

## Chapter 4



*Bergamot*  
USFWS photo

# Environmental Impacts

- Introduction
- Alternative A. Current Management
- Alternative B. Service-preferred Alternative
- Alternative C. Shrub and Forest Emphasis
- Cumulative Impacts
- Short-Term and Long-Term Productivity
- Unavoidable Impacts
- Potential Irretrievable and Irreversible Impacts
- Summary of Environmental Consequences by Alternative

## Introduction

This chapter describes the foreseeable environmental consequences of implementing the management alternatives A, B, and C in chapter 3. It also identifies any irreversible or irretrievable commitments of resources and the relationships between short-term uses and long-term productivity. When detailed information is available, we compare scientific analyses of the expected consequences, which we describe as “impacts” or “effects.” When detailed information is lacking, we base those comparisons on our professional judgment and experience.

This chapter is organized by alternative, then by major resources, to evaluate in greater detail the effects of the goals and issues identified in chapter 1. We describe the direct, indirect, short-term, beneficial or adverse effects likely to occur during the 15-year life span of this plan. Beyond that 15-year planning horizon, its descriptions must be more speculative. At the end of this chapter, table 4–1 presents a side-by-side comparison of the effects of each alternative.

When we do not have reliable, quantitative information, we use the terms “positive,” “negative,” or “neutral” as qualitative measures. A positive impact would enhance or benefit the resources under consideration and help accomplish refuge management goals and objectives over the short term (<15 years) or long term (>15 years). A negative impact implies an action that we predict would be detrimental to a resource over the short or long term, and possibly affect our ability to achieve refuge purposes, goals and objectives. A neutral impact means either (a) no discernible effect either positive or negative, or (b) positive and negative effects would cancel each other out.

Our geographic context for describing effects primarily focuses on refuge land, its resources, and the surrounding focus area. A larger context is presented for the effects on the socioeconomic environment (e.g., Ulster County and Town of Shawangunk), and air and water quality (e.g. Wallkill River Valley), because those resources cannot be defined in an area the size of this refuge.

Certain types of actions in chapter 3 do not require additional NEPA analysis, because they do not individually or cumulatively have a significant effect on the human environment. Those actions are “categorically excluded” from further NEPA analysis or review, and this chapter does not describe them further. They include but are not limited to the following:

- Conducting environmental education and interpretation programs, unless major construction is involved;
- Conducting research, inventories, or collecting other information on resources;
- Operating or maintaining existing infrastructure and facilities, unless major renovation is involved;
- Improving routine, recurring management activities;
- Developing access for the purposes of routine management or other small construction projects: e.g., fences, berms, small water control structures or interpretative kiosks;

- Planting vegetation;
- Reintroducing native plants or animals;
- Making minor changes in the amount or types of public use;
- Issuing new or revised management plans, when only minor changes are planned; and,
- Enforcing laws and refuge regulations.

## **Alternative A. Current Management**

### **Effects on the Socioeconomic Environment**

Public officials have expressed their concern about the amount of land in Ulster County now in a form of ownership, such as federal ownership, that precludes the collection of property taxes. That land represents 29 percent of the land in the county, and includes the refuge (federal ownership); the state prison, the Catskill Park and Lake Minnewaska State Park (state ownership); and religious or other not-for-profit entities (New York State Office of Property Services 2002).

To offset the removal of refuge land from tax rolls, the Refuge Revenue Sharing Program distributes to local taxing authorities an amount set each year by Congress, up to a maximum of three-quarters of 1 percent of the land's appraised value. In fiscal years 2002, 2003, and 2004 we distributed \$2,644, \$2,470, and \$2,374 in revenue sharing payments to the Town of Shawangunk.

Refuge land provides other socioeconomic benefits, such as the increasingly important ecotourism industry. Nearby Shawangunk Ridge attracts rock climbers from all over the world. The Delaware River Water Gap, about 1 hour away, also attracts many outdoor enthusiasts. The refuge, another natural attraction, complements those. A study by the Service found that resident and non-resident bird-watchers respectively spend about \$35 and \$134 per person, per day when engaged in wildlife viewing (USFWS 2003). Our study also reports that, of the total birders in the State of New York, 88 percent are state residents and 12 percent are non-residents. We have recorded visitors at the refuge who came from New York, Connecticut, New Jersey, and Pennsylvania to enjoy viewing wintering raptors and grassland birds. Applying the estimates from the study, the refuge total annual visitation of 5,500 contributes about \$257,840 annually to the state or local economies.

The refuge also provides aesthetic benefits by helping to preserve the quality of life and the rural, natural character of communities that are experiencing increases in residential development. It provides local residents with public access for recreational activities such as observing or photographing wildlife and hiking. Alternative A would not change those opportunities for public use, and current refuge regulations would remain in effect. They help maintain the quality of life important not only for local residents but also for refuge visitors. In summary, implementing alternative A would not change the local socioeconomic environment.

### Effects on Air Quality

We do not anticipate any major impacts on the current air quality in the Wallkill River Valley landscape from alternative A. It does not propose the use of prescribed fire or herbicides in any habitat restoration or management projects. It would continue to protect refuge land from residential, commercial, or industrial development, and prevent the additional degradation of air quality from increased vehicle emissions or industrial air pollutants associated with that development. Although the emissions of the vehicles visitors drive to the refuge contribute additional pollutants, such as ozone, that contribution is negligible compared to those of the urban and industrial centers within 100 miles of the refuge. Protecting natural vegetation and wetland as pollution filters would partially offset those vehicle emissions (Porter pers com, 1999).

The Brigantine Wilderness Area in New Jersey and the Lye Brook Wilderness Area in Vermont are the Class I air quality areas closest to the refuge, at approximately 100 miles and 150 miles distance, respectively. However, we do not expect any of our current activities to affect the air quality in those areas because of their distance and the prevailing winds, and because our activities contribute minimal pollutants. In summary, because refuge management activities would result in only a negligible adverse effect on air quality, and would not affect Class 1 air quality areas, we predict no violations of the State or Federal Clean Air Act from implementing alternative A.

### Effects on Water Quality

Likewise, we do not expect any impacts on the current water quality in the Wallkill River Valley landscape resulting from refuge management. Alternative A does not propose the application of herbicides in any habitat restoration or management project, nor does it propose the removal or installation of infrastructure, or the creation of non-permeable surfaces, which may contribute sediment in tributaries to the river. No projects are proposed that would alter the current hydrology of the refuge. It will protect refuge land from residential, commercial, or industrial development, and prevent the degradation of water quality associated with them, namely non-point and point-source pollution. The natural vegetation and wetland maintained on the refuge filter water pollutants, although we have not done a study to quantify that benefit. We predict no violations of the State or Federal Clean Water Act as a result of implementing alternative A.

### Effects on Soils

We do not anticipate any significant adverse impacts on refuge soils from current refuge management activities. We primarily mow 300 acres of grassland habitat each year to maintain conditions that, based on our observations, have resulted in only negligible soil compaction, erosion, or disturbance. During the last 5 years, we have not detected any loss in soil productivity. This alternative does not propose revegetation or the use of herbicides; thus, additional mechanical or chemical impacts to soils would not occur. Also, this alternative does not include any major construction or demolition projects, such as runway removal, which would require us to disturb significant areas of earth or import soil.

## Effects on Vegetation



Grasslands management on the refuge  
USFWS photo

Of the total 400 acres in grassland, alternative A proposes we continue mowing up to 300 acres annually to enhance habitats for grassland-dependent migratory birds and wintering birds of prey. Approximately 200 of the 300 acres are technically classified as wet meadow or emergent wetland. Mowing suppresses the colonization of grassland by woody plants. It will maintain the existing grass-dominated plant community over the long term. We would not manage the

existing 136 acres of northern hardwood woodland, so that forested habitat would continue to mature over the long term. In addition, the 30 acres of asphalt runway would remain unvegetated, except in areas where the asphalt has broken up and patches of vegetation have established themselves.

One of the primary plants currently dominating refuge wet meadows is purple loosestrife, an invasive, non-native plant. This species out-competes most native vegetation and will often replace native vegetation entirely on a site. The mowing we do also serves to control the spread of this plant, which occurs on over 300 acres of the refuge. In conjunction with researchers at Cornell University, we have also released *Hylobius* weevils as a biological control agent for purple loosestrife. The results are promising and

we would continue to monitor their establishment and affect on the plants.

Alternative A would not include additional weevil releases; however, purple loosestrife is expected to decrease in refuge wetland as the existing *Hylobius* population increases and becomes established.

## Effects on Endangered and Threatened Species

No Federal-listed endangered or threatened species are known to use the refuge. However, we learned in August 2005 that a hibernaculum of approximately 30,000 Indiana bats (*Myotis sodalis*), a Federal endangered species, is in Ulster County 18 miles to the northeast of the refuge. Also, roost trees are known approximately 9 miles north and south of the refuge. Bats from this and other hibernacula in New York are known to travel to roosts up to 40 miles, and possibly further. More on their habitat preferences is described in Chapter 2 “Affected Environment”. Given this new information, we will make a concerted effort to look for them in our forested habitat where they may roost, or in openings where they may forage. However, we are not proposing projects under this alternative that would modify the amount or distribution of these habitat types.

Several State-listed species use the refuge, in particular, grassland-dependent birds. Table 4-1 provides a list of those species and their status.

Table 4– 1. State-listed grassland-dependent birds

Species	State listing
short-eared owl	endangered
northern harrier	threatened
upland sandpiper	threatened
Henslow's sparrow	threatened
horned lark	species of concern
grasshopper sparrow	species of concern
vesper sparrow	species of concern

By annually mowing 300 acres, we would continue to prevent the establishment of shrubs and pioneer trees, and maintain habitat for grassland-dependent birds over the long term. However, we do not predict the abundance or diversity of grassland birds would increase substantially in the short or long term because this alternative neither increases the acreage nor improves the quality of existing grassland habitat.

Mowing also would continue to influence the abundance of rare wetland plants at the refuge. Of particular interest is Frank's sedge, which is listed as endangered by the NYSDEC and S1 by the New York Natural Heritage Program (NYNHP). This plant occurs in wet meadow habitats now managed for grassland birds and wintering raptors. Mowing may cause short-term negative impacts on Frank's sedge, but only if it occurs during the plant's most rapid growth period, which would not be our planned prescription. Over the long term, mowing would directly benefit these plants by preventing the natural succession of woody vegetation, which otherwise out-compete the sedge plants, and could reduce their population to extirpation.

Table 4-2 lists non-grassland-dependent species which also use the refuge and are State-listed. The actions in alternative A would have neutral impacts on these species over both the short and long terms, as no significant changes in habitat for these species would occur.

Table 4– 2. State-listed non-grassland-dependent birds

Species	State listing
loggerhead shrike	endangered
peregrine falcon	threatened
wood turtle	species of special concern
spotted turtle	species of special concern
sharp-shinned hawk	species of special concern
Cooper's hawk	species of special concern
northern goshawk	species of special concern
red-shouldered hawk	species of special concern
common nighthawk	species of special concern

## Effects on Birds

**Grassland-dependent birds.** As described above, mowing is designed to suppress the succession of woody plants and preserve grassland bird habitat over the long term. Mowing activities occur outside the bird nesting and fledging season, so there is no direct impact to nesting or fledging success of grassland or other birds from our activities. We typically mow the fields between July 15 and October 31. Alternative A would not increase substantially the abundance of grassland birds above their current levels because the acreage and habitat quality of grassland would not appreciably change.

**Shrubland-dependent birds.** Many shrubland-dependent birds use the refuge, including willow flycatcher, house wren, gray catbird, brown thrasher, blue-winged warbler, yellow warbler, and prairie warbler, which are all species of conservation priority on Partners In Flight (PIF) and North American Bird Conservation Initiative (NABCI) lists. Common yellowthroat, field sparrow, song sparrow, and northern cardinal also use the refuge. After the Department of the Army declared Galeville Airport excess to its needs, grassland areas were not mowed as frequently. They were invaded by gray dogwood and used by shrubland-dependent birds. Over the last 5 years, we have intensified mowing to suppress woody plants and restore grassland habitat. Those shrubland birds now primarily use the narrow edge between refuge grassland and early successional forest. That habitat would remain over the short term, but over the long term will change into a northern hardwood forest. As a result, alternative A would yield neutral impacts on the current status of shrubland birds over the short term, but would result in a gradual loss of this habitat over the long term.

**Forest birds.** Forest birds that use the refuge include red-bellied woodpecker, eastern wood-pewee, red-eyed vireo, black-capped chickadee, white-breasted nuthatch, black-and-white warbler, American redstart, and Baltimore oriole. Black-billed cuckoo, red-headed woodpecker, yellow-bellied sapsucker, wood thrush, and Canada warbler are PIF and NABCI priority species that also use refuge woodland. Alternative A would maintain the refuge's 136 acres of northern hardwood woodland for forest-dependent birds. Although that habitat type would continue to age over the long term, its quality as habitat for forest birds would not change appreciably due to the limitations of its size and area. Woodpeckers and other cavity nesters may be the only exceptions. They would benefit from the greater number of snags for foraging and nesting offered by older stands of forest.

**Other resident birds.** Alternative A would maintain the current ratio of forest woodland and grassland habitats used by other migratory and resident game birds, with no appreciable changes in habitat quality or quantity for either type. As a result, we predict negligible changes over the short or long term in the number or diversity of birds using the refuge. Because the alternative does not propose a hunting program, no loss of resident game species such as American woodcock and turkey would be attributable to hunting.

**Effects on Fisheries**

The refuge has only two water bodies with fish, including a 1/10-acre pond and a small, artificially channeled stream. No investigations have been conducted on fish diversity or abundance. However, we do know the pond supports large-mouth bass and sunfish which we suspect were stocked by local anglers and are not a natural, self-sustaining population. Alternative A does not propose any management activities that would impact these fish populations. The refuge is currently closed to fishing.

**Effects on Mammals**

Alternative A would have neutral impacts on most mammals that use the refuge. Species that use open habitats, including red fox, woodchuck, and meadow vole, would benefit from the continued annual mowing of 300 acres of refuge grassland. Mowing may temporarily displace or kill some individual animals, but the long-term improvement in habitat quality from activities already described would benefit those species. We predict no impact on population viability.

Maintaining the 136 acres of refuge woodland would sustain the current populations of forest-dwelling species, such as eastern gray squirrel and gray fox. Generalist species, such as striped skunk and white-tailed deer, will use both this habitat as well as the open habitats. Since Alternative A does not propose to enhance habitats for those species, we would predict no appreciable change in their populations.

Alternative A would not include a hunt program; consequently, we predict the white-tailed deer population would increase on the refuge over the short term and eventually reach a level of overabundance. That overabundance would cause over-browsing, which has direct, negative impacts on plant communities and wildlife habitat. Overabundance also increases concerns about the risk of visitor exposure to Lyme disease, depredation on neighboring agricultural land, and the frequency of deer-automobile collisions.

**Effects on Amphibians and Reptiles**

We have not conducted systematic surveys on the refuge for reptiles and amphibians. However, wood turtle and spotted turtle are State-listed special concern species that have been documented on the refuge. We predict alternative A would yield neutral impacts on refuge reptiles and amphibians. It would maintain vegetative cover types at their present size and distribution, and proposes no management actions that would impact or displace individuals. It also proposes no wetland or stream restoration projects that would improve habitat quality. Essentially, it would maintain the status quo for those species.

**Effects on Invertebrates**

We have not conducted systematic surveys for invertebrates on the refuge. Annual maintenance of 300 acres of grassland would likely provide abundant habitat for butterflies and other open field insects. Alternative A generally would yield neutral impacts on the current invertebrate community, because it would maintain the existing ratio of refuge vegetation cover types.



**Effects on Public Use and Access**

Alternative A would maintain the current level of programs and types of public use opportunities on the refuge from 1 hour before official sunrise to 1 hour after official sunset, seven days a week. It would not expand permitted uses, programs, or facilities. We would continue to allow public access on the former runways and taxiways for wildlife observation, photography, and interpretation, as well as snowshoeing, cross-country skiing and hiking. Refuge staff would continue to maintain a small parking area with capacity for about 5 cars and an information kiosk.

We estimate that approximately 5,500 visitors use the refuge each year, with a small increase resulting from increased residential development in the area. Alternative A would continue to enforce current restrictions on using motorized vehicles, bringing horses, pets, or bikes, trespassing into closed areas, and collecting plants and animals on the refuge.

**Effects on Cultural and Historic Resources**

We have never thoroughly surveyed the refuge for cultural resources, but our contact at the New York State Historic Preservation Office (SHPO) reports that no recorded sites are known, and the likelihood of sites with any integrity still existing is very low, due to the massive earth-moving and importing of soil that occurred in creating the runways. Service policy requires us to survey for cultural and historic resources before disturbing any ground. No activities of that magnitude would occur under alternative A. Mowing is not considered a ground-disturbing activity, according to our Regional Archeologists. However, should we identify sites eligible for the National Register, we will coordinate their protection with our Regional Archeologists and the New York SHPO. We have submitted this document for their review of its compliance with the National Historic Preservation Act, Section 106, and the Archeological Resources Protection Act.



*Wood Turtle*  
USFWS photo

**Alternative B.  
Our Preferred  
Alternative**

**Effects on the  
Socioeconomic  
Environment**

In alternative B, the concerns of county and local officials that too much land is in non-taxed ownerships would be the same as alternative A, as the present refuge land base would remain the same. The benefits of refuge revenue sharing would be similar to those in alternative A.

One notable difference is that this alternative would increase high-quality opportunities for wildlife-dependent public use, thereby increasing the value of the community as a destination for ecotourism. By enhancing visitor services on the refuge, we predict a 50 percent increase from the present 5,500 visitors per year to 8,250 per year. Based on estimates that both state resident and non-resident visitors engaging in bird-watching respectively spend about \$35 and \$134 per person per day, and the New York state visitor ratio of 88 percent state residents and 12 percent non-residents reported by the Service (USFWS, 2003), that increase could contribute approximately \$386,760 annually to the state or local economy each year.

In addition, alternative B proposes deer hunting. We predict the refuge would support 645 visits by deer hunters each year. We base that estimate on 43 hunting days per year and our very conservative estimate of 15 hunters per day. Based on the Service's 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation report for the state of New York, we estimate that hunters could contribute \$1,152 per visit in trip- and equipment-related expenditures in the local communities. The proposed hunt program could contribute an additional \$743,040 annually to the state or local economy each year.

However, we suspect those annual predictions overestimate the total contributions to state or local economies. Our assumption that refuge hunters would come primarily from the local area decreases those expectations. Also, some hunters would visit the refuge more than once, which would also tend to lower the expected contribution per hunter.

Cooperative haying and grazing are two public uses that will be allowed under special use permits (see appendix B). These uses are considered cost-effective methods for suppressing woody plant succession, which is our objective in improving habitat for grassland birds. Given limited staffing, equipment and maintenance funds, working cooperatively with local farmers to accomplish this work would achieve our habitat objectives while helping the local farming community sustain their agricultural businesses and way of life. It would also provide us an outreach opportunity to share grassland management techniques to benefit wildlife.

**Effects on Air Quality**

Alternative B would provide most of the same positive impacts on air quality as those described in alternative A, by preventing the residential, commercial, or industrial development of refuge land and maintaining native vegetation, which filters air pollution. On the other hand, this alternative includes actions we predict would have minor, short-term, negative impacts on air quality. Those include the use of prescribed fire and herbicides as grassland habitat management tools, both of which could emit toxins, and the use of heavy equipment for

runway removal and mowing. Planned refuge activities would also attract more visitors in vehicles that emit pollutants. While we are concerned with our activities contributing any measure of air pollution, we would insure that no activity, or combination of activities, would significantly contribute to a failure to comply with federal Clean Air Act standards.

The U.S. Congress amended the federal Clean Air Act in 1990 (CAA) to address a large number of air pollutants that are known to cause or may reasonably be anticipated to cause adverse effects to human health or adverse environmental effects. One hundred and eighty-eight specific pollutants and chemical groups were initially identified as hazardous air pollutants (HAPs), and the list has been modified over time. The cornerstone of the CAA is the effort to attain and maintain National Ambient Air Quality Standards (NAAQS). The CAA requires the Environmental Protection Agency (EPA) to set air quality standards for common and widespread pollutants after preparing “criteria documents” summarizing scientific knowledge on their health effects. Currently, six “criteria” pollutants are regulated: carbon monoxide, nitrogen dioxide, particulate matter, ozone, sulfur dioxide, and lead. Under CAA, the EPA and state agencies are responsible for collecting data on these six pollutants to measure compliance with NAAQS.

In a 2003 summary report of criteria air pollutants in Ulster County, New York, the only national ambient air quality standard not met that year was 3 instances when the 8-hour average ozone was exceeded (<http://www.scorecard.org/env-releases/cap/county>). Ulster County was ranked 17<sup>th</sup> worst, out of 25 counties in New York in 2003, for the level of non-attainment.

We would use management-ignited prescribed fire in alternative B as a technique to (1) manage habitat for grassland-dependent birds; (2) reduce hazardous fuels; and (3) control invasive, non-indigenous plants, in combination with other techniques, including mechanical, biological, and herbicidal treatments. We have included our proposed Fire Management Plan in appendix F.

We seek approval to use prescribed fire on up to a maximum of 400 acres per year. However, the wet soils of the refuge inhibit our extensive use of fire, and the cool-season grasses that dominate refuge fields have only a short time period during which fire can be applied to invigorate their growth. A more realistic use of prescribed fire would burn up to 75 acres of grassland annually to achieve our objectives above. Most likely, we would burn on one or two days per year, usually in the spring or fall, outside the bird nesting season. Section 118 of the CCA specifies that refuge fire management activities that result in the discharge of pollutants (smoke, carbon monoxide, particulate matter, and other pollutants) must comply with all applicable Federal, State, and local air pollution control requirements. New York has developed State Implementation Plans (SIPs) to mitigate the effects of those pollutants. NYSDEC reviews prescribed fire plans to ensure that their measures to mitigate air quality concerns are adequate, and requires a NYSDEC permit for all burns. Projects must be submitted to the local Forest Ranger Regional Office for compliance review. We would adhere to each of those requirements.

Managing smoke to avoid safety risks is also a critical component in planning a prescribed fire. To safeguard refuge visitors and neighbors, our prescribed fire plan addresses smoke emissions, plume direction, and identifying and protecting sensitive areas. We would pay close attention to wind conditions when burning near roads and highways to prevent driving hazards, and would not hesitate to postpone a burn in questionable wind conditions.

We would use herbicides to control invasive plants and enhance our ability to maintain high-quality grassland habitats. We would treat up to a maximum of 100 acres annually with herbicides such as glyphosate and 2, 4-D, although an average closer to 25 acres per year would be more likely, given the expense and labor required. Aerial spraying would not be permitted.

Oregon State University compiles study results from a consortium of university cooperative extension offices on the potential impacts associated with herbicides on its website (<http://extoxnet.orst.edu/pips>). Glyphosate is described as a broad spectrum, nonselective systemic herbicide for the control of annual and perennial plants. It usually is dispersed in salt form, and is practically nontoxic by ingestion, by skin exposure, or inhalation. It is poorly absorbed by humans and other animals. When it is ingested, research indicates it is largely excreted unchanged by large mammals. It has no significant potential to accumulate in animal tissue. Soil microbes primarily are responsible for breaking it down, and losses through volatilization or photodegradation are negligible (<http://extoxnet.orst.edu/pips/glyphosa.htm>). We predict no impacts on air quality, given the method of application, the levels of concentration, the size of the area, and the safety precautions we would use.

Many commercial products use 2, 4-D, which is regulated in the United States as a “general use pesticide.” A chlorinated phenoxy compound, in its salt form it is commonly used to control many types of broadleaf weeds. At very high concentrations, humans can absorb it through the skin and lungs, and prolonged breathing causes coughing, burning, dizziness, and temporary loss of muscle coordination. However, the concentrations and levels of exposure causing those symptoms far exceed those we would use. There is no evidence that 2, 4-D accumulates in significant levels in mammals or other organisms; research indicates it is nearly all excreted unchanged in urine when a human is exposed to high levels. It has a half-life between 10 and 20 hours in living organisms. Given the method of application, the size of the area, the levels of concentration, and the safety precautions we would use, we predict no impacts on air quality.

Our Regional Contaminants Coordinator, who ensures compliance with all Federal requirements, would approve all herbicides and their applications annually. We describe their ecological effects further in the sections below on water, soils, and vegetation.

Another proposed project with the potential to contribute air pollutants is the runway restoration project and our annual mowing of grasslands. These projects would require the use of non-road diesel equipment, such as farm tractors, crawler tractors, and backhoes. The non-road diesel industry had not



Heavy equipment used in annual mowing operations.  
USFWS photo

been regulated by the federal government until the EPA published their May 2004 Clean Air Non-Road Diesel Final Rule. This new rule established stringent pollution controls on all new diesel engines used in construction and agriculture (<http://www.epa.gov/nonroad-diesel/2004fr.htm>). One primary strategy is to markedly reduce the sulfur content of diesel fuel so it is cleaner burning.

A primary concern with non-road diesel engines is their contribution to ground-level ozone (especially oxides of nitrogen, or NO<sub>x</sub>) and particulate matter. High concentrations of ozone cause a range of health problems related to breathing, including chest pain, coughing, and shortness of breath. Particulate matter can become deposited deep in the lungs and results in premature death, increased emergency room visits,

and increased respiratory symptoms and disease. In addition, ozone, NO<sub>x</sub>, and particulate matter adversely affect the environment in various ways including crop damage, acid rain, and reduction in visibility (<http://www.epa.gov/indicators/roe/pdf/tdAIR1-1.pdf>).

Unfortunately, there are no measures with which to accurately calculate what our proposed project, and its use of diesel engine construction vehicles, would contribute to these criteria air pollutants. A study conducted by the EPA in 1991 was designed to quantify the contribution of non-road diesel engine air pollution from various sources to the overall air pollution levels in several EPA air quality non-attainment areas (<http://www.epa.gov/nonroad/nrstudy.pdf>), but a correlation with our project is difficult. The closest non-attainment area to the refuge was New York City. Overall, non-road diesel levels contributed were less than 50% of those contributed by street motor vehicles for the measured pollutants over the same time period. Most of this contribution occurred during the summer construction activity. One interesting assessment from the study was the comparison that 1 hour of crawler tractor use equaled 900 car miles in terms of the contribution of NO<sub>x</sub>. We estimate 12,000 hours of equipment use on this project. To minimize the extent and duration of resource impacts, the activity would occur in fall or winter when pollution levels are lower, and we would limit its duration to within one year. We do not predict this contribution would directly or indirectly cause the NAAQS to be exceeded.

Predicting quantifiable, direct or indirect impacts on air quality from increased visitor vehicle emissions is also problematic. Generally, motor vehicles are a large contributor to unhealthy levels of carbon monoxide, ozone, nitrogen oxides, and particulate matter. The 50-percent increase over current visitation we predict with implementing alternative B (8,250 visitors annually) would certainly release additional pollutants into the air. However, we do not predict that those would be significant enough to exceed air quality standards.

We do not predict impacts on the two Class 1 airsheds mentioned in alternative A, Brigantine and Lye Brook Wilderness Areas, due to their distance and the prevailing winds. Considering all of the activities proposed above, their potential impacts, and the limits and conditions within which we would manage them, we do not predict any violations of State or Federal Clean Air Acts.

### Effects on Water Quality

Alternative B would yield more long-term, positive impacts on water quality than those described in alternative A by building on them. It would also improve hydrological conditions by restoring asphalt runway to grassland, eliminating 30 acres of impermeable asphalt and concrete surfaces, and creating permeable soil conditions as close as possible to natural, historic conditions. A separate project in alternative B would restore, to the maximum extent practicable without negatively impacting grassland management, the natural hydrology of streams and wetland that have been channeled or drained on the refuge. For example, we would consider removing the drainage tile system to allow the main stream on the refuge, a tributary of the Wallkill River, to follow its natural drainage path. We do not predict any impacts, such as increased flooding, on adjacent private land. Finally, alternative B would indirectly result in improving watershed conditions by involving the staff in community efforts to reduce pollution and other threats to water quality.

The grassland management practices alternative B proposes include disking and grazing. Those may have minor, direct, short-term negative impacts on water quality. However, we predict their impacts would be low, because they would not occur on saturated soils or along streams where sediment or livestock excrement could be deposited directly into wet areas. Also, the risk from runoff is low, because the topography on the refuge is very flat. We would also fence stream and pond borders to prevent livestock from eroding their banks.

As described in the discussion on air quality, we would also treat up to a maximum of 100 acres with glyphosates or 2, 4-D annually. Aerial spraying would not be permitted. The risk of water contamination is very low to non-existent. Glyphosate will strongly adsorb to most soils, does not leach appreciably, and has low potential for run-off (<http://extoxnet.orst.edu/pips/glyphosa.htm>). If it contacts water, it adsorbs to suspended organic and mineral matters and is broken down primarily by microorganisms. Its half-life in pond water ranges from 12 days to 10 weeks. The compound is practically non-toxic to fish, and has a very low potential to build up in the tissues of aquatic invertebrates or other aquatic organisms (<http://extoxnet.orst.edu/pips/glyphosa.htm>).

Applied on soils, 2, 4-D has a half-life of less than 7 days, and the action of soil microbes readily breaks it down. Should run-off to aquatic systems happen, microorganisms readily degrade the compound. The rates of its breakdown in aquatic systems increase with increased nutrients, sediment load, and dissolved organic compounds in the water, but in oxygenated conditions, its half-life is 1 week to several weeks (<http://extonet.orst.edu/pips/24-D.htm>). At the concentrations we would use, we predict no adverse effects on water quality, fish, or other aquatic organisms.

Our Regional Contaminants Coordinator, who ensures compliance with all Federal requirements, would approve all herbicides and their applications annually. Considering all of the activities proposed above, and the limits and conditions within which we would operate, we do not predict any violations of State or Federal Clean Water Acts.

## Effects on Soils

Compared to alternative A, alternative B would allow us to use of a wider array of grassland management tools that affect soils, including mowing, grazing, prescribed fire, discing and other mechanical site preparation for revegetation and herbicides. As described in alternative A, mowing would continue to be the primary tool; we would use the others as needed to supplement mowing or in areas inaccessible to the mower. Although we would not use them all in any given year, their use would be more likely to result in direct effects on soils than mowing alone. On the other hand, we predict those would be short-term effects, and would not result in any long-term loss of soil productivity. Soil erosion and run-off would be minimal, because the refuge topography is flat, and we would not use those tools near streams and wetlands or during wet periods. Livestock grazing would occur at seasons and stocking levels to minimize overgrazing and avoid the loss of vegetation that could result in soil erosion and compaction. We would use management-ignited, prescribed fire under the conditions described in the Fire Management Plan (appendix F); that is, conditions that avoid a burn so hot that it would jeopardize the long-term productivity of soils.

As in the sections on air and water quality, above, we would treat up to a maximum 100 acres annually with herbicides, either glyphosates or 2, 4-D. Glyphosate is moderately persistent in soil, with an estimated average half-life of 47 days. It strongly adsorbs in soil, so it does not leach appreciably, and has low potential for runoff. The 2, 4-D also has low soil persistence: a half-life in soil of less than 7 days. Soil microbes primarily are responsible for its breakdown. At the concentrations we would apply, the potential is minimal that either compound would contaminate the soil. Our Regional Contaminants Coordinator, who ensures compliance with all Federal requirements, would approve all herbicides and their applications annually.

Alternative B also proposes removing about 30 acres of concrete and asphalt runway and restoring them to grassland. That major undertaking would have profound, direct, primarily beneficial effects on refuge soils over the short and long terms. The removal would include breaking up and exporting about 23,000 cubic yards of concrete and asphalt, and replacing them with soil imported from as close a local source as possible, and certified free of contaminants and noxious weeds. That soil would be mechanically distributed and landscaped across the 30 acres. The use of heavy equipment to tear up the pavement and replace soil likely would cause some localized compaction and rutting. However, we would subsequently plow, disc, and revegetate those areas, with the objective of restoring pre-runway soil characteristics and natural vegetation to establish a primarily grass-dominated plant community. We predict the long-term, net result of that project would substantially improve soil productivity.

Alternative B would not result in major changes in the 136 acres of northern hardwood, which would continue to mature without any management intervention. Species composition would stay essentially the same over the next 50 years. We would also continue to manage the 400 acres in grassland to benefit grassland-dependent migratory birds and wintering birds of prey, and would also restore another 30 acres to grassland habitat by converting asphalt and concrete runway.

### Effects on Vegetation

Compared to alternative A, alternative B proposes a wider array of vegetation management tools: not only mowing, but also haying, discing and other mechanical site preparation, grazing, burning prescribed fires, and applying herbicides and biological control agents. Scattered pioneer trees, namely, white ash and eastern red cedar, would be reduced to 1 tree every 10 acres, to promote grassland habitats by minimizing competition for space and light while also providing winter raptor perches. The use of a variety of tools is designed to promote grassland with greater diversity in structure and species composition and more effectively minimize encroachment by woody plants over the long term. It would also allow us to operate under adaptive management strategies, thereby providing flexibility in meeting our vegetation objectives under varying conditions from year to year.

Controlling invasive plants would be a high priority in alternative B. We would develop a treatment protocol that could include any of the management tools noted above for all known invasive plants growing on the refuge. That would allow us to experiment with treatment types and design so that, eventually, we could determine the most effective control for each invasive species. In particular, we would expand use of the biological control agents described in

alternative A to include *Galerucella* beetles to control purple loosestrife. Many of our refuges are cooperating in research led by Cornell University on that beetle and other biological control agents in the Northeast. We have had first-hand experience in using the *Galerucella* beetle effectively to control purple loosestrife on the Wallkill River Refuge in Sussex County, New Jersey, and Orange County, New York. The adverse impacts of beetles foraging on non-target plants are virtually undetectable. As the beetles suppress purple loosestrife, native wetland plants immediately reoccupy their wetland niches. We expect the treatments to diminish the abundance and diversity of purple loosestrife on the refuge by about 90 percent over the long term. By controlling invasive plants, alternative B would produce dramatic long-term benefits to native plant biodiversity on the refuge.



*Purple loosestrife, an invasive plant, is dominant in the refuge's wet meadows.*

USFWS photo



**Effects on Endangered and Threatened Species**

No Federal-listed endangered or threatened species are known to use the refuge. However, as we mentioned under alternative A, we recently learned of an Indiana bat hibernaculum 18 miles to the northeast of the refuge, and roost trees 9 miles north and south of the refuge. It is possible that Indiana bats may be using the refuge's forested habitat for roosting, and open areas for foraging. We do not propose any projects under alternative B that would modify the amount or distribution of these habitat types, except for restoring the 30 acres of runway to grasslands, and thus do not predict any adverse effects. However, we have initiated an informal Endangered Species Act, Section 7 consultation process with our New York Field Office to insure nothing we are proposing would cause harm to Indiana bats.

Alternative A describes the State-listed species on the refuge, which include one plant, two turtles, and numerous birds. The impacts of alternative B on the two State-listed turtles and non-grassland-dependent birds would resemble those of alternative A; that is, we predict neutral impacts on those species because we do not foresee dramatic changes in their habitat patch size, distribution, or quality.

The State-listed Frank's sedge grows in wet meadow habitats managed for grassland birds and wintering raptors. Each of our grassland management tools has the potential to cause short-term detrimental impacts on that plant, setting back at least that year's annual growth if applied during its most active growing period. Consecutive annual impacts during the growing season may eliminate individual plants entirely. We intend to avoid using those treatments during the most active growing period in areas where we know the plant grows. We also predict the potential for invigorating its growth by grassland management activities designed to reduce woody vegetation that could out-compete the sedge or dramatically reduce favorable growing conditions during critical periods. In alternative B, we would attempt to time our actions to sustain or increase the existing population of Frank's sedge, to the extent it does not jeopardize our ability to manage most of the grassland on the refuge. We predict our management would yield long-term benefits for Frank's sedge by reducing woody plants and protecting, mapping and monitoring the refuge population to avoid its extirpation by management activities.

We predict that the State-listed grassland-dependent birds identified in alternative A would directly benefit to a greater degree over the short and long terms from our implementing alternative B. Compared to alternative A, restoring the runways and taxiways would result in an additional 30 acres of high-quality grassland habitat, and would greatly enhance the existing 400 acres of grassland for birds dependent on that habitat type.

Alternative B would also allow us to use an array of tools to manage existing grasslands to maximize opportunities to improve habitat quality for grassland-dependent birds. None of those tools would be implemented during the nesting or fledging season for the birds, so we predict no direct loss of birds. We would

strive to alter the current monotypic grassland (e.g., the same species and structure) and create a diverse complex of grassland to meet the respective nesting requirements of each grassland bird species. The overarching goal in our management is to improve the quality, quantity and diversity of grassland habitats on the refuge over the long term, to support the greater diversity and abundance of nesting and wintering grassland birds. We predict the abundance of nesting pairs on the refuge could increase by up to 20 percent for certain species, such as bobolink and savannah sparrow. Our objective is to also increase nesting habitat for the short-eared owl, sedge wren, northern harrier and vesper sparrow.

In addition to the projects noted above, we would be restoring 30 acres of runway and taxiway to grassland. This project would be designed to remove the concrete and asphalt in late fall or winter so that no, or minimal, disturbance would occur to any of our focus species. For example, we would avoid working during breeding and nesting season for birds, or the flowering season for rare plants, and we would confine the disturbance area to the footprint of the runways and taxiways. Birds present would be disturbed, but would react by dispersing to quieter areas. We do not predict any bird mortality. We would also map out the rare plants sites and not allow any construction impact in those sites. Over the long term, however, there would be 30-acre increase in potential habitat for both the birds and rare plants.

#### Effects on Birds

**Grassland-dependent birds.** These impacts are described above under “Threatened and Endangered Species.”

**Shrubland-dependent birds.** Same as alternative A.

**Forest birds.** In addition to the impacts described for alternative A, the deer hunt proposed in alternative B would promote the development of the forest understory, an important foraging and nesting area for many forest birds. The proposed fall archery deer hunt would keep the deer population in check and prevent intense browsing of the forest understory. Intense browsing decreases structural complexity and degrades habitat for birds that use that forest layer.

**Other resident birds.** The habitat management proposed in alternative B would not appreciably impact other migratory or resident game birds that use the refuge, including American woodcock and wild turkey. Both of those tend to be generalists, and maintaining the current ratio of woodland and grassland would accommodate them. We predict a slight improvement in habitat quality for wild turkey from the predicted changes in forest understory, should deer hunting occur. As in alternative A, alternative B does not propose a woodcock or turkey hunt, so no losses would be directly attributable to hunting.

#### Effects on Fisheries

The refuge has only two water bodies with fish: a small, channeled stream and a 1/10-acre pond. The pond supports largemouth bass and sunfish, which have likely been stocked by visitors. Alternative B would result in opening the pond

to fishing, but does not propose to develop the fishery through stocking. Fishing pressure, however, would likely be very low as this site does not provide a high quality fishing experience, nor do we have plans to develop one. As a result, species composition would not change, but populations would diminish over time.

## Effects on Mammals

Generally, alternative B would yield neutral impacts on forest-dependent and generalist mammals that use the refuge, because their respective habitat types would remain the same in size, quality, and species composition and diversity. Preserving 136 acres of refuge woodland would continue to benefit forest-dwelling species such as eastern gray squirrel and gray fox. Generalist species, such as striped skunk and white-tailed deer, would use both habitat types. Alternative B does not propose to enhance habitat for any of those species, so we would not expect major changes in population levels for them.

Species that use open habitats would benefit from the continued maintenance of 400 acres of refuge grassland. Those species include red fox, woodchuck, and meadow vole. Mowing, haying, disking, and using prescribed fire may temporarily displace or even kill individual small mammals. This is also true of the runway restoration project. The restoration project may temporarily displace or kill small mammals during the construction phase, but we would attempt to minimize these impacts by requiring the vehicle traffic and removal of debris occur within the existing footprint of the runways and taxiways. Also, we would schedule the project for late fall or winter, outside the breeding season for most resident mammals. However, the long-term benefit of suppressing tree and shrub succession, and creating an additional 30-acres of grassland, would surpass that short-term loss, and we do not predict any long-term loss in population viability.

Alternative B proposes a fall archery deer-hunting program on the refuge. A direct loss of some individual deer would result. With a maximum predicted annual hunter number of 50, and a 15% success rate, potentially 8 deer would be taken each year. This success rate is based on an analysis ESPN did for the NY state 2004-2005 archery deer season ([http://espn.go.com/outdoors/hunting/s/h\\_deer\\_forecast04\\_NY.html](http://espn.go.com/outdoors/hunting/s/h_deer_forecast04_NY.html)). As a reference, in 2004, the Town of Shawangunk reported the total take of deer for the year was 464 (<http://www.dec.state.ny.us/website/dfwmmr/wildlife/deer/2004deertkbyco.pdf>).

The current population of deer utilizing the refuge is increasing, and threatens to degrade habitat, increase the number of deer-automobile collisions, increase the potential for exposure to Lyme disease, and deplete crops. A hunt program operated within State regulations would help prevent the refuge deer population from becoming overabundant. We would work with NY DEC and their wildlife management unit goals, to manage refuge deer populations at the level necessary to maintain quality habitat for diverse wildlife and minimize threats to agriculture and public health. NY DEC biologists have expressed concerns that deer populations are on the rise state-wide, and the number of hunters is declining. Since the state has utilized hunting to manage deer populations in

many areas, there are now management problems resulting with excessive deer numbers in areas where hunting pressure is low. We predict the deer population on the refuge would be reduced over the long term, but would be maintained at relatively stable levels within the capability of the habitat.

**Effects on Amphibians and Reptiles**

Systematic surveys for reptiles and amphibians on the refuge have not been conducted. However, wood turtle and spotted turtle are State-listed species of special concern that have been documented on the refuge. The impacts we identified for small mammals under our grasslands management program would be similar for amphibians and reptiles. That is, there may be some temporary displacement or loss of individual amphibians or reptiles, but we would primarily avoid the peak breeding season and confine our major restoration work to the already disturbed runways and taxiways. We predict the long-term benefit of maintaining grasslands, and creating an additional 30-acres of native habitat, would surpass any short-term losses, and we do not predict any long-term loss in population viability.

Alternative B also includes actions to restore refuge stream and wetland hydrology to the maximum extent practicable without negatively impacting grassland management. Wetland restoration would have positive impacts on the refuge herpetofauna in general, and most importantly, spotted turtle. Stream restoration would positively impact streamside salamander and wood turtle.

**Effects on Invertebrates**

Systematic surveys for invertebrates on the refuge have not been conducted. We predict impacts would be similar to what we projected for amphibians and reptiles and small mammals during grassland treatments and restoration; that is, there would be losses of individuals but not to the point where we would lose entire species or be able to maintain viable populations of native species.

Overall, we predict habitat quality for these species would improve over the long term with the reduction in invasive plant species and the runway restoration project. Under alternative B, we would expect the 430 acres of grassland to provide abundant habitat for butterflies and other open field insects during their spring and summer peak seasons.

This alternative also proposes actions to restore refuge stream and wetland hydrology to the maximum extent practicable without negatively impacting grassland management. The stream and hydrology restoration would increase over the long term the diversity of aquatic invertebrates that use the refuge, such as dragonflies, mayflies, and caddis flies.

## Effects on Public Use and Access

Alternative B would increase opportunities for wildlife-dependent public use and access by enhancing those programs and facilities at the refuge. In addition to the activities in alternative A, this alternative includes development of curriculum-based environmental education programs, interpretive programs, guided nature walks, an archery deer hunt, and fishing in the small pond. It also calls for the construction of a small visitor contact facility, nature trail, photography blinds, interpretive signage, and an expansion of the parking area. We estimate that approximately 5,500 visitors use the refuge annually; under alternative B we predict a 50-percent increase in that number. Most of that increase would result from coordinated group programs that restrict impacts on other users or wildlife, but it also includes the projected increase in numbers of hunters and anglers noted below.

We would implement a user fee in conjunction with the archery deer hunt program to help support it. Based on our best professional judgment, with consideration of safety zones, spacing between hunters and tree stands, and

hunter interest, we predict between 15 and 50 hunters per season would be accommodated. These numbers would generate from \$150 to \$500 per season by charging \$10 for each permit. Based on our experiences with implementing user fees on other refuges, we do not expect that fee to lessen hunter interest in the program.

We predict 52 angler days would be provided each year with the new fishing opportunity. While up to five anglers can be physically accommodated around the pond at any one time, we predict fishing interest would be low due to the low quality fishery and better opportunities in off-refuge local ponds, streams, and rivers. The refuge's opportunity is probably best suited for young children just learning how to use equipment. The primary fishing season would be April to October.



*Child enjoys fishing*  
USFWS photo

## Effects on Cultural and Historic Resources

All of the alternatives would maintain current restrictions on use of motorized vehicles, horse back riding, dog walking, bicycling, jogging, trespassing into closed areas, aircraft take-off and landings, or collecting plants or animals. We would continue to enforce against the most common violations of refuge regulations, including general trespass off runways, dog walking, bicycling, and use of motorized vehicles. An increase in visitors likely would yield an increase in violations.

Impacts would be similar to those in alternative A. We would comply with all Federal requirements in implementing the runway removal project, which is the major ground-disturbing activity. Should we identify sites eligible for the National Register, we will coordinate their protection with our Regional Archeologists and the New York State Historic Preservation Office (SHPO). We have submitted this document for their review of its section 106 compliance.

**Alternative C.  
Shrub and Forest  
Emphasis**

**Effects on the  
Socioeconomic  
Environment**

As in alternative A, alternative C would provide many local socioeconomic benefits, including refuge revenue sharing and increasing property values. The refuge also maintains open space and helps preserve the rural character of the area, which is experiencing rapid residential development. Because this alternative does not propose land acquisition, none of those benefits would decrease.

Although not to the same extent as in alternative B, alternative C also would increase and enhance opportunities for wildlife-dependent public use. This alternative would slightly increase the refuge contribution to ecologically based tourism and recreational opportunities for local residents. We expect a 25-percent increase above current levels of visitation, which is half the increase we expect in alternative B.

That would result in an increase from the present 5,500 visitors per year to 6,875 per year. Based on our estimates that both state residents and non-residents engaged in bird-watching activities spend \$35 and \$134 per person, per day, respectively, and given the New York state visitor ratio of 88 percent state residents to 12 percent non-residents reported by the Service (USFWS, 2003), this activity could contribute approximately \$322,300 to the state or local economies each year.

The projected contributions to the state or local economy from the hunting program resemble the projection in alternative B, because we expect the same number of hunters.

**Effects on Air Quality**

Alternative C includes the positive impacts on air quality described in alternative A by preventing the development of refuge land and maintaining native vegetation. This alternative includes management tools such as prescribed fire and herbicides that may have minor, negative impacts on air quality. Prescribed fire would be applied to a maximum of 50 acres per year to control exotic plants. However, 5 acres burned per year would be more typical. Most likely, all burning would occur on one or two days per year, usually in the spring or fall. The consequences would be minimal. All the precautions taken with prescribed fire in alternative B would also be taken in alternative C.

We would use herbicides as an important tool for controlling invasive plants, and would treat a maximum of 100 acres with herbicides in one year. The short term impacts would be as described in alternative B, but would diminish over the long term as forest became established and the need for herbicides diminished.

**Effects on Water Quality**

As in alternatives A and B, alternative C would yield long term, positive impacts on water quality by preventing the development of refuge land and maintaining native vegetation. Alternative C also proposes to demolish the runways and taxiways and restore them to shrubland and eventually, to forest. That would eliminate 30 acres of impermeable surface. Also as in alternative B, alternative C would restore the natural hydrologic flow on the refuge to the extent practicable by creating more natural stream channels and converting the

artificial pond to its natural condition as wetland habitat. Alternative C would also encourage the community to improve the health of the Wallkill River.

We would treat a maximum of 100 acres with herbicides in one year. However, we expect to treat an average of 10 acres per year with herbicides, because their expense and potential toxicity limit their application on the refuge. Aerial spraying would not be permitted. The herbicides we would use include glyphosates and 2,4-D. Those degrade rapidly at recommended application rates, so the potential for water contamination is minimal. Our Regional Contaminants Coordinator, who ensures compliance with all Federal requirements, would approve all herbicides and their applications.

Allowing most of the grassland habitat on the refuge to succeed to shrubland and forest would have neutral impacts on water quality over the short term, but over the long term, with management activities vastly reduced on the landscape, any potential threats from our activities would be greatly diminished.

### Effects on Soils

Alternative C would discontinue mowing and cutting brush on 400 acres of grassland, except where needed to control invasive plants. That would generally yield neutral or positive impacts on refuge soils as described in alternative B.

Alternative C proposes the removal of about 30 acres of concrete and asphalt runway and restoring these acres to grassland. The impacts would be the same as in alternative B. We would treat a maximum of 100 acres with herbicides in one year. However, we expect to treat an average of 10 acres per year with herbicides, because their expense and potential toxicity limit their application on the refuge. Aerial spraying would not be permitted. The impacts from the use of herbicides would be the same as described in alternative B.

### Effects on Vegetation

In alternative C, we would discontinue mowing 400 acres of grassland habitat, but would implement the runaway restoration proposal described in alternative B. However, we would plant native shrubs and trees instead of grassland in the project area. Generally, all 400 acres would succeed into shrubland and, eventually, into a northern hardwood forest, much like the 136 acres of forest now on the refuge, resulting in a total of 566 acres of forested refuge habitat.

Alternative C includes a proposal to restore the small artificial pond to wetland habitat. Consequently, aquatic plants would be eliminated in favor of shrub and forested wetland vegetation.

As in alternative B, we would develop a treatment protocol for all known invasive plants on the refuge, and would diversify the tools we use to control invasive and exotic species. That would allow us to experiment with treatment protocols and, eventually, control invasive and exotic species more efficiently. Alternative C also proposes working with partners to use biological controls on private land in the focus area to help stop the spread of purple loosestrife. The impacts in alternative C would resemble those in alternative B; however, once shrub and forest habitat became established, we would expect the need for invasive plant control to diminish over the long term.

### Effects on Endangered and Threatened Species

No Federal-listed endangered or threatened species are known to use the refuge. However, as we described under alternative A, we learned of an Indiana bat hibernaculum 18 miles to the north of the refuge, and roost trees 9 miles to the north and south of the refuge. It is possible that Indiana bats are using the refuge's forested habitat for roosting, and some of the open areas for foraging. We predict the potential to provide roosting habitat would dramatically increase over the long term under alternative C since the entire refuge would be converted to mature forested habitat.

Several State-listed species use the refuge as described in alternative A, in particular, grassland-dependent birds. Alternative C does not include maintaining the 400 acres of refuge grassland, which would succeed to shrub land within 15 years, and would no longer provide habitat suitable for these grassland-dependent birds. We predict the populations of those birds would be virtually eliminated in 15 years.

Allowing grassland habitat to succeed to shrubland and then to forest would create a less inviting environment for rare wetland plants on the refuge. Of particular interest is Frank's sedge, listed as endangered by the New York State Department of Environmental Conservation (NYSDEC) and as S1 by the New York Natural Heritage Program (NYNHP). Woody plant succession would likely reduce or possibly extirpate its present population in wet meadow habitats now managed for grassland birds and wintering raptors.

### Effects on Birds

By allowing grassland habitat to succeed to shrub in the short term, and eventually to forest over the long term, we predict a decline in most of the grassland bird species within 15 years, thus losing the refuge its identity as a unique area for grassland birds. Instead, the use of the refuge by shrubland-dependent species such as the golden-winged warbler and the prairie warbler would gradually increase in the short term. The NYSDEC lists the golden-winged warbler as a species of special concern (NYSDEC 1997). Our Region 5 list of birds of conservation concern includes golden-winged warbler and prairie warbler (USFWS 2002). PIF lists golden-winged warbler as a high-priority species for conservation in the Northern Ridge and Valley physiographic region (Pashley et al. 2000). NABCI ranks golden-winged warbler and prairie warbler as priority species in the Appalachian Mountain Bird Conservation Region (U.S. NABCI Committee 2000). Other birds that use early successional habitat include the song sparrow, field sparrow, eastern towhee, willow flycatcher and American woodcock.

In the long term (>25 years), refuge shrubland would succeed to hardwood forest. Consequently, shrubland-dependent bird species would decline, and hardwood-forest-dependent species such as black-billed cuckoo and wood thrush would increase.

Alternative C, like alternative B, proposes to implement a fall deer hunt, which would keep the deer population in check and prevent intense browsing of the forest understory. Intense deer browsing decreases structural complexity and degrades habitat for birds that use that forest layer. Consequently, as the



number of deer decreases, we predict a long term improvement in foraging and nesting habitat for forest-dependent birds.

### Effects on Fisheries

As we mentioned earlier, the refuge has only two water bodies with fish, including a 1/10 acre artificial pond and a small, channeled stream. No investigations have been conducted on fish diversity or abundance, although we know the pond supports largemouth bass and sunfish. Alternative C proposes restoring the pond to wetland habitat, in which case, bass and sunfish would no longer exist there.

### Effects on Mammals

Allowing grassland habitat to succeed to shrub-scrub habitat over the short term and, eventually, to forested habitat over the long term, would alter the refuge population of mammals. Those that use open, grassland habitat, such as red fox, woodchuck, and meadow vole would decrease, while those that use shrub and forested habitat, such as gray fox and gray squirrel, would increase. Generalist species such as striped skunk and white-tailed deer would use both types. Alternative C proposes a fall archery deer hunting program, as in alternative B. The impact would be the same.

### Effects on Amphibians and Reptiles

We have not surveyed the refuge systematically for reptiles and amphibians. However, wood turtle and spotted turtle, State-listed species of special concern, have been documented on the refuge. Alternative C includes actions to restore refuge stream and wetland hydrology to the maximum extent practicable. That restoration would have positive impacts on the refuge herpetofauna in general; most importantly, spotted turtle habitat quality would be improved. Stream restoration would positively impact streamside salamander and wood turtle. The transition from grassland to shrubland and forest would not greatly affect the diversity of species.



*Spotted turtle*  
USFWS photo

### Effects on Invertebrates

We have not conducted systematic surveys on refuge invertebrates. However, the natural succession from grassland to forest would result in fewer habitats for butterflies and other open field insects that use the refuge. Conversely, that habitat succession would directly benefit forest-dependent insects over the long term. This alternative also proposes actions to restore refuge stream and wetland hydrology to the maximum extent practicable. That would increase the diversity of aquatic invertebrates using the refuge, such as dragonflies, mayflies, and caddis flies.

**Effects on Public Use and Access**

Alternative C would increase opportunities for wildlife-dependent public use and access, but not to the extent of alternative B. We currently allow public access on the former runways and taxiways for wildlife observation, photography, and interpretation. Snowshoeing, cross-country skiing and hiking also are permitted. This alternative includes the development of curriculum-based environmental education programs, interpretive programs, and an archery deer hunt. Alternative C also calls for the development of a nature trail, as in alternative B. We now estimate that approximately 5,500 people visit the refuge each year. We predict a 25-percent increase in that number. That increase primarily would result from coordinated group programs, thus limiting additional impacts on other visitors or wildlife.

As in alternative B, alternative C also would maintain current restrictions on motorized vehicles, horses, pets, bikes, trespassing into closed areas, and collecting plants and animals. We would continue to enforce against violations of refuge regulations such as general trespass off runways, dogs, bikes, and motorized vehicles. Increasing numbers of visitors will likely yield increasing numbers of violations.

**Effects on Cultural and Historic Resources**

Alternative C does not propose actions that would impact cultural and historic resources. The same actions designed to avoid long term effects described in alternative B will be used in alternative C.

**Cumulative Impacts**

Cumulative impacts on the physical, biological, and human environment result from the combined effects of the proposed actions when added to other past, present, and reasonably foreseeable future actions. They can result from individually minor but collectively significant actions taking place over a period of time.

This assessment of cumulative impacts includes other agencies' or organizations' actions if they are interrelated and influence the same environment. Thus, it considers the interaction of activities at the refuge with other actions occurring over a larger spatial and temporal frame of reference.

**Air Quality**

None of the proposed alternatives would result in a significant cumulative impact on air quality on the refuge or in surrounding areas. Some short-term deterioration in air quality would be expected from management-ignited prescribed burns (except in alternative A), and from refuge visitors and others' automobile emissions. However, our management-ignited prescribed fire would occur under the stipulations of our Fire Management Plan (appendix F). Those are specifically designed to minimize impacts on air quality. The contribution of visitors' vehicle emissions is insignificant in this relatively rural landscape. The biggest contribution to air pollution comes from industrial and commercial centers outside the area.

**Physical Resources  
(Water Quality, Soils,  
and Wetland)**

None of the proposed alternatives would result in a significant impact on water quality, soils, or wetland. Only alternatives B and C propose projects that would impact those, and the projects are designed to improve soil, wetland, and water quality over the long term. They attempt to ameliorate the dramatic alterations caused by runaway construction. Alternative B through the grassland management practices such as discing, mowing, revegetation, grazing, and herbicide treatments may have minor, short-term negative impacts on water quality. We do not expect significant impacts from these management practices.

Soil erosion would be minimal, because the refuge topography is flat, and we would not use the grassland management techniques near streams and wetland or during wet periods. Alternatives B and C proposed removal of the runways would likely yield extensive soil disturbance. Maintenance of refuge land by mowing is expected to cause minimal soil compaction or disturbance.

In addition to the above practices, on adjacent private land practices, such as cattle grazing, use of herbicides, and mosquito spraying by the State could contribute to cumulative negative impacts on water quality, soils and wetland. In general, however, the highest present and foreseeable future adverse impact on water quality, soils and wetland in the refuge and surrounding area will be from increasing residential development, and the commensurate loss in vegetation, and increasing contribution of run-off of household and landscape pollutants.

**Biological Resources  
(Vegetation and Wildlife)**

All alternatives are intended to maintain or improve biological resources on the refuge and surrounding area. The combination of our refuge actions, partnership with other conservation organizations, outreach and education could result in significant, beneficial cumulative effects by (1) increasing protection and management for species of conservation concern; (2) protecting and improving grassland and wetland habitats that are regionally declining; and (3) reducing invasive, exotic plants.

In addition to pollution noted above, increasing residential development, including road construction in the surrounding refuge area, are factors that present adverse impacts in the present and foreseeable future of the wildlife through increased road kills, and habitat fragmentation.

**Cultural Resources**

We expect none of the alternatives to have significant cumulative adverse impact on cultural resources on the refuge or surrounding area. The refuge has not been thoroughly surveyed for cultural resources; however, the state SHPO has no recorded sites. Yet, should we identify sites eligible for the National Register, appropriate actions will be taken. Moreover, beneficial impacts could occur at various levels, depending on the alternative, because of the proposed environmental education and interpretation program on the refuge.

**Socioeconomic  
Resources**

We expect none of the alternatives to have a significant cumulative adverse impacts on the economy of the local community. Service land acquisition is not proposed under any alternative, thus, property tax revenue, the cost of

community services, and local property values would not be negatively impacted. In addition, the refuge provides many direct economic benefits to the local economy such as refuge revenue sharing payments to the Town of Shawangunk (2001-2003). Often property adjacent to national wildlife refuges increase their market values. Moreover, the refuge preserves open space, and helps to maintain the rural character of the area, which is undergoing rapid residential development.

Alternatives B and C propose improvements in wildlife-dependent public uses programs. Therefore we expect additional increases in economic benefits to the local community from the increase in the number of visitors. Promoting the refuge as a destination will encourage more people to use local community services and businesses.

**Short-Term and Long-Term Productivity**

This section evaluates the relationship between local, short term uses of the human environment and maintaining the long term productivity of the environment. By long term, we mean that the impact would extend beyond the 15 year planning horizon of this draft CCP/EA. Short term means less than 15 years.

All of the alternatives are clearly aimed at enhancing the long term productivity and sustainability of natural resources on the refuge, while also promoting this stewardship in the greater community. To varying degrees, the alternatives propose actions that promote long term partnerships, land and resource protection. Outreach and education are a priority in each alternative to encourage refuge visitors to become better stewards of our environment. All of the alternatives propose to reduce impacts on wildlife and habitats by eliminating incompatible, non-wildlife-dependent uses. An example of a non-wildlife-dependent use considered incompatible is flying model airplanes.

**Unavoidable Impacts**

None of the alternatives would result in an unavoidable, adverse environmental impact. We will undertake monitoring biological inventories as part of all alternatives, to enable our staff to adapt management actions as needed and address any unforeseen situations.

**Potential Irretrievable and Irreversible Impacts**

Irreversible commitments of resources are those which cannot be reversed, except perhaps in the extreme long term or under unpredictable circumstances. An example of an irreversible commitment is an action which contributes to a species' extinction. Once extinct, it can never be replaced.

By comparison, irretrievable commitments of resources are those which can be reversed. For example, an irretrievable commitment is the conversion of shrubland to grassland. If for some reason that conversion were terminated, the grassland would gradually revert to shrubland.

Several proposed actions would result in an irretrievable commitment of resources. The grassland management practices are an example. Species

assemblages may shift as a result of habitat management proposed for each of the alternatives. Alternative A will neither increase nor enhance grassland habitat. Alternative B, however, by restoring and enhancing the grassland habitat, would benefit most of the grassland birds; species that use edge or shrub habitat may move elsewhere. Alternative C would cause a decline in most of the grassland bird species within 15 years by allowing grassland habitat to succeed to shrub and eventually, to forest. More shrubland-dependent species, such as the golden-winged warbler and the prairie warbler, would increase their use of the refuge.

Other actions proposed to manage wildlife populations include an archery deer hunt program (except alternative A). All of the alternatives propose invasive plant control to promote a shift back to natural vegetative communities. Those proposed actions are designed to enhance habitat quality for species of concern or other native species.

Proposed wildlife and habitat management actions would result in an irretrievable loss of public use. All of the alternatives would eliminate non-wildlife-dependent public uses. The management of grassland-dependent migratory birds, other bird species of concern, and rare plants would restrict public access to certain parts of the refuge either seasonally or permanently. For example, a designated trail will allow people access only to certain areas. However, each of those actions is designed to protect natural resources over the long term and fulfill the mission of the National Wildlife Refuge System and the purposes for which the refuge was established.

## Summary of Environmental Consequences by Alternative

The following table provides a summary of impacts by alternative. The narrative descriptions in chapter 4 provide more details.



*Shawangunk Grasslands National Wildlife Refuge*  
USFWS photo

Table 4– 3. A summary comparing the foreseeable consequences of each alternative

	<b>Alternative A</b> <i>Current Management</i>	<b>Alternative B</b> <i>Preferred Alternative</i>	<b>Alternative C</b>
<b>Socioeconomic Factors</b>	<p>No change in current condition; estimate of total annual refuge visitation of 5,500 could contribute up to \$257,840 to the state or local economy.</p> <p>Service land ownership would remain the same; thus, refuge revenue sharing payments and impacts on property taxes are not affected.</p>	<p>Increase in refuge visitation by 50 percent could contribute annually approximately \$386,760 to the state or local economy.</p> <p>Proposed refuge hunt program could contribute an additional \$743,040.</p> <p>Service land ownership would remain the same; refuge revenue sharing payments and impacts on property taxes are not affected.</p>	<p>Increase in refuge by 25 percent could contribute annually approximately \$322,300 to the state or local economy.</p> <p>Proposed refuge hunt program could contribute an additional \$743,040.</p> <p>Service land ownership would remain the same; refuge revenue sharing payments and impacts on property taxes are not affected.</p>
<b>Physical Resources</b> <i>Air quality</i>	<p>No impacts; no change in current condition.</p>	<p>Short-term negative impacts from the use of prescribed fire, herbicides, and a predicted increase in the numbers of visitor car emissions.</p> <p>The impacts of these additional actions are not expected to exceed air quality standards.</p>	<p>Same as alternative B except any negative impacts from herbicide use would diminish with forest establishment.</p>
<i>Water quality</i>	<p>No impacts; no change in current condition.</p>	<p>Short-term negative impacts from potential discing, grazing, and using herbicides.</p> <p>No violations of the State or Federal Clean Water Acts from any of these activities.</p> <p>Long-term positive impacts by restoring asphalt runway to grassland.</p>	<p>In addition to alternative B:</p> <p>Negligible long-term, additional, positive impact from converting the artificial pond to its natural condition as wetland habitat.</p>

Table 4- 3. A summary comparing the foreseeable consequences of each alternative (continued)

	<b>Alternative A</b> <i>Current Management</i>	<b>Alternative B</b> <i>Preferred Alternative</i>	<b>Alternative C</b>
<i>Soils and wetland</i>	No impacts; no change in current condition.	Short-term negative impacts from potential mowing, discing, grazing, prescribed fire, and using herbicides. No long-term loss of soil productivity expected.	Elimination of grassland management reduces impacts from mowing, discing, grazing. Potential use of prescribed fire or herbicides to treat invasive plants would yield short- term impacts similar to alternative B.
<b>Biological Resources</b> <i>Vegetation</i>	No impact; no change in habitat type, condition or distribution.	Long-term positive impact on biodiversity and native vegetation by restoring asphalt runway to grassland and aggressively controlling invasive plants.  Rare plants, such as Frank’s sedge, would be monitored and protected to the extent practicable, given grassland management objectives.	Same as alternative B, except:  400 acres would succeed to shrubland and eventually, northern hardwood forest, causing a decrease in grassland and wetland habitat.  Over the long term, the need to control invasive plants would diminish.  Rare wetland plants, e.g., State-listed Frank’s sedge, would be reduced, possibly to extirpation.
<i>Endangered or Threatened Species</i>  (No Federal-listed species; State-listed species only)	No change in their habitat type, condition, or distribution.	State-listed grassland-dependent birds would benefit over the long term because of the increase in acreage and quality of grassland habitat.  No impact on the two State-listed turtles or non-grassland-dependent birds, because no dramatic change in their habitat type, condition, or distribution.	Over the long term, grassland-dependent birds would be eliminated as their habitat succeeds to shrubland and forest.  No impact on the two State-listed turtles because no dramatic change in their habitat type, condition, or distribution. Also, see bird discussion.

Table 4– 3. A summary comparing the foreseeable consequences of each alternative (continued)

	<b>Alternative A</b> <i>Current Management</i>	<b>Alternative B</b> <i>Preferred Alternative</i>	<b>Alternative C</b>
<i>Birds</i>	<p>No change in grassland-dependent birds.</p> <p>Gradual decrease in shrubland-dependent birds.</p> <p>No change in forest-dependent birds (expect older forests eventually to benefit woodpeckers and other cavity nesters).</p> <p>No direct loss for resident game birds because no hunting program is proposed; no further impacts on migratory or resident game birds because no change in their habitat over the short term.</p>	<p>Grassland-dependent birds would benefit over the long term because of the increase in the acreage and quality of grassland habitat.</p> <p>Gradual decrease in shrubland-dependent birds.</p> <p>Deer hunt program would benefit the forest understory and consequently, foraging and nesting area for many forest birds; no further impacts on forest-dependent birds because no change in their habitat.</p> <p>No direct loss for resident game bird since no hunting program proposed; no further impacts on migratory and resident game birds habitat because no change in their habitat over the short term.</p>	<p>Shrubland birds would benefit most in the short-term (&lt;15 years), while forest-dependent birds would benefit over the long- term (15+ years) as the vegetation is allowed to succeed to northern hardwood forest.</p> <p>Grassland-dependent birds would begin to diminish over the short term and be extirpated over the long term.</p> <p>Deer hunt program would benefit the forest understory and consequently foraging and nesting area for many forest birds.</p> <p>No direct loss for resident game birds since no hunting program proposed.</p>



Table 4- 3. A summary comparing the foreseeable consequences of each alternative (continued)

	<b>Alternative A</b> <i>Current Management</i>	<b>Alternative B</b> <i>Preferred Alternative</i>	<b>Alternative C</b>
<i>Mammals</i>	No impact; no hunt program; thus, the white-tailed deer population would increase over the short term and impact plant and wildlife habitat.	<p>No impact on forest-dependent mammals, because no change in their habitat type, condition or composition.</p> <p>Species that use open, grassland habitats would benefit over the long term from the maintenance of grassland.</p> <p>The fall archery deer hunt would eliminate individual deer, but not have a significant impact on the deer population in the area, which is regulated by NYSDEC. Some reduction in deer would increase the diversity of understory vegetation and enhance habitat for small mammal populations.</p> <p>Reductions in local deer numbers could potentially decrease deer-vehicle collisions and reduce the potential for Lyme disease.</p>	<p>Over the long term, mammals that use shrub and forested habitat would increase, while mammals that use open, grassland habitats would decrease.</p> <p>The impacts from the fall archery deer hunting program would be the same as alternative B.</p>
<i>Reptiles and Amphibians</i>	No impact because no change in their habitat type, condition or distribution.	Restoration of wetland hydrology would have a positive impact on the refuge amphibians and reptiles in general; and most importantly, would improve the habitat of State-listed spotted turtle and stream-side salamander.	Same as alternative B.
<i>Fisheries</i>	No impacts; no change in current condition.	Opening the 1/10-acre pond to fishing and disallowing fish stocking would diminish their numbers over time.	Restoring the pond to wetland habitat would eliminate the fish.

Table 4- 3. A summary comparing the foreseeable consequences of each alternative (continued)

	<b>Alternative A</b> <i>Current Management</i>	<b>Alternative B</b> <i>Preferred Alternative</i>	<b>Alternative C</b>
<i>Invertebrates</i>	No impact because no change in their habitat type, condition or distribution.	Grassland management provides habitat for butterflies and other open field insects. Habitat quality over the long term would be improved because of the reduction in invasive plant species.  Restoring stream and refuge hydrology would, over the long term, increase the diversity of aquatic invertebrates that use the refuge.	Elimination of grassland would decrease habitat for butterflies and other open field insects.  Over the long term habitat succession would directly benefit forest-dependent insects.  The diversity of aquatic invertebrates that use the refuge increases over the long term due to the stream and hydrology restoration.
<b>Public Use and Access</b> <i>Priority Public Uses</i>	No impacts; no change in current level of programs and types of public use opportunities. Visitor estimate is now 5,500 annually.	Expect a 50-percent increase in annual visitation to 8,250 resulting from the proposed increase in wildlife-dependent public use opportunities, such as interpretive programs, guided nature walks, archery deer hunt, and small pond fishing.  Access and programs would be improved by constructing a small visitor contact facility, nature trail, photography blinds, interpretative signage, and expanding the parking area.  However, increased visitation would result in an increase in violations.	Similar to alternative B, except:  Expected annual visitation would be 6,875  Fewer group programs, maintain existing parking capacity, and no fishing.
<b>Cultural and Historical Resources</b>	No impacts; no recorded sites known; and no ground-disturbing activities proposed in current management.	No recorded sites known.  Runway removal and all hydrology restoration would comply with Federal requirements for protecting archeological and cultural resources. The level of surveys would be commensurate with predicted impacts.	Same as alternative B.