



IMPORTANT BIRD AREA CONSERVATION PLAN
NAUGATUCK STATE FOREST- East and West Blocks

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Dedication

The Naugatuck State Forest Important Bird Area Conservation Plan is dedicated to the memory of Ed Jurzynski, a Beacon Falls resident and active member of the Naugatuck Valley Audubon Society, who worked tirelessly in his efforts to see the Naugatuck State Forest recognized as an IBA.

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Executive Summary

The following conservation plan was developed for the Naugatuck State Forest Important Bird Area (IBA), a 3,436 acre section of the Naugatuck State Forest (NSF) located in southwestern Connecticut. Its boundaries lie within the towns of Oxford, Naugatuck, Bethany, and Beacon Falls. This IBA was selected because its diverse habitats support a variety of breeding birds identified as endangered, threatened, or of special concern in Connecticut, as well as other birds of high conservation priority. It is also an important migratory stopover site for neotropical migrant birds. To date, 188 avian species have been observed in the IBA, 101 of which regularly or occasionally breed here. Recognized by Audubon Connecticut on December 9, 2004 for its shrubland and early to mid-successional forest habitats, the IBA also contains other critical habitats such as Pitch Pine (*Pinus rigida*) woodlands, Bear Oak (*Quercus ilicifolia*) shrublands, grassy glades, acidic wet seeps, and vernal pools. In addition to high priority avian species, other flora and fauna of conservation concern are found in the NSF.

This plan details the habitats, species, and significant features which led to the designation of the Naugatuck State Forest as an IBA. Also described are specific conservation concerns and threats, along with respective goals for maintaining site integrity and biodiversity. The plan was developed according to standards defined by National Audubon Society and Audubon Connecticut and meets one or more of the specific IBA criteria.

There are numerous conservation concerns and challenges which face the IBA and its wildlife. Management of forested and early successional habitats is vital to support a diverse assemblage of avian species. Most importantly, due to the ephemeral nature of early successional habitat, active management is a necessity, since without such maintenance these habitats would quickly revert to forested land. Development of lands outside the site boundaries can lead to water quality deterioration, noise pollution, and disturbances which can negatively impact the avian community and ecosystem. Encroaching development contributes to habitat loss and diminishes crucial wildlife resources. Furthermore, certain activities associated with site users or visitors have had negative impacts on both the landscape and the wildlife. Prohibited uses that degrade sensitive habitat, destroy vegetation, and disturb avian species, such as unleashed pets, the use of off-road vehicles, and unauthorized camping and dumping, are recurring problems in the IBA. There are also some natural concerns, such as deer overpopulation and the Hemlock Woolly Adelgid (*Adelges tsugae*), that can significantly alter the vegetative composition within the forest. An essential component of this conservation plan is to monitor the success of habitat management efforts within the IBA. Therefore, the establishment and/or continuance of monitoring and surveying work is crucial to determine the effectiveness of these management practices.

In an attempt to address the above mentioned conservation threats, as well as for the general health and overall enhancement of the natural features of the IBA, certain conservation goals and actions were created as part of this plan. Some of the main objectives of the plan are:

- Continue to actively manage forested and early successional habitats and enhance management regimes when possible;
- Maintain and/or increase breeding populations of key priority and other avian species;
- Establish a long-term monitoring program designed to assess priority species by building upon and expanding present survey efforts to ensure adequate coverage of appropriate areas and habitats;
- Identify and map key critical habitats, including Pitch Pine woodland and/or Bear Oak shrubland, grassy glades, vernal pools, and wet seeps, and conduct inventories and/or surveys of the flora and fauna in these critical habitats;

- Expand the IBA with land acquisitions;
- Boost public outreach through education and stakeholder involvement, and increase opportunity for the general public and enthusiastic individuals or groups to participate with projects designed to meet the IBA's conservation goals.

These goals are aimed at balancing the needs for a healthy forest, diverse ecosystem components, and a variety of wildlife, with the multiple recreational needs of the many people who visit and enjoy the forest.

An action plan has been created in order to actively address both the conservation threats and goals for the IBA. It is hoped that the elements of the action plan for the IBA can be implemented as soon as possible, with the long-term goal of reevaluating and reassessing it on a regular basis.

1.0 INTRODUCTION

This conservation plan was developed for the Naugatuck State Forest (NSF), which was recognized as an Important Bird Area (IBA) by Audubon Connecticut on December 9, 2004. Although the NSF consists of five distinct, non-contiguous blocks--East, West, Great Hill, Mt. Sanford, and Quillinan Reservoir--within or adjacent to the lower Naugatuck Valley, only the East and West Blocks comprise the IBA (Figure 1-1). These two blocks are bisected by a 1.5 mile section of the Naugatuck River which is flanked by the Route 8 highway (east) and the Metro-North train line (west). The boundaries of the two segments fall within four towns in southwestern Connecticut --Oxford, Naugatuck, Bethany, and Beacon Falls. Owned by the State and managed by the Connecticut Department of Environmental Protection (CTDEP), the IBA encompasses 3,436 acres of forestland, early successional grassland and shrubland, and various aquatic habitats. In particular, this IBA was recognized because of its high quality shrubland and mid-successional forest habitats and their roles in supporting State-listed, Audubon WatchList, and other bird species of conservation concern. The site also has several characteristics indicative of an important stopover site for migratory birds.

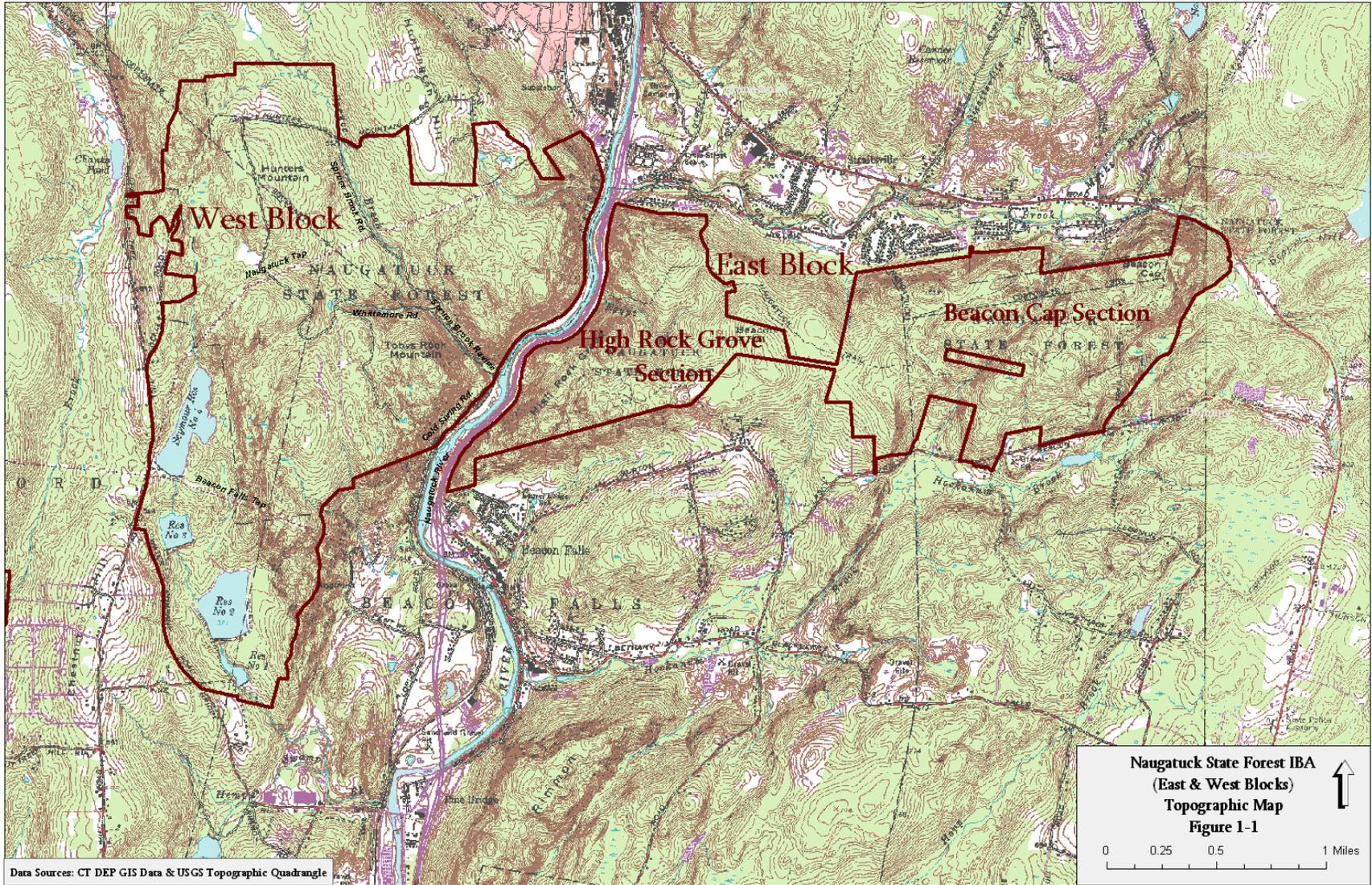
The objectives of this conservation plan are as follows:

- Catalog the natural resources within the forest;
- Identify habitats and their importance;
- Identify key bird species associated with the varied habitats within the IBA;
- Identify other key flora and fauna which occur on the site;
- Identify private and public interests which have a stake in conservation planning for the IBA, and describe their association with the property;
- Summarize management concerns, issues, and opportunities;
- Develop an action plan to complement current CTDEP plans and policies which maintain and protect natural resources of importance to birds within the forest.

The NSF, situated in the middle of a densely-developed valley, is a place of unique natural beauty. The wildness of its scenery is as necessary for human recreation as it is for birds and wildlife. This was equally true in the midst of the Industrial Revolution, when Samuel Orcutt (1882) wrote of his appreciation for this landscape:

“At the upper end of this little opening of the hills is Beacon Falls village, just above which at the Beacon Falls Dam, the hills close in, leaving little more than space for the river and the roads, and then again the scenery becomes wild and rocky. On the west side of the river the hills rise very abruptly to the height of three and four hundred feet, the rocks standing out in promontories successively, in a curve until they reach High Rock, which has an elevation above the river of four hundred and seventy five feet, and from which northward the hills gradually diminish in height to the village of Naugatuck.”

This impressive scene moved Orcutt to further describe it as “wild, romantic, picturesque, and attractive to travelers.” Fortunately for present-day travelers of both human and avian species, the NSF is still a rugged natural sanctuary, carefully preserved and managed to maintain an optimal balance of interests, and it is the goal of this Conservation Plan to help keep it so.



2.0 THE IMPORTANT BIRD AREA PROGRAM

The Important Bird Area (IBA) Program is a global initiative that was started by BirdLife International in Europe during the 1980s. The United States chapter developed out of a partnership between BirdLife International and the National Audubon Society (NAS) in 1995. The program is a large-scale effort to identify and attempt to preserve sites important in maintaining bird populations (NAS 2010).

The IBA Program “identifies, prioritizes, and works to conserve those places that are critical to the survival of bird populations” (NAS 2005). It is raising awareness about bird ecology, especially among important landholders and other stakeholders, in addition to identifying and managing the areas based on scientific techniques. By using these strategies, the IBA program is encouraging and enabling the conservation of millions of acres of land across the United States and the world. Currently 48 states participate in the IBA program, and over 2,100 privately- or publicly- owned sites covering 300 million acres across the U.S. have been designated as IBAs. For globally and continentally recognized sites, the National Audubon Society requires sites to meet one of four criteria (NAS 2012).

In order to achieve designation as an IBA in Connecticut, a site is required by Audubon Connecticut to meet at least one of the following five criteria:

1. Site is important to endangered or threatened species in Connecticut.
2. Site is important to species of high conservation priority in Connecticut.
3. Site contains rare or unique habitat within the state/region or an exceptional representative of a natural habitat, and holds important species or species assemblages largely restricted to a distinctive habitat type.
4. Site where significant number of birds concentrate for breeding, during migration, or in winter.
5. Site is important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education.

A copy of the Connecticut Audubon’s IBA fact sheet which describes site nomination and acceptance criteria is attached in Appendix A.

Audubon Connecticut has 27 publicly announced IBAs to date, all of which were identified with the intention of working toward minimizing the effects of habitat loss and habitat fragmentation occurring in Connecticut during the past few decades (<http://ct.audubon.org/IBAs.html>). Audubon Connecticut oversees large-scale conservation efforts in Connecticut, with an eye toward management of unique site requirements such as, size, habitat type, property ownership, etc. Through the use of scientifically sound methodology, site needs are prioritized, and individual conservation plans are developed with a strategic approach for future conservation and habitat management activities.

3.0 SITE BACKGROUND

3.1 Site Description

The Naugatuck State Forest IBA is located in the northwestern part of New Haven County in an area described by Bell (1985) as the Southwest Hills, a section of the Western Uplands. It is situated between the Borough of Naugatuck (north) and Town of Beacon Falls (south) while Oxford forms the western boundary and the Town of Bethany the eastern border (Figure 3-1). In this area, the IBA consists of 3,436 acres divided by the Naugatuck River into two separate parcels, the West Block and East Block, comprised of 2,228 acres and 1,208 acres, respectively.

The IBA holds an interesting diversity of habitats. Most of the forest is undeveloped, containing large tracts of forested land; some areas with rugged relief are quite difficult to access. There are a number of rocky summits and outcrops dispersed along the Naugatuck River corridor and elsewhere, and the northwest section of the West Block features about 20 acres of grassy open fields. Two powerline corridors are also located in the West Block, running generally east to west. Overall, the West Block is much more heavily used by the general public than the East Block, since it is more accessible and has a larger network of old roads and trails. The East Block, in contrast, is completely wooded and characterized by rough and rocky terrain. In addition, there are four water bodies—former reservoirs—in the southwest sector of the West Block which form an interesting landscape feature and attract a variety of users. Other water or wetland features include a Wildlife Impoundment, several small ponds, vernal pools, Spruce Brook, and the Naugatuck River itself. At present the river cannot be legally or practically accessed due to the intervening railroad line and highway, but it remains a dominant feature of the landscape, and various high spots within the IBA provide scenic views of the river and valley below.

Owned by the State of Connecticut and operated by the CTDEP, the IBA is managed for saw timber and firewood production, wildlife habitat, education and scientific study, and recreation. Forest management is an additional important function of the CTDEP, and timber harvests here serve as a source of income for the state's General Fund. Most forest management and recreational activities occur in the West Block.

The level of access to each block corresponds to the amount of visitor use in each. Recreational activity in the West Block is much higher due to its easy access and proximity to high-population areas. Access here is gained via several routes: from Naugatuck via the town road named Hunters Mt. Road; from Beacon Falls on Cold Spring Road, which becomes a state-owned Department of Transportation dirt road that flanks the Naugatuck River and ends at the junction with Spruce Brook Road (also incorrectly called Black Forest Road); or from several parking areas along the western boundary in Oxford (Figure 1-1). State-owned Spruce Brook Road also connects Hunters Mt. Road with Cold Spring Road, but, although it's paved, it is badly deteriorated at its eastern end as it descends through the ravine area to Cold Spring Road and the Naugatuck River. Road-legal vehicles are permitted on the three access roads but prohibited everywhere else on the property, unless there is specific authorization from the CTDEP. The only other exception is that snowmobiles may use designated trails in winter. No roads in the IBA receive winter maintenance, except for Hunters Mt. Road and from Spruce Brook Road to the shooting range (described below). Due to its steep grade, Spruce Brook Road is blocked off in winter at the shooting range itself and also at its junction with Cold Spring Road. The East Block is comprised of two distinct parcels linked by a narrow corridor; the High Rock Grove section (western parcel along the Naugatuck River) and the Beacon Cap section (eastern piece). Access to the East Block is much more limited, as it can only be entered on foot via either a blue-blazed hiking trail originating at Andrasko Road in the northwest corner of the block or Route 42 (Beacon Road) in the block's southeast corner.



Data Sources: CT DEP GIS Data & NAIP 2010 Imagery

**Naugatuck State Forest IBA
(East and West Blocks)
Color Orthophoto Map
Figure 3-1**

Permitted recreational uses of the IBA include hunting, fishing, bird watching, nature study, hiking, walking (including dog walking), and cross-country skiing. Horseback riding and mountain biking, less frequent activities at the site, are allowed on appropriate existing trails, although the NSF presently lacks trail signs and the resources to enforce trail-riding rules. Approved snowmobile trails—mostly restricted to the gravel roads—are also located in the West Block. Target shooting is popular at one designated location adjacent to Spruce Brook Road; the High Rock Shooting Association leases this property from the state and operates a shooting range which is open on weekends or by appointment (Figure 3-2). Hunting for deer, small game, and turkey is popular during the designated seasons. At the onset of the small game/upland bird season (third Saturday in October), the Forest can be teeming with hunters, especially on Saturdays.



Figure 3-2. High Rock Shooting Range.

Fishing is a popular recreational pursuit within the IBA. The Naugatuck River has in recent years become an increasingly bountiful sports fishery, and angling at various locations along the river impacts the IBA. Permitted access to the river is gained from the center of Beacon Falls or from Exit 25 off Route 8 in Naugatuck, on the north side of the IBA. (Note: Some anglers gain access from the west block by crossing the railroad tracks, although the practice is prohibited by CTDOT. The bridge on Cold Spring Road is being rebuilt in 2012, however, and the new design will allow river access during low flow periods). The reservoirs are also open to fishing, including ice fishing when conditions are suitable. Use of small non-motorized watercraft (e.g. canoe, kayak) is permitted on the Reservoirs, but, due to its size and proximity to the parking area, Reservoir 4 seems to be the water body of choice for the occasional paddler.

Attracting hikers and walkers, an intricate network of woods roads—including old logging and fire roads— and foot trails traverse the West Block of the IBA. These roads and trails vary with regard to condition and status. Some roads are minimally maintained by the state for authorized vehicle usage (e.g., state, logging, and emergency), but the trails are not. Two popular hiking trails to the north (North Cliffs) and south (Toby’s Rock Mountain) of Spruce Brook ravine reach summits which provide stunning views of the Naugatuck River gorge with its bedrock outcrops and sheer cliffs (Figure 3-3). Acquired in 2001, the former water company property encompasses the reservoirs, and their accompanying network of dirt roads and trails is regularly used for walking, dog-walking, and jogging.



Figure 3-3. View from Toby’s Rock Mt. looking northeast – NSF West Block.

Hikers, nature enthusiasts, and bird watchers frequently use the entire configuration of wood roads and trails in the IBA. Bird watching is a favorite pastime in the West Block, especially during spring and fall migration, as the area is situated along the Atlantic Flyway and attracts a variety of avian species (Devine and Smith 1996). In summer, bird watchers seek out species that breed in some of the specialized habitats present in the IBA.

Because the East Block is more remote and less accessible, it receives fewer visitors. A blue-blazed hiking trail (Naugatuck Trail) is accessed from Andrasko Road in the northwest corner of the block (High Rock Grove section) or from Route 42 (Beacon Road) in the southeast section of the block (Beacon Cap section). Entering from the northwest, the Naugatuck Trail follows a former logging road about 0.5 mile until it diverges from the logging road in the Egypt Brook ravine area and continues to Route 42 (Beacon Road) in Bethany. Along its length, the Naugatuck Trail meets with one short connecting spur trail (Whittemore Trail) leading to a small dirt parking lot on Route 42 (Beacon Road) and a second spur leading to a viewpoint. The second spur trail leads to the Beacon Cap summit at 770 feet (234.7 m), which presents a panoramic view of the countryside to the south and east. Beyond the Beacon Cap spur,

the Naugatuck Trail merges with a dirt road (Little Beacon--a former town--Road) before ending at Route 42 (Beacon Road) about a quarter mile east of the Whittemore Trail parking area.

3.2 Historical Use

The Naugatuck River Valley has a rich and colorful history. Prior to European settlement, Native Americans hunted and traveled through the area setting up camps along the Naugatuck and Housatonic Rivers. Early inhabitants of the area were of the Algonquian-speaking Paugussett tribe; the Paugussetts had a main encampment along the lower Naugatuck River near its confluence with the Housatonic River (DeForest 1852). A smaller group, the Naugatuck tribe occupied a village near the falls in Seymour (Barber 1849). The name "Naugatuck" itself is of Native American derivation meaning "one large tree" which reportedly referred to a location along the Naugatuck River north of the falls (Barber 1849), near the current Seymour-Beacon Falls town line. Orcutt (1882) reported what he felt was a more accurate interpretation of the name's derivation, stating that the pronunciation refers to "a tidal or broad river, or winding river." He believed that the river near the falls in Seymour, where the Naugatuck tribe resided, appropriately fit the descriptions of a winding river as it twists and turns in several directions over a short distance before and after the falls.

European settlers arrived in the area and formed the Derby settlement in 1651. Like most early settlements, Derby took advantage of the fresh water and means of transportation provided by the river. As Derby grew during the late-1670s through 1680, settlers began to disperse up the valley. Reportedly the Derby settlement at one time extended up the Naugatuck River and included Seymour, Beacon Falls, Oxford, and part of Naugatuck. During the eighteenth century, much of the upland area was settled and forest turned into farmlands; remnant stone walls still remain within the forest. In 1693, the land --which now includes at least the West Block--was purchased from the Derby Paugussetts' chieftains by a young Native American named Toby. According to Orcutt (1882), Toby was said to be a Narragansett Indian captured as a boy by Capt. Ebenezer Johnson of Derby during King Philip's War in 1676; he was held as a slave by Capt. Johnson for 12 years until set free. Toby owned the land until his death in 1734 and left it to Capt. Johnson's three sons and Timothy Wooster (Orcutt 1882). Toby's Rock Mountain in the IBA still carries the former owner's name. About 1815, John Sherman built a house and sawmill at the base of Spruce Brook Ravine (formerly known as Sherman's Gorge) and Toby's Rock Mountain (Hughes and Allen 1976). Major timber harvests took place during this period as trees were cut and milled for ship timber and used for fuel and charcoal production.

In the late 1700s and 1800s, the Naugatuck River Valley became an active industrial area when the Naugatuck River and tributaries were used for water power. Dams were built in Beacon Falls, Naugatuck, and elsewhere along the river to accommodate the growing industrial demand. A dam built in Beacon Falls backed the river up into the forest, forming an impoundment (Figure 3-4). Unfortunately, the rivers were also used as a dumping ground for sewage and industrial waste. Along with the growing industry in the mid-1800s came the building of the Naugatuck Railroad. This railroad line eventually threaded its way through the valley and facilitated shipment and receipt of raw materials and finished products.

Not long after the railroad was built, the Naugatuck Railroad Company identified a particularly scenic and unique spot between Naugatuck and Beacon Falls where the river passed through a narrow canyon--the forested area near Spruce Brook's outlet--and decided to develop it into a picnic grove. Eventually called High Rock Grove, this location became a premier picnic destination in 1876 (Hughes and Allen 1976) and reached its heyday in the 1880s. It boasted a 5000 square-foot roller skating rink, dancing pavilion, refreshment stand, and restaurant, along with a brass band which greeted passenger cars. It was advertised as the "famous, most extensive and popular pic-nic grounds in the State of Connecticut, noted for its Romantic and Weird-Like Scenery" (Leuchards 1977). Activities at that time included picnicking, row-boating, hiking, dancing, and roller-skating. Trails in use during that period led into Spruce Brook

Gorge (ravine) and up to the top of High Rock, the summit of Toby's Rock Mountain. High Rock Grove had a brief but busy life. During its prime, excursion trains to the Grove would run from Waterbury, Bridgeport, New Haven, and other points, making stops enroute. In a single season High Rock Park had 80,000 visitors (Hughes and Allen 1976).

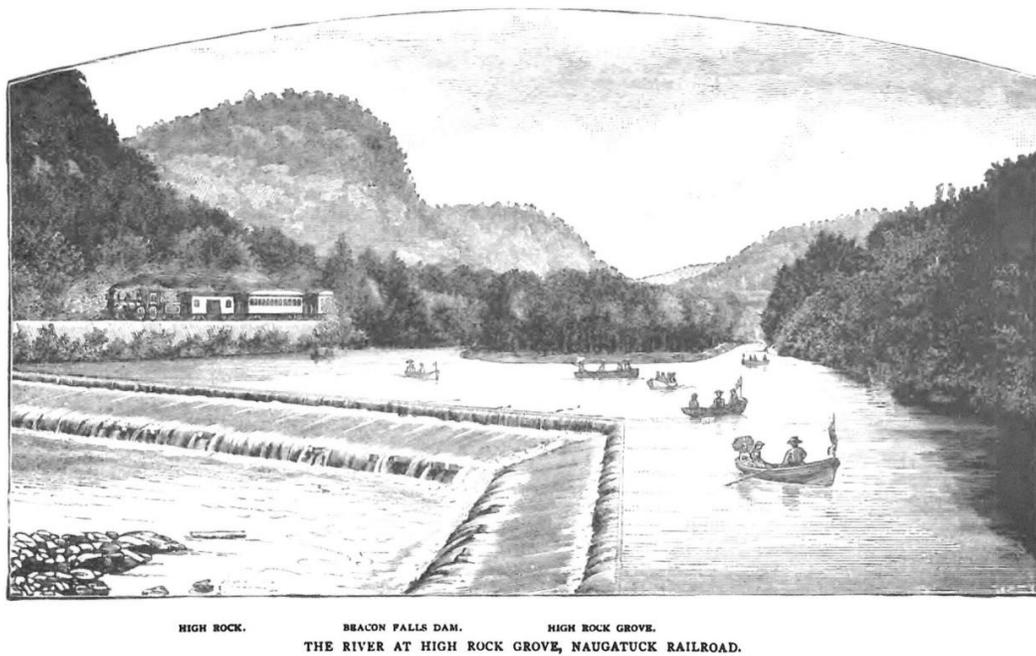


Figure 3-4. Drawing of the Beacon Falls Dam on the Naugatuck River with the Naugatuck State Forest in the background (Orcutt 1882).

Meanwhile, due to sewage and industrial waste discharges, the river was becoming noticeably more polluted by the late nineteenth century. The State Board of Health reported that the river reached the limits of permissible pollution due to discharges of municipal sewage and industrial wastes (Williston 1887). A subsequent report by the State Board of Health (1915) reiterated that the river was badly polluted and mill and factory discharges furthered a condition already deplorable. This grossly polluted condition was essentially unchanged into the late 1960s and early 1970s.

Around the same period, the Seymour Water Company started purchasing land west of the Naugatuck River along Pines Brook in Beacon Falls and Oxford--what is now part of the West Block of the NSF--possibly in response to the deteriorating status of the Naugatuck River and other nearby rivers. In 1899, a dam was constructed across Pines Brook--formerly known as Chestnut Tree Hill Brook--forming the first of what would eventually be four reservoirs (G. Haines pers. comm.). The second, Reservoir 2, was developed in 1909 and a third, Reservoir 3, in 1916 (G. Haines pers. comm.). The development of Reservoir 4 has a somewhat murky history. The dam as it appears now was constructed in 1950-51. A 1934 aerial map depicts a waterbody much the same as the reservoir looks today but without a large earthen dam along its southern end. However, a small obstruction which may be a beaver or old

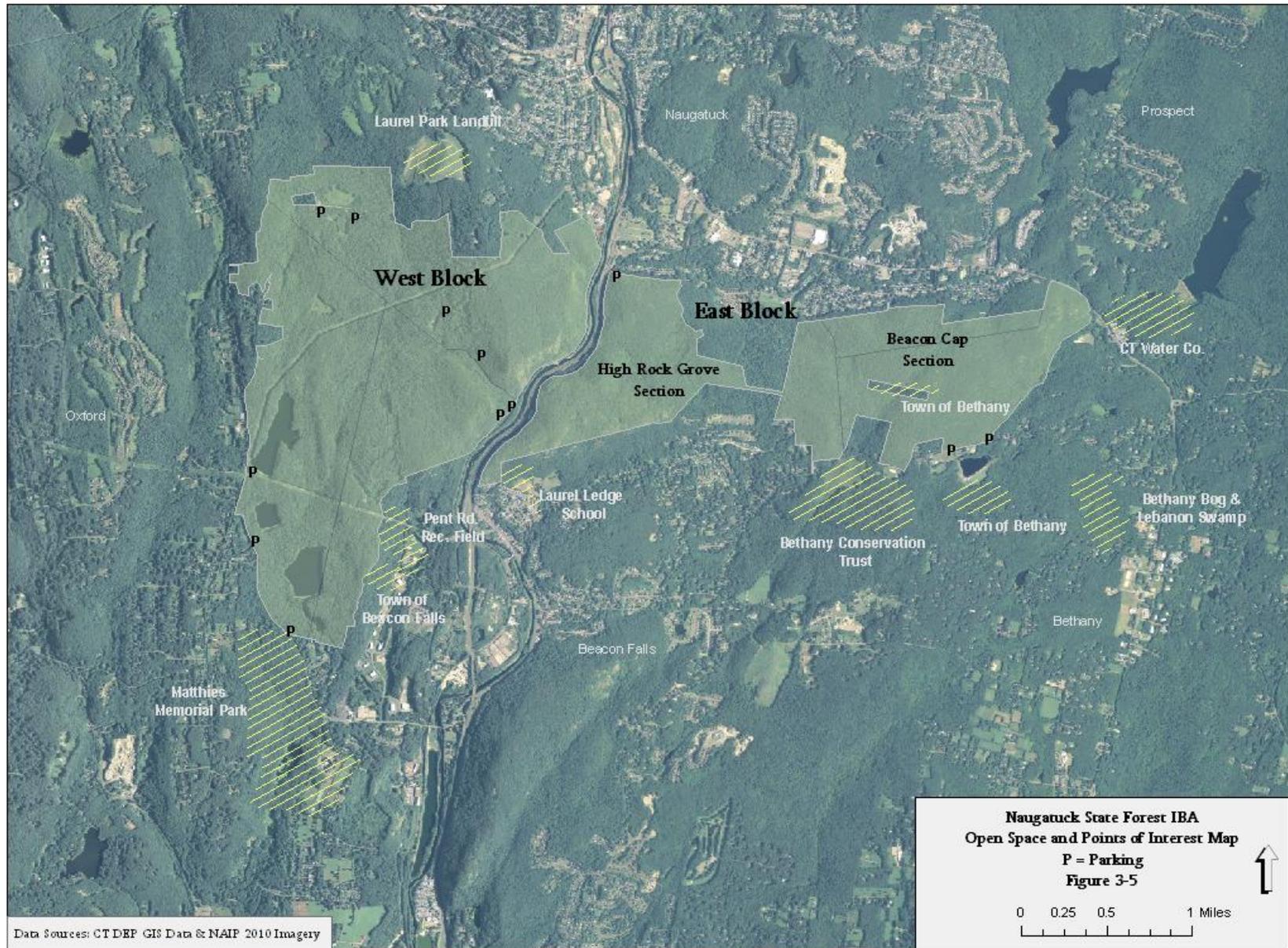
makeshift dam can be seen in the photograph. Later maps do not show a reservoir there until the 1950 and 1951 aerial photos. It is speculated that the 1938 hurricane destroyed the dam and consequently the former pond, which reportedly was called Chestnut Tree Hill Pond.

Starting in 1921, Harris Whittemore, a local industrialist and member of the State Forest and Parks Commission, began purchasing land in the Naugatuck Valley with the intention of donating the property to the state. Conifers were planted on 260 acres east and west of the Naugatuck River with the assistance of his forester, William Shepardson (CTDEP 2005a). Unfortunately, Mr. Whittemore died in 1928 prior to transferring the property. But heirs to the property continued to acquire land and subsequently donated about 2,000 acres to the state in 1931. In the 1930s, the Civilian Conservation Corps worked on the property and built roads, trails, fire ponds, picnic areas, and made other improvements. Since the initial land donation by the Whittemore family, the Naugatuck State Forest has expanded over the years as a result of further donations and land purchases. In 2001, there was a major acquisition of more than 500 acres of reservoir property. Several subsequent acquisitions have occurred since 2001. The most recent purchase was of a small in-holding (1.75 acres) in the West Block near the junction of Hunters Mt. and Whittemore Roads. Today, the IBA consists of 3,436 acres.

3.3 Abutting and Proximal Lands

The landscape surrounding the IBA is diverse and includes urban and commercial areas as well as rural properties. The Borough of Naugatuck lies directly to the north and is densely developed with urban and commercial property. Unfortunately in view of the scarcity of open space in the region, construction of a new 275-home residential development near the West Block's northern boundary was recently approved by the Borough. Immediately north of the West Block's boundary is the Laurel Park Landfill, an approximately 35-acre closed landfill (Figure 3-5). Due to landfill closure requirements, the site is maintained as required with grasses and forbs to prevent erosion of the cap, thus providing an early-successional grassland habitat. South of the IBA lies the Town of Beacon Falls, urban and commercially developed at its center, but becoming more residential and semi-rural at its outer eastern and western edges. Oxford forms the western boundary of the site; the landscape in Oxford is mostly rural, but a recent golf course development with about 300 homes is located approximately 0.25 mile west of the IBA's boundary. The town of Bethany spans the southeast landscape beyond the IBA. Bethany is predominately rural, with homes and old farms situated on large parcels and featuring many acres of open space. Nearly adjacent to the IBA in this area are protected lands owned by the Town of Bethany, the Bethany Land Trust, Inc., and the Connecticut Water Company.

Some protected tracts of land can be found in outlying areas within close proximity of the IBA (Figure 3-5). Matthies Park, owned by the Town of Beacon Falls, covers almost 260 acres in Beacon Falls and Oxford, where it abuts the southwest corner of the West Block. Also adjoining the West Block in Beacon Falls is the Pent Road Recreation Facility comprising almost 50 acres of athletic fields and forested habitat, split about evenly. Adjacent to the IBA in the same area, the town owns another parcel of 39 acres which borders the Pent Road Recreation Facility. The Region 16 School District, also in Beacon Falls, owns approximately 25 acres, part of which is developed as athletic fields; the other portion is forested land which extends up the steep mountainside toward rocky summits and balds along its boundary with the East Block. Some of these bald areas may actually be on the school district's property.



The Town of Bethany hosts a number of undeveloped properties in close proximity to the IBA's East Block (Figure 3-5). Within and adjacent to the IBA, the Bethany Land Trust, Inc owns approximately 125 acres known as Mendell's Folly. The property consists of a large beaver-maintained wetland complex with a forested upland component. Next to Mendell's Folly's eastern boundary, the town owns almost 145 acres of open space, which includes the 54-acre Veterans Memorial Park. To the east, the town's property adjoins the 62-acre Bethany Bog, an Atlantic White Cedar (*Chamaecyparis thyoides*) bog, owned by Yale University. Within the East Block's Beacon Cap section, surrounded by IBA property, is a small town-owned in-holding of 12 acres. Another significant property in Bethany is the nearly 4,000 acres of open space owned by the Connecticut Water Company and South Central Connecticut Regional Water Authority (Conservation Commission 2003). The Connecticut Water Company land in turn adjoins the East Block and stretches eastward across Route 63 (Amity Road), thereby forming an unbroken greenbelt which connects other water company properties and the NSF's Mt. Sanford Block. This greenbelt corridor extends south to West Rock Ridge State Park and New Haven.

Due to the IBA's immensity and its location within four separate municipalities, its borders touch upon several hundred properties. Although there are a great number of residential properties of five acres or smaller surrounding the IBA, they are not included in Table 3-1 or Figure 3-6. Most of the parcels greater than five acres are listed in Table 3-1, while the larger lots are presented on Figure 3-6. In most cases the parcels are lands without dwellings, but several contain a residence accompanied by a significant amount of undeveloped land. While most of the properties directly abut the IBA, a few of the listed properties adjoin other parcels which have an important connection to the IBA.

3.4 Stakeholders

This IBA was nominated by the Naugatuck Valley Audubon Society and subsequently recognized by Audubon Connecticut in December, 2004. Although the IBA is owned by the state and managed by CTDEP, there are many other stakeholders with a vested interest in the forest, ranging from outdoor recreation enthusiasts to timber harvesting operations.

Many, if not most, of the parties who are concerned about the use and management of the NSF are individuals or groups who pursue the variety of recreational activities discussed in the Site Description subsection above. They value the forest for its scenic qualities, natural resources, and/or wildlife, or utilize specific NSF amenities such as the trails or shooting range.

There are a number of other entities who have a stake in the future of the NSF---research organizations, towns, various conservation groups, and lumber associations. A list of the agencies, organizations, and individuals that have been identified as stakeholders can be found in Table 3-2.

Once potential stakeholders were identified, they were distributed a survey which sought to determine their levels of interest, aspects of the forest which they felt were most important, what conservation concerns they had for the forest, and their views regarding possible threats the IBA was facing (Appendix B). Stakeholders were also given an opportunity to review the draft conservation plan and were encouraged to provide input or comments. Comments, concerns, or suggestions received from stakeholders were incorporated into the final plan

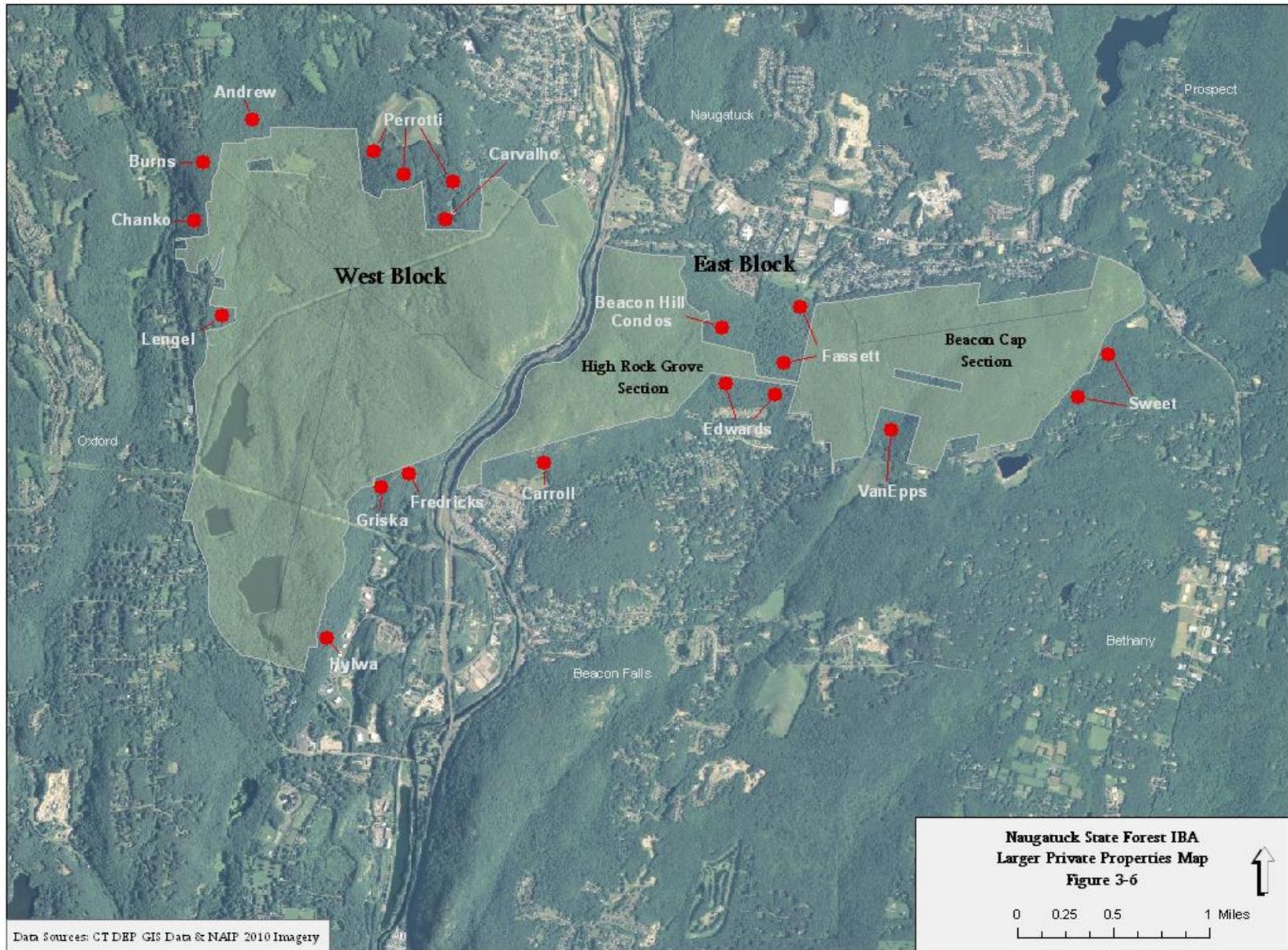


Table 3-1. Larger Lots Abutting the Naugatuck State Forest IBA.

Owner	Map No.	Block No.	Acreage and Comment
Beacon Falls			
Hylwa, A.	003	001-0013	31.84 With dwelling
Catalqano, C., A., & R.	004	001-0001	30.9 Abuts town recreational park
Town of Beacon Falls	004	001-0011	39.1 Undeveloped
Fredricks, H.	005	001-0002	30.0 With dwelling; may include balds
Griska, C. & D.	005	001-0007	51.9 May include balds
Beacon Hill Condo Asson.	015	0001-0001	53.26 Condos (w/ large parcel of vacant land)
Fassett Property Ltd. Partnership	015	001-0002	64.78 With vacant dwelling
Fassett, H. & H.	015	001-0002-A	34.0 With dwelling
Carroll, G.	016	001-0001	63.8 May include balds
Cote Siding and Windows	016	001-0019-A	16.36 Vacant residence
Regional School District #16	016	001-0001-A	24.8 Recreation fields; may include balds
Edwards, C	017	002-0002	49.76 With dwelling
Edwards, C	017	002-0033	28.64 With dwelling
Vardon, R. & T.	017	002-0001	21.57 With dwelling
Bethany			
Town of Bethany	104	Lot 1	12.0 Inholding within IBA
VanEpps, D	104	Lot 2	26.6
Sweet, Ray	110	Lot 4	6.1
Sweet, Rich.	110	Lot 6	60.5 Includes adjacent wetlands
Rostowsky, E	115	Lot 11	16.75 Arrowhead Grove
Sweet, Rich	116	Lot 1	33.5
Naugatuck			
Andrew, F	E	6W-29	102.92 With dwelling
Andrew, R	E	6W-21	3.52
Uhas et al.	E	6W-23	8.59
Laurel Park Coalition	I	6W-9.5	25.47
Laurel Park Associates ^a	I	6W-13 et al	7.75 (total of 9 additional parcels = 74.4 acres)
Laurel Park Coalition	I	6W-49.5	7.06
Perotti, F. et al.	I	6W-15	14.0
Perrotti, & Sons	I	6W-49	40.45
Perrotti, F	I	21W-1	16.2
Perrotti, F	I	21W-2	10.3
Machics	I	21W-3	20.0 With dwelling
Carvalho, B	I	21W-11	16.0
Oxford			
Burns,	36	4-5	31.2
Chanko	36	4-7	28.34
Ladyko	36	4-8	21.54
Lengel	36	4-12	10.64
DeBisshop	37	5-	23.07

^a Laurel Park Assoc. owns 10 parcels including the former landfill. Parcels include: 6W-13 and 6W-14, 6W-31, 6W-34, 6W-35, 6W-37, 6W-40, 6W-54, 6W-55, and 6W-59.

Table 3-2. List of Stakeholders and Their Association with the Naugatuck State Forest IBA.

Stakeholders	Association with Naugatuck State Forest
Stakeholders with direct IBA involvement	
Audubon Connecticut	Part of National Audubon and the entity responsible for managing the IBA program in the state.
State of Connecticut	Property owner.
Connecticut Department of Environmental Protection (CTDEP)	CTDEP's Forestry Division is the main steward while the Park & Recreation and Wildlife Divisions have supporting roles.
Naugatuck Valley Audubon Society (NVAS)	A local Audubon chapter with membership in the Naugatuck Valley region. The NVAS nominated the forest as an IBA.
Town Governments	
Borough of Naugatuck	Part of IBA within borough boundary
Town of Beacon Falls	Part of IBA within town boundary
Town of Bethany	Part of IBA within town boundary
Town of Oxford	Part of IBA within town boundary
State-wide Organizations or Corporations	
Connecticut Agricultural Experiment Station (CAES)	A state entity that conducts research on agricultural pests, chemicals, and forest health. CAES conduct forestry research within the IBA.
Connecticut Audubon Society (CAS)	State-wide environmental organization whose members occasionally visit the forest.
Connecticut Forest & Park Association	State-wide organization that maintains the blue-blazed trail (Naugatuck Trail) in the IBA's East Block.
Connecticut Light & Power (CL&P)	CL&P a subsidiary of Northeast Utilities manage the powerline rights-of-way in the IBA.
Connecticut Ornithological Association (COA)	State organization dedicated to the conservation, protection, and appreciation of birds. Members regularly visit the forest.
Connecticut Professional Timber Producers Association	Association represents professional lumber companies, several of which have won contracts to harvest timber in the forest.
Connecticut Sportsmen's Alliance	A group representing hunting interests in the state and hunters using the forest.
National Organizations	
Boy Scouts of America (Housatonic Valley Chapter)	Have worked on projects related to the Naugatuck River and may be able to assist with nest box projects and/or other forest related enhancements.
Girl Scouts of America	Similar to above group.
Local Organizations/Groups	
High Rock Shooting Association	Lease land from the state to operate a shooting range in the forest.
Naugatuck River Watershed Association	Local non-profit organization dedicated to the improvement of the Naugatuck River and watershed.
New Haven Bird Club	Local bird club with membership in the area.
Western Connecticut Bird Club	Local bird club from the area. Several club members watch birds in the forest.
Private Citizens	
Bruce Finnan	Local photographer and bird watcher who visits the forest.
Greg Hanisek	Local naturalist and COA member who regularly visits the forest.
Mark Szantyr	Bird watcher and COA member who formerly lived in the area and regularly visited the forest.
Roy Harvey	Local bird watcher and COA member who frequently visits the forest.
Sophie Zyla	Local photographer and student conducting research in the forest
Jeff Ruhloff	Local photographer and nature enthusiast who frequently visits the forest

4.0 NATURAL RESOURCE INVENTORY

4.1 Designation as an IBA

A diverse assortment of upland terrestrial and aquatic habitats makes the NSF a prime site for a variety of bird and wildlife. The NSF is a known or suspected breeding locality for several state-listed bird species and other avifauna of high conservation priority. It's also one of the state's important inland stopover areas for neotropical migrant birds. Audubon Connecticut recognized the IBA primarily for its early-successional shrubland and forest habitats. Other key habitats described in Connecticut's Comprehensive Wildlife Conservation Strategy Plan (CWCS) such as Pitch Pine (*Pinus rigida*) woodlands, Bear Oak (*Quercus ilicifolia*)---also known as Scrub Oak---shrublands, grassy glades, acidic seeps, and vernal pools, can be found within the IBA (CTDEP 2005b). The site also supports several state-listed reptiles, invertebrates, and plants.

To qualify as a state IBA, a site must meet at least one of five program criteria. Table 4-1 below lists the five criteria and describes the features of the NSF which conform to the requirements. The NSF meets at least four criteria---numbered 1, 2, 3, and 5 in this table---and may potentially conform to the criterion cited fourth on the table. While the IBA is known to be an important migratory corridor and stopover area for avifauna (Devine et al. 1989), it may not meet existing requirements, and additional review may be required to make a final determination.

Two of the IBA selection criteria focus primarily on bird species of conservation concern and are perhaps the most significant factors in the designation of this site as an IBA. With regard to the criterion One--the importance of the site for state endangered or threatened species--the presence of Golden-winged Warbler (*Vermivora chrysoptera*) as a possible breeder meets this criterion. This species is discussed in detail in Section 4.7. Criterion 2, which states that a site must be important to species of high conservation priority, is also met, with at least 100 bird species so designated having appeared in the NSF. Detailed remarks can be found in Section 4.7.

4.2 Abiotic Features

4.2.1 Climate

Connecticut's geographical position and topographic features shape the regional climate (Brumbach 1965), which is influenced by the interaction between continental air from the prevailing westerly winds and warm moist maritime air carried north from the Caribbean Sea (Metzler and Barrett 2006). In general, Connecticut has wide daily and seasonal temperature ranges, along with relatively uniform precipitation throughout the year.

Brumbach (1965) separates the state's climate into five divisions, primarily derived from geographic factors; the NSF lies within the climatological region called the Southwest Hills Division. Table 4-2 summarizes climatic data taken for the Southwest Hills Ecoregion described by Dowan and Craig (1976). Although not identical, the Southwest Hills Ecoregion overlaps Brumbach's Southwest Hills Climate Division, both of which include the IBA. Average monthly temperatures range from 29.5°F in winter to 85°F in summer with an annual mean temperature of 49.5°F (Table 4-2). Average annual precipitation is approximately 45 in.

Table 4-1. IBA’s Conformance with Audubon Connecticut’s State IBA Criteria

CT IBA SELECTION CRITERIA	SITE CONFORMANCE
1. The site is important to state endangered or threatened species.	The state-endangered Golden-winged Warbler (<i>Vermivora chrysoptera</i>) historically nested within the IBA and possibly again in 2006 – 2008.
2. The site is important to species of high conservation priority.	At least 100 species of conservation concern have been observed in the forest. Using the criteria “a species is known to breed at the site” the high priority species are Whip-poor-will (<i>Caprimulgus vociferous</i>), Blue-winged Warbler (<i>Vermivora cyanoptera</i>), Prairie Warbler (<i>Setophaga discolor</i>), Worm-eating Warbler (<i>Helmitheros vermivorum</i>) and Wood Thrush (<i>Hylocichla musteliana</i>).
3. The site contains rare or unique habitat within the state/region or an exceptional representative of a natural habitat, and that holds important species or species assemblages largely restricted to a distinctive habitat.	The site is comprised of diverse habitats, but most important are early successional shrublands and extensive forestland interwoven with a mixture of wetland and aquatic areas. Additionally, it contains key habitats such as grass glades and balds, acidic wet seeps, Pitch Pine-Bear Oak woodlands, and vernal pools, described in the Comprehensive Wildlife Conservation Strategy (CTDEP 2005b).
4. Significant numbers of birds concentrate for breeding, during migration, or in winter at the site.	The forest is known for supporting excellent concentrations of migratory landbirds including warblers and other Neotropical migrants (Devine et al. 1989). Common Nighthawk (<i>Chordeiles minor</i>) and Chimney Swift (<i>Chaetura pelagic</i>) annually migrate along the riverine corridor.
5. The site is important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education.	The NSF has served as a long-term research and/or monitoring site for avian study, and secondarily, for forestry study. Table 6-1 provides a summary of all former/current research conducted at the IBA.

Table 4-2. Climatic Data for the Southwest Hills Ecoregion.

Mean annual temperature	49.5 °F
Average winter temperature (December-February)	29.5 °F
Mean coldest month temperature	19 °F
Mean annual minimum temperature	-5 °F
Average seasonal snowfall accumulation	40 in. (1.0 m)
Average frost free season	160 days
Average summer temperature (June-August)	70 °F
Mean warmest month temperature	85 °F
Average annual precipitation	45 in. (1.2 m)

From Dowan and Craig (1976)

4.2.2 Topography

The Naugatuck State Forest lies in the southwestern part of the Western Uplands and predominantly in the Naugatuck Quadrangle, though a few acres in the extreme northeast corner of the East Block intrude into the adjacent Mount Carmel Quadrangle (Figure 1-1). The Western Uplands as described by Bell (1985) is an area of rolling hills and valleys, but the topography in the Naugatuck State Forest is in stark contrast, with rocky and rugged terrain, especially along the Naugatuck River Valley. The valley is narrow and steep-sided with a steeper gradient as it cuts through the forest (Flint 1978). Here the river bisects a canyon which looms 400-500 ft (122-153 m) above the valley floor with impressive cliffs of exposed bedrock, especially along the canyon’s western wall. Several benched terraces scattered along

the canyon's wall at 200 ft (61m), 250 ft (76 m), 400 ft (122 m), and 450 ft (137 m) were likely formed as a result of glaciofluvial processes.

Elevations in the forest vary from 150 ft (45.7 m) along the Naugatuck River to approximately 860 ft (262 m) in the northwest corner of the West Block (Figure 1-1). Changes in elevation along the riparian corridor can be dramatic, varying from 150 ft (45.7 m) along the river to 690 ft (210.3 m) at Toby's Rock Mountain. In the northeastern section of the East Block, the summit of Beacon Cap is approximately 770 ft (234.7 m).

4.2.3 Water Features

Various aquatic features are associated with the landscape in the NSF. These areas include reservoirs, ponds, brooks, intermittent creeks, and the Naugatuck River, along with wetlands and vernal pools. Although the Naugatuck River isn't technically within the forest, it's a dominant feature of the area and the drainage basin for the entire Naugatuck Quadrangle.

Numerous permanent water bodies are identified by name on topographical and/or CTDEP forest maps. All water bodies except for Beacon Hill Brook and Egypt Brook are within the West Block. Along the western boundary of the state forest are four manmade reservoirs which were formed by placement of earthen and rock dams across Pines Brook, which was formerly known as Chestnut Tree Hill Brook. Pines Brook flows north to south through the area entering the reservoir system via Reservoir 4 and exiting through Reservoir 1.

Hunters Pond and Wildlife Impoundment are additional manmade impoundments created by a concrete dam and earthen dike, respectively. The outflow from Wildlife Impoundment runs down gradient to Hunters Pond which in turn drains via Live Oak Brook into Spruce Brook. Spruce Brook is the main tributary which drains the center of the West Block flowing eastward through the ravine and into the Naugatuck River; Sugar Bush Brook, another tributary, parallels Spruce Brook along the block's northern boundary. Two unnamed ponds are located near the forest boundary in the northeastern section of the block, one of which forms the headwaters of Sugar Bush Brook.

In the East Block, Egypt Brook is the counterpart to Spruce Brook, draining the center of the block and flowing westward into the Naugatuck River. Along the East Block's north and east boundary is Beacon Hill Brook, which carries water from the area and follows the NSF boundary until it discharges into the Naugatuck River near the northwest corner of the block. Several unnamed tributaries drain the southern part of the block and eventually enter Bronson Brook, also known as Hockanum Brook, which empties into the Naugatuck River.

4.2.4 Water Quality

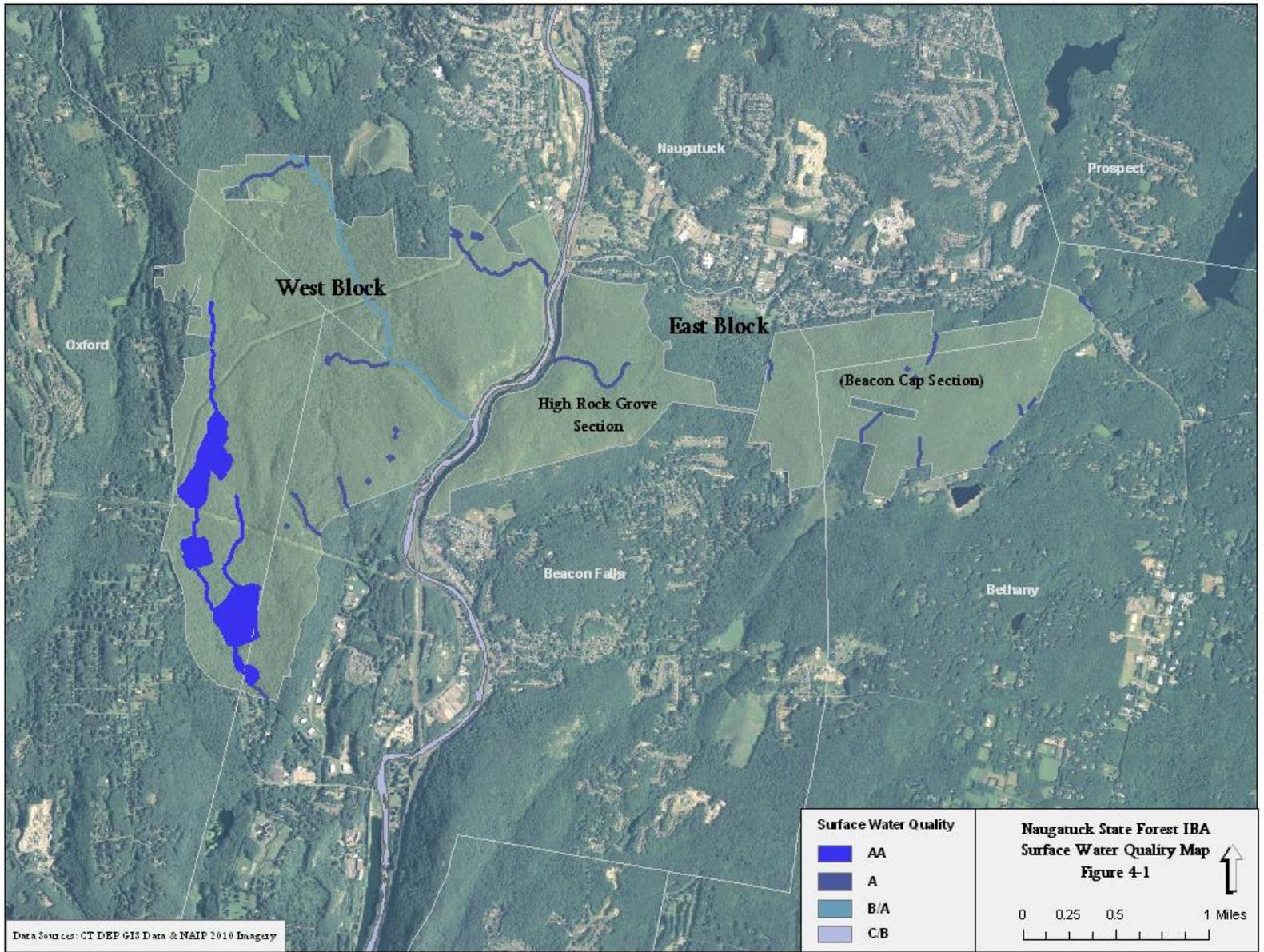
The Water Quality Standards (WQS) are important elements in Connecticut's clean water program and set overall policy for management of the state's surface and groundwater. The WQS address the protection of water quality and provide a classification system for state water bodies. Each classification contains descriptions which identify: allowable discharges; specific parameters for monitoring water quality; and designated uses that should be supported under the classification. Surface water has a classification, from best to worst of AA, A, B, C, and D. Waters classified as Class C and D are of unacceptable quality; the goal of management of these water bodies is their improvement to Class B or Class A status. Groundwater classifications, again from best to worst, are GAA, GA, GB, and GC. Any groundwater with a GB classification is presumed unfit for human consumption without treatment, while GC rated groundwater is unsuitable for use or development as a public or potable water supply.

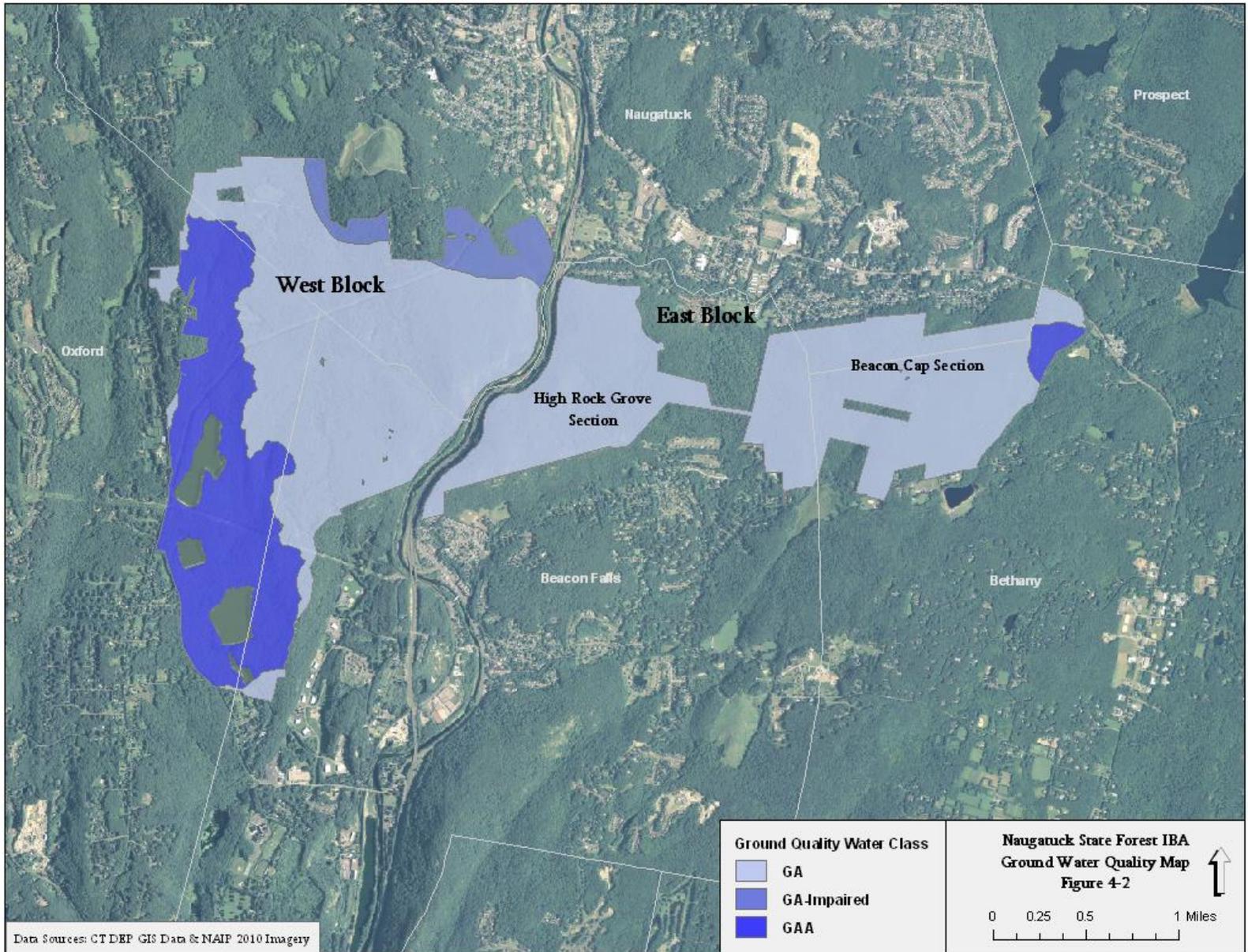
Surface Water Water quality classifications within the NSF are presented in Figure 4-1. Pines Brook and the former reservoirs are the only water bodies noted as Class AA waters. Designated use of Class AA surface waters are for: existing or proposed drinking water supplies; habitat for fish and other aquatic life and wildlife; recreation; navigation; and water supply for industry and agriculture (CTDEP 2002). All other waterbodies in the NSF, except for the Naugatuck River and Spruce Brook, are described as Class A surface waters. Surface waters with this classification are suitable as habitat for fish, other aquatic life, and wildlife; as potential drinking water supplies; for recreation and navigation; and as water supplies for industry and agriculture (CTDEP 2002).

Spruce Brook is classified as a Class B/A waterbody. According to CTDEP (2002), Class B/A surface water is designated for the same purposes as Class A water, but it may not be meeting the criteria for one or more designated uses. The water quality goal is achievement of the Class A Criteria and attainment of the designated uses as described above. Apparently, Spruce Brook's classification is compromised due to its close proximity to the former Kaladish property on Andrew Hill and, possibly, the Laurel Park Landfill; potential water quality degradation from landfill leachate or runoff likely accounts for this classification (C. Fitting, personal comm.).

The Naugatuck River has a water quality classification of C/B (Figure 4-1). At this time the river is not meeting the clean water criteria and/or not supporting one or more assigned designated uses, a direct result of historic and current impacts from point and non-point source pollution. Two of the river's designated uses are not being met: providing habitat for fish, other aquatic life, and wildlife; and suitability for recreational use. Habitat impairment causes are unknown but may result from several potential sources: sanitary sewer overflow (collection system failure), dredge mining, industrial point source discharge, unspecified urban stormwater, or municipal point source discharges (CTDEP 2006). The river is not meeting the designated use for recreation due to the presence of indicator bacteria. The presence of *Escherichia coli* bacteria is the cause of this impairment. The pollution contributing to the unacceptable levels of *E. Coli* is attributed to unspecified urban runoffs, sanitary sewer malfunctions, and/or unknown sources.

Ground Water Most of the groundwater within the NSF has a GA classification. Two small sections are considered GA- impaired and two other areas are designated as GAA (Figure 4-2). The portions of groundwater which have been designated as GA-impaired are likely assigned this more conservative rating due to close proximity to former disposal sites, the Kaladish property and the Laurel Park Landfill, since there is the potential for receiving degraded groundwater when it moves through fractured bedrock underlying the area. The groundwaters associated with the reservoir system and northeast corner of Beacon Cap section are classified as GAA. Both locations were assigned this classification because the watersheds are associated with existing or potential public water supplies. The reservoir system's watershed supplied public water until 1987, while the groundwater in the northeast section of Beacon Cap is part of the watershed for a nearby Naugatuck reservoir system (Figure 4-2).





4.2.5 Wastes Disposal Sites

Within close proximity to the NSF are two sites which formerly received sanitary, hazardous and/or industrial wastes. These sites are the Laurel Park Landfill, also known as Murtha's Dump, on Hunters Mt. Road, and the Kaladish property, also known as Kaladish Waste Disposal, on Andrew Mt. Road. Laurel Park Landfill (LPL) is located slightly north of the West Block's boundary on Hunters Mt. Road (Figure 3-5), while the former Kaladish property is situated northwest of Laurel Park Landfill on Andrew Hill near the headwaters of Spruce Brook.

Laurel Park Landfill received sanitary and industrial wastes from the 1930s until it closed in 1987. In 1981, the landfill was recognized as a federal Superfund Site because it received industrial and hazardous wastes. The property consists of 35 acres, 19 of which were used as the former landfill. In 1988 the landfill commenced the closure process. Among other stipulations of the closure, the facility was required to install a leachate collection system and place a multi-barrier cap with a vegetative cover over the former disposal area. Because leachate from the landfill contaminated nearby private wells, the property owners were also required to provide a public water supply to nearby residents.

The Kaladish property was initially investigated for environmental violations by CTDEP in the early 1980s and subsequently referred to the U. S. Environmental Protection Agency (USEPA). This 70-acre site received municipal and industrial waste from 1949-57. Industrial waste came from several entities including the former Naugatuck Rubber Company. Although investigations by the environmental agencies revealed evidence of former disposal, the EPA concluded that "no impacts to nearby residential populations or sensitive environments are known or suspected" (USEPA updated 2009). Recently, the property and adjacent land was approved by the Borough of Naugatuck for residential development of approximately 275 homes. Remediation of the former disposal areas is stipulated as a condition of the approval.

4.2.6 Bedrock Geology

The bedrock geology of the Naugatuck Quadrangle consists primarily of belts of folded metamorphic and igneous rock of Early and Middle Paleozoic age. This folded bedrock trends irregularly northeast to southwest (Flint 1978). These rocks are mostly schist and gneiss, but thin, diabase dikes of mid-Jurassic age intrude through the metamorphic rock in some areas. The Straight Schist is the predominant unit in the area and forms most of the high-ground between Naugatuck and Beacon Falls (Figure 4-3). It is silvery-gray, generally poorly layered schist composed of quartz, biotite, muscovite, oligoclase, garnet, and commonly staurolite, kyanite (or sillimanite); graphite is usually found throughout (Carr 1960, Rogers 1985).

A second unit, formerly referred to as the Prospect Gneiss by Carr (1960), but renamed by Rogers (1985) as The Taine Mountain and Collinsville Formation undivided forms a tongue-like projection through the reservoir area (Figure 4-3). The Taine Mountain Formation is a gray layered granofels, while the Collinsville Formation consists of a gray to silvery-gray, medium to coarse-grained schist imbedded with amphibolites and hornblende gneiss layers. Both formations are Ordovician in age.

Several minor formations include the Trap Falls Formation, Collinsville Formation (not in conjunction with Taine Mt.) and Buttress Dolerite, a traprock dike (Figure 4-3). The dolerite is dark gray, brown to gray weathering dolerite, compositionally similar to basalt (Rogers 1985). Geologically, the dolerite is a younger formation than those which surround it and it dates roughly from the mid-Jurassic period. Within the East Block, the dolerite dike tracks a northeast to southwest direction through the center of the Beacon Cap section where it lies within a valley and, in one location, a ravine.

4.2.7 Surficial Geology

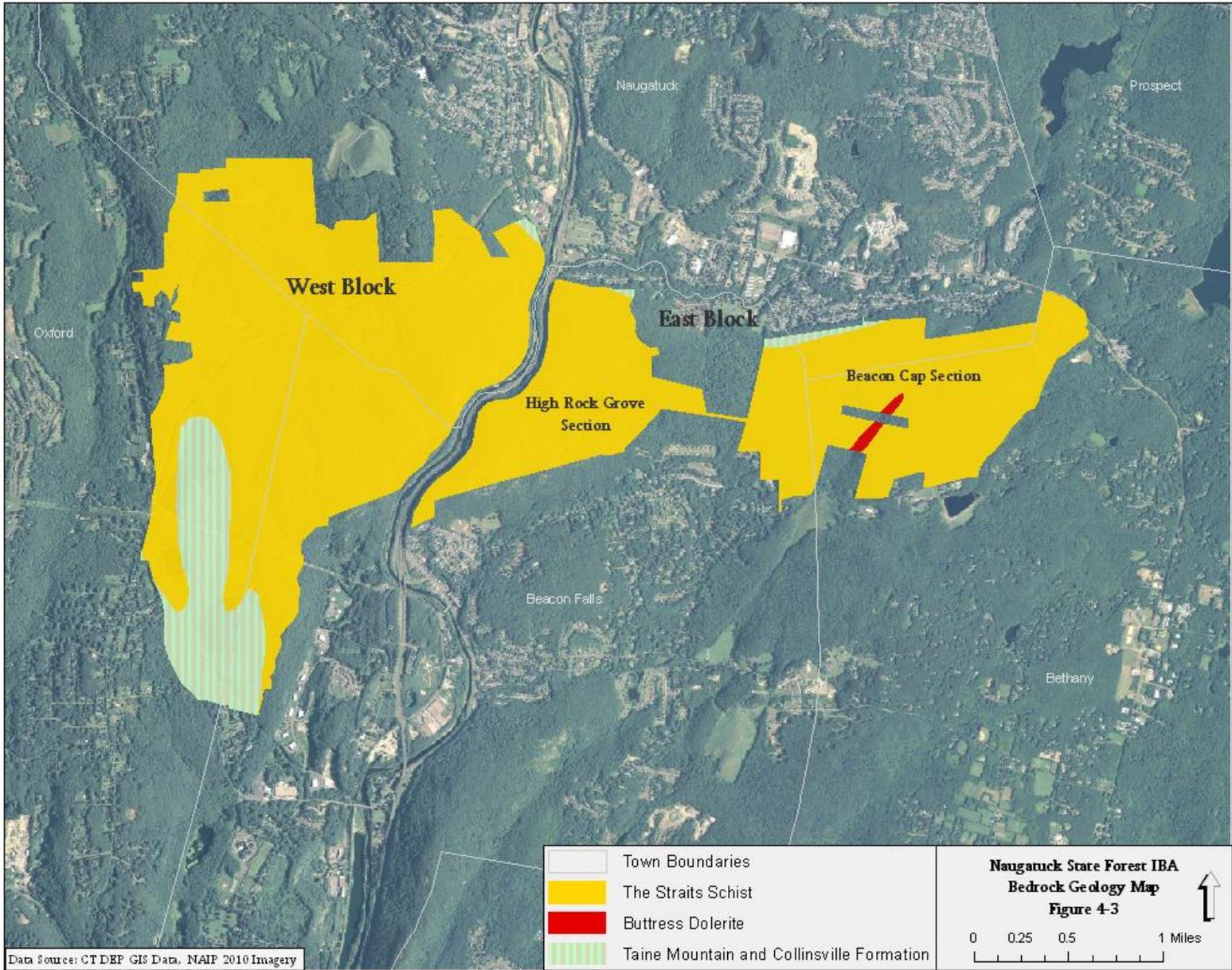
In Connecticut, the unconsolidated surficial materials that overlie bedrock are primarily of glacial origin laid down during the Wisconsin continental glaciations approximately 15,000 years ago (Flint 1971). These sediments, collectively known as glacial drift, consist of two general types. Till is deposited directly from glacier ice, while stratified sand and gravel drift settles in streams and lake-beds created by the melting of glacier ice. Both types are present in the Naugatuck State Forest. Postglacial sediments, primarily floodplain alluvium and swamp deposits, make up a minor portion of the unconsolidated material in the NSF. Alluvium is largely reworked from glacial materials and has similar physical characteristics.

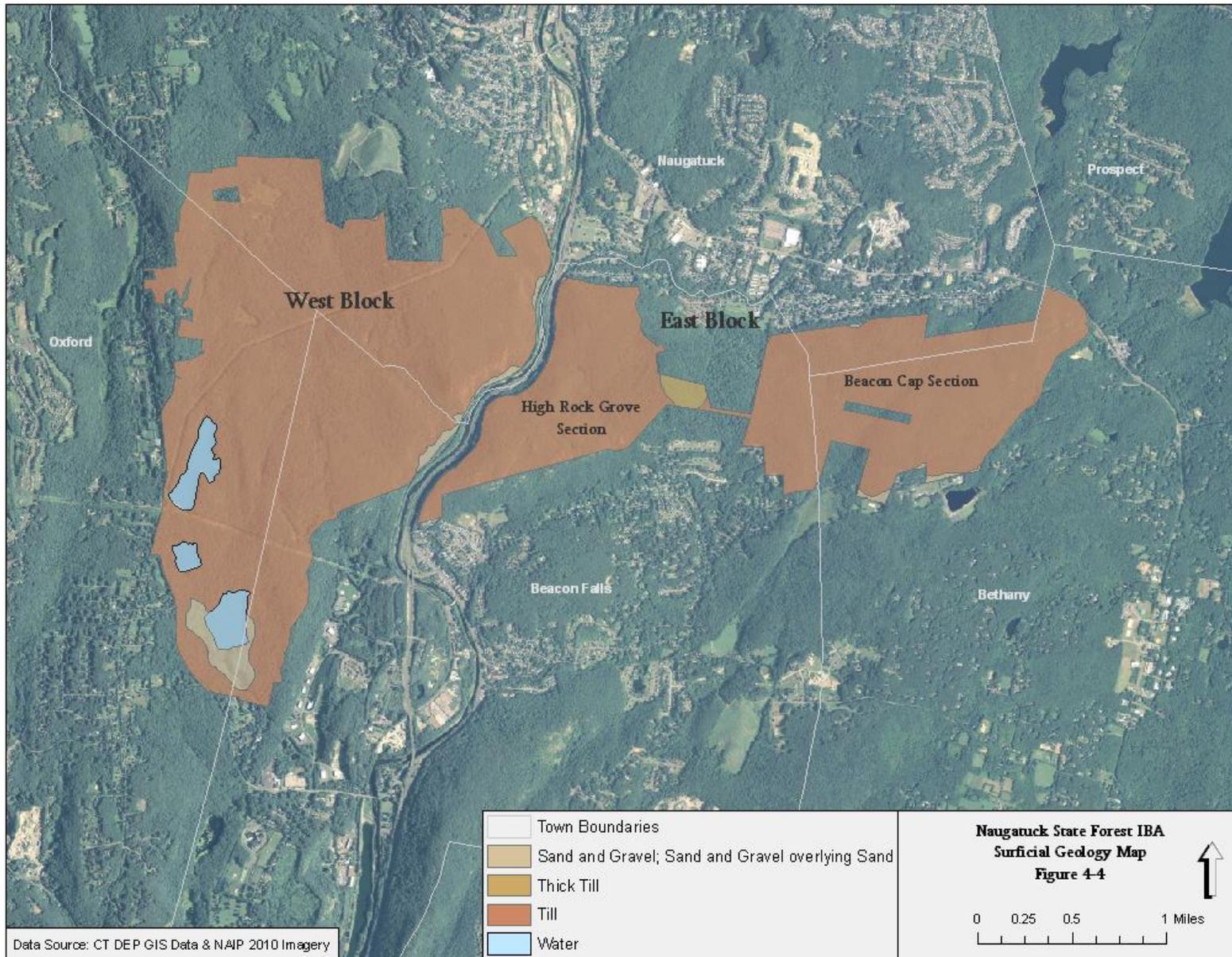
Till In the NSF, till is the predominant surficial material (Figure 4-4). It consists of a non-sorted mixture of particles, ranging in size from clay to large boulders that were laid down directly by the glacier as it moved or as it melted. The till forms a discontinuous mantle over the site, absent in areas with bedrock exposures. Otherwise the till is shallow in summit areas where bedrock is closer to the surface and deeper on mid and lower slopes of the site. In composition the till commonly resembles the bedrock underlying it or occurring a short distance to the north (Flint 1978). One location in the Eastern Block is denoted as containing thick till (Figure 4-4). Thick till is greater than 10-15 ft (3-4.5 m) in depth, and the lower portion is moderately to very compact and commonly less stony than upper till (Stone et.al. 1992).

Of particular geological interest is the presence of several large boulder erratics in the East Block. Flint (1978) mapped at least three such boulders, all greater than 10 ft (3 m) in diameter, in the Beacon Cap section. According to Flint (1978), although he located and marked numerous boulder erratics in the Naugatuck quadrangle, he probably missed many others. These rocks are quite unique and appear displaced, sitting atop upland hills or summits and differing from the surrounding bedrock. Another boulder erratic which seems to meet Flint's mapping criteria but isn't documented on his surficial geology map is found at the summit of Beacon Cap. It is unknown whether Flint overlooked this particular erratic or he felt it didn't meet his mapping criteria.

Stratified Drift Streams of melting water transported tremendous amounts of glacial debris derived directly from the glacier or from erosion of deposited till. Such deposits are characterized by layers of well-sorted to poorly-sorted gravel, sand, silt, and clay laid down by the flowing water, forming lakes and streams which occupied valleys and lowlands as the last ice sheet retreated (Stone et.al.1992). A small percentage of the unconsolidated materials in the IBA contain sand and gravel deposits. These surficial deposits occur in several locations in the lowlands surrounding Reservoir 1 and much of Reservoir 2, the Naugatuck River; and along the southern boundary of the East Block's Beacon Cap section (Figure 4-4).

Postglacial Deposits Postglacial sediments locally overlie the glacial deposits in a few locations in the NSF and make up a minor portion of the unconsolidated material. Alluvium deposits flank portions of the Naugatuck River where it forms a thin ribbon along the river channel (Figure 4-4). It is largely reworked from glacial materials and has similar characteristics. Swamp sediments contain silt, sand, and clay mixed with a high percentage of organic matter and form the "muck" below the water's surface. These deposits occupy shallow basins in several small and poorly drained wooded areas located northwest of Wildlife Impoundment and in two spots near the southern boundary of the Beacon Cap section of the East Block. These deposits are very small and aren't depicted in Figure 4-4, but they are denoted on Flint's (1978) surficial geology map of the quadrangle.





4.2.8 Soils

Within Naugatuck State Forest there are 21 soil types in 14 associations which vary greatly in depth, drainage class, slope ranges, run-off, and permeability. The majority of the soils are derived from schist, gneiss, and/or granite that were primarily formed from glacial till and, less commonly, glacial outwash (Reynolds 1979). Characteristics of all soil types distributed throughout the IBA are summarized in Appendix C.

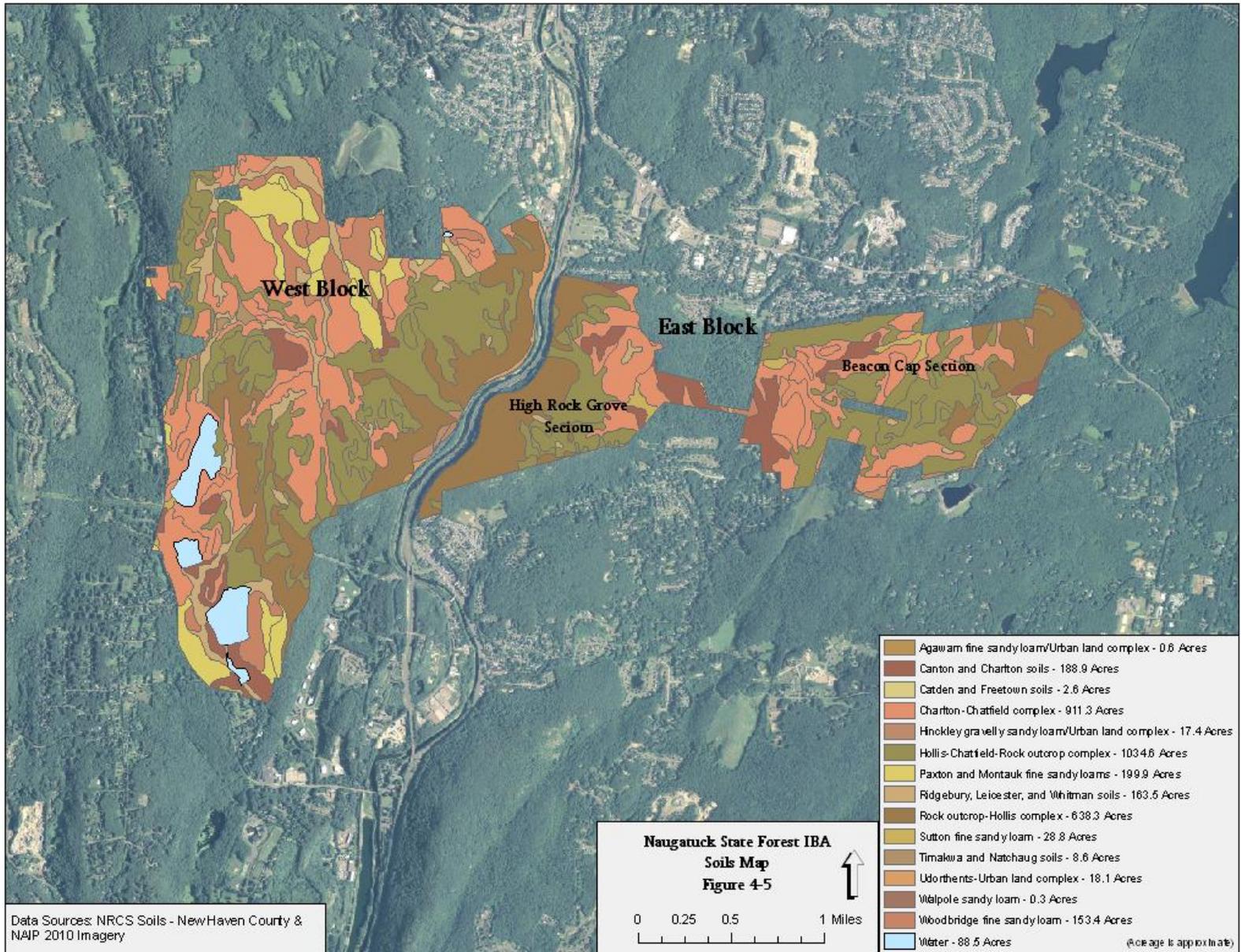
In the IBA, three soil units dominate the landscape: the Charlton-Chatfield complex, the Hollis-Chatfield-Rock outcrop complex, and the Rock outcrop-Hollis complex (Figure 4-5). The Charlton-Chatfield complex is moderately to very deep and well-drained, while the other two associations are also well-drained, but shallow to moderately deep. Characteristically, well-drained soils are favorable for plant growth, and encourage the variety of flora within the forest. Comparing the soils distribution map (Figure 4-5) with the West Block's forest stand map (Figure 4-5) reveals that the Charlton-Chatfield complex supports a forest cover of Northern Red Oak (*Quercus rubra*), Black Oak (*Quercus velutina*), and Sugar Maple (*Acer saccharum*). The Hollis-Chatfield-Rock outcrop and Rock outcrop-Hollis complexes, though also well-drained, are more shallow, and support flora that tolerate poorer quality soils, such as Chestnut Oak (*Quercus prinus*), Scarlet Oak (*Quercus coccinea*), and Mountain Laurel (*Kalmia latifolia*).

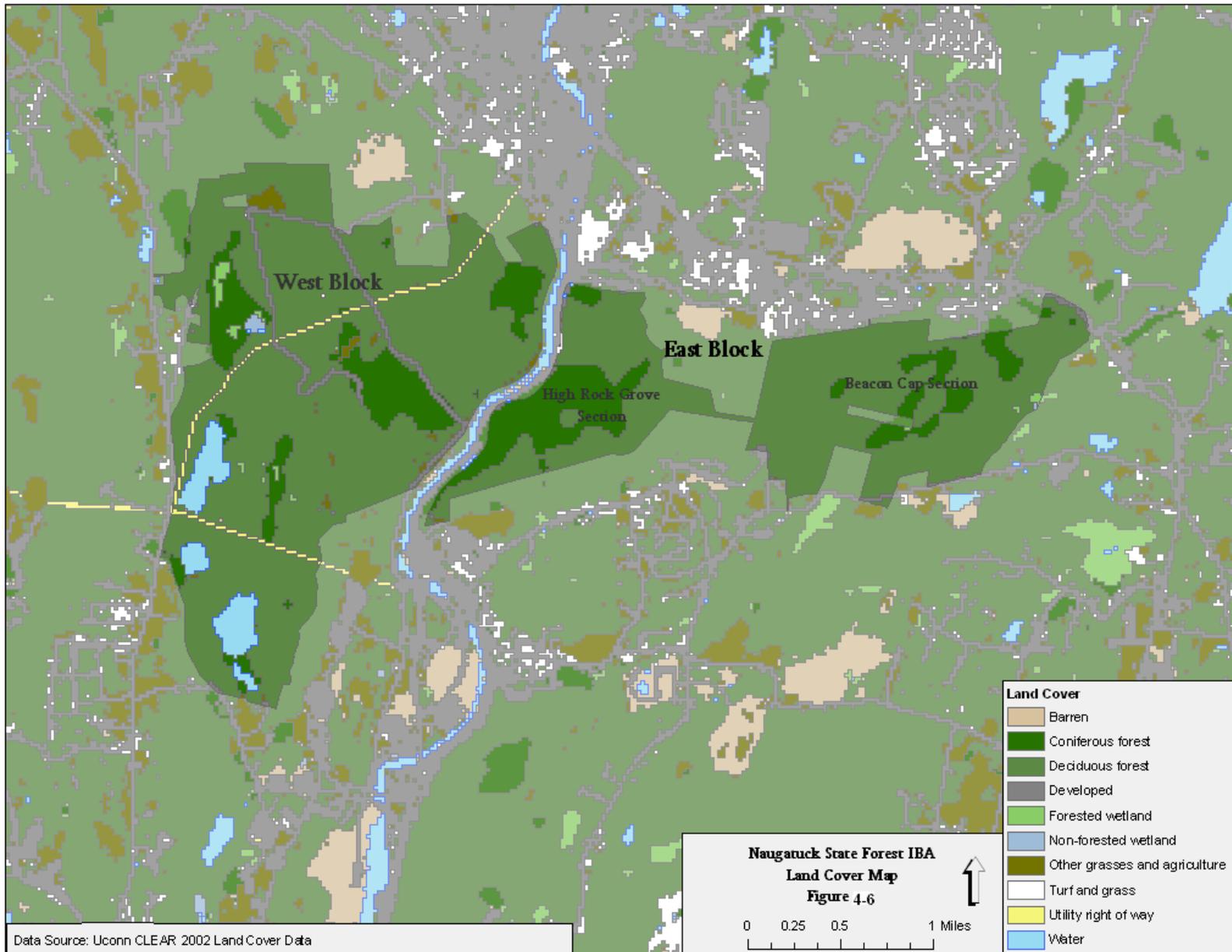
According to the CTDEP's (2005a) forest management plan, over 50% of the forested land in the West Block is dominated by Chestnut and Scarlet Oaks, species which thrive on lower quality soils. Forest stand data is not complete for the East Block, but the entire IBA contains approximately 1035 acres of Hollis-Chatfield-Rock outcrop complex, 910 acres of Charlton-Chatfield complex, and roughly 638 acres of Rock outcrop-Hollis complex (Figure 4-5). Thus the pattern would suggest that slightly less than 50% of the IBA is covered by woodland communities which include Chestnut and Scarlet Oaks (Hollis-Chatfield-Rock outcrop and Rock outcrop-Hollis complexes) and approximately 25% is covered by flora associated with the Northern Red Oak forest community (Charlton-Chatfield complex).

Other soils or soil associations depicted in Figure 4-5 which make up significant acreage in the IBA are the Paxton and Montauk fine sandy loams (approximately 6% of total acreage); Canton and Charlton soils (approximately 5% of total acreage); Ridgebury, Leicester, and Whitman soils (approximately 5% of total acreage), and Woodbridge fine sandy loam (approximately 4% of total acreage). The Ridgebury, Leicester, and Whitman soils consist of poorly-drained or very poorly-drained soils occurring on nearly level or gently sloped land in drainageways and depressions on glacial uplands (Reynolds 1979). In Connecticut, soils in this unit are considered wetland soils based on the drainage designation. Typically, these hydric soils support plants adapted to wet environments including such species as Red Maple (*Acer rubrum*), Yellow Birch (*Betula alleghaniensis*), and White Ash (*Fraxinus americana*).

4.3 Land Use/Land Cover

The dominant land cover within Naugatuck State Forest is principally deciduous forest, and to a lesser degree, coniferous forest (Figure 4-6). Aside from the Naugatuck River, the area contains five waterbodies larger than four acres: the four reservoirs in the southwest section of the West Block and Wildlife Impoundment a little northeast of Reservoir 4. Also in the IBA are several grassland sites, forested wetlands, including acidic wet seeps, and vernal pools, and pine-oak barrens. The Connecticut Light and Power Company (CLP), a subsidiary of Northeast Utilities (NU) maintains existing powerline equipment on two rights-of-way that traverse the West Block. The resulting corridors create significant shrubland habitat. Other important features of the NSF include an eight-acre shooting range cut into a gravel hillside toward the center of the West Block and the blue-blazed Naugatuck Trail which runs





through the forest's East Block. The land use cover map (Figure 4-6) depicts the dominant landscape within and surrounding the IBA.

4.4 Vegetation - Habitats and Natural Communities

The geographic and climatic location of Connecticut places the state almost entirely within the Appalachian Oak Forest Section of the Eastern Broadleaf Forest Province (Keys et al., 1995), a forest province consisting of tall, broadleaf trees predominately of oak, maple, beech, birch and hickory. In northwestern Connecticut, these forests gradually transform into the Northern Hardwoods Forest Section of the Laurentian Mixed Forest Province (Keys et al., 1995). Here northern hardwoods such as Sugar Maple, American Beech (*Fagus grandifolia*), and Yellow Birch, in conjunction with Eastern White Pine (*Pinus strobus*) and Eastern Hemlock (*Tsuga canadensis*) dominate the oaks on typical well drained sites (Metzler and Barrett, 2006). Geographically, the IBA falls within the eastern broadleaf forest community. However, forest species in some locations such as ravines and north facing slopes contain vegetative assemblages more indicative of the northern hardwood forest.

Cowardin et al. (1979) recognized five major aquatic systems in their classification hierarchy of wetland and deep water habitats: marine, estuarine, riverine, lacustrine, and palustrine. Three of these systems--riverine, lacustrine, and palustrine--occur in the IBA. Examples of these aquatic systems include the riverine-classified Naugatuck River and Spruce Brook and lacustrine-type reservoirs. Traditional wetlands such as forested swamps, shrub swamps, wet seeps, ponds, and vernal pools are classified as palustrine systems.

Habitats within the IBA encompass an assortment of deciduous (hardwood) and coniferous (softwood) forests and include steep wooded hemlock ravines and early successional areas. Intermingled with the terrestrial habitats are a variety of aquatic and wetland areas, the whole of which supports a tremendous diversity of flora and fauna. Some vegetative communities are particularly distinctive due to unique effects of position, soil, moisture regime, and human influences, including historical land use practices. The rolling and rugged topography also contributes to species diversity. Elevations range from approximately 150 ft (45.7 m) to 860 ft (262 m) and these elevations change dramatically along the riverine corridor where cliffs rise greater than 400 ft (122 m) above the valley floor. Woodland communities of xeric Chestnut Oak forests in the rocky uplands gradually change to Northern Red Oak and northern/mixed hardwoods, and finally, Red Maple and riverine communities in the lowlands.

Vegetation surveys conducted in 2007 and 2008 revealed the presence of approximately 200 species of plants (Appendix D) growing in a variety of habitats. These assessments were not meant to comprise a comprehensive botanical inventory of IBA flora but instead were conducted in order to provide additional habitat description and identification information. The surveys did, however, reveal the presence of a State-listed fern and key habitats as described by the CWCS (CTDEP 2005b). Habitats and plant associations in the IBA are discussed in the following subsections, while major habitats are summarized in Table 4-3.

4.4.1 Forest Habitat

Forested lands account for approximately 3,246 acres (1314 ha) or 95% of the 3,436 acres (1391 ha) in the IBA. The West Block contains 2,042 acres (826 ha) of forested land while the smaller East Block hosts 1,204 acres or 487 ha (Table 4-3). Except for a four-acre shrub swamp, the entire East Block is essentially forested land. Deciduous forests with several characteristic communities dominate the landscape; coniferous forests present here consists primarily of naturally occurring Eastern Hemlock woodlands or white pine plantations.

Table 4-3. Summary of Habitats within the Naugatuck State Forest IBA.

Type of Habitats		Acres ^a		Comments
		West Block	East Block	
Forest				
	Deciduous- mixed hardwoods	1912	922	
	Coniferous - conifer plantations	84 ^b	282	Includes hemlock in EB
	Coniferous - hemlock	46		
Early-Successional				
	Grasslands	20	-	
	Shrublands	43	-	
	Forest clearings and openings	18	-	
	Glades and balds (barrens)	?	?	Included in forest acreage
Aquatic - Lacustrine				
	Reservoirs	87.5	-	
Aquatic - Palustrine				
	Impoundment/ponds	5.5		
	Red maple swamps	-	-	Included in forest acreage
	Shrub swamps		4	
	Vernal pools	-	-	Included in forest acreage
	Acidic wet seeps	?	?	Included in forest acreage
Aquatic - Riverine				
	Naugatuck River	24 ^c	-	Bisects East and West Blocks
	Spruce & Egypt Brooks	-	-	Included in forest acreage
Miscellaneous				
	Shooting range, gravel banks,etc	12	-	
Total IBA Acreage		2228	1208	

^a Approximate acreage.

^b Includes 29 acres with a white pine grove and deciduous trees.

^c Not included in total IBA acreage; area is in addition to forest acreage.

CTDEP's Forestry Division compiled a detailed inventory of the forest types within the West Block and plotted these forest communities on a stand map (Figure 4-7). Information regarding tree stands, including stand identification number, size, location, species composition, and size classes per acre, is described in the CTDEP (2005) forest management plan (Appendix E). Table 4-4 provides tree stand data adapted from the management plan and includes slight adjustments for 22 additional acres of land acquired since the plan was put into effect. In the forest inventory of the West Block, CTDEP recognizes 14 different stand types. Ten of the tree stands are deciduous communities. The remaining four communities are classified as conifer associations, one of which contains mixed woodland holding both white pine and deciduous trees. Although a detailed stand map is lacking for the East Block the area is similar in composition to the West Block made up primarily of hardwood forests. There is a large section of white pine and hemlock near the western boundary of the block and scattered hemlock groves occur on slopes and in ravines such as Egypt Brook Ravine.

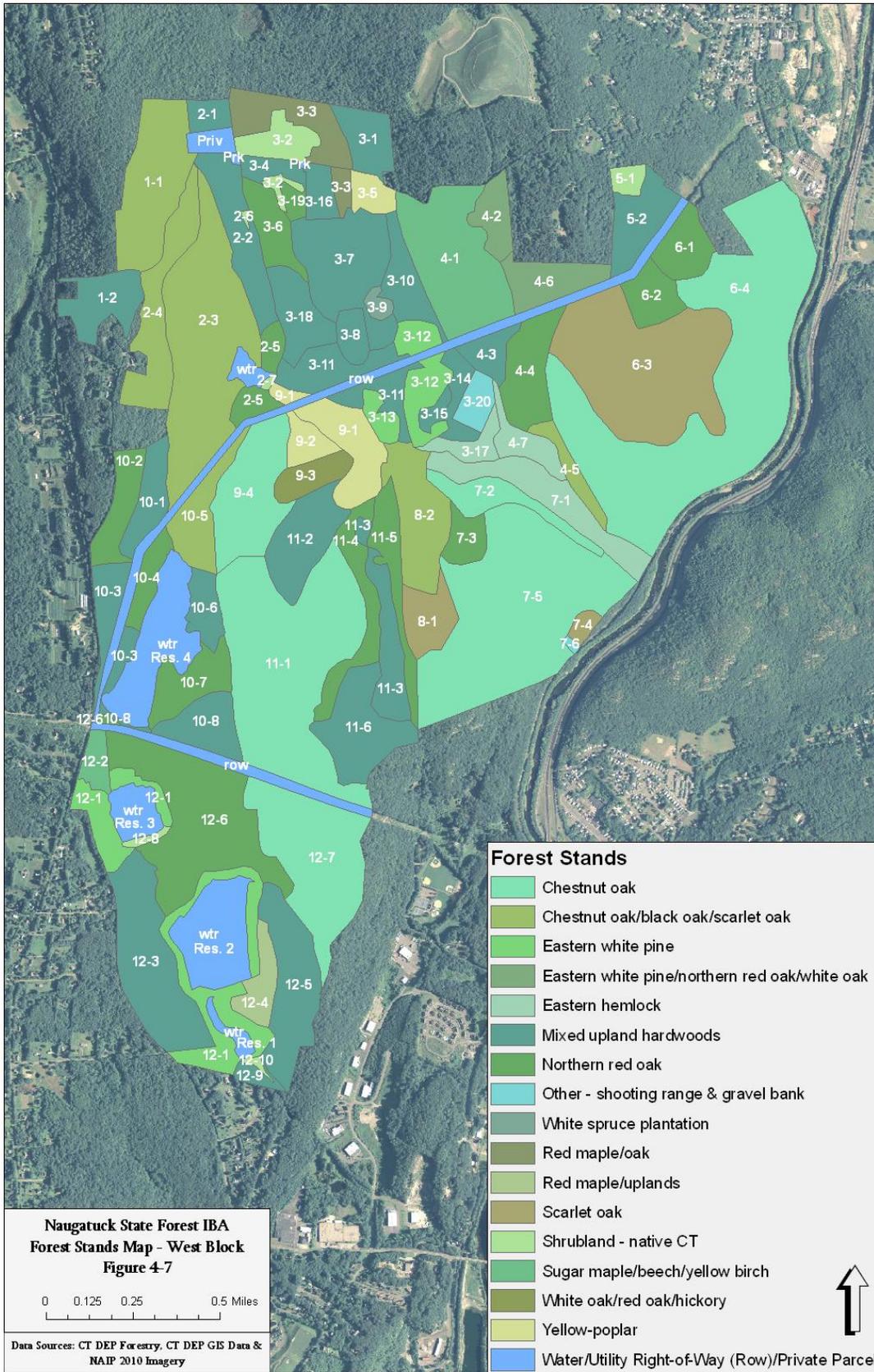


Table 4-4. Forest Stand Classifications within Naugatuck State Forest - West Block

Forest Type	Code	Stand Numbers	Total Acreage ^a	% Acreage ^a
Chestnut Oak ^b	CO	6-4, 7-2, 7-5, 9-4, 10-5, 11-1, 12-7	644	32
Mixed Upland Hardwoods	MUH	2-1, 2-2, 3-1, 3-4, 3-7, 3-8, 3-10, 3-11, 3-14, 3-15, 3-16, 3-18, 4-3, 5-2, 10-1, 10-3, 10-6, 10-8, 11-2, 11-3, 11-5, 12-3, 12-5	430	21
Northern Red Oak	NRO	1-2, 2-5, 3-6, 4-4, 6-1, 6-2, 7-3, 10-2, 10-4, 10-7, 11-4, 11-6, 12-6	292 (+26)	14
Chestnut Oak, Black Oak, Scarlet Oak ^b	CO/BO/SO	1-1, 2-3, 2-4, 4-5, 8-2	267	13
Scarlet Oak ^b	SO	6-3, 7-4	122	6
Sugar Maple, Beech, Yellow Birch	SM/BE/YB	4-1, 12-2	60	3
White Pine	WP	3-12, 3-13, 12-1	52	3
Hemlock	HEM	3-17, 4-7	46	2
Yellow Poplar	YP	3-5, 9-1, 9-2	41	2
White Pine, Red Oak, White Ash	WP/RO/WA	4-2, 4-6	29	1
Red Maple, Red Oak	RM/O	3-3	26	1
Red Maple	RM/O	12-4	12	1
White Oak, Red Oak, Hickory	WO/RO/HI	9-3	11	1
White Spruce	WS	N/A	3	0

^a Approximate acreage and percentage

^b Approximately 51% of the forested land is dominated by Chestnut and Scarlet oaks, species growing on xeric soils on rocky sites; most areas are inaccessible and/or trees exhibit poor growth patterns making silviculture unfeasible.

4.4.1.1 Deciduous Forest

Of the IBA's 3,246 forested acres (1314 ha), approximately 2,834 acres (1147 ha) are deciduous forest, with 1,912 acres (774 ha) in the West Block and 922 acres (373 ha) in the East Block. In the West Block, these are made up of 10 distinct deciduous forest stand types as described in the forest management plan mentioned above. Based on topography, soil, and moisture regime these communities can be grouped into several forest associations. The main communities encountered here are Chestnut Oak, Northern Red Oak, mixed/northern hardwood, Red Maple swamp, and riverine community.

Chestnut Oak Community This community dominates the forested acreage (>50%) in the West Block where it occurs on summits with bedrock outcrops and upper rocky slopes. The soil is dry to xeric and shallow over the underlying bedrock. Present within this forest type is Chestnut Oak, a characteristic species occurring in association with Black Oak, Scarlet Oak, White Oak (*Quercus alba*), Black Birch (*Betula lenta*), Gray Birch (*Betula populifolia*), and occasionally Eastern White Pine, hemlock, Eastern Red Cedar (*Juniperus virginiana*), and Shadbush/Downy Serviceberry (*Amelanchier arborea*). The understory is made up of seedlings and saplings of the canopy species and frequently Sassafras (*Sassafras albidum*) saplings as well, while the shrub layer consists mainly of Mountain Laurel, lowbush blueberry (*Vaccinium spp.*), and Sweet Fern (*Comptonia peregrina*) in open, sunny areas. Patches of Bracken Fern (*Pteridium aquilinum*) and greenbrier/catbrier (*Smilax spp.*) also occur in the understory, along with a spotty herbaceous layer of Little Bluestem (*Schizachyrium scoparium*), Poverty Oatgrass (*Danthonia spicata*), hairy cap moss (*Polytrichum spp.*) and several species of goldenrod (*Solidago spp.*), among others.

Northern Red Oak Community The Northern Red Oak type of forest occurs on upper and middle slopes with generally shallow soil, but here the soil has somewhat greater depth and is more moist than that found in the Chestnut Oak community. Red oak is dominant, but other canopy species include Chestnut Oak, Black Oak, Scarlet Oak, Black Birch, Red Maple, Sugar Maple and hickory (*Carya spp.*). Mountain Laurel is a common shrub; Pink Azalea (*Rhododendron nudiflorum*) and lowbush blueberries are also present. Making up the understory herbaceous layer are White Wood Aster (*Aster divaricatus*), Pinesap (*Monotropa hypopithys*), Indian Pipe (*Monotropa uniflora*), Christmas Fern (*Polystichum acrostichoides*), Ground Cedar (*Diphasiastrum digitatum*), and Ground Pine (*Dendrolycopodium obscurum*).

Northern/Mixed Hardwood Community A mixed/northern hardwood forest association occurs along the lower slopes and lower elevations with deep and moist soils. Dominant species can vary depending on site conditions, but include White Ash, Tuliptree/Yellow Poplar (*Liriodendron tulipifera*), Yellow Birch, Sugar Maple, and American Beech (*Fagus grandifolia*). Canopy species which may be mixed in include Red Maple, Shagbark Hickory (*Carya ovata*), Pignut Hickory (*Carya glabra*), red oak, White Oak, Black Cherry (*Prunus serotina*) and Black Birch. A shrub layer of Witch Hazel (*Hamamelis virginiana*), Spicebush (*Lindera benzoin*) and Maple-leaved Viburnum (*Viburnum acerifolium*) is characteristic of this community. The forest provides a dense, continuous canopy in summer and harbors a lush herbaceous ground cover in early spring. Growth of this ground cover slows down after the foliage emerges. Common species include Trout Lily (*Erythronium americanum*) and Canada Mayflower (*Maianthemum canadense*), while Wood Anemone (*Anemone quinquefolia*), Jack-in-the-pulpit (*Arisaema atrorubens*) Smooth Solomon's-seal (*Polygonatum biflorum*), False Solomon's-seal (*Smilacina racemosa*), Red Trillium (*Trillium erectum*), and Pink Lady Slipper (*Cypripedium acaule*) are less common but conspicuously scattered along the forest floor. Beech Drops (*Epifagus virginiana*), associated with beech trees, are found regularly.

Red Maple and Riverine Associations These communities which occur along the drainageways, bottomlands, and rivers, are discussed below in sub-sections relating to wetlands.

4.4.1.2 Coniferous Forest

The IBA contains various stands of both naturally occurring conifers and other planted groves (Figure 4-8). One prior landowner, the Whittemore family, planted trees in the West and East Blocks in the 1920s. Groves were also planted by the Civilian Conservation Corps in the 1930s, and the Seymour Water Company, which owned the reservoir property, planted trees for watershed protection in the 1940s-1960s. The planted groves are primarily Eastern White Pine and to a lesser extent Norway Spruce (*Picea abies*), but two smaller copses contain White Spruce (*Picea glauca*) and Douglas Fir (*Pseudotsuga menziesii*). Naturally-occurring Eastern Hemlock woodlands are found in Spruce Brook, Egypt Brook, and several smaller ravines, as well as on some north facing slopes, and in moist pockets along hillsides, and in other scattered locations throughout the forest. Unfortunately, many of these hemlock woodlands are infected with Hemlock Woolly Adelgid (*Adelges tsugae*) and their future survival is bleak. Pitch Pine (*Pinus rigida*) copses occur along some of the rocky ridges, cliffs and summits. These naturally-established woodlands usually appear in small clumps, most with southern exposures. Vegetation beneath the conifer woodland, although sparse, consists of scattered seedlings, shrubs, and forbs.



Figure 4-8. Naugatuck State Forest –View of the East Block and the extensive section of coniferous forest along the western edge of the High Rock Grove section.

A detailed discussion of the vegetation assemblages within the Pitch Pine community is described in the section below addressing rocky summit habitats. Within the description of the habitat accompanying the reservoirs are found the details of flora associations within White Pine and Norway Spruce communities.

Hemlock Ravines Of several hemlock ravines found in the forest, Spruce Brook Ravine is by far the most picturesque and beautiful (Figure 4-9). This steep-sided ravine is actually formed where Live Oak Brook and Spruce Brook merge near the headwaters of the ravine. Considering all the wonderful and unique features the forest has to offer, this gorge may be the most magnificent, with its clear, cool, water tumbling more than 300 feet through a series of falls, pools, and rapids until it empties into the Naugatuck River. The ravine is lined with mature hemlock. These large evergreens block most sunlight from the forest floor, providing an optimum environment for hemlock seedlings while suppressing the growth of other understory vegetation. Besides the seedlings and saplings of hemlocks, flora of the shaded understory include scattered Mountain Laurels, Spotted Wintergreens (*Chimaphila maculata*), Partridgeberries (*Mitchella repens*), Wild Sarsaparillas (*Aralia nudicaulis*), patches of sphagnum mosses (*Sphagnum spp*), and wood ferns (*Dryopteris spp*). A few Yellow Birches occur on the lower slope near the brook, and one interesting small patch of Striped Maple (*Acer pensylvanicum*) saplings, a species with a more northern affinity, is present. Other hemlock ravines found in the IBA are smaller, but similar in floral composition to Spruce Brook Ravine, and they lack the Striped Maple component.



Figure 4-9. Spruce Brook Ravine – NSF West Block.

4.4.2 Early Successional Habitats

Several early successional habitats are found within the IBA, most of which are actively managed. Currently, all managed habitats are restricted to the West Block, although there is within the East Block a single AT&T closed-canopy cable corridor less than 50 ft (15 m) wide. Without active management, early successional grasslands and shrublands would revert to forest through natural succession.

Also present in the IBA are several naturally-occurring barrens and glades where succession is arrested due to the presence of dry, shallow soils and/or occasional fires.

Early successional habitats and associated vegetative communities are described below.

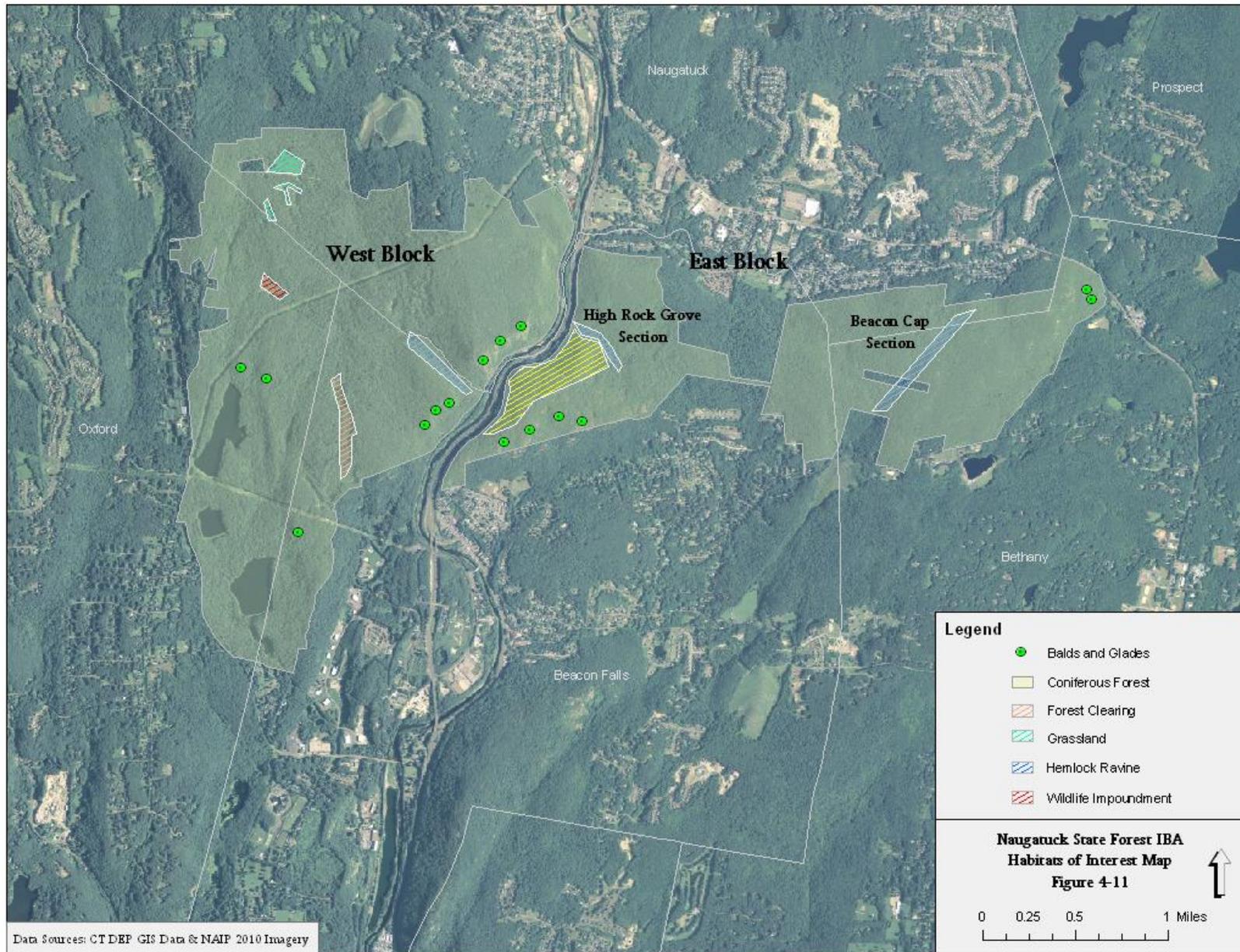
4.4.2.1 Grasslands

Grassland habitats account for approximately 20 acres within the IBA. This acreage is situated in the northwest corner of the West Block where several fields are located north and south of Hunters Mt. Road. The north field, approximately 13 acres, is the largest of the group (Figure 4-10 and Figure 4-11). South of the roadway behind a row of trees is the south field of approximately four acres. Two smaller fields are located southwest of the south field and west of Whittemore Road. Another small opening of about one acre, which is somewhat of an extension of the north field at its western edge has been reduced to a mud hole by the unauthorized use of four-wheel drive vehicles and/or ATVs and no longer supports much vegetation. Recent selective removal of trees, shrubs, and invasive vegetation by CTDEP has opened up and slightly expanded the north field and south field.



Figure 4-10. North Field – Naugatuck State Forest West Block.

Vegetation within the field areas consists of an herbaceous component of warm season grasses interspersed with forbs, small shrubs, and tree seedlings. Grassland shrubs include Meadowsweet (*Spiraea alba*), Staghorn Sumac (*Rhus typhina*), Winged Sumac (*Rhus copallinum*), and Sweet Fern. Forbs are well-represented by: Indian Hemp (*Apocynum cannabinum*), Butterfly weed (*Asclepias tuberosa*), Common Milkweed (*Asclepias syriaca*), Black-eyed Susan (*Rudbeckia hirta*), Purple-headed Sneezeweed (*Helenium nudiflorum*), Common Mullein (*Verbascum thapsus*), Yarrow (*Achillea millefolium*), Wild Oat (*Uvularia sessilifolia*), Red Clover (*Trifolium pratense*), and Bracken Fern. The grass component is mainly Little Bluestem (*Schizachyrium scoparium*), and patches of Fox-tail Grass (*Setaria faberi*).



4.4.2.2 Shrublands

Powerline Corridors An important habitat feature of the IBA is the presence of open corridors cut through the forest for the purpose of carrying and maintaining electrical transmission lines. Two of these strips located in the West Block transect the forest and account for 43 acres (17.4 ha) and 3.4 (5.4 km) linear miles of grassland and shrubland habitat. The Naugatuck Tap, the northern most powerline is 2.4 miles (3.8 km) in length, with an average width of 130 ft (39.6 m); the Beacon Falls Tap to the south is 1.0 mile (1.6 km) with an average width of 150 ft or 45.7 m (A. Johnson pers. comm.). Both powerline corridors run generally in an east-west direction, although the western section of the Naugatuck Tap turns in a southwest direction prior to Pines Brook and merges with the Beacon Falls Tap at the NSF boundary southwest of Reservoir 4 (Figure 4-7). Intensively managed by the utility company in order to maintain a “constant” stage of early successional development, the resulting habitat provides diversity in a predominately forested landscape. The vegetative makeup along these corridors varies due to geophysical characteristics, but the overall complexion of the habitat remains relatively consistent.

Vegetation here consists of numerous shrubs, tree saplings/seedlings, vines, and herbs. Mountain Laurel is scattered throughout but is dominant in higher elevations with dry and shallow soil. In these high locales the laurel sometimes forms a continuous shrub cover accompanied by scattered patches of Sweet Fern and Bracken Fern in sunny locations (Figure 4-12). Where Mountain Laurel is not dominant, other wooded plants include Red Cedar, Winged Sumac, Staghorn Sumac, Smooth Sumac (*Rhus glabra*), Sassafras, and Black Birch. Smooth Alder (*Alnus serrulata*), Sweet Pepperbush (*Clethra alnifolia*), Common Elderberry (*Sambucus canadensis*) and Silky Willow (*Salix sericea*) occur in the damp troughs, wet seeps, and along small creeks. Tangled patches made up of Poison Ivy (*Toxicodendron radicans*), Virginia Creeper (*Parthenocissus quinquefolia*), bramble (*Rubus spp.*), greenbrier (*Smilax spp.*), Groundnut (*Apios americana*), and Common Strawberry (*Fragaria virginiana*) are sprinkled throughout the landscape (Figure 4-13).



Figure 4-12. The Naugatuck Tap powerline corridor - NSF West Block.

The xeric or mesic soils support herbaceous plants such as Little Bluestem, Bluets (*Houstonia caerulea*), Whorled Loosestrife (*Lysimachia quadrifolia*), Wood Lily (*Lilium philadelphicum*), goldenrod (*Solidago spp.*), aster (*Aster spp.*), Yarrow, and Queen Anne's Lace (*Daucus carota*). Where the soils are more moist, other herbaceous species include Canada St Johnswort (*Hypericum canadense*), Boneset (*Eupatorium perfoliatum*), Joe-pye-weed (*Eupatorium spp.*), smartweed (*Polygonum spp.*), Nettle-chain Fern (*Woodwardia areolata*), Sensitive Fern (*Onoclea sensibilis*), and some rushes (*Juncus spp.*), and sedge (*Carex spp.*).

Invasive species appear individually or in small pockets within the corridors, although they are not abundant anywhere along the corridors. Species observed include Multiflora Rose (*Rosa multiflora*), Japanese Barberry (*Berberis thunbergii*), Autumn Olive (*Elaeagnus umbellata*), Winged Euonymus (*Euonymus alatus*), Asiatic/Oriental Bittersweet (*Celastrus orbiculatus*), Common Reed (*Phragmites australis*), and Japanese Knotweed (*Polygonum cuspidatum*). The largest concentration of invasive species occurs along the Naugatuck Tap from Pines Brook drainageway to the southwest corner of Reservoir 4.



Figure 4-13. Beacon Falls Tap powerline corridor - NSF West Block.

4.4.2.3 Forest Clearings and Wildlife Openings

Forest clearings and openings are the result of CTDEP's actively managed silviculture program of professional timber harvesting and permitted cordwood cutting. Temporary forest openings result when individual trees or groups of trees within a stand are selectively removed---uneven-aged management---or when a stand or part of a stand is clear cut---even-aged management. The former strategy enhances vertical stratification in the stand by opening the canopy and allowing sunlight to penetrate the lower

stratum. The eventual outcome of clear cutting is a return of an early successional habitat, although the early successional habitats created by timber harvest are dominated by tree reproduction and differ from other woody, early successional habitats (Thompson and DeGraaf 2001). In the West Block, one 18-acre (7.3 ha) plot along Game Plot Road was clear-cut in two stages during 1993 and 2001. In the first phase, three smaller plots were cut, and the second stage consisted of a long linear cut which connected all four openings. The result was successive growth of plants, trees, and shrubs of different age (Figure 4-14). In addition, several residual trees were left standing within the harvested clearing for additional wildlife habitat. [Note: Golden-winged Warbler was located here during 2006-2008; see Avian Review Section]. Vegetation in the area consists primarily of seedlings and saplings of the surrounding trees: Black Birch, Gray Birch, Large-toothed Aspen (*Populus grandidentata*), Black Cherry, Sassafras, and a variety of oak, maple, and hickory. Shrubs and vines are represented by brambles and Poison Ivy along with two invasive species, Autumn Olive and Asiatic/Oriental Bittersweet.



Figure 4-14. Shrubland created by clear-cutting timber harvest - NSF West Block.

4.4.2.4 Rocky Summits and Outcrops (Barrens and Glades)

Early-successional habitats which occur naturally are scattered throughout rocky outcrops, cliffs, and bedrock summits/balds in the NSF (Figure 4-11). Rocky Summits habitats, referred to as acidic rocky summits, grassy glades, and balds (Metzler and Wagner 1998) have distinct characteristics. Here the vegetation is adapted to grow in adverse environments. Depending on site conditions, vegetative communities may occur as isolated entities or transition from one to another. Some areas appear savannah-like with grasses and low-lying shrubs dispersed amongst widely scattered and stunted trees; others are grassy glades interspersed with low-lying shrubs and lichen covered bedrock. Within the IBA, all these communities occur in dry to xeric conditions with southern exposures and at elevations greater than 500 ft (152 m).

Dry rocky summits, grassy glades, and balds are categorized as imperiled ecosystems in Connecticut by Metzler and Wagner (1998) and as key habitats in the Connecticut CWCS (CTDEP 2005b). According to

Metzler and Barrett's (2006) vegetative classification, rocky summits and outcrops are considered non-forested communities within the Acidic Rocky Summits/Outcrops grouping. A description of the three communities follows:

- Pitch Pine Woodlands. These woodlands are described as open stands of trees, over five meters (16.4 ft) with crowns not usually touching, and generally forming 25-60% of cover (Metzler and Barrett 2006). In the NSF, Pitch Pine woodlands are found on rocky summits and along steep cliffs and usually in conjunction with Bear Oaks (*Quercus ilicifolia*) and Chestnut Oaks (*Quercus prinus*) among others. These woodlands mainly occur along the Naugatuck River corridor, the southwest corner of the East Block's High Rock Grove section, and along a ridgeline east of the reservoir complex. An example of this community is presented in Figure 4-15.

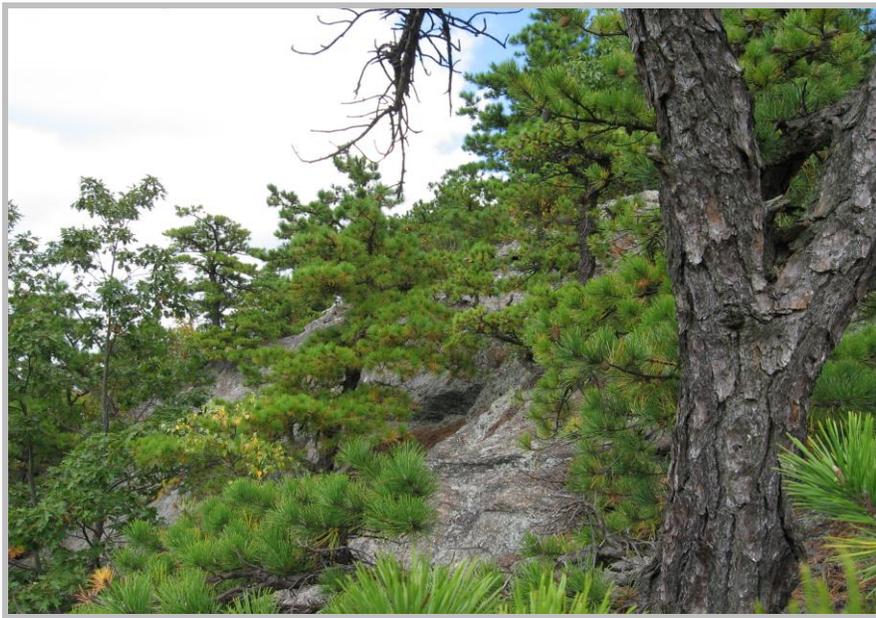


Figure 4-15. Pitch Pine Woodland - NSF East Block

- Bear Oak Shrublands. Similar to the Pitch Pine woodlands described above, but fewer trees grow in the environmentally inhospitable extremes of dry and poor soil found in this community. Deciduous shrublands contain shrubs greater than 0.5 meter (1.6 ft) tall with individual clumps overlapping or not touching, forming greater than 25% of the canopy coverage. Trees generally make up less than 25% of the vegetative cover (Metzler and Barrett 2006). Bear Oak shrublands occur in scattered pockets or loosely connected "islands" on summits or along bedrock outcrops throughout the East and West Block. Several sites are along the Naugatuck River corridor, but oak shrublands can also be found in the High Rock Grove and Beacon Cap sections of the East Block. A prominent site hosting this community is at Beacon Cap where several acres exist (Figure 4-16).
- Little Bluestem – Poverty Oatgrass Grasslands. According to Metzler and Barrett's classification, grassy glades are identified as graminoid herbaceous vegetation communities. Within this classification, herbs, grasses and grass-like plants (i.e., rushes and sedges), forbs, and ferns dominate, generally forming at least 25% of cover. Trees, shrubs and dwarf shrubs generally contribute less than 25% of cover. These glades are interspersed throughout the rocky summits and ridges in small

patches and often form a patched mosaic with bedrock outcrops and the Bear Oak and/or Pitch Pine communities. Several fine examples of this community occur in the southern section of the High Rock Grove section in the East Block (Figure 4-17).



Figure 4-16. Bear Oak shrubland at Beacon Cap - NSF East Block.

All three non-forested communities contain similar floristic associations. Depending on site conditions, the most common herbaceous plants include Little Bluestem, Pennsylvania Sedge (*Carex pensylvanica*) and/or Blue Ridge Sedge (*Carex lucorum*), Broomsedge Bluestem (*Andropogon virginicus*), Poverty Oatgrass (*Danthonia spicata*), Rosette Grass (*Dichanthelium spp.*), Cow-wheat (*Melampyrum lineare*), Pale Corydalis (*Corydalis sempervirens*), Orangegrass (*Hypericum gentianoides*), Bracken Fern, and Hairy Cap Moss (*Polytrichum spp.*). Shrubs occurring in these areas include Early Low Blueberry (*Vaccinium pallidum*), Late Low Blueberry (*Vaccinium angustifolium*), Black Huckleberry (*Gaylussacia baccata*), and Shadbush (Figure 4-18).

A community associated with the Acidic Rocky Summit/Outcrop grouping is identified as Mountain Spleenwort (*Asplenium montanum*). It is grouped within Metzler and Barrett's (2006) Acidic Rocky Summit and Bedrocks classification and occurs on gneiss, schist, granite, or sandstone. Though not an early successional habitat per se, this type of community is found on consolidated rock with scattered plants where the dominant species is Mountain Spleenwort. In Connecticut, this species is listed as Special Concern (recently downgraded from Threatened status). At least two such growing sites harboring Mountain Spleenwort were found in the West Block on cliff crevices, and it's likely this species occurs elsewhere since ample habitat seems to exist.



Figure 4-17. Grassy Glade with Pitch Pines – NSF East Block.



**Figure 4-18. Grassy glade and bald in the north cliffs area - NSF West Block.
Area was burnt by fire in late April 2008.**

4.4.3 Lacustrine Systems - Reservoirs

The former reservoir system lies along the western boundary of the NSF; it contains four reservoirs aligned in a north-south orientation with Reservoir 4 being the farthest north. Total area occupied by the four reservoirs is approximately 87.5 acres (35.4 ha) or about 3.9% of the West Block's acreage (2% of the entire IBA acreage). At 37 acres (14.1 ha), Reservoir 4 (Figure 4-19) is the largest waterbody with a

maximum depth of 17 feet (5.2 m). Reservoirs 3 and 2 (Figure 4-20) are smaller, at 11.5 acres (4.6 ha) and 34.5 acres (14 ha), respectively, but deeper with a maximum depth of about 22 feet (6.7 m) each. Reservoir 1, at 4.5 acres (1.8 ha), is much smaller than the others and holds a small component of emergent vegetation at its northern end. CTDEP sampled and tested the waters in Reservoirs 2-4 on August 23, 1991 and concluded the reservoirs were not thermally stratified at that time (T. Barry pers. comm.).

All of the reservoirs have a complete or partial conifer border. The conifer buffer around Reservoirs 1 and 3 is predominantly Norway Spruce and White Pine, while Reservoir 2 is largely surrounded by White Pine. Reservoir 4 has a White Pine border along its eastern edge, but is very loosely fringed with pines and mixed with deciduous species along the northern and western borders where it is also flanked by the northern powerline. A dike and the Beacon Falls Tap powerline corridor abut the southern boundary of the reservoir.

Vegetation surrounding the reservoir system is quite variable depending on the canopy. Ground cover beneath the conifers is predictably sparse containing a few shrubs, tree seedlings/saplings, forbs, and ferns. Canada Mayflower is a dominant forb of the understory here. Small patches of emergent vegetation consisting of bur-reeds, rushes and sedges interspersed with Blue Flag (*Iris versicolor*) and Cardinal Flower (*Lobelia cardinalis*) are scattered around the perimeter of Reservoirs 1, 2, and 3, but mostly lacking in Reservoir 4.

Beavers are noticeably active in Reservoir 2 and have constructed two lodges near the reservoir's northern end. Obvious signs of their engineering are evident around the northern periphery of the reservoir where fallen trees and gnarled stumps remain. Beavers recently constructed a small dam near the reservoir's inlet on Pines Brook, causing water to back up into the adjacent wetland.



Figure 4-19. Reservoir 4 looking north from the dam – NSF West Block.



Figure 4-20. Reservoir 2 view from the eastern ridgeline - NSF West Block.

4.4.4 Riverine Systems – Perennial and Intermittent Streams

The Naugatuck State Forest contains two of four subsystems of riverine systems, the Upper Perennial and Intermittent. The other two subsystems include the Lower Perennial and Tidal but these do not occur as parts of the NSF landscape (Cowardin, et al 1979). Rivers or streams in the Upper Perennial subsystem normally flow throughout the year and have a substrate consisting of rock, cobble, and gravel with isolated sandy patches. The Intermittent subsystem, also referred to as Headwater Streams, is the part of a riverine system in which water is flowing for only a portion of the year. At other times, the intermittent subsystem is marked by dry land or represented by small pools scattered across the landscape and down the hillside or slope. Within or adjacent to the NSF there are several perennial streams—Naugatuck River, Spruce Brook, Egypt Brook—and numerous unnamed intermittent streams.

Naugatuck River Although not a part of the state forest, the Naugatuck River divides the forest's East and West Blocks. It flows between the Metro-North Railroad Line (west) and Route 8 (east) on property owned by the Department of Transportation. From its headwaters in Torrington, the river flows about 40 miles to its confluence with the Housatonic River in Derby. Along its length, the river's elevation drops approximately 540 ft (164.5 m) or roughly 13 feet (3.9 m)/mile, thus indicating a relatively steep gradient. Much of the river consequently has rather fast flowing water containing rapids and riffles with intermittent pools.

In the Naugatuck State Forest, the river traverses approximately 1.5 miles (~25 acres) of landscape. During the early 1980s, Route 8 was widened and straightened between Naugatuck and Beacon Falls. As a result the stream channel was modified and rip-rapped to reduce erosion, and large boulders were placed in the streambed in an effort to enhance and improve the aquatic habitat. Currently, the Naugatuck River between Torrington and Derby is designated by CTDEP as a Trophy Trout Stream, which means that it is stocked with larger fish, but carries specific restrictions on creel limit and equipment usage. The section of river that winds through the NSF between Naugatuck and Beacon Falls is additionally recognized as a

Broodstock Salmon Area. Broodstock large Brown Trout (*Salmo trutta*) and Atlantic Salmon are regularly released to the river in an effort to enhance breeding populations.

The riverbank vegetative community consists primarily of Black Birch (*Betula lenta*), Gray Birch (*Betula populifolia*), Yellow Birch (*Betula alleghaniensis*), and Sassafras (*Sassafras albidum*) with an admixture of Eastern Cottonwood (*Populus deltoides*), Red Maple, Silver Maple (*Acer saccharinum*), Black Locust (*Robinia pseudo-acacia*), Northern Catalpa (*Catalpa speciosa*), and Slippery Elm (*Ulmus rubra*). Ailanthus/Tree-of-heaven (*Ailanthus altissima*) occurs infrequently along the riverbank. The understory vegetation is dominated by aggressive Japanese Knotweed (*Polygonum cuspidatum*) with some tree seedlings and saplings. Other flora dispersed in the understory includes Staghorn Sumac (*Rhus typhina*) with Buttonbush (*Cephalanthus occidentalis*) and Purple Loosestrife (*Lythrum salicaria*) closer to the river.

Spruce Brook and Other Perennial Streams Several perennial streams are located in the forest. Spruce Brook, a small tributary, Live Oak Brook, Sugar Bush Brook, and Pines Brook are in the West Block while Egypt Brook is found in the East Block. Spruce, Live Oak, and Egypt Brooks are discussed in the Hemlock Ravines section (Section 4.4.1.2). Pines Brook occurs along the western boundary of the West Block and drains through the reservoir system and wet deciduous and coniferous woodlands described in Sections 4.4.1.2 and 4.4.7.

Intermittent Streams During the wet seasons and spring snowmelt a number of intermittent streams drain the slopes of NSF and contribute their waters to the upper perennial subsystems. As such, they also represent the interface between upland and aquatic habitats. At other times, the intermittent subsystem is marked by dry land or represented by small pools scattered along a narrow channel. Because intermittent streams are transient so are their biological components. These may include cosmopolitan and also specialized plant and animal species that are able to colonize and inhabit temporary landscape components. As such, they further increase biological diversity of upland areas by adding rare and ephemeral species that are inherently valuable precisely because of their rarity.

During the dry periods, the course of these intermittent streams may be traced by characteristic sculpting and molding of terrain by water flow. Other identifiers include mostly sandy or organic muck hydrosols in stretches of low gradient and erosive channels along stretches of higher gradient. Woody vegetation associated with intermittent streams includes American Hornbeam/Blue Beech (*Carpinus caroliniana*), Yellow Birch, Spicebush, Winterberry (*Ilex verticillata*), and Pink Azalea. Herbaceous vegetation is limited because of erosive forces of the water, however, the wetter soils adjacent to and resulting from periodic water flow can produce species such as Jack-in-the-Pulpit.

4.4.5 Palustrine Systems - Wildlife Impoundment and Other Ponds

Wildlife Impoundment Aside from the reservoirs, Wildlife Impoundment at 4-5 acres is the largest body of standing water in the forest (Figure 4-21). The impoundment was formed by the construction of an earthen dike; an outlet flowing underneath feeds a tributary to Hunters Pond. In the early 1980s, the impoundment contained a number of dead and dying Red Maples so it was likely a Red Maple swamp prior to dam construction in the early 1970s. Beavers moved into the impoundment in 2007 and blocked the outlet with sticks and accompanying debris. This resulted in a rise in water level of several feet, nearly to the top of the embankment. Much of the wooded vegetation surrounding the pond is now in standing water. J. Milne reported the beavers were trapped and removed during the winter of 2008 and the outflow pipe will eventually be cleared of debris (per comm.).

With the exception of the dike area, the pond is surrounded by wooded vegetation consisting predominately of Red Maple, Black Birch, Gray Birch, Tupelo/Blackgum (*Nyssa sylvatica*), Sweet

Pepperbush, and Mountain Laurel. With the elevated water level, emergent vegetation is scarce or lacking except for a sprinkling of spikerush (*Eleocharis spp.*) and sedge (*Carex spp.*) along the dam's face. However, a noticeable aquatic bed of Fragrant Water-lily (*Nymphaea odorata*) interspersed with a mixture of Bullhead Lily (*Nuphar lutea*), Water-shield (*Brasenia schreberi*), and Purple Bladderwort (*Utricularia purpurea*) is present on the water's surface. The earthen dike itself supports a lush community of forbs with Common Milkweed, Swamp Milkweed (*Asclepias incarnata*), Indian Hemp, Joe-pye-weed, and goldenrod especially prevalent.



Figure 4-21. Wildlife Impoundment - NSF West Block.

Ponds Several other small ponds are scattered about the West Block; all are less than an acre in size and un-named with the exception of Hunters Pond. Two small ponds are located adjacent to the northern powerline corridor near the northeastern border of the block, while Hunters Pond and a second smaller pond, both with concrete dams, are located along Live Oak Brook. Over the years, sediments have filled these wetlands, so the configuration now resembles large puddles along a small creek.

4.4.6 Palustrine Systems - Vernal Pools, Wet Seeps, and Fire Ponds

Within the IBA are numerous vernal pools and/or wet seeps (a minimum of 15) distributed primarily throughout the forested land, but with a few along the powerline corridors. Additionally, several fire ponds are located in the West Block. All these wetlands are small in size, generally less than 0.5 acre (0.2 ha), but appear to be extremely important breeding areas for a variety of amphibians.

Vernal Pools Vernal pools are ephemeral ecosystems that are important components of the IBA landscape. These pools are shallow, freshwater aquatic habitats that rank among the most temporary of ecosystems, normally occurring in spring months when snow melt and rainfall fill woodland depressions with water, and typically drying during summer months by water loss through evaporation. These pools lack permanent stream inflows and outflows and are primarily underlain with bedrock or hydric soil which retards or prevents water percolation. Vegetation within these areas varies depending on site conditions. For example, one pool found along a powerline corridor contains grasses, rushes, and sedges along with a lush assemblage of forbs. Another vernal pool located in an upland forested area holds a

complement of wooded plants--Yellow Birch, Eastern Hemlock, Spicebush and Witch Hazel—surrounded by patches of sphagnum moss (*Sphagnum spp.*). A photograph of a vernal pool is provided in Figure 4-22.



Figure 4-22. Vernal Pool - NSF East Block.

Acidic Wet Seeps Numerous wet seeps are located in the East and West Blocks near the base of steep slopes or terraces on slopes. Acidic wet seeps form in areas where groundwater discharges to the land surface. Frequently, these seep areas have saturated soils, but contain little standing water. Acidic wet seeps are considered imperiled habitats by Metzler and Wagner (1998) and key habitats by CTDEP (2005b). Vegetation ranges from open woodlands and shrub types to wholly herbaceous, but often occurs as a patched mosaic of woody growth with herbaceous openings. Trees that typically border and shade these seepage areas include Yellow Birch, Red Maple, Eastern Hemlock, American Hornbeam/Blue Beech (*Carpinus caroliniana*), and American Chestnut (*Castanea dentata*). Wooded plants within and fringing the wetland include Sweet Pepperbush and Spicebush. Other flora growing within the seeps themselves include Royal Fern (*Osmunda regalis*), Cinnamon Fern (*Osmunda cinnamomea*), Sensitive Fern (*Onoclea sensibilis*), Interrupted Fern (*Osmunda claytoniana*), Green Wood Orchid (*Platanthera clavellata*), Skunk Cabbage (*Symplocarpus foetidus*), and several species of sedge, rush, and sphagnum moss. An example of a wet seep occurring in the IBA is presented in Figure 4-23.



Figure 4-23. Acidic Wet Seep - NSF East Block.

Fire Ponds At least three fire ponds constructed in the 1930s by the Civilian Conservation Corps are present in the southern section of the West Block. These wetlands are roughly circular and less than 10 meters (33 feet) in diameter, with depths varying from about 0.5–1.5 meters (1.6-4.9 ft). Initially, the ponds were used as water supplies to help suppress forest fires, but now it seems the ponds are functioning as vernal pools. During observations made in May 2008, all three ponds were full of water; but by late August of the same year, two ponds were dry. Additionally, amphibian egg masses within the ponds have been reported (CTDEP 2005a). All the fire ponds were located in oak woodlands with Yellow Birch, Spicebush, and sphagnum moss fringing the water's edge.

The vernal pools, wet seeps, and most likely, fire ponds provide valuable breeding habitats for a variety of amphibians such as newts, frogs, and toads along with populations of aquatic invertebrates. Species observed during 2008 spring and summer outings were Red-spotted Newt (*Notophthalmus v. viridescens*), Wood Frog (*Rana sylvatica*), and American Toad (*Bufo a. americanus*); numerous individuals were observed within or adjacent to these valuable wetlands.

4.4.7 Palustrine Systems - Forested Wetland - Red Maple Swamp

Palustrine forested wetlands are the most abundant and widely distributed wetland type in the state and throughout the northeast (Metzler and Tiner 1992, Golet et al 1993). These wetland forests are separated from other forest types by a preponderance of hydrophytes and the presence of hydric (poorly draining) soils. In this state, the vast majority of wooded wetlands are deciduous forested wetlands, with Red Maple swamps being the predominant type (Metzler and Tiner 1992). Although Red Maple is usually the dominant species, it may be mixed with other trees and appear as a co-dominant species.

Red Maple swamps are found in bottomlands, basins, and drainageways, falling mostly within the West Block of the IBA. Four notable areas featuring this habitat type are: the drainageway north of Reservoir 4 along Pines Brook; the section of bottomland east of the reservoirs at the base of the ridgeline; the bottomland/flood plain along the upper reaches of Spruce Brook; and a drainage basin north of Wildlife

Impoundment. The floristic composition within the swamps is similar, with the dominant trees Red Maple, but other tree species growing in these spots include Yellow Birch, Black Birch, White Ash, and sometime Eastern Hemlock. A few Swamp White Oaks (*Quercus bicolor*) may also be present. The understory layer invariably contains Witch Hazel, Spice Bush, High Bush Blueberry, Blue Beech, and Red Maple seedlings/saplings. Although the herb layer varies markedly, typical species are Skunk Cabbage (*Symplocarpus foetidus*), False Hellebore (*Veratrum viride*), Marsh Marigold (*Caltha palustris*), Jack-in-the-pulpit (*Arisaema triphyllum*), Spotted Jewelweed (*Impatiens capensis*), Sensitive Fern, Cinnamon Fern, and sphagnum moss.

4.4.8 Palustrine Systems - Shrub Swamp Wetland

Several shrub swamps are found within the IBA, mostly in association with Red Maple swamp communities. However, one large and more extensive shrub swamp is located along the southern border of the East Block below the Beacon Cap summit. This approximately four-acre shrub swamp is situated in a basin surrounded by steep hillsides and cliffs and adjacent to a dirt road which was once a town road. Shrubs dispersed through the swamp include Buttonbush, Highbush Blueberry, Speckled Alder (*Alnus rugosa*), Swamp Azalea (*Rhododendron viscosum*), Spicebush, Ironwood, and Pussy Willow (*Salix discolor*) with Mountain Laurel and Witch Hazel around the edges. Dominant trees occurring in the standing water and around the periphery include Red Maple, White Ash and Yellow Birch, while Skunk Cabbage, False Hellebore, Sensitive Fern, Cinnamon Fern and Spotted Jewelweed are common components of the herbaceous layer.

4.5 Avian Species Information

The presence of a mosaic of habitats in close proximity to the Naugatuck River, an important migratory corridor, results in a diversity of avifauna for the IBA. A combined list of observations by Devine and Szantyr from 1978 to 1989 reported a total of 162 species occurring in this area (Devine et al. 1989). By 1996, the total sightings recorded in the area increased to 168 species (Devine and Smith 1996), and currently stands at 188 species. A summary of all species observed in the IBA is included in Table F-1 (Appendix F). This table also contains information on seasonal occurrence, breeding status, and relevant comments. Of the 188 species, 101 regularly or occasionally breed, three are suspected to be breeding, and the remainders are migrants, winter visitors, or summer visitors (Appendix F, Table F-1). The majority of bird observations were made in the IBA or along the Naugatuck River between the East and West Blocks. Exceptions were a few species which occurred in close proximity to, but not actually within, the IBA. Three species were observed by the Laurel Park Landfill, near the NSF border, and a fourth was recorded from Andrew's Hill about 0.4 mile north of the West Block's boundary. These observations are noted on Table F-1 (Appendix F). Although the compilation of bird species began in 1978, the majority of these species regularly occur as migrants, breeders, or winter visitors.

4.6 Avian Species Overview

The IBA encompasses a significant tract of undeveloped and mostly contiguous forestland between the population centers of Naugatuck and Beacon Falls. It provides important habitat for a broad assemblage of birds. Neotropical migrants use the forest as a crucial stopover area to rest and forage during long journeys to and from the breeding or wintering grounds, while other species depend on the forest for sanctuary during the breeding season or in winter. In particular, the IBA offers prime breeding habitat for early successional/shrubland and forest species in an otherwise densely developed south-central Naugatuck River Valley.

Both the size and integrity of the NSF make it especially valuable habitat for area-sensitive forest interior species. Breeding species which occur here and primarily use forest interior habitat include: Barred Owl

(*Strix varia*), Pileated Woodpecker (*Dryocopus pileatus*), Eastern Wood-Pewee (*Contopus virens*), Great Crested Flycatcher (*Myiarchus crinitus*), Red-eyed Vireo (*Vireo olivaceus*), Veery (*Catharus fuscescens*), Wood Thrush (*Hylocichia mustelina*), Worm-eating Warbler (*Helmitheros vermivorum*), Ovenbird (*Seiurus aurocapilla*), and Scarlet Tanager (*Piranga olivacea*). Other forest breeders not as strictly associated with forest interiors, but which occupy forest edges, forest gaps, or less mature forests include Black-billed Cuckoo (*Coccyzus erythrophthalmus*), Yellow-billed Cuckoo (*Coccyzus americanus*), Least Flycatcher (*Empidonax minimus*), Yellow-throated Vireo (*Vireo flavifrons*), Black-and-white Warbler (*Mniotilta varia*), Hooded Warbler (*Setophaga citrina*), American Redstart (*Setophaga ruticilla*), and Baltimore Oriole (*Icterus galbula*). Some species denoted above utilize a combination of early successional, young forest, and more mature forest for foraging, while breeding, and during migration.

The steep-sided Spruce Brook Ravine with its towering hemlocks provides a cooler microclimate for several forest species with a more northern breeding affinity (Devine and Smith 1996). Unfortunately, the Hemlock Woolly Adelgid (*Adelges tsugae*) and hemlock scale infestation have taken their toll, and many of the diseased hemlocks on the upper slope were harvested in a pre-salvage cut in 1999. Hemlocks on the lower slope, however, remain somewhat healthy and continue to offer breeding sanctuary for Blue-headed Vireo (*Vireo solitarius*), Winter Wren (*Troglodytes troglodytes*), Hermit Thrush (*Catharus guttatus*), and Black-throated Green Warbler (*Setophaga virens*). Spruce Brook's picturesque waterfalls and deep pools split the gorge, providing excellent habitat for Louisiana Waterthrush (*Parkesia motacilla*), which regularly forages and nests along the watercourse.

Early successional areas in the form of powerline corridors, fields, or forest openings provide valuable breeding habitat for Gray Catbird (*Dumetella carolinensis*), Prairie Warbler (*Setophaga discolor*), Blue-winged Warbler (*Vermivora cyanoptera*), Chestnut-sided Warbler (*Setophaga pensylvanica*), Common Yellowthroat (*Geothlypis trichas*), Eastern Towhee (*Pipilo erythrophthalmus*), Field Sparrow (*Spizella pusilla*), Indigo Bunting (*Passerina cyanea*), and occasionally Brown Thrasher (*Toxostoma rufum*). American Woodcock (*Scolopax minor*) and Whip-poor-will (*Caprimulgus vociferus*) use these areas for foraging and/or nesting. In 1978, Golden-winged Warblers were found in the forest and occurred intermittently for about a decade. In 2006, after a long hiatus, this species reappeared within a re-established shrubland habitat.

In addition to general early successional shrubland habitats, the IBA contains ecologically unique barrens and associated glades at the rocky summits. These areas are characterized by a savannah-like vegetation structure. Pitch Pine and Bear Oak are dispersed in a patch mosaic with heath shrubs such as blueberry and huckleberry, grassy glades, and bedrock outcrops. Nutrient-poor, droughty soils and/or occasional wildfires have helped maintain the barrens in an arrested state of successional development. Barren habitats in the IBA appear to support a smaller suite of early succession species, including Prairie Warbler, Eastern Towhee, and Indigo Bunting. The bird component notwithstanding, barrens and glades potentially contain many other rare plants and wildlife.

Cliffs and ledges overlooking the Naugatuck River are used by an assortment of raptors and other species throughout the year, but become prime breeding habitat for Turkey Vulture (*Cathartes aura*), Black Vulture (*Coragyps atratus*), and Common Raven (*Corvus corax*) during spring and summer. Numerous pairs of Turkey Vultures nest along the cliffs on ledges or in crevices. This species increased dramatically during the last three decades and is now a year-round resident. Although Black Vultures and Common Ravens are less prevalent, they also use the cliffs for nesting. Red-tailed (*Buteo jamaicensis*), Red-shouldered (*Buteo lineatus*), and Broad-winged (*Buteo platypterus*) Hawks are regularly observed roosting on the cliffs or soaring above the valley; all have nested in woodlands surrounding or within the valley.

The acquisition of the former reservoir system in 2001, not only increased the forest's size by more than 500 acres but, more importantly, it expanded the diversity of habitat. These reservoirs provide important stopover habitat for migrant waterfowl and waterbirds, the complete extent of which is mostly unknown at present, since property access until 2001 was restricted by the previous owner. Though information about the diversity and abundance of waterbirds is incomplete, species observed in recent years include Wood Duck (*Aix Sponsa*), Common Merganser (*Mergus merganser*), Hooded Merganser (*Lophodytes cucullatus*), Ring-necked Duck (*Aythya collaris*), Bufflehead (*Bucephala albeola*), and Pied-billed Grebe (*Podilymbus podiceps*). Other species that breed in the IBA or in close proximity and have been recorded here include Green Heron (*Butorides virescens*), Great Blue Heron (*Ardea herodias*), Osprey (*Pandion haliaetus*), Bald Eagle (*Haliaeetus leucocephalus*), Spotted Sandpiper (*Actitis macularius*), and Eastern Kingbird (*Tyrannus tyrannus*).

Several species rely on the riparian corridor for migration and/or foraging. The riverine system is an important migratory passageway commonly used by Common Nighthawk (*Chordeiles minor*), Chimney Swift (*Chaetura pelagica*), and several species of swallows and raptors. Common Nighthawks migrate south from mid-August into September, and on a few occasions this species has been recorded along the river in impressive numbers (Devine and Smith 1996, B. Devine pers. observation). In addition, significant concentrations of Chimney Swifts occur along the watercourse during spring and fall migration. For example, on May 22, 2003, and September 2, 2003, more than 1000 swifts and swallows were observed actively foraging between Naugatuck and Beacon Falls during the course of their migration through the river valley (B. Devine pers. observation).

4.7 Avian Species of Conservation Priority or Concern

As a result of a compilation drawing upon the array of national, regional, and state lists, a total of 101 species—out of 188 which occur in the IBA—are considered to be of conservation priority and/or concern. Many of the species described in the previous section are of conservation concern and appear on myriad lists. They may be listed as species at risk by federal or state entities, be classified as globally threatened by the International Union for Conservation of Nature (IUCN), appear on the 2007 WatchList developed by Audubon/American Bird Conservancy (ABC), be cited as birds of conservation concern by USFWS, and/or designated as high conservation priority species by Partners in Flight (Rich et al. 2004). Connecticut DEP's Comprehensive Wildlife Conservation Strategy program also lists additional species as "most important," "very important," or "important" with regards to conservation concerns. Table 4-5 summarizes organizations, agencies, and/or committees which track species of conservation concern and identifies their respective lists. No avian species currently found in this IBA are federally-listed as endangered or threatened under the Endangered Species Act (ESA).

Table G-1 (Appendix G) identifies all species of conservation concern appearing on one or more of the above lists observed in the IBA. It also provides detailed information on conservation status as described by the listing entity and habitat information for species breeding in the IBA. It's noteworthy that numerous species fall within multiple lists. For instance, the Golden-winged Warbler is classified as globally threatened-vulnerable by IUCN, is listed in Connecticut as endangered, is designated a high priority species by Partners in Flight (PIF), appears on the Audubon/ABC 2007 WatchList as a red-listed species, and is noted as a bird of national and regional conservation concern by USFWS.

4.7.1 Connecticut State-Listed Species

Table G-1 (Appendix G) includes 22 State-listed bird species which have been recorded in the IBA. Of this number, 10 are designated as endangered, three are listed as threatened, and nine are classified as species of special concern (CTDEP 2010). At this site, the only possible breeding species which is classified as "threatened" or "endangered" is the Golden-winged Warbler. Table 4-6 below summarizes

these species and indicates conservation and seasonal status. Five species are confirmed or possible breeders: Whip-poor-will is known to breed in the IBA; Golden-winged Warbler is either successfully nesting or attempting to nest; and Broad-winged Hawk (*Buteo platyptera*), Brown Thrasher and Northern Saw-whet Owl may be breeding in some years. Two additional species at risk, American Kestrel (*Falco sparverius*) and Eastern Meadowlark (*Sturnella magna*), formerly nested here, but now occur only as migrants. There are some indications, however, that Eastern Meadowlark may be breeding at the nearby Laurel Park Landfill.

Table 4-5. Agencies and Organizations which list Avian Species of Conservation Concern or Priority.

Agency or Organization	List
United States/USFWS	Endangered and Threatened Species List
Connecticut/CTDEP	Connecticut species listed as Endangered, Threatened, or Special Concern
International Union for Conservation of Nature	IUCN Red List of Globally Threatened Species
U.S. Fish & Wildlife Service	Species listed in the <i>Birds of Conservation Concern 2008</i> . New England-Mid Atlantic Coast Region (BCR 30); Atlantic Northern Forest (BCR 14); and, Appalachian Mountains (BCR 28) ^a
National Audubon/ABC ^b	2007 WatchList , species of conservation concern
Partners in Flight	Species identified as “highest priority” or “regional priority” in Southern New England (Area 9) and Northern New England (Area 27)
Connecticut DEP	Species identified under the CWCS program as “Very Important” or “Important”

^a BCR: Bird Conservation Regions.

^b ABC: American Bird Conservancy

Golden-winged Warbler The status of Golden-winged Warblers as a nesting species is quite intriguing. The presence of this species initially appeared to coincide with salvage clear-cuts of diseased Red Pine (*Pinus resinosa*) stands in the West Block in the mid-to late 1970s. Following the removal of these tree stands, Golden-winged Warblers nested in the shrubby areas that grew back, albeit always in low numbers. The warbler’s presence then went undetected for almost two decades as the shrublands transformed into forests. During that period, however, hybrid “Brewster’s” Warblers were sporadically encountered in the IBA. In 2006, a singing male was discovered within an early successional habitat, one of the shrubland spots which had been clear-cut in 2001. At least one singing male subsequently occurred in both the 2007 and 2008 seasons. It is unknown if the male attracted a mate, if breeding occurred, or if any other individuals were even in the area.

This species requires territory within early successional areas supporting few deciduous trees and mixed with herbaceous groundcover and low, dense shrubs (Askins 2008). Preferred habitats can vary from dry upland slopes to wet bottomland with alder thickets. Territories usually include some forest edge. Golden-winged Warblers require large forest openings greater than 10 acres (4 ha), but they prefer sites between 25-37.5 acres (10-15 ha) in size, which can support five to six breeding pairs (Confer 1992a, Askins 2008). Typical breeding habitat used in Connecticut consists of abandoned farmland with scattered trees and shrubs, powerline corridors, alder swamps/beaver impoundments, and timber harvest areas. Nests are normally built on or near the ground, in grass tufts or weed clumps, or concealed in herbage at the base of shrub, tree, ferns, or briars (Confer 1992a, Confer 1992b). Nest sites are often located at the forest and field edges where brushy and herbaceous patches meet (Confer 1992a, Confer 1992b).

Whip-poor-will The NSF historically supported a small breeding population of Whip-poor-wills, dating back at least to the mid-1970s (Devine et al. 1989). Individuals were regularly heard near the forest boundary along Hunter Mt. Road in the West Block, on Spruce Brook Road by the powerline corridor,

and from the hillside above Spruce Brook Ravine. Observers in the East Block have heard birds calling from the Beacon Cap Summit area. Recent call-count surveys (2005-2008) in the West Block by CTDEP confirmed the presence of numerous individuals. While the Whip-poor-will population in the forest appears to be somewhat stable, the Eastern population trend for the species is more uncertain. Results from the North American Breeding Bird Survey (BBS) from 1966-2005 indicate a significant annual 2.8% rate of decline (Sauer et al. 2011). Furthermore, National Audubon in 2007 identified Whip-poor-will as one of the “common species in decline,” ranking it 17th on a list of 20 species. Reasons for this decline may be linked to many factors: habitat loss through development; forest maturation; fire suppression; forest fragmentation; and/or the spraying of insecticide for gypsy moths or other insects, which may reduce its food supply.

Table 4-6. Connecticut State-listed Species Recorded in the IBA.

Species	Status	Seasonal Occurrence and Comments
Common Loon	SC	Migrant
Pied-billed Grebe	E	Migrant
Great Egret	T	Migrant, summer visitor
Northern Harrier	E	Migrant, occasional winter at Laurel Park Landfill (LPL)
Bald Eagle	T	Migrant, winter; now breeds locally
Sharp-shinned Hawk	E	Migrant, winter
Broad-winged Hawk	SC	Migrant, occasional breeder
American Kestrel	T	Migrant, formerly nested
Upland Sandpiper	E	Migrant, one record during hawk watch at LPL
Long-eared Owl	E	Migrant, one record during CBC at LPL
Northern Saw-whet Owl	SC	Migrant, winter, and suspected breeder
Common Nighthawk	E	Migrant, especially late August-September.
Whip-poor-will	SC	Migrant, breeding population in the forest
Red-headed Woodpecker	E	Migrant, one record during hawk watch at LPL
Horned Lark	E	Migrant
Brown Thrasher	SC	Migrant, former (?) breeder
Golden-winged Warbler	E	Migrant, breeding possible
Northern Parula	SC	Migrant
Savannah Sparrow	SC	Migrant
Vesper Sparrow	E	Migrant
Bobolink	SC	Migrant
Eastern Meadowlark	SC	Migrant, formerly nested

Status: E = Endangered; T = Threatened; SC = Special Concern

Typical Whip-poor-will habitat is characterized by open deciduous, mixed, or coniferous woodlands, especially areas of young secondary growth which follow the disturbance of a more mature forest. Preferred sites are often on dry, sandy, soils which retard plant growth, thus resulting in the maintenance of a more open canopy (Clark 1994). Preliminary results from recent monitoring efforts in New England identified Pitch Pine-Bear Oak woodlands/barrens as key habitats which support higher densities of Whip-poor-wills than other forest types (Hunt 2006, King and Collins 2007). Interestingly, the IBA contains such habitats in both the East and West Blocks, although continued research is needed to determine to what extent these habitats are utilized for foraging or nesting. Particular areas which may warrant further investigation are the rocky summits hosting Pitch Pine woodlands and/or Bear Oak shrublands, and savannah-like woodland communities; forest openings and open forests created by timber harvest; and the powerline corridors. It’s likely that this spatial mosaic of several suitable habitat options plays an integral role in fulfilling the habitat requirements for the species.

Broad-winged Hawk In 2010, the Broad-winged Hawk was added to the State-list as a Species of Special Concern. It is a small, migratory raptor which nests in deciduous or mixed woodland often near woods roads or trails and frequently close to a lake, pond, or wetland (Smith and Devine 1994). In

Connecticut, migrating Broad-winged Hawks arrive from April through early May and set up the nesting territory. Two or three eggs are usually laid between mid May into early June, and the incubation period takes approximately 28 to 35 days. After a 29-30 day nesting period the young fledge and leave the nest (DeGraaf and Yamaski 2001). Adults generally remain in the vicinity of the nesting territory until fall departure in September.

The Broad-winged Hawk is an uncommon to rare nesting species in the IBA and has nested in the West Block at least sporadically over the years. Within the nesting territory, the birds can be quite inconspicuous until the eggs have hatched; thereafter, some adults may be more vocal and announce the presence of intruders with a piercing scream while encircling the nesting territory overhead.

Northern Saw-whet Owl Northern Saw-whet Owl is considered a possible breeding bird because it has occurred at least twice during the breeding season; one bird was heard calling in June 1981 in Spruce Brook Ravine, and another was heard at Hunters Mt. Road in mid-May 1991. The most recent documented observation in the IBA was an individual recorded during the Oxford CBC in December, 2005, near Reservoir 1.

The saw-whet owl is described as a regular migrant and winter visitor and an uncommon to rare breeding species in Connecticut (Devine and Smith 1994). The few breeding records for saw-whet owl have occurred in the more rural areas of northwestern Connecticut. This species uses open woodlands, normally near wetlands, for foraging and roosting (Petit 1995). During winter months, it prefers conifer roosts sites, especially Red Cedars and thickets of young spruce, white pine, and hemlock. As with many secretive nocturnal species the extent to which this owl actually occurs in the IBA is unknown. Because of the uncertainty of its breeding status, the Northern Saw-whet Owl is not included within the forest suite of key priority bird species.

Brown Thrasher Brown Thrasher was formerly a fairly common breeder in the forest's West Block (Devine et al. 1989). It occurred along Hunters Mt. Road and Whittemore Road in the abundance of shrubland habitat that proliferated after diseased Red Pine was clear-cut and farmland was abandoned. The Brown Thrasher, a denizen of shrub thickets, brushy hillsides, and woodland edges, prefers open areas with patches of bare ground to feed (Purnell 1994).

Brown Thrasher declined sharply in Connecticut and New England in the last two decades and is now cited as a species of special concern in the state. In a similar trend in the IBA over the past decade, the thrasher's breeding status here has changed considerably. Only a few individuals were encountered during field outings in the last decade, and those birds were thought to be nesting near the grasslands along Hunters Mt. Road. No individuals were found on visits to the IBA during the breeding seasons of 2007 and 2008 (Devine pers. observation). Another bird watcher who regularly visits the NSF reports he hasn't observed a thrasher there for several years (R. Harvey pers. comm.). Although there appears to be sufficient habitat in the IBA to accommodate this species, its current status as a breeder is not encouraging.

American Kestrel In the 1970s, American Kestrels nested in farmland on Hunters Mt. Road. Much of the acreage along the road within and adjacent to the forest was farmland or abandoned farmland containing hayfield, pasture, and orchard. With the exception of the Laurel Park Landfill, the farmland stretched northward to Andrew Hill, interspersed by hedgerows along stone walls and woodland patches. By the early to mid-1980s, as the land regenerated from grasslands to second growth woodlands, kestrels ceased nesting here. Kestrels are now observed in the IBA during fall migration and occasionally in winter at the Laurel Park Landfill.

Eastern Meadowlark The decline of the meadowlark as a breeder mimics the pattern described for the kestrel. In the 1970s it nested in open farmland near the end of Hunters Mt. Road in the vicinity of the north field, but at that time the field area was larger than it is today. While no longer a nesting species in the IBA, meadowlark may breed at the adjacent Laurel Park Landfill. Additional information on meadowlark will be discussed below in the subsection Desired Additional Species.

All remaining State-listed species in Table 4-6 are migrants, winter visitors, or occur during post-breeding dispersal in summer, such as Great Egret (*Ardea alba*). Exceptions are Bald Eagle (*Haliaeetus leucocephalus*) and Sharp-shinned Hawk (*Accipiter striatus*), which are discussed below in the subsection entitled “Desired Additional Species.”

4.7.2 Globally Threatened Species

Five bird species recorded in the IBA are globally threatened and defined as “vulnerable” or “near threatened” by the IUCN (IUCN...[updated 2008]). These species have been placed on the organization’s Red List of Threatened Species; the authority for the bird list has been delegated to BirdLife International. Red List species in Table 4-7 are Red-headed Woodpecker (*Melanerpes erythrocephalus*), Olive-sided Flycatcher (*Contopus cooperi*), Golden-winged Warbler, Cerulean Warbler (*Setophaga cerulea*), and Rusty Blackbird (*Euphagus carolinus*). All except the Golden-winged Warbler are rare to extremely rare migrants in the IBA. Red-headed Woodpecker is regarded as extremely rare, with only one observation made near the IBA’s northern boundary at Laurel Park Landfill in the mid-1980s. The Cerulean Warbler is a species that has only been encountered a few times during spring migration; the most recent sighting was of a singing male in May 2008. Attempts to relocate this individual were unsuccessful. Cerulean Warbler has never been known to nest in the NSF. While the Olive-sided Flycatcher is also known as a rare spring and late summer migrant, it probably occurs annually in very low numbers and simply escapes detection. Rusty Blackbird is an uncommon migrant in general throughout the state, but it’s rarely observed in the IBA. Most likely this can be attributed to limited foraging habitat in the form of swamps with adjacent agricultural land. Red List species are denoted on Table G-1 (Appendix G) as GT-IUCN-TP-V for vulnerable or GP-IUCN-TP-NT for near threatened.

Table 4-7. IUCN Globally Threatened Species Observed in the Naugatuck State Forest IBA.

Species	Red List Category
Cerulean Warbler	Threatened – Vulnerable (population decreasing)
Rusty Blackbird	Threatened – Vulnerable (population decreasing)
Red-headed Woodpecker	Near Threatened - Population decreasing
Olive-sided Flycatcher	Near Threatened - Population decreasing
Golden-winged Warbler	Near Threatened - Population decreasing

4.7.3 Other Priority Species

Notwithstanding the State-listed and globally threatened species discussed above, there are additional priority lists for birds of conservation concern. Of these, the Birds of Conservation Concern report generated by USFWS is mandated by law, while the remaining lists are primarily advisory in nature, e.g. 2007 WatchList. To assist partner agencies and organizations, the *Birds of Conservation Concern 2008* (USFWS 2008) uses three geographic scales: Bird Conservation Regions (BCR); USFWS Regions; and National, encompassing the United States in its entirety. For the purpose of this report, the BCR and National lists are most relevant. The BCRs are ecologically distinct regions in North America having similar bird communities, habitats, and resource management issues. Most of Connecticut is within BCR-30 (New England/Mid-Atlantic Coast Region), with only parts of the northwest corner falling into BCR-14 (Atlantic Northern Forest) and BCR-28 (Appalachian Mountains). The entire IBA is within BCR-30.

Twenty species recorded in the IBA are listed as birds of conservation concern by USFWS, 16 of which are of national priority and four of regional priority. These species are designated as USFWS-NC (national concern) and USFWS-NE (regional concern for the northeast) in Table G-1 in Appendix G.

Partners in Flight (PIF) describe physiographic areas within its regional conservation plans, and Connecticut is included within two physiographic areas: Area 9, Southern New England; and Area 27, Northern New England. Except for the state's northwest corner, Connecticut is in the Southern New England physiographic area, Area 9, as is the IBA. The overall priority pool of bird species for Area 9 is dominated by forest and early successional breeders, many of which are declining. Species noted by PIF as priority species are listed as PIF-HP (highest priority) and PIF-RP (regional priority) in Table G-1 (Appendix G).

National Audubon Society and the American Bird Conservancy (ABC) collaborated in the development of the 2007 WatchList for U.S. Birds (Butcher et al. 2007). This list is divided into the Red List species of greatest continental concern, and the Yellow List species of conservation concern but not to the extreme level of those on the Red List. The Yellow List is subdivided into "declining" species that may be currently widespread and relatively abundant, but are facing significant threats and undergoing population declines, and "rare" species, whose population may be stable and not facing extreme threats, but which have small ranges and small population sizes.

Thirteen species on the 2007 WatchList occur in the IBA: one species, Golden-winged Warbler is Red-listed, 11 species are Yellow-listed because they are declining; and the Blue-winged Warbler is Yellow-listed as rare because of its limited range and population size. These 13 species are designated on Table G-1 (Appendix G) as WatchList-Red or WatchList-Yellow.

4.7.4 Connecticut Comprehensive Wildlife Conservation Strategy Species

Connecticut launched the CWCS program in 2006 after an extensive two-year process of data compilation and review. The program presents a strategy for wildlife conservation in an effort to reverse the decline of wildlife populations and the loss of key habitats. The goal of the CWCS is to "keep common species common" and minimize future listings of species at risk. The CWCS categorizes species with the greatest conservation needs as either "most important," "very important," or "important." The program lists 148 bird species which have significant conservation needs. Of these species, 87 have occurred in the IBA, and 22 of them are State-listed Species. Forty-three of these 86 species are classified as "very important" or "important" and are not found on any of the other priority lists as described above; 29 of these are known or thought to breed (Appendix G, Table G-1).

4.8 Key Priority Species

The overall priority list of key IBA species is dominated by forest-breeding and early successional shrubland bird species (Table 4-8). This list is made up of species known to breed in the IBA and in need of conservation action to ensure long-term maintenance of healthy populations (Appendix G, Table G-1). It includes all State-listed and globally threatened breeding species, or, in the case of the Golden-winged Warbler, a species suspected of breeding. Also cited are most of the other species of high conservation priority. The priority list recognizes the importance of forest species as well as early successional stage species within the forest landscape.

For most of these species, the primary conservation action which will support their needs is long-term habitat protection. The fact that the NSF is in existence and provides a variety of critical vegetative communities is most important. Maintenance of a variety of current forest and early successional

management regimes, protection of the critical habitat areas, and vigilance with regards to conservation threats may be the best practices for species such as Baltimore Oriole, Rose-breasted Grosbeak, and Black-and-White Warbler. Priority species which thrive in more mature forested environments, such as Hairy Woodpecker (*Picoides villosus*), Eastern Wood-Pewee, Wood Thrush, and Scarlet Tanager should benefit from these sections being maintained as “natural areas.” The NSF is presently being managed so that greater than 2200 acres of forest--1200 acres in the East Block and greater than 1000 acres in the West Block--are left undisturbed. These areas have various aged stands, some 60 to 100 years old. The needs of the forest dwelling bird species should be served well for many years to come as the forested landscape ages. Other species on the list have special requirements and/or deserve special attention: they are discussed below.

With the exception of a few permanent residents, all forest breeders on the priority list are neotropical migrants. Some species select interior forest habitat for breeding, while others occupy forest clearings, openings, and gaps. Worm-eating Warbler and Hooded Warbler, forest breeders, are both regarded as uncommon in the state (Zeranski and Baptist 1990, Devine and Smith 1996, Hanisek 2005), but have significant populations in the IBA. A minimum of 10 male Hooded Warblers were found during a site visit in June, 2008. On other surveys during May, June, and July a total of 20 singing Worm-Eating Warblers were detected. While Worm-eating Warblers were found throughout the IBA, Hooded Warblers were only observed in the West Block. Hooded Warbler has occurred in the West Block at least since the early 1980s, and its presence there is likely associated with the ongoing forest management program, which creates openings and gaps in the forested habitat.

One priority species that merits attention and particular consideration is the Golden-winged Warbler. The needs of this species may be difficult to accommodate under the current NSF management scheme. Golden-winged Warblers require large forest openings greater than 10 acres (4 ha), but they prefer sites even larger, between 25-37.5 acres (10-15 ha) in size, which will hold five to six breeding pairs (Confer 1992b, Askins 2008). Given the size of the IBA, larger clear-cut or shelterwood cut areas greater than 25 acres (10 ha) may not be possible. An alternate forestry plan could involve smaller clear-cuts or shelterwood cuts linked with parcels in early successional stages, such as powerline corridors. Besides having specialized habitat requirements with regards to tree growth, Golden-winged Warblers are susceptible to cowbird parasitism; active site management for the warbler would entail simultaneous assessment for this concern (Dettmers and Rosenberg 2000). In addition, hybridization of Golden-winged Warbler with Blue-winged Warbler is a risk; Golden-winged Warblers have historically declined and often disappeared from areas where they cohabit with Blue-winged Warblers. Hybridization appears to be at least one factor contributing to the loss of the IBA's Golden-wing Warbler population in the 1980s. Golden-winged Warbler, although a species that bears watching and is of concern, may be a species whose small population will fluctuate in the IBA due to several factors which cannot be controlled.

Brown Thrasher, previously highlighted in this report, was once fairly common in the IBA following clear cutting of Red Pine. The species may no longer breed here, and, in fact, could also be considered a “desired additional species.” In the 1980s, Brown Thrashers were commonly encountered in the northwest section of the West Block within regenerating clear-cuts and abandoned farmlands. This species became harder to find over the next decade, however, and no birds were recorded during the 2007 and 2008 breeding season. Sufficient early successional habitat appears to be present in the IBA in the form of shrub-edged grassy areas and the powerline corridors, so habitat availability may be only one piece of the ecological puzzle about this shrubland specialist. Questions about the width of the powerline corridors, appropriate vegetative structure, and other features deserve further investigation. The question about this species' status on a regional scale should also be addressed. While there is no specific conservation action with regard to habitat enhancement which can be recommended at present, additional site monitoring and research to determine the status of Brown Thrasher in the IBA would be a logical next step.

Table 4-8. Key Priority Species List for the Naugatuck State Forest IBA.

Habitat	Species	Location in IBA
Forest		
	Broad-winged Hawk	Throughout IBA in forested areas
	Barred Owl	Throughout IBA in forested areas
	Hairy Woodpecker	Throughout IBA in forested areas
	Pileated Woodpecker	Throughout IBA in forested areas
	Eastern Wood-pewee	Throughout IBA in forested areas
	Great Crested Flycatcher	Throughout IBA in forested areas
	Common Raven	Throughout IBA, but mainly along Naugatuck River corridor
	Wood Thrush	Throughout IBA in forested areas
	Veery	Open woodland throughout IBA
	Black-and-white Warbler	Open woodlands and forested woodlands throughout IBA
	Worm-eating Warbler	Throughout IBA mainly along steep forested hillsides
	Hooded Warbler	Forest openings and gaps in West Block
	Louisiana Waterthrush	Along Spruce Brook, Egypt Brook, and Pines Brook, occasionally other small wooded streams
	Rose-breasted Grosbeak	Throughout IBA in open forest and regenerating cuts
	Scarlet Tanager	Throughout IBA in forested areas
	Baltimore Oriole	Throughout IBA in open woodland; edge habitat by reservoirs, fields, powerlines, and along Naugatuck River corridor
Early Successional		
	American Woodcock	Fields, powerline corridors, and young woodlands mainly in West Block
	Whip-poor-will	Fields, powerline corridors, bald areas, open woodlands mainly in West Block, but also at Beacon Cap in E. Block
	Northern Flicker	Fields, powerline corridors, open woodlands and summits
	Brown Thrasher	Fields and powerline corridors?
	Gray Catbird	Throughout IBA early successional habitats and forest edges
	Golden-winged Warbler	Regenerating forest cut in West Block; elsewhere?
	Blue-winged Warbler	Powerline corridors, field areas, regenerating cuts in West Block
	Prairie Warbler	Throughout IBA, powerline corridors, summits, regenerating cuts
	Chestnut-sided Warbler	Powerline corridors, field edges, regenerating cuts mainly in West Block
	Eastern Towhee	Powerline corridors, field edges, summits, regenerating cuts throughout IBA
	Field Sparrow	Powerline corridors and field areas in West Block.

One species of regional concern listed by Partners in Flight, the Black-billed Cuckoo, could potentially appear on the priority list, but has not been included. Although this species is occasionally observed in the IBA, its pattern of occurrence is irregular and usually coincides with outbreaks of Gypsy Moths and/or Tent Caterpillars. Since the presence and relative abundance of Black-billed Cuckoo (and Yellow-billed Cuckoo) is dependent upon the occurrence of insect prey and the species does not regularly breed in the IBA, there is no unique strategy which can be employed to attract this species. With regards to habitat needs, both cuckoo species should benefit by the current silviculture treatments--a combination of even-aged and uneven-aged management of forest stands--creating edge and gaps in the forest.

4.9 Desired Additional Species

Desired additional species are any of the avian species of conservation concern (Appendix G, Table G-1) which occur in the IBA, but they either do not nest or can no longer be confirmed as breeders. With some simple management changes requiring a minimum of effort and resources, several of these species could

be encouraged to nest in the IBA. Others could be attracted by maintaining and enhancing existing management practices as described in Section 6.

The potential additional species which would be desirable additions to the avifauna of the IBA are identified below. Included are two raptors, a game bird, two grassland species, and one forest dweller. Habitat needs and conservation enhancements which could tip the scales in the favor of these species are described.

Bald Eagle On June 28, 2007, Bald Eagle was removed from the Federal List of Endangered and Threatened Wildlife and Plants, and is now listed as a threatened species in Connecticut. In the past decade, eagles have expanded their breeding grounds in the state and now nest within many of the major river corridors, including the Naugatuck River. Recently they successfully nested within three miles of the IBA. In the IBA, Bald Eagles occur as migrants or occasional winter visitors along the Naugatuck River or in the reservoir area. While Bald Eagle hasn't been recorded during the breeding season, it seems like a prime candidate for future nesting due to population expansion of the species in the state and its close proximity to the NSF.

Bald Eagles choose tall trees, frequently White Pine, as nest sites, and usually nest adjacent to, or near, reservoirs and larger rivers in Connecticut. A forest management strategy which would encourage this bird to nest in the IBA amounts simply to leaving a number of large conifers or deciduous trees along the ridges above the Naugatuck River and/or the reservoir area. Since Bald Eagle is a high-profile species with easy visibility, no special survey or census evaluation would be required.

Sharp-shinned Hawk The pattern of occurrence for Sharp-shinned Hawk is similar to the Bald Eagle, but it's observed more frequently. Within the NSF, Sharp-shinned Hawk is regularly observed during migration and less commonly in winter. Although no attempted or successful nesting has been known to take place within the IBA boundary, this species is occasionally observed in the area during summer. Sharp-shinned Hawk nests in remote and extensive woodlands which are associated in many cases with adjacent fields or forest openings for foraging. Nests are usually placed in dense stands of conifers, including hemlock, spruce, or white pine, and less frequently in mixed pine-oak woodlands (Smith and Devine 1994).

Since ample forested habitat exists in the IBA, especially in the more remote East Block, Sharp-shinned Hawk could potentially nest here. No change to current forest management practices would be required, since the East Block will be managed as a "natural" area. However, because this species can be difficult to detect, some additional effort to conduct targeted, ongoing bird surveys during the breeding season would be necessary to assess this species' status as a possible breeder. Nest searches in winter could offer clues to potential areas used by breeding birds. In addition to searching for the presence of this raptor, surveys could possibly detect other priority species and/or identify overlooked key habitats.

Ruffed Grouse This medium-sized game bird of woodlands and thickets has declined significantly in Connecticut and the Northeast over the past two decades. During the CT Breeding Bird Atlas survey (1981-1986) the Ruffed Grouse (*Bonasa umbellus*) was recorded as a breeder or probable breeder within and/or adjacent to the NSF (Bevier 2004), but now hasn't been observed there for one-two decades. In some parts of its range the population is considered cyclic, peaking and ebbing every 8-10 years. In the Northeast, however, the decline is not attributed to a cyclic pattern but to a loss of early successional habitat. Re-establishment of a breeding population within the IBA would be an admirable goal.

Grouse are opportunistic herbivores, foraging on fresh leaves and buds in spring, masts, seeds of grasses, and other plants in summer and fall, and buds and acorns in winter. Favorite food sources are grapes, acorns, berries, greenbriers, nuts, and the buds of aspens, willows, alders, and birches (Martin et al. 1951).

Due to their varied diet and breeding requirements, habitats vary seasonally. Effective management of grouse populations, therefore, requires establishment and maintenance of favorable habitats in close proximity or adjoining one another. These include early successional scrub thickets, young forest stands of sapling-pole timber, and more mature forest. Optimal habitats would include a large log in a small herbaceous opening for spring drumming and a dense conifer thicket of sapling-pole timber for winter roosts.

Management practices employed in the IBA to regenerate forest stands through shelterwood or clear cuts and/or maintaining shrublands (powerline corridors) and field areas appear to satisfy several of the habitat requirements for the species. Additional actions could focus on aspen regeneration and the placement (or leaving behind) of log(s) in a log landing or other suitable opening for drumming.

Black-throated Blue Warbler While the Black-throated Blue Warbler (*Setophaga caerulescens*) is an uncommon to fairly common migrant in the IBA, it is not included on the key priority species list (Table 4-8) because it was not known to breed there. The status of this species could be changing, however. During a site visit in June 2008, a singing male was encountered in the East Block, and CTDEP recorded two individuals while banding in the summer of 2008 in the West Block (Liefert 2008). Due to this new information, it has been designated as a possible breeder on Table F-1 (Appendix F).

Black-throated Blue Warbler breeds within large tracts of unbroken, mature deciduous or mixed forests containing a dense undergrowth of saplings and shrubs, often found within hilly or rough terrain (Petit 1994). As ample habitat seems to exist in the IBA, this species simply may have been overlooked in the past, especially in the unsurveyed East Block, or it could be benefiting from the current forest management practices in the West Block. Additional research is needed to establish if it is a breeder.

Eastern Meadowlark and Bobolink Although at this time no grassland species of conservation concern are known to breed in the IBA, there are several open fields within the NSF landscape which provide excellent habitat biodiversity. In addition to their ecological roles in the lives of myriad butterflies, mammals, and game birds such as American Woodcock and Wild Turkey, the grassy areas and their edge habitats provide optimal breeding, foraging, and resting sites for many commonly-occurring bird species. It's evident the north field also attracts grassland species, such as Savannah Sparrow (*Passerculus sandwichensis*) in migration, American Tree Sparrow (*Spizella arborea*) in winter, and Eastern Bluebird (*Sialia sialis*) in the breeding season. Interestingly, a Clay-colored Sparrow (*Spizella pallida*), a western grassland breeder which rarely occurs in Connecticut, sang on territory for two weeks in May 2008, before departing the area.

Grassland-dependent species are presently omitted from the key avian species list, but two species, Eastern Meadowlark and Bobolink, might still be considered as desirable. Prior to the mid-1980s, Eastern Meadowlark nested in the north field. It's quite possible that either or both of these species now nest(s) at the 35-acre LPL east of the north field area. With the recent conservation enhancements either of these species could conceivably be future breeders.

Both Meadowlarks and Bobolinks are area-sensitive species dependent upon minimum acreage breeding sites. Meadowlarks normally require fields greater than 15 acres, with scattered shrubs and forbs for song perches (Jones and Vickery 1997). In addition, they prefer a thick layer of dead grass for cover and nesting material. Smaller fields can be used by Bobolinks, which require a minimum grassland area of 5-10 acres (Jones and Vickery 1997) and prefer sites with moister soils and a mosaic of grasses, sedges, and scattered broad-leaved forbs with minimal shrub cover (< 25%).

Over the past decade, CTDEP has committed considerable resources to manage field habitats in the West Block. These grassy areas, no larger than four acres each, are size-restricted in their ability to support

area-sensitive grassland species (Jones and Vickery 1997, Comins et al. 2005). One possible exception is the north field. At approximately 12-13 acres, the north field approaches a suitable size to potentially accommodate breeding grassland species such as Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark. It is close to fulfilling the minimal requirements for meadowlark breeding territory of approximately 15 acres, but the field exceeds the size restrictions of five to 10 acres needed for Bobolink.

At present, all of these fields are isolated from each other and not linked by grassland corridors. A possible management strategy would be to link at least the north and south fields with openings that are converted to grasslands, thereby increasing the amount of field habitat. This might be a possible attraction to meadowlark and Bobolink. However, the merits of increasing field habitat in this section of the NSF would have to be weighed against the possible consequences of increased human disturbance due to accessibility and the possible negative impacts of further fragmentation. Careful evaluation of such a plan would be important. Another possible option could involve the Laurel Park Landfill property which is situated directly east of the north field. Encompassing 35 acres of established grassland, this property is a significant parcel and potentially a source pool for breeding grassland species. Future efforts might consider property acquisitions and/or working with adjacent landholders for the purpose of developing an open corridor linking the LPL and the north field.

4.10 Non-avian Species

The IBA provides essential habitat for a wide array of invertebrates and non-avian vertebrates. Of course species diversity and abundance will vary seasonally. Non-avian species sampling by CTDEP have included fisheries surveys of the reservoirs in the West Block. One survey was done in 1991, and a more limited one was undertaken in 2001. An invertebrate light-trapping survey which focused on moths and beetles, also conducted in the West Block, was part of the Whip-poor-will study in 2008. There have been no other surveys for non-avian fauna in the West Block and no formal surveys have ever been conducted in the East Block. Observations made historically and in preparation of this report identified a minimum of: 31 species of butterfly including one subspecies, 22 mammal species, and 15 species of reptiles and amphibians (Devine, 1976-2008). The Fisheries Division of CTDEP recorded 23 species of fish found in the reservoirs and the Naugatuck River.

CTDEP's Natural Diversity Data Base (NDDDB) contains records for five State-listed species from the IBA area (Appendix H). Aside from Whip-poor-will and Golden-winged Warbler discussed in the previous section, there are records for one plant species, Mountain Spleenwort (*Asplenium montanum*). A single invertebrate, Columbine Borer (*Papaipema leucostigma*), and one reptile, Five-lined Skink (*Eumeces fasciatus*) have also been found in the IBA. In addition to these existing records, some additional species of state significance were discovered while resource surveys to supplement this report were being conducted by Devine in 2008. According to the NDDDB data, no species listed federally as endangered or threatened occur in the IBA.

4.10.1 Mammals

No mammal species of conservation concern were recorded during site surveys or reported from the NDDDB. Of note, however, was the collection of a road-killed New England Cottontail (*Sylvilagus transitionalis*) by B. Devine on March 26, 1976. This specimen, identified by examination of the skull, was discovered approximately 1200 yards (1097 m) west of Reservoir 3 on Riggs Street in Oxford. The study skin now resides in The White Memorial Conservation Center Collections, while the skull is in the mammal collection at Southern Connecticut State University. Although New England Cottontail is not presently listed as a species of conservation concern in Connecticut, it has been under review as a candidate for Endangered Species Act protection by the U.S. Fish & Wildlife Service (Anonymous 2006).

Mammals found within the IBA include a variety of insectivores, carnivores, piscivores, omnivores, and herbivores, all of which are fairly representative of Connecticut's terrestrial ecosystems (Table 4-9).

Table 4-9. Mammals Observed in the Naugatuck State Forest IBA

Species	Conservation Status	Comments
Opossum (<i>Didelphis virginiana</i>)		
Short-tailed Shrew (<i>Blarina brevicauda</i>)		
Star-nosed Mole (<i>Condylura cristata</i>)		
Unidentified Bat Species		
Eastern Cottontail (<i>Sylvilagus floridanus</i>)		
New England Cottontail (<i>Sylvilagus transitionalis</i>)	Pending federal review	Found west of IBA on Riggs St, Oxford, March 1976
Eastern Chipmunk (<i>Tamias striatus</i>)		
Woodchuck (<i>Marmota monax</i>)		
Gray Squirrel (<i>Sciurus carolinensis</i>)		
Red Squirrel (<i>Tamiasciurus hudsonicus</i>)		
Southern Flying Squirrel (<i>Glaucomys volans</i>)		
Beaver (<i>Castor canadensis</i>)		
White-footed Mouse (<i>Peromyscus leucopus</i>)		
Meadow Vole (<i>Microtus pennsylvanicus</i>)		
Muskrat (<i>Ondatra zibethicus</i>)		
Coyote (<i>Canis latrans</i>)		
Red Fox (<i>Vulpes vulpes</i>)		
Gray Fox (<i>Urocyon cinereoargenteus</i>)		
Black Bear (<i>Ursus americanus</i>)		Seen occasionally according to Forest Management Plan
Raccoon (<i>Procyon lotor</i>)		
Fisher (<i>Martes pennanti</i>)		Seen occasionally according to Forest Management Plan
Striped Skunk (<i>Mephitis mephitis</i>)		
River Otter (<i>Lutra canadensis</i>)		
Bobcat (<i>Felis rufus</i>)		Seen occasionally according to Forest Management Plan
White-tailed Deer (<i>Odocoileus virginianus</i>)		

Many species are generalists that extended their activities throughout the habitats within the IBA, using forest, field, shrubland, and aquatic areas. Common examples of these species included Opossum (*Didelphis virginiana*), Short-tailed Shrew (*Blarina brevicauda*), Eastern Cottontail (*Sylvilagus floridanus*), Eastern Chipmunk (*Tamias striatus*), Gray Squirrel (*Sciurus carolinensis*), Woodchuck (*Marmota monax*), White-footed Mouse (*Peromyscus leucopus*), Striped Skunk (*Mephitis mephitis*), Raccoon (*Procyon lotor*), and White-tailed Deer (*Odocoileus virginianus*).

Twenty-five species of mammals were found in the IBA; 22 were recorded by Devine, and three additional species were noted in CTDEP's forest management plan (CTDEP 2005a). Mammals were identified on site while surveys were being conducted, through collection and examination of road-killed animals, and /or by analysis of owl pellets. The only animals that were not identified as to species were bats. The New England Cottontail noted above, also included in the total number of animals, was collected just outside the IBA boundary. The 2005 CTDEP forest management plan additionally listed Bobcat (*Felis rufus*), Black Bear (*Ursus americanus*), and Fisher (*Martes pennanti*) as periodically

occurring in the IBA, but these species have never been recorded during field work by Devine. A summary of all mammals recorded in the IBA is presented in Table 4-9.

4.10.2 Amphibian and Reptiles (Herpetofauna)

Amphibian and reptiles are of particular conservation concern to biologists because their populations are experiencing long-term global declines (CTDEP 2005b). According to available scientific information and expert opinion, 24 of Connecticut's 49 amphibians and reptiles are also in decline (CTDEP 2005b). Unfortunately, no formal herpetofauna survey has ever been conducted, but considering the abundance of aquatic and terrestrial habitats, it's conceivable that numerous species exist there. Currently the NDDB contains one record of Five-lined Skink, listed in the state as Threatened. While CTDEP's 2005 forest management plan cites Eastern Box Turtle (*Terrapene c. carolina*), a species of Special Concern and a CWCS "very important" species in Connecticut, as occasionally being encountered in the West Block, the NDDB does not reflect any such record from the IBA area.

Random surveys conducted by Devine from 2008-2010 confirmed the presence of 15 species of herpetofauna, many of which are commonly encountered in wetland habitats (Table 4-10). More notable observations included Five-lined Skink, Eastern Box Turtle, and Wood Frog (*Rana sylvatica*), a vernal pool obligate species. Observations of Eastern Box Turtles and Wood Frogs were made in both the East and West Blocks while two juvenile skinks were discovered in the East Block. Also found were Red-spotted Newt (*Notophthalmus v. viridescens*), American Toad (*Bufo a. americanus*), and Gray-tree Frog (*Hyla versicolor*), all of which are listed as "important species" by the CWCS program (CTDEP 2005b). These three amphibians were encountered in several locations in both blocks of the IBA. All are described as facultative vernal pool species which utilize, but aren't dependent on, vernal pools for breeding.

Note: In June 2010, G. Milne found a road-killed Eastern Box Turtle near the field area on Hunters Mt. Road (G. Milne, pers. comm.).

Table 4-10. Reptiles and Amphibians Observed in the Naugatuck State Forest IBA.

Species	Conservation Status
Reptiles	
Black Rat Snake (<i>Elaphe o. obsoleta</i>)	
Eastern Garter Snake (<i>Thamnophis s. sirtalis</i>)	
Northern Water Snake (<i>Nerodia s. sipedon</i>)	
Common Snapping Turtle (<i>Chelydra s. serpentine</i>)	
Painted Turtle (<i>Chrysemys picta</i>)	
Eastern Box Turtle (<i>Terrapene c. carolina</i>)	State Special Concern, CWCS-VI
Five-lined Skink (<i>Eumeces fasciatus</i>)	State Threatened
Amphibians	
Eastern American Toad (<i>Bufo a. americanus</i>)	
Green Frog (<i>Rana clamitans melanota</i>)	
Gray Treefrog (<i>Hyla versicolor</i>)	CWCS-I
Bullfrog (<i>Rana catesbiana</i>)	
Wood Frog (<i>Rana sylvatica</i>)	CWCS-I
Pickerel Frog (<i>Rana palustris</i>)	
Northern Spring Peeper (<i>Pseudacris crucifer</i>)	
Red-spotted Newt (<i>Notophthalmus viridescens</i>)	CWCS-I

4.10.3 Fish

Several waterbodies within the IBA contain sizable fish populations. Numerous fish species are present in the Naugatuck River and the reservoirs, and some were noted in the small pond near the West Block's northeastern boundary. Additionally, Spruce Brook harbors a small population of native Brook Trout (*Salvelinus fontinalis*), according to E. Stevens (pers.comm.), a local angler.

Reservoirs In August 1991, the CTDEP Fisheries Division conducted fish surveys in Reservoirs 2, 3, and 4 when the owner expressed an interest in selling the four reservoirs and accompanying acreage to the state. At that time, fish surveys conducted by gill netting and snorkeling confirmed the presence of six species and indicated an abundance of Yellow Perch (*Perca flavescens*) and Large-mouth Bass (*Micropterus salmoides*) in Reservoir 2; small Brown Bullhead (*Ictalurus nebulosus*) in Reservoir 3; and Yellow Perch and small Brown Bullhead in Reservoir 4. All species recorded during the survey are identified in Table 4-11. In 2001, CTDEP attempted an electrofish survey of the reservoirs, but the boat could not be launched, so an angling survey was done instead (T Barry, pers. comm.). CTDEP caught few fish during this survey, though Large-mouth Bass were recorded in Reservoir 1.

Naugatuck River The Naugatuck River has become an important sports fishery with water quality improvement and, in the last decade, the reintroduction of Atlantic Salmon (*Salmo salar*) to the waterway. The river from Torrington to Derby is now known as a Trophy Trout Stream, while the section between Naugatuck and Beacon Falls, including the portion that flows through the NSF, is also recognized as a Broodstock Salmon Area. Mature broodstock Brown Trout (*Salmo trutta*) and Atlantic Salmon are regularly released to the river. Rainbow Trout (*Salmo gairdneri*) and Brook Trout are also released to the river as part of the CTDEP's stocking program.

Table 4-11. Fish species present in the Naugatuck State Forest IBA and the Naugatuck River.^a

Species	Naugatuck River	Reservoir 1	Reservoir 2	Reservoir 3	Reservoir 4
Brown trout (<i>Salmo trutta</i>) ^b	x				
Rainbow trout (<i>Oncorhynchus mykiss</i>) ^b	x				
Atlantic Salmon (<i>Salmo salar</i>) ^b	x				
Blacknose dace (<i>Rhinichthys atratulus</i>)	x				
Longnose dace (<i>Rhinichthys cataractae</i>)	x				
Creek chub (<i>Semotilus atromaculatus</i>)	x				
Common shiner (<i>Luxilus cornutus</i>)	x				
White sucker (<i>Catostomus commersoni</i>)	x				
Fallfish (<i>Semotilus corporalis</i>)	x				
Tessellated darter (<i>Etheostoma olmstedii</i>)	x				
Banded killifish (<i>Fundulus diaphanus</i>)	x				
American eel (<i>Anguilla rostrata</i>)	x				
Yellow perch (<i>Perca flavescens</i>)	x		x	x	x
Rock bass (<i>Ambloplites rupestris</i>)	x				
Largemouth bass (<i>Micropterus salmoides</i>)	x	x	x	x	
Smallmouth bass (<i>Micropterus dolomieu</i>)	x				
Redbreast sunfish (<i>Lepomis auritus</i>)	x				
Bluegill sunfish (<i>Lepomis macrochirus</i>)	x				
Pumpkinseed sunfish (<i>Lepomis gibbosus</i>)	x	x		x	x
Black crappie (<i>Pomoxis nigromaculatus</i>)	x				
Yellow bullhead (<i>Ameiurus natalis</i>)	x				x
Brown bullhead (<i>Ameiurus nebulosus</i>)	x			x	x
Chain pickerel (<i>Esox niger</i>)				x	
Sunfish spp. (<i>Lepomis spp.</i>)			x		x

^a Data from CTDEP Fisheries Division

^b Stocked by CTDEP

CTDEP's Fishery Division annually conducts electrofish surveys at two stations along the Naugatuck River. One station is immediately south of the forest in Beacon Falls while the other is north of the forest at the Prospect Street Bridge in Naugatuck. Sampled biennially or intermittently are two additional stations situated along the river south of Spruce Brook's outflow and in Naugatuck at Linden Park. Species recorded during the CTDEP's surveys are summarized in Table 4-11.

4.10.4 Insects – Lepidoptera

Due to its large size and diversity of habitats, the IBA likely harbors a tremendous assortment of insects, as these are worldwide in distribution and are found in all habitats. No formal scientific survey focused solely on insects or other invertebrates has ever been conducted in the IBA, although light trapping for moths and beetles was one element of the 2008 Whip-poor-will study.

The Order Lepidoptera, the butterflies and moths, are not only important for their beauty and role in pollination, but adults and larva alike are essential components of the food chain, providing a source of sustenance for larger invertebrates and vertebrates.

In the course of field surveys conducted within the IBA in 2007 and 2008, butterflies and moths were regularly observed (Devine pers. observation). Observations of butterflies were made throughout the IBA, but the north and south fields, powerline corridors, and earthen dam at Wildlife Impoundment attracted the most species. Devine confirmed the presence of 31 species, including one subspecies, of

butterfly (Table 4-12). During these surveys, numerous skippers were also observed, but only a few species were positively identified.

Data compiled during the Connecticut Butterfly Atlas Project (CBAP) from 1995-1999 recorded 38 species of butterflies occurring within the Naugatuck quadrangle. <<http://research.yale.edu/peabody/COLLECTIONS/cbap/>>. CBAP methodology employed dividing the quadrangle into six blocks, starting in the northwest corner of the quadrangle, with each block given its own designation using the quadrangle number 079 and block number such as 079-1. Four of the Project's atlas blocks--079-1, 079-2, 079-4, and 079-5--fall within part of the IBA. Of the 38 species of butterflies recorded in the quadrangle during the CBAP, 28 species were recorded by G. Hanisek (pers. comm.) within the IBA or in very close proximity. Nine of these species are in addition to the 31 species recorded in the IBA by Devine. These species are summarized in Table 4-13 below.

One species of butterfly, the Eyed Brown (*Lethe eurydice*), is State-listed as a species of Special Concern. One individual was observed during a survey on July 25, 2008, adjacent to the Naugatuck Tap powerline corridor in the West Block.

Numerous moths were observed during site visits, but only one species, Clymene Moth (*Hoploa clymene*), a tiger moth, was identified as to species. Additional information may be forthcoming when CTDEP identifies specimens collected during light-capture events in 2008. According to NDDDB records, the Columbine Borer, a species of Special Concern in the state, was previously recorded in the IBA.

Table 4-12. Butterfly Species Recorded in the Naugatuck State Forest IBA.^a

Species	Conservation Status
Hesperiidae (Skippers)	
Silver-spotted Skipper (<i>Epargyreus clarus</i>)	
Dreamy Duskywing (<i>Erynnis icelus</i>)	
Juvenal's Duskywing (<i>Erynnis juvenalis</i>)	
Hobomok Skipper (<i>Poanes hobomok</i>)	
Papilionidae (Swallowtails)	
Black Swallowtail (<i>Papilio polyxenes</i>)	
Eastern Tiger Swallowtail (<i>Papilio glaucus</i>)	
Spicebush Swallowtail (<i>Papilio troilus</i>)	
Pieridae (Whites and Sulphurs)	
Cabbage White (<i>Pieris rapae</i>)	
Clouded Sulphur (<i>Colias philodice</i>)	
Orange Sulphur (<i>Colias eurytheme</i>)	
Lycaenidae (Gossamer Wings)	
American Copper (<i>Lycaena phlaeas</i>)	
Eastern Tailed Blue (<i>Everes comyntas</i>)	
Spring Azure (<i>Celastrina ladon</i>)	
Summer Azure (<i>Celastrina neglecta</i>)	
Nymphalidae (Brushfoots)	
Great Spangled Fritillary (<i>Speyeria cybele</i>)	
Pearl Crescent (<i>Phyciodes tharos</i>)	
Question Mark (<i>Polygonia interrogationis</i>)	
Eastern Comma (<i>Polygonia comma</i>)	
Mourning Cloak (<i>Nymphalis antiopa</i>)	
American Lady (<i>Vanessa virginiensis</i>)	
Red Admiral (<i>Vanessa atalanta</i>)	
Common Buckeye (<i>Junonia coenia</i>)	
Red-spotted Purple (<i>Limenitis arthemis astyanax</i>)	
White Admiral (<i>Limenitis arthemis arthemis</i>)	
Viceroy (<i>Limenitis archippus</i>)	
Eyed Brown (<i>Lethe eurydice</i>)	State Special Concern
Appalachian Brown (<i>Lethe appalachia</i>)	
Common Wood Nymph (<i>Cercyonis pegala</i>)	
Little Wood-Satyr (<i>Magisto cymela</i>)	
Common Ringlet (<i>Coenonympha tullia</i>)	
Monarch (<i>Danaus plexippus</i>)	

^a Species observed by B. Devine 2007-2008.

Table 4-13. Butterfly Species Record in the Naugatuck Quadrangle during the Connecticut Butterfly Atlas Project 1995-1999.^a

Species	Quadrangle-Block
Lycaenidae (Gossamer Wings)	
Acadian Hairstreak (<i>Satyrrium acadia</i>)	079:2
Brown Elfin (<i>Callophrys augustinus</i>)	079:1, 079:2
Eastern Pine Elfin (<i>Callophrys niphon</i>)	079:4
Hesperiidae (Skippers)	
Long Dash (<i>Polites mystic</i>)	079:4
Peck's Skipper (<i>Polites peckius</i>)	079:2, 079:4
Tawny-edged Skipper (<i>Polites themistocles</i>)	079:2
Southern Cloudywing (<i>Thorybes bathyllus</i>)	079:4, 079:5
Northern Cloudywing (<i>Thorybes pylades</i>)	079:2
Northern Broken-Dash (<i>Wallengrenia egeremet</i>)	079:2

^a Species recorded in Naugatuck Quadrangle (079) in blocks 079-1, 079-2, 079-4, or 079-5 within or near the Naugatuck State Forest IBA.

4.11 Key Non-avian Species

According to data provided by the NDDDB, no federally Endangered or Threatened species have been reported from the IBA area. The following key species are cited based upon their significance as Endangered, Threatened, or of Special Concern in Connecticut. A description of these species accompanied by natural history information is below.

Five-lined Skink Favoring steep, open, rocky areas surrounded by forest, the Five-lined Skink is one of Connecticut's most elusive species (Klemens 2000). Its northeastern range limit extends into Western Connecticut, where its habitat is usually rugged and inaccessible and sometimes subject to periodic fires. Skinks are active from April into October and hibernate from late fall to early spring. In Connecticut, the primary conservation concern is the isolation of distinct and separate skink populations. This separation compromises the species' ability to recover after ecological catastrophes, e.g. fire and disease, through immigration of skinks from other areas (Klemens 2000).

Eastern Box Turtle Box turtles are restricted to low-lying areas of the state, and usually not found above 700 feet (Klemens 1993). Favorite habitats of this turtle include overgrown old fields and deciduous forest where ample cover and sunlight are available (Klemens 2000). Females reach maturity after approximately 12 years and mate between April and October. Four or five eggs are typically laid, and hatchlings emerge in about three months, usually in September. Box turtles can live up to 100 years, but normal life spans are 40-50 years. Conservation threats include road mortality, fragmentation of habitats, and disturbance.

Eyed Brown The butterfly known as the Eyed Brown is a Species of Special Concern in Connecticut. This species is partial to wetlands; it occurs in sedge marshes, fens, wet meadows, and swamps (O'Donnell et al. 2007). Adults feed on sap and bird droppings, while the larvae feed on various species of sedge (*Carex spp.*) The distribution in the state is hard to determine because Eyed Brown is very similar to Appalachian Brown (*Lethe appalachia*) (O'Donnell et al. 2007). In addition, the species are

regularly found in close association as their habitats often overlap. One flight period is described for this species, from late June to mid-August (O'Donnell et al. 2007).

Columbine Borer According to the Natural Diversity Data Base review, this small moth is identified as occurring in the vicinity of the IBA. There is scant information about the life history of this species, except for the following gleaned from Wagner et al. (2009). Phylogenetically, Columbine Borer belongs to a large family known as the noctuid or owlet moths, within a genus with 50 or so eastern species. The insects of this genus are referred to as “stalk borers” because of a major stage in their life cycles. In the fall, adults lay eggs in the vicinity of the larvae host plant, Wild Columbine (*Aquilegia canadensis*) or other species of the genus *Aquilegia*. Once the eggs hatch, the larvae bore into the stem of the host plant and tunnel to the root system. Caterpillars mature in July, and pupation occurs in the soil, with adult emerging from late August into early October. Wild Columbine, the larval host plant, occurs in rocky woodlands and grows in the cracks of ledges and ravines.

Mountain Spleenwort Mountain Spleenwort (*Asplenium montanum*) is a small fern, medium green in color with a unique appearance. It grows to only about three inches tall, but has long fronds about five-inches in length (Thomas and McIntire 2002). According to Metzler and Barrett (2006), Mountain Spleenwort occurs as small tufts lodged in crevices and cracks on shaded cliffs that receive periodic seepage, generally with little other vascular vegetation present. It's grouped within Metzler and Barrett's (2006) Acidic Rocky Summits and Bedrocks classification and occurs on gneiss, schist, granite, or sandstone. In Connecticut, Mountain Spleenwort is listed as a Species of Special Concern (downgraded from Threatened Status in 2010). Records in the Natural Diversity Data Base (NDDDB) indicate that this fern was formerly documented at two sites within the IBA, one in the West Block and the second within or near the East Block.

In the West Block, a single plant was observed in a crevice of a bedrock cliff in the summer of 2008 and in 2009, a small group of spleenwort was located on a cliff face. Additional Mountain Spleenwort plants likely occur along cliff faces, but their preferred habitat is very difficult to access without proper equipment, safeguards, and expertise.

5.0 CONSERVATION CONCERNS, THREATS, AND OPPORTUNITIES

Identifying significant threats to avian species as well as to the habitat they occupy is necessary for the development of a successful management plan. Conservation concerns or threats are activities or events that could negatively impact the health of the bird population in the IBA. The NSF faces a variety of potential threats, some serious and others less so. While various threats are apparent, such as habitat loss or degradation, others, including the colonization of invasive species or deer over-browsing, are more insidious. Negative impacts may result from activities within or outside the IBA, but whatever the source they have the potential to disrupt habitat ecology and reduce biodiversity within the IBA. The most serious threats to the NSF and its associated ecosystems include: lack of habitat management; invasive plants and pests; forest fragmentation and degradation; habitat destruction; and deer overpopulation.

5.1 Conservation Concerns and Threats

5.1.1 Habitat Management Concerns and Challenges

Avian diversity is directly linked to the active early successional and silviculture management regimes now occurring in the IBA. As described in Section 6.2, management of forested and early successional habitats is necessary to support a diverse assemblage of avian species, including the two suites of breeding species of priority concern. Most importantly, due to the temporal nature of early successional habitat, active and ongoing management is critical, because without such maintenance these habitats will quickly revert to forestland.

5.1.1.1 Early Successional Habitat

Early successional habitats such as fields and shrublands are ephemeral ecosystems which would without intensive management revert to forest through natural succession. In the IBA, maintenance of these habitats is essential to promote biodiversity and especially to sustain the suite of key priority shrubland species. While habitat management within the powerline corridors is maintained by CL&P to support utility requirements, management of fields and other shrublands by CTDEP is dependent upon agency resources and grant money, such as that available through the U.S. Department of Agriculture's Wildlife Habitat Incentives Program (WHIP). Without adequate funding or because of grant monies reduction CTDEP may be unable to perform these maintenance functions.

Field Areas To maintain the richness and abundance of flora and fauna within the West Block and the IBA as a whole, management practices which keep the fields open are necessary. Current management applications which seem to be working satisfactorily include burning the north and south fields on a two-three year rotation and annually mowing the two, smaller old fields (Section 6.2). Annual treatment of invasive plants using the selective application of low toxicity, non-persistent herbicides helps control these undesirable species (see Section 5.2).

Powerline Corridors Due to ongoing electrical power needs and utility requirements, the two powerline corridors in the IBA will be regularly managed by CL&P on a four-year maintenance schedule as described in Section 6. These corridors contain more than 40 acres of valuable shrub and grass-shrub habitats. Recent and former breeding bird surveys within the Naugatuck Tap corridor have documented the presence of scrub-shrub specialists including Field Sparrows and Blue-winged, Chestnut-sided, and Prairie Warblers. All of these species have significant declining population trends in Connecticut according to data compiled by the North American Breeding Bird Surveys (Sauer, et al 2011). Not only do the powerline corridors afford breeding sites for shrubland species, but they also provide foraging opportunities for species in adjacent forest stands and for migratory birds. Current threats to the powerline

corridors---and particularly the Naugatuck Tap---include the illegal use of off-road vehicles (ORVs) and to a lesser extent invasive plants (see Sections 5.1.2 and 5.1.5).

Recommendations

- As described in Section 6, continue with the present habitat management scheme for the fields. Mow and burn the fields as necessary and timely to maintain an optimal blend of grasses, herbaceous, and shrubby vegetation. Care must be taken to select an appropriate window for management to protect wildlife such as butterflies and reptiles, as well as nesting or migrating birds.
- Continue with the annual treatment of invasive plants using the selective application of low toxicity, non-persistent herbicides to help control these species (as described in Section 6). Also explore using new and innovative treatment options as they become available. Consideration must be given to the timing of herbicide applications to protect nesting avifauna and other vulnerable species especially invertebrates (e.g. butterflies, butterfly larva, dragonflies, etc) which are an important source of sustenance for insectivores. To protect nesting birds the application of herbicides would be best administered during the non-nesting period.
- Try to secure additional resources and funding through grants and other avenues to supplement resources for habitat management activities within the early successional habitats.
- Take aggressive steps to eliminate all ATV, ORV, and four-wheel drive activity within the NSF. Uncontrolled ATV activity increases noise, pollution, and habitat destruction. It may also aid in dispersal of invasive species. ATV activity disturbs wildlife and disrupts the normal wildlife cycle. It becomes critically important during the breeding season and may lead to nest and nestling abandonment. Enforcement can act as a deterrent to some ATV users. Establish locked gates at fire access forest roads and barriers (e.g. large rocks, concrete blocks, etc) at other potential points of entry. Felled logs may suffice in some areas while other access points can be blocked by erecting wood barriers that blend into the natural background (see Section 5.5).
- Conduct more focused bird surveys to evaluate avian productivity and nest predation within the corridors and field areas. Determine if the corridors are source habitat (avian reproduction exceeds population loss through mortality) or sink habitat (avian reproduction does not exceed mortality losses) areas.
- Routine maintenance of the powerline corridors is conducted on a four-year cycle (Section 6.2). The primary goal is to clear the corridor of unwanted woody vegetation, by cutting and/or selectively applying herbicide. CL&P contractors perform this service in a two-step process: the initial prep cut, done in winter; and, the second step---a foliar spray application---conducted after June 15. The foliar spraying is of concern because of the timing which coincides with peak breeding for many species of bird. Partner with CL&P, stakeholders, and experts to determine the most appropriate window for herbicide treatment which satisfy CL&P's goal, but is most protective of biodiversity in the corridors.

5.1.1.2 Forest Habitats

Currently, more than 3,200 acres of forested land exist in the NSF. CTDEP's primary goal for the IBA is to manage the area for timber production and wildlife diversity by passively managing 2,300 acres, and applying even-aged and uneven-aged silviculture treatments to the remaining 900 plus forested acres. The ultimate goal for the actively managed acreage is to have a composition of 10 % seedling, 30 % saplings/pole-timber, and the remaining 60% in saw-timber. This combination of active and passive management will provide habitat for avifauna requiring a range of successional habitats and support several suites of birds with specific ecological requirements varying from regenerating shrubland to old growth forest. Forest harvesting strongly influences the abundance and diversity of bird species and thus has the potential to increase the abundance of declining early seral species (King and DeGraaf 2004,

Askins et al. 2007). Major concerns associated with forested areas include habitat degradation and fragmentation, invasive species, lack of management, and deer overpopulation.

Forest Management Within the CTDEP’s Forest Management Plan is a 10-year work component (2004-2014) currently being implemented. The management scheme provides for a diverse forest structure which accommodates a variety of flora and fauna using different seral stages of succession. Since the development of a diverse forest structure appears to be proceeding in accordance with CTDEP’s management goals, there is sufficient reason to support the plan. Helping in the meantime, would be the pursuit of more detailed baseline information about the avian community within forested habitat.

Recommendations

- Continue to support the CTDEP’s forest management plan. However, additional detailed information is needed about the avian community to assess the plan’s effectiveness. Through the use of various census techniques, breeding bird productivity surveys, more targeted and concentrated on-site observations, and data analyses the effect of the present management scheme can be evaluated. Then, if necessary, recommendations for modifications or adjustments to the next 10-year work plan can be implemented to enhance avian diversity and/or abundance.
- In the IBA, shrubs, seedlings, and saplings resulting from timber harvests are left to regenerate with minimal management until trees become established and require thinning. One such successional area, an 18-acre opening along Game Plot Road, was clear-cut in two stages, with the second cutting taking place in 2001. Golden-winged Warbler possibly nested in this shrubland during 2006-2008. According to Thompson and DeGraaf (2001), because of rapid succession, breeding bird composition changes quickly in the first 10 to 15 years after clear-cuts. Within 7-10 years most species which prefer shrublands decline (Table 5-1). Eventually, the site enters the stem exclusion stage when the canopy closes and increases in height and the growing space is occupied fully by trees. This stage is the end of early successional habitat for most wildlife species. Ruffed Grouse and American Woodcock, however, prefer this stage because it lacks dense ground cover, but provides full canopy cover (Dessecker and McAuley 2001).

Table 5-1. Number of years after clear-cutting eastern deciduous forest that breeding early successional birds first appear, become common, and then decline. ^a

Species	First Appear	Become Common	Decline
Ruffed Grouse	10	15	20
Northern Flicker	1	1	7-10
Willow Flycatcher	1	2	5-7
Winter Wren	1	4	7-10
Veery	3	10	20
Cedar Waxwing	2	4	7-10
Blue-winged Warbler	1	2	7-10
Chestnut-sided Warbler	2	4	10
Prairie Warbler	2	2	10
Black & White Warbler	3	10	^b
Common Yellowthroat	2	6	10
Field Sparrow	1	2	5
Eastern Towhee	2	?	?
Rose-breasted Grosbeak	3	15	^b
Indigo Bunting	1	2	7-10
American Goldfinch	2	6	7-10

^a Data from Thompson and DeGraaf (2001). ^b Present until next cutting cycle.

Because the regenerating cut on Game Plot Road is now greater than 10 years since the last cutting, many of the desirable bird species breeding here may already be on the decline and soon

gone, as data in Table 5-1 would suggest. CTDEP does not expect to maintain the shrubland habitat here (G. Milne pers. comm.), so it is important that other even-aged harvests in the NSF be carefully timed. It is hoped that other early successional shrubland be created as current patches mature beyond the stand initiation period. This would ensure that suitable open patches which meet the specialized needs of priority species continue to be available. Patch cuts should be of different sizes, shapes, and with irregular borders to provide the greatest habitat variability

5.1.1.3 Rocky Summits

Several key habitats are dispersed through the summit areas. As described in Section 4, some of these communities contain Pitch Pine woodlands and/or Bear Oak shrublands growing on rocky locations under adverse conditions. These pine-oak communities are ecologically unique ecosystems which are fire-maintained and fire-dependent. Periodic fires rejuvenate this habitat by arresting ecological succession and destroying species not adapted to burning, thereby providing optimal conditions for certain adaptive species such as Pitch Pine and Bear Oak. Without fires, hardwood trees may become established and eventually displace pine-oak communities, although succession takes longer than in most other early successional habitat. Wild fires caused by carelessness, negligence, or arson are a normal occurrence in the IBA and many of the summit areas have sporadically been exposed to fire. The most recent fire event was in late April, 2008, when flames blazed up the slope north of Spruce Brook Road and into the north cliffs summit area, damaging shrubs, trees, and the herbaceous layer. But by September, the summit area was covered with a lush herbaceous layer. Bear Oaks were re-sprouting, and bole and basal areas on Pitch Pines were also sending out new shoots (Figure 4-18). Without intermittent wildfires some of these communities could cease to exist in the IBA.

Recommendations As described in Section 4, Pitch Pine-Bear Oak communities are unique and interesting ecosystems. To identify protection needs and make management recommendations for these communities, an initial inventory to locate and identify all noteworthy sites is the first priority. The number of key habitats found during site surveys in 2008 provides a fine starting point. Once these communities are located, an inventory and assessment can follow, with sites prioritized by overall habitat condition and occurrence of obligate pine-oak barren flora and fauna. After these tasks are completed an informed decision could be made regarding habitat improvements.

5.1.2 Exotic Species

5.1.2.1 Invasive Plants

Invasive plant species cause considerable problems in delicate ecological communities. Non-native exotic plants, once introduced, often grow quickly and uncontrollably, and can fill niches originally occupied by native species, subsequently changing the biological structure and composition of native communities. Not only are invasive species quick to establish, but, they also are frequently difficult to control or eradicate. Physical and chemical treatments include cutting, mowing, extracting, and applying herbicides; all can be used in efforts to control invasives, but some aggressive species are often impossible to eradicate, and containment is the only viable solution. However, indiscriminate applications of such aggressive methods may negatively impact native species.

Within the IBA and along the Naugatuck River, 14 species of invasive plants were identified. Garlic Mustard (*Alliaria petiolata*) went undetected during the 2007-2008 visits, but was observed in a parking lot and a log landing area along Hunters Mt. Road in 2010. It was also found during a 2001 survey of the reservoir area by Frederiksen et al (2001). Additionally, in 2010, Japanese Stilt Grass (*Microstegium vimineum*) was observed growing along Whittemore Road by Jeff Ward (per. comm.), who has voiced concern about this species' potential to spread rapidly. The majority of invasive species observed

displayed an affinity for early successional or wetland habitats. A summary of these plants is presented in Table I-1 (Appendix I). This list should not be construed as a complete inventory of all invasive plants in the IBA, but is rather a partial listing of the more obvious species encountered during site visits.

Invasive plants are not abundant anywhere in the IBA, but the largest dispersions were throughout the reservoir complex on earthen dams, within herbaceous openings, and especially along the powerline corridors near Reservoir 4. Invasive species growing there included honeysuckle (*Lonicera spp.*), Asiatic Bittersweet (*Celastrus orbiculatus*), Burning Bush/Winged Euonymus (*Euonymus alatus*), Autumn Olive, Japanese Barberry, and Japanese Knotweed. With the exception of Burning Bush, many of these species, including Japanese Honeysuckle (*Lonicera japonica*) were observed in an abandoned apple orchard/shrubland near the northeast boundary of the West block. Significant quantities of Japanese Barberry were observed on a wooded hillside along Hunters Mt. Road east of Spruce Brook. Species scattered throughout most of the early successional habitats include Multiflora Rose, Japanese Barberry, Autumn Olive, and Asiatic Bittersweet. Common Reed was noted in several small pockets in wet areas along the powerline corridors and other herbaceous patches.

Invasive plants that were observed only along the Naugatuck River corridor include Black Locust (*Robinia pseudoacacia*), Tree of Heaven (*Ailanthus altissima*) and Purple Loosestrife (*Lythrum salicaria*). Unfortunately, a particularly robust patch of Japanese Knotweed also dominates the understory vegetation along the riverine corridor. Black Locust, although native to North America, is not a native plant in New England, and it is considered an undesirable nuisance with the ability to spread rapidly and form thick homogeneous stands. These copses heavily shade the understory, preventing native herbs and shrubs from growing.

Table I-1 (Appendix I) provides information on the locations of the invasive plants in the IBA as well as measures which have been used to, or could be used, to eradicate and/or control the species. Several of these strategies are already being employed in early successional habitats by CTDEP and CL&P as described under Habitat Management in Section 6. Additional information about species identification and best management practices is provided by the Invasive Plant Atlas of New England (Mehrhoff et al. 2003).

Recommendations Future conservation efforts should include site monitoring and the continued use of invasive plant control or eradication measures. Monitoring on a regular basis (semiannual or annual) to track the abundance and spread of known undesirable species and to look for the introduction of new invasive species is desirable. If newly established plants or colonies are detected a concerted effort could be made using stakeholders and/or volunteers to eradicate these colonies before they become established and spread. Highly recommended would be a cooperative effort involving the IBA, Connecticut DOT, Naugatuck River Watershed Association, and other interested stakeholders in the development of an initiative to control the Japanese Knotweed which is overtaking the banks of the Naugatuck River. The overall impact of invasive knotweed on the riverine ecosystem can be dramatic, and control efforts are necessary.

5.1.2.2 Exotic Pests

Hemlock Woolly Adelgid and Hemlock Scales In certain parts of the IBA, forest stand health and composition is being affected by the Hemlock Woolly Adelgid and to a lesser degree by two hemlock scales. The Elongate Hemlock Scale (*Fiorinia externa*), native to Japan, is also a pest of Eastern Hemlock, and sometimes occurs in conjunction with another exotic pest — the Circular Hemlock Scale (*Nuculaspis tsugaet*). Mixed infestations of scales and adelgids can greatly hasten hemlock decline.

The woolly adelgid is an exotic insect first discovered in eastern North America in the early 1950s. By the mid-1980s, the adelgid had reached southern New England (USFS 2009). This aphid-like insect feeds on the young twigs of hemlocks where needles are attached, eventually reducing the tree's ability to produce new shoots. This is followed by needle drop, branch dieback, and thinning of the foliage (McClure 2001). After initial infestation, some trees die within 4-12 years, but site characteristic and other health factors, e.g. freedom from other insect pests and diseases in the target species, determine tree decline. Hemlocks located on cooler and moister sites, such as ravines and north facing slopes, show slower decline over longer periods than species on hilltops or under poor site conditions. The impact of the loss of hemlock, an important climax forest species, is poorly understood, but there is the potential for significant disruption to the biotic community, habitat structure, habitat diversity, and quality of the ecosystem.

Woolly adelgid infestation is occurring in Spruce Brook Ravine and elsewhere in the IBA. Hemlocks on the upper slopes of the ravine were culled in a pre-salvage cut in 1999 and replanted with Eastern White Pine. Hemlocks on the cooler, moister, lower slopes show signs of stress, but are still living.

Recommendations Alternatives for managing the adelgid, particularly in forests, are limited. At present, the CTDEP has no specific management plan addressing the hemlock decline, although the Department is monitoring stand health. Depending upon safety concerns, site locations, and accessibility, the Department may salvage hemlocks which succumb to the decline and replant the sites with Eastern White Pine. Research is being conducted on the state, regional, and national level (Ward et al. 2004). Currently, the Connecticut Agricultural Experiment Station (CAES) working with the USDA has conducted research on systemic insecticides and the release of the adelgid predatory beetle *Sasajiscymnus tsugae*. At the beetle release sites, hemlocks in previously damaged areas have recovered and display healthy crowns. Chemical strategies are being developed to protect hemlock trees until biological interventions can be fully implemented. It is hoped that an effective means of curtailing or eradicating this deadly menace will arrive before the hemlock stands in Spruce Brook Ravine and other locations are completely lost.

Gypsy Moths, Asian Longhorned Beetle, and Emerald Ash Borer Forest stands in the State have endured many outbreaks of exotic pests in the past century. The Gypsy Moth, an exotic pest from Europe, has been one of the most visible and detrimental. In the IBA, severe outbreaks of the pest occurred during the 1960s, mid-1970s, and again in the 1980s, defoliating much of the forest. Many trees, particularly oaks which the pest favors, eventually succumbed to stress following repeat outbreaks. Various factors help control Gypsy Moths in North America: A disease-causing fungus known as *Entomophaga maimaiga* was first introduced in 1910-1911 to control gypsy moth. This fungus only affects select families of moth caterpillars that encounter infected soil and plants or through contact with other infected caterpillars. The spores of the fungus germinate in the spring and work best if rain is abundant. *E. maimaiga* was responsible for widespread gypsy moth mortality in 1989 and 1990, when wetter than normal conditions were reported in May. Since this time, *E. maimaiga* has become a significant regulator of gypsy moth populations at both low and high densities (USDA 2011, PADNR 2009).

Two recently introduced pests, the Asian Longhorned Beetle (*Anoplophora glabripennis*) and the Emerald Ash Borer (*Agrilus planipennis*) have the potential to seriously impact forest health and tree species composition in the NSF. The Emerald Ash Borer (EAB), native to Asia, is responsible for the death or decline of tens of millions of ash trees in 14 states in the Midwest and Northeast. The first official U.S. identification of EAB was in southeastern Michigan in 2002. It is especially dangerous because there is no known treatment for ash borer infestations – trees must be felled and the wood disposed of through approved means (USDA 2010a). As the name implies, it targets and eventually kills members of the ash family including White Ash, a valuable forest species. Another exotic pest, the Asian Longhorned Beetle (ALB), was first detected in New York during 1996, and later found in Chicago, New Jersey, and more recently Worcester and Boston, Massachusetts. The beetle is a serious threat to

hardwood trees and has no known natural predator in the United States. If the Asian Longhorned Beetle becomes established here, it has the potential to cause more damage than Dutch elm disease, chestnut blight, and the Gypsy Moth combined, destroying millions of acres of America's hardwood forests (USDA 2010b).

Because EAB is already considered as established in certain parts of North America, eradication of the insect is no longer the goal. Instead, the focus now is on slowing or preventing the spread of the insect into new areas while managing and reducing its numbers in places where it is already found. Efforts to slow EAB's spread can have positive benefits and buy time until a more effective response to the insect can be found. Experts believe it will appear in Connecticut and have a major impact on ash trees. This stands in sharp contrast to the approach being used for the Asian Longhorned Beetle. In the beetle's case, eradication of the insect in North America is the goal. Due to the behavior of ALB, the potential for eradication is favorable. The interest in control of the EAB is just as strong, but, in all likelihood, should EAB be found in Connecticut, the response to its find will be very different. The nature of this response will depend on the site location and extent of infestation (CTDEP 2011a, CTDEP 2011b).

Recommendations While the CTDEP regularly monitors forest stand health in the IBA, it has no specific management plan to address Gypsy Moth infestation. If an outbreak should occur, the CTDEP would let it take its course, unless a more effective alternative is discovered beforehand. Depending upon safety concerns, site locations, and accessibility the Department might salvage hardwoods which succumb to the defoliation.

The first line of defense against the Emerald Ash Borer and the Asian Longhorned Beetle is to diligently monitor the IBA for visual signs of the borer or beetle. Surveys for all of these potential pests are conducted annually by the CAES in conjunction with CTDEP and other partners. In the NSF and other state forests, purple monitoring traps have been installed in an effort to detect the presence of the EAB. If the EAB is found the discovery triggers quarantine procedures for wood products including: firewood of all hardwood species; green lumber of ash; and, any other dead or living ash material including logs, stumps, roots, branches and composted or uncomposted chips. If ALB is found it would also trigger an immediate quarantine, with procedures similar to, but probably more inclusive, than EAB quarantine procedures (CTDEP 2011a, CTDEP 2011b).

5.1.3 Habitat Loss through Fragmentation and Degradation

A major issue plaguing the forest resource of Connecticut and southern New England is population growth and the associated loss of forested land to development. Residential or commercial development can impact the IBA and be detrimental to forest resources in numerous ways, the most obvious being habitat loss through fragmentation and degradation. Related concerns include the potential for surface and ground water degradation, light and noise pollution, and additional disturbances to wildlife by human and/or domestic animal activity.

When the NSF was donated to the State in 1931 much of the forest property and surrounding landscape was farmland or non-forest habitat. At that time the forest was comprised of approximately 2,000 acres located east and west of the Naugatuck River corridor. In the 1930s-40s, the powerline corridors were constructed and placed through this mostly open landscape. Since then, the NSF has been expanded with additional land acquisitions while the forest and surrounding habitat has regenerated into the forested landform we see today. Obviously, the IBA remains fragmented by the Naugatuck River corridor into the East and West Blocks and by the powerline corridors that bisect sections of the West Block. Even with the existing fragmentation, the IBA contains significant parcels of core forest, and approximately 2,300 acres (927 ha) of passively managed forestland. Roads and trails throughout the IBA, including the town-owned Hunters Mt. Road have closed tree canopies except when crossing or flanking reservoir dams,

powerline cuts, or early successional habitats. Furthermore, large parcels of protected conservation and water company lands are located east, southeast, and southwest of the IBA as described in Section 3.3. Unfortunately, recent and pending residential developments are encroaching on some of the other undeveloped areas buffering the IBA.

The Borough of Naugatuck recently approved a residential development of approximately 275 homes on 400-acres at Andrew Hill, which abuts the northern boundary of the West Block. The potential degradation of Spruce Brook is a significant cause for concern once construction commences. Placement of this development in close proximity to the headwaters of the brook can potentially affect water quality in several ways. These include soil disturbance and erosion during construction; the release of pollutants and sedimentation associated with remediation activities at the former Kaladish dumpsite; and, after project completion, the ongoing degradation caused by stormwater runoff and common residential non-point source discharges. It is entirely possible that these pollutants will compromise water quality, negatively impact the riparian habitat, and be detrimental to aquatic life. This in turn could affect species which forage on streamside invertebrates, such as Louisiana Waterthrush, a species that nests along the stream banks.

While Spruce Brook is designated as a Class “B/A” surface water, a lack of water quality data is available to corroborate this status. The brook was likely assigned this “degraded” status due to potential contamination from the Kaladish property, the former disposal site near its headwaters, and/or possibly the Laurel Park Landfill. In spite of this designation, a local angler reported that native Brook Trout inhabit Spruce Brook (E. Stevens, pers. comm.), which is indicative of high quality water.

Recommendations Once construction commences within the approved development, Spruce Brook should be regularly monitored visually for signs of pollution or of water quality deterioration, the most obvious of which is sedimentation or siltation of the streambed, or an oily sheen on the water. Testing the brook’s water for the Class A water quality criteria prior to construction would provide important baseline data. Thereafter, regular follow-up sampling and testing to compare against baseline findings would indicate if water quality is changing or deteriorating. In the event sedimentation is observed or contaminants are found in the brook, notification should be made to CTDEP’s Stormwater and/or Remediation Groups, the Borough of Naugatuck’s Engineering and Water Pollution Control Department, and the Licensed Environmental Consultant working with the Borough.

Another important recommendation for protecting the IBA's forestland and interior forest avifauna is for proponents of the NSF to form a cooperative venture or association that would partner with adjacent private landowners and landholders of large forested parcels (e.g. Bethany Land Trust, Town of Beacon Falls, Town of Bethany, and Connecticut Water Company). This entity could then advocate for the protection of these forest lands and promote forest health through responsible forest management practices.

5.1.4 Natural Threats

White-tailed Deer Overpopulation of deer is a threat often overlooked by the casual observer. White-tailed Deer have become a cause for conservation concern in Connecticut and much of the eastern U.S. (Askins 2006, Wagner 2007, Metzler 2007). In certain areas of Connecticut, population densities of White-tailed Deer have increased to the point where they have both direct and indirect negative impact on forest vegetation and other wildlife. Over-browsing or selective browsing by large deer populations reduces plant species richness and alters species composition, leaving browse-resistant and/or unpalatable vegetation to dominate the landscape. In extreme cases, deer consume the entire understory and the vegetative structure of the locale changes dramatically. If deer over-consume limited food crops such as acorns and other tree nuts, other species depending upon these masts, including Wild Turkey and Blue Jay

(*Cyanocitta cristata*) are affected. The loss of shrubs and dense herbaceous vegetation furthermore compromises the needs of birds and animals dependent on the vegetation for shelter, food, and/or nesting sites. Bird species which nest on the ground or in low-lying shrub are particularly vulnerable to this habitat loss or degradation (Askins 2006).

Recommendations Although there is a potential for deer over-browsing to become a conservation threat in the IBA, there is no indication that there is a significant threat at the present time. The forest understory remains diverse, containing a rich assortment of shrub and herbaceous vegetation. Deer hunting probably plays a vital role in controlling the local deer population, as the hunting season (bow, shotgun, and muzzleloader) is open between mid-September and late December. Research by Healy (1997) in an oak forest in central Massachusetts suggests that oak regeneration was prevented at deer densities greater than 10/km² (10/0.6 mile²), but oak regeneration and a diverse understory were maintained at deer densities of 3-6/km² (3-6/0.6 mile²). Also, Tilghman (1989) in northwestern Pennsylvania determined that deer density of 7/km² (7/0.6 mile²) was a reasonable management goal; at higher deer densities seeding density and height were reduced. Thus, maintaining deer density below 6-7/km² (6-7/0.6 mile²) would seem prudent for the IBA.

Future monitoring for signs of deer over-browsing will be an important element of conservation planning within the IBA. In addition, a determination of deer density would help to guide planning efforts related to deer management and protection of essential habitats.

Brown-headed Cowbird (*Molothrus ater*) The Brown-headed Cowbird is a known brood parasite which lays its eggs in the nest of a host species, frequently to the detriment of the host's eggs or nestlings. Nest parasitism by cowbirds was once believed to be a significant cause of the decline of songbird populations in North America, but much of that theory has been disputed by scientific research (Muehter 2009). Given the right conditions, however, cowbirds can have a negative impact upon the nesting success of certain protected species, especially those with small and concentrated breeding populations. In these more serious situations cowbird removal efforts have been employed.

Cowbirds were regularly observed during site visits in 2007 and 2008 to the early successional habitats. Moreover, cowbirds were recorded during early successional breeding bird surveys by the CTDEP in 2005 and 2006 and within the Naugatuck Tap powerline corridor by Devine in 1981 and 2008, but cowbird abundance was always quite low. Several recent studies in the northeast U.S. suggest the impact of cowbird nest parasitism is less with regard to shrubland breeding birds than once believed (Yahner 1995, King and Byers 2002). Researchers in western Massachusetts studied survival and reproductive success of Chestnut-sided Warblers within two powerline corridors (King and Byers. 2002). Of 86 nests only two were parasitized by cowbirds: one nest fledged two warblers and a cowbird, and the other was depredated (King and Byers 2002). In southeastern Connecticut, as part of a larger study, Askins et al. (2007) monitored the nests of Blue-winged Warblers in clear-cuts and shelterwood cuts. Although cowbirds were regularly observed in the study area, no nests (N=8) were found to be parasitized by cowbirds. Askins et al. (2007) did caution, however, that cowbirds may pose a concern for declining shrubland breeders, especially in clear-cuts where more snags are left behind as wildlife habitat.

Recommendations At present, it's uncertain what threat, if any, this species poses to the nesting success of scrub-shrub species in the IBA. Additional avian productivity research is needed to determine the impact of cowbirds on shrubland breeders in these habitats.

5.1.5 Human Disturbance or Activity

Human disturbance is the greatest threat to wildlife and sensitive habitats in the IBA. Numerous prohibited activities, such as off-road vehicle (ORV) usage, swimming, and unleashed dog-walking are generally associated with negative impacts on the environment and regularly take place in the NSF. The illegal dumping/disposal of garbage, construction debris, or other unwanted material is a regular occurrence. Acts of vandalism occur intermittently in the West Block, particularly during summer, while illegal campfires and/or arson caused fires which have burned more than 600 acres since 1984; some areas burnt more than once.

Several activities permitted in the NSF are also indirectly and directly having an impact on certain aspects of ecosystem protection. Some of the uses of the forest which may appear to be benign are in fact often contributing indirectly to species disturbance, habitat deterioration, and declining forest quality.

Off-road Vehicles Illegal use of all terrain vehicles (ATVs) and trail bikes in the IBA is a serious concern which has escalated in recent years. Locations most prone to abuse are near the reservoirs and especially along the Naugatuck Tap powerline corridor. These areas are accessed by various trails and woods roads which already have bar-gates and/or barriers to deter unauthorized vehicle entry. Habitat destruction and wildlife disturbance are directly caused by this illegal off-road vehicle (ORV) use. In addition, illegal ORV use is often disruptive and disturbing to other NSF visitors, decreasing their enjoyment and/or spoiling their recreational experience. It has been noted that ORV riders have on occasion also threatened visitors' safety by reckless driving. During an outing in November 2008, the author of this report witnessed a group of eight-10 ATVs and trail bike riders travelling at high speeds around the reservoir complex, a popular walking area. Starting in spring 2008 and continuing to the present time, a small grassy field at the end of Hunters Mt. Road was completely ruined as four-wheel drive vehicles destroyed the vegetative cover and thoroughly disturbed the soil, converting the field into a mud hole (Figure 5-1). Prior to this destruction, the small, warm season grassy area was a favorite site for migrant sparrows. In addition, recent activities from four-wheel drive vehicles destroyed grassland vegetation and scarred the north field itself, leaving deep ruts in the landscape. Another example of ORV abuse linked to habitat destruction occurred along the southern border of the East Block in July, 2008. A vernal pool/wet seep wetland here, a habitat of importance for Red Efts and other amphibians was destroyed by four-wheel drive vehicles.

Property and Habitat Abuses Acts of vandalism, including the defacing, damaging, or removing of signs, breakage of bar-gates or cutting of locks, and other general property abuses are of concern throughout the IBA, but are most prevalent near the reservoirs and summit areas. All contribute to resource and habitat degradation. Damage can be especially problematic in the sensitive ecological communities, such as the balds, ridge-top barrens, and glades harboring important Pitch Pine and Bear Oak communities. In these fragile ecosystems, signs of abuse are more obvious because of the open landscape. Regular site visits confirm that individuals or groups illegally camp or loiter in the NSF, in the course of which they negligently or deliberately destroy vegetation, litter, or otherwise disfigure the landscape. On numerous occasions fire rings, trash, broken bottles, trees and shrubs that have been cut or broken, trampled vegetation, and graffiti have been observed in several of the sites identified as important in this IBA. Areas particularly susceptible to illegal overnight or "partying" activities are summits on Toby's Rock Mt. and two areas in the High Rock Grove section of the East Block. Damage to these sensitive habitats can be serious and, in some cases irreversible. It is no surprise that wildlife dependent on these habitats is adversely affected. Not only are these illegal activities disruptive to the vegetation and associated wildlife, but they detract from the natural beauty of the state forest and these unique places. The overall quality of visitor experience in the NSF is greatly reduced as a result.

An example of habitat destruction and abuse observed within the IBA is provided in Figure 5-2. Figure 4-17 (taken on July 2, 2008) and Figure 5-2 (taken on August 22, 2008) both represent the same bald/grassy glade area before and after prohibited recreational use.



Figure 5-1. Small grassland destroyed by off-road vehicles - NSF West Block.



Figure 5-2. Destruction of glade habitat by prohibited activity - NSF East Block.

Dog-walking There are many visitors who use the forest for dog-walking, seemingly a pleasant activity. However, as noted during site visits in 2007 and 2008, about 75% of dog owners regularly disregard the mandatory leash requirement. The practice of allowing dogs to roam freely is particularly conspicuous in the reservoir area, the most popular place for this dog-walking activity. Many visitors are oblivious that this practice adversely impacts wildlife. During certain critical months, ground nesting birds may be disturbed and unduly stressed, and nest destruction is possible. Dogs wandering through vernal pools or wetland can destroy amphibian eggs or amphibians. In addition, most canines have a tendency to chase and sometimes catch mammals. Finally, dog waste which is not disposed of properly presents concerns about general sanitation and water quality, as well as aesthetics. Effective enforcement of the leash requirement can help protect wildlife and ensure that the area is more enjoyable for all site users.

Illegal Dumping and Disposal Illegal dumping of household garbage, construction debris, and other trash is a recurring problem and concern in the IBA. Another related issue is vehicle abandonment (Figure 5-3). During site surveys that were being conducted in preparation of this report, seven motor vehicles, one boat, and piles of trash and debris were observed within the IBA or on its boundary. Besides being unsightly and contributing to a general sanitation problem, debris and abandoned cars can also be a source of more serious soil and/or groundwater pollution, destroy natural vegetation, and provide shelter (and sometimes food) for nuisance wildlife. The addition of unnatural sheltering spots provides a refuge for species such as rats, cats, and other nuisance predators while concurrently destroying natural vegetation underneath. These nuisance species can have a direct negative impact on breeding birds, as they often include birds, as well as their nestling and eggs, in their diet.

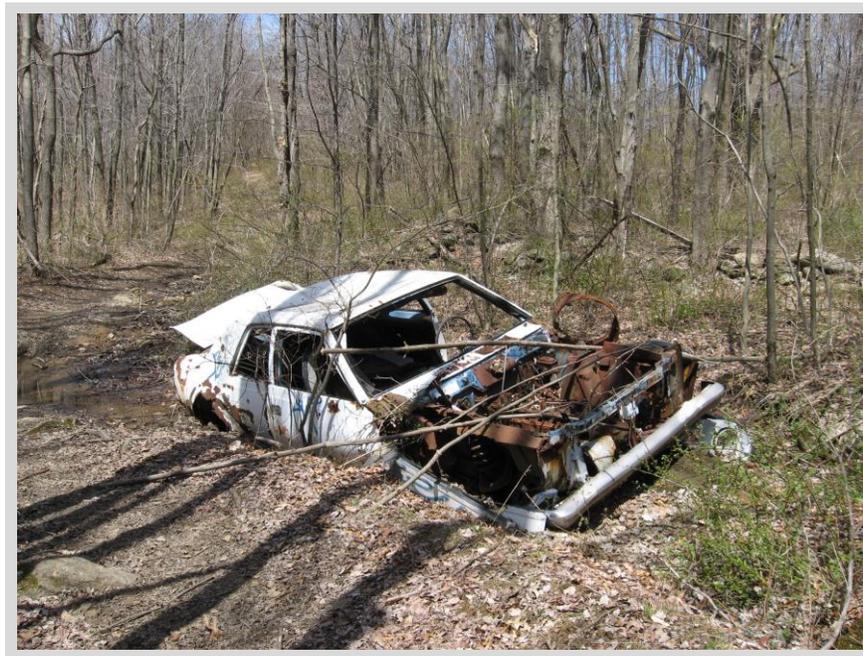


Figure 5-3. Abandoned vehicle in the Naugatuck State Forest – West Block.

Snowmobiling While snowmobiling is allowed in the NSF on designated trails in the West Block, some riders are using areas off-limits to snowmobiles and/or trails where snowmobile use is prohibited. Although one contributing factor is the lack of clear trail signs, some riders are knowingly using improper trails or creating new trails in the Forest. Although snowmobiling is usually considered to have less

impact on the NSF from a conservation standpoint, the activity is not completely benign. Snowmobiles can disturb wildlife as a result of excessive noise or off-trail riding. With regard to avian conservation issues, the main concern about snowmobiling relates to off-trail use and consequent damage to vegetation, along with possible environmental damage as a result of riding in wetland areas when snow and ice cover is insufficient. Any effects on avian species of conservation concern would be indirect.

Swimming The reservoirs have historically been off-limits for swimming due to water quality and safety concerns, and swimming is still a prohibited activity in the IBA. Nevertheless, swimming is prevalent in Reservoir 3 and takes place to a lesser degree in Reservoir 4. On the east side of Reservoir 3 is a campfire circle in a location frequented by young adults and swimming is part of their group activity in the summer months. The forest floor in this area is littered with broken beer bottles and other trash and a “no swimming” sign posted there by CTDEP has been partially obliterated and is no longer legible. Otherwise, Reservoir 3 is a small, but very picturesque waterscape nestled in a hollow and surrounded on three sides by large conifers, primarily Norway Spruce. Swimming is not as common in Reservoir 4, as the reservoir is closer to the roadway and more visible. In the summer of 2008, swimmers were observed several times near the reservoir’s more secluded northern end. Because the reservoirs are designated as Class AA water bodies, water quality is certainly the primary concern. Besides the potential impact of deteriorating water quality on the flora and fauna of the reservoirs, swimming can disturb and distract wildlife and other recreational users of the NSF. The reservoirs are important assets worth protecting, both for their attraction to anglers, and when swimmers are not present, a variety of piscivorous species such as kingfishers, herons, and occasionally otters.

Recommendations Prohibited human-related activities which contribute to habitat degradation and wildlife disturbance are perhaps the biggest challenge in the management of this IBA. Public education and additional signage could help to eliminate or curtail some activities. Educational and informational signs could be posted in conspicuous locations at main entry points, outlining rules about pets and prohibited uses of the NSF, such as swimming, camping, and unauthorized motorized vehicle use. The educational components of these signs would explain undesirable impacts on natural resources. Potential consequences of failure to comply could be posted as well. Also helpful would be signs showing designated hiking, walking, mountain-biking, and snowmobiling trails, the intent being to direct visitors away from sensitive habitats.

Monitoring the NSF for improper use is a complex matter, as is follow-up and enforcement. While CTDEP has regulations and rules which prohibit the activities described in this section, it lacks the resources to effectively police and enforce the requirements. Some illicit activities, such as motorized vehicle abuse, trash disposal, and vandalism represent social and criminal issues that are beyond the scope of this report. Also beyond the capacity of this report are enforcement ideas, many of which are known to CTDEP and NSF. The need for additional resources for combating these problems is obvious but dependent upon public funding and support. Designation of this location as an IBA may, in a best-case scenario, bring positive public attention and support to the NSF, and, eventually, additional funding for environmental protection of the Forest.

5.1.6 Shooting Range

The High Rock Shooting Range has been located near the center of the West Block along Spruce Brook Road since the early 1990s. On occasion, the extreme level of noise associated with this activity can be deafening, a likely disturbance to wildlife and recreational users. A more insidious environmental threat than the noise pollution, however, could be associated with the lead shot commonly used as ammunition. Two potential concerns are connected with the usage of lead shot. One potential hazard can occur when spent lead left at the site migrates into the groundwater via leachate or to Spruce Brook with runoff. A second possible biological hazard involves the unintentional ingestion of lead particles by birds or other

wildlife foraging in the sandy habitat within the range. Lead is a toxic metal that bioaccumulates in the body and causes neurological damage in birds and other wildlife. In 1991, knowing the dangers associated with lead usage, the USFWS banned the use of lead for waterfowl hunting. In July 2008, the USFWS banned the use of lead projectiles for hunting large game and non-game animals in the home range of the California Condor (*Gymnogyps californianus*); condors feeding on dead mammals were succumbing to lead poisoning after ingesting lead particles embedded in the carcasses.

Although lead shot does not readily leach from soil, the possibility exists nevertheless if environmental conditions are suitable. A more likely scenario, however, is the migration of particles with stormwater runoff into Spruce Brook. Once in the brook, lead could be ingested or assimilated by aquatic life, thus affecting invertebrates, fish, and other species in the food chain, including Louisiana Waterthrushes and other birds which feed on invertebrates along the brook. Furthermore, species foraging in the shooting range could inadvertently ingest lead. The impacts of this threat are currently unknown, but if they exist, the risks may be local, affecting birds and wildlife in the immediate area of the range and Spruce Brook.

Recommendations It's not apparent if the range has any restrictions on lead shot, but a review of current operating practices seems to be in order. Best management practices would likely dictate the use of non-lead shot. Steel and other non-lead alternatives are available, but more costly, and requiring these alternatives would perhaps meet with some degree of opposition by range users. However, providing users with information and educating them about the adverse effects of lead in the environment, particularly the risks to native wildlife, may help promote this practice. A second option would be to revise the lease language when the contract ends to require the use of lead free projectiles.

There is additional concern about the former location of the shooting range in a sandbank on Cold Spring Road. The former range still poses a threat to wildlife as the lead shot that was spent there remains in place. This area requires a referral to CTDEP staff members in the Remediation and/or Waste Engineering and Enforcement Divisions, and most likely, eventual proper closure.

5.1.7 Hunting

Hunting is not a direct threat to the avian community in the IBA, except, of course, to the three most popular game species--Wild Turkey (*Meleagris gallopavo*), Ring-necked Pheasant (*Phasianus colchicus*), and Ruffed Grouse. Wild Turkey is regularly observed and the population seems to be stable, if not slightly increasing. The status of the Ruffed Grouse is starkly different, however. Ruffed Grouse was once an uncommon resident, but now it seems to be extirpated from the NSF, as it appears to be in so many other parts of the state. Visits to the IBA over the past decade had failed to turn up a single individual (Devine pers. observation, Roy Harvey pers. comm.). While hunting may not be the primary cause for the grouse's decline in the IBA, it is likely a contributor to the species' extirpation here.

Hunting is more of a concern to IBA visitors--bird watchers and other outdoor enthusiasts--during the open season. Although dates vary from year to year, in general, small game (e.g. small mammals, squirrels, rabbits, etc.) hunting opens in early September and is followed by turkey hunting, and several layers of deer hunting, and again ending with small game. The hunting season, therefore, extends from approximately early September to the end of February. On the third Saturday in October when the small game-upland bird (e.g., pheasant and grouse) seasons opens, the IBA can be teeming with hunters especially in the early successional habitats (fields and shrublands) near the end of Hunters Mt. Road. Turkey hunting by bow and shotgun is also allowed in May for roughly four weeks.

Recommendations If visiting during hunting season it is essential that visitors pay attention to their surrounding, wear bright colored clothing or vests, and attempt to stay in open areas where visibility is

best. Hunting is not allowed on state owned lands on Sunday. If possible, site users should plan their visits for a Sunday during prime hunting season.

5.1.8 Bird WatchingError! Bookmark not defined.

Bird watching and bird photography are favorite pastimes in the NSF, and many individuals visit the area to search for unusual or rare migrants and breeding species. The most popular time for this activity is May and June which coincides with the most active breeding period for many species. While the majority of birdwatchers and photographers maintain respectful distances from rare species, one concern is the potential disturbance of priority species by overenthusiastic birders. Golden-winged Warbler, a rare species in Connecticut and a priority species in the IBA, is a “target” species for bird enthusiasts. Because it is a difficult species to find in the state, some birders are overzealous and inappropriately employ various techniques to draw a bird close.

Recommendations As described in the American Birding Association (ABA) “Codes of Ethics,” birders should “limit the use of recording and other methods of attracting birds, and never use such methods in heavily birded areas, or for attracting any species that is Threatened, Endangered, or Special Concern, or is rare in your area” (ABA 2009).

While this issue is not a common problem in the IBA, it deserves mention. Education about proper birding etiquette and ethics can be conveyed in the course of field trips and/or via information posted on site kiosks or boards.

5.1.9 Feral and Free-Roaming Domestic Cats

Feral cats as well as domestic free-roaming cats cause significant bird mortality in the wild. Recent estimates suggest that feral cats kill at least 3.5 million birds in Connecticut each year (Winter 2007). In addition, feral and domestic cats pose considerable ecological problems and are capable of spreading zoonotic diseases and parasites, such as rabies, cat-scratch fever, fleas, and hookworms, to other cats, wildlife, and people (Winter 2007).

Feral and domestic cats do not appear to be a pressing concern in the IBA, although lost and abandoned cats are sometimes encountered there. The NSF is far enough away from population centers so that domestic cats are rarely noted. Yet the same location feature (slightly distant from major population centers) combined with easy access, puts the NSF at risk as a dumping ground for unwanted items, even animals. In August 2008, a cage holding several cats was abandoned near the end of Hunters Mt. Road.

Recommendations Although not a serious issue in the IBA, the topic of outdoor and feral cats is still worth addressing through public education, both on field trips and posted on-site. The American Bird Conservancy has spearheaded a citizen education and action campaign called: “*Cats Indoors*” to end the unnecessary loss of birds and other wildlife by cat predation (ABC 2009).

5.1.10 Road Mortality

Road mortality is a critical conservation issue for many species, and efforts to reduce or curtail it thus far have met with limited success. The Route 8 corridor poses another real threat to wildlife as it disrupts habitat connectivity between the East and West Blocks and imposes a potential barrier to some species which are indiscriminately killed attempting to cross the roadway. While road mortality on the surface appears to be greatest among mammals, this is because larger dead mammals are more obvious in the overall landscape. Dead birds, amphibians, and reptiles often go undetected and/or are quickly removed and consumed by scavengers. Mortality is likely among these small species as well. One situation

exacerbating this problem is associated with a line of concrete barriers used to separate the northbound and southbound lanes along a one-mile portion of the roadway which falls between the East and West Blocks. These barriers are placed end-to-end without intermittent openings, so terrestrial animals reaching the median barrier in this section are trapped and have no opportunity to cross the highway. A corrugated-metal tunnel, approximately six ft (1.8 m) in diameter, was built beneath Route 8 during road improvements in the 1980s. The tunnel was constructed to provide stormwater drainage and allow anglers access to the Naugatuck River. Unfortunately, this tunnel is located where the barriers end. Vegetation has grown around the opening especially near the riverbank outlet, partially restricting access. At present there is no information about wildlife usage or passage through this conduit.

Recommendations Unfortunately, the problem of road-killed animals is one that occurs throughout the developed world and cannot be easily solved here. But several options for trying to minimize the percentage of animal deaths exist. An initial step would be to collect data to quantify and qualify species mortality and locations killed/found. Monitoring road mortality would be difficult, however, because Route 8 is a heavily traveled, winding, four-lane highway and stopping would be dangerous, but certain hours could be safer and quieter. After the extent of animal mortality has been determined, a case for improvements can be formulated and presented to the CTDOT and CTDEP. Several options to reduce or mitigate animal mortality along Route 8 include:

- Determine which section(s) of roadway are most critical for wildlife movement such as natural wildlife movement corridors that have been blocked by the roadway. This project may be done in conjunction with the initial collection of mortality data or as a separate action.
- Evaluate the potential for enlarging existing culverts to provide larger tunnel-ways to facilitate wildlife movement. Additionally, clear the existing tunnel-way of vegetation and debris at the inlet and outlet openings to aid animal passage.
- Install drift fences that funnel wildlife towards and through the culverts. Such drift fences have been constructed in certain western states and have proven very successful directing movement of large and small mammals, reptiles and amphibians. These fences have also been successful in aiding movement of reptiles and amphibians in a number of eastern states as well.
- Another possible solution is to recommend an alteration to the roadway concrete barriers that now extend along Route 8. Modify the barriers by placing a central archway opening of suitable size that allows animals such as Raccoons and rabbits, but also small mammals, reptiles, and the occasional bird to readily pass through them, thereby avoiding the long expanse of otherwise insurmountable “concrete wall” that now confronts animals that attempt to cross the road.
- Construction associated with the Naugatuck River Greenway Trail may present another opportunity to mitigate mortality depending on the route taken through or along the IBA (see Section 5.1.11). If a bridge is built across the river it could facilitate animal passage. Even without a bridge, construction may include the installation of fencing and/or shrub barriers along the trail which can be used in conjunction with drift fences to guide animals to conduits or tunnel-way(s).

There are no simple solutions to correcting this threat and any remedial action will take a joint effort and coordination by CTDOT, CTDEP, stakeholders, and other interested parties and individuals. Ideally implementing any or all of the corrective measures will reduce impacts to all wildlife, but in reality these measures will offer limited protection to avifauna.

5.1.11 Naugatuck Valley Greenway Trail

The Council of Governments of the Central Naugatuck Valley (<http://www.cogcnv.org/>), a regional planning agency, is proposing a Naugatuck River Greenway Trail with a key section that could go through the NSF. The current proposal recommends using the former roadbed/logging road (i.e. part of the blue trail) alongside Route 8 in the East Block for a portion of the greenway trail, but it's unclear at

this time where the trail will continue beyond where the roadbed presently ends, so this planning issue is a concern.

Recommendations Any proposed development associated with the greenway trail system must take care to maintain the integrity of the IBA. While the construction period connected with this project would likely be short-lived, it must be carefully planned to minimize impacts to nesting birds, wildlife, and critical habitats. On the positive side, a well-planned trail project could also provide immediate and long-term benefits to the forest. Several invasive species such as Autumn Olive and Multiflora Rose are currently growing along the blue trail; with proper management and planning, these species could be removed during the construction phase, thereby leading to their eradication in this section of the forest. The section can then be replanted with smaller trees and shrubs with high wildlife and aesthetics value, thus increasing habitat complexity and adding important mast bearing species for their food value.

5.2 Management Considerations and Opportunities

5.2.1 Important Wildlife Habitat Considerations

Residual Trees and Snags The retention of residual living and dead (snags) trees during timber harvesting provides habitat for avifauna that require perches, tree cavities, or bark foraging sites as the surrounding forest regenerates. Snags are standing dead or dying trees that regularly develop natural cavities or have cavities excavated by woodpeckers, other birds, and mammals. Dens normally occur in living trees with larger cavities suitable for large birds and mammals. Old “wolf trees” make exceptional den or cavity trees and should be left as wildlife habitat during harvesting operations. In Connecticut, a minimum of 25 avian species---owls, woodpeckers, chickadees, nuthatches, and others---regularly use such cavities for nesting, roosting, and protection from the elements or predators. Snags also provide shelter and essential habitat for amphibians, reptiles, and mammals. Snags, dens, and residual living trees are vital to the existence and survival of many species of birds in a regeneration cut. Living and dead trees can be scattered throughout a harvest area or clumped. The distribution and density of living trees and snags will affect which species benefit from the process, but living trees can also impact new tree growth after regeneration. Current CTDEP guidelines recommend three or more snags of 12 inches (30.5 cm) dbh or larger per acre and a minimum of one, 15-inch (38 cm) dbh den tree per acre (CTDEP 1999, CTDEP 2005a).

Slash and Coarse Woody Debris Slash, the remnants of logging, consists of cut branches, limbs, bark, and foliage and while unsightly, is beneficial to wildlife. Placing slash, brush, or other logging debris in loose rows or piles creates denning, refuge, and other sheltered areas for various types of organisms including mammals, amphibians, reptiles, and several species of birds (DeGraaf, et al. 2006). Coarse woody debris refers to downed wood on the forest floor e.g. fallen trees, large branches as well as logs and large pieces of wood left from logging operations. Slash and coarse woody debris left on the forest floor protects the landscape from erosion, recycles nutrients upon decomposition, and provides food and habitat for a wide range of organisms. The importance of slash to wildlife cannot be understated as ongoing research using cover boards---slats of coarse timber---at the White Memorial Conservation Center in Litchfield revealed many species of amphibian, especially salamanders, using this woody debris for shelter and refuge. Redback Salamander (*Plethodon cinereus*) and Red Eft are commonly found beneath this material and several other species of salamander are observed less frequently (J. Fischer per. comm.). A log greater than 12 inches (cm) left in a log landing can be used by Ruffed Grouse as a drumming station.

Mast Mast is a term commonly used to describe the seeds and fruits of woody plants consumed by wildlife. Hard mast include acorns, hickory nuts, walnuts, beechnuts, and pine seeds, whereas soft mast refers to berries such as black cherries, blackberries, raspberries, blueberries, and grapes. Hard masts are

typically produced in fall and are high in fat, carbohydrates, and protein. As a result, they provide an energy rich food source important to wildlife during the fall and winter months. Soft masts are soft, fleshy, perishable fruits that are often high in sugar, vitamins, and carbohydrates, and are usually not readily available in the winter months. These fruits, however, can be a crucial energy source for birds during nesting, post-fledging, and migration. A combination of mast producing trees and shrubs is important to sustain avian species and other wildlife throughout the year and in the event one crop fails to produce in one or more years.

In approximately 60 % of the forest stands within the West Block oaks are the dominant or co-dominant canopy cover. Hardwood stands with a high percentage of oaks offer excellent food and cover for birds and wildlife. Leaves, twigs, and young shoots provide browse for deer and rabbits and leaves serve as food for a variety of invertebrates including several species of moth larvae which feed exclusively on oak leaves. The acorns, however, provide the most valuable source of sustenance for a diverse variety of wildlife. Acorns are consumed by at least 96 species of wildlife and their greatest value is in the critical winter season when other foods are scarce (Martin et al. 1951). Wild Turkeys, Blue Jays, Ruffed Grouse, Red-headed Woodpeckers, deer, squirrels, and bears all readily consume acorns; however, the masts from oaks are not all alike. Oaks are grouped into two broad categories: the white oak group and red oak group occasionally referred to as the black oak group. In the IBA, trees in the white oak group include White Oak, Swamp White Oak, and Chestnut Oak, while Northern Red Oak, Scarlet Oak, Black Oak, and the scrubby Bear Oak fall under the red oak group. Acorns differ in physical and chemical properties across the genus, but show considerable consistency within each of these two groups. Acorns in the red oak group usually contain higher fat content, high tannin content, and usually require in our region at least a period of winter dormancy before germinating. In contrast, acorns of white oak species exhibit lower concentrations of both fat and tannin and germinate immediately after falling (Ofcarcik and Burns 1971, Kirkpatrick and Pekins 2002). Because acorns from the white oak group germinate shortly after falling they cannot be stored and therefore are consumed quickly by granivores and omnivores. In contrast, the longer germination period for acorns in the red oak group allows granivores more time to collect and cache acorns for winter storage or, consume the acorns throughout the winter.

The importance of oaks to the forested ecosystem was aptly summarized by McShea and Healy (2002). While oaks don't usually qualify as keystone species because of their dominance in both biomass and numbers, "oaks are far more critical than their numbers indicate, because their production of acorns is the linchpin upon which much of the forested ecosystem hinges. Effective management of oaks and by that we mean the retention of sufficient mast-crop potential and the effective regeneration of harvested stands is the key to maintaining wildlife populations and practicing true ecosystem management."

5.2.2 Management Opportunities

Forest Habitats Long term goals for the IBA are to protect, preserve, and manage habitats that enhance avifauna abundance and diversity as well as other wildlife for future generations. A key component of this will be to continue with and/or implement management practices that improve habitat quality and diversity. Management objectives, therefore, must consider the continuity and improvement of existing natural vegetation while concurrently eliminating invasive species and deterring disturbance factors. Through coordinated efforts between stewards, stakeholders, and other volunteers, existing habitats within the IBA could be improved or enhanced either in conjunction with timber harvest, powerline corridor maintenance, or as separate conservation actions. Several of these recommendations are known by CTDEP and are described in the forest management plan or other documents; they are being reiterated here to emphasize their importance to habitat management.

Recommendations

- Designate the 1100 acres in the West Block (forest stands: 1-1, 1-2, etc.) as “perpetually undisturbed forest” to clarify the intent of the language in the forest management plan. Also assign the entire East Block ---with the possible exception of the pine stand in the High Rock Grove Section that might require future thinning ---the same designation.
- Limit the more aggressive logging activities, such as shelterwood cuts, clear-cuts, and large selection cuts, to protect breeding birds during the peak breeding season---approximately May through July. During the peak breeding period conduct other less intrusive harvesting tasks.
- Ensure that the minimum numbers of snag and den trees are left standing following timber harvest. Current policy recommends that three snag trees >12 inches (0.3 m) dbh and one den cavity tree >15 inch (0.4 m) dbh remain per acre (CTDEP 1999, CTDEP 2005a). When harvesting, if the minimum number of snags cannot be left due to OSHA safety concerns or lack of suitable trees, girdle or cut living poorer quality trees to satisfy the recommendations. One cautionary note here, however, recent research in Connecticut forests suggested that too many snags may attract cowbirds and possibly impact the nesting success of shrubland breeders (Askins et al. 2007).
- To hinder the establishment and spread of invasive plants after timber harvests, plant log landings with a native grass and/or wildflower conservation mixture. Afterward, monitor log landing and skid roads for the establishment of invasive plants as such areas are prone to colonization. A recent example is the establishment of Garlic Mustard in a location---behind the bar gate at Forest Stand 4-2--- used as a log landing in 2008/2009. As suggested in the West Block’s Forest Management Plan, consider implementing an invasive species control component as a stipulation of the Timber Harvest Contract.
- An important way to attract Ruffed Grouse is through aspen management. When possible attempt to regenerate aspens in stands where they are present. Aspen and mixed stands of aspen and hardwood or aspen and conifers could be managed to maximize grouse densities. The ideal way to obtain maximum aspen regeneration is to clear-cut, exposing the ground to sunlight, which stimulates suckering from the roots of cut trees. Once aspen is established on a site, it will persist for many years if burned, broken down, or cut periodically. Harvesting during the winter usually provides the best aspen regeneration. Mixed oak-hickory woodlands also have a high potential for improving habitat for grouse. A mosaic of 1-10 acre regenerating cuts dominated by 5-15 foot tall oak or aspen saplings adjacent to mature timber provides the best year-round grouse habitat.

Powerline Corridors NU powerline management guidelines strive for grasses and forbs in the wire zone and shrubs in the outer zone which suggests a feathered effect from the center of the corridor to the woodland edge. While some areas along the corridors do exhibit vegetative structure similar to the recommended goal, other locations do not. Abrupt ecotones with little or no shrub cover are present in sections of the corridors. Various conservation actions can be employed to improve or enhance the vegetative structure and habitat quality along these corridors.

Recommendations

- Shelterwood or clear-cut treatments conducted in forest stands adjacent to the corridors can provide an opportunity to weave these regeneration cuts into the corridors. Not only could this feather the abrupt edge found in some areas but provide for irregular corridor borders thus softening the edge and creating additional habitat for shrubland specialists utilizing the corridors and adjoining patch cuts.
- Every 10 years, CL&P’s maintenance schedule requires side trimming of trees and shrubs extending into the corridor within 20 ft (6m) of the conductor. Through cooperative effort with NU/CL&P, CTDEP, and other stakeholders, this maintenance activity may be used advantageously to improve corridor edge habitat by cutting back trees to soften and feather the

ecotone in a manner similar to that described above for shelterwood harvests. Partnering with NU/CL&P is necessary to successfully implement this task.

- To increase vertical diversity and enhance shrubland habitat within the corridors consider planting native, mast producing shrubs or small trees in areas with minimal shrub coverage and/or locations where invasive shrubs were removed by cutting and/or herbicide treatment. Coordinate with NU to determine the types and amount of woody vegetation the company would find acceptable and allow to remain in the corridors. Some species to consider include Winterberry, **American Holly (*Ilex opaca*)**, Gray Dogwood (*Cornus racemosa*), High Bush Blueberry, and crab apple depending on soil and moisture conditions. Plantings can be vividly marked to identify and to avoid inadvertent treatment the next NU/CL&P maintenance round.
- Encourage production of mast producing vines and shrubs e.g. grapes, brambles, Virginia Creeper, etc. by releasing species already present to stimulate growth.
- Protect the current vegetative structure and composition by eliminating ATV activity within the corridors as described above.

5.2.3 Educational Opportunities

Interpretative displays in poster form placed at strategic locations are excellent for educational purposes. They simultaneously engage the interest of hikers, wildlife enthusiasts, and other IBA visitors, and promote natural history education and explain ongoing wildlife habitat projects. For NSF such displays can range from illustrating characteristic plant and bird species and their habitats to providing explanations for habitat improvement projects. These projects could include shelterwood cutting, planting mast species, and trail placement that minimizes disturbance while maximizing exposure to wildlife and their habitats. For maximum effectiveness these displays should be placed at appropriate locations recommended by biologists, foresters, and other interested stakeholders.

Various informational and educational materials are currently being discussed, planned, and/or developed for the IBA. Several such materials are expected to be offered as informational or interpretative handouts or web-based printouts from the CTDEP website. Another project moving forward is the development of interpretative signs to describe birds benefitting from specific timber harvest practices. When complete, these educational materials will be a valuable resource to community members, site users, and interested parties. They will advance awareness that the NSF is an IBA, and provide information about birds, their habitats, and ongoing habitat management practices.

Recommendations

- Finalize the “Bird Checklist for the Naugatuck State Forest” and make it available at kiosks/information boards in the forest and/or through CTDEP’s website.
- Complete the booklet on the advantages of forest management practices to the birds. A graduate student, under guidance from CTDEP and stakeholders, is preparing an education booklet that highlights habitat management techniques and birds of conservation concern benefitting from such management. Once complete, the booklet may be placed on the CTDEP’s website for the general public and IBA visitors.
- Develop posters/interpretative signage---as discussed in the paragraph above---for placement within the IBA.
- Consult with CTDEP staff and other interested forest users about the best locations and placements for the interpretive signs.

6.0 RECENT CONSERVATION ACTIVITIES

6.1 Land Acquisition

Subsequent to the initial property donation by the Whittemore family in 1931, adjoining land parcels were acquired and added steadily through the years. An acquisition in 2001 of more than 500 acres of former reservoir property was significant. Several smaller acquisitions followed, the most recent being the purchase of a 1.75-acre in-holding in the West Block in October, 2008. Although there is still some undeveloped land abutting the IBA property which could potentially be added to the existing parcel, undeveloped property surrounding the IBA is rapidly being procured by private developers. Recently, for example, a large parcel of ~400 undeveloped acres near the northern boundary of the West Block was approved for a residential development of approximately 275 homes by the Borough of Naugatuck. In Oxford, about 0.25 mile west of the IBA's western boundary, a large golf course-residential development which includes about 300 residential properties is nearly completed.

6.2 Habitat Management Activities

Four entities have principal responsibility for the current habitat management within the NSF: CTDEP's Forestry Division provides oversight for activities related to forestry management (e.g. timber harvest, cordwood cutting) and forest fire suppression; CTDEP's Wildlife Division (State Land Habitat Program) assists the Forestry Division with habitat management and invasive species control within the grassland complex; CTDEP's State Parks Division is responsible for recreational planning, posting signs, mowing, trash removal, and other routine maintenance activities; and Connecticut Light & Power (CL&P), a subsidiary of Northeast Utilities (NU), manages the habitat along the powerline corridors. Recent and on-going management activities are described below.

6.2.1 Field Management

The large field north of Hunters Mt. Road was formerly a mixture of hayfield, pasture, and apple orchard, which by the 1990s had gradually reverted to shrubland. Grassland management in the area has since 1998 been primarily within the purview of the CTDEP's Wildlife Division (State Land Habitat Program). Programs such as this historically have been underfunded, but in 1998 funding became available through the Department of Agriculture's (USDA) Wildlife Habitat Incentive Program (WHIP). This funding provided CTDEP with an opportunity to re-establish a desirable landscape of early successional grassland and old field habitat.

When the WHIP contracts went into effect, the management regime began with the restoration of the fields (Figure 6-1). With the exception of several fruit trees and Red Cedars, the areas were cleared of woody vegetation, and the understory was burned or mowed. At least five controlled burns, beginning in 1999, have occurred on a two-three year rotation in the north field and south field, the most recent being in April 2008. Several years ago, one of the remaining two old fields was burned only one time. Mowing of the old fields occurs on an annual basis, however. The next management strategy employed was a program of non-native invasive plant control. A significant portion of the site management includes control by selective herbicide spraying of species such as Autumn Olive and Multiflora Rose. Under the WHIP contract, the CTDEP has agreed to provide habitat management services in the IBA through 2011 (P. Rothbart pers. comm.). Habitat management until the contract expires will include regular mowing and invasive plant control.

6.2.2 Shrubland Management -- Powerline Corridors

Vegetation management to suppress large woody plants is undertaken by NU as a control measure within the powerline corridors. The company developed a draft document entitled *Northeast Utilities Wildfire Habitat Management Plan* as a guide for managing habitat within the corridors (Northeast Utilities 1999). According to this plan, vegetation is controlled by the application of mechanical or chemical treatment, but normally requires a combination of both methods to maintain the corridors in an optimum state. When herbicides are used, spray or liquid is applied to selective foliage, basal areas of plants, and/or cut stumps. The management regime strives for the establishment of grasses, forbs, and low-lying shrubs in the central zone beneath the wires and taller shrubs in the side zones. Scattered pockets of Red Cedar and other select shrubs are allowed in the wire zone, however. The plan also describes methods employed in sensitive environmental areas, such as wetlands, stream, or river crossings, and non-chemical use areas, including protected watersheds.

Powerline corridors in the IBA (and elsewhere) are serviced on a four-year cycle, unless powerline maintenance or repair dictates otherwise (A. Johnson pers. comm.). The maintenance process is completed in two phases: the initial prep cutting phase, done in winter, involves a removal of undesirable wooded growth by cutting and selectively applying herbicide(s) to the stumps to prevent re-sprouting. The second foliar treatment phase is conducted in late spring or summer (after June 15) and involves selectively spraying herbicide to the foliage and stems of individual plants. Several invasive species, including buckthorn, Autumn Olive, Multiflora Rose, and Japanese Barberry, are purposely targeted for treatment during maintenance activity. Every 10 years corridors are side-trimmed to remove taller shrubs and trees that extend into the corridor, as company policy requires a minimum of 20 ft (6 m) between branches and conductors. Routine maintenance was last performed in 2006 on the Naugatuck and Beacon Falls Taps and the next maintenance activity is scheduled for 2010, as both powerline corridors are on the same maintenance schedule (A. Johnson pers. comm.).

During 2007 and 2008, NU was involved in a major project replacing conductors along the Beacon Falls Tap. Activity in this corridor occurred over an extended period and involved the usage of heavy equipment which disturbed soil and vegetation in some areas. Company policies dictate the regrading and reseeded of larger areas of disturbance with a conservation grass seed mixture required by soil erosion and sediment control regulations and described within the *2002 Guidelines for Soil Erosion and Sedimentation Control* (Rothchild 2002).

6.2.3 Forest Management

Forest was the dominant landscape in New England during the pre-Colonial era. Natural disturbance such as fire, wind throw, blow-down, beaver activity, and flood, provided openings and diversity within the forest structure. In addition, Native Americans used fire to clear the forest to facilitate farming and hunting. Grassland and shrubland created by these disturbances formed a patch mosaic within the forested landscape. The arrival of the European settlers brought significant changes to the landscape. A majority of the forested land was cleared in the 1700s and early 1800s to create farmland. Subsequently, the abandonment of this agricultural land reached a peak in New England in the late 1800s to mid-1900s, and the vast amount of farmland slowly reverted to forest (Litvaitis 1993, Askins 2002). Today, the forest is again the dominant landform and natural disturbances, particularly, fire, flood, and beaver activity are suppressed or controlled by human activity. Consequently, open, early successional habitat which was common the last few centuries has declined precipitously within Connecticut and the northeast.

Silviculture mimics natural forest disturbances by removing trees or batches of trees within the forested landscape. Although one objective is to produce stands of commercially valuable trees, silviculture treatment nevertheless offers a powerful tool to create a varied landscape supporting a diverse flora and

fauna. Following a major disturbance, the growth of a forest is characterized by four stages of development: stand initiation, stem exclusion, understory re-initiation, and old growth (Oliver and Larson 1996). These stages are commonly recognized as seedling/sapling, pole timber, saw-timber, and large saw-timber (DeGraaf and Yamaski, 2003). Fast growing species such as aspen, birch, and Tuliptree may remain in the stem initiation stage for less than 10 years depending on site conditions. The stem exclusion phase begins when the canopy closes and increases in height and the growing space is occupied fully by trees. This stage is the end of early successional habitat for most wildlife species because the ground vegetation is shaded out and browse, herbage, and soft mast from shrubs are lost. Other species such as Ruffed Grouse and American Woodcock, however, prefer this stage because it provides dense overhead cover and lacks dense ground cover (Dessecker and McAuley, 2001).

Within tree stands, seedlings consist of trees < one inch (2.5 cm) diameter at breast height (dbh); saplings are trees one to five inches (2.5-12.5 cm) dbh; pole timber are trees five -11 inches (12.5 - 27.5 cm) dbh; and saw timber are trees >12 inches (30 cm) dbh. Breast height is 4.5 feet (1.37m) above the forest floor on the uphill side of the tree. For the purposes of determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground level. Basal area is a measure of stem density. It is determined by estimating the total cross-sectional area of trees at dbh, expressed in feet²/acre or meter²/hectare.

In the IBA, trees are grouped into forest stands, a basic silviculture unit identified by their forest cover type (e.g. Chestnut Oak, Eastern Hemlock, etc), age or size class, distribution, and condition. Forest cover types are consistent with the United State Forest Service's (USFS) classification of forest types based on the composition of important tree species in the overstory (canopy). Species status (i.e. dominant, important, etc) within the stand is determined by the proportion of the total stand basal area represented by each species or species group (i.e. hickory). In the West Block, CTDEP identifies each stand with a numerical designation such as 6-3, 3-10, where the first number refers to the compartment and the second identifies the stand within the compartment. Each compartment has an edge bordering a forest road to facilitate finding the compartment within the forest complex.

6.2.3.1 Selection and Identification of Forest Stands

Prior to any decision on silviculture treatments, CTDEP identified and delineated forest stands in the West Block using the following multistep process:

- **Initial evaluation:** Involves an office review of aerial, topographical, and soil maps, and other resource data to determine site characteristics, basic forest structure, and tentative size;
- **Site inspection:** The second step involves a systematic site evaluation by a CTDEP forester. This evaluation includes a field review of site specific characteristics and a botanical analysis. Depending on the potential acreage multiple grids are laid out for examination in each stand (large stands have more grids). Within each grid the forester inventories and collects botanical data including tree species, dbh, tree health, amount of overstory cover, the understory composition, and the amount of merchantable timber. **Note:** When conducting the site inspection, a forester could decide to modify the stand's boundaries if site and vegetative characteristics warrant such a decision, or a modification may occur later in the selection process.
- **Stand identification:** A final review of the field data is performed in the office. In the past, when the current 10-year forest plan was being developed, all data was manually reviewed without the assistance of a computer model and each stand was determined by its vegetative composition/structure and placed into a forest types described within the USFS Forest Inventory and Analysis (FIA) program. Current practices are more efficient and utilize a software program--Northeast Decision Model (NED)--designed by the USFS to perform statistical evaluations of forest landforms. By inputting relevant data and choosing management objectives the program provides several silviculture management options from which the forester can choose. It also automatically determines the forest type of the stand.

When using the former FIA program in certain cases, the forest type did not fit neatly into a category, so a decision was made to use the best fit. For example, Forest Stand 9-3 is considered a White Oak-Red Oak-Hickory Forest Type (Code 503) in the forest management plan which seems to indicate White Oak is dominant or co-dominant in the stand. The botanical analysis, however, reveals hickory is dominant followed by Red Maple, Northern Red Oak, and then White Oak. While White Oak is an important species in the stand it is not co-dominant, although large White Oak saw-timber is present. Future silviculture treatment will focus on increasing the proportions and size classes of White Oak and Northern Red Oak in Forest Stand 9-3, as both oaks are important species from a wildlife and economic perspective.

6.2.3.2 Classifications of Silviculture Treatments

Silviculture treatments are broadly grouped as regeneration cuttings or intermediate cuttings. Regeneration cuttings are designed to regenerate the stand naturally by providing for seedling (or stem) establishment and/or development (DeGraaf et al. 2006). Intermediate cuttings are made to improve stand composition, health, and growth between the time it is first established and the time of the final harvest. Intermediate cuttings primarily apply to even-aged forest stands, but may be employed in uneven-aged stands too.

Regeneration Systems/Cuttings Regeneration systems are categorized into two silviculture treatments: even-aged treatments and uneven-aged treatments. In the IBA, forest stands are managed using both of these treatment methods. A description of each type is presented below.

Even-aged Management Even-aged stands contain trees in the main canopy that are within 20 years of being the same age. They can be designated by age class i.e. 20-year stands, or sometimes by broad size classes: seedling stand, sapling stand, pole timber stand and saw timber/ large saw timber stands (DeGraaf, et al 2006). While there are several methods to regenerate even-aged tree stands, only two treatments are applied within the IBA:

- **Clear cutting** is a method used to regenerate a stand by removing most or all woody vegetation during the timber harvest creating a completely open area. Regenerating can then occur naturally from seeds on the ground or re-sprouting from stumps. When employing this process significant scarification of the soil occurs releasing minerals and nutrient for plant growth. Clear cuts favor shade intolerant species that thrive in full sunlight such as Quaking Aspen, Black Cherry, Tuliptree, Sassafras, and birch.

In the IBA the use of clear cuts is an uncommon treatment method last employed in 2001 with a linear cut of approximately five acres. This harvest joined together several other small clear cuts made in 1993. Interestingly, this was the location where Golden-winged Warbler was found in 2006-2008. Clear cut harvests range from two to five acres (0.8-2 ha) in size and since 1984 have accounted for 34 acres in the IBA (CTDEP 2005a).

- **Shelterwood** is the method of regenerating a stand by manipulating the overstory and understory to create conditions favorable for tree species (e.g. oaks) requiring partial shade. This method requires the gradual removal--normally in two or three separate cuts--of the overstory. The primary cut--**shelterwood establishment**--generally removes a large portion of the understory and lower crown canopy trees to allow the new stand to grow in partial shade and ensures a continued seed crop from the overstory. A second cut-- **shelterwood release**--in a three cut treatment removes approximately half the remaining canopy trees, while the final cut--**final shelterwood**--removes the remaining canopy trees.

This method differs from clear cutting because the next stand is established before overstory removal and the overstory protects the understory and distributes seeds until the final shelterwood removal.

The primary method for stand regeneration in the NSF is the shelterwood cut, which is employed in stands from approximately 10-40 acres (4-16 ha). CTDEP frequently uses the three-cut shelterwood technique with the shelterwood release and final shelterwood occurring approximately five to 10 years after the shelterwood establishment. The initial cutting removes approximately 50% of the overstory and most of the understory and lower canopy, while the second cut harvests about 50% of the remaining canopy. The remaining canopy trees are removed during the final cut, except for several snags and residual trees left behind as wildlife habitat. Oak stands are often regenerated using the three-cut shelterwood method with the establishment cut being made the year after a good acorn crop. As this is not always possible due to weather and varying markets for wood products, by delaying the final shelterwood for several years, it is likely that there will be at least one good acorn year during the shelterwood time frame.

Uneven-aged Management An uneven-aged stand contains trees of varying 20-year age classes, and holds trees of different size classes due to the range in age as well as growth rate. Forest stands managed under uneven-aged systems are normally comprised of three or more age classes. These cover types are adapted to regenerate under partial shade conditions and are designed to mimic small natural disturbances like individual tree mortality, or a moderate disturbance such as a wind or ice storm that damages a number of trees in a stand. Shade tolerant species such as Sugar Maple, Red Maple, Yellow Birch, Black Birch, beech, and hemlock, eventually predominate in uneven-aged management. In the NSF two uneven-aged treatment methods are used to manage forest stands. Uneven-aged management systems employ the following techniques:

- **Single-tree selection** is the removal of one or several trees in a small group which maintain a continuous cover
- **Group selection** is the removal of trees in a larger group and will generally not leave a canopy opening greater than 0.5 - 1.0 acre (0.2–0.4 ha) in the IBA. Shade tolerant species such as Tuliptree and Black Cherry may be generated using a large group selection cut.

The distinction between even-aged and uneven-aged treatment methods can be blurred with some treatments; for example, a small clear-cut may appear similar to a larger selection cut. Here the difference is primarily in the size of the harvest: < one acre (< 0.4 ha) for a group selection verses > 2 acres (> 0.8 ha) for a clear-cut.

According to Thompson and DeGraaf (2001), even-aged management in New England northern hardwoods provides habitat for more breeding birds than uneven-aged management. When a forest holds a range of even-aged stands--seedling, sapling, pole timber, and saw timber--it contains more than twice as many bird species as do extensive uneven-aged stands. All species that occur in uneven-aged stands are found in one or more size classes of even-aged stands and no breeding birds are restricted to uneven-aged conditions. Many species, however, are restricted to even-aged habitats, especially in regenerating and sapling stands, which are present for only a brief period in the life of the stand (DeGraaf 1987).

Intermediate Systems/Cuttings: Forest stands in the IBA are improved by intermediate cuttings which are used to manage even-aged stands but may be applied in uneven-aged stands as well. The chief purpose is to improve stand health--- to favor certain species, sizes, and quality---by removing less desirable competitors. When applying this treatment method the intent is not to regenerate trees, but to

release (open) the crown. Stand improvements are conducted through the non-commercial cordwood program or by commercial thinning in the NSF.

6.2.3.3 Silviculture Management in the IBA

Once forest stands are established a CTDEP Forester and a Wildlife Biologist collaborate on formulating silviculture treatments and also consider recommendations from a 2001 forestry study of the reservoir complex (Frederiksen, et al. 2001). Particular consideration is given to site characteristic, tree composition, historical practices, species benefitting from treatment, as well as the enhancement of biodiversity within the forest mosaic. Prior to any timber harvests, the forester marks all trees to be harvested. Certain trees are not targeted for harvesting because of their intrinsic value to wildlife as a food source and/or their contribution to flora diversity as unusual or rarer species. Examples of trees meeting this criterion include Black Cherry, Flowering Dogwood, Downy Serviceberry/Shadbush, Hop Hornbeam, and Blackgum. Depending on stand composition and predicted development, scattered conifers including hemlock, Norway Spruce, and White Pine, or small groups may be left behind to provide diversity, wildlife cover, and shelter.

In the West Block, approximately 46% of forest stands are being actively managed as wildlife habitat, for the production of commercial timber, and as cordwood for permit-holding State residents. These stands are managed for long-term sustainability under provisions developed for the CTDEP's forest management plan (CTDEP 2005a). CTDEP's long-term goal for forest stand composition is 10% seedling, 30% saplings/pole timber, and 60% saw timber. Forest management strategies described in the plan are discussed below:

Long-term Forest Management Objectives Currently the IBA is comprised of approximately 3,436 acres (1,391 ha) including 2,228 acres (902 ha) in the West Block and 1,208 acres (489 ha) in the East Block. The East Block is not included in the forest management plan, CTDEP has elected to "passively manage" this block as **perpetually undisturbed forest**, with the possible exception of a future thinning in a White Pine plantation within the High Rock Grove Section (Table 6-1). Aside from a narrow, closed-canopy AT&T cable right-of-way and a small scrub-shrub swamp, the East Block is essentially an unfragmented contiguous forest. The last planned timber harvest ---thinning in a White Pine stand--- occurred in the late 1980s. Summit trees are intermittently subjected to wildfires, so loss of trees occasionally occurs there.

Of the approximately 2,042 (826 ha) forested acres in the West Block, CTDEP proposed long term objective is to actively manage 942 acres (381 ha) or 46% while 1,100 acres (445 ha) or 54 % will remain "passively managed" as **perpetually undisturbed forest** (Tables 6-1 and 6-2, Figure 6-1). The undisturbed habitat occupies two large parcels: one approximately 600-acre unfragmented tract in the southeast section of the block and the other along a ridgeline, north and east of the reservoir complex (Table 6-1 and Figure 6-1). The ridgeline tract, however, is broken by the two powerline corridors. Active management will include both even-aged and uneven-aged treatments as presented below:

Even-aged Forest Management Even-aged silviculture management will occur on 608 (64.5 %) of the 942 acres. Most of the northern area of the block--land north of the Beacon Falls Tap powerline corridor--will receive even-aged treatment (Figure 6-1). This is intended to concentrate early successional and young forest habitats in areas previously disturbed by fires, Red Pine salvage removals, and insect outbreaks (Gypsy Moth and Hemlock Woolly Adelgid), and includes several fields and powerline corridors. A 100-year harvest rotation is planned for the management of these even-aged forest stands.

Overstocked stands not ready for regenerating will receive intermediate cuts and be thinned to provide optimum growing space for higher quality trees. Intermediate cuts will occur on a 20-year basis unless site specific conditions dictate otherwise.

Figure 6-1. Long-Term Forest Management Objectives for the Naugatuck State Forest IBA.

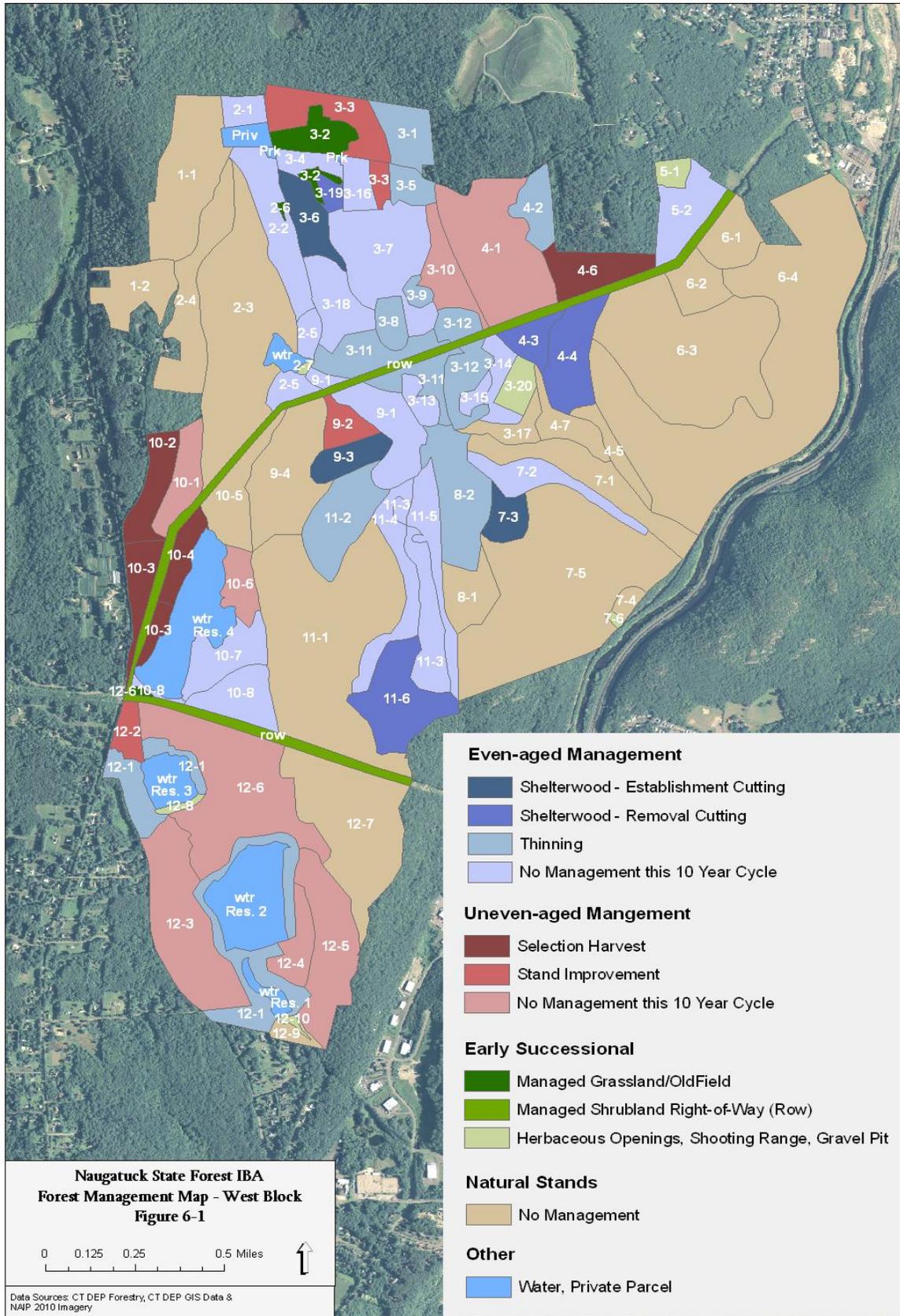
Block	Type Management	Rotation Length	Acres ^a	Comments
West	Even-aged	100 years	608	Stands harvested on a 100-year rotation
	Uneven-aged	20 years	334	Removal of about 33% of trees in each stand on a 20-year rotation
	Passive - no treatment	None	1,100	Perpetually undisturbed forest
Totals			2,042	
East	Passive - no treatment ^b	None	1,208	Perpetually undisturbed forest – not included in the forest management plan
Totals			1,208	

^a Approximate acreage; ^b Future thinning in a White Pine stand is possible.

Uneven-aged Management In the southern third of the block, uneven-aged management is proposed for 334 acres (35.5 %) of the managed 942 acres (Figure 6-1). These stands are located around the reservoir complex and have a rather continuous canopy (except for the reservoir themselves) due to former management strategies employed by the water company. Historically, thinning was the principal treatment method used under the water company’s ownership. Silviculture harvests will use single tree or group selection cuts to open up the canopy and enhance vertical stratification in the stands. Canopy openings will generally be less than 0.5 acre (0.2 ha), but occasionally up to 1.0 acre (0.4 ha). These canopy openings should provide enough sunlight for the development of some regenerating shade intolerant species. However, intermediate and shade tolerant species---beech, maple, and Yellow Birch---will eventually become most abundant.

Short-term Management Objectives (10-year plan) CTDEP devised a short-term management scheme for the IBA which is effective from 2004-2014 (CTDEP 2005a). Forest management goals for the 10-year work cycle involve 387 acres or approximately 41% of the 942 managed acres in the West Block (Table 6-2). At the end of the 10-year work cycle, CTDEP projects a managed forest composition of 9% seedling/sapling and the remainder pole-timber and saw-timber. Silviculture treatments planned for the 10-year period will include:

Even-aged Management Shelterwood establishment (three stands) or removal (four stands) cutting will occur on 95 acres (Table 6-2, Figure 6-1). Improvements by thinning will be conducted in 10 forest stands consisting of 173 acres. These stands will be thinned to improve species composition, growth rate, and timber quality. Additionally, 45 acres in two stands will be thinned by timber stand improvement (TSI). TSI is a harvesting activity employed through the cordwood cutting program, or included as a work requirement of a commercial timber harvest in a nearby stand.



Uneven-aged Management To meet the goals for uneven-aged management set forth in the long-term plan it will be necessary to convert four even-aged stands to uneven-aged stands. Selection harvests will be used to initiate the conversion of 60 acres in these four stands (Table 6-2 and Figure 6-1). In addition, timber stand improvements will be conducted on nine acres in Forest Stand 12-2.

Figure 6.2. Silviculture Treatment Schedule for the IBA during the 10-year Period: 2004-2014.

Block	Type Treatment and Method		Acres ^a	Comments
West	Even-aged	Shelterwood	95	
		Improvement thinning	173	
		TSI ^b	47	
	Uneven-aged	Conversion	60	Converting even-aged stands to uneven-aged stands.
		Non-commercial thinning	9	
Totals			384	
East	Passive –no treatment	Perpetually undisturbed forest	1,208	East Block not included in the forest management plan
Totals			1,208	

^a Approximate acreage; ^b Timber stand improvements

6.2.3.4 Timber Harvest Requirements

Timber harvesting operations by nature are disruptive and can cause environmental degradation to the landscape when conducted in a careless and haphazard manner. Proper planning and site management are key elements to reduce adverse impacts, and carefully conducted operations can even enhance aesthetic qualities of a forest stand. Therefore, wise selection of the appropriate regeneration method, application of Best Management Practices (BMPs) and other protective guidelines, and carefully-negotiated timber sale contracts are necessary ingredients to ensure environmentally sound harvesting.

Timber harvests in the IBA follow procedures described in the guidance document *Best Management Practices for water quality while harvesting forest products* (CTDEP 2007) plus additional requirements set forth in the State Contract “Agreement for Sale of Forest Products.” BMPs described in the guidance document are employed within the Naugatuck State Forest as important safeguards to reduce negative impacts imposed on the land and biotic community by these operations. Significant directives summarized from the guidance document are illustrated below:

- Develop an operational plan to reduce site impacts from erosion, sedimentation, and to increase efficiency of the harvest.
- Properly manage log landing areas—where logs are staged for transport---to minimize site impacts from disturbance. Without proper placement and management the concentrated activities at landing may cause soil compaction, erosion, and sedimentation of waterways.
- Keep harvesting activities out of stream channels, except for the necessary and proper installation of stream crossing structures, which are described in the BMPs.
- Manage skid roads and trails to reduce site impacts: keep roads/trails uphill from wet or steep areas; identify appropriate stabilization, drainage, and erosion control measures; identify and describe methods to eliminate or minimize water accumulation on skid roads/trails, etc.
- Prevent negative impacts from logging on wetlands and riparian areas: establish buffer strips of unharvested trees along both sides of perennial and intermittent streams and water bodies. Perennial streams require 100 ft (30.5 m) buffers and intermittent streams require 50 ft (15 m) buffers.

- Protect vernal pools during harvesting operations: prohibit equipment from entering vernal pools; keep woody debris out of the pool's depression; and maintain an undisturbed 50 ft (15 m) vegetation buffer around the pool. If operation must occur within the buffer zone, do so only in the winter when the ground is frozen and snow covered to minimize disturbance of leaf litter and soils, and leave a minimum of 50 % canopy cover.
- Establish erosion control measures: use appropriate BMPs for soil erosion and sedimentation control to protect wetlands and watercourses from degradation.
- Once logging is complete, grade haul roads, skid trails, and log landing to eliminate ruts; install water bars if necessary to eliminate/reduce runoff.
- Plant areas with exposed soil on landings, approaches to stream crossing, and steep slopes on skid trails with a conservation seed mixture.
- Properly store and manage hazardous materials e.g. fuels, oils, and lubricants, to avoid contamination of the soil, surface water, and groundwater. Follow all federal, state, and local rules for management and storage of hazardous materials.
- Protect property owners and buyers with a written contract, which stipulates many of the requirements listed above.

Beside the requirements discussed above in the BMP guidance document, the State Contract contains several sections with stringent restrictions protective of forest lands and the environment. Much of the contract is standard--boiler plate--language except for Section-H which presents an opportunity to describe site specific requirements. Special directives required in the timber harvest contract include:

- Monetary penalties for cutting or damaging any unmarked trees (Section 8-A).
- Buyer must use care not to damage property and must leave the premises in a neat and clean condition approved by the State (Section 8-B).
- All logging slash must be cut to a height of less than six feet (m). No slash shall be left within 25 ft (7.5 m) of a road, authorized trail, watercourse, or boundary (Section 8-C). Slash within 100 ft (30 m) of a regularly traveled public road, authorized trail, watercourse, or boundary shall be lopped to a height of less than four feet (1.2 m).
- Prior to operation, the locations of main skid roads, stream crossings, and yarding areas must be approved by the State (Section 10-A).
- All existing woods roads, fire lanes, hiking trails, and public roadways must be kept clear of tree tops, logs, brush, or other obstructions and any damage caused to roads, ditches, trails, bridges, fences, etc shall be promptly repaired at the expense of the buyer (Section 10-B).
- If ground conditions become unacceptable and damage may occur to an area, the State reserves the right to suspend operation until conditions improve (Section 10-C).
- Before work is suspended by weather/soil condition or completed the buyer must perform erosion control measures such as grading skid trails, installing water bars, creating broad bases dips, filling mud holes with stone, grading or draining truck access roads, or other drainage or erosion control measures as needed to the satisfaction of the State and block access roads as required by the State (Section 10-D).
- Buyer must obey all State fire laws and use precaution to prevent forest fires; no skidding can occur on any State maintained trail or firebreak without State permission; if a fire hazard requires precaution the buyer must carry out all preventive measures as prescribed by the State; and, the buyer shall be liable for any claims arising from forest fires attributed to the buyer's operation.
- No solid waste can be stored on the property or left on the property by the buyer (Section 15).

All access roads to logging areas within the NSF are protected by bar-gates to discourage illegal or unintended vehicle access. Bar-gates are placed either along Town-owned roads (e.g. Hunters Mt. Road, Chestnut Tree Hill Road) or on forest roads such as along Spruce Brook Road, at logging access points.

6.2.4 Invasive Plants Management

Invasive plant management consists of the control measures for the grassland and shrubland habitats as described above (Sections 6.2.1 and 6.2.2), as well as some additional practices employed by CTDEP's Parks Division. This group performs a minimal amount of invasive species control in the IBA via routine mowing and shrub cutting operations. In September 2008, as part of a routine maintenance operation, the Parks employees mowed and removed shrubs including Autumn Olives and honeysuckles that were growing on the earthen dams along Reservoir 3 and Reservoir 4.

An experimental treatment to control or eradicate Japanese Barberry is being tested in the NSF by the CTDEP. Treatment involves using a back-pack propane torch to incinerate the plant. Preliminary results from a 2006 pilot study conducted by the Connecticut Agricultural Experiment Station (CAES) elsewhere in the state were encouraging and suggest the method is effective in eradicating or controlling barberry (Ward et al. 2007). In some cases, however, depending on the size of the shrubs, a second burn may be required. This method can be particularly effective in sensitive areas such as parks, nature preserves, or along watercourses where herbicide use is restricted or not sanctioned. To accommodate the NSF test trial, CTDEP's Forestry Division received grant money from the Naugatuck Valley Audubon Society to purchase the propane torch. In June and July 2008, CTDEP conducted a test trial in several lightly infested forest stands along Hunters Mt. Road. Although the trial test killed about 95% of the invasive barberry, the process was labor intensive and would be very difficult to administer in an area heavily infested with barberry (G. Milne pers. comm.).

6.3 Monitoring and Research

The NSF has long been an active research and monitoring site for wildlife and forestry studies. Since the early 1960s numerous projects have occurred in the NSF, primarily within the West Block. Various avian research studies initiated by CTDEP and volunteers or by non-governmental individuals or organizations have taken place. In addition, several forestry studies have been undertaken, and two long-term projects being carried out by the AES are currently under way. Table 6-1 summarizes all known scientific research and monitoring projects pertaining to the IBA, both in the past and ongoing.

The methodology and variety of bird research and monitoring projects is quite extensive. While some surveys have looked at the presence and comparative abundance of certain species (Whip-poor-will, woodcock) or groups of birds (e.g., owls, woodland raptors, etc.), others have focused on different aspects of avian ecology such as habitat associations and seasonal occurrences.

6.3.1 Early-Successional Habitat Bird Surveys

Grassland and shrubland birds have declined drastically in Connecticut and the northeast following abandonment of farming and subsequent development or forest regeneration of former grasslands. It's not coincidental that grassland birds have also disappeared at an alarming rate. Sauer et al. (1995) noted that grassland birds showed the most consistent decline of any ecological group of birds monitored by the Breeding Bird Surveys (BBS), and these declines are prevalent throughout North America. In 1998, the CTDEP initiated the Grassland Survey of state-owned lands to conduct inventory for grassland bird populations. Using standardized techniques developed by PIF for surveying grasslands in the northeast, baseline data on grassland bird communities was gathered. Later in 2005, the grassland survey was modified so that data on shrubland birds could also be collected on state-owned properties with early-successional shrubland habitats.

Table 6-1. Summary of Research and Monitoring Projects Conducted in the NSF.

Type of Research	Year(s)	Comments
Avian Related Activity - CTDEP		
Early-successional survey	2002 - present	Breeding bird point count survey
Migratory bird stopover habitat survey	2002 - 2004	Point count survey for migrants
Woodcock survey	2003 - 2005	Roadside listening survey
Woodland raptor survey	2004 - present	Play-back method survey
Whip-poor-will (WPW) study	2005 - present	Multiphase study
Winter nightbird survey	2006 & 2008?	Roadside play-back survey
Summer nightbird survey	2006 & 2008?	Roadside play-back survey
Monitoring avian productivity & survivorships program (MAPS)	2008 - present	Breeding bird banding program
Bluebird nest box program	2000 - present (intermittent)	Depends on available resources
Non-avian Activity - CTDEP		
Invertebrate survey	2008	Associated with WPW study
Other Avian Related Activity		
Oxford Christmas bird count	~1980 to present	One-day survey mainly in W. Block
Powerline breeding bird survey	1981 & 2008	Breeding bird survey
Forestry Related Activity		
Tree crown study	1988 - present	CT Agricultural Experiment Station
Tree health study	1994 - present	CT Agricultural Experiment Station
Ravine microclimate study	1961	Thesis research by C. Bosworth
Hemlock salvage reforestation study	2002	Harvard University
Forest Study of the Reservoir Parcel	2001	Yale School of Forestry/Env.Studies

Between 2002 and 2004, three grassland survey plots were established in the West Block and monitored annually. Starting in 2005, when the program expanded to include shrubland habitat, two additional point count plots were added and monitored by CTDEP. The five point count circles are located in the north field, south field, an old field west of Whittemore Road, and two sites along the Naugatuck Tap powerline corridor east of Whittemore Road (Appendix J). Surveys were conducted during early morning between mid-May and mid-July and involved four site visits each year. For a complete description of the survey protocol refer to Appendix J.

In 2010 and 2011, the CTDEP expanded the shrubland survey protocol to include regeneration shrubland monitoring. Four new sites were surveyed following recent shelterwood harvests. Two of these sites are located along Spruce Brook Road northeast of the shooting range where final shelterwood harvests were completed in 2009 (Forest Stands 4-3 and 4-4), and two additional sites are being surveyed south of the wildlife plot area along Game Plot Road (Forest Stand 11-6). Point count and avian productivity surveys are being conducted in these new locations.

6.3.2 Migratory Bird Stopover Habitat Survey

While the loss of habitat at breeding and wintering sites is a major problem for migratory birds, loss of critical habitat for feeding and resting during migration is equally problematic. Loss of suitable stopover habitat places additional stress on migrating birds and results in farther distances traveled between foraging sites. This potentially weakens birds and makes them more susceptible to other threats, such as predation and inclement weather. In addition, arriving on breeding territory in a weakened state may compromise a bird's breeding success.

Since information about critical stopover sites for migrating birds is incomplete or lacking in Connecticut, the CTDEP initiated the Migratory Bird Stopover Habitat Survey in 2002 to assess the use of potential stopover habitats along the Housatonic, Naugatuck, Thames, and mid-lower Connecticut Rivers. Survey protocol was similar to procedures developed for the Silvio O. Conte Migratory Bird Stopover Habitat Survey conducted from 1996-1998 along the upper Connecticut River.

CTDEP and volunteers conducted three separate migratory bird surveys within the NSF from 2002 through 2004. Two surveys were performed in the West Block--one adjacent to the Naugatuck River on Cold Spring Road (CTN-A3) and the other along Whittemore and Game Plot Roads at a higher elevation in the forest (CTN-C5). A third survey (CTN-C6) was conducted in the East Block along the southern boundary of the Beacon Cap section. Surveys took place once per week for six weeks from late April through late June, and during five weeks from late August through September. Each survey route contained 10 point-count circles which were sampled for 10 minute intervals. Copies of the Migratory Bird Stopover Habitat Survey Protocol, survey locations, and point circles are attached in Appendix J.

Data collected during the 2002 -2004 migratory bird stopover habitat survey has yet to be reviewed and evaluated by CTDEP.

6.3.3 Woodcock Survey

An American Woodcock survey was conducted by the CTDEP in the NSF from 2003-2005. The woodcock survey followed protocol developed by the USFWS; each survey route was 3.6 miles in length and contained 10 listening points spaced at 0.4 mile intervals. Three minutes were spent at each listening point on the survey route. USFWS survey protocol requires a randomly selected route; CTDEP, however, deviated from that procedure by choosing a survey route specifically designed to census for woodcock in the West Block. A map of the survey route with listening points is presented in Appendix J.

Data collected by CTDEP noted the presence of eight birds in 2003, 16 in 2004, and two in 2005. According to Min Huang (pers. comm.), the 16 woodcock heard in 2004 seemed unusually high, and there may have been an error in the data.

6.3.4 Woodland Raptor Survey

Ten species of raptor are currently listed as endangered, threatened, or of special concern in Connecticut, including the recent addition of the Broad-winged Hawk as a Species of Special Concern. Since knowledge of the status and distribution of many woodland raptors is limited, CTDEP initiated the Woodland Raptor Survey in 2004. The raptor survey was designed to collect baseline data on six hawk species---Broad-winged, Red-tailed, Red-shouldered, Sharp-shinned, and Cooper's (*Accipter cooperii*) Hawks and Northern Goshawks (*Accipter gentilis*). During these site surveys, field observers also record sightings of Turkey Vulture and Common Raven.

Woodland raptor surveys are conducted in forested areas by CTDEP and/or volunteers and involve using tape-playback of a Great Horned Owl (*Bubo virginianus*) call. Census protocol requires participants to plan a survey route with census points spaced at 0.5 miles intervals. During the survey season from March through June, each census point was visited six times for a 10-minute interval per visit. From 2004 to the present, woodland raptor surveys have been conducted in the East Block near the southern boundary of Beacon Cap along a route with three census points. Since the survey's inception, no raptors have been recorded, but observations of Turkey Vultures were made (E. Victory pers. comm.). A complete description of the survey protocol and survey location is in Appendix J.

6.3.5 Whip-poor-will Study

Roadside Survey Historically the IBA has had a breeding population of Whip-poor-wills within its boundaries (Devine et al. 1989). In recent years, this species has become the focus of considerable conservation attention due to the mounting evidence of significant population decline over most of its range. Based on this concern, in 2005, the CTDEP decided to launch the first phase of a multi-year Whip-poor-will research project in the IBA. Phase one was a precursor to more intensive research planned for later years. Starting in 2005, a roadside listening survey mimicking USFWS woodcock survey protocol, i.e. traveling a predetermined census route with 10 listening points spaced 0.4 mile apart, and sampling each point for three minutes, was conducted. The annual survey was required to be conducted between May and early July under specific lunar conditions. Each survey started 15 minutes after sunset and continued until all stations were completed, but the survey could not take longer than 105 minutes to complete. The goal of phase one was to obtain baseline data on population size and distribution of Whip-poor-wills in the IBA. A different survey route was used in 2006, with listening stations at least 0.5 mile apart, but otherwise the procedures remained the same. A copy of the 2006 survey protocol and route is in Appendix J.

In 2007, the Whip-poor-will survey procedure was modified by CTDEP to reflect knowledge gained from previous years and some new information supplied through the Northeast PIF Study Group. A listening survey was still performed, but the survey area was subdivided into a grid pattern with listening points separated by 500 meter (ft). Two or more surveyors worked together. If a Whip-poor-will was detected at a station, one listener would move along the grid in an effort to determine the Whip-poor-will's calling site by triangulation. In addition, there was a concerted effort to determine the number of birds that were calling. In order to accommodate the new procedure, time spent at each station was also expanded from three to five minutes. The study introduced two additional elements in 2008--a capture and radio tagging component, and a light capture investigation of insects.

Radio-telemetry In 2008, the CTDEP enhanced the Whip-poor-will study by incorporating a banding and radio-tagging element. Activity centers identified by vocalization during previous years suggested a potential productive location for a banding station along the Beacon Falls Tap powerline corridor. Mist nets were strategically placed in prospective flight corridors in an effort to capture and radio-tag birds. Although nets were set on eight nights, no Whip-poor-wills were captured in 2008.

Invertebrate Trapping In conjunction with the Whip-poor-will study, in 2008, an invertebrate trapping investigation was performed on approximately 10 nights. In an attempt to determine prey availability, CTDEP collected insects, primarily moths and beetles, from captures in light traps using UV bulbs. Insects collected during this part of the Whip-poor-will investigation have not yet been identified, but the majority of specimens were moths (L. Saucier pers. comm.).

6.3.6 Winter Night-bird Survey

CTDEP established an owl monitoring study in 2006, which in 2007 was revised and identified as a winter night-bird survey. Each survey was conducted by CTDEP personnel or volunteers along a predetermined route with 10 listening stations spaced 0.5 mile apart. During the first year, the survey had to be conducted one time between March and early April and began at midnight. If no vocalization was heard following a three minute passive listening period, participants used tape play-back to try to elicit responses from any of five species of owl. After the first listening phase, play-back began with a prescribed 20 seconds broadcast per species interspersed with listening periods. In 2007, some procedural revisions were made, although survey routes remained the same. The revised protocol required two surveys, both done in each of two designated time frames--February 15 to April 15 and March 15 to April 30--with each survey at least five days apart. Also, the time spent at each survey station for the entire

procedure was decreased to 15 minutes. Finally, the protocol changed so that tape play-back calls for only three species of owls were broadcasted during the surveys: Eastern Screech-Owl (*Megascops asio*), Long-eared Owl (*Asio otus*), and Barred Owl. Refer to Appendix J for detailed descriptions of the owl monitoring program and winter night-bird survey.

One survey route circles the periphery of the IBA, with 10 listening stations in Beacon Falls, Bethany, and Oxford. Two of the listening stations on Chestnut Tree Hill Road in Oxford (OW79-08 and OW79-09) are on the IBA's western boundary. A map displaying the survey route and listening stations is provided in Appendix J.

6.3.7 Summer Night-bird Survey

CTDEP established a summer night-bird monitoring study which was similar to the winter night-bird survey in 2006-2007, and the same survey route with 10 listening stations was followed (Appendix J). Summer survey requirements involved listening for and documenting calling owls and Whip-poor-wills as well as keeping a record of any vocal amphibians. Two summer surveys spaced at least one week apart took place May through July and coincided with the amount of lunar light during phases of the moon from a quarter moon to full moon. If no bird vocalizations were heard during an initial three minute listening period, participants broadcasted a taped call of Northern Saw-whet Owl in attempts to elicit responses. After the first listening period, the taped owl call was broadcast for 20 seconds, then followed by a 2 minute 40 second listening period. Refer to Appendix J for the full descriptions of the summer night-bird monitoring program.

6.3.8 Monitoring Avian Productivity and Survivorship (MAPS) Program

The Institute for Bird Populations (IBP) coordinates the United States and International Monitoring Avian Productivity and Survivorship (MAPS) programs. When CTDEP started a long-term bird banding study in the IBA to examine population and annual hatching survivorship of songbirds in May, 2008, they followed MAPS protocol. By following MAPS protocol for design and implementation, the Department ensured the use of established standards for data collection (Liefert 2008). Data can thus be shared with the IBP. A study area was established in the West Block near the intersection of Whittemore and Game Plot Roads. This area was chosen for several reasons, but partly because it included forestland with open patches due to a recent timber harvest.

The MAPS procedure involves the use of mist net to capture and band birds. On each of seven days within the study period May 31 – August 8, 10 nets were set up in a 25-acre area. These nets were separated by approximately 100-150 m (ft) and monitored every 40-50 minutes for bird captures. Birds caught in the nets were banded and measured; additional details about the birds were collected prior to their release. In 2008, research technicians caught 89 individuals (77 adults) of 26 species, while an additional 14 individuals were recaptures (Liefert 2008). A summary of the avian species banded in 2008 can be found in The Wildlife Bulletin (Liefert 2008).

6.3.9 Nest Box Program

In the early 2000s, the CTDEP placed a number of nest boxes in the field north of Hunters Mt. Road. Although the original intent was regular—at least twice per year—monitoring of the boxes, nest boxes were irregularly checked due to lack of field resources. Since the initial nest boxes were erected, several have been vandalized and/or have deteriorated over the years. Six nest boxes are currently in-place and functional, while the plan is to replace or repair missing or broken nest boxes as resources become available (P. Picone pers. comm.). Species regularly using these boxes for nesting include Eastern

Bluebird (*Sialia sialis*), House Wren (*Troglodytes aedon*), Tree Swallow (*Tachycineta bicolor*), and Black-capped Chickadee (*Poecile atricapillus*).

6.3.10 Oxford Christmas Bird Count

Frank Chapman started the first Christmas Bird Count (CBC) on Christmas Day in 1900. The CBC began in an attempt to change the traditional practice of the Christmas Day shoot to a bird count. In 1928, Alfred P. Harger, an avid bird watcher and naturalist, started the Oxford Christmas Bird Count. Alone and on foot, he conducted the Christmas Count for 29 years, walking as much as 16 miles on the day of the count. In 1957, he began using a vehicle sparingly, but he still continued without assistance until 1972, soon after the Naugatuck Valley Audubon Society was formed. Although started in 1971, NVAS officially became a chapter of National Audubon in 1973 and in 1974 began sponsoring the Oxford CBC.

The Oxford CBC is conducted within a circle 15 miles in diameter centered on Route 188 in Oxford. A majority of the IBA is located within this circle, which includes the forest's West Block and about 60% of the East Block. (Appendix J). Although much of the forest is within the CBC circle, it wasn't surveyed until the late 1970s. Starting in the early 1980s, the West Block received regular coverage, but due to limited and difficult access the East Block only received cursory, if any coverage.

6.3.11 Powerline Corridor Breeding Bird Survey

In 1981, B. Devine conducted breeding bird surveys along the Naugatuck Tap powerline corridor in the West Block. Three surveys were performed between late-May and early-July along a one km (0.62 mile) powerline transect. Each survey started at the intersection of Spruce Brook Road and continued west crossing Whittemore Road and ending near the former water company boundary (Appendix J). Surveys were done between 0600-0900 hrs and not during rainy or windy conditions. A second set of surveys was conducted in 2008, using the same criteria and procedures as in 1981. The purpose of the 2008 survey was to compare species diversity and abundance with baseline data compiled in 1981.

Results from the 1981 and 2008 surveys are summarized in Table 6-2. Species richness increased slightly in 2008, with 41 versus 38 in 1981. Although abundance was reduced by greater than 33% for four shrubland breeders—Gray Catbird, Common Yellowthroat, Blue-winged Warbler, and Eastern Towhee--it increased for two species, Prairie Warbler and Chestnut-sided Warbler. Baltimore Oriole, a species of forest opening and edges, also showed a decline in numbers. It's unclear if the changes in abundance reflect actual long-term trends for these shrubland breeders or if other factors are responsible. Several variables which may have influenced the data include:

- A wetter than normal spring and summer of 2008. Did this condition impact nest success or failure? Or delay nesting?
- The final survey in 1981 (July 11) was nine days later than in 2008 (July 2). Were additional young of the year recorded in 1981 because the survey was later? Was the increased density of the four shrubland breeders in 1981 indicative of post breeding dispersal of immature or juvenile birds?
- Changes to the vegetation structure. Has this factor impacted any shrubland breeding species?
- In 1981, the nearby shooting range was not in its current location. Does the shooting range play any role in breeding bird population changes?
- A slight increase in Brown-headed Cowbird density. Has this had an impact on nesting success of the four shrubland species?

Additional study and observation is needed in order to assess the population densities of key shrubland species along the powerline corridors. Since CTDEP conducts point counts at two stations in the same powerline corridor, a review and evaluation of that data may shed additional light on this issue.

Table 6-2. Breeding Bird Survey along Naugatuck Tap Powerline Corridor NSF - West Block.^a

Species	Surveys							Totals	
	1981			2008				2008	1981
	1 5/26	2 6/6	3 7/11	4 5/29	5 6/14	6 7/02			
Red-tailed Hawk (<i>Buteo jamaicensis</i>)			2						2
Red-shouldered Hawk (<i>Buteo lineatus</i>)					1	1		2	
Mourning Dove (<i>Zenaida macroura</i>)				3	1	2		6	
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)		1							1
Chimney Swift (<i>Chaetura pelagica</i>)				2				2	
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)				1				1	
Downy Woodpecker (<i>Picoides pubescens</i>)		2	3		1			1	5
Hairy Woodpecker (<i>Picoides villosus</i>)	1	1							2
Red-bellied Woodpecker (<i>Melanerpes carolinus</i>)				1	2	1		4	
Northern Flicker (<i>Colaptes auratus</i>)	1	1	2	2				2	4
Eastern Wood Pewee (<i>Contopus virens</i>)		1	1	1				1	2
Eastern Phoebe (<i>Sayornis phoebe</i>)			1			1		1	1
Great Crested Flycatcher (<i>Myiarchus crinitus</i>)		1			1			1	1
Eastern Kingbird (<i>Tyrannus tyrannus</i>)			1					0	1
Yellow-throated Vireo (<i>Vireo flavifrons</i>)		1		1		2		3	1
Red-eyed Vireo (<i>Vireo olivaceus</i>)		2		1	2	1		4	2
Blue Jay (<i>Cyanocitta cristata</i>)		4	2		1	2		3	6
American Crow (<i>Corvus brachyrhynchos</i>)			1	1	11	20		32	1
Black-capped Chickadee (<i>Poecile atricapillus</i>)					5	2		7	
White-breasted Nuthatch (<i>Sitta carolinensis</i>)				1		2		3	
Tufted Titmouse (<i>Baeolophus bicolor</i>)	1				1	3		4	1
Blue-gray Gnatcatcher (<i>Poliopitila caerulea</i>)		1							1
Veery (<i>Catharus fuscescens</i>)		3	3	1				1	6
Wood Thrush (<i>Hylocichla mustelina</i>)	1		1	2	1			3	2
American Robin (<i>Turdus migratorius</i>)			5		1	4		5	5
Gray Catbird (<i>Dumetella carolinensis</i>)	2	8	11	3	2	7		12	21
Brown Thrasher (<i>Toxostoma rufum</i>)		1							1
Cedar Waxwing (<i>Bombycilla cedrorum</i>)				2				2	
Blue-winged Warbler (<i>Vermivora cyanoptera</i>)	4 ^b	8	2	4	4			8	14
Chestnut-sided Warbler (<i>Setophaga pensylvanica</i>)	4	5	3	3	6	4		13	12
Prairie Warbler (<i>Setophaga discolor</i>)		2		2	3	3		8	2
Pine Warbler (<i>Setophaga pinus</i>)				1	1			2	
Hooded Warbler (<i>Setophaga citrina</i>)					1			1	
Black and White Warbler (<i>Mniotilta varia</i>)	1	2	1	1				1	4
Yellow Warbler (<i>Setophaga petechia</i>)				1				1	
American Redstart (<i>Setophaga ruticilla</i>)		1		2		1		3	1
Ovenbird (<i>Seiurus aurocapilla</i>)	1	3		4	1	3		8	4
Common Yellowthroat (<i>Geothlypis trichas</i>)	4	5	10	4	3	4		11	19
Scarlet Tanager (<i>Piranga olivacea</i>)	2			1		1		2	2
Eastern Towhee (<i>Pipilo erythrophthalmus</i>)	2	8	12	2	5	5		12	22
Field Sparrow (<i>Spizella pusilla</i>)		1	6	2	1	5		8	7
Song Sparrow (<i>Melospiza melodia</i>)	1	1	4						6
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	2	1	1	2				2	4
Indigo Bunting (<i>Passerina cyanea</i>)	1	6		3	2	4		9	7
Northern Cardinal (<i>Cardinalis cardinalis</i>)				2				2	
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)			1						1
Common Grackle (<i>Quiscalus quiscula</i>)			7						7
Brown-headed Cowbird (<i>Molothrus ater</i>)	1	3		2	1	4		7	4
Baltimore Oriole (<i>Icterus galbula</i>)	2	3	11	3	2	4		9	16
American Goldfinch (<i>Carduelis tristis</i>)	2	1			1	2		3	3
Total Species	19	28	23	31	26	25		41	38

^a Surveys conducted by B. Devine.

^b One Blue-winged Warbler in appearance singing an aberrant song similar to GW Warbler; possible hybrid.

6.3.12 Forestry Research

AES Crop Tree Study The Agricultural Experiment Station (AES) is conducting a long-term study of red oak pole timber in the IBA and several other forests in Connecticut. This research was initiated in 1988 in two study plots along Whittimore Road and involves selective removal of undesirable trees surrounding the desirable species such as red oak, in order to study the crop tree's development (Ward 2008).

AES Forest Health Study Another long-term study is being conducted by AES in the West Block. Since 1994, AES has monitored tree health on a one-acre plot in Stand 8-2. This location is one of 51 forest plots being monitored state-wide by researchers who are studying defoliation, disease, and measuring diameter at breast height (dbh) as part of the research (P. Trenchard pers. comm.). Approximately 20-30 trees are monitored in each plot; species being monitored in the IBA are Chestnut Oak, red oak, and maple.

Ravine Forest Study Chester Bosworth, a graduate student at Southern Connecticut State University, conducted thesis research in the lower section of Spruce Brook Ravine in 1961. His research focused on microclimatic differences caused primarily by temperature variations and the resulting effects on vegetation in the ravine forest (Bosworth 1961).

Vegetation Study Following Hemlock Adelgid Infestation Salvage Cuts A vegetative analysis of hemlock salvage cuts was performed in several Connecticut and Massachusetts forests in 2002. This research focused on 10 study sites, one of them the Mt. Sanford Block of the Naugatuck State Forest. The main objective of this study was to evaluate understory vegetation of hemlock stands infected by the woolly adelgid. Shrub and ground cover were analyzed beneath infected and uninfected stands and following clear cutting of diseased hemlocks. Results indicated substantial vegetative changes occurred beneath the dominant species with significant impacts on the biotic communities within these woodlands (Orwig and Kizlinski 2002).

Although this particular hemlock study was not conducted within the IBA, it took place in the nearby Mt. Sanford Block of the NSF, less than two miles east of the Beacon Cap Section. It provides valuable insight into the substantial changes that occur following hemlock die-back and subsequent harvesting. Species diversity, vegetative structure, stand environmental conditions, and ecosystem processes are all affected.

Forest Study of the Reservoir Parcel In 2001, students from the Yale University School of Forestry and Environmental Studies were retained by the Council of Governments of the Central Naugatuck Valley and CTDEP to conduct a forestry study of the reservoir complex and to provide forest management recommendations for the parcel (Frederiksen, et al. 2001).

6.4 Public Outreach and Education

The IBA is part of the Connecticut State Forest system, which offers recreational and, at present, limited educational opportunities for the public. Current public outreach and education activities at the Naugatuck State Forest are:

- Placement by CTDEP of information signs in several locations of the West Block;
- Watershed service projects performed by volunteers associated with the NRWA;
- Maintenance of the blue-blazed Naugatuck Trail by the CT Forest and Park Association (CFPA);
- Environmental and natural history educational workshops, classes, or meetings;

- Bird and nature walks offered by members of the NVAS.

Educational signage was placed at the intersection of Spruce Brook and Cold Spring Roads as part of the Naugatuck River Greenway project. The signs provide interesting historical, geological, and natural history information about the NSF and Naugatuck River watershed. Signs posted near the Forest entrance at the junction of Hunters Mt. and Spruce Brook Roads and at three entrance points to the reservoir area specifically identify the locations and list permitted and prohibited activities. At the entrance to Reservoir 1 is a small sign identifying the NSF as an Important Bird Area. Additional educational notices are posted to describe particular events such as timber harvest and invasive plant control and their benefits. In the East Block, a few blue-blazed trail signs are posted, along with specific notices at the Andrasko Road entrance listing prohibited activities (camping, campfires, and motor vehicles).

Several non-profit organizations regularly perform volunteer work within the IBA or along the Naugatuck River corridor. Members of the NVAS annually or biennially lead bird or natural history walks in the IBA. These outings are normally posted in local papers and always open to the public. Volunteers working in association with the NRWA have contributed numerous hours to riverbank clean-ups, beneficial plantings, and placement of bird nest boxes along the watercourse. Many volunteers are Boy Scouts and/or ecology club students from local schools. The blue-blazed trail in the East Block is maintained by the CFPA members who organize trail work parties as well as hiking trips to Beacon Cap.

The IBA was frequently used as an outdoor classroom by science professors from Southern Connecticut State University (SCSU) and other environmental professionals. For many years, professors teaching such topics as field botany, ecology, field mycology, field natural history, and ornithology led class trips to the NSF to study the flora, fauna, and natural communities. The ecology class, for example, performed/performs surveys of Spruce Brook Ravine and prepared/prepares detailed reports of their findings. It is unclear if SCSU faculty continues to use the forest as an outdoor classroom; several of the professors have retired, and a recent inquiry to the biology department went unanswered. The CTDEP's Forestry Division will occasionally host forestry demonstrations and sponsor meetings of the Connecticut Chapter of the Society of American Foresters within the IBA.

No Child Left Inside Program In 2006, a major state initiative coordinated by CTDEP was designed in an effort to reconnect youngsters with the outdoors, build the next generation of environmental stewards, and showcase state parks and forests. This special educational and public outreach program was created to encourage families and visitors to enjoy all the recreational resources and outdoor activities offered by Connecticut's state parks, forests and waterways. While the NSF is not a featured site, it's being used as a letterbox location. Letterbox sites are self-guided activities used to encourage families to get outdoors, hike, and look for clues to find a hidden letterbox. Families participating in the program must register and then follow clues left on the CTDEP's website. Successful participants will follow the clues which eventually lead to a hidden letterbox; inside is a stamp which is used to stamp a participant's booklet. Letterboxing was actually started in 2003 as part of the State Forest Centennial celebration, but was partnered with the "No Child Left Inside" Program when that began in 2006. More information regarding the "No Child Left Inside" Program and Letterboxing can be found at the State of CT (c 2001-2011) and CTDEP (2011c) websites.

7.0 CONSERVATION GOALS

These conservation goals have been developed from or have emerged out of the conservation concerns and threats facing the IBA. General management needs have also been given serious consideration. The goals are as follows:

- Continue to actively manage forested and early successional habitats and enhance management regimes when possible;
- Maintain and/or increase breeding populations of key priority and other avian species;
- Establish a long-term monitoring program designed to assess priority species by building upon and expanding present survey efforts to ensure adequate coverage of appropriate areas and habitats;
- Identify and map key habitats, including Pitch Pine woodland and/or Bear Oak shrubland, grassy glades, vernal pools, and wet seeps, and conduct inventories and/or surveys of the flora and fauna in these critical habitats;
- Expand the IBA with land acquisitions;
- Boost public outreach through education and stakeholder involvement, and increase opportunity for the general public and enthusiastic individuals or groups to participate with projects designed to meet the IBA's conservation goals.

7.1 Habitat Management and Maintenance

Avian biodiversity is directly related to the active silviculture and early successional management regimes now occurring in the IBA. Under the stewardship of CTDEP, the site operator, the NSF has been managed and its various habitats maintained. Continued management of forested and early successional habitats is necessary to support a diverse assemblage of avian species, including the two suites of breeding species of priority concern. Due to the ephemeral nature of early successional habitat, active management is critical as these habitats would quickly revert to mature forest without management. The grasslands and old fields represent an important facet of the early successional habitat, therefore, continued maintenance of these grasslands is recommended to achieve the goal of greater overall biodiversity within the IBA. Not fully explored in the IBA are the ridge-top barrens and glades which provide additional early successional habitat. These locally unique sites seem to hold a smaller suite of shrubland birds and distinctive vegetative assemblages; further assessment of these areas is required. In the future, specialized management techniques may be necessary.

7.2 Monitoring and Surveying

Avian monitoring is critical for all stages of conservation planning, including assessment of population status and evaluating the success of conservation action. Therefore, a long-term monitoring program that accurately assesses bird populations within the IBA's varied habitats is an essential component of this conservation plan. This program should also be capable of evaluating the effectiveness of habitat management techniques on priority avifauna and, if appropriate, other wildlife. Without effective monitoring, data review, and interpretation by competent observers and researchers, the richness and abundance of bird populations within the IBA could easily remain undetected and/or underestimated. The majority of avian research and/or monitoring has occurred in the West Block. For example, the CTDEP's Whip-poor-will research which is currently under way is quite extensive, and should provide important ecological information regarding the species distribution and habitat usage within the IBA. Other significant species and/or specific habitats, however, have not received the same degree of attention. Additional monitoring and/or enhancements to the present protocols are needed to thoroughly assess

shrubland species within the powerline corridors, or breeding birds in forested habitat, prior to, and following various silviculture treatments. The East Block of the NSF, unlike the West Block, has been overlooked over the years, and the avian abundance and diversity there is virtually unknown. Except for the migratory bird habitat stopover survey (2002-2004) and the woodland raptor survey performed the past few years, no formal avian research has been conducted in this woodland. The East Block is a large, 1200-acre tract of essentially undisturbed forested land; woodland bird surveys in this area could provide a better understanding of the forest interior breeding bird population.

Monitoring, data assessment, and further research within all areas of the NSF will play a vital role in the development of a comprehensive action plan. Through this process, it is possible to adapt management techniques, as needed, to best ensure the long-term success of many species of birds, plants, and other wildlife, as well as contribute to the overall vitality of the forest.

7.3 Key Habitat Inventory

One notable and vital goal is the identification and mapping of critical or key habitats within the IBA. Aside from observations during the preparation of this report, no formal research has been conducted so far on this front; very little knowledge about these unique areas exists. A complete and accurate assessment of these special areas would help to determine distribution patterns within the IBA. Detection of vernal pools, for example, could lead to knowledge about the status and distribution of amphibians and reptiles. Wet seeps and ridge-top barrens and glades can provide special conditions for unique plants or invertebrates. These sites must first, however, be located and identified so that inventories of state-listed and/or other rare species can proceed.

7.4 Land Acquisition

Another desirable goal of this conservation plan is the expansion of the IBA. Although much of the surrounding landscape is already developed or slated for development, opportunities still exist for land acquisitions which would benefit and enhance the present NSF holdings. Some properties, for example several parcels along Hunters Mt. Road, are undeveloped and would make fine additions to the NSF. A narrow corridor linking the East Block's High Rock Grove section with the Beacon Cap section contains undeveloped properties to the north and south. Increasing the IBA acreage in this area would protect the forested habitat from suburban encroachment and concurrently benefit forest interior species. Also in the East Block, the Town of Bethany owns a 12-acre in-holding within the Beacon Cap section; procurement of this property may be possible, and the Town of Bethany's 1998 Open Space Plan supports this idea (Martin et al. 1998). Other properties in Beacon Falls abut and/or contain priority habitats that include balds, glades, Pitch Pine woodlands, and Bear Oak shrubland; such properties would be welcome land additions (Table 3-1). Due to the pressure of increasing development, this plan encourages the State of Connecticut and the stewards of the NSF to explore expansion by acquiring certain abutting properties to increase the amount of open space and wildlife habitat in the region.

7.5 Education and Public Outreach

There are many individuals and organizations that already have a deep association and respect for the NSF, and appreciate the variety and diversity of its wildlife and habitats and the impressive breadth of its scenery and recreational value. Once trained in the conservation plan process, these stakeholders and interested parties (see Section 3.4) could form the nucleus of an important group of volunteer educators who would share their various skills and interests regarding the IBA, and encourage others to join them. Interested parties could also play an important role in promoting the forest's contribution to the public life of the community, such as its natural resources and recreational opportunities. This outreach effort could extend to presentations for local organizations, exhibits at local or state events, and/or the creation of a

“Friends of NSF”- type foundation with its own web presence and online resources. Such an organization might also be a source of additional funding for particular projects to benefit the NSF, to augment limited CTDEP resources.

Individuals or groups who have an important role in the conservation plan are more likely to provide valued assistance with programs such as monitoring bluebird houses, conducting point-count or other breeding bird surveys, and/or helping to control or eradicate invasive plant species. Such volunteers should be recognized as being part of the overall plan to keep the IBA healthy, thus strengthening their commitment to the IBA and the wildlife and habitats within. Ongoing volunteer recruitment is highly recommended.

CTDEP staff and other managers of this conservation plan should consult regularly with interested and knowledgeable stakeholders concerning implementation of specific parts of the plan. If they feel included in the process, the spectrum of stakeholders will provide invaluable resources, expertise, and enthusiastic support. This collaborative, participatory approach could build a partnership for future project planning, and contribute to the success of the plan, and to the well-being of the NSF.

8.0 ACTION PLAN

The diversity of habitats which makes the NSF such a valuable and desirable asset to the individuals who enjoy its range of recreational uses also makes conserving, preserving and maintaining these habitats a significant challenge for its managers and stewards. One of the biggest problems is preventing illegal or prohibited actions that harm or threaten carefully managed or fragile environments. Unfortunately, the NSF has no regular CTDEP staff presence to help deter improper action and property abuses or to work on a regular basis with habitat management, site maintenance, or grounds keeping. The recommendations presented in this section of the Conservation Plan cumulate the concerns and enhancements described in Section 5 and outline the actions necessary to maintain and improve the NSF as an Important Bird Area.

8.1 Habitat Management and Enhancement

Field Areas As described in Section 5.1, management of early successional habitats is necessary to support a diverse assemblage of avian species, including the suite of early successional priority species. Most importantly, due to the temporal nature of early successional habitat, active and continuous management is critical. Actions needed to improve, enhance, and protect the field habitats are denoted below, while additional detail is provided in Section 5 and Section 6 of this plan.

Recommendations

- **Field Management** Continue with the current management regime for the field areas---burn and mow on a regular basis---as described in Section 6.2. Also, continue with the annual treatment of invasive plants using selective application of low toxicity, non-persistent herbicide (also see Invasive Plants and Exotic Species below).
- **Field Protection** The prohibited use of four-wheel vehicles and ORVs has destroyed a small warm season grassland adjacent to the north field and also damaged the north field by scarring the field with deep ruts and destroying vegetation.

Take aggressive steps to eliminate all ATV, ORV, and four-wheel drive activity within the NSF and particularly the early succession habitats. Uncontrolled ATV activity increases noise, pollution, and habitat destruction. It may also aid in dispersal of invasive species. ATV activity disturbs wildlife and disrupts the normal wildlife cycle. It becomes critically important during the breeding season and may lead to nest and nestling abandonment. Enforcement can act as a deterrent to some ATV users. Establish locked gates at fire access forest roads and barriers. (e.g. large rocks, concrete blocks, felled logs or other obstacles) at potential points of entry. Felled logs may suffice in some areas while other access points can be blocked by erecting barriers that blend into the natural background (see Section 5.1.5). Another viable option, which CTDEP broached with the Borough of Naugatuck in the past seems worthy of revisiting; install a bar-gate across the end of Hunters Mt. Road at the first parking area.

- **Edge Improvement** Provide for greater vegetative diversity along abrupt field edges (e.g. northern edge of the North Field) by converting these ecotones to low-contrast edges. Low-contrast gradual edges can develop by allowing shrubs, tree seedlings/saplings to grow along the ecotone. These edges can be gradually woven into the forest structure by selective removal of some upper canopy trees along the forest exterior which would encourage the growth of additional herbaceous vegetation. Not only will this add to plant diversity but should create additional habitat conducive to some shrubland breeding species.
- **Find Additional Funding** Attempt to secure additional funding through grants and other avenues to supplement resources for habitat management activity. A potential source of revenue was recently established through legislation, see Section 8.6 for information about Public Act No. 11-192.

- **Grassland Connectivity** Explore options for increasing grassland acreage through land acquisition, conservation easement, or landscape management changes in the vicinity of the north and south fields. There may be benefits to linking the north field and south field via a grassland corridor. At present these fields are isolated from each other by a forest stand. A grassland corridor connecting both fields would provide a larger grassland parcel which could possibly attract area-sensitive grassland breeders. However, the merits of increasing field habitat in this section of the NSF would have to be weighed against the possible consequences of increased human disturbance---especially by four-wheel drive/off-road vehicles---due to accessibility and the possible negative impacts of further fragmentation.

Another interesting option for increasing grassland acreage in the IBA could involve the Laurel Park Landfill property which is situated directly east of the north field. Encompassing 35 acres of established grassland, this property is a significant parcel and potentially a source pool for breeding grassland species. Future efforts might consider property acquisitions and/or working with adjacent landholders to establish conservation easements for the purpose of developing a grassland corridor linking the LPL and the north field. To evaluate the LPL potential, conducting bird surveys at the former landfill should reveal if any State-listed grassland species are breeding there, if so, this would provide additional incentive to seriously consider this proposal.

Powerline Corridors The two powerline corridors provide greater than 40 acres of scrub-shrub and grass-scrub habitat within the IBA, which are important to shrubland avifauna of conservation concern. Several opportunities exist to improve and enhance the vegetative structure and composition within the corridors, but partnering with NU/CL&P is necessary to affect positive changes to this habitat.

Recommendations

- **Establish a Dialogue with NU/CL&P** Establish a dialogue and partnership with NU/CL&P regarding management in the powerline corridors, discuss and exchange ideas about enhancing or improving the shrubland habitat there. Review NU's habitat management plan and, during the next routine maintenance operation, evaluate the field procedures. Discuss the finding with NU/CL&P and provide suggestions and/or recommendations to strengthen the plan and/or field procedures, with the ultimate goal of improving shrubland habitats within the rights-of-way.
- **Corridor Maintenance** Routine maintenance of the powerline corridors is conducted on a four-year cycle (Section 6.2). The primary goal is to clear the corridor of unwanted woody vegetation, by cutting and/or selectively applying herbicide. CL&P contractors perform this service in a two-step process: the initial prep cut, done in winter; and, the second step---a foliar spray application---conducted after June 15. The foliar spraying is of concern because of the timing which coincides with peak breeding for many species of bird. Partner with CL&P, stakeholders, and experts to determine the best window for herbicide treatment which meets CL&P's goal, but is most protective of biodiversity in the corridors.
- **Conductor Trimming** Every 10 years, CL&P's maintenance schedule requires side trimming of trees and shrubs extending into the corridor within 20 ft (6m) of the conductors. Through cooperative effort with NU/CL&P, CTDEP, and other stakeholders, this maintenance activity may be used advantageously to improve corridor edge habitat by cutting back trees to soften and feather the ecotone in a manner similar to that described above for the fields. Partnering with NU/CL&P is necessary to successfully implement this task.
- **Enhance Vertical Diversity** To increase vertical diversity and enhance shrubland habitat within the corridors consider planting native, mast producing shrubs or small trees in areas with minimal shrub coverage and/or locations where invasive shrubs were removed by cutting and/or herbicide treatment. Coordinate with NU to determine the types and amount of woody vegetation the company would find acceptable and allow to remain in the corridors. Some species to consider include Winterberry,

American Holly (*Ilex opaca*), Gray Dogwood (*Cornus racemosa*), High Bush Blueberry, and crab apple depending on soil and moisture conditions. Plantings can be vividly marked to identify and to avoid inadvertent treatment the next NU/CL&P maintenance round.

- **Release Existing Species** Encourage production of mast producing vines and shrubs e.g. grapes, brambles, Virginia Creepers, greenbrier, etc. by releasing species already present to stimulate growth.
- **Corridor Protection** Protect the current vegetative structure and composition by eliminating ATV activity within the corridors as described above under Field Areas.

Forest Management Forest management is another important component of this IBA plan. Silviculture practices applied by CTDEP through implementation of its Forest Management Plan allow for a variety of habitats, hosting different suites of associated species.

Recommendations

- **Forest Management Plan** Support the CTDEP's forest management plan and obtain additional detailed information about the forest avian community in order to assess the plan's effectiveness. Through the use of various census techniques, breeding bird productivity surveys, more targeted and concentrated on-site observations, and data analyses the effect of the present management scheme can be evaluated. Then, if necessary, recommendations for modifications or adjustments to the next 10-year work cycle can be implemented to enhance avian diversity and/or abundance.
- **Timing of Regeneration Harvests** In the IBA, shrubs, seedlings, and saplings resulting from timber harvests are left to regenerate with minimal management until trees become established and require thinning. Approximately 10 years after a regeneration cut many of the desirable scrub-shrub species breeding there start to decline and may soon be gone (Table 5-1). Therefore, even-aged harvests in the NSF must be carefully timed to compensate for successional changes and should be created before current patches mature beyond the stand initiation period. This would ensure that suitable open patches which meet the specialized needs of shrubland priority species continue to be available. Patch cuts varying in sizes, shapes, and with irregular borders provide the greatest habitat variability.
- **Blending Regeneration Harvests with Powerline Corridors** Shelterwood or clear-cut treatments conducted in forest stands adjacent to the corridors can provide an opportunity to weave these regeneration cuts into the corridors. Not only could this feather the abrupt edge found in some areas but provide for irregular corridor borders thus softening the edge and creating additional habitat for shrubland specialists utilizing the corridors and adjoining patch cuts.
- **Deer Overpopulation** The overpopulation of deer is a potential conservation concern in the IBA. While deer overpopulation does not appear to be a present conservation concern, monitoring for signs of over-browsing is necessary. Deer studies in nearby states suggest maintaining a density below 6-7 deer/km² (0.6 mile²) is an acceptable population size (Tilghman 1987, Healy 1997). Therefore, future monitoring for signs of deer over-browsing will be an important element of conservation planning within the IBA. In addition, a determination of deer density would help to guide future planning efforts related to deer management and protection of essential habitats.
- **Designation of Passively Managed Forest Areas** Designate the 1100 acres in the West Block (forest stands: 1-1, 1-2, etc.) as "perpetually undisturbed forest" to clarify the intent of the language in the forest management plan. Also assign the entire East Block ---with the possible exception of the pine stand in the High Rock Grove Section that might require future thinning ---the same designation.
- **Limit Logging during Avian Breeding Season** Limit the more aggressive logging activities, such as shelterwood cuts, clear-cuts, and large selection cuts, to protect breeding birds during the peak breeding season---approximately May through July. When possible, conduct less intrusive harvesting tasks during the peak breeding period.
- **Snags and Den Trees** Ensure that the minimum numbers of snag and den trees are left standing following timber harvest. Current policy recommends that three snag trees >12 inches (0.3 m) dbh and one den cavity tree >15 inch (0.4 m) dbh remain per acre (CTDEP 1999, CTDEP 2005a). When

harvesting, if the minimum number of snags cannot be left due to OSHA safety concerns or lack of suitable trees, girdle or cut living poorer quality trees to satisfy the recommendations. One cautionary note here, however, recent research in Connecticut forests suggested that too many snags may attract cowbirds and possibly impact the nesting success of shrubland breeders (Askins et al. 2007).

- **Invasive Plant Control** To hinder the establishment and spread of invasive plants after timber harvests, plant log landings with a native grass and/or wildflower conservation mixture. Afterward, monitor log landing and skid roads for the establishment of invasive plants as such areas are prone to colonization. A recent example is the establishment of Garlic Mustard in a location---behind the bar gate at Forest Stand 4-2--- used as a log landing in 2008/2009. As suggested in the West Block's Forest Management Plan, consider implementing an invasive species control component as a stipulation of the Timber Harvest Contract.
- **Habitat Management for Ruffed Grouse** An important way to attract Ruffed Grouse is through aspen management. When possible attempt to regenerate aspens in stands where they are present. Aspen and mixed stands of aspen and hardwood or aspen and conifers could be managed to maximize grouse densities. The ideal way to obtain maximum aspen regeneration is to clear-cut, exposing the ground to sunlight, which stimulates suckering from the roots of cut trees. Once aspen is established on a site, it will persist for many years if burned, broken down, or cut periodically. Harvesting during the winter usually provides the best aspen regeneration. Mixed oak-hickory woodlands also have a high potential for improving habitat for grouse. A mosaic of 1-10 acre regenerating cuts dominated by 5-15 foot tall oak or aspen saplings adjacent to mature timber provides the best year-round grouse habitat.
- **Promote Responsible Forest Management** Another important recommendation for protecting the IBA's forestland and interior forest avifauna is for proponents of the NSF to partner with adjacent private landowners and landholders of large forested parcels (e.g. Bethany Land Trust, Town of Beacon Falls, Town of Bethany, and Connecticut Water Company). This entity could then advocate for the protection of these forest lands and promote forest health through responsible forest management practices.

Invasive Plants and Exotic Pests The IBA contains a variety of invasive plant species (Section 5.1.2, Table I-1), but measures to control these undesirable plants have been employed by CTDEP and CL&P for many years. Also of conservation concern is the threat from exotic pests which have the potential of drastically altering the vegetative structure within the IBA.

Recommendations

- **Invasive Plant Management** Future conservation efforts should include the continued use of invasive plant control measures as described in Section 6.2. In addition, the site should be monitored on a semiannual or annual basis to track and record the location and abundance of these undesirable species, as well as monitor the possible presence of additional invasive species. During site surveys, the focus should be on managed early successional habitat and "unmanaged" herbaceous openings around the reservoir area and other areas described in Section 5.1.2 or below. If newly established plants or colonies are detected (e.g. Japanese Stilt Grass) a concerted effort could be made using stakeholders and/or volunteers to eradicate these colonies before they become established and spread. Several stakeholders/site users expressed an interest in participating in such an effort.

The WHIP contract provides for treatment for the field habitats through 2011. In the meantime, it would be helpful to identify other potential resources/sources of funding to assist with future invasive species control. Research and explore other new and innovative treatment options as they become available.

- **Powerline Corridors Management for Invasive Species** Review CL&P's habitat management procedures for invasive species control within the rights-of-way as described in its management plan

and as executed in the field. Partner with CL&P and work to improve any shortcomings associated with current practices.

- **Japanese Barberry** Measures should be implemented to control and/or eradicate Japanese Barberry that is spreading into the woodlands along Hunters Mt. Road.
- **Japanese Stilt Grass** In 2010, Japanese Stilt Grass was detected growing along Whittemore Road by Jeff Ward (per. comm.), who has voiced concern about this species' potential to spread rapidly. Efforts should focus on the eradication of this species before it becomes established and colonizes new areas within the NSF.
- **Japanese Knotweed** Highly recommended would be a cooperative effort involving the IBA, Connecticut DOT, Naugatuck River Watershed Association, and other interested stakeholders in the development of an initiative to control the Japanese Knotweed which is overtaking the banks of the Naugatuck River. The overall impact of invasive knotweed on the riverine ecosystem can be dramatic, and control efforts are encouraged. Perhaps, a project such as this can be tied into the Naugatuck Greenway Trail development which is discussed below.
- **Hemlock Woolly Adelgid** In certain parts of the IBA, forest stand health and composition is being affected by the Hemlock Woolly Adelgid and to a lesser degree by two hemlock scales. Mixed infestation by the adelgid and scale has the potential to hasten hemlock decline. The impact of the loss of hemlock, an important climax forest species, is poorly understood, but there is the potential for significant disruption to the biotic community, habitat structure, habitat diversity, and quality of the ecosystem.

In the IBA, the CTDEP has no specific management plan addressing the hemlock decline, although the Department is monitoring forest health. Depending upon safety concerns, site locations, and accessibility, the Department may salvage hemlocks which succumb to the decline and replant the sites with Eastern White Pine. Research is being conducted on the state, regional, and national level (Ward et al. 2004). Currently, the Connecticut Agricultural Experiment Station (CAES) working with the USDA has conducted research on systemic insecticides and the release of the adelgid predatory beetle *Sasajiscymnus tsugae*. It is hoped that an effective means of curtailing or eradicating this deadly menace will arrive before the hemlock stands in Spruce Brook Ravine and other locations are completely lost.

- **Gypsy Moth** In the IBA, severe outbreaks of the Gypsy Moth occurred during the 1960s, mid-1970s, and again in the 1980s, defoliating much of the forest. Many trees, particularly oaks which the pest favors, eventually succumbed to stress following repeat outbreaks.

While the CTDEP regularly monitors forest stand health in the IBA, it has no specific management plan to address Gypsy Moth infestation. If an outbreak should occur, the CTDEP would let it take its course, unless a more effective alternative is discovered beforehand. Depending upon safety concerns, site locations, and accessibility the Department might salvage hardwoods which succumb to the defoliation.

- **Asian Longhorned Beetle and Emerald Ash Borer** Two recently introduced pests, the Asian Longhorned Beetle and the Emerald Ash Borer have the potential to seriously impact forest health and tree species composition in the NSF.

The first line of defense against the Emerald Ash Borer and the Asian Longhorned Beetle is to diligently monitor the IBA for visual signs of the borer or beetle. Surveys for all of these potential pests are conducted annually by the CAES in conjunction with CTDEP and other partners. In the NSF and other state forests, purple monitoring traps have been installed in an effort to detect the presence of the EAB. If the EAB is found the discovery triggers quarantine procedures for wood products including: firewood of all hardwood species; green lumber of ash; and, any other dead or living ash material including logs, stumps, roots, branches and composted or uncomposted chips. If

ALB is found it would also trigger an immediate quarantine, with procedures similar to, but probably more inclusive, than EAB quarantine procedures (CTDEP 2011a, CTDEP 2011b).

Wildlife Impoundment Beavers have dammed the water outlet at Wildlife Impoundment, raising the water level in the impoundment three to four ft (0.9-1.2 m) and nearly to the top of the earthen dam. In the winter of 2008, beavers were trapped and removed, but others have relocated there and the dam is again blocked by debris. In the southwest corner of the dam water has overflowed and/or breached the dike, eroding a narrow runoff channel along the earthen dam. This is the same location where a small sandbar/mud flat is found when the water level is low in mid-late summer. This sandbar regularly attracts a few shorebirds--Solitary Sandpiper (*Tringa solitaria*), Spotted Sandpiper, Least Sandpiper (*Calidris minutilla*), and Semipalmated Sandpiper (*Calidris pusilla*)--during fall migration.

Recommendations

- Clear the obstruction from the outlet pipe to protect the integrity of the earthen dam and to let the water level return to normal.

8.2 Biological Monitoring and Assessments

Avian monitoring is vital during all stages of conservation planning, including assessment of population status and evaluating the success of conservation management. Additionally, monitoring for invasive species, critical habitats, unique flora and fauna, deer overpopulation, and water quality are necessary to protect crucial resources, habitats, and biodiversity, as well as to identify other significant features and/or organisms within the IBA.

Bird Surveying and Monitoring A primary goal of this conservation plan is to monitor the IBA for priority (and other) breeding birds by expanding upon present efforts and/or establishing additional surveys. A long-term monitoring program that accurately assesses bird populations within the IBA's varied habitats is an essential component of this conservation plan.

Recommendations

- **Long-term Monitoring Program** Establish a long-term monitoring program in the IBA that accurately assesses the breeding and migratory bird populations in the IBA. This program should include breeding bird monitoring in early successional and forested habitats, but also consider monitoring for migrants that use or may use the IBA as stopover habitat.
- **Forest Breeding Bird Surveys** Conduct breeding bird surveys in the forested habitats within the IBA. This is one habitat previously overlooked for an entire guild of breeding birds. The MAPS program, initiated in 2008 by CTDEP is an excellent start and the only attempt to monitor forest breeding birds and the first such study associated with surveying an area following a shelterwood timber harvest. Additional surveys in unmanaged and managed—before and after timber harvest—habitats are needed, however, to completely assess richness, abundance, and productivity of forest breeding species. These surveys could be conducted in the East and West Block throughout the range of forested habitats. Data gleaned from these surveys will help to evaluate forest management regimes and guide future management efforts.

Continue to monitor forest breeding birds through the MAPS project and establish a long-term monitoring program to evaluate the breeding bird populations in the IBA's forested habitats. Several stakeholders responding to the IBA questionnaire expressed a desire to assist with bird monitoring efforts.

- **Early Successional Habitat Surveys** Continue to monitor the field and powerline shrubland habitats using point count circles as described in Section 6.3. Explore the possibility of enhancing the

present monitoring regime by adding additional point count circles and/or conducting nest productivity surveys in these habitats. Review and evaluate monitoring data from past years to establish species composition and evaluate trends in bird populations. Survey data should provide useful information regarding avifauna richness, abundance, and distribution within the fields and corridors and insight into areas hosting specific priority species. This information could then be used to assist in the development of future management strategies to improve or enhance habitat quality within the corridors. These point counts may also provide information on the status of Brown Thrasher and Golden-winged Warbler.

- **Whip-poor-will Research** Continuation of the ongoing Whip-poor-will study is strongly recommended. Whip-poor-will has become the focus of considerable conservation attention within the IBA since 2006, when CTDEP initiated the first phase of a multi-year research investigation. Whip-poor-will research is concentrating on population size and distribution, prey selection and availability, and vegetative composition of habitats used for foraging.
- **Golden-winged Warbler and Brown Thrasher Surveys** Attempt to determine the extent of the Golden-winged Warbler and Brown Thrasher breeding populations/status in the IBA. Conduct surveys in powerline corridors, fields, and regenerating shrub-scrub areas. Attempt to determine if these species are successfully breeding or still occur during the breeding season. Surveys can be accomplished jointly with enhanced powerline, field, and regeneration cut surveys, or done independently. Conduct point count or transect surveys along the Beacon Falls Tap and Naugatuck Tap powerline corridors to search for evidence of breeding. For the thrasher, if site surveys determine it is no longer a breeder, attempt to determine why, by initiating a more detailed ecological study.
- **American Woodcock Survey** In the West Block, a roadside listening survey for American Woodcock was conducted by CTDEP from 2003-2005. Information on the current status of the woodcock population in the NSF would help to evaluate the effectiveness of habitat management regimes and assist with future planning strategies.

Consider implementing another woodcock survey in the IBA, using the same census route as the previous survey. The woodcock survey is not resource intensive, and only requires about 1.5 hours during one evening in April/May. A survey could be performed on a biennial or triennial basis if necessary. New data can be compared to baseline data, albeit, the 2004 data is suspect, and it can help to evaluate the effectiveness of habitat management regimes on the woodcock population in the West Block.

- **Nest Box Program** Due to resource constraints, CTDEP lacks the ability to monitor and/or maintain the nest boxes in the field habitats on an ongoing or regular basis. To support CTDEP efforts, establish a group of dedicated stakeholder or interested parties to assist with the nest box monitoring and maintenance program. Also consider expanding the program by placement of additional nest boxes along the powerline corridors and herbaceous openings (dams) by the reservoirs and Wildlife Impoundment. Volunteers could be used during the breeding season to monitor nest boxes, clean boxes, and record data on species usage, clutch size, number of fledglings, etc. Breeding bird data can be tabulated and reported to stakeholders and other interested parties on an annual basis. Repairs to boxes and/or new installations can also be made by volunteers during the non-breeding season.
- **Hawk Watch** The NSF may prove to be a worthwhile hawk watch site. Migrant hawks are regularly observed during late summer and fall, in the vicinity of the north field and along the Naugatuck River corridor. A suitable site for such a venture could be the north field, although it does not offer a completely open view to the north. No other area in the IBA seems to fulfill the best criteria for a hawk watch station. The LPL, near the IBA's northern boundary, would be an excellent location for a hawk watch; it was used as such a site for one or two years in the early to mid-1980s. Since the LPL is private property, permission would be required to access this site.

Consider the possibility of establishing a fall hawk watch in the IBA. Not only would a hawk watch supply data on raptor diversity and abundance, but it could be an indicator of species using the NSF as a migratory stopover site.

- **Nighthawk Survey** Explore the possibility of establishing a Common Nighthawk watch in the IBA. Common Nighthawk is a threatened species in Connecticut and a species of conservation concern in much of the northeast. In Connecticut, nighthawks migrate south from approximately mid-August into early September and this species is known to utilize the Naugatuck River valley as a migratory corridor.

Consider establishing a nighthawk watch in the IBA. The watch can be conducted for approximately three weeks each year, from mid-August through the first week in September. These watches should start about 1.5 hours before sunset and end when darkness falls. The start time, however, is subject to review and may be modified to account for overcast nights or other circumstances

- **Migratory Bird Stopover Habitat Survey** The NSF has been described as an important stopover area for neotropical migrants, but the extent to which the IBA is used has not been determined. Between 2002 and 2004, CTDEP monitored migratory bird stopover habitat along several of the larger riverine corridors within the State, of which, three separate survey routes--East Block (CTN-C6), Naugatuck River corridor (CTN-A3), and West Block (CTN-C5)--were conducted within or adjacent to the NSF. Data collected during this study, however, have not been reviewed or evaluated to determine the IBA status as stopover habitat.

Analyze and interpret the migratory bird stopover data collected during the 2002-2004 surveys. Once this task is complete, the value of the IBA as stopover habitat in comparison to other sites within the study area will be known. Also important is the value of the three IBA surveys to migratory birds. Knowing the status of the IBA surveys can impact future bird studies and/or habitat management projects and could be another important tool to use for site planning.

Habitat and Wildlife Assessments Various assessments, inventories, and surveys not directly associated with avian monitoring or surveys are needed in the IBA. These other assessments and surveys are diverse and include such items as critical habitat assessments and surveys for water quality degradation, lead contamination, and feral cat colonies. Key and critical habitats should be assessed and inventoried for obligate flora and fauna. No formal botanical survey has been conducted throughout the IBA and due to the presence of unique habitats and interesting geological features rare and unusual flora may be present.

Recommendations

- **Key Habitat Inventory and Assessment** As described in Section 4.4.2 and 5.1.1.3, the IBA holds several critical habitats including Pitch Pine woodlands and/or Bear Oak shrublands, balds and grassy glades, acidic wet seeps, and vernal pools. Ridge-top Pitch Pine-Bear Oak barrens and shrub-dominated blueberry heath lands also found in the summit areas are important habitats for rare moths and butterflies (Wagner et al. 2003). Furthermore, other species of conservation concern including two State-listed species, Five-lined Skink and Mountain Spleenwort occur in these summit areas. Beside the summit areas, vernal pools frequently host amphibians of conservation concern, while wet seeps are important habitats for rare and unusual plants, insects, and, amphibians.

Finding and mapping all of the IBA's critical habitats is strongly recommended. A complete and accurate assessment would help to determine distribution patterns and areas needing protections from disturbance and/or abuse. Once these habitats are identified an inventory for obligate flora and fauna can follow, with sites prioritized by overall habitat condition and occurrence of obligate flora and fauna.

- **Dolerite (Diabase) Dike Inventory** Another area of potential significance and worthy of investigation is the dolerite (diabase) dike feature in the East Block (Section 4.2.6). Dolerite is one of the two types of traprock occurring in CT, and many rare plant species (calciphiles) are associated with it that wouldn't otherwise be found on the predominately acidic bedrock types that dominate the NSF (B. Moorhead per. comm.).
- **Spruce Brook** Water quality may be adversely impacted by site construction on Andrews Hill and remediation activity associated with the cleanup of the former Kaladish disposal site.

Monitor water quality in Spruce Brook prior to and subsequent to construction of the housing development on Andrews Hill. Testing the water for the Class A water quality criteria parameters prior to construction would provide essential baseline data on water quality. Water testing, thereafter, can be compared to baseline data to gauge the water quality and guide management decisions. Additionally, monitor the brook for visual signs of sedimentation or siltation or an oily sheen after construction commences.

- **Shooting Range** As described in Section 5.1.6, lead contamination is a concern at the present and former shooting ranges in the IBA. A site assessment should be undertaken to evaluate the potential harm these sites pose to birds, wildlife, and the environment. Since the ranges are within the state forest, it is advisable to request assistance from the CTDEP's Site Remediation Division. Staff members in this division have the expertise and ability to test, monitor, and properly evaluate the site for lead contamination. Also recommended would be a partnership with the High Rock Shooting Association to develop a plan for eliminating the use of lead-based ammunition. Another option to consider when the lease expires is to change the language of the new contract to require usage of non-lead ammunition.
- **Feral and Free Roaming Cats** As discussed in Section 5.1.9, feral cats as well as domestic free-roaming cats cause significant bird mortality in the wild. While feral and domestic cats do not appear to be a pressing concern in the IBA, lost and abandoned cats are sometimes encountered there. Although not a serious threat, the topic of outdoor and feral cats is still worth addressing through public education, both on field trips and signs posted on-site. The American Bird Conservancy has spearheaded a citizen education and action campaign called: "*Cats Indoors!*" to end the unnecessary loss of birds and other wildlife by cat predation. Information and education materials can be obtained from ABC (2009). A prudent measure would be to periodically check the IBA for feral cats and/or cat colonies.
- **Road Mortality** The Route 8 corridor poses a real threat to wildlife in the IBA. Invertebrates and vertebrates alike are indiscriminately killed as they try to move between the East and West Blocks. An initial step would be to collect data to quantify and qualify species mortality and locations killed/found. After the extent of animal mortality has been determined, a case for improvements can be formulated and presented to the CTDOT, CTDEP and IBA stewards. Several options to reduce or mitigate animal mortality along Route 8 include:
 - Determine which section(s) of roadway are most critical for wildlife movement such as natural wildlife movement corridors that have been blocked by the roadway. This project may be done in conjunction with the initial collection of mortality data or as a separate action.
 - Evaluate the potential for enlarging existing culverts to provide larger tunnel-ways to facilitate wildlife movement. Additionally, clear the existing tunnel-way of vegetation and debris at the inlet and outlet openings to aid animal passage.
 - Install drift fences that funnel wildlife towards and through the culverts. Such drift fences have been constructed in certain western states and have proven very successful directing movement of large and small mammals, reptiles and amphibians. These fences have also been successful in aiding movement of reptiles and amphibians in a number of eastern states as well.

- Another possible solution is to recommend an alteration to the roadway concrete barriers that now extend along Route 8. Modify the barriers by placing a central archway opening of suitable size that allows animals such as Raccoons and rabbits, but also small mammals, reptiles, and the occasional bird to readily pass through them, thereby avoiding the long expanse of otherwise insurmountable “concrete wall” that now confronts animals that attempt to cross the road.
- Construction associated with the Naugatuck River Greenway Trail may present another opportunity to mitigate mortality depending on the route taken through or along the IBA (see Section 5.1.11). If a bridge is built across the river it could facilitate animal passage. Even without a bridge, construction may include the installation of fencing and/or shrub barriers along the trail which can be used in conjunction with drift fences to guide animals to conduits or tunnel-way(s).

8.3 Site Maintenance, Improvements, and Grounds Keepings

Recommendations

- **Forest Boundary Markings** Property boundary markers are lacking in some sections of the NSF. In particular, no boundary markers delineate the southern boundary of the East Block’s High Rock Grove section. In this area, a line of loosely-connected rocky summits are found. According to available maps, these summits appear to be in close proximity to the IBA’s boundary. Without knowledge of the property line, it’s impossible to determine which summits and critical habitats are within the IBA or on adjoining private property. If any of these key habitats are outside the IBA’s footprint, these properties should be noted and recommended for potential future acquisition and/or conservation easement.

Identify and mark the NSF boundary in the southern section of the High Rock Grove section and elsewhere in the IBA where boundary markers are absent.

- **Spruce Brook Road Repair** The upper section of the roadway between Hunters Mt. Road and the shooting range was repaired in 2007. However, east of the shooting range Spruce Brook Road is badly deteriorated. The road presently is very rough which likely reduces or discourages vehicle usage; repair to this roadway should be considered to allow for safer travel. One advantage associated with the poor road condition is that vehicles using this route now do so at a slower speed. While road maintenance is necessary, this improvement can lead to potential negative impacts associated with increased traffic volume and faster vehicle speed.

Make improvements to the roadway, but consider the potential impacts from increase traffic and higher rates of speed. Install speed bumps or other devices to reduce speed.

- **Human Disturbance** Prohibited human-related activities which contribute to habitat degradation and wildlife disturbance are perhaps the biggest challenge in the management of this IBA. Numerous prohibited activities, such as ATV and off-road vehicle usage, swimming, camping, illegal dumping, and walking unleashed dogs are generally associated with negative impacts on the environment and regularly take place in the NSF. Monitoring the NSF for improper use is a complex matter, as is follow-up and enforcement. While CTDEP has regulations and rules which prohibit the activities described in Section 5.1.5, it lacks the resources to effectively police and enforce the requirements. Some illicit activities, such as motorized vehicle abuse, trash disposal, and vandalism represent social and criminal issues that are beyond the scope of this report. Also beyond the capacity of this report are enforcement ideas, many of which are known to CTDEP. The need for additional resources for combating these problems is obvious but dependent upon public funding and support.

Public education and additional signage could help to eliminate or curtail some activities. Educational and informational signs could be posted in conspicuous locations at main entry points, outlining rules about pets and prohibited uses of the NSF, such as swimming, camping, and unauthorized motorized vehicle use. The educational components of these signs would explain undesirable impacts on natural resources. Potential consequences of failure to comply could be posted as well. Also helpful would be signs showing designated hiking, walking, mountain-biking, and snowmobiling trails, the intent being to direct visitors away from sensitive habitats.

Designation of this location as an IBA may, in a best-case scenario, bring positive public attention and support to the NSF, and, eventually, additional funding for environmental protection of the NSF.

- **Illegal Dumping/Disposal** Illegal dumping of household trash, construction debris, and other refuse is a recurring problem and concern in the IBA. Another related issue is vehicle abandonment. Approximately seven-eight abandoned motor vehicles, one boat, and refuse were observed within the IBA or on its boundary. Four vehicles and the boat were on the NSF property, while the other vehicles were either on forest property or adjoining town-owned land in Oxford or Beacon Falls. Abandoned vehicles provide refuge for nuisance animals, pose a threat to the environment, and a safety concern to site users. The boat is sitting on a small pond accessible from land and presents an additional safety concern as well.

Junk vehicles (and boat) should be removed from the NSF and/or town properties. With the exception of the boat, the abandoned vehicles can be sent for recycling, with minimal or possibly no cost. The present value of scrap metal is high, so removal of the vehicles may not be cost prohibitive. One caveat is access; inaccessible vehicles may result in higher and/or additional removal fees. Regarding trash and debris, one commenter suggested that stakeholders partner with local communities, organizations, and forest users to have an annual or biennial forest clean-up day. Work parties can organize to locate/collect trash and debris and coordinate with local transfer and/or disposal outlets to remove the materials.

- **Naugatuck River Greenway Trail** The Council of Governments of the Central Naugatuck Valley is planning a Naugatuck River Greenway Trail with a key section likely going through the NSF. The recent plan recommends using the former roadbed/logging road alongside Route 8 in the East Block for a portion of the trail, but it's unclear at this time where the trail will continue beyond where the roadbed presently ends, so this planning issue is a concern.

Any proposed development associated with the greenway trail system must take care to maintain the integrity of the IBA. Construction associated with this project must be carefully planned to minimize impacts to nesting birds, wildlife, and critical habitats. On the positive side, a well-planned trail project could also provide long-term benefits to the NSF. Several invasive species such as Autumn Olive and Multiflora Rose are currently growing along the blue trail; with proper management and planning, these species could be removed during the construction phase and then be replanted with smaller trees and shrubs with high wildlife and aesthetics value, thus increasing habitat complexity and adding important mast bearing species for their food value. Other potential benefits are described above under Invasive Plant Management (Section 8.1) and Road Mortality (Section 8.3).

8.4 Educational Materials

Various informational and educational materials are currently being discussed, planned, and/or developed for the IBA. Several such materials are expected to be offered as informational or interpretative handouts or web-based printouts from the CTDEP website.

Recommendations

- Finalize the “Bird Checklist for the Naugatuck State Forest” and make it available at kiosks/information boards in the forest and/or through CTDEP’s website.
- Complete the booklet on the advantages of forest management practices to the birds. A graduate student, under guidance from CTDEP and stakeholders, is preparing an education booklet that highlights habitat management techniques and birds of conservation concern benefitting from such management. Once complete, the booklet may be placed on the CTDEP’s website for the general public and IBA visitors.
- Develop posters/interpretative signage for placement within the IBA.
- Consult with CTDEP staff and other interested forest users about the best locations and placements for the interpretive signs.

8.5 Land Acquisitions

Due to the pressure of increasing development, this plan encourages the NSF to explore expansion by acquisition or conservation easements of certain abutting properties in order to increase the amount of open space and wildlife habitat in the IBA and region. Several potential properties are identified in Section 3.3 and Section 7.4 of this plan.

Recommendations One property initially worth pursuing is owned by the Town of Bethany. Within the East Block’s Beacon Cap section, surrounded by IBA property, is a town-owned in-holding of 12 acres (Figure 3-1). Procurement of this property may be possible, and the Town of Bethany’s 1998 Open Space Plan recommends selling the property to the state. Other properties in Beacon Falls and Naugatuck abut Laurel Park Landfill and/or contain priority habitats that include balds, glades, Pitch Pine woodlands, and Shrub Oak shrubland; such properties should be considered for procurement or conservation easement (Figure 3-1 and Table 3-1).

8.6 Potential Funding and Other Resources

- **Connecticut Conservation Corps Program** The 2009 budget bill, HB 6365, included a proposal to fund a new Connecticut Conservation Corps program. Although the bill did not pass, it serves as an example of positive legislative action that could be of significant value to the IBA. The program outlined in the bill was designed to employ young adults to help maintain facilities operated by the CTDEP’s Division of Conservation and Preservation. Workers (or volunteers) employed in a similar program could assist with sundry tasks aimed at improving the NSF including trash pickup, invasive species control, habitat management, posting of signage, and trail building/improvement, among others.
- **Naugatuck River Greenway Project** The Naugatuck River Greenway Trail is an ambitious project planned to extend from Torrington to Derby, at the river’s confluence with the Housatonic River. In Derby, approximately two miles of greenway trail was constructed and opened in 2006, while Naugatuck has a much shorter span completed. Other towns along the river are in different stages of greenway planning and/or development. The Council of Governments of the Central Naugatuck Valley (<http://www.cogcnv.org/>) has actively been pursuing the development of the Naugatuck River Greenway Trail between Thomaston and Beacon Falls. Along its breadth, the greenway will traverse the NSF, which is denoted as a centerpiece for the greenway (Frederiksen et al. 2001). At present, the exact route through the IBA has not been determined, as the greenway may go through the East or West Block (S. Gold pers. comm.). A recent greenway proposal recommends a route through the East Block. Once the greenway trail becomes a reality

in the NSF, not only will it provide recreational activities, but a great opportunity for environmental education as well. Signage could be placed along the greenway to identify historic, geologic, natural history, and environmental points of interest and/or information, including the site's status as an IBA.

Greenway Small Grant Program The CTDEP Greenway Small Grants Program will provide grants of up to \$5,000 for the planning, design, and implementation, including education, of greenway projects around the state, but the spending cap per year for these grants is \$50,000. In 2008, approximately \$50,000 was given to 10 recipients for greenway projects. Municipalities, regional planning organizations, and non-governmental groups may apply for grants; however, property acquisition and construction are not eligible for funding. This program, funded by the purchase of the Greenway license plates, could provide resources for future education projects associated with the greenway and IBA.

- **Society of American Foresters** The Society of American Foresters (SAF) provides small grants for public information or educational projects aimed at enhancing the public understanding of professional forestry and the forestry profession. These projects should have a focus on public education with the intent of attracting media attention and not be designed exclusively for the benefit of foresters and/or members of the organization (e.g. not for technical sessions or society meetings.). The project must be primarily sponsored and organized by local SAF members---New England Society of American Foresters---and their members should be involved. Examples of IBA projects that may meet the organization's requirements include: a guide to identifying birds which benefit from the forest management practices; signage/dioramas near the north field describing management activities, such as burning, harvesting, mowing, etc. that benefit early successional bird species; and/or a bird watchers trail guide to the IBA which highlights forest management activities that benefit birds (G. Milne, pers. comm.). For additional information about grants and the grant process refer to the New England Society of American Foresters webpage (<http://www.nesaf.org>).
- **Public Act No. 11-192** In July 2011, a change was made to the Forestry statutes to allow for a new forestry fund, known as "the timber harvesting revolving account." This fund is a separate account within the General Fund and permits up to \$100,000 of proceeds from timber harvesting in state forest and state wildlife management areas to be deposited into the account. The fund is to be used for the purpose of developing management plans and all other reasonable direct expenses related to the administration and operation of such plans. Donations can be contributed to the account also. While this fund isn't exclusively for use in the NSF, the CTDEP Forestry Division is intending to use some funding for invasive species control in state forests.

8.7 NSF Stewardship

The NSF is wholly owned by the State of Connecticut, and is principally managed by the CTDEP's Forestry Division. The CTDEP is therefore the primary steward of the IBA, and will naturally take the leadership role in any partnership opportunities recommended in this Conservation Plan. The CTDEP has ably maintained the diverse habitats and wildlife found within the forest, and the expertise and experience of its staff will be a valuable and necessary part of any future actions impacting the IBA. Collaborative efforts involving community conservation groups, and/or individual volunteers partnering with CTDEP will form a solid framework for accomplishing the goals outlined in Section 7, and implementing the recommendations of this section and enlarging the stewardship role to include the full spectrum of IBA stakeholders working under the direction of CTDEP.

9.0 EVALUATION (Measures of Success)

Over the next several years the effectiveness of the Conservation Plan for this IBA can be measured a number of ways. A definite measure of success will be if the monitoring protocols are adopted and the breeding bird surveys document stable, or, preferably, increased species diversity. Survey and monitoring results, therefore, will be the one main measure of success. Bird surveys of forest and early successional habitats will indicate how the habitat management regimes are working. Successful habitat manipulation and expansion will be reflected in stable or increasing numbers of priority breeding species and an overall increase in biodiversity within the IBA.

Another measure of success will be a decrease in the number and abundance of invasive plant species, which can be measured by the results of site monitoring and the effectiveness of control and/or eradication measures. The effectiveness of invasive species management will be reflected through a decrease in the total area covered by invasives or an increase of native plants.

Other key measures of success will be indicated by the following:

- The total number of stakeholders actively involved with implementing conservation actions to assist CTDEP efforts. The forging of partnerships between various conservation groups and individuals will be necessary to achieve the goals and recommendations described within the Conservation Plan. There will be a need for manpower as well as resources, which can best be achieved through partnerships.
- The effectiveness of conservation actions to curtail or reduce habitat destruction and property abuse;
- The number of key habitats located, mapped, and assessed in the IBA;
- The inventory of obligate flora and fauna found within the key habitats;
- The amount of acreage added to the IBA through land acquisitions or conservation easements.

Regular assessment of these measures will help to determine the success of the management plan and indicate whether it is necessary to redirect efforts to protect and/or enhance habitat, biodiversity, and avian species.

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APPENDIX A

AUDUBON CONNECTICUT IBA CRITERIA



IMPORTANT BIRD AREAS IN CONNECTICUT



GUIDELINES FOR SELECTION OF IBAs

In an effort to further the conservation of birds and their habitats in Connecticut, the National Audubon Society, Connecticut Ornithological Association, and participating Partners in Flight organizations are seeking information on sites that may qualify as Important Bird Areas in Connecticut. The primary goals of the IBA Program are to:

1. **Identify and designate** key sites for birds
2. **Establish priorities** for land managers
3. **Activate public participation** in bird conservation efforts
4. **Provide public education** and outreach opportunities.

DEFINITION:

An Important Bird Area is a site that provides essential habitat to one or more species of Connecticut's breeding and non-breeding birds. They are generally discrete sites that support one or more high-priority species, large concentrations of birds, exceptional habitat, and/or have substantial research value. Such sites may be protected or unprotected, public or private, and any size amenable to conservation efforts.

BACKGROUND:

Important Bird Areas have no legal land-use implications, are broadly applicable, and generally work as just one piece of the conservation puzzle. Even in states where many sites have been nominated, they should not be viewed as the only sites important to birds, or as the only sites in the state needing protection. They are voluntary means of attaining local conservation by building and mobilizing networks of birders and conservation professionals. They can attract funding and can effect land-use planning at the local level.

SUGGESTED GUIDELINES:

- A. Sites already designated as conservation areas, such as National Wildlife Refuges, Wildlife Management Areas, Nature Conservancy Preserves and Audubon Centers, may be nominated, as well as other, unprotected sites. Whether or not a site meets one or more of the criteria should be the sole basis for designation as an IBA.
- B. Sites are selected to represent all Partners in Flight-designated priority species and habitats in the state.
- C. Sites are selected in part to **utilize potential partnerships**, e.g. sites on the public/private land interface.
- D. Sites will be scattered widely across the state but should include sites near urban centers, selected to **encourage public access** and considered "demonstration" or "illustrative" sites to **emphasize educational opportunity**.
- E. Sites may change continually because locations that best illustrate important phenomena can come and go.
- F. Sites will be designated only through a process that includes discussions with the affected landowner(s) and documentation of landowner contacts (see also Land Ownership Guidelines on back of this page).
- G. Review of sites submitted for consideration will take into account the likelihood of continued use and habitat suitability of the site, including any potential effects that selection may have on increased visitation and resultant disturbance by visitors.
- H. Sites need to meet only *one* of the Criteria to qualify as an IBA, though many will meet more than one.



IMPORTANT BIRD AREAS IN CONNECTICUT



CRITERIA FOR SITE SELECTION

1

Sites important to endangered or threatened species in Connecticut.

Description: Sites that regularly support significant breeding or non-breeding densities of one or more of the following species listed as endangered or threatened in the state of Connecticut. Applies primarily to breeding or wintering sites, though regular migratory areas may be considered if known to be of exceptional importance. The site should be one of regular and/or recent occurrence in the last ~10 years. Thresholds will vary and may include sites with 1% of the state population (if known) in a season, or the 3-5 sites in the states with the highest regularly occurring numbers.

Endangered
Pied-billed Grebe
American Bittern
Bald Eagle
Northern Harrier
Sharp-shinned Hawk
Peregrine Falcon

Black Rail
King Rail
Common Moorhen
Upland Sandpiper
Roseate Tern
Barn Owl
Long-eared Owl

Common Nighthawk
Red-headed Woodpecker
Horned Lark
Sedge Wren
Golden-winged Warbler
Yellow-breasted Chat
Vesper Sparrow

Grasshopper Sparrow
Threatened
Least Bittern
Great Egret
Snowy Egret
Blue-winged Teal

Piping Plover
Least Tern
Short-eared Owl
American Kestrel
Purple Martin

2

Sites important to species of high conservation priority in Connecticut.

Description: Sites that regularly support significant breeding or non-breeding densities of the following species identified as state species of conservation concern, as Audubon WatchList species, and as high conservation priorities by Partners in Flight. Thresholds will vary, but may include sites with 25 or more breeding pairs, 5% or more of the seasonal state population (if known), or the 2-3 sites in the state with the highest regularly occurring numbers. May also include sites with significant complement of species.

Common Loon
Little Blue Heron
Cattle Egret
Yellow-crowned Night Heron
Glossy Ibis
Brant
American Black Duck
Broad-winged Hawk
Northern Bobwhite
Black Rail
Clapper Rail
American Golden-plover
Piping Plover
American Oystercatcher
Willet
Upland Sandpiper

Eskimo Curlew
Whimbrel
Hudsonian Godwit
Marbled Godwit
Red Knot
Purple Sandpiper
Buff-breasted Sandpiper
Short-billed Dowitcher
American Woodcock
Wilson's Phalarope
Common Tern
Black Shimmer
Black-billed Cuckoo
Short-eared Owl
Saw-whet Owl
Whip-poor-will

Chimney Swift
Red-headed Woodpecker
Hairy Woodpecker
Olive-sided Flycatcher
Eastern Wood-Pewee
Alder Flycatcher
Willow Flycatcher
Least Flycatcher
Great Crested Flycatcher
Eastern Kingbird
Common Raven
Sedge Wren
Bicknell's Thrush
Wood Thrush
Brown Thrasher
Blue-winged Warbler

Golden-winged Warbler
Northern Parula
Black-throated Blue Warbler
Blackburnian Warbler
Prairie Warbler
Bay-breasted Warbler
Cerulean Warbler
Black-and-white Warbler
Prothonotary Warbler
Worm-eating Warbler
Louisiana Waterthrush
Kentucky Warbler
Canada Warbler
Scarlet Tanager
Rose-breasted Grosbeak

Eastern Towhee
Field Sparrow
Savannah Sparrow
 Ipswich Sparrow
Henslow's Sparrow
Saltmarsh Sharp-tailed Sparrow
Seaside Sparrow
Bobolink
Eastern Meadowlark
Rusty Blackbird
Baltimore Oriole
Purple Finch

3

Sites that contain rare or unique habitat within the state/region or an exceptional representative of a natural habitat, and that hold important species or species assemblages largely restricted to a distinctive habitat type.

Description: Sites with habitats that are rare or unique in the state, or are exceptional examples (large and intact) of the habitats that should support, or could be managed to support, the full complement of bird species dependent on that habitat type. Examples in Connecticut might include grasslands (Eastern Meadowlark, Bobolink, Savannah Sparrow, etc.), saltmarsh (Seaside and Sharp-tailed Sparrows, rails, etc.), and mature forest (Cerulean Warbler, Scarlet Tanager, Wood Thrush, Ovenbird, etc.). Consideration will also be given to sites with exceptionally high species and habitat diversity, and some attempt will be made to distribute representative sites throughout the state.

4**Sites where significant numbers of birds concentrate for breeding, during migration, or in winter.**

Description: Sites that consistently support significant numbers of one or more species in the breeding or non-breeding seasons, including migration. Significant numbers are not easily defined. The following guidelines are suggested to provide some logical thresholds for site selection. Except where indicated, numerical estimates should be based on a short period of time, e.g. one-time counts such as daily surveys -- not on cumulative totals. Introduced, feral, and nuisance species (Mute Swan, resident Canada Goose, Monk Parakeet, American Crow, European Starling, etc.) should not be counted.

(4a) Waterfowl: The site regularly supports 500 or more waterfowl in winter and/or 1,000 or more waterfowl in migration (staging).

(4b) Gulls and Terns: The site regularly supports 100 or more terns or 500 or more gulls in a season.

(4c) Shorebirds: The site regularly supports 500 or more shorebirds (over a short period) at any time of the year.

(4d) Wading Birds: The site regularly supports 25 or more breeding pairs of wading birds or 100 or more individuals feeding or in migration.

(4e) Raptors: The site is a “bottleneck” or migration corridors for >5,000 migratory raptors (seasonal total).

(4f) Landbirds: The site is an important migratory stopover or seasonal concentration site for migratory landbirds. Sites may qualify on the basis of exceptionally high numbers of birds during migration, high densities of breeding species as shown from point counts or other surveys; or as “migrant traps” relative to the surrounding areas. Strong consideration will be given to areas with consistently high overall species diversity or diversity within a particular group (e.g., warblers).

(4g) Single-species Concentrations: The site regularly supports significant concentrations of a “congregatory” species but may not meet the thresholds above. Such sites should support a higher proportion of a species statewide population (>1%, if known) than other similar areas.

5**Sites important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education.**

Description: These are generally sites with a distinguished record and/or unique potential for long-term research and monitoring, or exceptional educational value. Such sites may occur in urban, suburban, rural, or other settings. Evidence should be cited showing the area’s value, such as publications of research conducted at the site.

National IBA Criteria

IBAs may be significant at different geographical scales – state, national, continental, or global. Sites that appear to meet the criteria at these other scales will be forwarded to the American Bird Conservancy for review. The following thresholds for national Important Bird Areas and can be used to identify sites with particularly high potential as Connecticut IBAs:

Sites that support:

- >10,000 waterfowl over a short period (not a whole season);
- >20,000 shorebirds, or 5% of flyway population over a short period (not a whole season);
- >10,000 raptors over a season;
- >2,500 wading birds (e.g. herons) over a short period;
- >1% of the national, continental, or flyway population of a congregatory species.

LAND OWNERSHIP GUIDELINES

The cooperation and participation of private landowners and public land managers is key to the success of the IBA Program. When considering any site as an Important Bird Area, whether public or private, great discretion should be exercised in order to respect the rights and authority of landowners and managers, and to avoid the creation or perception of potential conflict. The IBA Program offers potential recognition and assistance for good land stewardship, and should be used to foster trust and cooperation with landowners and managers.

Points to consider when nominating a site:

- Private landowners and/or public land managers should be notified in person if their land is being considered as a potential IBA.
- Private landowners and/or public land managers should be invited to participate in the IBA process.
- Private landowners and/or public land managers should be consulted before a site is positively identified as an Important Bird Area. "Identified" means that a site has been found, on a scientific basis, to meet the IBA site criteria.
- Permission should be obtained from private landowners and/or public land managers before any information on a site is made public, or any site is formally "designated" as an Important Bird Area.
- Private landowners and/or public land managers should be given every opportunity to participate in any discussions concerning their land, especially conservation planning or habitat management.
- Volunteers should never trespass on private property or enter public lands unauthorized, where authorization is required; always respect property rights and posted signs; and never engage in activities likely to arouse suspicion or hostility.
- If you encounter any negative reaction, or even anticipate such a reaction, on the part of a landowner or land manager, contact the IBA Coordinator. Do not try to pursue contact on your own if you are unsure of the response.

APPENDIX B

NAUGATUCK STATE FOREST IMPORTANT BIRD AREA SURVEY FORM



Buzz Devine
18 South Street
Plymouth, CT 06782

Dear Naugatuck State Forest Stakeholder,

In December of 2004, the Naugatuck State Forest (West & East Blocks) was recognized by Audubon Connecticut as one of Connecticut's 26 Important Bird Areas (IBA) for its high quality shrubland and forest habitat that provides prime breeding areas for State-listed and Audubon WatchList (species of conservation concern) species and stopover habitat for migrating landbirds. The IBA program is a global effort to identify the sites that are most important to birds. A key component of the program is to work with property owners and other partners to conserve the sites, focusing on the factors that make each one important.

Audubon Connecticut has received funding to work with the State of Connecticut and the Naugatuck Valley Audubon Society and other interested parties to develop conservation strategies for the Naugatuck State Forest. These strategies will be summarized in an IBA conservation plan that is currently being developed for the forest. An important part of the conservation planning process is to engage stakeholders (agencies, organizations, and individuals) in the development of the plan. We have identified you or your organization as a potential interested party.

Attached please find a questionnaire and information regarding the Naugatuck State Forest IBA. We would appreciate your written comments for inclusion in the conservation plan and in order to address any questions, concerns, or suggestions you may have.

Thank you very much for your participation in this exciting project. We look forward to working with you on the development and implementation of this plan.

Sincerely,

Buzz Devine, Conservation Plan Consultant

Important Bird Area Conservation Plan: Naugatuck State Forest (West & East Blocks), Beacon Falls, Bethany, Naugatuck, and Oxford, CT.

Information Survey

Naugatuck State Forest (West & East Blocks) is a 3,436-acre multi-use state owned forest managed by the Connecticut Department of Environmental Protection and located along the Naugatuck River in Beacon Falls, Bethany, Naugatuck, and Oxford. Naugatuck State Forest was recognized as an Important Bird Area (IBA) by Audubon Connecticut in 2004 for its high quality shrubland and forest that provide habitat for state-listed and Audubon WatchList species, and serve as stopover habitat for migrating landbirds. Identifying the forest as an IBA makes it part of a global network of sites that have been recognized for their importance to birds.

As part of the IBA program, a Conservation Plan is being developed for the forest. The purpose of the Conservation Plan is to document the existing attributes and needs of the Naugatuck State Forest and to outline a plan for the management and conservation of this important and unique resource. We would appreciate participation from individuals and groups who have particular knowledge of the forest and who would like to contribute to the development of this plan. Please respond to the following questions by mail (address above), email: NaugyIBA@comcast.net or call Buzz Devine at 860-283-0744.

Your Name and Address:

Phone: _____

Email: _____

1. Describe your or your organization's interest in Naugatuck State Forest:

2. What important educational or recreational resources exist at the forest?

3. Which features of the forest do you feel are the most important for bird conservation?

4. Do you know of any current or potential threat that could threaten these resources?



5. In your opinion, what are the key issues that should be addressed in the Conservation Plan?

6. Are there any improvements you would suggest for the forest?

7. Would you or your organization be willing to participate (directly or indirectly) in conservation planning for the forest, and in what capacity?

8. Would you or your organization be interested in helping with monitoring or surveying efforts at the forest?

9. Beside the groups/individuals noted on the attached distribution list, are you aware of any other groups/individuals that would be interested in the conservation activities at the forest?

Other comments:

Attachment 2: IBA Information Sheet for Naugatuck State Forest

Naugatuck State Forest (main block only) ~3,542 Acres 73° 3' W
Beacon Falls, Bethany, New Haven County 41° 27' N

Status: Recognized IBA.

Ownership: State of Connecticut.

Habitats: **Primary** – Mix of habitats. **Secondary** – Conifer forest, deciduous forest, shrub, swamp, river/stream, pond/lake.

Land Use: **Primary** – Forestry, nature and wildlife conservation, hunting/fishing, undeveloped, other recreation or tourism. **Secondary** – Water supply, horseback riding, rifle range.

Threats: **Serious** – Habitat conversion (invasive plants and succession).

Site Description: Naugatuck State Forest is comprised of mixed hardwoods, pine plantations, laurel thickets, swampy areas, streams, and a hemlock ravine. Particularly important to birds are the early successional habitats from grasslands to shrubland to young forest. The park is enjoyed by picnickers and hikers, and Larkin Bridle Trail is popular with equestrians. Spruce Brook Ravine has long been regarded as one of the state's most beautiful sites. The waterfalls here are spectacular, especially in the winter when the ice falls and ledges form. In addition to the numerous hiking trails, a portion of the forest has been sanctioned by the state as a rifle range.

IBA Criteria: Connecticut Endangered and Threatened species; High Conservation Priority Species; Rare, Unique or Representative Habitat; Long-term Research and/or Monitoring.

Birds: Naugatuck State Forest is a wild and undeveloped area between three developing towns. Due to the diversity of habitats, it is an area that is capable of supporting many species of birds. During spring migration, roughly 25 species of Warblers can be spotted, including those of high conservation priority: Blue-winged, Worm-eating and Canada; as well as Olive-sided Flycatchers. Hemlock Ravine and its cooler climate serve as a nesting habitat for Louisiana Waterthrush, another species of high conservation priority. From late April to August, Whip-poor-wills are rather common. Blue-winged Warblers are fairly common nesters and the early successional habitats support significant populations of other species dependent on this habitat type, including American Woodcock. The site is possibly used as a migratory corridor for Common Nighthawks, which can be plentiful on overcast evenings from mid-August to mid-September. Because the early successional habitat is changing back into woodland, the once common Brown Thrasher is now declining. Certain areas of the forest serve as critical stopover habitat during the fall migration.

Non-avian Resources: In addition to being an important wildlife habitat, Naugatuck State Forest also functions as a site for forestry, shooting sports (in the rifle range), horseback riding and hiking. Hunting is permitted throughout the forest, which is important to control the size of the deer herd, thereby reducing the impact of deer on the forest and early successional habitats of the forest. High Rock Grove was an important tourist attraction in the late 1800's, when the site was called High Rock Park, and is still frequented today. In late summer, a variety of butterfly species can be found in the brushy fields of the park.

Existing Conservation Measures: The DEP Forestry Division's land management practices ensure a wide variety of habitats within the forest, thereby allowing the persistence of the early successional habitats. Deer hunting is allowed throughout the forest, helping to control the size of the deer herd.

Nominator: Edward Jurzynski, Naugatuck Valley Audubon.

State-listed Species:

Species	Breeding	Winter	Migration	Dates
Whip-poor-will, SC	Yes	-	Yes	To 2007
Common Raven, SC	Yes	Yes	Yes	To 2007
Long-eared Owl, E	-	Yes	Yes	To 2007
Saw-whet Owl, SC	-	Yes	Yes	To 2007
Brown Thrasher, SC	Yes	Yes	Yes	To 2007
Golden-winged Warbler	Yes		Yes	2006, 2007

Attachment 4: Distribution List

1. Audubon Connecticut
2. The Borough of Naugatuck
3. Boy Scouts of America - Housatonic Council
4. The Connecticut Agricultural Experiment Station
5. Connecticut Audubon Society
6. Connecticut DEP – Forestry Division
7. Connecticut DEP – Wildlife Division
8. Connecticut Forest and Park Association
9. Connecticut Ornithological Association
10. CT Professional Timber Producers Association
11. CT Sportsman Alliance
12. High Rock Shooting Association
13. New Haven Bird Club
14. Naugatuck Valley Audubon Society
15. Naugatuck Valley Watershed Association
16. The Town of Beacon Falls
17. The Town of Bethany
18. The Town of Oxford
19. Western Connecticut Bird Club
20. Mr. Roy Harvey
21. Mr. Greg Hanisek
22. Mr. Bruce Finnan
23. Mr. Mark Szantyr

APPENDIX C

SOILS FOUND IN THE NAUGATUCK STATE FOREST

Table C-1. Soils Found in the Naugatuck State Forest IBA.

Soil Series	Soil Types	Slope Ranges/ Description	Lithology	Run-off	Permeability
Agawam Series	Very deep, well-drained soils	0-15%, on level to steep soils on outwash plains and high stream terraces	Schist, granite, gneiss, and phyllite	Negligible to low	High in the upper solum and high or very high in the lower solum and substratum
Canton Series	Deep, well-drained soils	0-35%, on nearly level to very steep glaciated plains, hills, and ridges	Granite, gneiss, and some fine-grained sandstone	Medium	Moderately rapid in solum; Rapid in substratum
Catden Series	Very deep, very poorly drained soils	0-2%, in woody and herbaceous organic materials in depressions on lake plains, outwash plains, moraines, and flood plains	Formed in woody and herbaceous organic materials	Very low or negligible	Moderately low to high.
Charlton Series	Very deep, well drained loamy soils	0-50%, on nearly level to very steep till plains and hills	Schist, gneiss, or granite	Medium to rapid	Moderate or moderately rapid
Chatfield Series	Moderately deep, well drained, and somewhat excessively drained soils	0-70%, on nearly level to very steep glaciated plains, hills and ridges.	Granite, gneiss, or schist	Medium to very rapid	Moderate or moderately rapid
Freetown Series	Very deep, very poorly drained organic soils	0-1%, in depressions or on level areas on uplands and outwash plains.	Highly decomposed organic material		Moderately high or high
Hinckley Series	Very deep, excessively drained soils	0-60%, on nearly level to very steep soils on terraces, outwash plains, deltas, kames, and eskers	Formed in water-sorted sand and gravel derived principally from granite, gneiss, and schist	Negligible to low.	High or very high.
Hollis Series	Shallow, well drained and somewhat excessively drained soils	0-60%, nearly level to very steep bedrock-controlled hills and ridges	Schist, granite and gneiss	Negligible to very high.	Moderate or moderately rapid
Leicester Series	Very deep, poorly drained loamy soils	Commonly <3%, but ranges from 0-8%, nearly level	Schist, gneiss, and granite	Slow	Moderate or moderately rapid in the surface layer and subsoil; Moderate to rapid in the substratum
Montauk Series	Very deep, well drained granitic soils	0-35%, nearly level to very steep upland till plains and moraines	Glacial till mantles underlain by firm sandy till	Low to high	Moderate or moderately rapid in the solum; Slow or moderately slow in the substratum
Natchaug Series	Very deep, well drained soils	0-2%, in depressions on lake plains, outwash plains, till plains, moraines, and flood plains.	Formed in woody and herbaceous organic materials.	Negligible or very low.	Moderately low to very high in the organic layers and moderately low to high in the loamy material
Paxton Series	Moderately deep to very deep, well drained loamy soils	0-35%, nearly level to steep till plains, hills, and drumlins	Schist, gneiss, and granite	Medium to rapid	Moderate in the surface layer and subsoil; Slow or very slow in the dense substratum
Ridgebury Series	Very deep, somewhat poorly and poorly drained soils	0-15%, nearly level to gently sloping in low areas in uplands	Granite, gneiss, schist	Slow to medium	Moderate to moderately rapid in the solum; Slow or very slow in the substratum

Soil Series	Soil Types	Slope Range/ Description	Lithology	Run-off	Permeability
Sutton Series	Very deep, moderately well drained loamy soils	0-15%, nearly level to strongly sloping till plains, low ridges, and hills. Lower sloped glaciated hills.	Schist, gneiss, granite	Slow to medium	Moderate to moderately rapid in the surface layer, subsoil, and substratum
Timakwa Series	Very deep, very poorly drained soils	0-2%, in depressions on lake plains, outwash plains, till plains, moraines, and flood plains	Formed primarily in woody organic materials with some herbaceous materials	Negligible or very low	Moderately low to high in the organic layers and high or very high in the sandy material
Udorthents	Well-drained to excessively well-drained.	0-15%, sandy loam-silt loam or loose to very firm gravelly analogues.	Cut and borrows, surface and subsoils modified or removed	Variable	Very rapid to slow.
Urban	Variable	0-25%, but dominantly 0-8%.	Man-made/disturbed areas covered by roads, buildings, etc.		N/A
Walpole Series	Very deep, poorly drained sandy soils	0-8%, nearly level to gently sloping soils in low-lying positions on terraces and plains	Formed in sandy glaciofluvial and stratified drift materials derived mainly from crystalline rocks.	Slow	Moderately rapid in the solum and rapid or very rapid in the substratum
Whitman Series	Very deep, very poorly drained soils	Typically 0-2%, but range up to 8%, nearly level or gently sloping depressions and drainageways on uplands	Granite, gneiss, schist	High	Moderate or moderately rapid in the solum; Slow or very slow in the substratum
Woodbridge Series	Moderately well drained loamy soils	Commonly <8% but ranges from 0-25%, nearly level to moderately steep till plains, hills, and drumlins	Schist, gneiss, and granite	Slow to rapid	Moderate in the surface layer and subsoil; Slow or very slow in the dense substratum

APPENDIX D

PLANT SPECIES OBSERVED IN THE NAUGATUCK STATE FOREST

Table D-1. Plant Species Observed in the Naugatuck State Forest During 2008.

TREES	
Eastern Red Cedar	<i>Juniperus virginiana</i>
White Spruce	<i>Acea glouca</i>
Norway Spruce	<i>Picea abies</i>
Blue Spruce	<i>Picea parriana</i>
Pitch Pine	<i>Pinus rigida</i>
Eastern White Pine	<i>Pinus strobus</i>
Douglas Fir	<i>Pseudotsuga menziesii</i>
Eastern Hemlock	<i>Tsuga canadensis</i>
Striped Maple	<i>Acer pensylvanicum</i>
Red Maple	<i>Acer rubrum</i>
Silver Maple	<i>Acer saccharinum</i>
Sugar Maple	<i>Acer saccharum</i>
Shadbush/Do.Serviceberry	<i>Amelanchier arborea</i>
Yellow Birch	<i>Betula alleghaniensis</i>
Black Birch	<i>Betula lenta</i>
White/Paper Birch	<i>Betula papyrifera</i>
Gray Birch	<i>Betula populifolia</i>
Am. Hornbeam/Blue Beech	<i>Carpinus caroliniana</i>
Pignut Hickory	<i>Carya glabra</i>
Shagbark Hickory	<i>Carya ovata</i>
Mockernut Hickory	<i>Carya tomentosa</i>
American Chestnut	<i>Castanea dentata</i>
Northern Catalpa	<i>Catalpa speciosa</i>
Flowering Dogwood	<i>Cornus florida</i>
American Beech	<i>Fagus grandifolia</i>
White Ash	<i>Fraxinus americana</i>
Tuliptree	<i>Liriodendron tulipifera</i>
Blackgum/Tupelo	<i>Nyssa sylvatica</i>
Hop Hornbeam	<i>Ostraya virginiana</i>
American Sycamore	<i>Platanus occidentalis</i>
Eastern Cottonwood	<i>Populus deltoides</i>
Large-tooth Aspen	<i>Populus grandidentata</i>
Quaking/Trembling Aspen	<i>Populus tremuloides</i>
Black Cherry	<i>Prunus serotina</i>
Apple	<i>Prunus spp.</i>
White Oak	<i>Quercus alba</i>
Swamp White Oak	<i>Quercus bicolor</i>
Scarlet Oak	<i>Quercus coccinea</i>
Scrub/Bear Oak	<i>Quercus ilicifolia</i>
Chestnut Oak	<i>Quercus prinus</i>
Northern Red Oak	<i>Quercus rubra</i>
Black Oak	<i>Quercus velutina</i>
Shiny Winged Sumac	<i>Rhus copallina</i>
Smooth Sumac	<i>Rhus glabra</i>
Staghorn Sumac	<i>Rhus typhina</i>
Tree of Heaven	<i>Ailanthus altissima</i>
Black Locust	<i>Robinia pseudoacacia</i>
Sassafras	<i>Sassafras albidum</i>
American Basswood	<i>Tilia americana</i>
American Elm	<i>Ulmus americana</i>
Slippery Elm	<i>Ulmus fulva</i>

SHRUBS	
Common Juniper	<i>Juniperus communis</i>
Japanese Yew	<i>Taxus cuspidata</i>
Speckled Alder	<i>Alnus rugosa</i>
Smooth Alder	<i>Alnus serrulata</i>
Japanese Barberry	<i>Berberis thunbergii</i>
Buttonbush	<i>Cephalanthus occidentalis</i>
Sweet Pepperbush	<i>Clethra alnifolia</i>
Sweet Fern	<i>Comptonia peregrina</i>
Autumn Olive	<i>Elaeagnus umbellata</i>
Winged Euonymus	<i>Euonymus alata</i>
Black Huckleberry	<i>Gaylussacia baccata</i>
Witch Hazel	<i>Hamamelis virginiana</i>
Winterberry	<i>Ilex verticillata</i>
Sheep Laurel	<i>Kalmia augustifolia</i>
Mountain Laurel	<i>Kalmia latifolia</i>
Spicebush	<i>Lindera benzoin</i>
Pink Azalea	<i>Rhododendron nudiflorum</i>
Swamp Azalea	<i>Rhododendron viscosum</i>
Pasture Rose	<i>Rosa carolina</i>
Multiflora Rose	<i>Rosa multiflora</i>
Rose	<i>Rosa spp.</i>
Bramble	<i>Rubus spp.</i>
Pussy Willow	<i>Salix discolor</i>
Silky Willow	<i>Salix sericea</i>
Common Elderberry	<i>Sambucus canadensis</i>
Meadowsweet	<i>Spiraea alba</i>
Steeplebush	<i>Spiraea tomentosa</i>
Late Low Blueberry	<i>Vaccinium augustifolium</i>
Highbush Blueberry	<i>Vaccinium corymbosum</i>
Early Low Blueberry	<i>Vaccinium pallidum</i>
Maple-leaved Viburnum	<i>Viburnum acerifolium</i>
Arrowwood	<i>Viburnum dentatum</i>
VINES	
Ground Nut	<i>Apios americana</i>
Striped Wintergreen	<i>Chimaphila maculata</i>
Asiatic Bittersweet	<i>Celastrus orbiculatus</i>
Common Strawberry	<i>Fragaria virginiana</i>
Wintergreen	<i>Gaultheria procumbens</i>
Japanese Honeysuckle	<i>Lonicera japonica</i>
Honeysuckle	<i>Lonicera spp.</i>
Partridgeberry	<i>Mitchella repens</i>
Virginia Creeper	<i>Parthenocissus quinquefolia</i>
Bristle Dewberry	<i>Rubus hispidus</i>
Catbrier/Greenbrier	<i>Smilax spp.</i>
Poison Ivy	<i>Toxicodendron radicans</i>
Periwinkle	<i>Vinca minor</i>
Grape	<i>Vitis spp.</i>

FORBS	
Yarrow	<i>Achillea millefolium</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Common Ragweed	<i>Ambrosia artemisiifolia</i>
Pearl Everlasting	<i>Anaphalis margaritacea</i>
Wood Anemone	<i>Anemone quinquefolia</i>
Indian Hemp	<i>Apocynum cannabinum</i>
Wild Sarsaparilla	<i>Aralia nudicaulis</i>
Jack-in-the-Pulpit	<i>Arisaema atrobens</i>
Swamp Milkweed	<i>Asclepias incarnata</i>
Common Milkweed	<i>Asclepias syriaca</i>
Butterfly-weed	<i>Asclepias tuberosa</i>
White Wood Aster	<i>Aster divaricatus</i>
Aster	<i>Aster spp.</i>
Wild Indigo	<i>Baptisia tinctoria</i>
Water Shield	<i>Brosenia schredberi</i>
Marsh Marigold	<i>Caltha palustris</i>
Pale Corydalis	<i>Corydalis sempervirens</i>
Pink Lady Slipper	<i>Cypripedium acaule</i>
Queen Anne's Lace	<i>Daucus carota</i>
Beechdrops	<i>Epifagus virginiana</i>
Trout Lily	<i>Erythronium americanum</i>
Boneset	<i>Eupatorium perfoliatum</i>
Joe-pye-weed	<i>Eupatorium spp.</i>
Japanese Knotweed	<i>Fallopia japonica</i>
Wild Geranium	<i>Geranium maculata</i>
Purple-headed Sneezeweed	<i>Helenium nudiflorum</i>
Day Lily	<i>Hemerocallis fulva</i>
Orangegrass	<i>Hypericum gentianoides</i>
Spotted Jewelweed	<i>Impatiens capensis</i>
Blue Flag	<i>Iris versicolor</i>
Cardinal Flower	<i>Lobelia cardinalis</i>
Birdfoot Trefoil	<i>Lotus corniculatus</i>
Whorled Loosestrife	<i>Lysimachia quadrifolia</i>
Purple Loosestrife	<i>Lythrum salicaria</i>
Canada Mayflower	<i>Maianthemum canadense</i>
Cow-wheat	<i>Melampyrum lineare</i>
Pinesap	<i>Monotropa hypopithys</i>
Indian Pipe	<i>Monotropa uniflora</i>
Grape Hyacinth	<i>Muscari botyordes</i>
Bullhead Lily	<i>Nuphar lutea</i>
Fragrant Waterlily	<i>Nymphaea odorata</i>
Pokeweed	<i>Phytolacca americana</i>
Green Wood Orchid	<i>Platanthera clavellata</i>
May Apple	<i>Podophyllum peltatum</i>
Fringed Polygala	<i>Polygala paucifolia</i>
Smooth Solomon's-Seal	<i>Polygonatum biflorum</i>
Smartweed	<i>Polygonum spp.</i>
Black-eyed Susan	<i>Rudbeckia hirta</i>
False Solomon's-Seal	<i>Smilacina racemosa</i>
Goldenrod	<i>Solidago spp.</i>
Skunk Cabbage	<i>Symplocarpus foetidus</i>
Starflower	<i>Trientalis borealis</i>
Red Clover	<i>Trifolium pratense</i>
Red Trillium	<i>Trillium erectum</i>

*Bold lettering indicates invasive species

^a State Listed Species of Special Concern

FORBS (CONT.)	
Broad-leaved Cattail	<i>Typha latifolia</i>
Purple Bladderwort	<i>Utricularia purpurea</i>
Wild Oat	<i>Uvularia sessilifolia</i>
False Hellebore	<i>Veratrum viride</i>
Common Mullen	<i>Verbascum thapsus</i>
Cowvetch	<i>Vicia cracca</i>
Violet	<i>Viola spp.</i>

GRAMINOIDS (Grasses, Rushes & Sedges)	
Big Bluestem	<i>Andropogon gerardii</i>
Broomsedge Bluestem	<i>Andropogon virginicus</i>
Densetuft Hairsedge	<i>Bulbostylis capillaris</i>
Blue Ridge Sedge	<i>Carex lucorum</i>
Shallow Sedge	<i>Carex lurida</i>
Pennsylvania Sedge	<i>Carex pennsylvanica</i>
Sedge	<i>Carex spp.</i>
Sedge	<i>Cyperus sp.</i>
Poverty Oatgrass	<i>Danthonia spicata</i>
Rosette Grass	<i>Dichanthelium acuminatum columbianum</i>
Rosette Grass	<i>Dichanthelium acuminatum implicatum</i>
Rosette Grass	<i>Dichanthelium dichotomum dichotomum</i>
Spike-rush	<i>Eleocharis spp.</i>
Green's Rush	<i>Juncus greenii</i>
Rush	<i>Juncus spp.</i>
Japanese Stilt Grass	<i>Microstegium vimineum</i>
Common Reed	<i>Phragmites australis</i>
Bulrush	<i>Schoenoplectus sp.</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Bulrush	<i>Scirpus spp.</i>
Foxtail	<i>Setaria faberi</i>
Bur-reed	<i>Sparganium spp.</i>

FERNS & FERN ALLIES	
No. Maiden-hair Fern	<i>Adiantum pedatum</i>
Mountain Spleenwort ^a	<i>Asplenium montanum</i>
Hayscented Fern	<i>Dennstedtia punctilobula</i>
Wood Fern	<i>Dryopteris spp.</i>
Horsetail	<i>Equisetum spp.</i>
Ground Pine	<i>Dendrolycopodium obscurum</i>
Ground Cedar	<i>Diphastrium digitatum</i>
Shining Clubmoss	<i>Hyperzia lucidula</i>
Sensitive Fern	<i>Onoclea sensibilis</i>
Cinnamon Fern	<i>Osmunda cinnamomea</i>
Interrupted Fern	<i>Osmunda claytoniana</i>
Royal Fern	<i>Osmunda regalis</i>
Christmas Fern	<i>Polystichum acrostichoides</i>
Bracken Fern	<i>Pteridium aquilinum</i>
New York Fern	<i>Thelypteris noveboracensis</i>
Marsh Fern	<i>Thelypteris palustris</i>
Netted Chain Fern	<i>Woodwardia areolata</i>
MOSESSES	
Hairy Cop Moss	<i>Polytrichum spp.</i>
Sphagnum Moss	<i>Sphagnum spp.</i>

APPENDIX E

CTDEP FOREST MANAGEMENT PLAN

APPENDIX F

LIST OF BIRD SPECIES RECORDED IN THE NAUGATUCK STATE FOREST

Table F-1. List of Bird Species Recorded in the Naugatuck State Forest.

SPECIES	SEASONAL STATUS	COMMENTS
Swans, Geese, and Ducks		
Snow Goose (<i>Chen caerulescens</i>)	Migrant	Seen overhead
Canada Goose (<i>Branta canadensis</i>)	Resident	
Mute Swan (<i>Cygnus olor</i>)	Winter	
Wood Duck (<i>Aix sponsa</i>)	Migrant, Breeder, Winter*	
American Wigeon (<i>Anas americana</i>)	Migrant	
American Black Duck (<i>Anas rubripes</i>)	Migrant, Winter*	
Mallard (<i>Anas platyrhynchos</i>)	Resident	
Green-winged Teal (<i>Anas crecca</i>)	Migrant, Winter*	
Ring-necked Duck (<i>Aythya collaris</i>)	Migrant, Winter	
Long-tailed Duck (<i>Clangula hyemalis</i>)	Migrant	One record at Reservoir 4
Bufflehead (<i>Bucephala albeola</i>)	Migrant	
Hooded Merganser (<i>Lophodytes cucullatus</i>)	Migrant, Winter	
Common Merganser (<i>Mergus merganser</i>)	Resident	
Grouse, Turkeys, and Quails		
Ring-necked Pheasant (<i>Phasianus colchicus</i>)	Resident	
Ruffed Grouse (<i>Bonasa umbellus</i>)	Former Resident	Appears to be extirpated
Wild Turkey (<i>Meleagris gallopavo</i>)	Resident	
Loons		
Common Loon (<i>Gavia immer</i>)	Migrant	Seen overhead
Grebes		
Pied-billed Grebe (<i>Podilymbus podiceps</i>)	Migrant	
Cormorants		
Double-crested Cormorant (<i>Phalacrocorax auritus</i>)	Migrant, Summer	
Bitterns and Herons		
Great Blue Heron (<i>Ardea herodias</i>)	Migrant, Summer, Winter*	
Great Egret (<i>Ardea alba</i>)	Migrant, Summer	
Green Heron (<i>Butorides virescens</i>)	Migrant, Breeder*	
Black-crowned Night-Heron (<i>Nycticorax nycticorax</i>)	Migrant, Summer	
American Vultures		
Black Vulture (<i>Coragyps atratus</i>)	Migrant, Breeder	
Turkey Vulture (<i>Cathartes aura</i>)	Resident	
Eagles and Hawks		
Osprey (<i>Pandion haliaetus</i>)	Migrant, Summer	Breeds near IBA
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Migrant, Winter	Breeds near IBA
Northern Harrier (<i>Circus cyaneus</i>)	Migrant	
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	Migrant, Winter*, Summer*	
Cooper's Hawk (<i>Accipiter cooperii</i>)	Resident, Possible Breeder	
Northern Goshawk (<i>Accipiter gentilis</i>)	Migrant, Winter*	
Red-shouldered Hawk (<i>Buteo lineatus</i>)	Migrant, Breeder	
Broad-winged Hawk (<i>Buteo platypterus</i>)	Migrant, Breeder	
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	Resident	
Falcons		
American Kestrel (<i>Falco sparverius</i>)	Migrant	
Merlin (<i>Falco columbarius</i>)	Migrant	
Plovers		
Killdeer (<i>Charadrius vociferus</i>)	Migrant, Breeder	
Sandpipers		
Solitary Sandpiper (<i>Tringa solitaria</i>)	Migrant	
Spotted Sandpiper (<i>Actitis macularius</i>)	Migrant, Breeder	
Upland Sandpiper (<i>Bartramia longicauda</i>)	Migrant	One record at Laurel Park Landfill
Semipalmated Sandpiper (<i>Calidris pusilla</i>)	Migrant	
Least Sandpiper (<i>Calidris minutilla</i>)	Migrant	
American Woodcock (<i>Scolopax minor</i>)	Migrant, Breeder	
Gulls		
Ring-billed Gull (<i>Larus delawarensis</i>)	Migrant, Summer, Winter	
Herring Gull (<i>Larus argentatus</i>)	Migrant, Summer, Winter	
Iceland Gull (<i>Larus glaucooides</i>)	Winter	Rare in winter on Naugatuck River
Lesser Black-backed Gull (<i>Larus fuscus</i>)	Winter	Rare in winter on Naugatuck River
Glaucous Gull (<i>Larus hyperboreus</i>)	Winter	Rare in winter on Naugatuck River
Great Black-backed Gull (<i>Larus marinus</i>)	Migrant, Summer, Winter	
Pigeons and Doves		

Rock Pigeon (<i>Columba livia</i>)	Resident	
Mourning Dove (<i>Zenaida macroura</i>)	Resident	
Cuckoos		
Black-billed Cuckoo (<i>Coccyzus erythrophthalmus</i>)	Migrant, Breeder*	
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	Migrant, Breeder*	
Typical Owls		
Eastern Screech-Owl (<i>Megascops asio</i>)	Resident	
Great Horned Owl (<i>Bubo virginianus</i>)	Resident	
Barred Owl (<i>Strix varia</i>)	Resident	
Long-eared Owl (<i>Asio otus</i>)	Migrant, Winter	One record near Laurel Park Landfill
Northern Saw-whet Owl (<i>Aegolius acadicus</i>)	Migrant, Winter, Possible Breeder*	
Goatsuckers		
Common Nighthawk (<i>Chordeiles minor</i>)	Migrant	
Whip-poor-will (<i>Caprimulgus vociferus</i>)	Migrant, Breeder	
Swifts		
Chimney Swift (<i>Chaetura pelagica</i>)	Migrant, Breeder	
Hummingbirds		
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)	Migrant, Breeder	
Kingfishers		
Belted Kingfisher (<i>Megaceryle alcyon</i>)	Migrant, Breeder, Winter*	
Woodpeckers		
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>)	Migrant	One record near Laurel Park Landfill
Red-bellied Woodpecker (<i>Melanerpes carolinus</i>)	Resident	
Yellow-bellied Sapsucker (<i>Sphyrapicus varius</i>)	Migrant, Summer, Winter*	
Downy Woodpecker (<i>Picoides pubescens</i>)	Resident	
Hairy Woodpecker (<i>Picoides villosus</i>)	Resident	
Northern Flicker (<i>Colaptes auratus</i>)	Migrant, Breeder, Winter*	
Pileated Woodpecker (<i>Dryocopus pileatus</i>)	Resident	
Tyrant Flycatchers		
Olive-sided Flycatcher (<i>Contopus cooperi</i>)	Migrant	
Eastern Wood-Pewee (<i>Contopus virens</i>)	Migrant, Breeder	
Yellow-bellied Flycatcher (<i>Empidonax flaviventris</i>)	Migrant	
Acadian Flycatcher (<i>Empidonax virens</i>)	Migrant, Breeder	
Willow Flycatcher (<i>Empidonax traillii</i>)	Migrant, Breeder *	No current breeding records
Least Flycatcher (<i>Empidonax minimus</i>)	Migrant, Breeder	
Eastern Phoebe (<i>Sayornis phoebe</i>)	Migrant, Breeder	
Great Crested Flycatcher (<i>Myiarchus crinitus</i>)	Migrant, Breeder	
Eastern Kingbird (<i>Tyrannus tyrannus</i>)	Migrant, Breeder	
Shrikes		
Northern Shrike (<i>Lanius excubitor</i>)	Migrant, Winter	
Vireos		
White-eyed Vireo (<i>Vireo griseus</i>)	Migrant	Three records
Yellow-throated Vireo (<i>Vireo flavifrons</i>)	Migrant, Breeder	
Blue-headed Vireo (<i>Vireo solitarius</i>)	Migrant, Breeder	
Warbling Vireo (<i>Vireo gilvus</i>)	Migrant, Breeder	
Red-eyed Vireo (<i>Vireo olivaceus</i>)	Migrant, Breeder	
Philadelphia Vireo (<i>Vireo philadelphicus</i>)	Migrant	One record
Jays & Crows		
Blue Jay (<i>Cyanocitta cristata</i>)	Resident	
American Crow (<i>Corvus brachyrhynchos</i>)	Resident	
Fish Crow (<i>Corvus ossifragus</i>)	Resident	
Common Raven (<i>Corvus corax</i>)	Resident	
Larks		
Horned Lark (<i>Eremophila alpestris</i>)	Migrant	
Swallows		
Tree Swallow (<i>Tachycineta bicolor</i>)	Migrant, Breeder	
Northern Rough-winged Swallow (<i>Stelgidopteryx serripennis</i>)	Migrant, Breeder	
Bank Swallow (<i>Riparia riparia</i>)	Migrant, Breeder	
Barn Swallow (<i>Hirundo rustica</i>)	Migrant, Breeder	
Chickadees & Titmice		
Black-capped Chickadee (<i>Poecile atricapillus</i>)	Resident	
Tufted Titmouse (<i>Baeolophus bicolor</i>)	Resident	
Nuthatches		

Red-breasted Nuthatch (<i>Sitta eorgiana</i>)	Migrant, Breeder*	
White-breasted Nuthatch (<i>Sitta carolinensis</i>)	Resident	
Creepers		
Brown Creeper (<i>Certhia eorgiana</i>)	Migrant, Breeder*, Winter	
Wrens		
Carolina Wren (<i>Thryothorus ludovicianus</i>)	Resident	
House Wren (<i>Troglodytes aedon</i>)	Migrant, Breeder	
Winter Wren (<i>Troglodytes troglodytes</i>)	Migrant, Winter, Breeder	
Kinglets & Thrushes		
Golden-crowned Kinglet (<i>Regulus satrapa</i>)	Migrant, Breeder*, Winter	Breeding suspected in mid-80's
Ruby-crowned Kinglet (<i>Regulus calendula</i>)	Migrant, Winter	
Blue-gray Gnatcatcher (<i>Poliopitila caerulea</i>)	Migrant, Breeder	
Eastern Bluebird (<i>Sialia sialis</i>)	Resident	
Veery (<i>Catharus fuscescens</i>)	Migrant, Breeder	
Gray-cheeked Thrush (<i>Catharus minimus</i>)	Migrant	
Swainson's Thrush (<i>Catharus ustulatus</i>)	Migrant	
Hermit Thrush (<i>Catharus guttatus</i>)	Migrant, Breeder, Winter	
Wood Thrush (<i>Hylocichla mustelina</i>)	Migrant, Breeder	
American Robin (<i>Turdus migratorius</i>)	Resident	
Thrashers		
Gray Catbird (<i>Dumetella carolinensis</i>)	Migrant, Breeder, Winter*	
Northern Mockingbird (<i>Mimus polyglottos</i>)	Resident	
Brown Thrasher (<i>Toxostoma rufum</i>)	Migrant, Breeding, Winter*	May no longer breed
Starlings		
European Starling (<i>Sturnus vulgaris</i>)	Resident	
Pipits		
American Pipit (<i>Anthus rubescens</i>)	Migrant	
Waxwings		
Cedar Waxwing (<i>Bombocilla cedrorum</i>)	Migrant, Breeder, Winter	
Wood-Warblers		
Ovenbird (<i>Seiurus aurocapilla</i>)	Migrant, Breeder	
Worm-eating Warbler (<i>Helmitheros vermivorum</i>)	Migrant, Breeder	
Louisiana Waterthrush (<i>Parkesia motacilla</i>)	Migrant, Breeder	
Northern Waterthrush (<i>Parkesia noveboracensis</i>)	Migrant, Breeder*	
Golden-winged Warbler (<i>Vermivora chrysoptera</i>)	Migrant, Breeder*	Rare, may have bred 2006-2008
Blue-winged Warbler (<i>Vermivora cyanoptera</i>)	Migrant, Breeder	
Black-and-white Warbler (<i>Mniotilta varia</i>)	Migrant, Breeder	
Tennessee Warbler (<i>Oreothlypis peregrina</i>)	Migrant	
Nashville Warbler (<i>Oreothlypis ruficapilla</i>)	Migrant	
Connecticut Warbler (<i>Oporornis agilis</i>)	Migrant	
Mourning Warbler (<i>Geothlypis philadelphia</i>)	Migrant	
Kentucky Warbler (<i>Geothlypis formosus</i>)	Migrant	One record
Common Yellowthroat (<i>Geothlypis trichas</i>)	Migrant, Breeder	
Hooded Warbler (<i>Setophaga citrina</i>)	Migrant, Breeder	
American Redstart (<i>Setophaga ruticilla</i>)	Migrant, Breeder	
Cape May Warbler (<i>Setophaga tigrina</i>)	Migrant	
Cerulean Warbler (<i>Setophaga cerulea</i>)	Migrant	Only a few records
Northern Parula (<i>Setophaga americana</i>)	Migrant	
Magnolia Warbler (<i>Setophaga magnolia</i>)	Migrant	
Bay-breasted Warbler (<i>Setophaga castanea</i>)	Migrant	
Blackburnian Warbler (<i>Setophaga fusca</i>)	Migrant	
Yellow Warbler (<i>Setophaga petechia</i>)	Migrant, Breeder	
Chestnut-sided Warbler (<i>Setophaga pensylvanica</i>)	Migrant, Breeder	
Blackpoll Warbler (<i>Setophaga striata</i>)	Migrant	
Black-throated Blue Warbler (<i>Setophaga caeruleascens</i>)	Migrant, Possible Breeder	
Palm Warbler (<i>Setophaga palmarum</i>)	Migrant	
Pine Warbler (<i>Setophaga pinus</i>)	Migrant, Breeder	
Yellow-rumped Warbler (<i>Setophaga coronata</i>)	Migrant	
Prairie Warbler (<i>Setophaga discolor</i>)	Migrant, Breeder	
Black-throated Green Warbler (<i>Setophaga virens</i>)	Migrant, Breeder	
Canada Warbler (<i>Cardellina canadensis</i>)	Migrant, Breeder*	Suspected of breeding late-80's
Wilson's Warbler (<i>Cardellina pusilla</i>)	Migrant	
Tanagers		
Scarlet Tanager (<i>Piranga olivacea</i>)	Migrant, Breeder	
Towhees, Sparrows, & Longspurs		

Eastern Towhee (<i>Pipilo erythrophthalmus</i>)	Migrant, Breeder, Winter*	
American Tree Sparrow (<i>Spizella arborea</i>)	Migrant, Winter	
Clay-colored Sparrow (<i>Spizella eorgi</i>)	Migrant	Very rare, one record in 2008
Chipping Sparrow (<i>Spizella eorgiana</i>)	Migrant, Breeder	
Field Sparrow (<i>Spizella pusilla</i>)	Migrant, Breeder, Winter*	
Vesper Sparrow (<i>Pooecetes gramineus</i>)	Migrant	
Savannah Sparrow (<i>Passerculus sandwichensis</i>)	Migrant	
Fox Sparrow (<i>Passerella iliaca</i>)	Migrant, Winter	
Song Sparrow (<i>Melospiza melodia</i>)	Resident	
Lincoln's Sparrow (<i>Melospiza lincolni</i>)	Migrant	
Swamp Sparrow (<i>Melospiza eorgiana</i>)	Migrant	
White-throated Sparrow (<i>Zonotrichia albicollis</i>)	Migrant, Winter	
White-crowned Sparrow (<i>Zonotrichia leucophrys</i>)	Migrant	
Golden-crowned Sparrow (<i>Zonotrichia atricapilla</i>)	Migrant	Very rare, one record near IBA
Dark-eyed Junco (<i>Junco hyemalis</i>)	Migrant, Winter	
Snow Bunting (<i>Plectrophenax nivalis</i>)	Migrant, Winter	
Cardinals, Grosbeaks, & Buntings		
Northern Cardinal (<i>Cardinalis cardinalis</i>)	Resident	
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	Migrant, Breeder	
Indigo Bunting (<i>Passerina cyanea</i>)	Migrant, Breeder	
Blackbirds & Orioles		
Bobolink (<i>Dolichonyx oryzivorus</i>)	Migrant	Breeds at Laurel Park Landfill
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	Migrant, Breeder, Winter*	
Eastern Meadowlark (<i>Sturnella magna</i>)	Migrant	May breed at Laurel Park Landfill
Rusty Blackbird (<i>Euphagus carolinus</i>)	Migrant	
Common Grackle (<i>Quiscalus quiscula</i>)	Migrant, Breeder, Winter*	
Brown-headed Cowbird (<i>Molothrus ater</i>)	Migrant, Breeder, Winter*	
Baltimore Oriole (<i>Icterus galbula</i>)	Migrant, Breeder	
Finches		
Pine Grosbeak (<i>Pinicola enucleator</i>)	Migrant, Winter	Rare, irruptive in winter
Purple Finch (<i>Carpodacus purpureus</i>)	Migrant, Winter, Breeder*	
House Finch (<i>Carpodacus mexicanus</i>)	Resident	
Red Crossbill (<i>Loxia curvirostra</i>)	Migrant, Winter	Rare, irruptive in winter
White-winged Crossbill (<i>Loxia leucoptera</i>)	Migrant, Winter	Rare, irruptive in winter
Common Redpoll (<i>Carduelis flammea</i>)	Migrant, Winter	Rare, irruptive in winter
Pine Siskin (<i>Carduelis pinus</i>)	Migrant, Winter*	
American Goldfinch (<i>Carduelis tristis</i>)	Resident	
Evening Grosbeak (<i>Coccothraustes vespertinus</i>)	Migrant, Winter	Rare, irruptive in winter
Old World Sparrows		
House Sparrow (<i>Passer domesticus</i>)	Resident	

Seasonal Status:

Winter	Winter Visitor, Non-breeder
Summer	Summer Visitor
Resident	Year-round resident, normally breeds
Migrant	Migrant
Breeder	Breeder
*	Occasional

APPENDIX G

KEY AVIAN SPECIES OBSERVED IN THE NAUGATUCK STATE FOREST IBA

Table G-1. Key Avian Species Observed in the Naugatuck State Forest IBA.

SPECIES	CONSERVATION STATUS	HABITAT DESCRIPTION ^a
American Black Duck (<i>Anas rubripes</i>)	Watchlist-Yellow	Migrant and occasional winter visitor on the reservoirs, Naugatuck River, or Wildlife Impoundment.
Long-tailed Duck (<i>Clangula hyemalis</i>)	CWCS-VI	Migrant, only one record from Reservoir 4 in November 2009.
Hooded Merganser (<i>Lophodytes cucullatus</i>)	CWCS-VI	Migrant and winter visitor found along the Naugatuck River, resevoirs, or occasionally Wildlife Impoundment.
Common Merganser (<i>Mergus merganser</i>)	CWCS-I	Nests in large cavities of trees in woodlands along major rivers or large open reservoirs.
Ruffed Grouse (<i>Bonasa umbellus</i>)	CWCS-VI	Nest on the ground in mixed coniferous-deciduous woodlands with well-developed understory.
Common Loon (<i>Gavia immer</i>)	State SC	Migrant only, found on reservoirs or observed migrating overhead.
Pied-billed Grebe (<i>Podilymbus podiceps</i>)	USFWS-NE, State E	Migrant only, prefers quiet ponds, lakes, and sluggish streams with extensive emergent vegetation.*
Great Blue Heron (<i>Ardea herodias</i>)	CWCS-I	Nests in wet wooded areas, often by the margins of lakes, ponds, or marshes, but sometimes in wet areas in the interior of forests. Often nests in open, dead trees. Requires relatively shallow water for foraging.
Great Egret (<i>Ardea alba</i>)	State T	Migrant and occasional summer visitor along Naugatuck River.
Green Heron (<i>Butorides virescens</i>)	CWCS-VI	Nests in densely wooded vegetation along ponds, rivers, and lakes. Nests are typically well-concealed and located in a bush or tree, 8-30 ft off the ground, often with water underneath.
Black-crowned Night-Heron (<i>Nycticorax nycticorax</i>)	CWCS-I	Migrant and occasional summer visitor along Naugatuck River.
Osprey (<i>Pandion haliaetus</i>)	CWCS-I	Migrant and summer visitor, nests south of IBA boundaries along the Naugatuck River.
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	USFWS-NC, State E	Migrant and winter visitor; presently nests within 3 miles of the IBA.
Northern Harrier (<i>Circus cyaneus</i>)	State E	Migrant and occasional winter visitor.
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	State E	Not known to nest; Occurs in remote and extensive woodland, often with adjacent fields or forest openings used for foraging. Nests in dense stands of conifers including mixed stands of hemlock, spruce, or white pine, and, less frequently, mixed woodlands of white pine and oak.
Cooper's Hawk (<i>Accipiter cooperii</i>)	CWCS-I	Breeding habitat consists of deciduous or coniferous stands near wetlands or open areas such as fields, shrubby growth, or clearings. Often nests in submature woodlands.
Northern Goshawk (<i>Accipiter gentilis</i>)	CWCS-I	Migrant and occasional winter visitor.
Red-shouldered Hawk (<i>Buteo lineatus</i>)	CWCS-I	Swamps, river valleys, and bottomland forests are required for nesting. Upland forests are used if adjacent to open or semi-open marshes, wet meadows, or the edges of ponds and lakes. Mature, deciduous canopy preferred.
Broad-winged Hawk (<i>Buteo platypterus</i>)	CWCS-I	Diverse habitat selection. Traditionally associated with deep tracts of deciduous or mixed forests. May also nest in isolated woodlots, often near roads and houses, and almost invariably close to a lake, pond, or wetland. Nests in deciduous trees of 25-35 ft.
American Kestrel (<i>Falco sparverius</i>)	State T	Migrant only, formerly nested; requires open terrain for hunting and cavities, particularly tree holes, for nesting. Favors grassland or shrubland at the edge of forest or open country with scattered trees.
Solitary Sandpiper (<i>Tringa solitaria</i>)	USFWS-NC	Migrant only, occasionally seen along the edges of Wildlife Impoundment or Naugatuck River.

Spotted Sandpiper (<i>Actitis macularius</i>)	CWCS-I	Nests in open country on the ground in dry, often sandy, well-drained soils with a relatively thin cover of herbaceous vegetation. Prefers areas near ponds, lakes, or rivers with a shoreline suitable for foraging.
Upland Sandpiper (<i>Bartramia longicauda</i>)	USFWS-NC, State E	Very rare migrant, one record from Laurel Park Landfill.
Semipalmated Sandpiper (<i>Calidris pusilla</i>)	USFWS-NE, CWCS-I, Watchlist-Yellow	Migrant only, found on coastal mudflats, estuaries, inland ponds, lakes, and rivers. *
American Woodcock (<i>Scolopax minor</i>)	PIF-HP, CWCS-VI	Commonly nests on the ground in low immature patches of hardwoods with a moist soil and near a field edge. Occasionally nests in fields of herbaceous vegetation not far from the edge of woods. A stream or wet area is typically nearby.
Black-billed Cuckoo (<i>Coccyzus erythrophthalmus</i>)	PIF-HP, CWCS-VI	Commonly nests in brushy or "edge" sites, often located on a boundary between woodlands and more open countryside. Nests in shrubs or trees under 6 ft from the ground.
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	CWCS-VI	Most commonly occur in brushy or edge situations rather than in dense thick woods. Nests usually 5-10 ft off the ground.
Eastern Screech-Owl (<i>Megascops asio</i>)	CWCS-I	Occurs in hardwood or mixed forests, woodlots, old apple orchards, wooded suburban neighborhoods, or less frequently, forested wetlands or tree-lined city streets. Nest in tree cavities or nest boxes.
Great Horned Owl (<i>Bubo virginianus</i>)	CWCS-I	Almost invariably found in mature upland forests. Prefers edges of the forest. Requires suitable trees, often conifers, for concealed roosting. Nest in abandoned nest of raptors, squirrels, and other species; less frequently use tree hollows, ledges, or on structures.
Barred Owl (<i>Strix varia</i>)	CWCS-I	Requires mature hardwoods, preferring areas near wetlands. Occurs in wooded swamp, bottomlands, hollows, river valleys, or forested slopes near wet areas. Nest in large tree cavities, hollows in the top of broken snags or occasionally nest boxes.
Long-eared Owl (<i>Asio otus</i>)	State E	Requires dense, cool conifer stands for roosting and nesting and adjacent open areas such as clear-cuts, fields, pastures, crop lands, or marshes for hunting. Not known to breed in the NSF.
Northern Saw-whet Owl (<i>Aegolius acadicus</i>)	State SC	Most commonly found in conifer woodlands or mixed deciduous and conifer woodlands, often near wetland. Nests in tree cavities or nest boxes.
Common Nighthawk (<i>Chordeiles minor</i>)	State E	Migrant only; nest on gravel rooftops in cities. Formerly nested on bare ground or rock in open areas.
Whip-poor-will (<i>Caprimulgus vociferus</i>)	USFWS-NC, State SC	Found in scrubby immature woods or areas of regrowth following disturbance in more mature forest. Sites often on relatively dry, sandy soils.
Chimney Swift (<i>Chaetura pelagica</i>)	PIF-RP, CWCS-VI	Originally nested in trees, but currently found in chimneys. Forages over large variety of habitats.
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)	CWCS-I	Nests in forest openings and woodlands, edges, and gardens. Nests commonly placed in deciduous trees over running water.
Belted Kingfisher (<i>Megaceryle alcyon</i>)	CWCS-I	Nest in burrows placed in banks along or near rivers, streams, and lakes.
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>)	GT-IUCN-TP-NT, USFWS-NC, State E, Watchlist-Yellow	Migrant, one record near the IBA's boundary.
Hairy Woodpecker (<i>Picoides villosus</i>)	PIF-RP	Inhabits mature woodland, forested wetlands, wooded edges of streams and ponds, and, less commonly, well wooded urban open space, and orchards. Rarely found in developed areas. Nest in tree cavities.
Northern Flicker (<i>Colaptes auratus</i>)	CWCS-I	Inhabits open woodland, orchards, and shade trees of towns and cities. Utilizes dead snags, poles, and fences for cavity nests.
Pileated Woodpecker (<i>Dryocopus pileatus</i>)	CWCS-I	Found in mature deciduous or mixed deciduous-conifer woodlands of uplands or forested wetlands, wooded parks, suburbs, or urban open space. Requires large, old timber, and often prefers extensive tracts of woodland or smaller woodlots connected by wooded corridors.

Olive-sided Flycatcher (<i>Contopus cooperi</i>)	GT-IUCN-TP-NT, USFWS-NC, Watchlist-Yellow, CWCS-I	Typically nests in conifers, often in open areas where snags are present in a woodland setting. Often found with beaver ponds, or standing water where snags are present.
Eastern Wood-Pewee (<i>Contopus virens</i>)	PIF-RP, CWCS-I	Breeds in mature deciduous woodland or mixed deciduous-coniferous forest, often with the presence of a forest gap or broken canopy.
Acadian Flycatcher (<i>Empidonax virescens</i>)	CWCS-VI	Typically breeds in moist woodlands along streams or other waterways with a fairly dense canopy and relatively open understory. Most Connecticut sites contain many conifers.
Willow Flycatcher (<i>Empidonax traillii</i>)	Watchlist-Yellow, CWCS-I	Breeds in wet brushy areas. Nests commonly placed in dense stands of willow shrubs over 7 ft high with moist soil or water underneath. Irregular or sporadic breeder in the NSF.
Least Flycatcher (<i>Empidonax minimus</i>)	PIF-RP, CWCS-VI	Breeds in areas where shrubs or saplings are mixed with shorter herbaceous vegetation. Typically found within or adjacent to woodlands, often with open water or wetlands nearby.
Great Crested Flycatcher (<i>Myiarchus crinitus</i>)	PIF-RP, CWCS-VI	Typically nests in holes in trees in mature woodlands, either deciduous or mixed coniferous-deciduous, usually in the vicinity of a forest gap such as near the edge of a pond in the woods.
Eastern Kingbird (<i>Tyrannus tyrannus</i>)	PIF-RP, CWCS-I	Occurs around open areas including ponds, lakes, marshes, fields, and lawns. Nests typically placed in trees near and overlooking such an open area.
White-eyed Vireo (<i>Vireo griseus</i>)	CWCS-I	Migrant only; three records.
Yellow-throated Vireo (<i>Vireo flavifrons</i>)	CWCS-I	Associated with deciduous forest with at least some very tall trees and a considerable contrast in height of the vegetation within the territory, so that territories may border or include roads and even small open fields.
Blue-headed Vireo (<i>Vireo solitarius</i>)	CWCS-VI	Breeds in mixed coniferous-deciduous woodland in Connecticut.
Warbling Vireo (<i>Vireo gilvus</i>)	CWCS-I	Breeds in isolated groups of deciduous trees, typically with a lush growth of canopy and surrounded by more open country. These sites are often along the shores of lakes, open marshes, streams, or rivers.
Common Raven (<i>Corvus corax</i>)	State SC	Breeds in mountainous or hilly terrain with rocky outcroppings and cliff faces within primarily coniferous or mixed deciduous woodlands. Nests in relatively undisturbed areas with restricted public access, often on rock ledges and coniferous trees.
Horned Lark (<i>Eremophila alpestris</i>)	State E	Migrant only.
Northern Rough-winged Swallow (<i>Stelgidopteryx serripennis</i>)	CWCS-I	Occurs in coastal, suburban, and rural areas where there is water. Commonly nests in holes in walls, drainage pipe openings of abutments, crevices in old stone foundations, especially along rivers where bridges once crossed, and in retaining walls along the coast. Occasionally use dirt banks for nesting.
Bank Swallow (<i>Riparia riparia</i>)	CWCS-I	Occurs in rural open areas, especially near water, over which it will feed. Dependent on sand banks and sloughed off embankments to place nest burrows.
Red-breasted Nuthatch (<i>Sitta canadensis</i>)	CWCS-I	Associated with coniferous or mixed coniferous-deciduous woodland, may forage in deciduous trees. Nests placed in cavities, commonly in dead trees or limbs, though bird houses used on occasion.
Brown Creeper (<i>Certhia americana</i>)	CWCS-I	Utilizes deciduous and mixed deciduous-coniferous woodland, pine forests, and, especially, forested wetlands with mature standing timber. Nest under bark of dead or diseased large trees.
Winter Wren (<i>Troglodytes troglodytes</i>)	CWCS-I	Associated with conifers and water. Often found near cool, narrow ravines and swamps forested with conifers, often hemlock. Requires abundance of dead timber and slash for nesting.
Golden-crowned Kinglet (<i>Regulus satrapa</i>)	CWCS-VI	Often nests high in conifers, especially spruce, within predominantly coniferous, or mixed coniferous-deciduous forest. May have nested in the White Spruce grove in the 1980s.

Blue-gray Gnatcatcher (<i>Poliopitila caerulea</i>)	CWCS-I	Found in any habitat with trees from abandoned pastures and urban parks to mature hardwood forest. Avoid largely coniferous woodland. Seldom seen far from a stream, river, or standing water. Occur mainly in mesic streamside woodland of oak, hickory, and maple but also in silver maple and cottonwood on floodplains of major rivers.
Veery (<i>Catharus fuscescens</i>)	PIF-RP, CWCS-I	Found in lowland woods, thickets, and swamps, especially with dense undergrowth. Prefers areas with thickest cover 3-10 ft above the ground and moist substrates.
Swainson's Thrush (<i>Catharus ustulatus</i>)	CWCS-I	Migrant only, uses various habitats for foraging.
Hermit Thrush (<i>Catharus guttatus</i>)	CWCS-VI	Breeds in a broad range of woodland, including more open forest and edge habitats. Generally found from moderate to high elevations. Nests on the ground in shrubs.
Wood Thrush (<i>Hylocichla mustelina</i>)	PIF-HP, USFWS-NC, Watchlist-Yellow, CWCS-VI	Occurs in moist deciduous and mixed coniferous-deciduous woodland, especially near streams or other wetlands. Prefers forests with maximum canopy height of at least 35-40 ft, as well as moist substrates and thick herb and shrub cover.
Gray Catbird (<i>Dumetella carolinensis</i>)	PIF-RP, CWCS-I	Nest low in dense shrubery or tangled thickets, frequently in the vicinity of swamps, streams, or wet meadows. Occurs in a range of habitats, from hedgerows or shrubs in suburban yards to woodland edges and cattail marshes. Absent from dense woods.
Brown Thrasher (<i>Toxostoma rufum</i>)	State SC	Nest in thickets, brushy hillsides, and woodland edges. Prefer open areas with patches of bare ground on which to feed.
Ovenbird (<i>Seiurus aurocapilla</i>)	PIF-RP, CWCS-I	Nests on the ground in deciduous or mixed deciduous-coniferous forests growing on well drained soils.
Worm-eating Warbler (<i>Helmitheros vermivorum</i>)	PIF-HP, USFWS-NC, CWCS-VI	Breeds in deciduous forest or mixed deciduous and hemlock forest, usually on steep, well-drained hillsides or ravines with dense undergrowth, but occasionally where the ground is quite open.
Louisiana Waterthrush (<i>Parkesia motacilla</i>)	PIF-HP, CWCS-I	Associated with flowing streams with nests placed nearby in earthen banks or along the upraised root systems of fallen trees.
Blue-winged Warbler (<i>Vermivora pinus</i>)	PIF-HP, USFWS-NE, Watchlist-Yellow, CWCS-VI	Breeds in successional habitats with deciduous plants. Found in second-growth deciduous forest with understory saplings or shrubs, shrubby abandoned farm fields, open edges of streams, rivers, and marshes, and openings in mature deciduous forests.
Golden-winged Warbler (<i>Vermivora chrysoptera</i>)	GT-IUCN-TP-NT, USFWS-NC, State E, PIF-HP, Watchlist-Red	Typically breed in ephemeral, early successional habitats that support sparsely distributed deciduous plants. Found in abandoned farmlands with scattered trees and shrubs, bordered by second-growth deciduous forests.
Black-and-white Warbler (<i>Mniotilta varia</i>)	PIF-RP, CWCS-VI	Nests in deciduous or mixed deciduous-coniferous woodlands. The nest is hidden on the ground, commonly at the base of a tree trunk.
Kentucky Warbler (<i>Geothlypis formosus</i>)	USFWS-NC, Watchlist-Yellow	Migrant, only one record in the IBA
Hooded Warbler (<i>Setophaga citrina</i>)	CWCS-I	Prefers mixed deciduous woodland and forest. Inhabits thickly wooded areas that have dense thickets and sporadic sunny openings. Prefers hillsides and slopes in our region.
American Redstart (<i>Setophaga ruticilla</i>)	CWCS-I	Inhabits a wide array of forested and shrubby habitats including alder and willow swamps, reforestation pastures, mature deciduous and mixed forests, and second growth deciduous woodlands. Most commonly found in forests with a thick midstory of saplings.
Cape May Warbler (<i>Setophaga tigrina</i>)	USFWS-NC, USFWS-NE	Migrant only, found in coniferous and mixed woodlands, spruce plantings, edge habitat, and parks.*
Cerulean Warbler (<i>Setophaga cerulean</i>)	GT-IUCN-TP-V, PIF-HP, USFWS-NC, Watchlist-Yellow, CWCS-VI	Migrant only with few records in the IBA. Breeds in upper canopy of mature deciduous woodlands, frequently along rivers.*
Northern Parula (<i>Setophaga americana</i>)	State SC	Migrant only, uses various habitats for foraging.

Magnolia Warbler (<i>Setophaga magnolia</i>)	CWCS-I	Migrant only, found in open coniferous and mixed conifer-hardwood forest, particularly young second growth.
Bay-breasted Warbler (<i>Setophaga castanea</i>)	USFWS-NE, Watchlist-Yellow, CWCS-I	Migrant only, found in conifer plantations, open deciduous and mixed woodlands. *
Blackburnian Warbler (<i>Setophaga fusca</i>)	PIF-HP, CWCS-I	Migrant only, associated with tall conifers, particularly hemlocks, spruces, and pines.*
Chestnut-sided Warbler (<i>Setophaga pensylvanica</i>)	PIF-HP, CWCS-VI	Commonly breeds in edge situations with hardwood trees and underbrush. Sites are often rather dry but streams run through some breeding areas. On occasion, nests in woods, though typically not in dense or mature unbroken woodland.
Black-throated Blue Warbler (<i>Setophaga caerulescens</i>)	PIF-HP, CWCS-VI	During migration, occupies a variety of habitats, including mature and secondary growth forest, parks, gardens, and residential neighborhoods. Breeds within large tracts of unbroken, mature deciduous or mixed forests containing a dense undergrowth of saplings and shrubs, often found within hilly or rough terrain.
Yellow-rumped Warbler (<i>Setophaga coronata</i>)	CWCS-I	Migrant only, found in conifers, open deciduous and mixed woodland.*
Prairie Warbler (<i>Setophaga discolor</i>)	PIF-HP, USFWS-NC, Watchlist-Yellow, CWCS-VI	Breeds in brushy areas with mixed vegetation including scattered conifers generally less than 10 ft high. Can breed in relatively small patches of habitat.
Black-throated Green Warbler (<i>Setophaga virens</i>)	CWCS-I	Inhabits mature forest, usually mixed, especially hemlock-norther hardwoods. In southern Connecticut hemlock ravines are favorite sites.
Canada Warbler (<i>Cardellina canadensis</i>)	PIF-HP, USFWS-NC, Watchlist-Yellow, CWCS-VI	Breeds in dense vegetation, often including mountain laurel, along the banks of small streams or other wet areas within woodlands. Nest on or near the ground.
Scarlet Tanager (<i>Piranga olivacea</i>)	PIF-HP, PIF-RP, CWCS-I	Breeds in a wide variety of forest types. May occur in relatively young successional woodland but prefers mature deciduous forest or mixed coniferous forest.
Eastern Towhee (<i>Pipilo erythrophthalmus</i>)	PIF-RP, CWCS-VI	Prefers the dense undergrowth of upland woodlands, often in dry locations with low covers of blueberry for breeding. During migration found in a variety of locations from field edges and thickets to swamps.
Field Sparrow (<i>Spizella pusilla</i>)	PIF-RP, CWCS-VI	Utilizes abandoned fields or sites that include a substantial amount of relatively short woody trees together with bunch grasses. Soil is commonly sandy and well drained, though there can be standing water nearby.
Vesper Sparrow (<i>Pooecetes gramineus</i>)	State E	Migrant only, found near the large field several times.
Savannah Sparrow (<i>Passerculus sandwichensis</i>)	State SC	Migrant only, found in the large field during migration.
Swamp Sparrow (<i>Melospiza georgiana</i>)	USFWS-NE	Migrant only, found in the large field and along powerline corridors.
Dark-eyed Junco (<i>Junco hyemalis</i>)	CWCS-I	Migrant and winter visitor.
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	CWCS-VI	Occurs in a wide range of wooded habitats from young successional woodlands, groves of mature trees such as hedgerows and suburban shade trees, to mature forest. Avoid forests dominated by conifers.
Indigo Bunting (<i>Passerina cyanea</i>)	CWCS-VI	Prefers old fields, often power line clearings. Low shrubby growth is ideal for nesting.
Bobolink (<i>Dolichonyx oryzivorus</i>)	USFWS-NC, State SC	Migrant only, occasionally in the large field, usually heard migrating overhead.
Eastern Meadowlark (<i>Sturnella magna</i>)	State SC	No longer nests in IBA, may nest in nearby Laurel Park Landfill. Typically found in large, grassy fields with elevated singing perches, such as fence posts or isolated trees. Nests in a wide range of grass cover and vegetation density, though more frequently found in more grassy vegetation as opposed to forbs.
Rusty Blackbird (<i>Euphagus carolinus</i>)	GT-IUCN-TP-V, Watchlist-Yellow	Migrant only, found in swampy woodlands and shrubby areas near water. *

Baltimore Oriole (<i>Icterus galbula</i>)	PIF-HP, CWCS-I	Utilizes mature, typically deciduous trees for nesting. Usually near some open area such as roadway, lawn, or field. Avoids the interior of continuous woodland.
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Conservation Status Key:

GT-IUCN-TP-V	Globally Threatened Species, IUCN List, Top Priority- Vulnerable
GT-IUCN-TP-NT	Globally Threatened Species, IUCN List, Top Priority- Near Threatened
PIF-HP	Partners In Flight Highest Priority
PIF-RP	Partners In Flight Regional Priority
Watchlist- Red	Audubon/ABC Watchlist, Red
Watchlist- Yellow	Audubon/ABC Watchlist, Yellow
USFWS-NC	USFWS Birds of Conservation Concern, National
USFWS-NE	USFWS Birds of Conservation Concern, Regional Concern in the Northeast
CWCS-VI	CT DEP Comprehensive Wildlife Conservation Strategy, Very Important
CWCS-I	CT DEP Comprehensive Wildlife Conservation Strategy, Important
State E	State Listed- Endangered
State T	State Listed- Threatened
State SC	State Listed- Special Concern

^a Habitat descriptions for breeding birds taken from: The Atlas of Breeding Birds of Connecticut (Bevier 1994) unless denoted with an *.

* Habitat information for migrants taken from Connecticut Birding Guide (Devine and Smith (1996). Other notes in habitat column by B. Devine.

APPENDIX H

CTDEP NATURAL DIVERSITY DATA BASE LETTER



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION



Bureau of Natural Resources
Division of Wildlife
79 Elm Street, 6th Floor
Hartford, CT 06106
Natural Diversity Data Base

May 13, 2008

Buzz Devine
Audubon Connecticut
18 South Street
Plymouth, CT 06782

re: Important Bird Area Conservation Plan
for Western Block of the Naugatuck State
Forest in Bethany, Beacon Falls,
Naugatuck and Oxford, Connecticut

Dear Buzz:

I have reviewed Natural Diversity Data Base maps and files regarding the area delineated on the map you provided for the proposed "Important Bird Area" conservation plan for the western block of the Naugatuck State Forest in Bethany, Beacon Falls, Naugatuck and Oxford, Connecticut. According to our information, there are state-listed wildlife species that occur in the vicinity of this project site. I have attached a list of the state-listed wildlife and have sent your letter to Julie Victoria (DEP-Wildlife; 860-642-7239) for further review. Ms. Victoria will write to you directly with her comments. You may contact Ms. Nancy Murray (DEP-Wildlife; 860-424-3589) if you have questions regarding the plant species.

Natural Diversity Data Base information includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department's Geological and Natural History Survey and cooperating units of DEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substitutes for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available.

Please contact me if you have further questions at 424-3592. Thank you for consulting the Natural Diversity Data Base. Also be advised that this is a preliminary review and not a final determination. A more detailed review may be conducted as part of any subsequent environmental permit applications submitted to DEP for the proposed site.

Sincerely,

Dawn M. McKay
Dawn M. McKay
Biologist/Environmental Analyst 3

Cc: Julie Victoria, NDDB # 16154

Species List for Request Number R16154

5/13/2008

<u>Scientific Name</u>	<u>Common Name</u>	<u>State Protection Status</u>
Animals		
<i>Caprimulgus vociferus</i>	Whip-poor-will	SC
<i>Eumeces fasciatus</i>	Five-lined Skink	T
<i>Papaipema leucostigma</i>	Columbine Borer	SC
<i>Vermivora chrysoptera</i>	Golden-winged Warbler	E
Plants		
<i>Asplenium montanum</i>	Mountain Spleenwort	T
<i>Asplenium montanum</i>	Mountain Spleenwort	T

APPENDIX I

INVASIVE PLANT SPECIES

Table I-1. Invasive Plant Species observed in the Naugatuck State Forest IBA and adjacent Naugatuck River.

Species	Location	Potential Control
Tree of Heaven (<i>Ailanthus altissima</i>)	Along the Naugatuck River.	<ul style="list-style-type: none"> - Hand pulling effective only on saplings. - Cutting twice a year. - Herbicide (triclopyr) applications prior to late summer.
Black Locust (<i>Robinia pseudoacacia</i>)	Primarily found along the Naugatuck River	<ul style="list-style-type: none"> - Hard to control. Most effective method is cutting, and then applying herbicides. - Repeated treatments often necessary, and cutting alone usually ineffective.
Multiflora Rose (<i>Rosa multiflora</i>)	Scattered throughout the IBA: powerline corridors, reservoir, and open areas.	<ul style="list-style-type: none"> - Hand-pulling/grubbing effective with small plants & small populations - Repeated cutting stops the spread of small populations. - Mowing of large populations provide partial control. - Herbicides (Glyphosate & triclopyr) often effective.
Japanese Barberry (<i>Berberis thunbergii</i>)	Scattered throughout the forest: powerline corridor, reservoirs, and open areas; also, in woodland along Hunters Mt. Road.	<ul style="list-style-type: none"> - Hand-pulling/grubbing often effective. - Mowing/cutting controls the spreading of the plant, but will not remove the plant. - Herbicides effective on young plants.
Autumn Olive (<i>Elaeagnus umbellata</i>)	Scattered location along powerlines, fields, scrublands, & reservoir dams	<ul style="list-style-type: none"> - Most effective combination includes mowing seedlings, cutting or burning saplings/trees, and spraying or burning the stumps.
Winged Euonymus (<i>Euonymus alatus</i>)	Mainly in the vicinity of the reservoirs along powerline corridors, also in other herbaceous openings.	<ul style="list-style-type: none"> - Cutting and applying herbicide (Triclopyr) to stumps effective - Foliar spraying with herbicide (Triclopyr) effective; sometimes repeated treatments are necessary.
Japanese Honeysuckle (<i>Lonicera japonica</i>)	By the reservoirs area; reverting apple orchard north side of west block	<ul style="list-style-type: none"> - Hand-pulling effective with small populations. - Herbicides somewhat effective with repeated occurrence. - Mowing usually ineffective.
Honeysuckle sp. (<i>Lonicera spp.</i>)	Primarily near the reservoirs	<ul style="list-style-type: none"> - Hand-pulling, grubbing effective on seedlings only. - Herbicide treatments (Glyphosate & Triclopyr) effective especially combined with cutting.
Asiatic Bittersweet (<i>Celastrus orbiculatus</i>) (aka Oriental Bittersweet)	Mainly in the vicinity of the reservoirs, but occasionally in other herbaceous openings.	<ul style="list-style-type: none"> - Repeated cutting in small populations effective - Grubbing effective in small populations - Herbicides (triclopyr) effective; sometimes repeated treatments are necessary.
Japanese Knotweed (<i>Polygonum cuspidatum</i>)	Pockets found throughout, especially prevalent along the Naugatuck River	<ul style="list-style-type: none"> - Grubbing (removing all roots) - Repeated cutting, at least 3 times per year, for at least a few years. - Herbicides (Triclopyr & Glyphosate) were temporarily effective, but re-sprouting did occur.

Species	Location	Potential Control
Purple Loosestrife (<i>Lythrum salicaria</i>)	Along the Naugatuck River; small pockets near Wildlife Impoundment.	<ul style="list-style-type: none"> - Hand-pulling/grubbing (removing roots) - Cutting effective for younger plants - Leaf-eating beetles prove effective for killing the plants - Mowing was unsuccessful.
Common Reed (<i>Phragmites australis</i>)	Several pockets scattered about the area: along the north powerline corridor near Pines Brook; behind 2 nd bar-gate on Hunters Mt. Road;	<ul style="list-style-type: none"> - Cutting & Pulling successful - Covering cut stands with black plastic raises the temperature and kills the plant. - DeepRoot Phragmites Barrier – a geomembrane prevents the spread of Phragmites when surrounding the stand. - Herbicides: Glyphosate is effective with repeated treatments.
Garlic Mustard (<i>Alliaria petiolata</i>)	Hunters Mt. Road behind 1 st bar-gate and parking area on south side of road; also reported from the reservoir area.	<ul style="list-style-type: none"> - Hand pulling (for small populations) - Cutting (for medium/large populations) - Prescribed burning - Herbicides (spring burns more effective than fall burns)
Japanese Stilt Grass (<i>Microstegium vimineum</i>)	Reported from Whittemore Road by J. Ward.	<ul style="list-style-type: none"> -Hand pulling in August/September before seed production can be effective on small populations -Cutting in late summer, follow by annual monitoring for 7 years is effective to eradicate larger stands. -Extensive populations can be controlled by applying herbicide like Glyphosate.

Additional information on management and control measures can be found at: <http://www.hort.uconn.edu/CIPWG/> and <http://nbii-nin.ciesin.columbia.edu/ipane/index.htm>

APPENDIX J

IBA BIRD SURVEYS: PROTOCOLS AND LOCATIONS