

## Chapter 3



*Deer at Shawangunk Grasslands National Wildlife Refuge*  
USFWS photo

# Refuge and Resource Descriptions

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## Introduction

This chapter describes the physical, cultural, socioeconomic, administrative, and biological resources of the refuge environment. It relates those resources to our refuge goals and key management issues, and provides context for our management direction, which we present in chapter 4.

## Natural Landscape Setting

Our Southern New England—New York Bight Coastal Ecosystems Program in Charlestown, Rhode Island, published the following information on physiographic provinces and habitat complexes in “Significant Habitats and Habitat Complexes of the Hudson River/New York Bight Watershed” (USFWS 1997). The refuge lies in the northern section of that watershed (map1–1).

## Landscape Formation

The watershed is a rich and varied regional physical landscape containing a number of distinctive geomorphic provinces and sections. Its variety results from several concurrent and successional events: the combination of complex bedrock and surficial geology and recent glacial history in the northern half of the region; historic mountain-building and land-uplifting forces; and the dynamic processes of erosion, sedimentation, and chemical and physical weathering acting on rocks of varying hardness. Such extraordinary physiographic diversity and geological complexity, together with climatic and historical events, contributed directly to the region’s remarkable biological diversity and the current distribution patterns of its fauna and flora.

One of the most interesting, significant factors in shaping the modern landscape of much of the watershed and, indeed, much of North America, has been the work of glaciers and the continental ice sheet during the most recent glacial period, the Pleistocene Epoch. Although the Pleistocene began more than a million years ago, and was characterized by a series of at least four major glacial advances (glacial stages) and retreats (interglacial stages), its last glacial stage, the Wisconsin, has most profoundly influenced the landscape of the northern section of this region. The Wisconsin glacier, which began between 70,000 and 100,000 years ago, retreated from this region between 10,000 and 15,000 years ago. That process yielded the two sections of the watershed; the northern, glaciated portion, which includes the refuge, and the southern, unglaciated portion. Measurably, observably distinct, their landscapes and biota contrast markedly with each other and with the watershed.

During the height of glaciation, the northern section of the watershed was covered by an ice sheet up to 1.6 kilometers (1.0 mile) thick, although its thickness considerably diminished along its margins and eastern portions. Over the entire glaciated portion of the watershed, a layer of unsorted and unconsolidated glacial debris and glacial till, ranging from clay particles to huge boulders, was deposited directly on the landscape by the advancing glacier.

As the Wisconsin glacial front retreated in response to a warming global climate, the glacier left many smaller recessional moraines and other distinctive glacial landforms, (e.g., kames, kettles, eskers, and drumlins) across the landscape

north of the terminal moraine. Meltwater from the melting ice sheet, in association with the moraines, created several large glacial lakes in the watershed. The most prominent lakes are Glacial Lake Passaic, Glacial Lake Hackensack, Glacial Lake Hudson, and Glacial Lake Albany. Those lakes lasted for thousands of years, and their remnants are visible today in the form of lakeshore sand and dune deposits and basins of deep marsh peat and lake sediments. In addition to those large lakes, many smaller lakes and wetlands north of the terminal moraine also were formed from preglacial streams blocked by glacial deposits, or were excavated into the bedrock by the ice.

### Physiographic Provinces and Habitat Complexes

Physiographic provinces and habitat complexes in the watershed are delineated based on the combination of landscape features (geology, landforms, topography, altitude, relief, geologic and glacial history, and hydrology) and associated biological communities and species populations. The province serves as the primary hierarchical landscape unit within which the various individual habitat complexes are grouped and described.

The refuge lies in the Shawangunk Valley Habitat Complex which is a subdivision of the Appalachian Ridge and Valley physiographic province. The valley is broad and gently rolling, with open fields devoted to agriculture. The Shawangunk Ridge forms the western boundary, while the much lower Hoagerburg Ridge forms the eastern boundary.

A prominent feature in this habitat complex is the Shawangunk Kill. It originates in the town of Greenville and flows northeast, parallel to the Shawangunk Ridge for much of its length, before turning east and joining the Wallkill River; its total length is about 56 kilometers (35 miles). The Kill drains a watershed of about 380 square kilometers (147 square miles). Downstream of Pine Bush, it has a gentle gradient, dropping an average of about 1.9 meters per kilometer (10 feet per mile).

### Air Quality

National Ambient Air Quality Standards monitor six types of air pollutants (carbon monoxide, nitrogen dioxide, ozone, lead, particulate matter, and sulfur dioxide) known to affect visibility, acid deposition, and human, animal or plant health. Five of those pollutants factor into the EPA's Pollutant Standards Index, a daily measure providing an overall rating of air quality (good, moderate, unhealthy, very unhealthy, or hazardous). The air quality rating in Ulster County was good or moderate throughout 2002 (<http://www.epa.gov/air/data>).

## Cultural Resources

Before European settlement, this area was populated by the Munsee branch of the Lenape (Delaware) people, who occupied the upper Delaware Valley, the adjacent Catskill foothills, and most of what is now the state of New York south of the Catskills, as well as northern New Jersey (Kraft 2001). The Waronawanka (Waranawankong), known to history as the Esopus Indians, were the Munsee tribe present in the region of the Shawangunk Grasslands Refuge. They inhabited the Rondout-Wallkill Valleys/Shawangunk Mountain region southward to their boundary with the Murderer's Kill Indians (Moodna Creek, near Cornwall) and southwestward along the Shawangunks to their border with the Minisink tribe, near where present Interstate 84 crosses the ridge in western Orange County (Fried 2005).

## Prehistoric Resources

The Esopus grew maize and a few other crops, in addition to hunting, fishing and gathering. Their first contact with Europeans was with Henry Hudson in 1609. Fur trading by the Dutch took place along the Hudson River during the years that followed, and the first permanent settlers arrived at Fort Orange (Albany) and New Amsterdam (Manhattan) in the mid-1620s. The mouth of the Rondout Creek was recognized very early as a good place to transfer goods between large sailing vessels and smaller boats, since the river was relatively shallow above the point.

## Historic Land Uses

In 1652-53, settlers moved south from the Fort Orange area to where a bend in the Esopus Creek brings it within three miles of the Rondout's mouth. Thus began the Dutch settlement known as Esopus or Groote Esopus (also "Wildwyck") and later as Kingston. The settlers farmed the Esopus flood plain using the Rondout as their harbor. Disputes and incidents of violence soon erupted, culminating in two wars, in 1659-60 and 1663-64 (Fried 1975). A number of Indian tribes served as mediators between the Esopus and the Dutch during the Esopus Wars, including not only nearby tribes such as the Mohicans and Wappingers, but also the Mohawks, Senecas and Hackensack Indians, whose proximity to the major Dutch settlements at Fort Orange and New Amsterdam made them useful to both sides (Fried 1975). In 1664, a peace treaty ended the final conflict with the now impoverished Esopus Indians. Later the same year, the Dutch lost their North American colonies to the English. By 1684, the Esopus tribe had sold most of their ancestral lands to the colonies, though many Indians continued living on portions of the land until settlers actually took possession during succeeding decades. The Lenape population had been ravaged not only by war, but by European diseases for which they had no natural immunity. The last known sale of land by an Esopus Indian in Ulster County occurred in 1770 (Fried 2005).

The refuge itself lies close to two sites of great historic interest; only a mile to the west, the Esopus tribe had a major village on the Shawangunk Kill that was the scene of a dramatic battle and rescue of prisoners by Dutch forces in 1663, during the Second Esopus War. Two miles northwest of the refuge, Gertrude

Bruyn and her three young children became the first people of European ancestry to settle on the Shawangunk Kill, sometime between 1682 and 1686. Bruyn's deed from the Esopus Indians in 1682 contains the earliest reference to the name Shawangunk (Fried 2005).

In the late seventeenth and early eighteenth centuries, settlement spread rapidly through the valleys of the Wallkill and Shawangunk Kill. During the French and Indian War, there were some Munsee raids on European settlements west of the Wallkill River. Some residents moved east, back toward the Hudson, and four blockhouses were built by the English on the Delaware River (Snell 188 and Headley 1908 in Maymon et al. 2002). During the French and Indian War, the western Delaware, including some Munsee, sided with the French. Peace settlements resulted in their subjugation to the Iroquois and Iroquois sale of their land to Europeans. The Munsee moved west, first to Ohio, then Indiana, Kansas, Oklahoma, Wisconsin and Canada. Federally recognized tribes which may contain Munsee descendants are:

- Stockbridge-Munsee Community of Wisconsin
- Delaware Tribe of Indians

Henry Hudson's voyage of 1609 had occurred during the terminal stage of the Late Woodland period of Lenape culture. The dispersed, semi-permanent human landscape that Hudson saw drastically changed in the next three centuries through warfare, permanent nucleated settlement, agriculture, industry, mining, transportation and the damming of the Hudson and its tributaries.

From 1790 to 1816, farming on moderate sized tracts produced wheat and other small grains, cheese, butter, wool, liquor, livestock, and maple syrup. About 1800, road construction improved. One of the greatest impacts on the landscape of the Wallkill River Valley took place in 1804: the first attempt to drain the river by ditching its banks. Three years later, the attempt to remove limestone from the riverbed began. Roughly two decades later, the Cheechunk Canal was built to drain the upstream portion of the Wallkill, because valley farmers wanted to create a landscape more suitable for agriculture from the unproductive, swampy area known as the "Drowned lands."

Although these projects made available some of the most productive agricultural lands in New York State, the stagnant waters that resulted created health risks. Farther downstream, major dams on the river at Montgomery, Walden and Wallkill created waterpower for the local industry. When the river is very low, evidence of an old wooden dam is still visible at Galeville, just beyond the east boundary of the refuge. This dam was reportedly destroyed by ice in 1883. An 1880 account indicates the hamlet of Galeville contained "a Methodist church, a hotel, a school-house, a grist-mill, a saw-mill, an axe-helve and spoke-factory, a wagon- and blacksmith-shop," while five years earlier, a map had shown a "store & P.O." as well (Sylvester 1880; Beers 1875). On the Shawangunk

Kill, a dam was built at Tuthilltown, four miles north of the refuge, where a historic eighteenth century mill still operates today using waterpower.

Sheep raising and wool manufacturing become important during the early decades of the nineteenth century (Maymon et al. 2002). After the Civil War, the Wallkill Valley Railroad changed not only the landscape and settlement patterns but also agricultural practices of the region. From 1868 to 1872, the new railway was laid down along the valley to Kingston from Montgomery in Orange County, where it linked to the Erie Railway and thus to the great



*An airport, constructed during the 1940's, is one of the many significant land use changes in the refuge's history.*  
USFWS photo

markets of the New York metropolitan area (Mabee 1995). This spurred the livestock and, particularly, the dairy industry. The townships of Shawangunk and Gardiner became a center for dairy farming, a way of life that remained dominant well into the second half of the twentieth century.

Meanwhile, population and commerce gravitated to locations along the rail corridor; the hamlet of Gardiner sprang up where only fields had existed, and Wallkill increased significantly in size and importance. Older mill-hamlets such as Tuthilltown and Galeville now began their decline. Finally, the automobile played a vital role in development patterns, stimulating the construction of hard-surfaced roads in the valley. With vastly enhanced mobility, commercial growth became concentrated in regional population centers such as New Paltz and Walden and, especially, Newburgh, Kingston, Poughkeepsie and

Middletown, while many of the smaller hamlets lost most if not all of their places of business. The recent past of the refuge has included a history as a farm field, use as an airport, and a role as a training location for U. S. Marshals.

## Socioeconomic Setting

### Demographics

The Wallkill Valley population has increased by 14.8 percent over the past decade. Higher demand for residential development inevitably followed. Housing densities have increased by 20 percent over the past 10 years, while population densities have increased by 13.9 percent. Predictably high occupancy rates will increase that trend exponentially over time. That trend does not directly threaten the refuge. However, coupled with the growth of urban centers, it will increase the demand on the recreational resources of the refuge.

### Industry

Tourism is an important economic activity in Ulster County, and offers opportunities for recreation in the Catskill Mountains and on the Hudson River. The Shawangunk Mountain range, just northwest of the refuge, is recognized internationally as a premier area for rock climbing, as a globally unique ecosystem of mountaintop dwarf pine barrens, and as the most spectacular array of vertical cliffs east of the Rockies. Agriculture still contributes to the local economy, but has declined in importance.

Ulster County has a population of 178,028 (U.S. Census Bureau 2001). Its retail and manufacturing sectors employ about 8,000 and 6,500 people, respectively. The Town of Shawangunk, which includes the refuge, has a population of 12,022 (U.S. Census 2000). On a larger, regional perspective, the industries that dominate the Wallkill River Valley are the fields of education, health, and social services, closely followed by the profession of retail trade. The shift between the agricultural and construction industries has been the most notable. Between 1990 and 2000, agriculture decreased by 2.16 percent while construction increased by 1 percent.

### Refuge Contributions to the Local Economy

A national wildlife refuge provides many benefits to the local economy. These include, but are not limited to, the benefits of open space and associated reduced cost of community services and increased property tax values; revenues generated from the refuge revenue sharing program; and, revenues from refuge visitors who purchase equipment, lodging, or meals in support of their refuge activities.

#### Benefits of Open Space

The “cost of community services” compares the cost per dollar of revenue generated by residential or commercial development to that of revenue and savings generated by working land and/or an open space designation. On the one hand, residential development expands the tax base, but the costs of increased infrastructure and public services (e.g. schools, utilities, emergency and police services, etc., nearly always offset any increase in tax revenue. On the other hand, undeveloped land requires few town services and places little pressure on the local infrastructure.

The American Farmland Trust (2002) and the Commonwealth Research Group (1995) studied over 100 communities in the United States to evaluate the overall contribution of agriculture and open space lands with residential, commercial, and industrial development. In the 11 New York communities evaluated, residential development costs always exceeded revenue, and working land and open space always generated more public revenues than they received back in public services. Another report titled “Economic Benefits of Parks and Open Spaces” provides examples of property values increasing in the vicinity of open spaces (Trust for Public Land 1999).

Refuges also provide valuable recreational opportunities for local residents and maintain a rural character important to many people’s quality of life. Ecologically, refuges maintained as natural lands perform valuable services to a local community, such as the filtration of pollutants from soil and water, that otherwise would have to be provided technologically at great expense.

### Refuge Revenue Sharing

Under the Refuge Revenue Sharing Act of June 15, 1935, the Service pays local taxing authorities refuge revenue sharing payments based on the acreage and value of refuge land in their jurisdiction. The payments are calculated in one of three formulas, whichever yields the highest amount: three-quarters of 1 percent of the appraised value of that land, 25 percent of the gross receipts from the sale of refuge products, or 75 cents per acre of land held in fee title. We reappraise the value of refuge land every 5 years. Until we reappraise a newly acquired property, the formula uses the purchase price.

The money for refuge revenue sharing payments comes from the sale of oil and gas leases, timber, grazing, and other Refuge System resources, and from congressional appropriations. Those appropriations are intended to make up the difference between the net receipts in the refuge revenue sharing fund and the total amount due to local taxing authorities. The actual amount paid varies from year to year, because Congress may or may not appropriate funds sufficient for payments at full entitlement.

At full entitlement, refuge revenue sharing payments on wetland and on land formerly assessed as farmland sometimes exceed their real estate taxes; payments at less than full entitlement sometimes fall short. For example, the actual payment in 2001 and 2002 was just less than 50% of full entitlement. The Town of Shawangunk received \$2,591 in refuge revenue sharing payments from the Service in 2001; \$2,644 in 2002; \$2,470 in 2003; and \$2,374 in 2004.

### Revenues from Wildlife Watching

The refuge provides opportunities for wildlife watching enthusiasts which aligns to local and statewide economic benefits. These benefits are due to trip related amenities, such as food, lodging, transportation and other trip costs, such as equipment rental or public land fees. According to the Service publication, “2001



*Wildlife watching benefits local and state economies*  
USFWS photo

National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USFWS 2002), a total of 3,524,000 people annually participated in wildlife watching in the State of New York: 24 percent State residents and 8 percent non-residents.

On the national level, wildlife watching trip-related expenditures decreased in the decade (1991–2001) by 16 percent. On the other hand, equipment purchases nearly doubled from 1991 to 2001, showing a 90-percent rise. Nationally, wildlife watching trip-related expenditures equaled a total of \$8.2 billion in 2002. The national average expenditure for an individual wildlife watching participant was \$448 annually.

Our current estimate of 5,500 annual refuge visitors who are primarily there to view wildlife, potentially contributes \$257,840 in expenditures given the estimates in the 2001 survey.

**Refuge Administration**

**Staffing and Infrastructure**

Shawangunk Grasslands Refuge does not have permanent staff on location; it is administered by Wallkill River Refuge staff based out of that refuge's headquarters in Sussex, NJ. Appendix E presents the approved staffing chart and shows the allocation of staff between the refuges. Annual operating and maintenance funding and staff support for the two refuges are combined. Staffing and equipment to manage the refuge adequately are lacking. Its only facilities are a temporary trailer used for storage, a kiosk and refuge entrance sign, and an access road and small parking area. All equipment and staff are transported as needed from Wallkill River Refuge, about a 1-hour drive away.

**Special Use Permits, Including Research**

At present and in the recent past, all of our special use permits have been issued to conduct inventories and research. In 2002, we issued a permit to the Wildlife Conservation Society to conduct amphibian and reptile surveys on the refuge. In 2004, we issued a permit to Southern Vermont College to conduct vegetation surveys and test vegetation sampling techniques. In 2005, we issued a permit to Audubon New York to conduct breeding bird surveys. For several years now, we have permitted and cooperated in a study on the impact of using insects as biological control agents for purple loosestrife. That research, initiated by and funded through NYSDEC, is coordinated by Dr. Bernd Blossey of the Department of Natural Resources, Cornell University, in collaboration with Victoria Nuzzo of Natural Areas Consultants. Details on each of these projects can be obtained from the Wallkill River Refuge Headquarters.

**Our Partnerships**

As a relatively new refuge, developing strong partnerships is critical to achieving our mission. Refuge partnerships, described below, are few at present, but very important in helping to implement our goals and objectives.

**New York State Department of Environmental Conservation**

We are pleased with the positive relationship we have with the NYSDEC. In addition to participating on our planning team, they have shared data on Federal- and State-listed species and other ecologically diverse areas in the greater Hudson and Wallkill River Valley. They also actively work with local communities to increase the protection of State-listed threatened and endangered species and important migratory bird habitat.

**Audubon New York**

This organization provided a major supporting role in the establishment of the refuge. Audubon New York designated the former Galeville Airport as an Important Bird Area in 1998. That designation brought awareness of the value of the site for grassland-dependent birds and helped justify its protection as a refuge. Further, Audubon New York has been a steadfast supporter of our position that model airplane flying is not compatible with the mission of the Refuge System or the purposes of the refuge.

**Audubon Society, Rockland Chapter**

This organization has helped secure funds for the printing of a refuge bird brochure and other items that support wildlife observation. This brochure is still the only publication developed specifically for the refuge.

**Edgar A. Mearns Bird Club**

This club has actively supported the presence of the refuge and contributed a bench, which has facilitated wildlife observation on the refuge.

**John Burroughs Natural History Society**

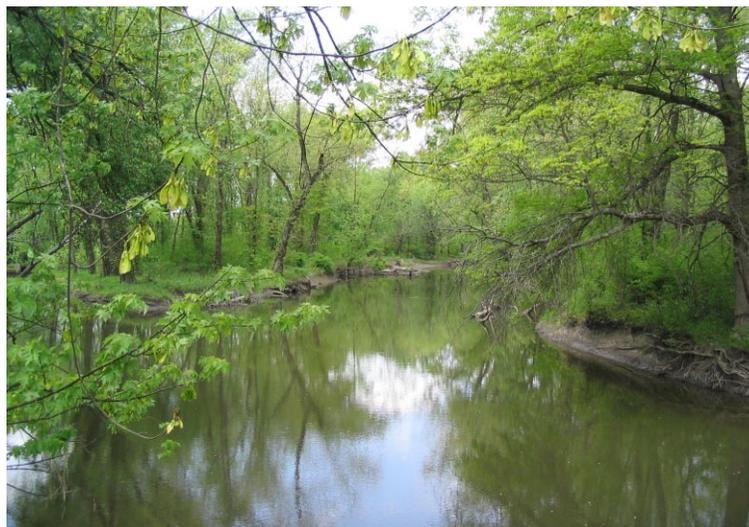
This organization conducts annual grassland breeding bird surveys using standard Service protocol. This monitoring is a critical component of our grassland bird management program.

**Wildlife Conservation Society, Metropolitan Conservation Alliance**

This organization (MCA) has identified areas outside the refuge of conservation importance and has provided training opportunities for local governments near the refuge in balancing economic growth and development with natural resources protection. Their efforts have assisted the refuge by creating positive and more open communication with municipalities regarding natural resource stewardship. The MCA has also conducted herpetological surveys on the refuge to provide more information to our refuge database.

**Walkill River Task Force**

This group is a bi-state, multi-agency organization developed to bring more awareness to the Walkill River. The task force has proven very successful in raising local and municipal official awareness, increasing support for protection of the river, and providing opportunities for the public to access the river. Their support for the river has resulted in increased knowledge and support for the refuge.



*Walkill River*  
USFWS photo

**Volunteers and Friends Programs**

Although small, our volunteer program at the refuge overlaps our other partnerships, and soon will become more established. It now consists primarily of members of the John Burroughs Natural History Society, who conduct bird surveys; refuge neighbors, who monitor the refuge for problems; and, a number of local residents, who have offered to do various tasks at the refuge. We would like a Friends Group to form in the future, but none has been initiated to date.

## Physical and Biological Resources on the Refuge

### Topography and Soils

Decades of disturbance to the soils of the refuge include logging, agriculture, and the construction of an airport (Stevens 1992). Local residents recount that its runways and taxiways were created by filling wetlands with thousands of tons of fill imported from nearby floodplains during the 1940s. The concrete runways and asphalt taxiways, comprising 30 acres total, still exist although they have not been maintained and are breaking up in many places. The two runways, running perpendicular to each other, are each approximately 3,500 linear feet, and 100 feet wide. An outer perimeter taxiway extends 7,300 linear feet, and 43 feet wide, and connects to the runways via 7 connector taxiways which are each 415 feet long and 43 feet wide. The airfield pattern can be seen on Map 1-2 in Chapter 1. In addition to the runways and taxiways, an extensive system of cement culverts was installed to drain water from the airfield. That drainage system feeds into an eroded, channeled stream. However, Stevens also describes soils located farther from the runways as less disturbed. Only the surface layer (A-horizon) of those soils has been mixed. Chapter 4 describes our plans to restore the runways to more native habitats.

Perched wetlands and wetland plant communities cover about 400 acres on the refuge (Stevens 1992), where high clay content in the upper soil horizons prevents the downward percolation of rainwater and snowmelt. In fact, the groundwater table is more than 3 feet below the surface throughout much of the refuge, where pits and channels between eroded earthen hummocks characterize the ground surface. That pit and hummock topography may result from freezing and thawing in the saturated surface layer of the soil.

### Federal-Listed Threatened or Endangered Species and Other Rare Species or Habitats of Concern

No Federal-listed species are known to inhabit the refuge. However, in August 2005 we learned from our Ecological Service's New York Field Office that a hibernaculum of 30,000 Indiana bats (*Myotis sodalis*), a Federal endangered species, lies in Ulster County 18 miles to the northeast of the refuge. In addition, there is documented summer roosting by these bats nine miles to the north and south of the refuge. This new information indicates that the refuge could provide potential roosting and foraging habitat for these bats since they appear to be in the vicinity. Our New York Field Office provided a fact sheet describing habitat requirements for these species to help guide us in evaluating whether a refuge project would impact potential Indiana bat habitat. Some of the highlights on Indiana bat habitat from the fact sheet include:

- They typically hibernate in caves and mines during the winter and roost under bark or in tree crevices in the spring, summer, and fall;
- Their roost habitat is characterized by a live or dead tree,  $\geq 5$  inches d.b.h., with exfoliating or defoliating bark, or containing cracks or crevices accessible to bats;
- Maternity colonies generally use suitable trees  $\geq 9$  inches d.b.h.;
- Tree structure appears to be more important than a particular tree species or habitat type;

- Streams, floodplain forests, and impounded water bodies provide preferred foraging habitat, and bats may travel 2-5 miles from roost sites to forage; and,
- Other foraging habitat includes forest canopies, open fields, along cropland borders and wooded fencerows; and over farm ponds and pastures, all within proximity to tree cover.

The 1999 Agency Draft Indiana Bat Revised Recovery Plan provides additional descriptions of habitat, natural history, threats, and recommendations for recovery across the species' range. This plan can be accessed at: <http://nyfo.fws.gov/es/ibatdraft99.pdf>. We will continue to work with our New York Field Office to obtain the latest information on where bats are located, and to assess the implications to our refuge management.

Appendix A lists State-listed species and other species of management concern, many of which are described in more detail below.

Several rare or uncommon plants grow on the refuge. Stevens documented one of the most noteworthy, Frank's sedge (*Carex frankii*), which is ranked endangered by the NYSDEC and S1 by the New York Natural Heritage Program (NYNHP) (Stevens 1992). Stevens also documented small-flowered agrimony (*Agrimonia parviflora*), purple milkweed (*Asclepias purpurascens*), small white aster (*Aster vimineus*), Bush's sedge (*Carex bushii*), coontail (*Ceratophyllum echinatum*), and watermeal (*Wolffia brasilinsis*).

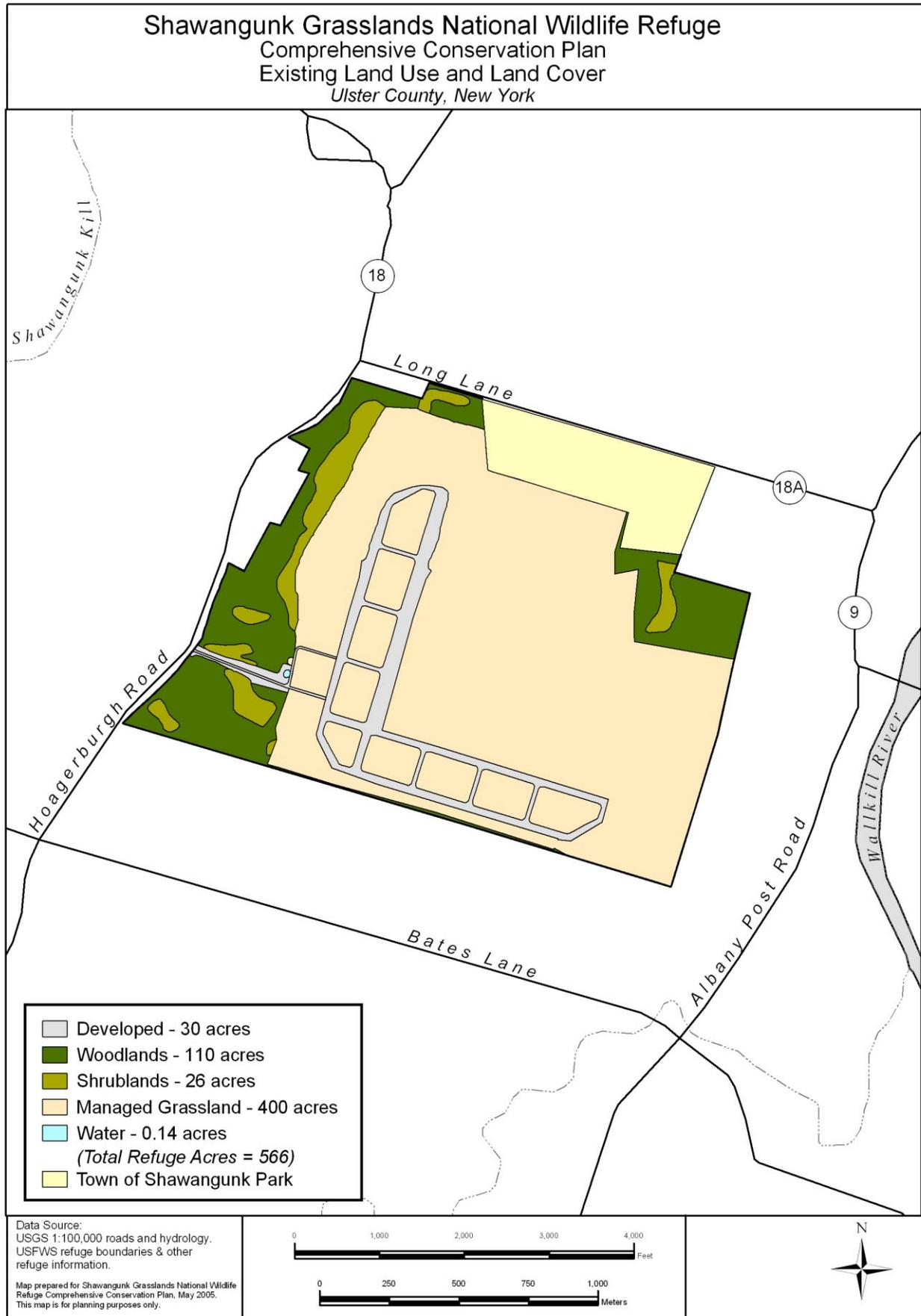
## Vegetation and Habitat Types

### Wetlands

The refuge comprises 566 acres, of which 400 acres are managed as open fields or grassland, but were classified by Stevens as a "seasonal perched wetland." Stevens (1992) delineated and described those wetlands before the refuge was established. The soils of those areas have a high clay content in the upper horizons, which prevents downward percolation of rainwater and snow-melt. Consequently, they often have standing water into the growing season, but dry out every year. The primary wetland plants include the invasive purple loosestrife (*Lythrum salicaria*), reed canary-grass (*Phalaris arundinacea*), and common reed (*Phragmites australis*). An additional 136 refuge acres is comprised primarily of upland hardwood woodland and some shrubland in transition to woodlands (see map 3-1). The remaining 30 acres of asphalt and concrete runway and taxiway is described above under the topography and soils discussion above.

### Grasslands

Most of the 400 acres of the refuge actively managed as open field or grassland habitat is dominated or co-dominated by Kentucky bluegrass (*Poa pratensis*). However, several broadleaf herbaceous plants are also common, including bedstraw (*Galium sp.*), beard-tongue (*Penstemon digitalis*), slender mountain-mint (*Pycnanthemum tenuifolium*), goldenrod (*Solidago spp.*), aster (*Aster spp.*), and common milkweed (*Asclepias syriaca*). The wetlands plants listed



above are also common. Unfortunately, the invasive purple loosestrife is a major component. Trees scattered throughout the grassland include the white ash (*Fraxinus americana*), American elm (*Ulmus americana*), eastern red cedar (*Juniperus virginiana*), and pin oak (*Quercus palustris*).

Our primary habitat management objective on the 400 acres has been to maintain the dominance of grasses in those fields. Without frequent management, natural succession will shift that dominance to broadleaf herbaceous plants and shrubs, and ultimately to trees, causing the refuge to lose its suitability as habitat for grassland-dependent birds. In particular, our current treatment methods aim at suppressing goldenrod, purple loosestrife and gray dogwood (*Cornus racemosa*). Mowing is now our primary technique to halt that succession. We have been mowing 200 to 300 acres annually since 2000. In Chapter 4 we describe our plans to expand the grassland and consider other management techniques, such as haying, grazing, disking, revegetating, applying herbicides, and prescribed burning.

### Upland Forest and Shrublands

The 110 acres of woodlands on the refuge are classified primarily as mixed oak-hardwood forest (see map 3-1). Dominant species include red oak (*Quercus rubra*), white oak (*Q. alba*), pin oak, black oak (*Q. velutina*), red maple (*Acer rubrum*), sugar maple (*A. saccharum*), shagbark hickory (*Carya ovata*), American beech (*Fagus grandifolia*), and tulip tree (*Liriodendron tulipifera*). We are allowing the 26 acres in small patches now dominated by shrubs and surrounded by woodland to succeed to woodland.

### Ponds

A one-tenth-acre artificial pond created several decades ago by the damming of a drainage ditch stands near the entrance to the refuge. It supports a small warm-water fishery dominated by largemouth bass (*Micropterus salmoides*) and sunfish (*Lepomis spp*), but does not have significant value for wildlife. Fishing there has not been permitted; however, it will be allowed under this CCP.



Pumpkinseed  
USFWS photo

### Invasive Species

Purple loosestrife is the most abundant, invasive, non-native species on the refuge. Although typically found in emergent marshes, that species has become co-dominant in refuge grassland and wet meadow habitats. The extensive soil alterations during airport construction probably facilitated its invasion by yielding bare soils and a perched water table, thus creating ideal conditions for germination.

A root-mining weevil (*Hylobius transversovittatus*) has been released as a biological control agent of purple loosestrife at the refuge. Although the weevil population has increased annually, it has not had a profound effect. We are cooperating in a Cornell University study of the interaction of the weevils, loosestrife, and mowing at the refuge. Leaf beetles (*Galerucella sp.*) also have been released on the refuge. The leaf-feeding beetles do not appear to have established themselves at the release sites. A native flea beetle is also feeding heavily on purple loosestrife at the refuge and in surrounding areas. We will continue to monitor its impact.

## Birds

Breeding, migrating and wintering grassland-dependent birds are our management focus. However, the refuge supports many other species. More than 141 species of birds, including 58 breeding species, have been documented. We maintain an annotated bird list on our website <http://shawangunk.fws.gov>.

### Grassland Birds

The refuge is among a dwindling number of sites in New York State, and one of only two sites in the Hudson Valley, large enough to support the entire assemblage of Northeastern grassland birds (NYSDEC and Office of Parks, Recreation and Historic Preservation 2002). This diversity led to our identifying the “Galeville Grasslands” as a significant habitat in the New York Bight watershed (USFWS 1997). Subsequently, the Hudson River Estuary Biodiversity Project Steering Committee identified the refuge as a Biodiversity Focus Area in the Hudson River Valley (Penhollow 1999). Further, Audubon New York named the refuge an Important Bird Area, a designation given only to places that support significant abundance and diversity of birds (Wells 1998).

Grassland-dependent birds have declined more consistently and over a wider geographic area during the last 30 years than any other group of North American birds (Robbins et al. 1986, Askins 1993, Knopf 1995, Askins 1997, Sauer et al. 1997). As a result, most grassland birds appear on lists of rare and declining species. The NYSDEC (1997) list of endangered, threatened, and special concern species includes short-eared owl (endangered), northern harrier, upland sandpiper, Henslow’s sparrow (threatened), and horned lark, grasshopper sparrow, and vesper sparrow (special concern). Our Northeast Region list of Birds of Conservation Concern (2002) includes upland sandpiper, short-eared owl, and Henslow’s sparrow. Partners-In-Flight (PIF) lists upland sandpiper, Henslow’s sparrow, and bobolink as high conservation priority species in the Northern Ridge and Valley physiographic region in which the refuge lies (Pashley et al. 2000). The North American Bird Conservation Initiative (NABCI) ranks Henslow’s sparrow as a priority species in the Appalachian Mountain Bird Conservation Region (U.S. NABCI Committee 2000). All of these species can be found at the refuge sometime during the year.

The refuge is recognized as one of the most important grassland bird nesting areas in the state (Wells 1998). It hosts nesting birds such as the northern harrier, upland sandpiper, grasshopper sparrow, Henslow’s sparrow, savannah



*Bobolink*  
Scott A. Vincent ©

sparrow, vesper sparrow, eastern meadowlark, and bobolink. We conduct point-count surveys of breeding grassland birds at the refuge in cooperation with the John Burroughs Natural History Society (see “Our Partnerships,” above). Those “singing male” surveys document maxima of 8 upland sandpipers, 91 bobolinks, and 68 eastern meadowlarks (U.S. Fish and Wildlife Service 2002, unpublished data). Further, a maximum of 15 Henslow’s sparrows have been reported during the breeding season (Treacy 1982). Table 3–1 summarizes our survey data from 1998 to 2004. Evidence of breeding short-eared owls has been observed, but their nesting has never been confirmed.

The primary wintering grassland birds at the refuge include northern harrier, short-eared owl, horned lark, and eastern meadowlark. According to Wells, up to 16 short-eared owls and 6 northern harriers have been observed at the refuge in winter, as well as flocks of 60 to 80 horned larks. Refuge winter raptor surveys frequently document 7 to 9 short-eared owls and 12 to 17 northern harriers (USFWS 2003, unpublished data). Remarkably, the John Burroughs Natural History Society (1969) reported a maximum of 21 short-eared owls, and Askildsen (1993) reported a maximum of 36 northern harriers.

The refuge also provides important habitat for migrant grassland birds in spring and fall. Northern harriers migrating along the Shawangunk Mountains often stop at the refuge to rest and forage. Migrant short-eared owls arrive at the refuge in early November and depart in late April. Flocks of up to 100 bobolinks gather at the refuge in August and September, and flocks of up to 50 eastern meadowlarks in April, October, and November. As many as 19 vesper sparrows have been counted at the refuge in October (Kahl, USFWS 2001, personal observation).

**Table 3–1. Grassland birds breeding on the refuge 1998–2004**

Species	Maximum	Years
northern harrier	1	2002 and 2003
upland sandpiper	8	2001 and 2002
grasshopper sparrow	2	1998, 2002 and 2003
Henslow’s sparrow	2	2002 and 2003
savannah sparrow	14	1998
vesper sparrow	2	2003
eastern meadowlark	68	1998
bobolink	91	2004

### Other Birds of Conservation Concern

Several non-grassland-dependent bird species on the refuge also appear on the State list of endangered, threatened and special concern species (NYSDEC 1997). Loggerhead shrikes (endangered) used to be an uncommon, but regular

migrant at the refuge. They are now very rare. Large flocks of common night-hawks (special concern) forage over the refuge during migration, and have been reported to use the runways as daytime roosts. Sharp-shinned hawk, Coopers hawk, northern goshawk, and red-shouldered hawk (special concern) rest and forage at the refuge in winter, spring, and fall. Peregrine falcons (threatened) have been seen at the refuge during fall migration. Refuge birds on our Northeast Region list of Birds of Conservation Concern, the Partners-In-Flight (PIF) list of high conservation priority species (Pashley et al. 2000), and the North American Bird Conservation Initiative (NABCI) priority species list (U.S. NABCI Committee 2000) include black-billed cuckoo, red-headed woodpecker, yellow-bellied sapsucker, wood thrush, and prairie warbler.

### Mammals, Reptiles, Amphibians, Fish, and Invertebrates

We have not conducted systematic surveys on the refuge for mammals, reptiles, amphibians, fish, or invertebrates. However, the wood turtle (*Glyptemys insculpta*) and spotted turtle (*C. guttata*), State-listed species of special concern, have been documented on the refuge.

### Contaminants

Even though no significant evidence of serious or widespread environmental contamination appears on the refuge, our New York Field Office and members of the public have expressed concern that its previous use as a military airport may have left some contaminants. For example, the communications center, demolished around 1973, may have contained polychlorinated biphenyls (PCBs), heavy metals, petroleum products or asbestos, which could now be present in soils or groundwater. An environmental engineer from our Division of Engineering, Environmental and Facility Compliance, made the following recommendations for the site:

1. Dispose of old treated timbers and telephone poles (now completed) and test the underlying soil for contaminants.
2. Conduct a Phase I environmental site assessment, in accordance with the standards of the American Society for Testing and Materials (ASTM). That assessment will determine whether hazardous materials are present on the refuge, whether additional testing may be necessary, and identify any corrective actions that may be required.

### Public Use on the Refuge

#### Priority Wildlife- Dependent Public Uses

The refuge has been currently open for wildlife observation and photography, environmental education and interpretation. Bird watching is the most popular activity. Visitors travel from within New York and from adjacent states to view breeding grassland birds and wintering birds of prey. Public access is limited to foot traffic on the existing runways. Access by ski and snowshoe is permitted in winter. Visitor facilities consist of a kiosk with brochures and refuge information, and a parking lot that can accommodate up to five cars. Refuge trails are open year-round 1 hour before official sunrise to 1 hour after official sunset. Hunting has not been previously allowed, but archery hunt will be implemented under this CCP. Fishing

**Non-wildlife-Dependent  
Public Uses**

has also not previously been allowed in the small man-made pond, but it will also be a new activity allowed with implementation of this CCP.

We have observed several unauthorized public uses at the refuge, including people walking dogs, jogging, bicycling, riding horses, using all-terrain vehicles and other motorized vehicles, landings and take-offs by private planes on the runways. Since the refuge was established, we have not allowed those activities for several reasons. First, these activities are not wildlife-dependent recreational uses, nor are they necessary for the safe, practical, or effective conduct of a priority public use. Second, based on our observations at this site, birds are more likely to flush from nests and foraging areas in response to these activities, in comparison to a birdwatcher or photographer on foot. Finally, because of this open setting, these activities are likely to interfere with visitors who are engaging in priority public uses.

Despite regulations against these activities, many of them persist and they remain law enforcement issues. In the past, our refuge law enforcement officer concentrates on providing visitor safety on our trails and monitoring and enforcing refuge regulations.

On the refuge's northern boundary, the Town of Shawangunk has a 55-acre parcel planned for a town park (see map 3-1). At present, there are no developments except for a gravel driveway. However, we expect that once additional funding is secured, town officials will follow through with their plans to develop recreational athletic fields. Since no physical barrier, either natural or manmade, is currently planned between ownerships, the developed park may result in occasional non-wildlife-dependent activities, such as dog-walking, jogging, horseback riding, and bicycling, drifting onto the refuge. Through outreach, education, and law enforcement we will try to prevent these activities from moving onto refuge lands.

Model airplane flying is another non-wildlife-dependent activity that received a lot of attention when the refuge was first established. In 2001, we drafted a compatibility determination on flying model airplanes and competitive model airplane events on the refuge. In developing that draft, we conferred with NYSDEC and the leading grassland bird researchers in the Northeast. We also consulted local bird experts with a thorough knowledge of the refuge, and completed an extensive review of the ornithological literature. We found scientific evidence that model airplane activities will negatively impact the grassland-dependent birds for which the refuge was established. Consequently, our compatibility determination stated that model airplane activities and competitive events are not compatible, and that this use would not be allowed. We released the draft compatibility determination for a 75-day period for public review on November 26, 2001. We received approximately 2,300 responses, and carefully reviewed them, including about 1,650 form letters from model airplane enthusiasts.

The Regional Chief of the National Wildlife Refuge System approved a final compatibility determination on February 20, 2002 (appendix B). It determines that model airplane flying and competitions will have direct and indirect negative effects on the wildlife being managed at the refuge and on the public visiting the refuge seeking a wildlife-dependent experience, and will materially interfere with and detract from the fulfillment of the Refuge System mission and refuge purposes. The final compatibility determination concludes that model airplane flying and competitions are not compatible uses, and will not be allowed on the refuge.