportunities is from environmental education. An increase in environmental education, primarily off-site, would aid in support for acquisition efforts as well as

general understanding of endangered species in the area. Hunting may be needed to help control local deer populations, which are currently high. There could be the potential for impacts to other habitats if public use increases.

4.5.1.5 Other Rare Species

The objectives for increased inventory and review of information on other species would help ensure the protection of the entire rare community of algific talus slopes and may prevent future listing of other species, particularly snails. Scientific information on existing or even new species, on geology, and other features would meet the Refuge System goals for conserving a diversity of fish, wildlife, and plants and conserving representative ecosystems. There could be increased risk of impacts to the habitat from inventory work, mitigated by actions in Section 4.5.1.1. Work on algific talus slopes will only be done with stringent oversight and restrictions.

4.6 Water Quality and Soils

Most Refuge units contain streams and springs that have the potential to be impacted from nonpoint source runoff because of the karst topography. Water quality in northeast Iowa is generally affected by excess nutrients and pesticides as well as increased sediment loads. Refuge lands receive some runoff and soil erosion from agricultural fields. This runoff can affect sinkholes and streams to potentially affect endangered species habitat and general water quality. Runoff also affects general forest quality and loss of soil on the Refuge.

All of the alternatives protect Refuge lands from runoff and erosion, and improve soil retention and water quality in the local areas by setting land aside. Depending on surrounding land uses, runoff impacts to the Refuge could become worse under Alternative A. Alternative A has little emphasis on neighboring land uses, invasive species, or acquisition to protect buffer areas. Alternatives B and C provide more protection of land around algific slopes that would minimize these effects to endangered species and water quality. Alternative C also proposes more attention to work with adjacent landowners to minimize these effects through other programs. Study of sinkholes may also provide insight into nonpoint impacts to soil and water. Study of restoration options will assist in determining the best way to reduce threats from neighboring land uses.

4.7 Economic Effects of Alternatives

4.7.1 Refuge Expenditures

Approximately $11,050 of the Refuge budget were spent in a two county area on non salary items such as equipment, supplies, and fuel in FY2004. This amount would likely continue under Alternatives A and B and increase under the preferred alternative. More staff time and funds would be needed for Alternative C which adds a wildlife biologist position. An approximate 50 percent increase in operations funding would be needed to support an additional position. Funds for habitat restoration and studies would also be needed but could come from cooperative efforts with Refuge partners.

4.7.2 Wildlife-dependent Recreation

At least the current level of public use in the form of hunting, fishing, and wildlife observation and photography would remain in all three alternatives. Two of nine Refuge units are open to the public and both are in Clayton County, Iowa. Hunting, fishing, wildlife observation and photography account for approximately 55 visitor days annually to the Refuge. The majority of the use is hunting. These activities result in activity related equipment purchases and travel-related goods and services.

Most expenditures are from residents within the county, but there are some visitors from other counties and states. The total annual expenditures for current levels of hunting are estimated at $556 with a tax revenue of $46. Other activities would provide a lesser amount of expenditures. Visitor days may increase under all three alternatives because of a greater demand for public land and recreation. Alternative C would provide the most opportunity for increased public use and associated economic impacts.

4.7.3 Refuge Land Acquisition

In 2003, the Refuge Revenue Sharing payments to four counties for the Refuge totaled $2732. These are payments under the Refuge Revenue Sharing Act (16USC 715s) intended to offset losses in tax revenues based on an appraised value of the land. Payments are based on the greater of:

- 75 cents/acre;
- 0.74 percent of appraised value; or
- 25 percent of the net receipts collected from the Service unit.

These payments would continue under all alternatives according to the Act and congressional appropriations.

Some lands proposed to be acquired by the Refuge under Alternatives B and C are currently used for agricultural production or timber harvest. Many of the areas acquired for the Refuge are marginal land for agricultural production because they are highly erodible. Algific slopes themselves provide very little pasture or timber value. Agricultural uses would not continue under Refuge ownership, with the exception of a small amount of cooperative farming for Refuge management. The Service's cooperative farming program may be used for ground preparation prior to planting native vegetation and would be used on a temporary basis. These crops would provide a small amount of income for a cooperative farmer.

Alternative B proposes the most land acquisition of 3400 acres. Alternative C proposes 2275 acres. This acreage is scattered over a large area (Figure 1 on page 7). Land use would change on only a portion of this acreage. Most agricultural land is used for corn, soybeans, or beef and dairy cattle production. Acreage removed from crop production is estimated at 600 acres. Annual crop value is estimated at $19,000 each for corn and soybeans. Assuming most of the additional land would be forested land where endangered species habitat occurs, approximately 1,800 acres may be removed from private timber harvest. Assuming that about 120 acres are acquired each year for 15 years, and that this acreage would only be harvested once in a 15-year time period, the average annual timber production would decrease by about $57,000. The economic impact of corn, soybeans, and timber would total about $1.42 million over 15 years. Tax revenue associated with agricultural sales would also decrease by about $120,000 annually. Some of these values are based on land in Iowa. Some proposed acquisition may also occur in Illinois, Minnesota and Wisconsin where values could be different.

4.8 Cumulative Effects

Alternative A contains no additional land acquisition for endangered species habitat protection. This situation, combined with little ongoing habitat protection by other agencies, would have a cumulative effect of taking much longer to reach recovery goals for target species, if they were reached at all. Minimal invasive species control on the Refuge in Alternatives A and B, combined with little control of land use on adjacent lands, may cause an increase in invasive species in the local area. Habitat restoration on acquired lands in all alternatives, in addition to restoration occurring on adjacent lands, would be beneficial to wildlife, soil conservation, water quality, and aesthetics.

The preferred alternative (Alternative C) would have a potential to increase public use and the associated developments, such as parking areas and a trail on the Howard Creek unit. These developments could also be added to new units of the Refuge if they are opened to public uses. A potential for disturbance from increased public use combined with increased Refuge management activities may cause a cumulative increase in disturbance to endangered species habitat. However, we anticipate that the increase in public use will be small and actions of increased law enforcement and public education will negate this cumulative impact. In addition, any new public uses would only be allowed where sufficient buffer to endangered species habitat exists. Management actions such as invasive species control or study of algific slopes are also intended to be completed in ways that minimize disturbance. Thus, the cumulative impact of disturbance is minor.

Alternatives B and C would provide an increase in the number of acres of land protected by a conservation organization. The cumulative impact from increased acquisition is protection of other biological and physical resources in addition to the targeted endangered species. There may also be some additional land protection from other agencies during the same time period that would protect additional biological resources. The cumulative effect of alternative C is recovery of listed species.

Land will be taken out of agricultural production through Refuge acquisition that could cause small economic effects (see Section 4.7). Increased urban development and private recreational land acquisition in the next 15 years could also take land out of agricultural production for a cumulative local economic effect. The additional Refuge acquisitions will be small parcels scattered over a large area that would not contribute greatly to other land use changes.

4.9 Summary of Environmental Consequences by Alternative

The consequences of each alternative are summarized in Table 3.

Table 3: Environmental Consequences

	Alternative A: Present Course of Habitat Protection and Limited Public Use (No Action)	Alternative B: Habitat Protection Emphasis	Alternative C: Habitat Protection, Increased Management, and Integrated Wildlife-Dependent Recreation
Cultural Resources	Meet legal obligations and resources will be protected.	Same as Alt. A.	Same as Alt. A.
Listed Species	Recovery goals not met. Delisting will not occur.	Primary recovery goal of permanent protection is met with aggressive land acquisition. Delisting may not occur because minimal management to meet other recovery goals.	Multiple recovery goals met and delisting is likely to occur for the Iowa Pleistocene snail with an intermediate amount of land acquisition. Significant progress towards recovery for Northern monkshood and Leedy's roseroot.
Habitat	Lack of desirable habitat for other trust species. Potential for negative effects on algific talus slopes. 40 acres of grassland restored in 4 years. 48 acres of forest planted, other forests restored through natural succession	Lack of desirable habitat for other trust species. Potential for negative effects on algific talus slopes. 40 acres of grassland restored in 4 years. Forest restored through natural succession.	Beneficial effects for other trust species. Maintain or benefit on algific talus slopes. 40 acres of grassland restored in 4 years and 116 acres of forest planted in 8 years.
Wildlife-Dependent Recreation	No change in public support for refuge mission. No increase in public opportunities. Slight increase in public use.	Same as Alt. A.	Increased public support for Refuge mission Increased public opportunities, primarily by environmental education. Moderate increase in public use and slight increase in potential for disturbance.

Table 3: Environmental Consequences

	Alternative A: Present Course of Habitat Protection and Limited Public Use (No Action)	Alternative B: Habitat Protection Emphasis	Alternative C: Habitat Protection, Increased Management, and Integrated Wildlife-Dependent Recreation
Other rare species	No additional protection, threats may increase.	Protection of 5 sites and 200 acres will begin proactive protection of these species. No inventory and no new information on these species.	Protection of 3 sites and 75 acres will begin proactive protection of these species. Inventory of species will aid in understanding of sites and threats. Activity on algific slopes for inventory causes increased risk for disturbance mitigated by identified actions.
Economic Impact	The economic impact of current Refuge activities is minor. Refuge expenditures remain similar to 2004. Wildlife-dependent recreation related expenses are minor and remains the same. No new land acquisition.	Refuge expenditures would be similar to 2004. Wildlife-dependent recreation related expenses remains the same. Refuge land acquisition will take some land out of agricultural production but minor amount overall.	Refuge expenditures would increase slightly over 2004. Wildlife dependent recreation related expenses may increase slightly. Refuge land acquisition will take some land out of agricultural production but minor amount overall.
Administrative Support	No change.	No change.	Increased.
Prescribed Fire	Improved wildlife habitat. Benefit of increased recreational opportunity from quality wildlife habitat. Smoke could be a temporary hazard. No impacts to listed species.	Same as Alt. A	Same as Alt. A.

Table 3: Environmental Consequences

	Alternative A: Present Course of Habitat Protection and Limited Public Use (No Action)	Alternative B: Habitat Protection Emphasis	Alternative C: Habitat Protection, Increased Management, and Integrated Wildlife-Dependent Recreation
Cumulative effects	Recovery goals would take much longer to occur, if at all. Likely increase in invasive species.	Only a portion of recovery goals met Likely increase in invasive species.	Multiple recovery goals met. Delisting of Iowa Pleistocene snail. Reduction in invasive species.
	Undesirable wildlife habitat with little restoration.	Same as Alt. A.	Increase in desirable wildlife habitat
	Least overall protection of habitat, water quality, soils, aesthetics.	Most overall protection of habitat, water quality, soils, aesthetics through acquisition.	Medium overall protection of habitat, water quality, soils, aesthetics through acquisition. Additional protection of these features through other means than acquisition.
		Most land acquisition. Increased urban development and private recreational land combined with Refuge acquisition will increase land taken out of agriculture. Refuge lands are small tracts over large area.	Medium land acquisition. Increased urban development and private recreational land combined with Refuge acquisition will increase land taken out of agriculture. Refuge lands are small tracts over large area.