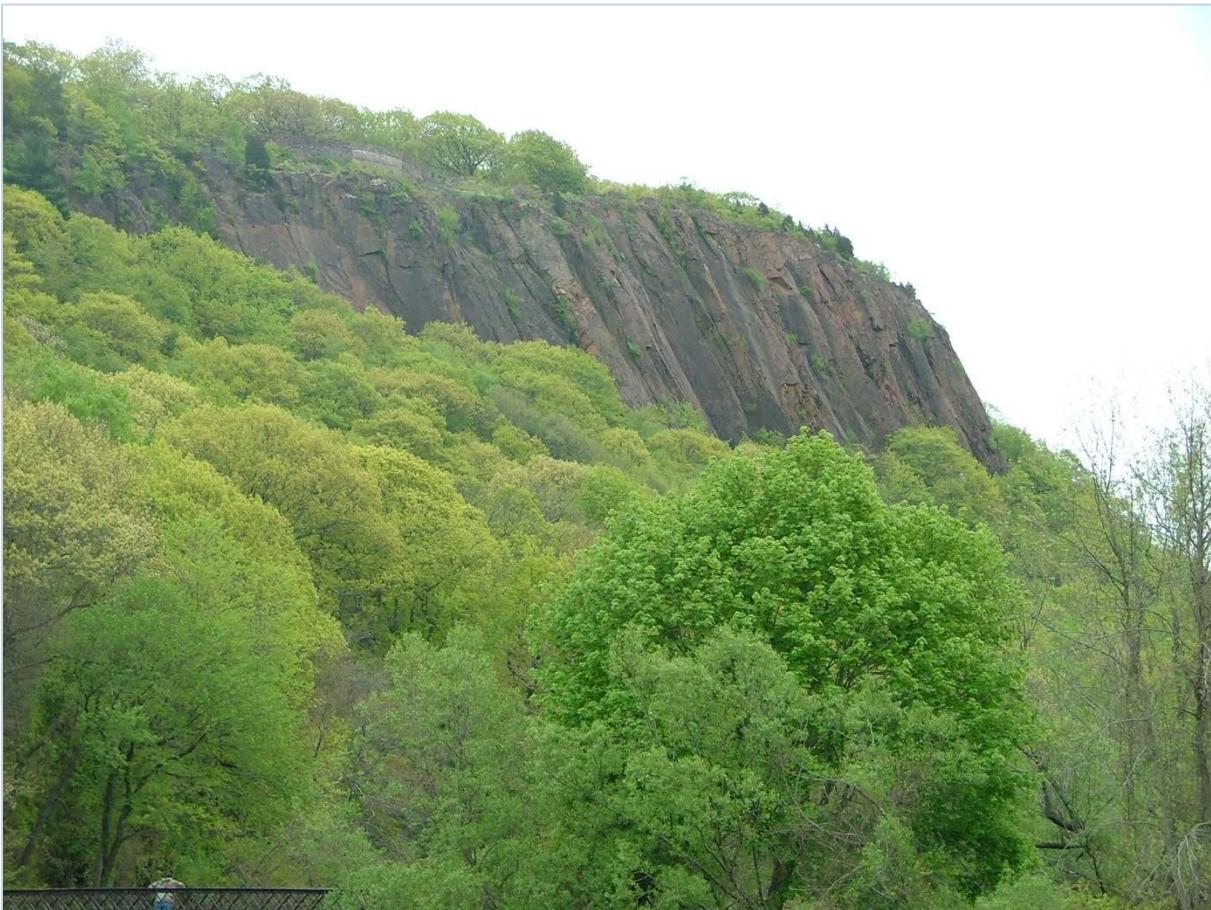




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**Important Bird Area Conservation & Management Plan
East Rock Park IBA**

(includes Edgerton Park and
South Central Regional Water Authority Lands)

Hamden & New Haven, Connecticut

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Executive Summary

The East Rock Park (ERP) Important Bird Area (IBA) encompasses approximately 426 acres and is comprised of East Rock Park, Edgerton Park, Eli Whitney Museum, and the adjacent South Central Regional Water Authority property in the East Rock and Whitneyville neighborhoods of New Haven and Hamden, CT. The Mill River and a large trap rock ridge bisect the central portion of the IBA in an approximate north to south orientation. East Rock Park, Edgerton Park, and the Eli Whitney Museum are listed on the National Register of Historic Places. This IBA was identified as such by AudubonCT in 2001 because it met the following Program Criteria: Presence of High Conservation Priority Bird Species; Unique or Representative Habitat; and Exceptional Concentrations of Migratory Landbirds. Spring migratory movements of songbirds through the IBA are renown. Despite the importance of the park for avifauna, the park is also valued by several stakeholders as a valuable recreational resource and destination.

There are a number of notable natural features within the IBA including the mature landscaping features of Edgerton Park, the tidal Mill River, the basalt ridgeline, and the varied habitats within the IBA. The forested habitat block within the IBA contains stands of deciduous, coniferous, and mixed forests, the composition of which changes with position along the toposequence. Inland vegetated wetlands occur in the IBA, as do watercourse and floodplain habitats and hillside seeps. Recreational fields within the IBA are surrounded by dense thickets of both native and non-native invasive plant species. Grassy fields, open summit woodlands and balsds within the IBA offer additional habitat diversity. Many of the native plants within these habitats provide valuable food, cover, or both to avifauna and other wildlife species. Still other attributes are sought by rare fauna, notably nesting Peregrine Falcons, and dozens of other species of conservation concern. The ERP IBA is also known for occasional vagrant bird species which attract throngs of birders from CT and beyond, adding to the value of the IBA as a tourist destination. A forest bird assessment, conducted independently and prior to the field observations made in support of the ERP IBA Conservation Plan, are incorporated by reference herein. The forest bird assessment identified breeding avifauna of conservation concern that prefer forest interiors, a unique habitat attribute given the urbanized landscape in which the IBA is located. Forest health within the IBA suffers from a loss of coniferous stand inclusions and little to no regeneration of understory and canopy trees.

Other conservation concerns and threats identified within the IBA include feral cats and dogs off-leash, illegal dumping or disposal of trash, various pathogenic diseases and pests to which our northeastern flora and fauna are exposed, competition with invasive plant species – many of which have significant coverages within the IBA and continue to spread rapidly, anthropogenic disturbance, and deer over-browse. Despite options to address or manage many of these threats, IBA land stewardship suffers from a lack of funding and staff to implement comprehensive land stewardship measures beyond general maintenance. However, the IBA is fortunate to have a lengthy list of stakeholders that can be engaged to support the park's department staff. Recommended conservation actions identified as necessary to protect the IBA's habitats and habitat attributes include invasive plant control, tree care and forest management measures, proper waste management, continued comprehensive stewardship/outreach efforts, and vegetation/habitat restoration/conservation measures within the IBA. Recommended priority actions for the protection of rare species, habitat matrices improvement, invasive plant and deer management measures, outreach and education measures, and habitat connectivity measures are provided herein as are measures to evaluate success.

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1.0 INTRODUCTION

The East Rock Park (ERP) Important Bird Area (IBA) encompasses approximately 426 acres and is comprised of East Rock Park, Edgerton Park, and the adjacent South Central Regional Water Authority property in the East Rock and Whitneyville neighborhoods of New Haven and Hamden, CT, respectively. This land mass straddles the border between New Haven's East Rock and Hamden's Whitneyville neighborhoods. The boundary of the IBA is depicted in **Figure 1-1 – Site Location**.

2.0 THE IMPORTANT BIRD AREA PROGRAM

Audubon's Important Bird Area Program began in 1995 and is a partnership between Audubon and BirdLife International. The program is part of a global effort to identify sites that are most important for maintaining populations of birds and to focus conservation efforts toward protecting these sites. Important Bird Areas are sites that provide essential habitat for one or more species of birds. IBAs may include public or private lands and may or may not include areas currently designated as protected land. To qualify as an IBA in Connecticut, sites must satisfy at least one of the following criteria:

- Sites important to endangered or threatened species
- Sites important to species of high conservation priority
- 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
- Sites where significant numbers of birds concentrate for breeding, during migration, or in winter, and
- Sites important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education.

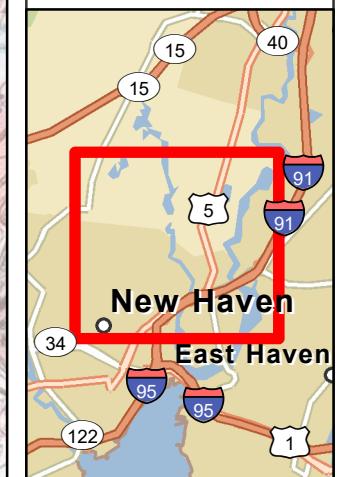
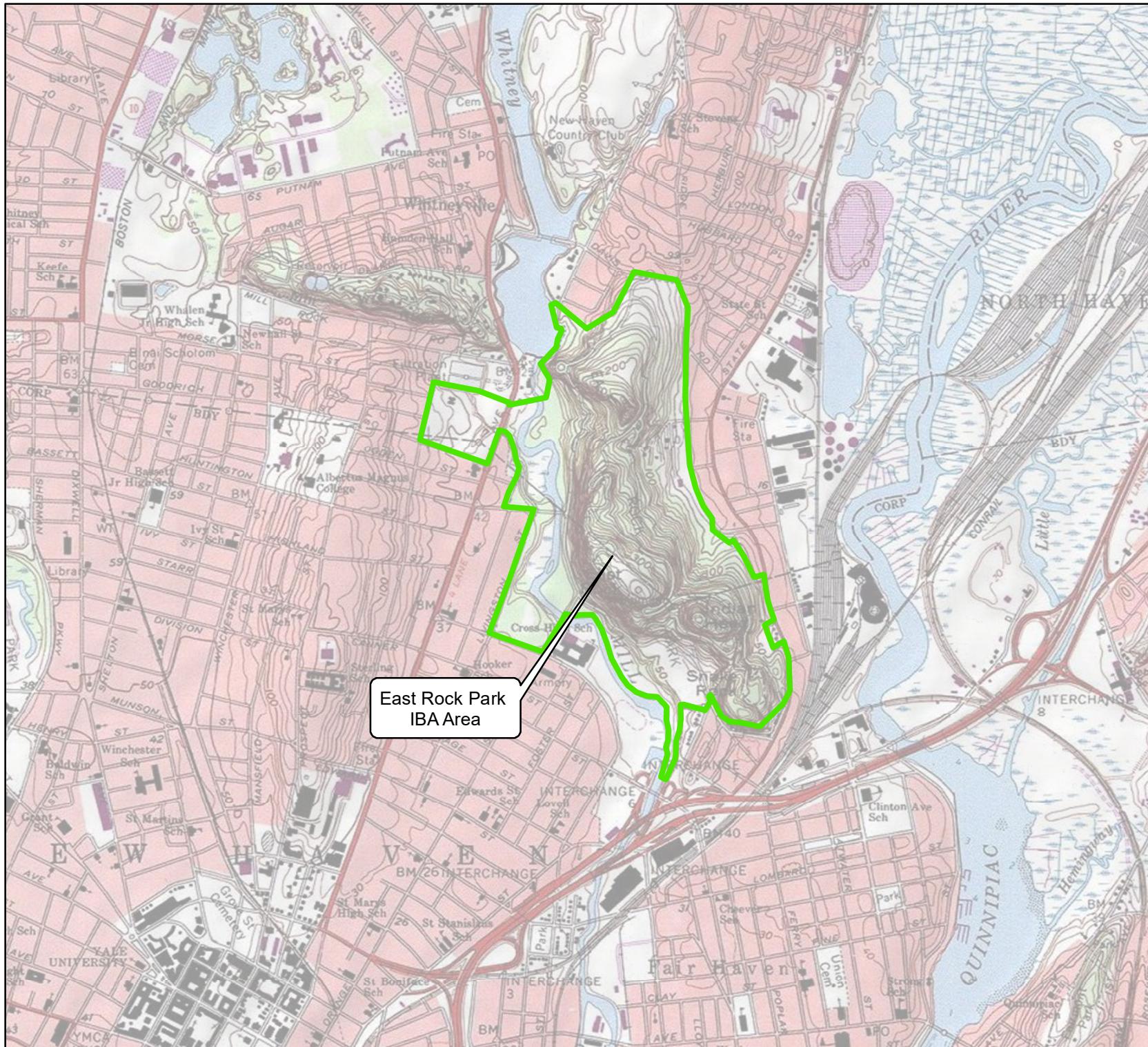
East Rock Park

Important Bird Area (IBA)
Overview Map
Hamden and New Haven
Connecticut

Figure 1

Legend

 East Rock Park Boundary IBA



USGS Quadrangle:
New Haven



0 250 500 1,000 1,500 2,000
Feet



3.0 SITE BACKGROUND

3.1 Geographic Location

The geographic centroid of the IBA is Located at 72° 55' W, 41° 20' N. The boundary of the IBA extends from State Street, Park Drive, and Ridge Road on the east to Whitney Avenue, Edgehill Road, Livingston Street, and Mitchell Drive on the west; and from Davis street in Hamden on the north to Willow Street and Rock Street on the south in New Haven. The Mill River bisects the site along the west side of the IBA, and a large trap rock ridge composed of East Rock, Indian Head, and Snake Rock bisects the central portion of the IBA. Both the river and the ridge traverse the site in an approximate north to south orientation.

3.2 History

The ERP IBA has a rich history of land uses and abuses, much like many parts of New England and the rest of the country. The presence of a mill stone artifact at the Eli Whitney Museum attests to the use of the Mill River as an energy source – much like most of Colonial America’s streams and rivers. The date of the first mill to operate in the IBA was c. 1640. Boats plied the waters of the Mill River by the late 1700s, likely flat-bottomed scows or skiffs to move products of trade. In 1804 a foundry was built on the Mill River constructed of traprock quarried from the East Rock Quarry. In 1816, 50,000 cubic feet of stone was removed from East Rock and sent by scow downriver to construct Trinity Church. The East Rock Quarry continued in operation until the construction of the dam at Whitneyville (W. Brown, personal communication).

Buildings were constructed in Whitneyville in the early 1800s beginning with the Connecticut Historic Trust Barn built in 1816 at the corner of Whitney Avenue and Armory Street, followed by a boarding house and cider press in 1822. Housing for married mill workers was built in 1822 along Armory Street. In 1860, a dam was constructed on the Mill River to produce power for Eli Whitney’s Armory (W. Brown, personal communication).

The growth of the city, spurred by the onset of the industrial revolution and the influx of immigrants, no doubt resulted in the generation of more refuse. As was common in many parts of the country, the refuse was often dumped at the outskirts of town in wetland areas, which were not arable and thus considered “wastelands”. In the case of New Haven, this included the extensive salt marshes along the Mill River. Indeed, the salt marshes extended far upriver reaching the base of East Rock. Eighteenth and nineteenth-century diary entries by Yale College students refer to hikes beginning at the college, traversing salt marshes at the base of East Rock, then ascending to the top (Kelley, 1974). Furthermore, paintings from 19th century artists such as John Maier’s *View of New Haven from Indian Rock* (1852), and Titus Darrow’s *Panorama of New Haven from East Rock* (1876) depict extensive marshlands along a widely meandering Mill River, looking south from the ridgeline to New Haven Harbor.

East Rock Park was designed by Donald Grant Mitchell and the Olmsted Brothers, while Edgerton Park was designed by Robert Storer Stephenson. East Rock was established as a City Park in 1888, Edgerton in 1965. Both parks are listed on the National Register of Historic Places, with Edgerton Park being added in

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1988 (#88001469) and East Rock Park being added in 1997 (#97000299). Both parks were recognized for the historical value of their architecture and landscape design¹.

3.3 Designation as an IBA

East Rock Park was identified as an IBA by AudubonCT in 2001 due to a number of criteria. These include the following:

- Presence of High Conservation Priority Species of Birds
- Unique, or Representative Habitat
- Exceptional Concentrations of Migratory Landbirds, and
- Use of the site for Long-term Research and/or Monitoring.

¹<http://www.nationalregisterofhistoricplaces.com/ct/new+haven/state2.html>



4.0 PROPERTY STAKEHOLDERS AND LAND USE REQUIREMENTS

4.1 Property Stakeholders

Both Parks are owned by the City of New Haven. Aside from the City of New Haven, the Friends of East Rock Park, Eli Whitney Museum, and the Regional Water Authority are major stakeholders in the park management. Friends of East Rock Park is a community-based volunteer support organization founded in 1982. Their mission is to enhance public use and awareness of the Park. This is done via sponsoring ranger programs and promoting community involvement. For instance, the Friends of East Rock Park raised the money for the equipment in the College Woods playground and they help the Park Staff via trail and river clean-ups and otherwise². The Regional Water Authority manages Lake Whitney, above the falls on the Mill River, and buildings on the property within the ERP IBA. The Edgerton Park Conservancy helps with preservation of the park natural and historical resources, facilities, and attributes, and works alongside the City of New Haven to help plan and coordinate musical and dramatic events, as well as several fairs.

Table 4-1 lists the organizations identified as active stakeholders in the IBA.

Table 4-1. Organizations Identified as Stakeholders of the ERP IBA	
Stake Holder	Role / Site Use
City of New Haven Department of Parks, Recreation and Trees	Site Management; Security; Education / Outreach
Eli Whitney Museum	Education/Outreach – Museum located within the IBA
Yale University	Urban Resources Initiative; recreational destination for students, faculty, and staff
Albertus Magnus College	Recreational destination for students, faculty, and staff
Friends of East Rock Park	Friends of East Rock Park – a community and environmental advocacy group that “ <i>encourages neighbors to meet each other, celebrate the environment and become stewards of the park</i> ”. It is composed of neighborhood residents and others with interest in East Rock Park
New Haven Bird Club	Birding destination for membership
Hamden Hall Country Day School	Living Classroom / Outdoor Laboratory
Wilbur Cross High School	Living Classroom / Outdoor Laboratory
Foote School	Living Classroom / Outdoor Laboratory
St. Rita's School	Edgerton Park if a Field Trip Destination (Crosby Conservatory and Carriage House)
St. Thomas School	Uses Edgerton Park for outdoor Gym Class sports and field day
CT Historic Preservation Trust	Headquarters located within the IBA

² <http://www.cityofnewhaven.com/parks/parksinformation/eastrockpark.asp#info>

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Crosby Conservancy	Group concerned with the management and preservation of park attributes, history, natural resources and facilities. Maintains the Greenhouse and Gardens at Edgerton Park
Regional Water Authority	City water supply (Lake Whitney) / Water Treatment Plant location and facilities within the IBA
Connecticut Department of Energy and Environmental Protection	Natural Diversity Database Inventory and Mapping
City of Hamden Police Department	Security
City of New Haven Police Department	Security

5.0 NATURAL RESOURCES

5.1 Physiographic Features

The stone massifs of East Rock Ridge, Indian Head, and Snake Rock are major topographic and physiographic features in the ERP IBA and are all distinct features of the same traprock ridgeline. The trap rock areas within the ERP IBA share the typical physical characteristics of other traprock ridges in the state. Typically, on the eastern side of the mountain, the system is characterized by a gradual to moderate sloping basalt massif overlain by shallow, warm, and relatively dry soil. Soils become shallower as one heads westward toward the summit of the massif. At the apex, the vegetation grows on shallow to bedrock droughty soils. Moisture deficits become a major stressor to vegetation in the summer as the basalt massif heats up in the afternoon sun, and precipitation events become less frequent (Lee, 1985).

In many of the ridges, the western facing slope is characterized by an abrupt cliff or steep slope that faces the afternoon sun to the west, and therefore heats up when exposed to the sun at the hottest times of the day. The deep talus slopes typically found at the foot of the western cliff faces act as reservoirs of cooler rock, groundwater, air, and even in some cases, prolonged ice from the previous winter and spring lasting longer into the spring seasons than surrounding areas. These reservoirs serve as sources of denser, cooler air that flows out from beneath the talus. The western slope is typically subjected to updrafts of warm air as prevailing westerly wind currents bisect the north-south trending ridges and is forced upward (Lee, 1985). The geologic and hydrologic features that influence the site's ecology are further discussed below:

5.1.1 Bedrock

East Rock was formed about 200 million years ago as the continents were in the process of moving away from each other. Molten rock from deep in the earth emerged through stress cracks formed in the sandstone bedrock of the New Haven area. The molten rock cooled to form dolerite, also known as basalt or traprock. As dolerite is much more resistant to erosion than the surrounding sandstone, glacial actions and the forces of weathering combined to erode away the softer sandstone, exposing the more erosion resistant basalt massif known as the East Rock Ridge and other traprock ridges in the area (de Boer and Wareham, 2013). The summit of East Rock Park now rises more than 350 feet above the floor of the Mill River valley at its base³

5.1.2 Soils

Ten major soil types are identified by the Natural Resource Conservation Service (NRCS) as occurring within the IBA. Distribution of these soil types across the IBA are depicted in **Figure 5-1**. A summary of the soil characteristics is provided in **Table 5-1**. This information is useful in determining where native plants or proposed supplemental plants are likely to grow best. For instance, those soils with an “excessively well-drained”, “somewhat excessively well-drained”, and “well-drained” drainage class will

³ <http://www.cityofnewhaven.com/parks/parksinformation/eastrockpark.asp#geology>



Figure 2
NRCS Soils Map



East Rock Park Important Bird Area (IBA) Conservation and Management Plan

Conservation Management Plan
Boundary

NRCS Soils Boundary



Table 5-1 NRCS-mapped Soil Series within the East Rock Park IBA

Soil Attribute	Series Name				
	Penwood	Manchester	Holyoke	Hollis	Branford
Drainage Class	Excessively well drained	Excessively well drained	Somewhat excessively – well drained	Somewhat excessively – well drained	Well drained
Depth of Deposit	Very deep	Very deep	Shallow	Shallow	Very deep
Formed in	Sandy outwash	Sandy and gravelly glacial outwash and stratified drift	Thin mantle of glacial till over bedrock.	Thin mantle of glacial till over bedrock	loamy over sandy and gravelly outwash
Slope	0-15%	0-45%	0-60%	0-60%	0-15%
Depth to Bedrock			25-50 cm	25-50 cm	
Acidity	v. strongly - strongly	v. strongly – mod. acid	Extremely to mod. acid	Extremely to mod. acid	Very strongly to moderately acid
Characteristic Vegetation	Red, White, Black, & Chestnut Oaks; White Pine, Pitch Pine, Gray Birch, Aspen, White Pine Pitch Pine, Poplar.	Red, White, Black, & Chestnut Oaks; Gray Birch, Hickories, Red Cedar, Hemlock, White Pine; Gray Black Birch.	Red, White, Black, & Chestnut Oaks; Hickories, White Pine, Eastern Hemlock, Gray Birch, Black Birch.	Red, White, Black, & Chestnut Oaks; Hickory, Gray Birch, White Pine, Eastern Hemlock and White Ash.	

Soil Attribute	Series Name				
	Cheshire	Wethersfield	Rippowam	Natchaug	Timakwa
Drainage Class	Well drained	Well drained	Poorly drained	Very poorly drained	Very poorly drained
Depth of Deposit	Very deep	Very deep	Very deep	Very deep	Very deep
Formed in	Supraglacial till	Dense basal till	Recent alluvium derived mostly from granite, gneiss, and schist	Woody and herbaceous organic materials.	Woody and herbaceous organic materials over sandy deposits
Slope	0 – 60 %	0 – 35 %	0 – 3 %	0 – 2 %	0 – 3 %
Depth to Bedrock	Commonly > 6 feet	Commonly > 6 feet	N/A	N/A	N/A
Acidity	Strongly Acid	Extremely to mod. acidic	very strongly acid to neutral with some subhorizon being moderately acid, slightly acid, or neutral within a depth of 40 inches	ultra-acid to slightly alkaline in the organic layer; strongly acid to moderately alkaline in the substratum	ultra-acid to moderately acid but the range includes slightly acid or neutral in some places; strongly acid to neutral in the substratum.
Characteristic Vegetation	Red, White, & Black Oaks; hickories, White Ash, Sugar Maple, Red Maple, Gray Birch, White Pine, Eastern Hemlock.	Red, White, and Black Oak, hickory, ash, Sugar Maple, Red Maple, American Beech, Gray Birch, White Pine, and Eastern Hemlock.	Red Maple, willows, and alders.	Red Maple, Skunk Cabbage, and Sphagnum Moss.	Red maple, Skunk Cabbage, and Sphagnum Moss.

support predominantly upland vegetation, while those with “poorly drained” and “very poorly drained” soils will support a predominance of wetland vegetation (hydrophytes). Excessively well drained soils are prone to drought conditions, therefore typically only drought resistant species persist. Steep sloped soils are more vulnerable to erosion than moderate to shallow sloped soils. Almost all of the soils in the IBA are acidic, meaning plants requiring neutral to basic soil pH will compete poorly with the native vegetation, if they survive at all. Other soils conditions to consider include the depth to bedrock and how the soil series formed. For instance, shallow to bedrock soils may be unstable for the growth of tall trees and subject plantings to drought conditions, whereas soils formed in dense basal till may be hard to dig in when adding supplemental plantings.

5.1.3 Hydrology / Hydrologic Features

The Mill River is the main hydrologic feature in the ERP IBA. This riverine watercourse originates approximately 14 miles north of the IBA in Cheshire, CT. It drains an area of approximately 16,286 acres in the southern coastal area of Connecticut. From its origin, the Mill River flows southerly to Lake Whitney, a reservoir owned by the Regional Water Authority which provides drinking water to the City of New Haven. The reach of the River as it flows through the ERP IBA in the area from the Whitney Dam to East Rock Road is mapped by the USFWS as a Riverine, Lower Perennial watercourse with an unconsolidated Bottom and Permanently flooded water regime (R1UBH). The Lower Perennial subsystem designation is used to describe low gradient watercourses with no tidal influence and consistent baseline flow. The Class designation of Unconsolidated Bottom refers to watercourses with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%. The reach of the river from East Rock Road south to the southern limit of the ERP IBA is mapped by the USFWS service as a Riverine Tidal watercourse with an unconsolidated Bottom and Permanently flooded- tidal water regime (RIUBV).

5.2 Biotic Features

Biotic resources refer to the flora and fauna of the ERP IBA. The total number of plant and animal species within the ERP IBA is currently unknown. Initial inventories are outdated, and the distribution and occurrence of some former species has changed. The following subsections identify characteristic flora and fauna of the ERP IBA. A comprehensive list of flora observed by the author during the preparation of this Management Plan is provided in **Appendix A**. Current locations of rare species as reported by the Connecticut Department of Energy and Environmental Protection Natural Diversity Database (CT NDDB) Program are included in the NDDB Consultation Package a copy of which is included as **Appendix B**.

5.2.1 Characteristic Flora of Wetland and Watercourse Habitats

The Mill River Riverine system is flanked by vegetated wetlands along its entire length as it bisects the ERP IBA. Extensive Palustrine Forested Wetlands occur on floodplain portions of the river that were spared the historic filling. These forests are composed of Sycamore (*Platanus occidentalis*), Red Maple (*Acer rubrum*), and Basswood (*Tilia americana*). Eastern Cottonwood (*Populus deltoides*) is also present.

Palustrine Scrub/Shrub Wetland occur as both discrete cover type units, and as interspersed cover types with palustrine emergent or palustrine forested areas. Characteristic species found in the Palustrine Scrub

Shrub areas include shrub willows (*Salix* spp.), Silky Dogwood (*Cornus amomum*), and Buttonbush (*Cephalanthus occidentalis*).

Areas of Palustrine Emergent Wetlands contain both non-persistent and persistent vegetation. Non-persistent emergent vegetation includes lily pads, etc., while the persistent vegetation noted consists predominantly of Common Reed (*Phragmites australis*), the latter forming large monoculture stands along the lower reaches of the tidally influenced river segment.

5.2.2 Characteristic Flora of Upland Habitats

Ridge Summit: Trees of the summit include Sassafras (*Sassafras albidum*), Chestnut Oak (*Quercus prinus*), Red Oak (*Quercus rubra*), Post Oak (*Quercus stellata*), Black Cherry (*Prunus serotina*), and Red Cedar (*Juniperus virginiana*). Among the herbaceous plants that grow along the shallow soils of the summit and in the crevices between exposed bedrock, one can find Early Saxifrage (*Micranthes virginiana*), Bastard Toadflax (*Comandra umbellata*), Wavy Hairgrass (*Deschampsia flexuosa*), and Wild Columbine (*Aquilegia canadensis*).

Midslope Elevations: The western slope of the site is dominated by a mixed-deciduous woodland characterized by medium to large - sized trees growing from a steep-sided shallow to bedrock slope, or exposed bedrock. The exposed bedrock is typically highly fractured. The deciduous community of the western slope is dominated by oak and hickory in well drained upper midslope areas, Sugar Maple (*Acer saccharum*), Black Birch (*Betula lenta*), and American Beech (*Fagus grandifolia*) in the lower midslope. White Oak (*Quercus alba*) is also present. Witch Hazel (*Hamamelis virginiana*) forms a sparse shrub layer on the upper portions of the midslope areas, while Spicebush (*Lindera benzoin*) is prevalent in lower layers. Poison Ivy (*Toxicodendron radicans*) is a representative liana species. Few herbaceous plants are present due to the closed canopy, but notable populations of spring ephemerals can be found in certain areas throughout the park with Dutchman's Breeches (*Dicentra cucullaria*), Trout Lily (*Erythronium americanum*), and Canada Mayflower (*Mianthemum canadense*) frequently encountered. The eastern slope is characterized by deeper, richer soils that support a northern hardwood forest of similar composition as described for the western slope. In between the peaks, cooler ravine areas are forested with Eastern Hemlocks (*Tsuga canadensis*).

Lowerslope Elevations: At the toe of slope lies the Mill River floodplain on the western side of the IBA, and the Quinnipiac River Valley on the eastern side. Lower slope elevations, especially on the western side along the Mill River are dominated by Red Maple, Basswood (*Tilia americana*), and Willow (*Salix nigra*) in the tree layer. The shrub layer is dominated by Silky Dogwood, and willows (*Salix* spp.). Highbush Blueberry (*Vaccinium corymbosum*) and Northern Arrowwood (*Viburnum recognitum*) are also present.

5.2.3 Characteristic Flora of Ruderal Habitats

Along the edges of the now and former access roads (e.g., Trowbridge Road and English Drive, etc.), and around areas cleared for recreation, the edge habitat is often dominated by invasive plant species. In the open park-like setting of the summit by the Soldier's Monument, much of the habitat has been changed or impacted and often includes plants characteristic of ruderal habitats (e.g., waste places). In these locations, the shrub layer is often dominated by Multiflora Rose (*Rosa multiflora*), Morrow's Honeysuckle (*Lonicera morrowii*) and Winged Euonymus (*Euonymus alatus*). A sapling layer is often present at the



ecotone of perimeter woodlands in these areas. Woody plants noted within the sapling layer include Tree of Heaven (*Ailanthus altissima*), Sassafras, and Black Birch. At the north and south ends of the summit the disturbed vegetation community grades back to deciduous woodland dominated by oaks. Here, Lowbush Blueberry (*Vaccinium angustifolium*) forms a distinct shrub layer. Throughout the park, edge habitats are typically infused with Asiatic Bittersweet (*Celastrus orbiculatus*) and Japanese Honeysuckle (*Lonicera japonica*).

5.2.4 Rare Flora and Other Plant Species of Conservation Concern

The Connecticut DEEP Natural Diversity Database Inventory (NDDB) report (Refer to **Appendix B**) revealed several rare plant species known to now or formerly occur in East Rock Park. The preferred habitat, bloom times, and wetland indicator status for these species was determined and is presented in **Table 5-2**. The current status of these plants is unknown as they do not appear in recent Connecticut Botanical Society reports from East Rock Park and Dr. Lauren Brown (personal communication), a Plant Conservation Volunteer, has had no luck finding some of the species during recent searches. An additional list of plants noted within the IBA that are identified in the Connecticut Wildlife Action Plan as plant species of Greatest Conservation Need is provided in **Table 5-3**. These are plants with exceptional value to various wildlife taxa and should be preserved when possible. Still other plants with high wildlife value recommended for preservation or supplemental plantings are provided in **Table 5-4**.

5.3.5 Fauna

Faunal diversity of the East Rock Park includes not only common generalist species that are well-adapted to urban life, but also (somewhat surprisingly) specialist species and species indicative of larger undeveloped habitat blocks which typically do not occur in densely populated urban and suburban areas. Characteristic and notable fauna of the ERP IBA are discussed below.

Lepidoptera: Dowhan and Craig (1976) note that the CT Traprock cliffs are well known for their concentrations of rare butterflies. Lee (1985) noted that the presence of rare butterflies at West Rock helped to decide on preservation and state ownership of the land during a 1979 heated political battle over future ownership and management. Among the rare butterflies noted at the time were the Falcate Orange-tip (*Anthocaris midea*), the Sleepy Duskywing (*Erynnis brizo*), and the Silvery Checkerspot (*Chlosyne nycteis*). The Falcate Orange-tip is now considered common in the state but locally confined to its specific habitat type (traprock ridges). The Sleepy Duskywing is listed as a threatened species in Connecticut, has disappeared from many parts of its former range, and now only occurs in a few scattered localities in Connecticut. The Silvery Checkerspot appears to have been extirpated from the state, as attempts to locate it during the Connecticut Butterfly Atlas Project (O'Donnell et al, 2007) failed to produce a single locality in the state, and subsequent field excursions to locations of former colonies failed to locate individuals.

Herpetofauna: Reptiles and amphibians known to occur in the park include Gray Tree Frogs, American Toad, Bullfrog, Green Frog, Pickerel Frog, and Wood Frog as representative amphibians, and Painted Turtle, Snapping Turtle, Garter Snake, Dekay's Brown Snake, and Eastern Black Rat Snake as representative reptiles. Red-eared Sliders, a non-native turtle species has also become established in the Mill River drainage. Northern Leopard Frog and Smooth Green Snake are two additional listed species

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Table 5-2. Rare Plants Now or Formerly Occurring at East Rock Park, their preferred habitat, bloom times, and wetland indicator status

TAXON	COMMON NAME	STATE/ FED. STATUS	HABITAT	BLOOM TIME	NWI INDICATOR STATUS
<i>Aristida longespica</i>	Needlegrass	SC/	moist or dry often sandy or sterile soil		FACU
<i>Asclepias viridiflora</i>	Green Milkweed	E/	dry, open, generally sandy soils & sand plains (Dowhan and Craig, 1976)	Jul-Aug	NI
<i>Carex viridula</i>	Little Green Sedge	E/	salt marshes, moist calcareous meadows & pond shores	Jun-Jul	OBL
<i>Crassula aquatica</i>	Pygmyweed	E/	tidal mudflats of estuaries near the limit of highwater (Dowhan and Craig, 1976)	Jul, Aug, Sep	OBL
<i>Cypripedium parviflorum</i>	Yellow Lady's-Slipper	SC/	calcareous bogs, mossy swamps and woods, wet shores, damp rocks (Fernald, 1950)	May - July	FAC
<i>Eriocaulon parkeri</i>	Parker's Pipewort	E	muddy tidal shores (Dowhan and Craig, 1976)	Jul, Aug, Sep	OBL
<i>Liatris novae-angliae</i>	Blazingstar	SC/	dry woods and openings (Fernald, 1950)	Aug, Sep	UPL
<i>Limosella australis</i>	Welsh Mudwort	SC/	tidal sand and mud (Magee and Ahles, 1991)	Jul - Sep	OBL
<i>Muhlenbergia capillaris</i>	Hairgrass	E/	rocky cliffs, especially dry, exposed trap-rock ledges	Sep	FACU
<i>Pedicularis lanceolata</i>	Swamp Lousewort	T	rich, often calcareous meadows and shores (Fernald, 1950)	Aug - Oct	FACW
<i>Phaseolus polystachios var polystachios</i>	Northern Wild Kidney Bean	SC*/	dry, rocky, wooded hillsides (Dowhan and Craig, 1976)	Aug	NI
<i>Silene stellata</i>	Starry Champion, Whorled Catchfly	SC/	woods and clearings (Fernald, 1950)	Jul - Sep	NI
<i>Sporobolus heterolepis</i>	Northern or Prairie Dropseed	E/	dry trap-rock ridges	Aug, Sep	FACU
<i>Verbena simplex</i>	Narrow-Leaved Vervain	SC*/	dry or sandy soil (Fernald, 1950)	May - Sep	NI

FAC=Facultative Plant

FACU= Facultative Upland Plant

FACW = Facultative Wetland Plant

NI=No Indicator Status

OBL=Obligate Wetland Plant

U=Upland Plant



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Table 5-3. Additional Plant Species of Conservation Concern Noted in the ERP IBA – (Species Identified as GCN Species in the State Wildlife Action Plan [CTDEEP, 2015])

Common Name (Scientific name)	Conservation / Indicator Status	Location(s) on Site	Notes
Black Oak (<i>Quercus velutina</i>)	GCN - Important	Driest parts of the forested upland	Acorns important wildlife source
Field Milkweed (<i>Asclepias syriaca</i>)	GCN - Important	Open field	Host plant for Monarch Butterfly
Highbush Blueberry (<i>Vaccinium corymbosum</i>)	GCN - Important	Wetland areas	Important pollinator, songbird, and wildlife food-producing plant
Lowbush Blueberry (<i>Vaccinium angustifolium</i>)	GCN - Important	Dry forest upland	Important pollinator, songbird, and wildlife food-producing plant
Pignut Hickory (<i>Carya ovata</i>)	GCN - Important	Upland Forest	Important wildlife food source
Red Cedar (<i>Juniperus virginiana</i>)	GCN - Important	Open fields, Ridgelines and Summits	Important songbird food and cover
Sugar Maple (<i>Acer saccharum</i>)	GCN - Important	Upland Forest midslopes	Important later winter, early spring food source for pollinators
Yarrow (<i>Achillea millefolium</i>)	GCN - Important	Fields	Important pollinator food source

Table 5-4. Other Plants with High Wildlife Value Recommended for Preservation or Supplemental Planting

Native Hard Mast-producing Woody Plants	Other oaks (Pin, Bear, Post, Chestnut, White); Other hickories (Shagbark Hickory, Mockernut Hickory); birches, alders, American Beech, Northern Bayberry
Native Soft Mast-producing Woody Plants	Flowering Dogwood, Hackberry, Tupelo, Black Cherry, Northern Spicebush, Elderberry, Silky Dogwood, Allegheny Blackberry, Black Raspberry, Sassafras, Northern Arrowwood, Maple-leaved Viburnum
Soft mast-producing Lianas	Poison Ivy, Virginia Creeper, Green Brier, Fox Grape, Riverbank Grape
Important Herbs	ragweed, Pokeweed,
Winter food	Fragrant Sumac, Staghorn Sumac, Round-headed Bush Clover, Winterberry
Important Pollinator Plants	Early Flowering Plants (e.g., Willow sp., Spring Ephemerals); Basswood, Buttonbush, Sweetpepperbush, goldenrods, boneset, jewelweed, Mountain Laurel, Cardinal Flower, Lupine, clovers, Blue Vervain.

<http://extension.psu.edu/natural-resources/wildlife/landscaping-for-wildlife/pa-wildlife-7>

formerly reported to have occurred at East Rock Park (CT DEEP NDDB, 2016) but their persistence in the ERP IBA is doubtful as much of the suitable habitat for these two species is gone. There are also historical reports of Box Turtle from the area (D. Quinn, personal communication).

Avifauna: The City of New Haven Department of Parks and Recreation has a *Checklist of the Birds of East Rock* that was composed and printed during Mayor John DeStefano's administration (1994-2014). It lists over 200 bird species identified in East Rock Park. The eBird Checklist for East Rock Park lists 209 species. A significant bird species known to breed within the IBA is the state-threatened Peregrine Falcon (*Falco peregrinus*) (**Figure 5-2**). Stephen Broker of the Connecticut Ornithological Association provided the following information regarding the status of this rare falcon in the IBA in recent years:

- One bird present at ERP from 2009-2010 hatched in 2005. It was also banded in the nest in its rooftop nest box in Margate, NJ in 2005 by Kathy Clark.
- Another bird present at ERP in 2012, hatched in 2008. It was banded in the nest on 3 July 2008 by Kathy Clark of New Jersey Department of Environmental Protection in Margate, NJ in a salt marsh south of Atlantic City, NJ.
- Yet another bird present at ERP from 2012-2015 was a bird that hatched in 2004. It was banded in the nest on 20 May 2004 by Michael Amaral (regional director, USFWS) on the Fleet Bank Building in Providence, Rhode Island.
- While no specific information on egg-laying or hatching/fledging young since 2015 was obtained, reports of a territorial pairs observed on the cliff face were noted from 2015 through 2018 (Stephen Broker, personal communication). Therefore, it is apparent that Peregrine Falcons have been present at East Rock on a continuing basis.

Various other species identified as Greatest Conservation Need species in Connecticut's Wildlife Action plan occur as breeding residents in the ERP IBA. Notable among these species are a variety of Neotropical migrant songbirds. A Breeding Forest Bird Inventory conducted by AudubonCT and their consultant in conjunction with the CT Agricultural Experiment Station identified the following Neotropical migrant songbird species of high state or regional conservation priority within the ERP IBA during the breeding season: Eastern Wood-Pewee, Great Crested Flycatcher, Eastern Kingbird, Wood Thrush, Brown Thrasher, Prairie Warbler, Black-and-white Warbler, Worm-eating Warbler, Louisiana Waterthrush, Scarlet Tanager, Rose-breasted Grosbeak, Eastern Towhee, and Baltimore Oriole. The ERP IBA is also known for occasional rarities which attracts throngs of birders from CT and beyond. Examples of birds whose breeding ranges do not normally include New England that have been recorded in East Rock Park adding to its legacy as one of the top 25 birding sites in CT (Proctor, 1978) include the following: Chuck-will's Widow, Hermit Warbler, Yellow-throated Warbler, Summer Tanager, and Blue Grosbeak. Avifauna and other vertebrates of Greatest Conservation Need are listed below in **Table 5-5**.

Mammals: Among the most visible non-avian wildlife in the park are mammals such as White-tailed Deer, Eastern Cottontail Rabbit, rodents (squirrels, beavers, rats, and mice). Mole tunnels were typically noted in the moist river floodplain soil, and tracks through tall grass indicate the likely presence of Short-tailed Shrew or Meadow Vole. A nocturnal component consists of raccoon, opossums, bats, skunks, and perhaps weasels. Red Fox was confirmed by the discovery of a recent road kill along the Black Trail adjacent to Whitney Avenue (Spring, 2017). Recent additions to the mammalian biodiversity include Coyote and Fisher, the latter seen by many observers in the spring of 2016. River Otters, weasels, and Mink may make their way down the Mill River valley as well and therefore are expected to occur in the park from time to time.



Figure 5-2. An East Rock Peregrine Falcon

(Photo Credit: Stephen Broker, Connecticut Ornithological Association)

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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME <i>(Scientific Name)</i>	CT STATUS	REQUISITE HABITAT	NOTES
Herpetofauna			
Box Turtle <i>(Terrapene carolina)</i>	GCN – Important CT Special Concern	Forest/Field transition zones, forested wetlands	Historical records from East Rock Park (D. Quinn, personal communication)
Wood Frog <i>(Lithobates sylvaticus)</i>	GCN - Important	PFO Wetlands	Requires seasonal (e.g., “vernal”) pools with no fish population
Gray Tree Frog <i>(Hyla versicolor)</i>	GCN - Important	PFO Wetlands	
Avifauna*			
Alder Flycatcher <i>(Empidonax alnorum)</i>	GCN – Important CT Special Concern	Dense shrub wetlands	Migrant
American Bittern <i>(Botaurus lentiginosus)</i>	GCN – Most Important; CT Endangered	Mill River wetlands	Rare migrant
American Kestrel <i>(Falco sparverius)</i>	GCN – Most Important; CT Special Concern	Open fields of the IBA such as Rice Fields, RWA property	Rare migrant
American Oystercatcher <i>(Haematopus palliatus)</i>	GCN – Very Important CT Threatened Federal BCC species (sp.)	Potentially Mill River wetlands	Appears on the Checklist of Birds for East Rock but IBA does not provide favorable habitat
American Redstart <i>(Setophaga ruticilla)</i>	Forest interior indicator sp.	Floodplain/Riparian Forest	Breeding resident
American Woodcock <i>(Scolopax minor)</i>	GCN – Most Important	Moist woodland with thick organic soils and dense shrub layer bordering open fields	Migrant; potential breeding resident
Baltimore Oriole <i>(Icterus galbula)</i>	GCN – Important	Within or proximal to Floodplain/Riparian Forest	Appears on the Checklist of Birds for East Rock
Black-billed Cuckoo <i>(Coccyzus erythrophthalmus)</i>	GCN – Very Important	Forest edges with multiple vegetation layers	Breeding resident

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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME <i>(Scientific Name)</i>	CT STATUS	REQUISITE HABITAT	NOTES
Blackburnian Warbler <i>(Setophaga fusca)</i>	GCN – Important	Tall mature oaks	Migrant
Black and White Warbler <i>(Mniotilla varia)</i>	GCN – Important; Forest interior indicator sp.	Mature deciduous upland forests	Breeding resident
Black-throated Blue Warbler <i>(Setophaga caerulescens)</i>	GCN – Very Important	Mature forest with Mountain Laurel understory	Formerly nested
Blue-gray Gnatcatcher <i>(Polioptila caerulea)</i>	Forest interior-edge indicator sp.	Mature deciduous upland forests	Breeding resident
Blue-winged Warbler <i>(Vermivora cyanoptera)</i>	Federal BCC Species	Shrublands and Shrubby ecotones	Breeding resident
Broad-winged Hawk <i>(Buteo platypterus)</i>	GCN – Very Important CT Special Concern	Forest Interiors	Likely to be seen from atop East Rock in fairly large numbers on days of favorable conditions during Autumn migration
Brown Creeper <i>(Certhia americana)</i>	GCN – Important	Mature hemlock - dominated forest interior	Uncommon migrant
Brown Thrasher <i>(Toxostoma rufum)</i>	GCN – Very Important CT Special Concern	Dense dry thickets and shrubland such as along the toe of the rock face and edge of Rice Field	Former? Breeding resident?
Canada Warbler <i>(Cardellina canadensis)</i>	GCN – Very Important	Palustrine Forested Wetland adjacent to the Mill River	Migrant
Cerulean Warbler <i>(Setophaga cerulea)</i>	GCN – Very Important Federal BCC Sp.	Migrant through deciduous forests and woodlands	Rare migrant
Chestnut-sided Warbler <i>(Setophaga pensylvanica)</i>	GCN – Very Important	Early successional forest and shrubland	Migrant; Potential breeding resident?
Chimney Swift <i>(Chaetura pelasgica)</i>	GCN – Very Important	Mill River riparian corridor	Often observed foraging over Mill River, or above tree tops as seen from atop East Rock



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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME <i>(Scientific Name)</i>	CT STATUS	REQUISITE HABITAT	NOTES
Common Loon <i>(Gavia immer)</i>	GCN – Important Federal BCC Sp.	Lake Whitney	Migrant sp.
Common Nighthawk <i>(Chordeiles minor)</i>	GCN – Very Important CT – Endangered	Open airspace above the IBA	Large flights often viewed at dusk from top of East Rock
Common Tern <i>(Sterna hirundo)</i>	GCN – Important CT Special Concern	Mill River	Breeds in Long Island Sound. May forage along lower reaches of the Mill River from time to time
Eastern Kingbird <i>(Tyrannus tyrannus)</i>	GCN – Important	Floodplain/Riparian Forest	Breeding resident
Eastern Screech Owl <i>(Megascops asio)</i>	Predator	Floodplain/Riparian Forest	Found within knot holes of mature deciduous trees along the Mill River
Eastern Towhee <i>(Pipilo erythrrophthalmus)</i>	GCN – Very Important; Forest interior-edge indicator sp.	Woodland areas with dense understory	Breeding resident
Eastern Whip-poor-will <i>(Caprimulgus vociferous)</i>	GCN – Most Important CT Special Concern	Open woodland with dense understory along ridgeline summit	Migrant
Eastern Wood Pewee <i>(Contopus virens)</i>	GCN – Important; Forest interior indicator sp.	Interior forest gaps and woodlands	Often uses exposed perches to sing and visually search for insect prey
Gray Catbird <i>(Dumetella carolinensis)</i>	Forest Interior-edge sp.	Throughout the park in areas of dense shrub coverage	One of the more common breeding summer resident birds in the park
Great Egret <i>(Ardea alba)</i>	GCN – Very Important CT Threatened	Mill River Wetlands, Lake Whitney Dam	Breeds on offshore islands, uses Mill River to forage and Lake Whitney for fresh water
Great-crested Flycatcher <i>(Myiarchus crinitus)</i>	Forest interior- edge indicator sp.	Interior forest gaps and woodlands	Breeding resident
Hairy Woodpecker <i>(Picoides villosus)</i>	Forest Interior indicator sp.	Mature forests	Breeding resident



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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME <i>(Scientific Name)</i>	CT STATUS	REQUISITE HABITAT	NOTES
Hooded Warbler <i>(Setophaga citrina)</i>	Forest interior indicator sp.	Often encountered along the northern end of Trowbridge Drive	Migrant
Horned Lark <i>(Eremophila alpestris)</i>	GCN – Most Important CT Endangered	Rice field, RWA fields	Status in IBA uncertain
Indigo Bunting <i>(Passerina cyanea)</i>	GCN – Very Important	Forest/Field edges	Breeding resident
Kentucky Warbler <i>(Geothlypis formosa)</i>	Federal BCC Sp.	Mesic forest areas	Formerly a regular spring visitor to East Rock Park
Least Tern <i>(Sternula antillarum)</i>	GCN – Most Important CT Threatened Federal BCC Species	Mill River	Occasionally wanders up coastal river drainages
Little Blue Heron <i>(Egretta caerulea)</i>	GCN – Important CT Special Concern	Mill River emergent wetlands	Rare migrant
Louisiana Waterthrush <i>(Parkesia motacilla)</i>	Forest interior indicator sp.	Mill River riparian forest	Migrant
Marsh Wren <i>(Cistothorus palustris)</i>	GCN – Very Important	Mill River emergent wetlands	Uncommon migrant
Northern Flicker <i>(Colaptes auratus)</i>	GCN – Very Important	Open woodlands and lawn, Rice Athletic Fields	Breeding Resident
Northern Harrier <i>(Circus cyanea)</i>	GCN – Most Important CT Endangered	Mill River Emergent Wetlands	Uncommon migrant
Northern Parula <i>(Setophaga americana)</i>	GCN – Important CT Special Concern	Mill River Riparian Woodlands and Forest	Migrant
Northern Waterthrush <i>(Parkesia noveboracensis)</i>	GCN – Important	Mill River Scrub/shrub Swamps	Migrant
Osprey <i>(Pandion haliaetus)</i>	GCN – Important	Mill River and Lake Whitney Open Water areas	Summer Resident breeds proximal if not within the IBA

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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME <i>(Scientific Name)</i>	CT STATUS	REQUISITE HABITAT	NOTES
Ovenbird <i>(Seiurus aurocapilla)</i>	GCN – Important; Forest interior indicator sp.	Mature deciduous forests	Breeding Resident
Peregrine Falcon <i>(Falco peregrinus)</i>	GCN – Important Federal BCC Species CT Threatened	East Rock Cliff face	Breeding Resident
Pied-billed Grebe <i>(Podilymbus podiceps)</i>	GCN – Most Important CT Endangered	Mill River, Lake Whitney	Migrant
Pileated Woodpecker <i>(Dryocopus pileatus)</i>	Forest interior indicator sp.	Mature forest areas	Requires large diameter trees with a DBH > 18"
Piping Plover <i>(Charadrius melanotos)</i>	GCN – Most Important	Barrier beaches and sand flats	Appears on the Checklist of Birds for East Rock but IBA does not provide favorable habitat
Prairie Warbler <i>(Setophaga discolor)</i>	GCN – Most Important; Federal BCC	Open woodlands of the ridge line summit and west faces	May be a breeding resident at the summit of East Rock
Purple Martin <i>(Progne subis)</i>	GCN – Important	Open fields adjacent to waterbodies	Rare migrant
Red-eyed Vireo <i>(Vireo olivaceous)</i>	Forest interior - edge indicator sp.	Throughout the forested interior areas of the IBA	Common Breeding Resident
Red-shouldered Hawk <i>(Buteo lineatus)</i>	Predatory Raptor	Forest Interior	Potential Breeding Resident
Rose-breasted Grosbeak <i>(Pheucticus ludovicianus)</i>	GCN – Important; Forest interior-edge indicator sp.	Forested areas with dense sub-canopy	Breeding Resident
Ruby-throated Hummingbird <i>(Archilochus colubris)</i>	Feeding guild specialist	Often spotted along the Mill River vegetated wetlands	Breeding Resident
Ruddy Turnstone <i>(Arenaria interpres)</i>	GCN – Important;	? – hypothetical visitor to open fields during a shorebird migration fallout	Appears on the Checklist of Birds for East Rock but IBA does not provide favorable habitat

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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME <i>(Scientific Name)</i>	CT STATUS	REQUISITE HABITAT	NOTES
Ruffed Grouse <i>(Bonasa umbellus)</i>	GCN – Very Important; Forest interior-edge indicator sp.	Likely extirpated from the IBA	Historically recorded at East Rock Park but now likely extirpated from the IBA
Sanderling <i>(Calidris alba)</i>	GCN – Very Important	? – hypothetical visitor to open fields during a shorebird migration fallout	Appears on the Checklist of Birds for East Rock but IBA does not provide favorable habitat
Scarlet Tanager <i>(Piranga olivaeous)</i>	GCN – Very Important; Forest interior indicator sp.	Mature deciduous forest areas	Interior forest with mature deciduous or mixed forest cover
Semipalmated Sandpiper <i>(Calidris semipalmatus)</i>	GCN – Very Important; Federal BCC Species	? – hypothetical visitor to open fields during a shorebird migration fallout	Appears on the Checklist of Birds for East Rock but IBA does not provide favorable habitat
Sharp-shinned Hawk <i>(Accipiter striatus)</i>	GCN – Most Important CT Endangered	Forest margins and open woodlands	Migrant
Snowy Egret <i>(Egretta thula)</i>	GCN – Most Important CT Threatened Federal BCC Sp.	Mill River Wetlands	Summer resident (breeds off-shore)
Veery <i>(Catharus fuscescens)</i>	GCN – Important; Forest interior indicator sp.	Lowland and Riparian mature forested areas	Breeding Resident
White-eyed Vireo <i>(Vireo griseus)</i>	GCN – Important	Dense shrub thickets such as along the border of Rice Field	Breeding Resident
Willow Flycatcher <i>(Empidonax traillii)</i>	GCN – Important	Dense scrub/shrub wetland areas and margins	Migrant
Wood Thrush <i>(Hylocichla mustelina)</i>	GCN – Most Important; Forest interior indicator sp. Federal BCC Sp.	Mature deciduous forests with subcanopy	Breeding Resident
Worm-eating Warbler <i>(Helmitheros vermivorum)</i>	GCN – Very Important; Forest interior indicator sp.	Forested hillsides of East Rock, Indian Head, and Snake Rock	Breeding Resident

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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME <i>(Scientific Name)</i>	CT STATUS	REQUISITE HABITAT	NOTES
Yellow-billed Cuckoo <i>(Coccyzus americanus)</i>	GCN – Very Important; Forest interior-edge indicator sp.	Forest/Field Edge; Mill River Riparian Corridor	Requires low dense, shrubby vegetation. Principal predator of Eastern Tent Caterpillars and Gypsy Moth Caterpillars
Yellow-breasted Chat <i>(Icteria virens)</i>	CT Endangered	Dense thickets and shrubland areas	Rare migrant
Yellow-crowned Night Heron <i>(Nyctanassa violacea)</i>	GCN – Important CT Special Concern	Mill River Wetlands	Rare summer visitor
Yellow-throated Vireo <i>(Vireo flavifrons)</i>	Forest interior – edge indicator sp.	Mature deciduous forests areas along Farnum Drive, Trowbridge Drive, and upper English Drive	Regular migrant; potential breeding resident

*Refer to Appendix A for assessment of breeding birds conducted by AudubonCT, Ferrucci and Walicki, LLC, and the CT Agricultural Experiment Station

Mammals

Red Bat <i>(Lasiurus borealis)</i>	GCN – Most Important	Mill River riparian corridor	Confirmed migrant – breeding status unknown
Fisher <i>(Martes pennanti)</i>	Top Predator	Mature forest	Important top carnivore for natural control of metafauna; visual confirmation (m. ob.) in ERP in 2016 – breeding status unknown
Coyote <i>(Canis latrans)</i>	Top Predator	Uses multiple habitats	Important top carnivore that offers potential for natural deer control – breeding status unknown

Other GCN spp.

Bluefish <i>(Pomatomus saltatrix)</i>	Opportunistic Predator; Federally-managed Marine Species	Mill River up to Tide Gates	Important Recreational species caught by anglers fishing from atop the tide gates
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Table 5-5. Notable Indicator Fauna Species and Species of Conservation Concern Reported within the ERP IBA

SPECIES NAME (<i>Scientific Name</i>)	CT STATUS	REQUISITE HABITAT	NOTES
American Eel (<i>Anguilla rostrata</i>)	GCN – Most Important; Federally-managed Marine Species	Mill River	Found in Mill River up to dam at Lake Whitney
Blue Crab (<i>Callinectes sapidus</i>)	GCN – Very Important	Mill River	Occurs in summer in Mill River up to the fall line

GCN = Greatest Conservation Need
BCC = USFWS Bird of Conservation Concern
Sp. = Species (singular)
Spp. = Species (plural)

6.0 Conservation Concerns and Threats

A number of conservation concerns and threats were identified during the preparation of the Conservation and Management Plan. Many of these threats were identified via visual observations made by the author and via discussions with stakeholders. Some historical threats to the park are no longer of any real concern (such as the plans to construct an extension of I-91 through East Rock Park in the 1970s which were successfully opposed and stopped by residents on both sides of Whitney Avenue) (Hall, 2002). Other threats and conservation concerns are chronic and will always be a component of any successful park management planning.

6.1 Feral Cats and Off-leash Dogs

Feral cats were not frequently encountered in the interior of the ERP IBA, but since much of the ERP IBA is surrounded by urban residential property, they are expected to occur. Local residents should be educated of the following truthful facts about cats and wildlife:

- Cats with bells on their collars still capture and kill wild birds and animals
- Even well-fed cats kill wildlife
- Wildlife injured by cats rarely survive, even if they escape, and
- Outdoor cats are at risk of exposure to many hazards including disease, parasites, predators, and vehicles (www.njaudubon.org).

Outdoor cats should at least be spayed or neutered. Cats kill 2.4 billion birds/year and 12.3 billion small mammals/year. They can have significant impact to ground-nesting or low to ground-nesting birds and small mammals.

Dogs are a threat to biodiversity as well, especially to ground nesting birds. Dogs should be kept on leashes, under the control of their owners, and on trails, at all times throughout the ERP IBA. Off-leash dogs risk impact to the biodiversity of the ERP IBA in one more of the following ways:

- They may spread invasive species propagules deeper into native vegetation associations
- They may seek out and find and kill ground nesting birds, and waterfowl young and their eggs
- They pose a predatory threat to young wildlife that may not have



Figure 6-1. Off-leash dogs pose a threat to ground-nesting birds and their young.

the ability to escape predation including species of conservation concern detected in the IBA such as juvenile Box Turtles (Dodd, Jr., 2001)

- They may impact sensitive seasonal pool communities
- They may trample and destroy rare plants
- They may foul high surface water quality watercourses, and
- They may harass large mammals posing a threat of injury to those species and to themselves.

In addition, dog owners allowing their dogs to roam off-leash risk injury to their dogs from:

- Disease-carrying and sickly organisms
- Territorial animals, and
- Conflicts with other off-leash dogs.

For a discussion regarding unleashed dogs harassing wildlife in rural environments, see Lowry and McArthur (1978) and Hammerson (2004). It is understood this constraint may be unpopular with dog-owners, but the disparity in the behavior exhibited among breeds and individual dogs warrants regulation of ALL dogs regardless of their breed and level of training, especially in a multi-use park, and one with multiple sensitive environmental receptors.

6.2 Illegal dumping / disposal of trash/Pollution

Illegal dumping is a chronic problem in the park and park personnel struggle to keep up with the removal of large items such as tires, mattresses, roofing shingles, full garbage bags of trash, etc. Refuse is often thrown from vehicles along the auto roads or left behind at picnicking areas, viewing areas, and recreation fields.

Scavenging animals often pull garbage out of receptacles and disperse articles that were properly disposed of to begin with. The presence of garbage attracts opportunistic predators that also prey on nesting birds or their eggs, so it is important to remove food scraps and garbage from picnicking areas promptly. As discussed in Section 6.3.1, bulky waste can also harbor breeding populations of mosquitoes, which may proliferate disease.

Discarded monofilament line is often found along the trails by the park rangers. The monofilament line poses a threat to nesting birds that may attempt to use it as nesting material and become entangled.

Stormwater that collects on impermeable surfaces within and surrounding the IBA often finds its way into the Mill River. When stormwater that collects on impermeable surfaces flows to catch basins, the catch basins often directly discharge to the Mill River via outfall culverts, offering little potential for pollutant renovation. Common pollutants in stormwater often include fecal coliform bacteria, petroleum products, heavy metals, antifreeze and other automotive fluids, surfactants, and sediment. These chemicals have varying degrees of toxicity to aquatic life and degrade the habitat quality of wetland-dependent species including waterfowl, shorebirds, long-legged waders, and other species.

6.3 Disease and Pests

Disease and pest concerns include those potentially impacting floral and faunal species and those that may affect humans while visiting the ERP IBA.

6.3.1 Mosquito-borne Illness

West Nile Virus (WNV), spread by mosquito vectors is of paramount concern in recent years, as it can have acute (lethal) effects on various bird taxa. Since mosquitoes are the vectors of human parasites, they are of management concern. Larval and pupae mosquitoes may occur in seasonal or temporary pools within the ERP IBA and surrounding areas. Larval and pupae mosquitoes are also often found in bulky waste, where items such as tires and plastic containers hold rain water where breeding can occur. Since 1999, the Connecticut Agricultural Experiment Station has established permanent mosquito monitoring stations within various communities to monitor for WNV and Eastern Equine Encephalitis (EEE), among other arboviruses, from June to October. Mosquitoes are collected from traps set at these monitoring stations, identified to species level, and then sent to a virology laboratory to test for WNV. This network of monitoring stations includes one in New Haven, where a trap station (NH54) is operated at Beaver Pond Park, and another in Hamden (H50) at Lake Wintergreen. Results of monitoring are available through the Connecticut Agricultural Experiment Station. As of August, 2017, 1,207 mosquitoes were collected from the New Haven trap and 479 from the Hamden trap and none were found to be positive for carrying WNV, EEE, or Jamestown Canyon Virus (JCV), despite there being positive detections in West Haven (WNV), North Haven (JCV), and East Haven (JCV).

6.3.2 Tick-borne Illness

Ticks are also vectors of parasites that cause disease in humans such as Rocky Mountain spotted fever, rickettsiae, monocytic and granulocytic ehrlichiosis, babesiosis, Lyme disease, anaplasmosis and approximately six other diseases for which pathogens or other causative agents have been identified including, most recently, Powassan. Tick associations with other pathogens are not yet clearly understood or defined. The most common carriers of tick-borne diseases in the northeast are the Black-legged Ticks (*Ixodes scapularis* and *I. pacificus*) two species responsible for transmission of Lyme disease, granulocystic ehrlichiosis, and babesiosis (Stafford, 2004). However, other species of ticks may also act as vectors. The White-footed Mouse (*Peromyscus leucopus*) and White-tailed Deer (*Odocoileus virginianus*) are considered major reservoir hosts for Lyme disease. Visitors to the ERP IBA should be warned via signage of the potential for ticks in the woodland, grassland, shrubland, and other heavily vegetated areas of the ERP IBA. Signs posting the warning of tick borne illness may also help to deter people from entering closed areas where they might otherwise trample rare vegetation, initiate soil erosion, disrupt nesting birds, etc.

6.3.3 Rabies

The occurrence of rabies in wildlife, especially raccoons and foxes, is a potential management concern. The public should be informed that any wild animals encountered within the ERP IBA should not be fed, touched, or harassed. Animals acting strangely should be reported to park ranger station or the CTDEEP Wildlife Division at (860) 424-3011.

6.3.4 Forest Tree Diseases

There are a number of diseases currently plaguing, or threatening to plague, the health and composition of our forests in the Northeast. The cause of these diseases can be classified into four major groups: abiotic stressors, air pollutants, pathogens, and forest insect pests. Abiotic stressors include temperature and moisture injury, winter injury, frost, high temperatures, drought, and excessive water (prolonged inundation). These stressors, if initiated by natural processes, are an integral part of forest ecology and thus management to control or mitigate their effects is rarely warranted. Air pollutants known to impact tree health include ozone, sulfur dioxide, and

hydrogen fluoride. Many of the significant impacts to forest tree health due to air pollution have been mitigated by State implementation plans to meet National Ambient Air Quality Standards. Thus, site-specific actions are not warranted unless a discrete point source that can be definitively identified as the cause of negative impact can be identified within or proximal to a natural area. Suspected point sources in, adjacent, or proximal to the ERP IBA have not been identified as part of this report.

However, tree diseases caused by tree pathogens and forest tree insects are a major cause of concern for protecting tree health within the ERP IBA. Tree pathogens can be further categorized into diseases of hardwoods versus diseases of conifers. Hardwood diseases include dieback and decline syndromes (e.g., Sapstreak Disease of Sugar Maple, Beech Bark Disease, Oak Decline), wilt diseases (e.g., Oak Wilt), leaf diseases (e.g., Anthracnose, leaf blisters, leaf rusts, powdery mildews, *Phyllosticta* Leaf Spot, Tobacco Ringspot Virus of Ash, Ash Yellows, etc.), and root diseases (e.g., *Armillaria* Root-rot). Conifer diseases include various needle afflictions (rusts, blights, needlecasts, etc.) and twig/stem diseases (e.g., White Pine Blister Rust, Pine – Oak Rust, etc.) (Skelly et al., 1987). Pathogens may be either host-specific or inter-specific.

Like the pathogens, forest tree insect pests are also divided broadly into two main categories: those that afflict hardwoods and those that afflict conifers. Hardwood insect pests include leaf-eating insects such as Gypsy Moth (*Lymantria dispar*), Oak Leafroller (*Archips semiferanus*), Forest Tent Caterpillar (*Malacosoma disstria*), etc.; sucking insects such as Pear Thrip (*Taeniothrips inconsequens*) and Periodical Cicada (*Magicicada* sp.), and meristematic insects such as the invasive Asian Long-horned Beetle (*Anoplophora glabripennis*) and the invasive Emerald Ash Borer (*Agrilus planipennis*), the latter of which has recently been documented in Connecticut and has major potential to afflict wide-scale damage to many of our dominant and economically viable eastern forest trees. Conifer insect pests include defoliators such as Hemlock Loopers (*Lambdina fiscellaria*) and the introduced pine sawflies (*Neodiprion* spp.), sucking insects such as various aphids, adelgids, spider mites, thrips, etc., and meristematic insects such as various pine and spruce weevils and beetles. The Eastern Hemlock Woolly Adelgid (*Adelges tsugae*) is a significant pest inflicting hemlock in Southern New England. It has caused wide-scale mortality of hemlock stands in parts of Connecticut, especially stands growing on shallow to bedrock soils. The hemlocks growing within the ERP IBA did not appear to exhibit large scale die-back but should be monitored closely for signs of Adelgid infestation and resultant stress.

6.4 Invasive Plant Species

The ERP IBA contains more than three dozen species of non-native, invasive plants. The elimination of all these species from the ERP IBA's habitats would be labor intensive, unsustainable, and therefore is an unrealistic goal. Instead, short-term control efforts should be focused on containment, while the various long-term control methods can be adequately assessed based upon site-specific conditions. For instance, herbicide application can be an effective control tool if applied in a proper manner, but in order to protect sensitive non-target biota, surface water, drinking water supplies, and other sensitive environmental receptors, the application of herbicides should be avoided whenever alternative control measures are available, effective, and feasible. It can be argued that even pesticides in use and approved for use today for controlling invasive species may have insufficient toxicological studies supporting their safe use in certain habitats. Safe use is often a matter of proper application and dosage. Recent scientific evidence associates various potential teratogenic, carcinogenic, and mutagenic effects and various toxicities associated with pesticides in use today. If nothing else, use of supposedly "safe" herbicides is still dependent upon proper application, handling, storage, and use.

Apparently feasible control methods are discussed in the literature, but selection of the controls is based upon cost, available labor, effectiveness, limitations, response of the target plant species and availability of follow-up monitoring, control, and replacement with native plant species – all factors influenced by site-specific conditions (e.g., soil type, accessibility, proximity to sensitive environmental receptors, etc.)

Non-native invasive plants are prolific within portions of the ERP IBA. They include herbaceous, liana, shrub, and tree species. Some representative non-native invasive plant species noted during our field inspections of the ERP IBA include those listed in **Table 6-1**. More species may exist, and new ones are suspected of being recently escaped into a “wild” setting (Bill Moorhead, personal communication). Despite known impact to the native floristic composition of the state, some non-native plant species still provide important habitat function to certain bird species. For instance, Multiflora Rose provides suitable nesting cover for shrubland birds at the site. This species is also reportedly fed upon by some polyphagous caterpillars. Therefore, care must be taken not to impact species of conservation concern that utilize this special habitat coverage during removal or control projects, and to replace the lost function by re-planting native species. Yet other common invasives noted in the park such as *Celastrus*, *Euonymus*, *Berberis*, *Ligustrum*, *Lonicera*, and *Ailanthus* are shunned by most if not all polyphagous caterpillars (Schweitzer et al., 2011).

This is concerning for the ERP IBA since it is a known migratory stopover site for Neotropical migrant insectivorous birds that rely on an abundance of insect prey (including caterpillars) as a food source during migration, and the areal coverage of many of these non-native plants appears to increase each year. In addition to the species listed in Table 6-1 below, there are a number of non-native species that were identified in the ERP IBA that are *potentially invasive*. These species are NOT included on the Connecticut Invasive Plant Working Group list of invasive plants in Connecticut, but are reported to be invasive in natural areas in the U.S. by the Invasive Plant

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TABLE 6-1. INVASIVE PLANT SPECIES NOTED WITHIN THE ERP IBA WITH POTENTIAL TO IMPACT BIRD HABITAT

Common Name <i>(Scientific Name)</i>	Location(s) on site	Potential Control Alternatives*	Reference for Further Control Details/Information
TREES			
Norway Maple <i>Acer platanoides</i>	Black Trail and various other locations in ERP IBA; Edgerton Park	Hand pulling (seedlings); Weed wrench (saplings - but follow-up required for new seedlings after soil disturbance); cutting followed by painting stumps with triclopyr; spraying (summer) with solution of glyphosate (seedlings and small saplings); basal bark (trees) application with triclopyr in late summer or winter	Kaufman and Kaufman, 2012
Tree of Heaven <i>Ailanthus altissima</i>	Summit, along roadsides and ruderal lots within the ERP IBA	Girdling with basal bark application of herbicide and tackifier (e.g., Pathfinder II); application should be conducted anytime between August and October	Kaufman and Kaufman, 2012
Black Locust <i>Robinia pseudacacia</i>	Black Trail, Mill River Floodplain	Cut stump herbicide applications to larger diameter trees; repeated mowing of young sprouts will eventually exhaust energy reserves in roots	Kaufman and Kaufman, 2012
Castor aralia <i>Kalopanax septemlobus</i>	Mill River floodplain, Edgerton Park (esp. Black Trail from E. Rock Road to Whitney Avenue; also Edgerton Park)	Little information available regarding control; hand removal of seedlings and culling of larger trees presumed to be effective in early stages of infestation	Contact Arnold Arboretum as this species is suspected of originating from progeny gifted by Harvard University (Port, 2014)
White Mulberry <i>Morus alba</i>	River Trail	Hand pulling (Seedlings); repeated frequent cutting, or foliar spray with glyphosate (saplings); cut stump, or basal bark application of triclopyr	Kaufman and Kaufman, 2012
SHRUBS			

* Be sure to heed all health and safety warnings, permitting requirements, and environmental/ecological recommendations associated with any chemical control method. Information for herbicides can be found at http://www.pesticideinfo.org/Search_Chemicals.jsp



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TABLE 6-1. INVASIVE PLANT SPECIES NOTED WITHIN THE ERP IBA WITH POTENTIAL TO IMPACT BIRD HABITAT

Common Name <i>(Scientific Name)</i>	Location(s) on site	Potential Control Alternatives*	Reference for Further Control Details/Information
Glossy Buckthorn <i>Rhamnus frangula</i>	Black Trail adjacent to and north of East Rock Road	Herbicides used for brush control can be applied to foliage, or can be painted onto freshly cut stems.	Kaufman and Kaufman, 2012
Japanese Barberry <i>Berberis thunbergii</i> and Common Barberry <i>Berberis communis</i>	Japanese Barberry noted Throughout site; Common Barberry noted on Summit along Yellow Trail	Mechanical, fire, and chemical methods. Mechanical methods and hand pulling conducted in spring may be effective where numbers are limited (shallow but tough roots allow it to be hand pulled with a weed wrench tool or mattock). Controlled burns in a fire-resistant plant community may be effective. Otherwise, burns directed specifically at the stem of the bush using a propane torch is recommended. Burn in early spring before or just after leaves emerge. A summer follow-up burn may be necessary. Herbicides used for brush control can be applied to foliage, or can be painted onto freshly cut stems.	Kaufman and Kaufman, 2012
Multiflora Rose <i>Rosa multiflora</i>	Woodland edges esp. between field and forest, and within some forest gaps.	Mechanical and chemical methods: Frequent repeated cutting or mowing (3-6 x per year) for two to four years; herbicide application to cut stem anytime in August through October	http://www.nps.gov/plants/alien/fact/romu1.htm
Autumn Olive <i>Elaeagnus umbellata</i>	Woodland edges esp. between the old fields and forest; invading CT Historic Preservation Trust property	Sprouts vigorously after cutting, so effective management requires removal of roots or cutting/girdling the stem and then application of an herbicide like triclopyr; treatment most effective in late summer.	http://www.maipc.org/PlantInvadersMidAtlanticNaturalAreaS5thEdition.pdf Kaufman and Kaufman, 2012.
Winged Euonymous <i>Euonymous alatus</i>	Widely distributed	Sprouts vigorously after cutting or burning. Therefore, effective management via stem cutting requires subsequent application of an herbicide like glyphosate (apply in early summer).	http://www.maipc.org/PlantInvadersMidAtlanticNaturalAreaS5thEdition.pdf

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TABLE 6-1. INVASIVE PLANT SPECIES NOTED WITHIN THE ERP IBA WITH POTENTIAL TO IMPACT BIRD HABITAT

Common Name <i>(Scientific Name)</i>	Location(s) on site	Potential Control Alternatives*	Reference for Further Control Details/Information
		Toxic to some animals – protect conservation grazers against poisoning by installing barriers or using portable fencing.	Kaufman and Kaufman, 2012
Invasive Shrub Honeysuckles <i>Lonicera</i> spp. (<i>L. morrow</i> , <i>L. tartarica</i>)	Widely distributed	Pull or dig shrubs out of ground – follow up required to remove seedling that may sprout from disturbed soils; cut repeatedly in spring and fall when shrub is trying to translocate nutrients and carbohydrates (may take several years in succession). Spray foliage with herbicide late in growing season, or paint herbicide onto cut stumps from summer into winter.	Kaufman and Kaufman, 2012
Wineberry <i>Rubus phoenicolasmus</i>	Various locations throughout the ERP IBA	Treat with a systemic herbicide such as glyphosate or trichlopyr; apply to foliage before seeds have matured or to canes after cutting/mowing.	http://www.maipc.org/PlantInvadersMidAtlanticNaturalAreaS5thEdition.pdf
Privets <i>(Ligustrum</i> spp.)	River trail	Mechanical methods and hand pulling with a weed wrench tool or mattock; cut stems and apply glyphosate or trichlopyr to re-sprouts (late autumn or early spring); also glyphosate or trichlopyr	Kaufman and Kaufman, 2012
LIANAS			
Oriental Bittersweet <i>Celastrus orbiculatus</i>	Various locations (esp. woodland edges) throughout the ERP IBA	Hand removal where practical; cut vines at ground level and again at 4 to 5 feet above ground surface. Roots will re-sprout so subsequent treatment with herbicide (glyphosate or trichlopyr will be required) Chemical cut/paint during growing season, or foliar application in late summer (glyphosate or trichlopyr) may be effective	http://www.maipc.org/PlantInvadersMidAtlanticNaturalAreaS5thEdition.pdf
Japanese Honeysuckle <i>Lonicera japonica</i>	Various locations throughout the ERP IBA	Herbicide application only effective control but necessitates attention to proper timing. Some herbicides ineffective. Apply glyphosate late in the season when most other vegetation is dormant but honeysuckle vines still have leaves	http://www.maipc.org/PlantInvadersMidAtlanticNaturalAreaS5thEdition.pdf Kaufman and Kaufman, 2012

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TABLE 6-1. INVASIVE PLANT SPECIES NOTED WITHIN THE ERP IBA WITH POTENTIAL TO IMPACT BIRD HABITAT

Common Name <i>(Scientific Name)</i>	Location(s) on site	Potential Control Alternatives*	Reference for Further Control Details/Information
Chinese Wisteria <i>Wisteria sinensis</i>	Along east side of Mill River, north of East Rock Road	Mechanical: Cut vines and mow or cut re-sprouts repeatedly until the root is starved. Chemical: cut vines and apply glyphosate or triclopyr to the stems and re-growth	Kaufman and Kaufman, 2012
English Ivy <i>Hedera helix</i>	Edges bordering residential properties vicinity of East Rock Road and Livingston Street	Satellite invasions: Small patches can be pulled up or dug up, but care must be taken to get all the rhizomes. Larger colonies can be controlled by covering with black plastic tarps. Goats will graze and kill English Ivy. Large coverage of the vines in canopies can be killed by cutting the main vine stems at a convenient height.	Kaufman and Kaufman, 2012
Porcelainberry <i>Ampelopsis brevipeduncularia</i>	Various locations at field edges and clearings	Pruning to prevent flower buds from forming can help slow the spread and dispersal of this plant, as will pulling up the vines before fruiting; cut vines in summer, then apply herbicide (triclopyr or glyphosate) to new sprouts in early summer	Kaufman and Kaufman, 2012
Swallow-wort <i>Cynanchum</i> sp.	Mill Reservoir dam overlook, Trowbridge Drive roadside	Dig up subsurface root crowns for removal and proper disposal; hand-pulling before the plants set seed can reduce or prevent seed dispersal but will not eliminate the plant; foliar spray of triclopyr and glyphosate applied after flowering has begun	Kaufman and Kaufman, 2012
Chocolate Vine <i>Akebia quinata</i>	Summit along chain link fence at summit (southern end of Yellow Trail)	Cut vines repeatedly until root is exhausted or dig up vines to remove them; spray foliage with glyphosate or triclopyr	Kaufman and Kaufman, 2012
HERBS			

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TABLE 6-1. INVASIVE PLANT SPECIES NOTED WITHIN THE ERP IBA WITH POTENTIAL TO IMPACT BIRD HABITAT

Common Name <i>(Scientific Name)</i>	Location(s) on site	Potential Control Alternatives*	Reference for Further Control Details/Information
Japanese Knotweed <i>Fallopia japonica</i>	White Trail River Floodplain	Cut or pull stalks repeatedly during the growing season to deplete the rhizome but this may take many years for larger stands; foliar spraying with systemic herbicide (glyphosate or triclopyr) in late summer may still be necessary to kill roots and rhizomes; combined cutting and herbicide application to cut stems may yield greater success; stem injection from June to September may be effective but labor intensive	Kaufman and Kaufman, 2012
Garlic Mustard <i>Alliaria officinalis</i>	River Trail; Black Trail and various other locations	Spraying soil around satellite invasion areas with vinegar to change the soil pH should be tried as a pilot project. In areas of large infestations, systemic herbicide application (glyphosate, triclopyr) may be necessary prior to seed set; hand pulling and proper disposal may be effective for smaller infestations when soils are moist. Cutting to ground level in spring can prevent formation of flowers and seeds, but should be followed up with application of glyphosate to prevent development of new flowering shoots.	Kaufman and Kaufman, 2012
Mugwort <i>Artemesia vulgaris</i>	Entrance field at Eli Whitney Museum	Repeated monthly mowings for several years to halt spread of monocultures; directed applications of clopyralid and glyphosate several times during the growing season	Kaufman and Kaufman, 2012
Common Reed <i>Phragmites australis</i>	Mill River White Trail	Burning, flooding, grazing, disking, and aerial herbicide applications have all been used but each has its constraints and limitations. Repeated cutting to exhaust energy reserves in the roots followed by herbicide application of resprouts may offer some	Kaufman and Kaufman, 2012



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TABLE 6-1. INVASIVE PLANT SPECIES NOTED WITHIN THE ERP IBA WITH POTENTIAL TO IMPACT BIRD HABITAT

Common Name <i>(Scientific Name)</i>	Location(s) on site	Potential Control Alternatives*	Reference for Further Control Details/Information
		lasting control. Since stems are hollow, cutting followed by dripping glyphosate formulated for use near water down the hollow stems may be effective	
Purple Loosestrife <i>Lythrum salicaria</i>	Mill River central island	Biological control: Controls with Galerucella beetles has been effective on sites that are not inundated in the spring for long durations since the larvae emerge from the soil. Hand-pulling of small invasion areas. Will need to be done repeatedly to exhaust the seed bank	Kaufman and Kaufman, 2012
Yellowflag Iris <i>Iris pseudacorus</i>	River trail upstream of Iron footbridge	For small satellite invasions, digging up small patches including the rhizomes may be effective, as may wiping leaves or spot applications with glyphosate; larger colonies will require cut foliage, following spraying with glyphosate.	Kaufman and Kaufman, 2012
Dames Rocket <i>Hesperis matronalis</i>	Yellow Trail	Hand pulling may be effective for small satellite invasions but would likely require work in several consecutive years to exhaust the seed bank; larger infestations can be sprayed in late fall with glyphosate	Kaufman and Kaufman, 2012
Goutweed <i>Aegopodium podagraria</i>	River Trail across from old Pumphouse	Satellite invasions: Small patches can be pulled up or dug up, but care must be taken to get all the rhizomes. Larger colonies can be controlled by systemic herbicide application (glyphosate), frequent mowing, covering with black plastic tarps, or a combination of the above.	Kaufman and Kaufman, 2012
Water Shamrock <i>Marisela quadrifolia</i>	Mill River	No known effective biological or physical control methods reported; reportedly susceptible to the herbicide bensulfuron methyl	Cao, L, and L. Berent (2017)

Atlas of the United States⁴. They include such species as Castor Aralia (*Kalopanax septemlobus*), *Aralia elata*, and *Celandine major*. In keeping with the recommended approach framework for managing invasive species, it is recommended that these plants be removed from the site before they have the potential to spread throughout the ERP IBA and become the source of additional satellite invasion areas.

6.5 Anthropogenic Disturbance

The various disturbances associated with human activity within the ERP IBA can have a cumulative impact on the site's ecology. Since the ERP IBA is surrounded by residential property, rather than other protected lands in a larger, forested landscape matrix, threats to biodiversity from development and pollution could become significant factors on a local scale in the future. Heavy trail use by hikers, joggers, dog-walkers, and mountain bikers can pose management challenges associated with soil erosion and the resultant sedimentation of downgradient wetlands and watercourses. Hikers, horses/horseback riders, mountain bikers, dog walkers, birdwatchers, and others that deviate from the trail system could potentially do one or more of the following:

- Trample plants of conservation concern
- Introduce non-native plant species propagules
- Trample or kill ground-nesting birds, their nests, eggs, or young
- Initiate or exacerbate soil erosion problems, and
- Disturb various roosting birds of conservation concern, especially raptors.

Predators often track the scent of humans and pets within natural areas, therefore humans and pets wandering off-trail can lead predators into different parts of the ERP IBA where sensitive species of conservation concern may be nesting. People and pets deviating from the trail system are also at greater risk of encountering known



Figure 6-2. In multi-use parks, conflicts among special interest groups may arise. In this case, potential conflict between joggers and birders could be avoided by scheduling the race two weeks later (which would be after the height of songbird migration), moving the race start time to later in the morning, or having the race finish in the park at noon when birders have mostly left the IBA.

⁴ <http://www.invasiveplantatlas.org>

and potential biological hazards within the ERP IBA such as poisonous plants, biting and stinging insects, stinging plants, and aggressive wildlife that may be defending young, a den site, or other resources.



7.0 Conservation Actions and Recommendations

7.1 Invasive Plant Control

Some invasive plant removal control efforts have occurred within the ERP IBA to date. Large *Celastrus* vines have been cut at the base to kill the larger mature individuals, Norway Maples have been removed from portions of Edgerton Park, and general invasives control efforts have been carried out around the Eli Whitney Museum. While bearing in mind that the park is maintained with human education/recreation as the primary function, the removal of various invasive plants from the site would enhance the wildlife habitat value by preserving floristic diversity. Many of the invasive plants on the Site form dense monospecific stands that displace native vegetative species. These highly invasive plants often invade areas where the soil has been disturbed or are easily dispersed to the site via birds, wind, or other vectors.

Managers should be vigilant to colonization by additional non-native invasive species. If new colonizations are discovered, a rapid response eradication team could be dispatched to dispense with the newly discovered invasives while their populations are still manageable (e.g., *Castor aralia*). The secondary focus of control efforts (after rapid response action to prevent new invasions) should be to focus control efforts at satellite invasion areas (new populations of invasives that are small enough to easily remove before they become unmanageable). Third, invasives should be addressed along the invasion front of existing infestations to halt their spread and to contain the invasion. Care should also be taken not to affect the habitat of species of conservation concern during control or removal projects. For instance, removal of invasive shrubs could impact birds via removal of suitable nesting habitat and cover, and so, at the very least should not be conducted during nesting season. It would be prudent to inventory all non-native invasive plant species, assess their relative extent, coverage, and possible impact in order to prioritize species based on the urgency and need for control; and to find suitable native or non-invasive analogs that will replace the habitat functions lost upon the removal of the target invasive species. Delineation of invasive plant infestations will establish a baseline that will be useful in calculating potential rates of spread and resultant impact to habitat.

7.2 Tree Care and Forest Management

Ideally, tree care across the site should be conducted in such a way as to retain as many of the special habitat attributes and microhabitat elements as possible. Fallen trunks, brush piles, hollow snags, standing dead wood and large pieces of exfoliating bark from mature trees are important microhabitat requirements of fauna, especially birds, bats, and squirrels, and should be retained on site as safety permits. Dead lower branches are often used as “hawking sites” by aerial insectivores that sally out from these preferred perches to snatch insects from the air. Supracanopy trees are often favored by raptors for nesting and as vantage perches during hunting. Rotted centers, knotholes and abandoned woodpecker holes are valued by other cavity-nesting species such as Great Crested Flycatcher and Eastern Screech Owl for cover and breeding sites, however large shade trees with rotted centers often blow down during high winds. An arborist or tree care expert with knowledge of wildlife habitat attributes could help the maintenance staff determine which trees do not pose safety hazards to patrons and therefore can be retained for their wildlife value. Artificial nesting structures can also be added to existing trees on the property in areas that lack cavities. Fallen twigs and branches can be cleared off from trails and stacked in areas out of sight by patrons where they can be used by wildlife. Downed trunks and large diameter

branches can be cut and stacked away from trailsides to provide alternative cover for small mammals and to rot and return nutrients back into the soil and detrital energy pathways. Oftentimes, toppled trees are still alive and partially rooted and may continue to grow, adding some structural diversity to the understory especially in areas where deer overbrowse may have removed or reduced the shrub and sapling layer coverage.

Forest management measures, particularly how they pertain to Forest Bird Habitat, are addressed in detail in the Forest Bird Habitat Assessment provided as **Appendix C**. Loss of conifers due to pest damage (e.g., loss of Eastern Hemlock due to hemlock woolly adelgid) and storm damage (which has taken a toll on mature White Pines) has likely contributed if not caused the demise of breeding Black-throated Green Warbler and Pine Warbler populations in the IBA. Measures to encourage forest tree regeneration are needed.

7.3 Green Waste Management

Groundskeeping and general maintenance often results in the generation of surplus green wastes such as leaf litter, vegetation clippings and trimmings, surplus soil and rock materials, and surplus wood. It is recommended that when feasible, rocks, wood, brush, and leaves should be segregated into separate piles. Rock piles and wood piles offer superb hiding structures for small mammals and herpetofauna. Grass trimmings should be composted with surplus soil. Leaf litter should be composted separately as it can turn compose material too acidic. Soil piles can be temporarily stored, then reused on site as needed if they did not originate from areas infested with invasive species. Soils generated from areas infested with invasive species should be properly disposed of off-site at facilities licensed to accept such wastes. Care should also be taken to prevent the erosion of stockpiled soil material into downgradient surface waters, by keeping soil piles covered with tarps and surrounded by a combination of haybales and silt fence sediment control barriers. Green wastes should not be stockpiled in flood plains, nor located within or adjacent to wetlands and watercourses. No other types of wastes (e.g., food wastes, animal carcasses, construction demolition debris, trash/litter, etc.) should be mixed in with the green waste. Stock pile areas should be secured to prevent against illegal dumping.

7.4 Chemical Management

7.4.1 Pesticides

The term "pesticide" is often misused as a synonym for "insecticide" but more properly used it may encompass many forms of chemical pest control in addition to insects such as fungus (fungicides), "weeds" (herbicides), roundworms (nematocides), rodents (rodenticides), etc. The most commonly used pesticides in landscaping applications are herbicides used for weed control. Given the potential impacts to human health and the environment discussed above, it is important to understand the fate of these chemicals in the environment, once they are released, either through prescribed application, disposal, spillage, or other uncontrolled loss. If applied properly (i.e., by a licensed applicator and in accordance with manufacturer recommendations and at the proper concentrations) insecticides and herbicides typically adhere to the intended leaf surface targets and may safely be used for the application they were intended. However, because of the potential impacts associated with improper use and resultant dangers to human health and the environment, other alternatives should be considered before resorting to synthetic chemical pesticide application. An Integrated pest management approach allows managers to explore a variety of options for pest control.

Integrated Pest Management is defined by the University of Connecticut as "a sustainable approach to managing pests" where "practitioners base decisions on information that is collected systematically as they integrate

economic, environmental, and social goals”⁵. As part of an IPM program, a number of alternatives are assessed to control the pest in an effective manner given site-specific constraints, attributes, goals, objectives, and concerns. Alternatives that could be selected include one or more techniques of biological, cultural, mechanical, physical, genetic, or chemical control measures acting singularly or collectively.

Appropriate precautions are recommended for all chemical use. These precautions include both general usage and site-specific measures, collectively referred to as best management practices for pesticide use. Best Management Practices include but are not necessarily limited to such measures as the following:

- proper storage of the chemicals in a manner that is compliant with local, state, and federal regulations (this typically means but is not necessarily limited to storage in manufacturer-approved vessels, in a secure location with appropriate placarding, and with accompanying spill containment kits);
- compliance with other regulatory controls such as supplying maintenance staff with proper training and certification for application/usage, or contracting professional applicators that are fully licensed and permitted;
- compliance with label directions (e.g., treatments applied in the correct doses and during the recommended conditions), to ensure effectiveness, and efficiency in application, and;
- proper notification to the public as required by law.

7.4.2 Fertilizers

Fertilizers are important in maintaining turfgrass growth in a manner necessary to create desirable lawns. The fertilizers and other soil amendments contribute to the overall health and vigor of desired turf especially in areas where growth and vigor may be constrained by poor lighting, undesirable soil pH, or heavy foot traffic. However, as previously discussed, they can also cause environmental problems if they get into ground and surface waters. Best Management Practices for fertilizer use include:

- Determine fertilizer rate of application and ratio of the macronutrients (Phosphorous, Potassium, and Nitrogen) based upon soil and plant tissue testing since periodic testing will help alert the groundskeeper of possible plant nutrient deficiency and over-fertilization
- Use slow-release forms of natural organic fertilizers. The most commonly used fertilizers consist of various mixtures of compounds containing the macronutrients nitrogen, phosphorous and potassium, and
- Other soil amendments used in smaller amounts include sulfur, calcium, magnesium and micronutrients.

Regarding the micronutrients, if one of these compounds is deficient and therefore limiting to plant growth, increasing the concentration or application rate of nutrients may not result in significant increased plant growth and vigor, but instead wastes the amendment and can lead to contamination of environmental media. For instance, nitrogen is the most commonly applied fertilizer and is essential for growth and color of turfgrass. Because of its environmental fate in the soil media, regular applications are required to maintain effective levels. Yet nitrogen is potentially a very harmful fertilizer as well. Nitrates that reach drinking water supplies can have

⁵ <http://www.hort.uconn.edu/ipm/>

severe effects on humans, such as birth defects, cancer, and central nervous system damage, whereas nitrous oxides are a major criteria pollutant regulated by the Clean Air Act because of its contribution to the depletion of stratospheric ozone. Application of micronutrients to the soil media is risky since under natural conditions they occur at such low concentrations, it is hard to administer amendments in such a way as to obtain those proper concentrations. Maladjustments can result in plant and animal toxicity.

Best Management Practices for fertilizer application are similar to those for pesticides (e.g., follow manufacturers recommendations for storage, usage, disposal; train appropriate staff on handling requirements; and assess alternatives for usage). Application of fertilizers should be done in a manner that reduces runoff into surface waters. Therefore, buffer zones where fertilizer use is reduced or otherwise limited should be established around water features.

7.4.3 Stormwater Management

In some areas, stormwater retrofits to address a direct pathway of pollutants to the Mill River represents a costly solution toward improving the river's water quality. Nevertheless, stormwater infrastructure improvements should be incorporated into long-term planning. These measures may include retrofitting area catch basins with hydrodynamic separators, deep sumps, or forebays before or after the discharge point. Short-term measures that should be considered for immediate implementation include increased maintenance for catch basins without the above features that discharge directly to the Mill River and stenciling catchbasin inlet hoods in order to inform the public that the outfalls of the catchbasin discharge directly to the Mill River and eventually, Long Island Sound. In the long-term, park managers should work with the City to implement improvements. Improved stormwater management measures should be incorporated into future projects within the IBA and its watershed. This will require coordination with various city offices such as parks, public works, engineering, and the conservation commission. Municipalities within the Mill River Watershed should refer to the *Mill River Watershed Based Plan* (Fuss and O'Neill, 2018).

7.5 Stewardship / Outreach

The need for stewardship and outreach measures implementation was not identified as a primary management recommendation at ERP, due to the extensive list of stakeholders and the high production of student programming. However the various stewardship groups should be made aware that the New Haven Parks department is short on staff and funding to implement stewardship measures beyond general maintenance. Stakeholder groups , especially birding organizations, should be encouraged to adopt specific stewardship projects in support of park staff by coordinating with the New Haven City Parks Department. AudubonCT has lead by example by creating pollinator and bird habitat patches via their urban oasis program. Other conservation organizations should be encouraged to follow suit or support the programs implemented by others.

Current public outreach and education measures for which stakeholders could assist park staff include the following:

- Organizing and implementing community service projects conducted by volunteers (e.g., invasive species control days, etc.)
- Sponsoring community educational signage explaining the importance of ecosystem services, and
- Conducting bird/nature walks led by park staff and local naturalists.

Additional educational signage could be erected throughout ERP and grounds of the IBA, and at adjacent points of interest. Some signage topics could be resource-specific (such as the identification of a plant community type or typical resident bird species such as the existing one depicting migrant songbirds near the park's boundary with the Eli Whitney Museum), while other signs could offer more system-wide information (such as explanations of hydrologic cycles, nutrient flow, productivity, and various other biotic and abiotic processes in the coastal environment and why they are important to avian ecology). Still other signage could provide information regarding the natural communities of the site or region and the habitat management techniques conducted on site by park personnel to date.

7.7 Vegetation Restoration

Edgerton Park has embarked on a native plant restoration project in the northeast sector of the park. This restoration involves the replanting of native northeastern forest trees and shrubs, control of invasive plants and dedication of a sector of the park for woodland re-establishment.

The City should explore the feasibility of repairing the self-regulating tide gates on the Mill River. Incoming flood tide water ascending the Mill River are partially blocked by the tide gates, preventing the upstream reach of the river from experiencing full tidal range inundation of salt water. This has likely led to the proliferation of Common Reed in the lower reaches of the Mill River since these stands of reed are not inundated long enough to be impacted by the saltwater. Restoration of the full tidal exchange could be a natural way to restore some of the rare brackish water tidal plants that historically occurred along the Mill River. However, increased inundation of the lower segments of the Mill River could also impact a homeless encampment on the river floodplain near the Cedar Hill neighborhood. The City would need to coordinate with civic leaders and organizations that work to end homelessness to address the encampment and relocate its inhabitants before the river's tidal cycle is restored.

Certain fields within the IBA that are not regularly used for recreational purposes have the potential to support species of conservation concern such as insect pollinators. It is recommended that these field areas be managed

General conservation mowing recommendations for the site (applicable to the collective early successional habitat management units) are as follows:

- ♦ Defer mowing until after bird-breeding season and migration, at least until late November but preferably until late winter
- ♦ Set cutter at a height of 6 inches or higher to avoid mowing fauna such as turtles, snakes, or small mammals
- ♦ Consider use of flushing bars to move birds out of way of mower
- ♦ Mow in patterns that allow animals to escape to adjacent refugia (from interior outward)
- ♦ Refrain from mowing at night or late evenings when birds are less reluctant to flee from path of mower
- ♦ Leave un-mowed strips of older more mature grassland with forb composition periodically throughout the fields to provide greater plant diversity and hence a broader food base
- ♦ Control invading Autumn Olive, Multiflora Rose, and other invasives from field edges, and
- ♦ Implement rotational mowing on select areas so that the different fields are mowed in different years.

as early successional habitats. In the absence of fire, grazing, or some other disturbance mechanism, mowing appears to be the most feasible way of maintaining these management units as early successional stages. However, conservation mowing measures should be implemented for these management units. Delaying mowing until well after the growing season reduces the likelihood of directly impacting animals using the fields for foraging or concealment. Delaying mowing until the end of winter avoids the elimination of persistent herbaceous plants that may retain seeds on the stem well into winter months for foraging winter resident birds and small mammals. Setting the mower height high avoids mowing the basal rosettes of perennial plants, allowing them to flower and seed the following year, and helps to avoid directly impacting small animals that may be present. It is best to rotate mowing schedules so that all fields are not mowed at the same time, thereby allowing the various management units to have different vegetative coverage characteristics. A summary list of recommended conservation mowing measures is provided in the inset below.

7.8 Artificial Nest Boxes

Eastern Bluebirds (*Sialia sialis*) and Tree Swallows (*Tachycineta bicolor*) would benefit from appropriate nest boxes placed strategically within the open areas of the site. Eastern Bluebird houses are readily used by Tree Swallows which may competitively exclude bluebirds from nesting in boxes erected for them. Having pairs of bluebird boxes at each nest box location may reduce competition between the two species which may occur if only one box was erected. Once a Tree Swallow pair is established in a nest box, it will exclude other Tree Swallows from the territory, freeing the second box for use by Eastern Bluebirds. These boxes should be placed out in the open and mounted atop poles fitted with predator baffles.

Another challenge to encouraging and attracting successful nesting bluebirds is competition with House Sparrows (*Passer domesticus*). House Sparrows inevitably compete with Eastern Bluebirds for nest boxes and often competitively exclude Eastern Bluebirds from nest boxes. House Sparrows have been known to kill and maim bluebird eggs and young and may also do the same to adult bluebirds trying to defend their nest. Unless House Sparrows can be managed effectively, nest boxes for bluebirds should not be erected.

Purple Martins (*Progne subis*) ('Threatened' CT-ESA) nest in colonies at nearby locations (Guilford, Madison, Milford, etc.). This aerial insectivore is reportedly a rare spring migrant within the ERP IBA. Much of the site is no longer suitable for this species as forest succession has fragmented the once formerly extensive network of open farmland adjacent and proximal to the site. The north end of the ERP IBA in the vicinity of Lake Whitney appears to be a suitable location for Purple Martin houses. However, the installation of martin houses would be met with the challenges of House Sparrow invasion and the need for routine (annual at least) maintenance, requiring a dedicated patron for monitoring and maintenance.

At night, bat species become the predominant aerial insectivores replacing swifts, swallows, martins and flycatchers in this feeding guild. Properly designed, built, placed, and maintained boxes could be established to provide supplemental roosting sites, maternity sites, and hibernacula for arboreal species. A bat house has been erected on the north end of the ERP IBA on the Eli Whitney museum property. Other areas of the ERP IBA are also suitable for bat box installation, such as other locations along the Mill River, the wood margin between Edgerton Park and the SCRWA property, the edge of Rice Field, and the Archery Field. Hollow snags, standing dead wood and large pieces of exfoliating bark from mature trees are important microhabitat requirements of bats and should be retained on site as safety permits.



Figure 7-1. Bat Box at Eli Whitney Museum

8.0 Action Plan

This section discusses recommended actions that should be taken to enhance and improve upon the habitat attributes of the ERP IBA. Elements of the Action Plan that refer to specific areas within the IBA are depicted graphically in **Figure 8-1**. General discussions of Action Plan elements is provided in the following subsections.

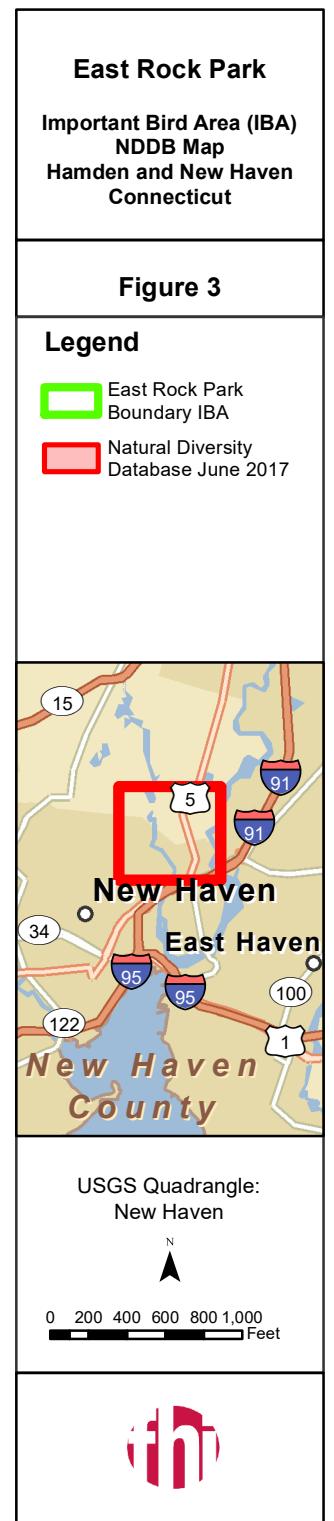
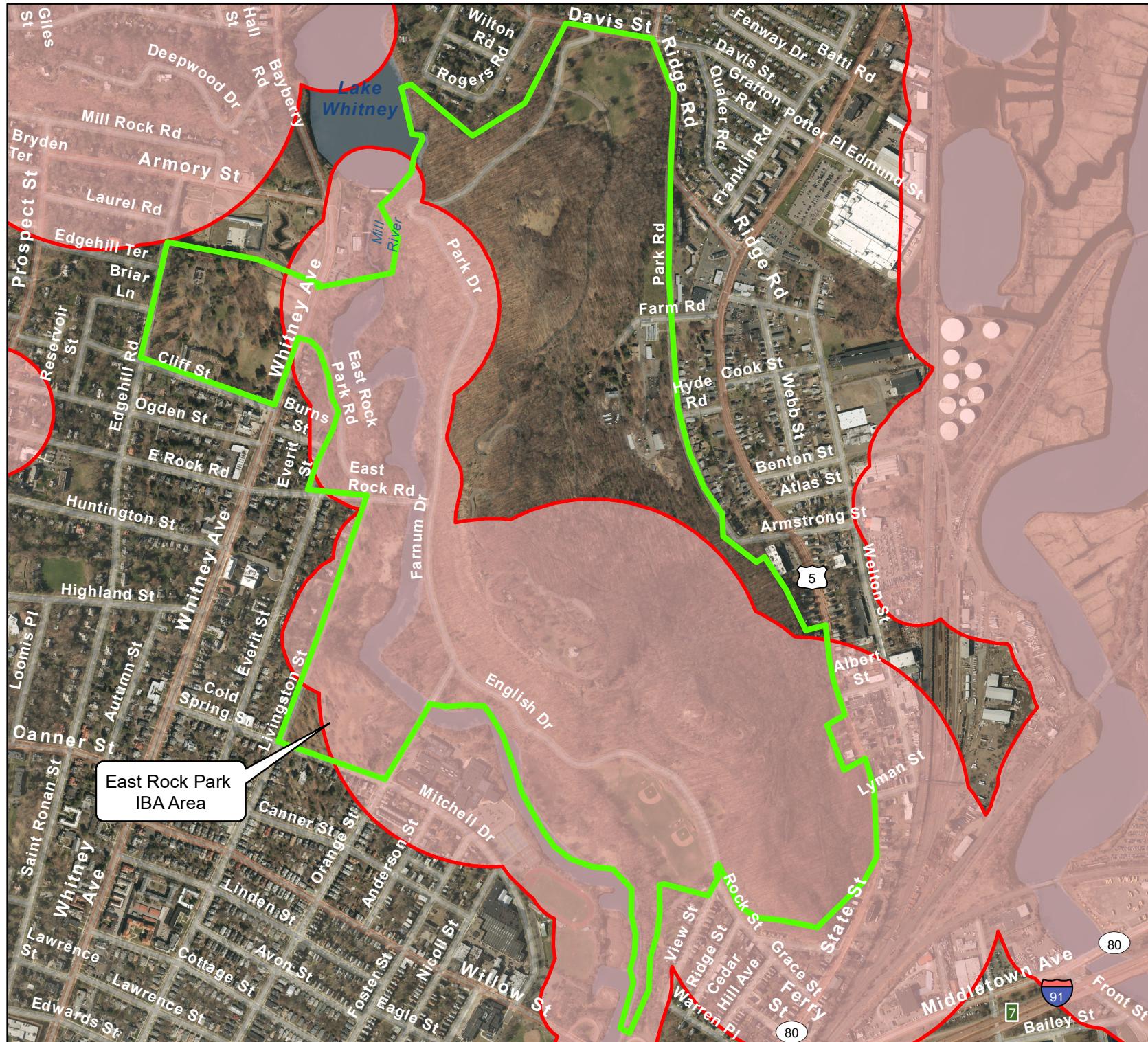
8.1 Protection of Rare Species

East Rock Park staff have taken measures to protect rare species either directly or indirectly. For instance, the closure of the traprock cliff faces for rock climbing not only protects potential rock climbers from scaling unsafe fractured traprock faces, but also protects cliff-nesting birds of conservation concern such as the Common Raven (formerly listed in the CT Endangered Species Act as Special Concern, but currently delisted) and Peregrine Falcon (a CT Threatened Species). The possibility remains for additional listed bird species – many of which pass through the park on migration – to stay and nest during breeding season. Examples include but are not necessarily limited to the following: the state endangered Red-headed Woodpecker (*Melanerpes erythrocephalus*), which could conceivably nest within the hollow of a park shade tree, and the Brown Thrasher (*Toxostoma rufum*), which could nest in dense tangles of shrubs and vines growing along the dry ridgeline. Measures should be taken to protect additional rare avifauna as needed via trail closures, deferred vegetation cutting, and other best management practices to be implemented during breeding season.

Rare non-avian vertebrate fauna that are reported to occur within the ERP IBA include the Eastern Box Turtle (*Carolina terrapene*). The presence of Box Turtles in the park should be taken into consideration when mowing field edges/margins, with the mower deck set high enough to prevent striking turtles that may wander out into the field edges.

Since the advent of white-nose syndrome (WNS) in the northeast and elsewhere in North America, more bat species are now listed in the state and federal Endangered Species Acts. The roadways through the park afford the opportunity of a rapid assessment of bat usage, contributing to the data gap prevalent for this taxa within the ERP IBA.

Additional rare plant species may occur within the park, particularly in association with the traprock ridge. Botanical surveys should be taken before any major land use changes occur on the property. A list of rare plant species known from New Haven County Trap Rock Ridges is presented in Table 8-1 and may be useful as a general list of target species for future surveys along the trap rock ridges in ERP IBA.



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Table 8-1. List of Rare Plant Species Reported from New Haven County Trap Rock Ridges			
Common Name <i>Scientific Name</i>	Habitat Requirements	Flowering Period	CT Status
American Ginseng <i>Panax quinquefolius</i>	Rich woods (Gleason and Cronquist, 1991) Rich woods (M) Rich and cool woods (Gray and Fernald, 1950) Rich woods (Gleason and Britton, 1958)	June-July (Gleason and Cronquist, 1991) June-July (Magee and Ahles, 1999) June-July (Gray and Fernald, 1950) July-Aug. (Gleason and Britton, 1958)	SC
Cat-tail Sedge <i>Carex typhina</i>	Moist to wet woods and marshes (Gleason and Cronquist, 1991) Wet meadows, wet deciduous woods and bottomlands	June to September (Magee and Ahles, 1999)	SC
Few-fruited Sedge <i>Carex oligocarpa</i>	Moist rich woods (Gleason and Cronquist, 1991) Rich deciduous woods (M) Calcareous woods and copses (Gray and Fernald, 1950) Dry woods and thickets (Gleason and Britton, 1958)	May-July (Magee and Ahles, 1999) May-July (Gray and Fernald, 1950) May-July (Gleason and Britton, 1958)	SC
Golden Seal <i>Hydrastis canadensis</i>	Deep rich woods (Gleason and Cronquist, 1991) Rich woods (M) Rich woods (Gray and Fernald, 1950) Woods (Gleason and Britton, 1958) Rich shady woods, moist areas on woodland edges (Internet)	April-May (Gleason and Cronquist, 1991) April-May (Magee and Ahles, 1999) April-May (Gray and Fernald, 1950) April (Gleason and Britton, 1958)	E
Goldies Fern <i>Dryopteris goldiana</i>	Moist rich woods in circumneutral soil (Gleason and Cronquist, 1991) Rich, often calcareous woods and rocky hillsides (M) Rich, mostly calcareous, woods (Gray and Fernald, 1950) Rich woods (Gleason and Britton, 1958)	June-Sept. (Magee and Ahles, 1999) June-Sept. (Gray and Fernald, 1950) July-Aug. (Gleason and Britton, 1958)	SC

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Table 8-1. List of Rare Plant Species Reported from New Haven County Trap Rock Ridges

Common Name <i>Scientific Name</i>	Habitat Requirements	Flowering Period	CT Status
Green Adder's-mouth <i>Malaxis unifolia</i>	Damp woods and bogs (Gleason and Cronquist, 1991) Rich deciduous woods, meadows, deciduous swamps, wet coniferous woods, bogs (M) Dry or moist woods, borders of swamps or bogs, or on gravelly slopes (Gray and Fernald, 1950) Woods and thickets (Gleason and Britton, 1958)	July-Aug. (Magee and Ahles, 1999) Late May-Aug. (Gray and Fernald, 1950) July (Gleason and Britton, 1958)	E
Mountain Mint <i>Pycnanthemum torrei</i>	Dry upland woods (Gleason and Cronquist, 1991) Dry woods and thickets (M) Dry, often fertile, woods and thickets (Gray and Fernald, 1950)	July-Sept. (Magee and Ahles, 1999) Late June-Sept. (Gray and Fernald, 1950)	E
Narrow-leaved Glade Fern <i>Diplazium pycnocarpon</i>	Cool woods and talus slopes in circumneutral soil (Gleason and Cronquist, 1991) Rich wooded slopes, ravines and rocky woods (M) Rich (mostly calcareous) wooded slopes, ravines, and bottomlands (Gray and Fernald, 1950)	July-Sept. (Magee and Ahles, 1999) Aug.-Sept. (Gray and Fernald, 1950)	E
Sedge <i>Carex hitchcockiana</i>	Rich moist woods (Gleason and Cronquist, 1991) Rich, moist deciduous woods (M) Calcareous or rich woods (Gray and Fernald, 1950) In woods and thickets (Gleason and Britton, 1958)	May-July (Magee and Ahles, 1999) May-July (Gray and Fernald, 1950) May-July (Gleason and Britton, 1958)	SC
Small Yellow Lady's Slipper <i>Cypripedium parviflorum</i>	Moist or wet low places (Gleason and Cronquist, 1991) Wet <i>Thuja</i> woods, calcareous decid. swamps, moist decid. woods (M) Bogs (chiefly calcareous), mossy swamps and woods, wet shores, damp rocks, etc. (Gray and Fernald, 1950) Woods and thickets (Gleason and Britton, 1958) Woodland, dappled shade, shady edge (Internet)	May-July (Gleason and Cronquist, 1991) May-June (Magee and Ahles, 1999) May-July (Gray and Fernald, 1950) May-July (Gleason and Britton, 1958)	SC
Squirrel Corn <i>Dicentra canadensis</i>	Rich woods (Gleason and Cronquist, 1991) Rich woods (M) Rich woods (Gray and Fernald, 1950) Rich woods (Gleason and Britton, 1958) Rock gardens, woodlands, dappled shade, shady edge, deep shade (Internet)	April-May (Gleason and Cronquist, 1991) April-May (Magee and Ahles, 1999) April-May (Gray and Fernald, 1950) April-June (Gleason and Britton, 1958)	SC



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Table 8-1. List of Rare Plant Species Reported from New Haven County Trap Rock Ridges

Common Name <i>Scientific Name</i>	Habitat Requirements	Flowering Period	CT Status
Swamp Cottonwood <i>Populus heterophyla</i>	Wet low woods and swamps (Gleason and Cronquist, 1991) Bottomlands, swamps, wet woods (M) Inundated swamps and bottomlands (Gray and Fernald, 1950) Swamps (Gleason and Britton, 1958) Heavy water-logged clay soils on edges of swamps and bottomlands.	April-May (Magee and Ahles, 1999) April-May (Gleason and Britton, 1958)	T
Wall Rue <i>Asplenium ruta-muraria</i>	Rock crevices and ledges, mostly on limestone; interruptedly circumboreal (Gleason and Cronquist, 1991) Calcareous rock crevices, cliffs and ledges (M) Calcareous cliffs and ledges, mostly local (Gray and Fernald, 1950) On limestone (Gleason and Britton, 1958) Old walls, basic rocks in hilly areas (Internet)	June-Sept. (Magee and Ahles, 1999) May-Sept. (Gray and Fernald, 1950)	T
Wild Currant <i>Ribes rotundifolium</i>	Rocky upland woods (Gleason and Cronquist, 1991) Rocky open woods (M) Open rocky places and thickets, Ascending to highest crests (Gray and Fernald, 1950) Rocky woods (Gleason and Britton, 1958)	April-May (Gleason and Cronquist, 1991) April-May (Magee and Ahles, 1999) April-early June (Gray and Fernald, 1950) May-July (Gleason and Britton, 1958)	SC
Willdenow's Sedge <i>Carex waldenowii</i>	Moist woods, especially in acid soils (Gleason and Cronquist, 1991) Rich hardwood forests (M)	May-July (Magee and Ahles, 1999)	E

8.2 Habitat Matrices Improvement

Through coordinated efforts between stakeholders, stewards and maintenance staff, existing habitats within the ERP IBA could be improved or enhanced, to benefit avifauna. Various management measures could be implemented to increase habitat value without affecting existing uses.

8.2.1 Supplemental Plantings

Planting native shrubs that bear fruit and mast beneficial to avifauna (**Figure 8-2**) is one way to increase habitat value without affecting existing uses. Selecting for timber with high wildlife value via forest management is another. An important aspect of matrix improvement is to assure that not only is food available for the species of conservation concern, but also that the following is considered:

- A variety of food types are present supplying all feeding guilds (e.g., insectivores, granivores, frugivores, nectarivores) with sustenance either directly or indirectly
- Food items such as fruits and mast are available at varying times throughout the seasons
- Food items present a variety of nutritional options for consumers, and
- Food plants are located in areas where they are able to maximize their production without being outcompeted by low value invasive competitors.

The relative nutritional content of food-producing plants beneficial to avifauna that occur within the ERP IBA and some examples of flora within the ERP IBA that provide food high in this nutritional category are presented in **Table 8-2**. Examples of shrub species with high value to avifauna that thrive in the ecoregions of southern New England, and the species to which they are beneficial are provided in **Table 8-3**. Areas where invasive shrubs are removed should be replanted with one or more of these species that are appropriate for the soil, light, and hydrologic conditions in order to prevent the re-colonization of the removed invasive plants. Successive follow-up treatments for the removed invasive plants may be needed to exhaust the seed bank before replanting with native plant specimens. Follow-on care of the planting specimens may also be required (e.g., watering, fertilization, pruning, etc.) for the early stages after planting while the new plants become established.

It is recommended that vegetation buffers be preserved adjacent to wetlands, and watercourses. Recommendations for buffer widths typically vary as a function of the type of wetland or watercourse resource, the resident biota within the resource, slope steepness and other factors. Additionally, the City of New Haven Inland Wetland Regulations have jurisdiction over activities that may disturb vegetation within the upland review area of a wetland. Generally speaking for wildlife management and water quality benefit, the wider the buffer, the better. In areas of the site where the ecotone is abrupt, increasing the vegetation structural diversity is recommended. This can be done by judicious pruning of existing trees to allow sunlight to reach lower vegetation layers, plantings to establish a shrub layer, or via the erection of deer exclosures.



Figure 8-2. Some Plants that Occur within the IBA that are Beneficial to Avifauna: Top left: Winterberry, Top Right: Staghorn Sumac, Center Left: Black Elderberry, Center Right: Poison Ivy, Bottom Left: Silky Dogwood and Bottom Right, Pokeweed

Table 8-2. Relative Nutritional Content of Food Producing Plants that Occur within the IBA		
Nutrition Category	Some Examples of Flora within the IBA that Provide Food High in this Nutritional Category	Avifauna Benefited
High lipid content	Flowering Dogwood, Spicebush, Sassafras, Northern Arrowwood, Virginia Creeper	Thrushes (except American Robin), Gray Catbird Yellow-rumped Warbler, American Tree Swallow (Place and Stiles, 1992)
High protein content	Solomon's seal, Spicebush	American Robin (Witmer, 1996), Eastern Kingbird, Great Crested Flycatcher
High carbohydrate content	Black Cherry	Gray Catbird, Rose-breasted Grosbeak, Eastern Kingbird, American Robin, Brown Thrasher, Swainson's Thrush, Wood Thrush, Pileated Woodpecker, Red-bellied Woodpecker (Martin et al., 1951)
	Highbush Blueberry	Gray Catbird, Eastern Bluebird, American Robin, Brown Thrasher, Veery, Tufted Titmouse, Eastern Towhee
	Pokeweed	Eastern Bluebird, Gray Catbird, Northern Mockingbird, Veery, Cedar Waxwing
	Spicebush	Veery, Wood Thrush
	Grapes	Wild Turkey, Northern Cardinal, Gray Catbird, Wood Duck, Northern Mockingbird, five species of thrushes, Fox Sparrow, Brown Thrasher, Cedar Waxwing, Pileated Woodpecker
Emergency sustenance foods (Low nutrient or less palatable foods that are retained on the stem late into winter when other food is scarce)	Maple-leaved Viburnum, Green Briar, Winterberry, sumacs, Eastern Red Cedar	Winter residents, wintering individuals of normally migratory species, early returning spring migrants

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Table 8-3. Recommended Shrub Species for Coastal Southern New England with Importance to Avifauna (from Kress 2006)

Species	Avifauna benefitted	Conservation Notes
Bayberry (<i>Morella [Myrica] pensylvanica</i>)	Eastern Bluebird, Gray Catbird, Brown Thrasher, White-eyed Vireo, Red-bellied Woodpecker, Tree Swallow, Yellow-rumped Warbler	Especially important component in the diets of Tree Swallows and Yellow-rumped Warbler
Brambles (<i>Rubus allegheniensis</i> ; <i>R. hispida</i> , et al. spp.)	49 spp., esp. Wild Turkey, Ruffed Grouse, Gray Catbird, Cedar Waxwing, Veery, Orchard and Baltimore Orioles, Yellow-breasted Chat	Exceptional coverage for nesting songbirds and small mammals (<i>R. allegheniensis</i>);
Dogwoods (<i>Cornus stolonifera</i> , <i>C. florida</i> and <i>C. ammonum</i>)	Ruffed Grouse, Wild Turkey, Eastern Bluebird, Northern Cardinal, Gray Catbird, Purple Finch, Northern Flicker, Yellow-breasted Chat, American Robin, Brown Thrasher, Hermit Thrush, Gray-cheeked Thrush, Cedar Waxwing, Red-eyed Vireo, Warbling Vireo, Pine Warbler various other songbirds	Fruits are highly valuable to avifauna including Neotropical migrant passerines. Some of the fruits may persist into winter
Hackberry (<i>Celtis occidentalis</i>)	Eastern Bluebird, Northern Cardinal, Yellow-shafted Flicker, Mockingbird, American Robin, Fox Sparrow, Brown Thrasher, Cedar Waxwing, Eastern Phoebe, Gray Catbird	At least 25 bird species in the northeast eat the fruit which persist into the winter making it a valuable food source for avifauna
Hawthorns (<i>Crataegus</i> spp.) Note: The identification of these shrubs to species level may be difficult so finding pure native stock may be challenging	18 spp. including American Robin, Northern Cardinal, Blue Jay, and other songbirds especially Fox Sparrows and Cedar Waxwings	The dense thorny branches of this shrub make it an exceptional coverage for nesting birds
Highbush Blueberry (<i>Vaccinium corymbosum</i>)	34 spp. of birds including Gray Catbird, American Robin, Eastern Bluebird, Orchard Oriole	Requires well-drained sunlit sites

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Table 8-3. Recommended Shrub Species for Coastal Southern New England with Importance to Avifauna (from Kress 2006) (Continued)

Serviceberry (<i>Amelanchier canadensis</i>)	Downy Woodpecker, Hairy Woodpecker, Gray Catbird, Eastern Bluebird, Northern Cardinal, American Robin, Brown Thrasher, Swainson's Thrush, Veery, Wood Thrush, Eastern Towhee, Cedar Waxwing, Baltimore Oriole and other songbirds	Grows in a variety of habitats from swamps to rocky dry hillsides. Early spring blooms attract insects and pollinators and thus are important to insectivores
Sumacs (<i>Rhus glabra</i> , <i>R. copallina</i> , <i>R. typhina</i> , <i>R. aromatica</i>)	Ruffed Grouse, Ring-necked Pheasant, Wild Turkey, Eastern Bluebird, Northern Cardinal, Gray Catbird, Purple Finch, Northern Flicker, Northern Mockingbird, Eastern Phoebe, American Robin, Brown Thrasher, Hermit Thrush, various other songbirds	Not a preferred food but an important winter sustenance especially later in the winter season when other foods have been depleted
Viburnums (<i>Viburnum acerifolium</i> , <i>V. recognitum</i>)	Ruffed Grouse, Wild Turkey, Pileated Woodpecker, American Robin, Brown Thrasher, Great Crested Flycatcher, Cedar Waxwing, Gray-cheeked and Hermit Thrush	Fruits available during fall migration



8.2.2 Invasive Species Control

The primary over-arching goal in invasive species management for the ERP IBA should be the same as advocated by the Invasive Plant Atlas of New England (IPANE) assessment group (Mehrhoff et al., 2003), which is: “No New Invasions” either for new invasive species in the region and for new satellite invasion areas of existing invasive species. Most of the species listed in Table 6-1 have areas of major infestations, and additional satellite invasion areas. Often these satellite invasion areas are rather limited in extent and consist of a manageable number of stems. In such cases, control is warranted. For instance, Japanese Knotweed has become well established along the lower reach of the Mill River forming a continuous infestation of the flood plain. Smaller isolated pockets of this plant were noted upstream, and elsewhere within the park (e.g., the ravine below the stone arch bridge on Trowbridge Road).

In addition to the species in Table 6-1, other plants that may be potentially invasive should also be controlled while their populations are still manageable. These species may not appear to be invasive now because their populations may still be in the lag period. Examples include the Castor Aralia (**Figure 8-3**) and Laceshrub along the Black Trail and, Chocolate Vine along the chainlink fence at the summit.

As a follow-on recommendation to addressing “no new invasions”, a number of trees included on the City of New Haven Trees Division List of Recommended Trees (prepared in conjunction with the Yale Urban Resources Initiative) are considered invasive. They include the species presented in **Table 8.4**. It is recommended that the city work with the Urban Resource Initiative and park staff to revise the list of recommended street trees.



Figure 8-3. Castor Aralia – A potentially invasive tree species that has become established in East Rock Park and therefore may warrant early eradication.

The secondary focus of control efforts (after rapid response action to prevent new invasions) should be to focus control efforts on satellite invasion areas (small newly established populations that are still small enough to be managed). The third step is to address control efforts along the invasion front of existing infestations within the ERP IBA to halt their spread and to contain the invasion. Efforts could then expand inward from there toward the invasion center as resources allow. Care should also be taken not to affect the habitat of species of conservation concern during control or removal projects. For instance, removal of invasive shrubs could impact shrubland birds via removal of suitable nesting habitat and cover, and so, at the very least should not be conducted during nesting

Table 8-4. Tree Species Included on the City of New Haven's Tree Division List of Recommended Street Trees and Justification for Recommended for Removal		
Common Name	Scientific Name	Reason for recommended removal from the list
Lacebark Elm	<i>Ulmus parvifolia</i>	Infestations confirmed in Worcester and Hamden Counties, MA (Sorrie and Somers, 2009)
Goldenrain Tree	<i>Koelreuteria paniculata</i>	Confirmed infestations in all Long Island, NY counties; also Bronx, New York, Westchester, and Putnam Counties in NY, (NatureServe, 2015) and Barnstable, Co. MA (Sorrie and Somers, 2009)
Horse Chestnut	<i>Aesculus hippocastanum</i>	Verified Infestations from all RI counties; all Long Island, NY counties; Fairfield Co., CT; and a number of southeastern NY counties (Various authors)
English Oak	<i>Quercus robur</i>	Verified infestations in all RI counties except Providence; seven eastern MA counties; Suffolk, Queens, Rockland, and Orange Counties in NY
“Crabapple Species”	<i>Malus</i> species	<p>Five species are identified in the Invasive Plant atlas of the United States and therefore should be discouraged from planting. They are as follows: Japanese Flowering (<i>Malus floribunda</i>), Plumleaf (<i>M. prunifolia</i>), Siberian (<i>M. baccata</i>), Paradise Apple (<i>M. pumila</i>), and European Crabapple (<i>M. sylvestris</i>).</p> <p>To discourage the selection of these species from being planted, “Crabapple Species” should be removed from the Tree Division’s list of recommended trees, or specific species or cultivars that have not been identified as potentially invasive should be suggested.</p>
Maple, Hedge	<i>Acer campestre</i>	Infestations reported in Washington Co., RI; Barnstable Co., MA; and Queens, Nassau, and Orange Counties in NY
Plum, Purpleleaf	<i>Prunus cerasifera</i>	Infestations reported in four Massachusetts Counties
“Cherry Species”	<i>Prunus</i> species	Nine <i>Prunus</i> species identified as potentially invasive, are listed in the Invasive Plant Atlas of the United States. These species include the Bird Cherry (<i>Prunus padus</i>) one of the half dozen or so species listed as commercially available at nurseries on the Tree Division list of Recommended Trees. Bird Cherry infestations are reported from all Long Island, NY counties except Queens Co. (Nature Serve, 2015). No Infestations are yet mapped by the Atlas for CT counties.

season. It would be prudent to: inventory all non-native invasive plant species, assess their extent, coverage, and possible impact; to prioritize species based on the urgency and need for control; and to find suitable native or non-invasive analogs that will replace the habitat functions lost upon the removal of the target invasive species. Delineation of invasive plant infestations will establish a baseline that will be useful in calculating potential rates of spread and resultant impact to habitat. As a short term recommended measure, existing high value native shrubs that are currently competing heavily against non-native plant species should be released from the competition by clearing invasives away from the desired native shrub.

8.2.3 Deer Management

Although native to our eastern forests, White-tailed Deer (**Figure 8-4**) are a concern to the health and vigor within many of our natural areas, especially in southwestern Connecticut. Once almost extirpated from the state, the White-tailed Deer has made an amazing population recovery and now southwestern CT has some of the highest deer densities in CT. In local municipalities that do not allow hunting as a means of population management, local population densities can rise even higher. The abnormally high densities have resulted in over-browsing of native herbaceous plants, seedling trees, and even ground-nesting bird eggs. High-density deer populations also help spread the distribution of deer ticks (see below) and other disease-carrying vectors, increase the rate of deer vs. automobile collisions, and reduce the overall habitat quality of forest and woodland habitats. Deer have been identified as the third most serious threat to butterflies in Connecticut since they eat and sometimes kill the host plants of lepidoptera, they inadvertently consume eggs and larvae on the plants, they consume nectar flowers, and they alter the vegetative structure of the forest community by consuming shrubs, herbaceous plants, and tree seedlings (Schweitzer et al, 2011).



Figure 8-4. White-tailed Deer are Prevalent and Likely Over-abundant within the IBA and Appear to be Impacting the Regeneration of Native Vegetation

8.3 Outreach / Education

An expanded outreach program is recommended and should use a combination of approaches to reach the widest array of audiences. For instance, notices or articles regarding the goals of habitat management could be communicated to neighborhood residents using social media, blog posts, newsletters, list serves, direct mailings, trail side signage, and links to the City Park Department's website. Having a docent at strategic locations in the IBA (e.g., the covered bridge at the Eli Whitney Museum) and during strategic times (e.g., during college orientation, parent's day, or homecoming, or during the International Festival of Arts and Ideas) has been

suggested as one way to potentially achieve greater stakeholder involvement. The more residents begin to fully understand the value of ecosystem services and the threats to these services, the more they are likely to contribute to its preservation, or at least to respect the natural resources rather than exploit them.

Trailside signage is an effective way to educate the public on the value of the IBA's natural resources. Some examples of trailside signage that could be developed include the following:

1. Why the site is an IBA
2. Forest Birds of Conservation Concern
3. Shrubland Birds of Conservation Concern
4. Fish-eating Birds of the Mill River
5. Aerial Insectivores (birds and bats)
6. The 13 Functions and Values of Wetlands
7. Identifying Non-native, Invasive Plants
8. Characteristic Flora and Fauna of Trap Rock Ridge systems
9. Fish of the Mill River or other River Fauna of Conservation Concern
10. Recognizing Poison Ivy and other Toxic and Stinging Plants
11. Deer Tick Area Warning
12. Detritivore Pathway
13. Forest Succession
14. Native pollinators

The ERP IBA can be an ideal setting for using cell-phone technology for student conservation training. For instance, Drew, et al. (2017) advocated using Pokémon™ GO as a game-to-class pipeline to teach ecology as it helped students overcome barriers of species identification competency, produced data sets that could be utilized for analysis of "species" population distributions with the various Pokemon characters being used to mimic species diversity (richness and abundance). The University of Connecticut's Conservation Training Partnership (CTP) uses greenspace in an urban setting (Common Ground High School) to train high school students paired with adults to learn GPS tracking using Track Kit and data collection through EpiCollect using cell phones. The ERP IBA offers an excellent setting for project sites for the UCONN CTP program or similar training via local schools and universities.

Friends of East Rock Park, School Groups, and other civic organizations should engage with the City of New Haven Department of Public Works to implement a catch basin stenciling or placarding project that notifies residents that the catch basin drains directly to the Mill River and thus into Long Island Sound. Such a project would increase awareness of water quality issues and count toward Municipal Separate Storm Sewer System (MS4) compliance pursuant to the Clean Water Act.

Various additional education opportunities should be explored, as education opportunities centered in the park can be mutually beneficial to the property owners and the students. University research projects located in the park have the potential to generate income for paid positions or stipends for property management. An example of a graduate student research project that might be beneficial to the city is an analysis of the economic benefits that East Rock and Edgerton Park bring to the communities in which they are located

Finally, all stewardship/education/outreach measures should be highlighted in social media as a way to attract more interest and visitation to East Rock Park.

8.4 Habitat Connectivity

It is apparent from the diversity and abundance of migrant birds that pour into the ERP IBA in the spring, that East Rock Park is an important stopover site for migratory birds. Moreover, it is the first stop on a fourteen-mile corridor that heads north along the Mill River. The migratory corridor passes through supporting landscapes such as the New Haven Country Club, the South Central Regional Water Authority property around Lake Whitney in Hamden and other vegetated patches. This corridor eventually links the ERP IBA to such habitat blocks as the Sleeping Giant State Park, Quinnipiac River State Park, West Rock State Park IBA, and the Naugatuck Forest IBA in the surrounding municipalities of Hamden, Cheshire, and North Haven. Priorities for land conservation via acquisition or establishment of conservation easements should be identified along the Mill River drainage to protect and enhance this landscape level dispersal corridor and further connect these existing habitat blocks.

There is also opportunity to extend habitat connectivity southward along the Mill River. The City of New Haven received a grant from the CT DEEP Trails & Greenways Program and The CT Greenways Council for development of a trail along the Mill River between the East Rock Neighborhood at Blake Field and Grand Avenue. The development of the trail will connect segments already in existence that are used for walking, bird watching and fishing, but which are fragmented, discontinuous with each other and poorly marked / developed. The city has embarked on construction of the trail which will consist of two multi-use riverfront trail segments: one segment will extend from the Ralph Walker Skating Rink on State Street, south to the Amtrak rail line, and the other from James Street to Grand Avenue. These segments would connect at “The District”, a redevelopment project located at 470 James Street. Development of these trail segments will include the identification and control of invasive plant species and the use of native plantings in final landscaping design, providing opportunity for birds and wildlife to find enhanced habitat with suitable food and cover along longer reaches of the Mill River. These trail systems would also provide the opportunity for education through the signage options previously discussed in this report.

9.0 Evaluation – Measures of Success

Management success could be gauged from both a social and ecological science aspect. Feedback from the public could be one measure of success. Feedback could be solicited through response forms attached to or incorporated in newsletters, brochures, trailside boxes, or e-mailings. Reduction in the number of complaints issued by stakeholders in response to site management decisions might be another measure of success. Hard data collected as a result of any monitoring efforts that may be implemented on site could demonstrate and quantify the degree of success obtained from restoration efforts.

Surveys could be generated and circulated to stakeholders to solicit feedback on restoration efforts completed. Measures of success that could be quantified include, but are not limited to the following:

- Number of habitat improvement or enhancement actions completed
- Number of populations of priority species documented to be stable or increasing
- Area impacted by invasive plants decreasing
- Areal coverage of newly established native plant species
- Native species richness, abundance, or diversity stable or increasing, and
- Number of successful nests, fledged young, plant stems, catch per unit effort, etc. of priority species produced each year.
- Invasive plant populations contained, areal extent reduced, awareness increased
- No new invasives established
- Number of school groups visiting, and programs completed
- Number of historical Listed Species re-found, and populations re-established on site
- Faunal lists updated by taxonomic categories
- Number of forest interior bird species confirmed breeding
- The number of comments and “likes” on social media and social media performance metrics
- Targeted surveys of Stakeholders

In order to implement a study, a researcher must first submit a research study proposal to the City of New Haven Parks, Recreation and Trees Department Director's attention. Based on the scope and potential impact of the proposed study, a review will be necessary to determine what permissions are needed to commence the proposed study.

10.0 Limitations

FHI's ecological assessments were performed in accordance with generally accepted practices of other consulting natural resource specialists providing similar services during similar temporal conditions and in similar geographical settings. FHI personnel observed the degree of care and skill generally exercised by other consulting natural resource specialists under similar circumstances and conditions. FHI's findings and conclusions must be considered not as scientific certainties, but rather as our professional opinion based upon the interpreted significance of the data gathered during the course of this assessment which was subject to the financial and temporal limitations specified in our proposal. No other warranty, expressed or implied, is made.

The purpose of this study was to assess the biological site conditions, subject to the terms and limitations of the contractual agreement as well as seasonal conditions that may affect the detection and prevalence of biological diversity during the time of observation. Our goal was to identify the biological indicators of diversity and ecosystem health, so that we could make appropriate recommendations for ecological stewardship.

The observations described in this report were made on the dates referenced and under the conditions stated therein. Conditions observed and reported by FHI are based upon the visual inspections of surface conditions at the site during the specific date and time of observation. Such conditions are subject to change due to various environmental and circumstantial factors beyond the control of FHI. There may be variations between the results of this assessment(s) and other past or future assessments due to these inherent environmental factors.

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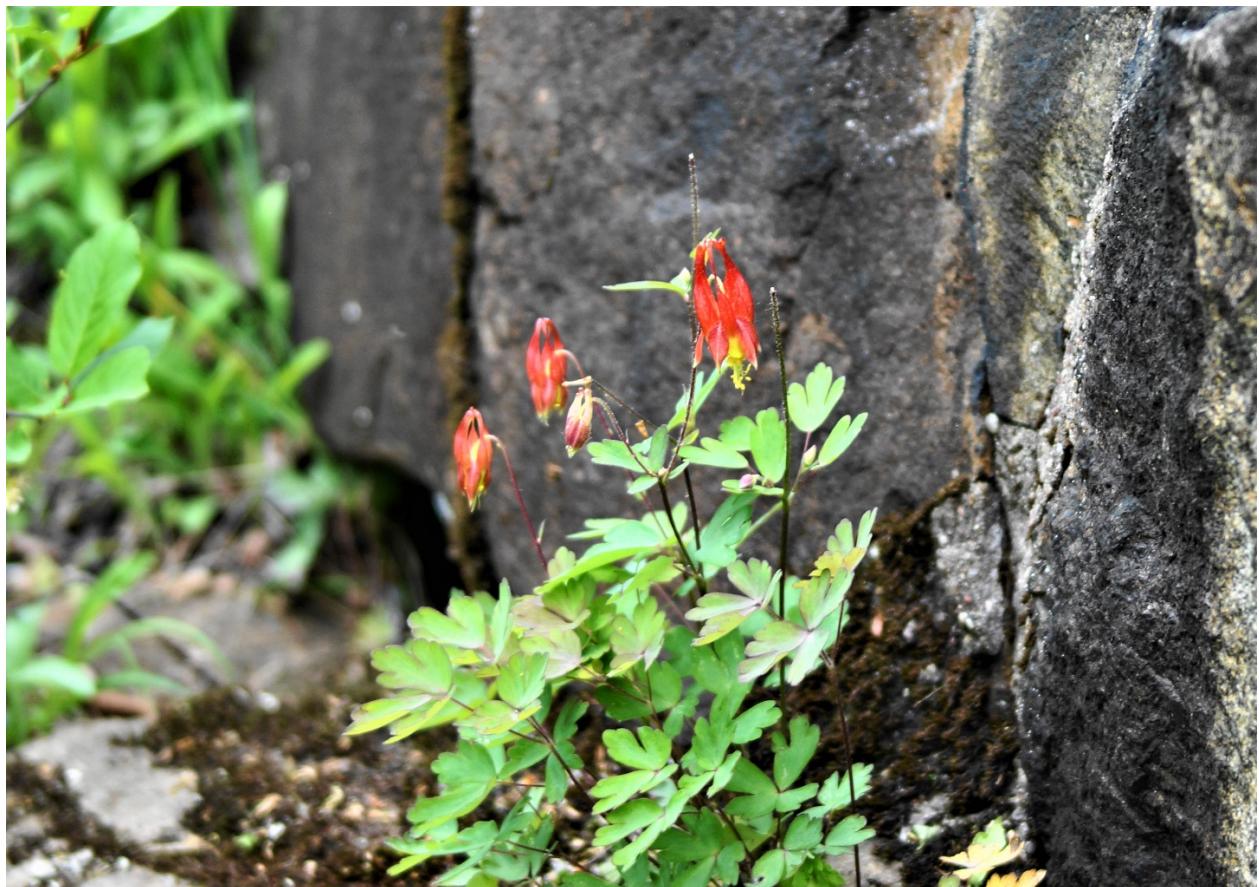
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Appendix A – Comprehensive List of Plants Noted within the IBA



Columbine (*Aquilegia canadensis*) near the rock summit



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Appendix B – CT DEEP NDDB COORDINATION RESPONSE LETTER

Appendix C – FOREST BIRD HABITAT ASSESSMENT



Great Crested Flycatcher (*Myiarchus crinitus*)



Audubon CONNECTICUT

Forest Bird Habitat Assessment

**East Rock Park, City of New Haven
New Haven, CT**

437.3 Mapped Acres



Assessment Date: May 24, 2016

Report Date: September 9, 2016

Prepared for: City of New Haven

Prepared by:

Audubon Connecticut

Ferrucci & Walicki, LLC

Connecticut Agricultural Experiment Station

Bird photos courtesy of Patrick Comins, Audubon Connecticut and AJ Hand (left to right): Black-throated Blue Warbler, Scarlet Tanager, Wood Thrush, and Black-throated Green Warbler. All other photos are from this property and are courtesy of Ferrucci & Walicki, LLC unless otherwise noted.

Background

Breeding bird surveys have shown that the forests of New England are globally important for bird populations. Connecticut's **forests are home to some of the highest concentrations of bird species breeding in the continental United States**; they are a "nursery" for approximately 70 species of neo-tropical migratory birds. Although some of these birds are still common in our area – **many are experiencing long-term population declines and have been identified by Audubon Connecticut as Priority Species**. Audubon Connecticut's Forest Bird Initiative focuses its conservation efforts on **Priority Species** giving us an opportunity to keep these species common before they become threatened or endangered.

Since 85% of our region's forests are privately-owned, large blocks of forest may be owned by hundreds of individual landowners with different priorities. Even the smallest properties can be critical parts of large forested landscapes that provide high-quality habitat for breeding birds. **Small actions by individual forest landowners can have a significant impact on maintaining large blocks of high quality habitat for future bird populations.** Audubon Connecticut is partnering with foresters, the Department of Energy and Environmental Protection, and the Connecticut Agricultural Experiment Station, to provide **technical assistance and educational opportunities for landowners** who want to make a difference for birds in their forests. If you are interested in taking the next steps in improving and diversifying your woods with birds in mind, specific activities may be eligible for cost-share through the USDA Natural Resources Conservation Service (NRCS). The NRCS is a federal agency whose mission is to help farmers and landowners complete activities that improve conservation values on their properties.

Habitat assessments and bird surveys are provided to qualifying landowners free of charge due to generous support from the U. S. Forest Service, the Northeast State Foresters Association and individual donations.

Purpose

Information in this report is presented from the landscape level to the property level. This assessment was conducted by an Audubon biologist, Connecticut Agricultural Experiment Station technicians, and a Connecticut licensed forester in order to:

- Determine what birds are currently utilizing the habitats on the property.
- Describe and assess current forest bird habitat conditions on the property.
- Make recommendations for protecting and improving habitat for a suite of priority forest birds.

Birds and Habitat Types

The Bird Watcher's Dozen, listed on page 3, is a representative subset of Connecticut's Priority Birds. These species are relatively common in CT and were the birds we focused on during your habitat assessment. A forest with suitable habitats for these species likely provides habitats for a wide range of additional species.

The Birdwatcher's Dozen - Connecticut



American Woodcock
Call: Peent
Habitat: Deciduous woods with a dense understory. Requires some open areas for courtship display.



Black-throated Blue Warbler
Song: Beer, beer, beer, bee
Habitat: Deciduous or mixed woodlands with 50-80% canopy cover and a dense shrub understory. Sensitive to forest fragmentation.



Black-throated Green Warbler
Song: Zee, zee, zee, zoo, zee
Habitat: Strongly associated with Hemlocks. Prefers a closed canopy and uneven-aged woodlands.



Chestnut-sided Warbler
Song: Please, please, please to meetcha
Habitat: regenerating deciduous woods of 5-10 years old.



Eastern Wood Pewee
Song: Pewee or wee ooh
Habitat: Prefers deciduous woods with a nearly closed canopy and an open mid-story. Snags serve as foraging perches.



Louisiana Waterthrush
Song: Hey, hey, hey, watch where your going
Habitat: Forages along woodland streams, nests adjacent to stumps and other woody debris, prefers a nearly closed canopy.



Pileated Woodpecker
Song: Key, key, key, key, key....loudest in the middle
Habitat: Requires large trees for nesting and roosting cavities. Forest block size and the presence of snags are also important.



Red-eyed Vireo
Song: Here I am, where are you
Habitat: Requires moderate understory vegetation. Forages in the mid-story and canopy. Often found near canopy gaps.



Scarlet Tanager
Song: A scratchy cheerily, cheerilo; the call sounds like chick burr.
Habitat: Uneven aged deciduous woods (oaks and maples) with a mostly closed canopy.



Veery
Song: a descending spiral of notes
Habitat: Deciduous woods with a moderately closed canopy and a dense understory. Uses woody debris for nest sites and shelter. Often found in riparian areas.



Wood Thrush
Song: Eolay, ching, ching
Habitat: Deciduous or mixed woods with a closed canopy and a moderate mid-story and shrub layer. Likes a fairly open forest floor with damp soil.



Worm-eating Warbler
Song: an insect like trill
Habitat: Found on slopes with mature deciduous or mixed trees. Prefers a closed canopy and a shrubby understory.

Developed by Audubon CT with support from NEFA and USFS. Photos by AJ Hand, P Comins, and C Folsom-O'Keefe.

Priority Birds

We share our northern forests with as much as 90% of the global breeding populations of dozens of species of migratory birds, including the Scarlet Tanager, Wood Thrush, Black-throated Blue Warbler, and Worm-eating Warbler (Partners in Flight). We have a responsibility to look out for the future of these birds because our forests are the core of their breeding range. Audubon Connecticut refers to these birds as **Priority Species**. Fortunately, because these birds are still common in our region, we have the opportunity to protect and enhance their breeding habitat now before they become threatened or endangered. Knowing which species are or may be nesting on your property is a great way to ensure that you're making a positive difference. A full list of species observed on your property during the habitat assessment can be found in Appendix A.

Connecticut Priority Birds					
Mature Hardwoods/Mixed Forest	Confirmed	Potential	Young Hardwoods /Mixed Forest	Confirmed	Potential
American Redstart	X		Canada Warbler		
Black-and-white Warbler	X		Chestnut-sided Warbler		
Blackburnian Warbler			Eastern Whip-poor-will		
Black-throated Blue Warbler			Northern Flicker	X	
Blue-gray Gnatcatcher		X	Ruffed Grouse *		
Blue-headed Vireo			Forest Edges/Dense Shrubs		
Broad-winged Hawk			Baltimore Oriole	X	
Brown Creeper			Black-billed Cuckoo		
Cerulean Warbler			Blue-winged Warbler		
Eastern Wood Pewee	X		Brown Thrasher		
Hairy Woodpecker *	X		Eastern Towhee		X
Hermit Thrush			Gray Catbird	X	
Hooded Warbler		X	Indigo Bunting		X
Northern Goshawk			Orchard Oriole		
Ovenbird	X		Prairie Warbler		
Pileated Woodpecker *		X	Rose-breasted Grosbeak	X	
Purple Finch			Yellow-billed Cuckoo	X	
Red-eyed Vireo	X		Riparian Corridors or Wetlands		
Red-shouldered Hawk		X	Barred Owl *		
Ruby-throated Hummingbird		X	Eastern Kingbird	X	
Scarlet Tanager	X		Eastern Screech Owl *	X (I/o)	
Sharp-shinned Hawk			Great-crested Flycatcher	X	
Veery		X	Least Flycatcher		
Winter Wren			Louisiana Waterthrush	X	
Wood Thrush	X		Willow Flycatcher		X
Worm-eating Warbler	X		Mature Softwood Forest		
Yellow-throated Vireo		X	Pine Warbler		
			Black-throated Green Warbler		

* denotes year-round residents. I/o indicates that the land manager has noted this bird.

How the Assessment Was Done

For the purposes of this report, the East Rock Park property was broken into five areas with distinct land use and land cover types after superimposing the property boundaries over an aerial photograph. We then used a three-pronged approach to evaluate each stand: a biologist from Audubon Connecticut observed which birds were present, a consulting forester [from Ferrucci & Walicki] conducted a qualitative assessment of vegetation and natural features, and a team from The Connecticut Agricultural Experiment Station (CAES) completed a quantitative inventory of vegetation and structural attributes by sampling one point approximately every 6.5 forested acres. A total of 50 sample points were taken. These observations and data were combined into the assessment of your entire property. The Audubon Connecticut bird observations can be found in Appendix A and the CAES quantitative assessment can be found in Appendix B.

Property Summary

Overall this property provides a variety of habitats for many species of birds. This property is critical not only for the birds that nest and breed here, but is a magnet for migrating birds in spring and fall. This property is a recognized Important Bird Area, and due to its large size and strategically relevant location, serves as an irreplaceable stopping point for dozens of species of migrating birds along the Atlantic Flyway.

Many species of interior forest breeding birds were noted during our visit to the property. The mixture of upland and wetland hardwood dominated forest, along with open water, ephemeral drainages, a portion of the Mill River (which is tidally affected), and trap rock ridges and sheer cliffs all provide important potential food and nesting resources for many species. There are some pockets of softwood trees (pine and hemlock with scattered individuals of cedar) in the overstory and midstory scattered throughout the property which helps provide additional diversity. Many of the hemlock have died and or are in poor health due to hemlock woolly adelgid and/or hemlock scale. There are also some very large diameter "legacy trees" in the upland hardwood stand.

Right: A large crowned tulip poplar in the northwestern portion of Area 1 may act as a "legacy tree". These large diameter trees can act as magnets for birds and other wildlife while they're alive and can provide cavities as they begin to rot, alive or dead.



Left: Dense thickets of invasive plants like this burning bush in the northwestern portion of Area 3 can be found in places on the property. Invasive plants can provide beneficial wildlife habitat, but wherever possible, encourage native species that serve a similar purpose if preferable.

Invasive plants are a major issue in places on the property and if addressed, should be done so using a phased approach. Invasive plants can provide habitat structure that can be beneficial to some nesting and migrant birds so some invasive plants could be allowed to persist over time until native plants can be re-established in treated areas. This is especially true in riparian areas. If invasive plants are removed, replacing them with native alternatives that provide similar structural attributes, serve as sources of nectar and mast, and host a variety of insects (bird food) would be ideal.

Hemlock and trees on the property are declining and will continue to succumb to mortality or are already dead. Where safety is not an issue these trees could be left standing so they can help provide habitat as snags and downed woody material.

Landscape Context

The composition of the landscape that immediately surrounds your property affects how wildlife will use the property. Heavily forested landscapes, with large connected blocks of mature forest, will likely contain the suite of forest priority birds. The value in each category highlighted in **color** is the value that best describes this area. The values below are for the 2500 acres surrounding your property.

Feature	Value for forest birds			Comments
	Good	Fair	Low	
% Forest Cover	>70% of area	50-70% of area	<50% of area	Significant amounts of development surround the property
Forest Block Size	>2500 acres	500-2500 acres	<500 acres	Development, parcelization and fragmentation are common, and the forest block is smaller than 500 acres, but nearly composes 500 ac. itself!
% Established Forest >20 years (with some old forest >100 years)	>80% of forest	70-80% forest	<70% forest	It appears as though most of the forest in this area is established forest, and trees are frequently in people's yards
% Young Forest <20 years	3-5% of forest	5-10% of forest	<3% or >10% forest	There are minimal amounts of young forest in this area (<3%)

Landscape Description

As seen on the maps on pages 7 and 8, this property plays an invaluable role on a landscape level. It is the largest property in the area and provides an island of critical nesting, breeding and stopover habitat for birds, and provides year round habitat for many other wildlife species. This property is located within a very densely populated and highly fragmented landscape. Most of the development is residential with very small lots, though there is some industrial uses. The size and location of the property in the context of its surroundings is also important. It is part of a “green” space near development and the Long Island Sound, which helps it act as a magnet for wildlife – particularly migrating and nesting birds which can see it from the air. In addition to the size and location of the property, the fact that a portion of the Mill River is contained within the property and the Quinnipiac River flows just to the east, provides additional habitat opportunities.

Other important “green spaces” adjacent to the property which help to increase the value of the area for birds and other wildlife include the grounds at the Eli Whitney Museum, open and shrubby meadows and wetlands at a property owned by the South Central Connecticut Regional Water Authority (RWA), Edgewood Park, and the Quinnipiac River Marsh Wildlife Area. All of these areas including East Rock Park as the anchor, combine to form an important block of habitat for many species of birds and other wildlife.

Right: White pine regeneration in Area 2 underneath black birch saplings that have so far outcompeted them. The pine is a result of a pilot project done to remove dying hemlock and plant pine to retain a softwood component on the property.

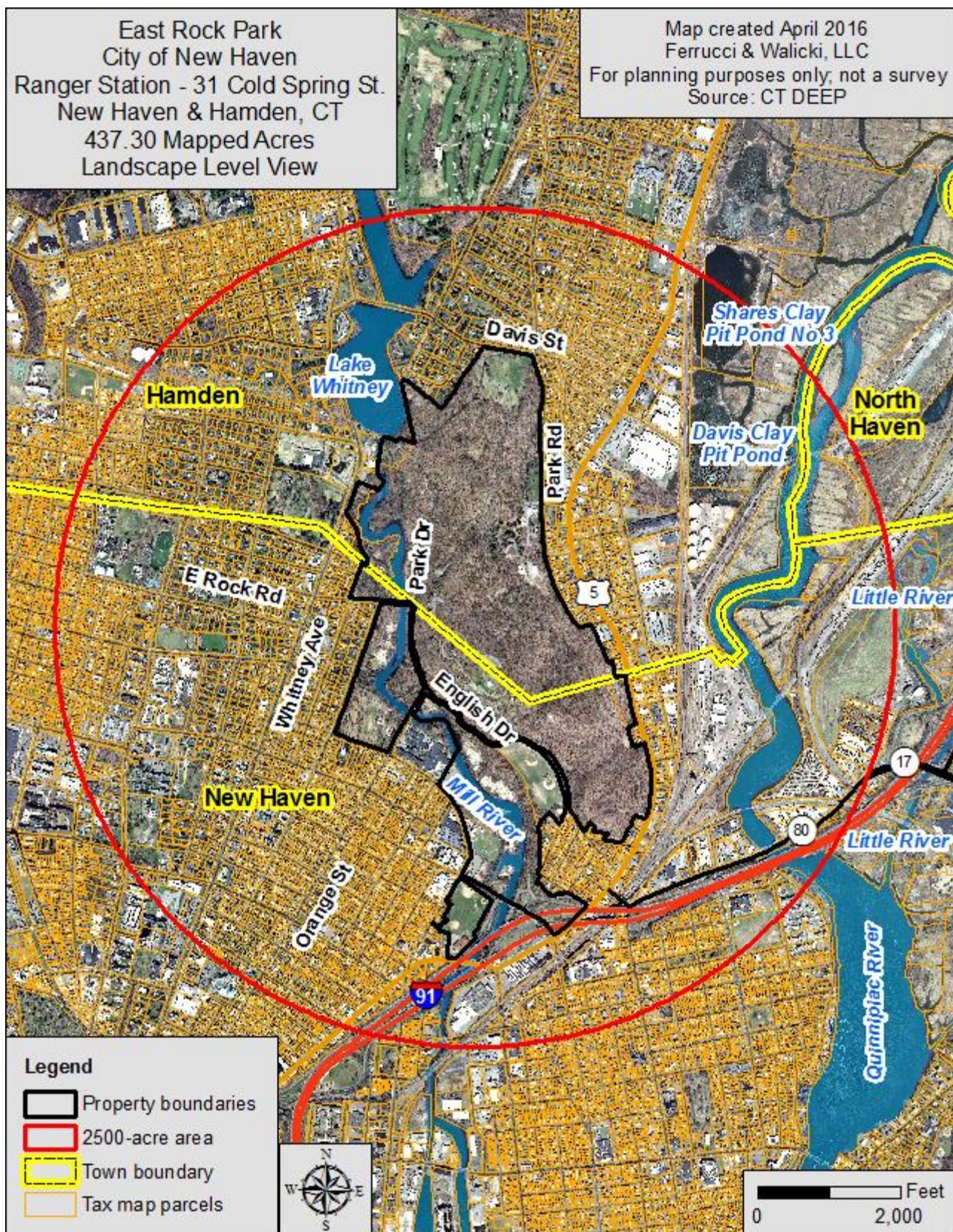


The property is adjacent to Lake Whitney, which is a reservoir frequented by species such as Osprey, swallows and many other water oriented species. This is the largest fresh water body in the region examined in this report. Small maintained open areas, the water features, the presence of some softwood habitats, edges, wetlands, marshes, and areas of sheer cliffs on this property are valuable on the micro and macro landscape levels. Keeping visitor experiences in mind (human and otherwise), continuing to protect water quality and soil integrity while continuing to maintain and enhance the health, diversity and structural complexity of native vegetation on this property can improve habitat quality for birds and other wildlife.

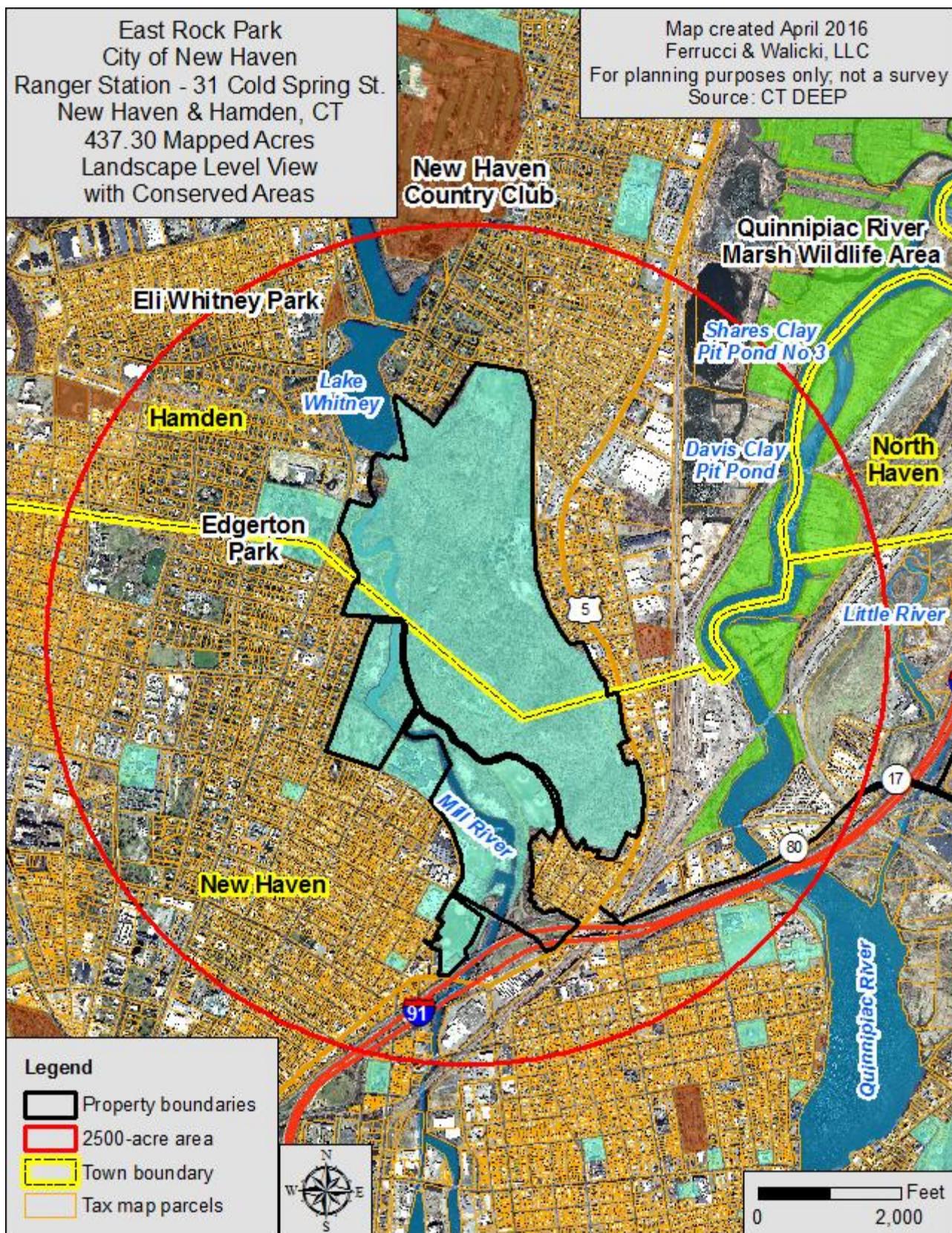


Above: View of the Rice Fields to New Haven and beyond from the Indian Head lookout. East Rock's large block of forest among such a heavily developed area along many species' migration routes enhances this area's importance for birds.

Landscape Context Maps



Nearby Conserved Properties



Property Narrative

General Description

This +/- 437 acre property is located just west of Route 5 and just north of Route 91 in the north-central portion of New Haven, Connecticut and the south-central portion of Hamden, CT. As evidenced by stone walls, stumps, developed areas, hiking trails, bridges and roads, and many historical photos some of which are prominently displayed, this property exhibits a long history of use by people. The land's history of human use has helped to shape this property into what we see today.

Right: The multiple sprouts from a fallen tree along the trail in Area 3 is one of many interesting sights trail users can observe.



This property has a great mix of habitats with many features that are beneficial for a wide variety of birds. In addition to the upland forest which provides a respite for many species of birds during spring migration, there are also trap rock ridges, a tidally affected portion of the Mill River, and wetlands. Our visit took place toward the end of May, which is at the tail end of spring migration and, for many species in the beginning of their breeding season. Many of the birds noted during our visit to the property were breeding on the property, but a few may have been utilizing the habitats while migrating further north to breed. The mixture of upland hardwood forests, some containing a residual but declining softwood component, forested wetlands, riparian forests, open areas, developed areas, sheer cliffs, and a relatively slow-moving portion of the Mill River all help to provide a diversity of cover, nesting sites, and foraging areas for a multitude breeding and migrating birds.



Left: The very thin crown of a dying hemlock in the central portion of Area 1.

Snags (standing dead trees), cavity trees, and coarse and fine woody material were found throughout the property in relatively high numbers. This is at least in part due to the declining health of hemlock in the area which frequently has resulted in hemlock mortality. Continuing to recruit these features by leaving snags and cavity trees where safety is not a concern, and, potentially, by periodically cutting some trees (especially hardwoods) and leaving their tops whole or mostly whole can help provide continued habitat diversity.

The quality of the vertical and horizontal structure on this property varies, but overall provides good to excellent habitat. While portions of the area containing minimal amounts of functional understory, in other places the loss of hemlocks has allowed for light to reach the forest floor, stimulating some growth in the understory. Much of the value of this property is in the fact that it is a relatively large area of forest in a highly developed landscape.

Even though the park is fragmented heavily with paved access roads and numerous well-used hiking trails, it provides an excellent stopover and nesting area for many species of birds. The riparian areas along Mill River are especially well-used in migration. In addition to that, thermals associated with the sheer rock ledges, provide excellent gliding locations for a variety of raptors.

Buildings, Roads, and Yards

Habitat loss and degradation caused by human development are some of the leading threats to Connecticut's wildlife. Forests become fragmented when they are broken into small, unconnected patches. Causes may include residential and commercial development, roads, houses, and lawns. Think about the following features to keep your forest intact and functioning for birds.

Feature	Condition			Comments
	Good	Fair	Needs Work	
Building Envelope	Small	Moderate	Large	Outbuildings increase the footprint of the built environment
Lawn	Small	Moderate	Large	Due to the soccer and baseball fields at Rice Fields. Dense edge vegetation and nest boxes in this area help improve habitat diversity.
Landscaping	Lots of native plants and nectar sources	Some native plants	Few or no native plants	Increasing native sources of nectar, mast and structural components (i.e. small, densely growing trees and shrubs) that can provide cover and potential nesting areas can improve habitat near developed areas and/or other open areas such as Archery Field.
Forest roads and trails	All <20' wide	Most < 20' wide	Many >20' wide	Many access roads throughout the park are paved and are fairly wide.
Forest edges	All soft edges	Some soft edges	No soft edges	Currently there are minimal amounts of soft edges near the river and some along Rice Fields and Archery Field. There may be potential to create more soft edges in these & other parts of the property.

Plant Diversity

Forest birds rely on a diversity of native plants for food, cover, and as nest sites. Maintaining a variety of native plants and controlling non-native, invasive plants benefits birds in your woods.

Feature	Condition			Comments
	Good	Fair	Needs Work	
Native plant diversity	High	Moderate	Low	This property has a good diversity of native species with some unique habitat types especially in the higher elevations of the less populated parts of the park.
Invasive plant infestation	None	Low	Moderate to severe	Invasive plants aren't everywhere, but where they occur, populations can be very dense
Soft mast native fruits and berries	Abundant	Some	Absent	Black cherry, apple trees, spicebush, lowbush blueberry, huckleberry & maple leaf viburnum are found in places on the property, but are not uniformly distributed.

Feature	Condition			Comments
	Good	Fair	Needs Work	
Softwood pockets in hardwood stands	Present		Absent	Hemlock was once a major component of the forest, but much of the hemlock is either dead or dying. Some pockets of white pine exist in the understory some of which were part of a planting project. Continuing to enhance the softwood component would benefit breeding birds and migrants.

Forest Structure

Well-developed forest structure can be a signature of a healthy forest and key to supporting a wide diversity of living things in your woods. It's not mess; it's structure!

Feature	Condition			Comments
	Good	Fair	Needs Work	
Understory	Dense	Moderate density	Sparse	A well-developed understory of desirable native species is present in parts of the property. Other times the understory is either functionally absent and sometimes dominated by invasive plants.
Midstory in mature forests	Dense	Moderate density	Sparse	The midstory is moderately dense in many places. Beech in particular forms dense pockets of midstory in places.
Canopy gaps in mature forests	Present		Absent	Where present, there is mostly desirable native plants providing good structural diversity, though invasive plants exist in some openings as well. Gaps will increase with the continued decline of hemlock and ash. Monitoring these areas for the development of invasive plant populations and treating them before they become established is important.
Leaf litter	Present		Absent	
Snags and cavity trees	Many	Some	Few or none	Present in varying levels throughout the property, but many places contain dead hemlock
Downed dead wood	Many	Some	Few or none	Coarse woody material is frequently present, but fine woody material is less prevalent
Big trees	Present		Absent	Many

Other Habitats

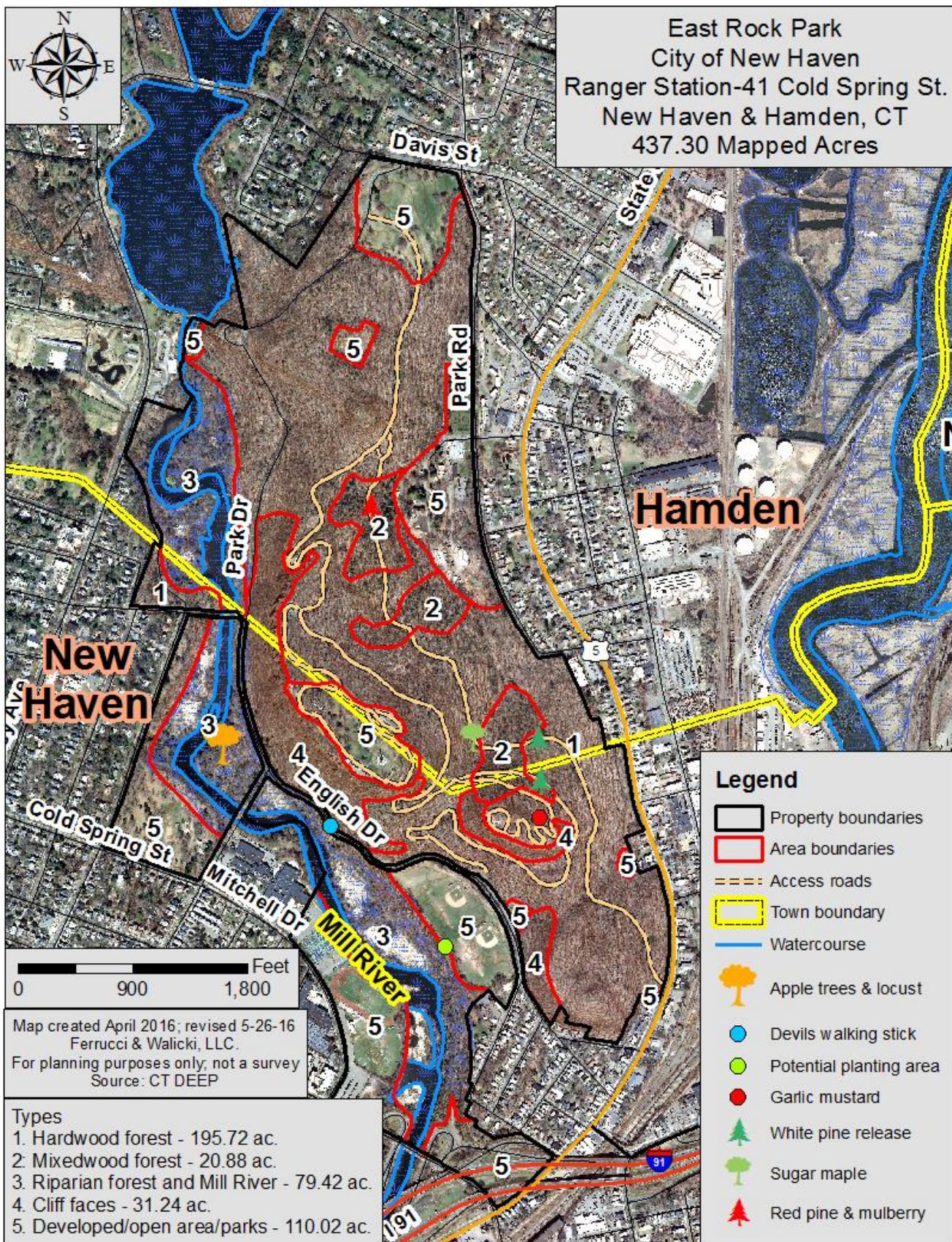
These habitats add diversity and habitat value for birds within forested landscapes.

Feature	Condition			Comments
	Good	Fair	Needs Work	
Waterways and riparian areas	Good condition	Fair condition	Poor condition	The riparian areas along the Mill River appear to provide excellent cover and nesting opportunities for a variety of species in places in spite of a high percentage of the vegetation being invasive. In addition there are places of compaction and minimal amounts of erosion along the shorelines of the Mill River due to heavy foot traffic.
Wetlands	Good condition	Fair condition	Poor condition	Again generally good but with invasives in areas
Meadows	> 1 acre AND mowed every 2-3 years	> 1 acre OR mowed every 2-3 years	< 1 acre AND mowed every year	Archery Field has great potential to improve upon the plantings and mowing regime. Making sure mowing is done at times when it makes most sense for birds and other wildlife and increasing natives sources of nectar and mast can make this area even better.
Hayfields	Grassland bird-friendly		NOT Grassland bird-friendly	N/A



Above: Large diameter or “coarse” woody material in the northwestern portion of Area 1. Having sufficient amounts of coarse wood material can provide a source of food, shelter and cover for birds and other wildlife.

Property Features Map



Stand Descriptions and Recommendations

For the purposes of providing recommendations, the property was broken into five distinct land use and land cover types. These include two forested stands, partially forested riparian areas and the Mill River, sheer cliff faces, and developed areas that surround the office, athletic fields and other infrastructure. The Property Features Map on page 14 shows the locations of the areas as well as some interesting features we noted during our visit. Each area is special and offers unique habitat opportunities.

The following descriptions and recommendations contain language that you may wish to become more acquainted with. Some unfamiliar terms can be looked up in the glossary at the end of the report and may include words used by foresters to describe woodlands or different management activities. Becoming more accustomed to this language will help you in communicating your property goals.



Area 1: Hardwood forest (195.72 ac.) – Area 1 is the largest stand and makes up all of the upland hardwood forest on the property. The topography is highly variable, and the soils are generally well-drained with short steep sections, and pockets of some more mesic soils. The higher elevations contain relatively thin soils and short-bodied trees.

Left: In spite of limited heights of trees due to thin soils, portions of Indian Head contain good structural complexity with an overstory, a relatively dense midstory and scattered understory shrubs.

This is an even-aged to two-aged stand which has a well-developed, fairly tall (in most places), mostly closed canopy as well as some sapling and small

pole-sized trees. The northern portion of the stand is older and more established than the southern portion. The most commonly found overstory species include a variety of oaks with hickory, black birch, red maple, sugar maple, beech, tulip poplar, sycamore, and white ash with pockets of declining hemlock. Hard and soft mast producing species throughout this area include oak, beech and hickory (hard mast) and an occasional black cherry (soft mast). The higher elevations contain some interesting tree species that aren't frequently observed in the area including what appears to be post oak.

Right: A close up of the leaf at Indian Head that may be post oak.

Populations of white ash are present but are also showing fairly severe decline. Ash trees in the northeastern United States are in decline from "ash yellows" and "ash decline" and are expected to be further impacted by the non-native invasive emerald ash borer beetle. No sign of the beetle was detected on our visit, though it is known to be in the area. There were a fair amount of snags found in this area mostly due to dead and dying hemlock. The presence of snags on the property are



important for a variety of species that feed on insects on and in snags as well as their potential to become cavity trees which can be used by birds and other wildlife for nesting and cover.

Midstory tree species include beech and red maple with an occasional hemlock along with witch hazel. The midstory is moderately dense in many places. A dense midstory and understory are important features for forest nesting birds in our area because the vast majority of these birds nest between ground level and 30 feet above the ground. Regeneration, native shrubs, and other vegetative features that occur in these layers can help provide quality habitat for a variety of species of birds and other wildlife.

A functional¹ understory (i.e. vegetation from 0-5 feet tall) is lacking in places, but is present in others. Where understory vegetation is present, species frequently include a varied mix of tree seedlings and saplings, fern, witch hazel, rhododendron (frequently found along roadsides), herbaceous species including maple-leaf viburnum, and invasive plants as well as some pockets of lowbush blueberry. Non-native invasive plant species are located in portions of this area including garlic mustard, Japanese barberry, Japanese stiltgrass, multiflora rose, autumn olive, and Asiatic bittersweet. Populations of invasive plants tended to be worse along the roads, edges, and in some openings.



Above left: Dense native tree seedlings and small saplings (mostly black birch) in the central portion of Area 1. This regeneration was able to become established due to the canopy gap that exists above it (picture above right) which allows sunlight to reach the forest floor.

Important features for forest birds in this area includes the heavy preponderance of oak in the overstory, pockets of dense blueberry, rhododendron and other understory plants, the presence of some softwood in the overstory and midstory, and the semi-open areas near the heights of land that contain low, shrubby growth. There are many microhabitats within this stand which provide diversity. Some of which we noted during our visit were a sugar maple grove noted on the Property Features Map on page 14 and an old, now somewhat overgrown garden close to one of the several attractive old stone bridges.

Forest birds that were present in this stand include Eastern Wood Pewee, Red-eyed Vireo, Wood Thrush, Worm-eating Warbler, and Scarlet Tanager, among others.

¹ "Functional" in this case refers to bird habitat. Usually it refers to the ability of a certain feature to provide cover, forage, nest location or other requirements for breeding.

Recommendations for Area 1:

In many places, active forest management on the property may be either unfeasible or potentially undesirable. This is due to a potential lack of access, sections with steep, rocky slopes, and perhaps most importantly the high volumes of recreational use that portions of this property receives year round. The following recommendations all may be feasible, but likely on a fairly small scale. If implemented they would need to be located in places that make sense based on general amounts of visitation and the potential positive impact the treatment may have. If any of these treatments are to occur, developing educational signage and programs that explain what is being done and why it is beneficial for birds, other wildlife and the forest in general would be useful. Audubon CT would be willing to help with this.

If the following recommendations are of interest, it may be desirable to implement a few different kinds of treatments as experimental/demonstration areas in specific places on the property. Creating demonstration sites in different forest types would also be helpful as the resulting habitat conditions can improve diversity of structure, age and size classes.

Treat invasive plant species. As infestations are relatively heavy in places, it may make sense to begin to tackle areas where populations are less dense and perhaps over time use a phased approach to begin to treat more. Also, address areas with eroding soils on trails, roads etc.

If an appropriate area can be found in which such an activity could be feasible and desirable, a limited crop/mast tree release in this area would allow more growing space for desirable species including oak, hickory, cherry, yellow poplar, and sugar maple. Increasing the growing space for these species can maintain and/or enhance the vigor of individual trees, which in turn can lead to an increase in production of flowers and mast. This is beneficial for birds because they can eat some of the additional mast, or feed on insects that may be feeding on the flowers. Sunlight reaching the forest floor may also stimulate the growth of an understory that attracts some species such as the Veery, particularly in wet areas. Release the crowns of crop/mast trees on at least three sides removing vegetation within 10 to 15 feet around the existing crown. If this is to be done, attempt to avoid areas with heavy infestations of invasive plants and/or treat invasive plants prior to cutting trees in the overstory.

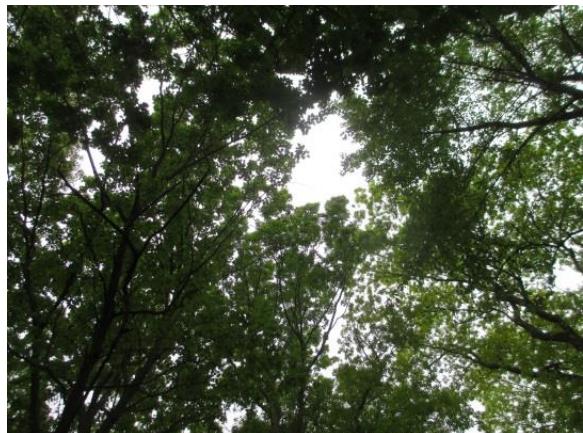
Consider creating additional small canopy gaps and/or expanding existing gaps to increase the structural diversity in the stand. Again, if this is to be done, avoid areas with infestations of invasive plants and treat invasive plants prior to cutting trees in the overstory. Canopy gaps encourage the development of additional size and age classes of trees which diversifies structure and provides additional options for cover, and potentially nesting and forage. Gaps can improve fruit production by allowing direct sunlight to reach understory shrubs and herbaceous species such as blueberry and maple-leaf viburnum. Canopy gaps also frequently increase the presence of insects which are a critical source of protein for birds during the nesting season. Interior forest breeding birds such as Scarlet Tanager and Eastern Wood-Pewee will often be found feeding in and on edges of small gaps within the forest.

Consider removing declining white ash that may become hazard trees along main well-traveled roads, while leaving some for future snags as long as doing so will not compromise safety for visitors to the property. If there



Above: In addition to a lack of sunlight in many places, deer browse (as seen on this heavily chewed rhododendron in the central portion of Area 1) is an issue that can negatively impact forest health and bird habitat.

are areas with high percentages of ash that appear to be declining, consider cutting at least some of the ash. The resulting canopy gaps can help to enhance additional size and age class diversity of vegetation, though monitoring for invasives following the opening of the canopy is important.



Above left: The young sugar maple seedlings in the forest adjacent to Rice Fields will grow very slowly and may persist in the understory for years as they are relatively shade tolerant. At some point however, unless the mostly closed canopy (picture above right) above them is opened to allow some sunlight, they will likely eventually die.

Consider releasing vigorous looking softwoods from competition where it makes sense to do so based on overstory composition and condition, and the location within the landscape of the trees to be released. Maintaining and enhancing a vigorous softwood component within a hardwood forest, especially when there can be groups of softwood as opposed to scattered individuals can be beneficial for a variety of species. A few such species include Black-throated Green Warbler, Blackburnian Warbler, Magnolia Warbler, Brown Creeper, and Pine Warbler, all of which may not be breeding here, but likely use the area during migration.

Where feasible, retain snags, cavity trees, and some large diameter/wolf trees.

If trees are to be cut, consider leaving the tops of felled trees whole or mostly whole to provide additional fine woody material. Where possible, periodically pile 2-3 tops together to enhance the functionality of that feature.

Area 2: Mixedwood forest (20.88 ac.) – This area is found in portions of the center of the property. Much more of the property used to be in a mixedwood (i.e. mix of hardwood and softwood trees) forest condition, but due to the effect of the hemlock woolly adelgid and hemlock scale – both non-native invasive insect pests – much of the hemlock that used to exist here is either dead or declining. Much of the hemlock that is still alive here is in fairly poor health.

The small pockets of mixedwood forest type that remain contain declining hemlock, and white pine. Some years ago a pilot project was begun to replace a portion of the dying hemlock with another softwood species, white pine. A small section of the property was cut, and following the cutting white pine were planted. As stated earlier softwood pockets can provide a habitat feature that enables some species of birds and other wildlife to use an area for breeding or other life requirements that without the softwood may otherwise be unsuitable or less desirable for such species.

The white pine in this area is now mostly an understory and lower midstory species that has been outcompeted by the hardwood species (mostly black birch) which regenerated naturally following the cutting that took place. Though the pine is still in fair health they are growing relatively slowly and over time due to lack of sunlight may

stagnate and eventually die. One way to avoid this would be to increase the amount of sunlight reaching the pine by cutting some of the birch saplings that are currently overtopping the pine.



Above: The pilot project in Area 2 that included the patch cutting of trees and subsequent planting of softwoods has been moderately successful in that there is still a component of softwood growing in the understory. If possible, cutting pockets of the black birch saplings that overtop them to release the softwood saplings could help ensure they become a part of the next forest. This softwood diversity can help provide habitat that hardwood forests alone may not.

Bird species noted in this area include Wood Thrush and Gray Catbird. With an increase in prevalence of healthy softwood, species such as Pine Warbler, Black-throated Green Warbler, Blackburnian Warbler, and Blue-headed Vireo may benefit as breeding and stopover habitat becomes more abundant.

Recommendations for Area 2:

As hemlock continues to decline the softwood component of this stand is likely to become less functional as individual trees are not as useful as groups of softwood trees. In order to improve the possibilities of softwood remaining a viable and functional part of this property, consider augmenting native regeneration with targeted plantings. Species to consider include white pine and Norway spruce. Each of these species serves a unique ecological purpose, and certain suites of species of birds and other wildlife will be more prone to use some over others so keeping the softwoods diverse can be important.

In the area where trees were cut and white pine were planted, consider releasing some of the white pine saplings by cutting some of the black birch saplings overtopping them.

If desired, consider attempting to find places in this stand or others where planting some additional softwood trees would be reasonable. If this is done, plant a mix of softwoods, attempt to plant them in small groups and keep in mind the relative amounts of sunlight reaching the seedlings at the time of planting as different trees will have different tolerances of shade.

Area 3: Riparian forest, wetland and Mill River (79.42 ac.) – This area is found along the western side of the property and generally encompasses and surrounds the portion of the Mill River that flows through the property. Soils in this area are mostly poorly-drained and relatively flat. Some structural diversity in terms of dense understory was found in this area. Much of the vegetation along the river is invasive including phragmites and knotweed toward the southern end of this area, and dense patches of burning bush and multiflora rose along the northern end. Some native plants also exist. Interestingly, it appears as though irrespective of whether or not other features of the invasive plants here are beneficial (i.e. nectar and mast), the structural attributes provide good cover and potential nesting areas for a variety of migrants and breeding birds.

Right: The Mill River with dense vegetation along its banks that can provide great cover for a variety of species.



Many of the trees in the overstory in Area 3 are red maple, but a variety of other hardwoods are found here as well including ash, oaks, sassafras, hackberry, hickory, elm, basswood, willow, beech, locust, Norway maple, and some birches. A portion of this area east of the headquarters for the park contains an interesting mix of species that occupy portions of the overstory and midstory including some crabapple trees and black locust. The midstory is generally lacking, and outside of the shrubby wetland areas near the northwestern end of the area, overstory canopy is generally closed. Where canopy gaps exist the understory is frequently occupied by invasive plants. Some plantings of shadblush and other saplings have been completed along the river in places over the last several years, which eventually can enhance native sources of nectar and soft mast. Plantings such as these, especially when the plants have sufficient sunlight to produce fruit can be very beneficial for a variety of species of birds and other wildlife.



Above: Dense invasive plants cover portions of Area 3 as seen here in the west central portion of the area.

Understory species in this area include fern, poison ivy, rhododendron and a variety of invasive plants. In addition to the invasive plants in Area 3 mentioned above, other invasives include privet, mugwort, bittersweet, Norway maple, locust, Japanese barberry and garlic mustard. Portions of this area contain some of the densest populations of invasive plants on the property.

In places, the understory vegetation provides good cover and nesting substrate, and is relatively absent in others. Over time, attempting to slowly replace some invasive plants with native alternatives that can provide similar structural components and serve as native sources of nectar and mast would be ideal.

The riparian area and shrubby wetland west of the river near the northern end of the property is perennially a hot spot for migrating birds in spring. Deer populations in this area appear fairly high, and browse damage to native seedlings may be part of the reason invasive plants have been so successful in becoming established here.

Habitat features that are useful for birds in this area include patches of dense understory, access to water, some canopy gaps, and some trees and shrubs that produce soft mast.



Above: View from the bridge crossing the Mill River in the northwestern portion of Area 3. Frequently, a variety of waterfowl, wading birds, woodpeckers, and birds of prey can be seen in and above the water and in the dense vegetation along the shorelines.

Bird species noted in these areas include Great-crested Flycatcher, Warbling Vireo, Louisiana Waterthrush, American Redstart, Yellow Warbler, Baltimore Oriole, and Red-winged Blackbird.

Recommendations for Area 3:

Using a slow and deliberate phased approach, attempt to control some populations of invasive plants. As infestations are relatively heavy in places, it may make sense to begin to tackle areas where populations are less dense and again over time use a phased approach to begin to treat more.

If invasive plants that provide structural attributes used by birds and other wildlife are removed, attempt to replace them fairly soon after with native alternatives that provide similar structure, but can also provide native sources of nectar and mast. Removal of invasive and replacement with natives should take place in the fall, to avoid spring migration and the nesting season.

Continue to maintain and consider planting additional native species similar to the plantings that have been done over the last several years. If this is to be done, consider shrubs and small trees that can provide structure, nectar and mast. If there are areas where it would make sense to do so, consider planting some appropriate softwood species as well.

Where apple trees are noted, consider releasing them from any overtopping competition.

The riparian area by the Eli Whitney Museum receives heavy foot traffic. Reinforcing some of the trails with crushed gravel in this area might be considered.

Area 4: Cliff faces (31.24 acres) – This area is located mostly in the western and southwestern portions of the property, and contains areas of exposed trap rock and sheer cliffs. Vegetation in these areas is mostly limited to shrubs and small trees as soils here are very shallow to non-existent, and are generally excessively drained. This area is generally west and southwest facing. At the toes of the slopes, there are more trees mostly dominated by a variety of species of oak and hickory.

Right: The sheer cliff faces that give East Rock (seen here from the Indian Head vista) its dramatic appearance provide nesting habitat for a variety of important species of birds and plants.

These cliffs provide habitat for a variety of species of wildlife including some birds such as Peregrine Falcon and Common Raven that use the cliffs for nesting. In addition, hawks and vultures frequently glide over the cliffs using the thermals that are affected by the geologic feature and the heat absorbed and radiated by the cliffs. In addition, some of the best views in the area of the City of New Haven and the Long Island Sound can be found at the top of some of these cliff faces.



At the tops of some of the cliff faces there are cleared areas that allow the views noted above. The vegetation growing in the cleared areas is mostly shrubby with some saplings and small poletimber sized trees along with some pockets of invasive plants, particularly ailanthus. The dense regrowth that occurs following the clearing of these areas can provide good cover and nesting habitat.

Bird species noted in these areas include Yellow-billed Cuckoo and American Redstart.



Recommendations for Area 4:

Continue to monitor and maintain existing view clearings, roads, paths and trails in these areas. Otherwise, continue to allow these areas to develop.

Area 5: Developed/open areas/parks (110.02 acres) – This area is found in various parts of the property mostly in the west and southwest. It contains all of the developed facilities of the park including the Trowbridge Environmental Center, and associated maintained open park space, the Rice Fields and other athletic fields and facilities, a rose garden on the eastern side of the property, a developed area at the height of land where the monument exists, a mowed and maintained area around the parking area to access the main driving road to the top of East Rock, and Archery Field.

Left: A Tree Swallow using one of the nest boxes along the edge of Rice Field.

Many of the edges of these areas, especially the western edge of Rice Fields contain invasive plants.

Birds utilize all of these areas for different life requirements from nesting (i.e. nest boxes along the edge of Rice Fields, to feeding on the many insects that can be found even in the developed areas. Trees in these areas vary widely from ornamental plantings of copper beech to native plantings and naturally occurring native species in and along edges of other openings.

Most of the edges that surround the openings on the property are “hard edges”. This means the vegetation changes from very short, generally maintained grasses to tall, relatively mature forest very abruptly. In order to improve habitat for birds and other wildlife, it may be feasible to “soften” some of these edges. Softening the edges or creating a “stadium effect” creates a more gradual transition zone of vegetation between the grasses and tall trees beyond. This can be done by either cutting groups of trees along the existing edge and allowing vegetation in the cut areas to regenerate or by allowing some of the open areas along the edge to regenerate by stopping or increasing intervals between maintenance activities there. The best location for this on this property is probably at Archery Field.

Bird species noted in this area include Red-tailed Hawk, Tree Swallow, American Robin, Blue Jay, Common Yellowthroat, and Yellow Warbler.

Recommendations for Area 5:

Consider softening edges along some of the fields. If soft edges are to be created, be sure to choose areas where invasive plants don't currently exist. If invasives plants are nearby, treat invasives prior to cutting any overstory trees.

If feasible, over time, remove and replace invasive plants with native alternatives that can provide additional nectar, mast and structure for birds and other wildlife. One potential location for this where it could act as a demonstration site is along the west edge of Rice Fields as noted on the map on page 14.

Continue to maintain and consider installing additional nest boxes. The boxes installed in summer 2016 may now be sufficient for Rice Field but considering installing some boxes at Archery Field if a reasonable location can be found could be good. Where feasible, consider pairing some nest boxes. When they are paired, frequently one of the boxes will be occupied by a Tree Swallow which will chase other Tree Swallows away. This allows Eastern Bluebirds to nest in the other box, as their habitat requirements are different, they typically don't compete for the same food resources.

Summary of Recommendations

Some of these recommendations may not be able to be completed without some cost (i.e. the activities may be non-commercial).

Important Bird Area Small Matching Grants may be available for smaller project (up to \$2500). While the Urban Wildlife Refuge Partnership may be able to provide native plants and assistance in removing invasives.

All areas: Monitor for invasive plant species and treat them before they become widely established. Follow up treatments and monitoring are always recommended. In areas where trees may be cut, consider leaving the tops of felled trees whole or mostly whole to provide temporary structural components for birds and other wildlife.

Whenever possible, attempt to limit tree cutting during times of the year when birds may be nesting (i.e. April 15-August 15). If any of these recommendations are undertaken, we strongly recommend keeping the public informed of what is happening with signage and tours explaining what is happening and why. If trees are to be cut, you might consider working with local wood-fired pizza restaurants to utilize some of the wood harvested from the property for local burning uses.

Area 1: Attempt to treat invasives; limited crop and/or mast tree release; consider creating small canopy gaps to improve structural diversity; remove and retain some ash; retain and release healthy softwoods; retain snags, cavity trees and large diameter trees; consider creating brush piles.

Area 2: Consider softwood plantings; release white pine regeneration in experimental treatment area where pine was planted.

Area 3: Attempt to treat invasives using a phased approach; replace any removed invasives with native alternatives; consider additional plantings that can provide nectar, mast, and/or softwood conditions; release apple trees.

Area 4: Continue to monitor and maintain existing view clearings, roads, paths and trails in these areas. Otherwise, continue to allow these areas to develop.

Area 5: Soften edges; remove invasive plants and replace with natives that can provide nectar, mast and/or structure using a phased approach; continue to maintain and consider additional paired nest boxes.

Additional Property Recommendations:

- Continue working with your Forester and discuss implementing some of the recommendations.
- Update your existing forest management plan to include consideration for birds.
- Learn the *Birdwatcher's Dozen* by sight and sound.
- Start bird monitoring on my property.
- Learn more about invasive plants and develop a plan for monitoring and control.
- Talk with my neighbors (i.e. representatives from Hamden and the Eli Whitney Museum) about what I learned. Have a conversation about opportunities to coordinate management across property boundaries.
- Keep interior forest intact; avoid subdividing forest (or plan subdivisions that maintain maximum continuous forest cover), minimize construction of new roads or trails greater than 20 feet wide, and keep new buildings close to existing roads.
- Promote a diversity of forest age classes from very young (<20 years; <10% of the property) to very old (>20 years with some forest >100 years; >75% of the property) across the property and landscape.
- Promote a dense understory and midstory of native trees and shrubs.
- Retain biological legacies including large-diameter (24"+ DBH) living trees, snags, and downed deadwood.
- Retain tree tops on site during timber harvests and avoid or minimize lopping slash.
- Contact Audubon Connecticut for follow up assistance, to review a new or updated management plan, or to consult on the implementation of one of our recommendations.

Terms and Explanations

Big Trees: Live trees greater than 19 – 24 inches diameter at breast height (DBH which is measured 4.5 feet above ground level).

Importance for Forest Birds: Big trees are a key characteristic of old forests and high-quality mature forest habitat for songbirds. Researchers in Wisconsin found priority birds were more abundant and successful in forests with >10% of the live basal area in big trees (19+ inches DBH) than in forests with fewer big trees (Managed old-growth silvicultural study (MOSS), Wisconsin Department of Natural Resources, 2013). Structurally-sound, large-diameter trees are important stick nest sites for woodland raptors, such as the Northern Goshawk. If retained as legacies, these large trees can also provide cavity nest sites for large woodland birds including owls and Pileated Woodpeckers.

Building Envelope: Open space cleared around a house or other building.

Importance for Forest Birds: The 200-300 feet into the woods surrounding clearings and openings associated with development, such as houses, are noisier, less sheltered, and vulnerable to invasion by domestic animals and nest predators and parasites. The impacted area also favors a new group of relatively tough, generalist omnivores such as raccoons, jays and crows that outcompete and may prey on more specialized mature forest priority species, such as Wood Thrush and Black-throated Blue Warbler. Keeping building envelopes small is one way to minimize this negative impact on surrounding forest habitat.

Canopy: The uppermost layer(s) of tree foliage in the forest. Many second or third growth stands in CT contain similar aged trees and have a relatively uniform canopy height.

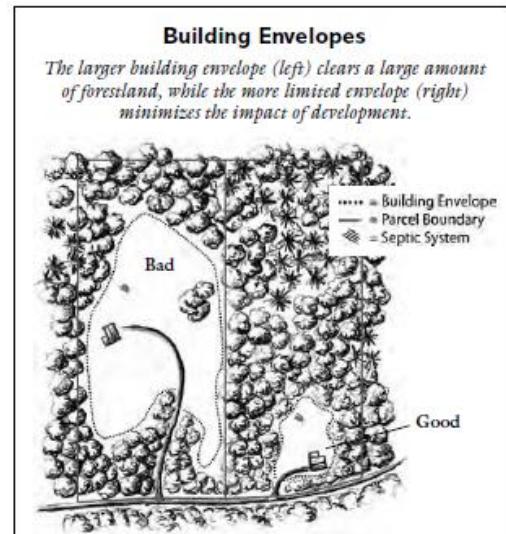
Importance for Forest Birds: Forest birds have specific habitat requirements for breeding and nesting. Canopy density, height, distribution, and species mix all impact the quality of habitat the canopy provides and in turn can affect the species of birds that may use the area.

Canopy Gap: A canopy gap is an opening in the canopy of a mature forest ranging in size from one tree crown up to 1/4 acre.

Importance for Forest Birds: Birds such as the Eastern Wood-Pewee forage in canopy gaps, which also allow sunlight to reach the forest floor through the upper canopy stimulating new growth in understory and midstory. Gaps created where trees fall, blow over, or are cut down are a normal and important part of a healthy forest and high-quality mature forest habitat.

Crop Tree: A tree that has been selected as desirable to manage into the future.

Importance for Forest Birds: See description of *Importance for Forest Birds* for *Crop Tree Release* below



Source: *Community Strategies for Vermont's Forests and Wildlife: A Guide for Local Action*. Vermont Natural Resources Council. 2013. Drawing by Jeannie Sargent.

Crop Tree Release: A silvicultural treatment in which individual trees or groups of trees are given additional growing space and sunlight by removing competition from adjacent trees. Removing adjacent trees that are competing with the crowns of crop trees is important to maintain vigor of crop trees. Crop tree release frequently works best when the trees are released from competition on at least 3 sides of the crown (out of 4 sides that can be likened to the cardinal directions) and at least 10-15 feet of growing space is created.

Importance for Forest Birds: Crop tree release (CTR) is a relatively small scale treatment that increases the vigor of individual trees or small groups of trees, which in turn can provide additional mast, as well as additional vegetation for nesting, cover and forage. In addition, CTR can provide coarse and fine woody material and can stimulate regeneration on the forest floor, which can in turn enhance structural diversity providing additional habitat opportunities.

Downed Deadwood: Coarse woody material (CWM) are downed logs and branches >4 inches in diameter. Fine woody material (FWM) are limbs and branches <4 inches in diameter including slash.

Importance for Forest Birds: CWM provides perch sites for singing (e.g. by Ovenbird) and other male courtship displays, and provides habitat for the insects and other arthropods that are a significant part of the breeding season diet of many birds. Ruffed Grouse tend to use CWM >8 inches diameter as drumming perches. When aggregated in piles (e.g. tree tops or slash piles) FWM offers a nesting substrate and cover for Louisiana Waterthrush and Veeries. Scattered individual pieces have minimal habitat value.

Forest Block: A large area of contiguous forest cover.

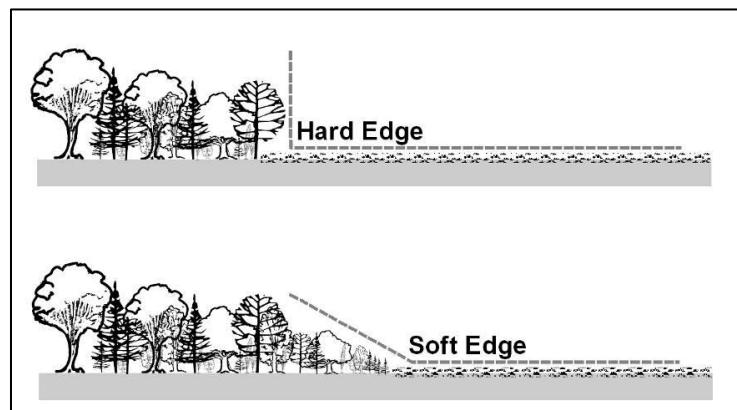
Importance for Forest Birds: Very large (>2500 acres) blocks of contiguous forest provide the highest quality habitat for interior-nesting birds like Wood Thrush that reproduce more successfully away from edges and development. Large blocks also likely contain the full range of habitat types and conditions required to support most or the entire suite of priority birds. Smaller forest patches >500 acres in size provide important habitat in more fragmented landscapes and can connect larger patches. Patches <500 acres in size can still support breeding birds in heavily forested landscapes and are important habitat during the migration season. Think about your land as it fits within a larger mosaic.

Forest Cover: Area of land that is forested or wooded.

Importance for Forest Birds: Heavily forested landscapes (70+% forest cover) provide the greatest quantity, diversity, and quality of habitat for priority birds compared to fragmented and/or developed landscapes with lower percentages of forest cover.

Forest Edge: The boundary between forest and open land, such as a field or backyard.

Importance for Forest Birds: The transition from low herbaceous vegetation to tree canopy can be considered either a “soft” or “hard” edge. A soft edge is a gradual change in vegetation height moving into the forest. This gradual transition is important for buffering interior forest specialists like the Wood Thrush from the incursions of nest predators (such as raccoons and skunks) and nest parasites (such as the Brown-headed Cowbird) that are frequently found in open and developed areas. A gradually increasing canopy height helps to shield interior-nesting birds



from view by predators and parasites. Additionally, the brushy conditions that often develop in a soft edge may provide breeding habitat for young forest habitat bird species including Chestnut-sided Warbler and Blue-winged Warbler.

Forest Structure: The density and physical orientation of live and dead vegetative, woody, and herbaceous plants and trees in a forest. See horizontal structure and vertical structure for more in-depth descriptions of different views of forest structure.

Importance for Forest Birds: Diverse forest structure can provide many habitat requirements for forest birds. Increasing the complexity of the forest structure through the maintenance or enhancement of tree and plant species diversity, the creation of canopy gaps, the establishment of regeneration, and the retention and recruitment of snags, cavity trees and woody material on the ground can all help to improve not only ecological diversity and forest health, but also can improve bird habitat.

Fragmented Forest: Forest that is broken into small, unconnected patches primarily due to some form of development (e.g. residential, commercial, or major roads).

Importance for Forest Birds: Fragmentation increases the occurrence of “generalist” wildlife species, such as raccoons and skunks, and the parasitic Brown-headed Cowbird both of whom decrease nesting success of interior-nesting forest birds. Fragmentation also decreases connectivity. Larger landscapes are better for forest interior birds and act as wildlife corridors for mammals and migrating bird populations. Isolated islands of habitats are at greater risk to loss of biodiversity.

Hardwood Forest: A forest dominated by broad-leaved (i.e. deciduous) trees which lose their leaves in the fall.

Importance for Forest Birds: Some breeding birds are associated with hardwood forests, such as Chestnut-sided Warbler, Eastern Wood-Pewee, and Scarlet Tanager.

Horizontal Structure: The arrangement of different habitat types across the landscape.

Importance for Forest Birds: A landscape with mature and young forest habitats, open fields, and wetlands would be rich in horizontal diversity. Landscapes with greater horizontal diversity support a greater diversity of breeding forest birds and other wildlife.

Interior Forest: Forest condition that occurs with increasing distance from a forest edge.

Importance for Forest Birds: As perceived from a bird’s perspective, interior forest conditions begin to occur approximately 200-300 feet from a forest edge. At this distance, negative edge-associated effects such as nest predation, parasitism, and creep from invasive plant species generally no longer occur. Interior-nesting species, such as Scarlet Tanager, Wood Thrush, Ovenbird, Black-throated Blue Warbler, and Red-eyed Vireo, have greater reproductive success when they nest away from forest edges.

Invasive Plant: A plant that is able to establish on many sites, grow quickly, and spread to the point of disrupting native ecosystems. Often non-native.

Importance for Forest Birds: Non-native, invasive plants, such as bush honeysuckles, bittersweet, Autumn olive, burning bush, buckthorn, and Japanese barberry, present a variety of threats to forest health in Connecticut and the northeast. Although some species of native forest birds successfully use these shrubby, woody plant species as nesting sites and eat their fruits, the fruits generally have low nutritional value and the invasive plants reduce the diversity of other nesting and foraging options in forest ecosystems. Many invasive plants can form dense uniform stands that outcompete and can crowd out native plants. The threat is exacerbated by its impacts on native insect populations that may require certain plants for food and in turn pollinate these native plants. This can eliminate two forms of food

resources for bird populations. Overall, non-native, invasive plant species degrade the quality of native forest bird habitat in our region.

Leaf Litter: Dead plant material such as leaves, bark, and twigs that has fallen to the ground.

Importance for Forest Birds: An abundant layer of moist leaf litter is home to an array of insects, mites, and spiders. These arthropods make up a significant component of Ovenbird, Veery, and Wood Thrush diets during the breeding season. Ovenbirds also rely upon a deep layer of deciduous litter for constructing their ground nests, and nest site selection is strongly associated with this habitat variable.

Mast Tree: A tree that produces seeds, nuts, or fruit eaten by wildlife. There are two general categories of mast: hard mast and soft mast. Hard mast includes oak acorns and nuts including hickory, beech, walnut, hazelnut and other nut producing trees and shrubs. Soft mast includes all fruits produced by shrubs and trees including blackberries, raspberries, blueberries, huckleberries, apples, shadblush, and black cherry among others.

Importance for Forest Birds: See description of *Importance for Forest Birds* for *Mast Tree Release* below

Mast Tree Release: This is basically the same silvicultural practice as described in *Crop Tree Release* toward the beginning of this section except it focuses on the release of mast trees specifically. The method of releasing the trees from competing vegetation is the same.

Importance for Forest Birds: Mast – both hard and soft – can be an important source of food for birds.

Even trees that produce large nuts like acorns which many songbirds do not eat because the nuts are too large can still provide valuable food sources for birds due to the volume of insects that feed on leaves and flowers.

Mature Forest Habitat: For birds a forest is considered structurally mature when the forest canopy is greater than 30 feet tall.

Importance for Forest Birds: Many priority birds breed in mature forest habitats where they find nest sites, cover, and food. Typically, the quality of mature forest habitat increases for forest birds as a forest ages and structure diversifies. Pole stands – the youngest type of mature forest habitat - are typically structurally simple and attract a small suite for forest birds including Ruffed Grouse and American Redstart. Older stands with understory and midstory layers, canopy gaps, large trees, snags, and logs, attract a much greater diversity of birds including Black-throated Blue Warbler, Wood Thrush, Canada Warbler, and Black-throated Green Warbler.

Midstory: Live, woody vegetation in the 6-30 foot height range including trees and shrubs.

Importance for Forest Birds: High stem and foliage densities of woody plants in this forest layer provide nest sites, foraging substrates, and protective cover for many forest birds. Stand-wide coverage is desirable but not necessary; well distributed patches are sufficient. The majority of priority bird species nest and/or forage within the first 30 feet of the forest floor. Nests of Wood Thrush, American Redstart, Black-throated Green Warbler, and Red-eyed Vireo are most commonly found in the midstory level.

Mixed Forest: A forest made up of hardwood and 25-75% softwood tree species.

Importance for Forest Birds: Some breeding birds are associated with mixed forests, such as Black-throated Blue Warbler, Wood Thrush, and Worm-eating Warbler.

Natural Resources Conservation Service (NRCS): An agency that is a branch of the USDA whose mission is to help farmers, ranchers and landowners achieve conservation goals on their properties.

Importance for Forest Birds: NRCS helps to fund on-the-ground activities to improve habitat conditions for wildlife, including birds.

Poletimber: Trees that are between 4.5 inches and 11 inches in diameter measured outside the bark at 4.5 feet above the ground.

Importance for Forest Birds: Frequently poletimber has foliage in lower canopy strata (i.e. in the midstory) than sawtimber-sized trees. If the midstory foliage is dense enough, forest breeding birds can use it for nesting, forage and cover. Species such as Wood Thrush use poletimber stands for nesting and as singing perches.

Sawtimber: Trees that are 11 inches or greater in diameter measured outside the bark at 4.5 feet above the ground.

Importance for Forest Birds: Sawtimber is often the largest and most mature trees in the forest and provide larger scale structure within a variety of forested habitat types. Sawtimber also tends to have greater capacity for seed/fruit production.

Silviculture: The art and science of growing trees. This is the study that forestry and forest management is based on.

Importance for Forest Birds: Many of the silvicultural techniques that are traditionally used in forestry are beneficial for creating and maintaining quality bird habitat when applied appropriately.

Snags and Cavity Trees: Snags are standing dead or partially dead trees that are relatively stable. Cavity trees may be alive or dead.

Importance for Forest Birds: Snags provide opportunities for nesting cavity excavation by Yellow-bellied Sapsuckers and Northern Flickers, and existing cavity trees provide potential nesting cavities for owls. Aspen and birch species are frequently chosen as trees to excavate. Cavities are often made in trees with the heartwood and sapwood decay fungi. Branches on snags may be used as foraging perches and nest sites. Suggested targets for snags and cavity trees combined are ≥ 6 per acre, with one tree >18 inches DBH and 3 >12 inches DBH.

Soft Mast: Soft fruits and berries.

Importance for Forest Birds: Fruits including cherry, apple, *rubus* species (e.g. blackberry and raspberry), dogwood, shadblush, and others are important food sources for forest birds. In the late summer and early fall, after fledging and before migrating, many birds feed on these fruits and the insects that are attracted to them in order to build up critical fat reserves needed to endure long fall migrations.

Softwood Forest: A forest dominated by coniferous trees, usually “evergreen” (the exception being tamarack), with needles or scale-like leaves.

Importance for Forest Birds: Some breeding birds are associated with softwood forests, such as Magnolia Warbler and Blue-headed Vireo. Other birds, such as Blackburnian and Black-throated Green Warbler, are associated with small clusters of softwood trees called inclusions in hardwood stands. For this reason, maintaining or increasing the softwood component in hardwood stands increases their overall habitat value.

Stand: Forested area on a property with relatively uniform vegetation composition, age class, size class, density, and site quality so as to be considered relatively homogenous.

Importance for birds: Birds require a variety of habitat types depending on the species for different stages of life and activities throughout the year (i.e. breeding, nesting, foraging etc.). Having a diversity of stand types, and features within stands can help provide quality habitat for different species and needs within birds' life cycles.

Understory: Live vegetation in the 1-5 foot height range, including tree seedlings and saplings, shrubs, and herbaceous vegetation.

Importance for Forest Birds: High stem and foliage densities of woody plants in the understory provide nest sites, foraging substrates, and protective cover for many forest birds. Stand-wide coverage is desirable but not necessary; well distributed patches are sufficient. Herbaceous plants may also be used by songbirds for foraging and nesting, but generally less so than woody plants. Species in this layer frequently used by birds include sugar maple, American beech, hobblebush, mountain laurel, *rubus* species, and striped maple. Black-throated Blue Warbler and Wood Thrush place nests in this layer, and Canada Warbler and Veery tend to nest on or near the ground, concealed by dense understory growth. The best breeding habitats for Prairie Warbler and Chestnut-sided Warbler are patches of dense, low growth with <30% overstory cover in patches >1 acre in size (young forest habitat conditions).

Vertical Structure: The complexity of vegetation and other structures as they are vertically arranged in the forest.

Importance for Forest Birds: A forest with a well-developed understory, midstory, and canopy exhibits complex or diverse vertical structure, which offers habitat for a greater array of bird species compared with a structurally simple forest. Non-living features, such as coarse woody material and the microtopography of the forest floor, add to the complexity of vertical structure.

Young Forest Habitat: Forest patches greater than one acre in size dominated by a high density of seedlings, saplings, and shrubs less than 20 feet tall.

Importance for Forest Birds: Several priority birds and many other wildlife species use young forests during all or part of their life cycle. Chestnut-sided Warbler, American Woodcock, and Blue-winged Warbler all use young forests during the breeding season. Although these species may be found in patches smaller than one acre in size, research has shown that abundance and nesting success is greater in larger patches. Young forest habitats include regenerating patchcuts, clearcuts, and old fields. Early-successional young forest habitats dominated by shade intolerant species such as aspen and paper birch are particularly valuable for woodcock and grouse. Shrublands that will never mature into forest, such as those associated with beaver wetland complexes, can also attract species associated with young forest habitats since they have a similar vegetative structure. Recent research has also shown the importance of young forest habitats as post-breeding habitat for birds that nest in mature forest, such as Worm-eating Warbler and Red-eyed Vireo. Young forest provides dense, protective cover for juveniles, and can also provide abundant sources of soft mast, which are important pre-migration food sources. Young forest habitats are ephemeral; they generally only persist 10-15 years where forest regenerates after a patch or clear-cut and slightly longer on old field sites. Due to natural forest succession and development, the amount of this habitat type is decreasing in our region, which is a threat to the species associated with it.

Appendix A - Bird species observed during habitat assessment. The numbers at the tops of each column indicate the area in which the birds were noted. The numbers in the column indicate the numbers of individuals noted, while an X indicates a species was observed.

Name: Corrie Folsom-O'Keefe, Eric Hansen, Dan Barvir Date: 5/24/16 Property: East Rock Park	1 hard wood forest	2 mixed wood forest	3 riparian forest	4 cliffs	5 open areas	NOTES
Canada Goose						
Mute Swan			L/O			
Wood Duck						L/O
American Black Duck						
Mallard					X	
Hooded Merganser						
Common Merganser						
Ring-necked Pheasant						
Ruffed Grouse						
Wild Turkey						
Great Blue Heron						
Green Heron						
Turkey Vulture						
Black Vulture						
Osprey						L/O
Bald Eagle						
Sharp-shinned Hawk						
Cooper's Hawk						possible
Northern Goshawk						
Red-shouldered Hawk						possible
Broad-winged Hawk						
Red-tailed Hawk					X	
American Kestrel						
Peregrine Falcon						L/O
Killdeer						
Spotted Sandpiper						possible
American Woodcock						
Rock Pigeon (i)						
Mourning Dove			X			
Black-billed Cuckoo						
Yellow-billed Cuckoo				X		
Eastern Screech Owl						
Great Horned Owl						

	1 hard wood forest	2 mixed wood forest	3 riparian forest	4 cliffs	5 open areas	NOTES
Barred Owl						
Eastern Whip-Poor-Will						
Chimney Swift						possible
Ruby-throated Hummingbird						possible
Belted Kingfisher						
Red-bellied Woodpecker						possible
Yellow-bellied Sapsucker						
Downy Woodpecker	X					
Hairy Woodpecker			X			
Northern Flicker	X					
Pileated Woodpecker						
Eastern Wood-Pewee	2					
Acadian Flycatcher						
Alder Flycatcher						
Willow Flycatcher						
Least Flycatcher						
Eastern Phoebe						possible
Great Crested Flycatcher	X		X			
Eastern Kingbird						
White-eyed Vireo			X			
Yellow-throated Vireo						
Blue-headed Vireo						
Warbling Vireo			X			
Red-eyed Vireo	4					
Blue Jay	X		X		X	
American Crow						
Fish Crow						
Common Raven						
Purple Martin						
Tree Swallow					X	
N. Rough-winged Swallow						possible
Bank Swallow						
Cliff Swallow						
Barn Swallow						observed
Black-capped Chickadee	X					
Tufted Titmouse						possible
Red-breasted Nuthatch						
White-breasted Nuthatch	X					

	1 hard wood forest	2 mixed wood forest	3 riparian forest	4 cliffs	5 open areas	NOTES
Brown Creeper						
Carolina Wren						
Winter Wren						
House Wren						possible
Blue-grey Gnatcatcher						possible
Golden-crowned Kinglet						
Eastern Bluebird						
Hermit Thrush						
Wood Thrush	3	1				
Veery						
American Robin		X	X		X	
Grey Catbird		X	X		X	
Northern Mockingbird						
Brown Thrasher						
European Starling (i)			X			
Cedar Waxwing			X			
Ovenbird	X					
Worm-eating Warbler	1					
Louisiana Waterthrush			X			
Northern Waterthrush						
Golden-winged Warbler						
Blue-winged Warbler						
Black-and-white Warbler	X					
Blackpoll Warbler	X					
Nashville Warbler						
Connecticut Warbler						
Mourning Warbler						
Common Yellowthroat	X		X		X	
Hooded Warbler						L/O
American Redstart	X		X	X		
Cerulean Warbler						
Northern Parula						
Magnolia Warbler	X					
Blackburnian Warbler						
Yellow Warbler			X		X (edge)	
Chestnut-sided Warbler						
Black-throated Blue Warbler						

	1 hard wood forest	2 mixed wood forest	3 riparian forest	4 cliffs	5 open areas	NOTES
Pine Warbler						
Yellow-rumped Warbler						
Prairie Warbler						
Black-throated Green Warbler						
Canada Warbler						
Eastern Towhee						possible
Chipping Sparrow						
Field Sparrow						
Savannah Sparrow						
Song Sparrow			X			
Swamp Sparrow						
White-throated Sparrow						
Dark-eyed Junco						
Scarlet Tanager	3					
Northern Cardinal	X					
Rose-breasted Grosbeak	X					male and female
Indigo Bunting						possible
Bobolink						
Red-winged Blackbird			X			
Eastern Meadowlark						
Common Grackle	X		X			
Brown-headed Cowbird					X	
Orchard Oriole						
Baltimore Oriole			X		X	
Purple Finch						
House Finch						
American Goldfinch			X			
House Sparrow (i)			X			
Total No. of Species per stand	20	3	21	2	10	

Appendix B – CAES Data

The pages below contain summaries of quantitative data collected from your property by the CT Agricultural Experiment Station

East Rock Park, New Haven

**327.3 acres of assessed forest land
50 sample points across property**

Quantitative habitat descriptions

The following pages provide a quantitative assessment of habitat features found on your property. The assessments were completed using a series of systematically located points across all of the forested area on your property, but does not include open fields and wetlands without trees (e.g., marshes).

At each point, we evaluated a range of habitat features on a 1/20 acre plot using the criteria shown below. These values were pooled to capture the range of conditions found across the entire property (pages B2-B8).

Forested portions of properties are often composed of distinct stands (also referred to as "areas" in this report) with relatively uniform vegetation composition, age class, size class, density, and site quality so as to be considered relatively homogenous. For example, the vegetation and structural attributes in conifer stands usually differ greatly from adjacent hardwood stands. Each stand may provide unique opportunities for providing habitat for a distinct suite of priority forest birds. The final pages include summaries at the stand level.

2015 Connecticut Agricultural Experiment Station habitat assessment team (l to r): Amanda Massa (Team Leader), Sarah Kucharski, Sarah Tolbert, and Supervising Technician J.P. Barsky.



Category criteria for 1/20 acre plots (26.33 ft or 8.03 m radius)

Vegetation cover, canopy closure, soft mast

- Absent - covered <5% of plot
- Low - covered 5-30% of plot
- Medium - covered 30-70% of plot
- High - covered >70% of plot

Canopy height

- Short - trees <20 ft tall
- Medium - trees 20-60 ft tall
- Tall - trees >60 ft tall

Nesting and wetland features

- Absent - not found within plot
- Inside - observed within plot
- Outside - observed outside of plot

Habitat features

- Absent - not found within plot
- Low - few leaves / one or two pieces of coarse woody debris
- Medium - average leaf litter/several pieces of coarse woody debris
- High - thick leaf litter / many pieces of coarse woody debris

East Rock Park, New Haven

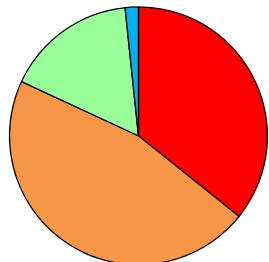
Property summary (327.26 acres, 50 sample points)

Groundlayer vegetation cover (0-5 feet tall)

	Absent	Low	Medium	High
Native herbaceous	36%	46%	16%	2%
Native shrubs	17%	67%	11%	5%
Non-native species	23%	43%	18%	15%
Species mix	Hardwood	Mixed	Conifer	
	100%	0%	0%	



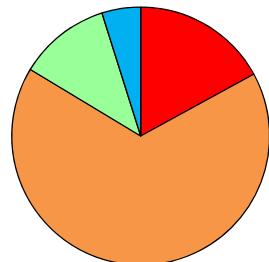
Native herbaceous



- Absent
- Low
- Medium
- High

Native herbaceous plants are ideal for foraging and provide cover for species such as the Veery. Typical examples include: asters, mayflowers, goldenrods, skunk cabbage, sarsaparilla, and jewelweed. These plants should be encouraged as they serve as a food source for invertebrates that are consumed by some birds, as well as providing sources of nectar, seeds, and fruit.

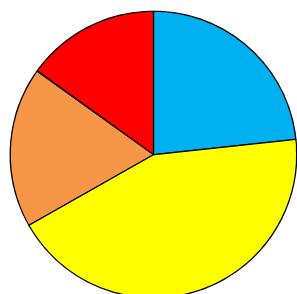
Native shrubs < 5 ft tall



- Absent
- Low
- Medium
- High

Native shrubs are relatively small woody plants that may bear fruit or host insects that provide seasonal forage for birds. Shrubs also provide a structural base for nests and cover from predators and weather for birds such as the Veery and Black-Throated Blue Warbler. Some examples of native shrubs are beaked hazelnut, brambles, mapleleaf viburnum, mountain-laurel, and witch-hazel.

Non-native species < 5 ft tall



- Absent
- Low
- Medium
- High

Non-native plant species may provide nesting opportunities, but because they decrease the overall diversity and quality of native habitat, it is desirable to replace them with native species. In addition, they do not support as many insect as native plants. Common examples of non-natives are: Japanese barberry, Oriental bittersweet, multiflora rose, Japanese stiltgrass, and winged euonymus.

East Rock Park, New Haven

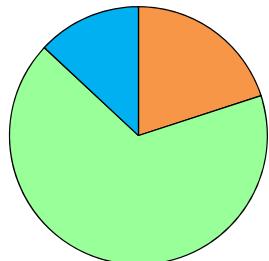
Property summary (327.26 acres, 50 sample points)

Midcanopy vegetation (5-30 feet tall)

	Absent	Low	Medium	High
Midcanopy cover	0%	20%	67%	13%
Species mix	Hardwood	Mixed	Conifer	
	98%	2%	0%	



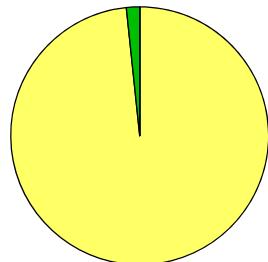
Midcanopy cover



- Absent
- Low
- Medium
- High

Midcanopy cover consists of all tree and shrub foliage within the 5-30 ft zone above the forest floor. High midcanopy cover (foliage density) provides cover, nesting, and foraging for species such as the Red-Eyed Vireo and Wood Thrush. Typical midcanopy species include: red maple, hemlock, birch, witch-hazel, and spicebush, and shadblush.

Midcanopy type



- Hardwood
- Mixed
- Conifer

Midcanopy type is defined as the predominant type of trees and large shrubs found in the midstory (5-30 ft zone). Three types are recognized: hardwood (deciduous), conifer (evergreen), or mixed (hardwood and conifer). Seed or fruit producing species provide a seasonal food source and seeds for regeneration. Conifers provide important thermal cover during the winter months and cover from predators year-round.

East Rock Park, New Haven

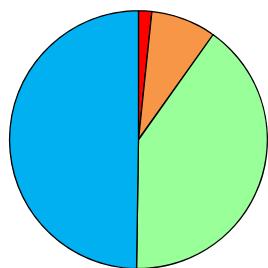
Property summary (327.26 acres, 50 sample points)

Upper canopy vegetation (>30 feet tall)

	Absent	Low	Medium	High
Upper canopy cover	2%	8%	40%	50%
Canopy height	Short	Medium	Tall	
Species mix	Hardwood	Mixed	Conifer	
	94%	6%	0%	



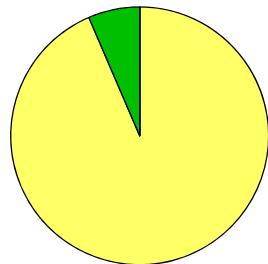
Upper canopy cover



- Absent
- Low
- Medium
- High

Upper canopy cover is an estimate of horizontal area covered by tree crowns, i.e., the shade cast by trees at high noon. Low cover allows abundant sunlight to reach the forest floor and often has dense herbaceous and shrub layers. Medium cover provides conditions for the maintenance of a midstory. Stands with high cover usually have sparse midstories with few, if any, herbaceous plants and tree seedlings.

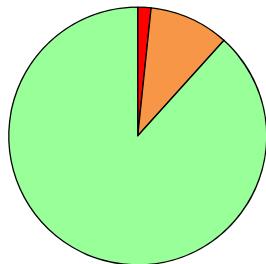
Canopy type



- Hardwood
- Mixed
- Conifer

Canopy type is defined as the predominant type of trees that are taller than 30 ft. To encourage diversity of food resources, and in turn a diversity of bird species, trees that produce soft mast should be maintained as a valuable food resource. Maintaining yellow birch is crucial for birds with an insectivorous diet. Conifers should be encouraged in hardwood stands and vice versa.

Canopy height



- Short
- Medium
- Tall

Canopy height influences nesting site potential in all forest stages. Increasing vertical stratification (any different heights) tends to increase diversity of bird species. Shorter tree heights favor species such as the Chestnut-Sided and Worm-Eating Warblers, while species such as the Scarlet Tanager and Pileated Woodpecker prefer taller woods with taller trees.

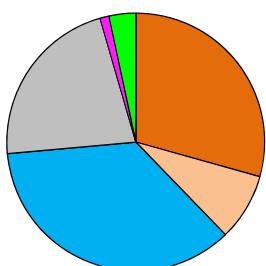
East Rock Park, New Haven

Property summary (327.26 acres, 50 sample points)

Forest composition - basal area (feet²/acre)

	<u>Hard mast</u>		<u>Dry seeds</u>		Soft	Conifer	Total
	Oak	Beech	Maple	Other			
Pole (5-11" diameter)	9	2	10	6	0	1	29
Saw (>11" diameter)	43	6	17	13	0	3	83
Total	52	9	27	19	1	4	112

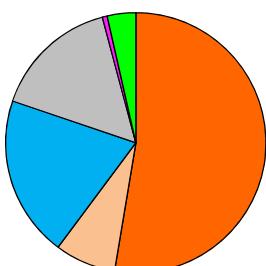
Poletimber



- Oak
- Beech
- Maple
- Other
- Soft
- Conifer

Poletimber is a term used to describe trees four to ten inches in diameter. They often fill the gaps when larger trees die - thus forming the upper canopy trees of future forests. Retaining higher proportions of hard and soft mast trees, while limiting dry seed trees, will promote a healthy, diverse mix of species.

Sawtimber



- Oak
- Beech
- Maple
- Other
- Soft
- Conifer

Sawtimber trees are 11 inches in diameter or greater. They are often the largest and most mature trees in the forest and have the greatest seed/fruit production. By varying the amount of sawtimber present in a woodland through active forest management, landowners can aid in providing diverse habitats for many priority bird species.

Hard mast - species that produce nuts such as oaks, hickories, and beech.

Soft mast - species that produce fruits such as cherries, shadblush, sassafras, and blueberries.

Dry seeds - species that produce small, dry seeds such as maples, birches, aspens.

Conifers - evergreen species that produce dry seeds and also provide thermal cover such as pines, hemlocks, and cedars.

East Rock Park, New Haven

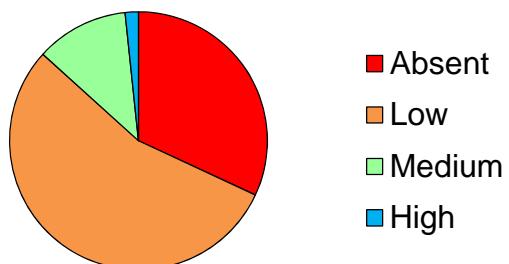
Property summary (327.26 acres, 50 sample points)

Habitat features

	Absent	Low	Medium	High
Coarse woody material	32%	55%	12%	2%
Leaf litter	0%	48%	35%	16%
Soft mast	32%	29%	28%	11%

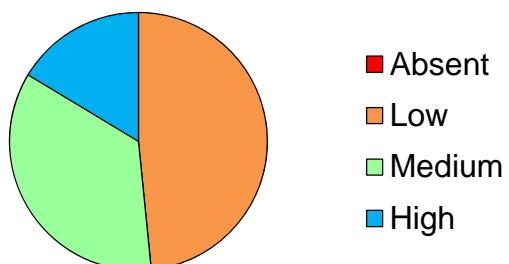


Coarse woody material



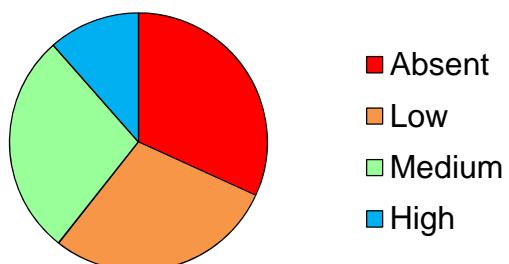
Coarse woody material (CWM) is comprised of downed trees and branches with diameters of 4 inches or greater. CWM may function as a perch site for singing birds, a substrate for wood-rotting fungi, and a habitat for insects and other invertebrates that provide a protein-rich diet for birds during the breeding season and when feeding their chicks.

Leaf litter



Leaf litter is the distribution, amount, and depth of deciduous leaves and needles that cover the ground. Leaf litter is an important habitat for insects and invertebrates. It is also important for ground nesters like the Ovenbird which makes its nest from leaves and downed materials. Equally important, litter leaf reduces the risk of soil erosion during periods of heavy rainfall.

Soft mast



Soft mast is an estimate of potential fruit production that includes berries and drupes. Soft mast trees produce a valuable food resource for not only small birds, but for many mammalian species. Examples of soft mast producing species include trees (blackgum, sassafras, cherry, dogwood), shrubs (blueberry, viburnums, spicebush, raspberries, blackberries), and vines (grape, Virginia creeper).

East Rock Park, New Haven

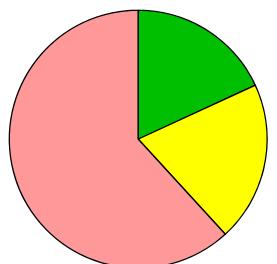
Property summary (327.26 acres, 50 sample points)

Nesting features

	Inside	Outside	Absent
Brush piles or tops	18%	20%	62%
Cavities	42%	35%	24%
Snags	47%	28%	25%



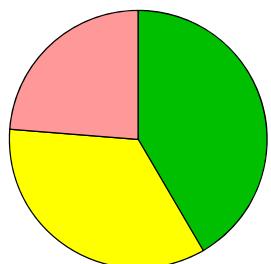
Brush piles or tops



- Inside
- Outside
- Absent

Brush piles or tops are either a large pile of woody material or a large section of a broken-off tree top with intact branches and twigs. It provides understory structure for nesting as well as habitat for insects and other small prey that provide food for birds.

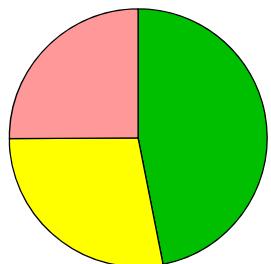
Cavities



- Inside
- Outside
- Absent

Cavities and larger hollows in tree trunks or branches provide good locations for nests because they provide some protection from weather and predators. Owls, Pileated Woodpeckers, and Nuthatches are among several species that utilize cavity trees.

Snags



- Inside
- Outside
- Absent

Snags refer to a standing dead tree, often missing a top, and most of the smaller branches. Snags provide opportunities for excavating nests, perch sites, and possible mating rituals. The insect larvae in the decaying wood of snags provide an excellent food source for woodpeckers.

East Rock Park, New Haven

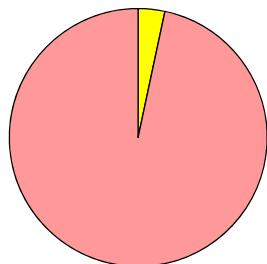
Property summary (327.26 acres, 50 sample points)

Wetland features

	Inside	Outside	Absent
Rocky stream	0%	3%	97%
Wetland	16%	13%	71%



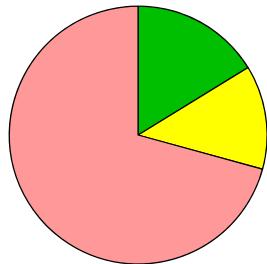
Rocky stream



- Inside
- Outside
- Absent

Rocky streams or streams with gravel bottoms within a forest provide an important water source for many wildlife species and potential nesting areas for bird species such as the Louisiana waterthrush. Tip-up mounds and root plates from fallen trees in close proximity to streams improve the quality of these areas for many species.

Wetland



- Inside
- Outside
- Absent

Wetlands are defined as areas with water saturated soils. Forested and shrubby wetlands provide structure and frequently contain coarse and fine woody debris. They tend to have shorter trees with low canopy heights and dense shrubs and herbaceous plant communities. Wetlands add to the complexity of the landscape and diversity of the forest stands.



East Rock Park, New Haven (Stand-1, 196 acres, Hardwood)

Groundlayer vegetation cover (0-5 feet tall)

	Absent	Low	Medium	High
Native herbaceous	39%	42%	17%	3%
Native shrubs	19%	67%	14%	0%
Non-native species	25%	39%	22%	14%
Species mix	Hardwood	Mixed	Conifer	
	100%	0%	0%	



Midcanopy vegetation (5-30 feet tall)

	Absent	Low	Medium	High
Midcanopy cover	0%	19%	72%	8%
Species mix	Hardwood	Mixed	Conifer	
	97%	3%	0%	



Upper canopy vegetation (>30 feet tall)

	Absent	Low	Medium	High
Upper canopy cover	3%	6%	31%	61%
Canopy height	Short	Medium	Tall	
	3%	3%	94%	
Species mix	Hardwood	Mixed	Conifer	
	97%	3%	0%	



Forest composition - basal area (feet²/acre)

	Hard mast		Dry seeds		Soft	Conifer	Total
	Oak	Beech	Maple	Other			
Pole (5-11" diameter)	7	2	9	7	1	1	27
Saw (>11" diameter)	48	6	19	14	1	2	90
Total	56	9	28	21	1	3	117

East Rock Park, New Haven (Stand-1, 196 acres, Hardwood)

Habitat features

	Absent	Low	Medium	High
Coarse woody material	19%	58%	19%	3%
Leaf litter	0%	42%	47%	11%
Soft mast	33%	33%	22%	11%



Nesting features

	Inside	Outside	Absent
Brush piles or tops	6%	22%	72%
Cavities	56%	28%	17%
Snags	53%	31%	17%



Wetland features

	Inside	Outside	Absent
Rocky stream	0%	6%	94%
Wetland	3%	6%	92%



Category criteria for 1/20 acre plots (26.33 ft or 8.03 m radius)

Vegetation cover, canopy closure, soft mast

Absent - covered <5% of plot
Low - covered 5-30% of plot
Medium - covered 30-70% of plot
High - covered >70% of plot

Canopy height

Short - trees <20 ft tall
Medium - trees 20-60 ft tall
Tall - trees >60 ft tall

Nesting and wetland features

Absent - not found within plot
Inside - observed within plot
Outside - observed outside of plot

Habitat features

Absent - not found within plot
Low - few leaves / one or two pieces of coarse woody debris
Medium - average leaf litter/several pieces of coarse woody debris
High - thick leaf litter / many pieces of coarse woody debris



East Rock Park, New Haven (Stand-2, 21 acres, Mixedwood)

Groundlayer vegetation cover (0-5 feet tall)

	Absent	Low	Medium	High
Native herbaceous	0%	75%	25%	0%
Native shrubs	25%	25%	50%	0%
Non-native species	25%	75%	0%	0%
Species mix	Hardwood	Mixed	Conifer	
	100%	0%	0%	



Midcanopy vegetation (5-30 feet tall)

	Absent	Low	Medium	High
Midcanopy cover	0%	25%	25%	50%
Species mix	Hardwood	Mixed	Conifer	
	100%	0%	0%	



Upper canopy vegetation (>30 feet tall)

	Absent	Low	Medium	High
Upper canopy cover	0%	0%	75%	25%
Canopy height	Short	Medium	Tall	
	0%	25%	75%	
Species mix	Hardwood	Mixed	Conifer	
	25%	75%	0%	



Forest composition - basal area (feet²/acre)

	Hard mast		Dry seeds		Soft	Conifer	Total
	Oak	Beech	Maple	Other			
Pole (5-11" diameter)	23	3	10	20	0	8	63
Saw (>11" diameter)	10	0	20	20	0	28	78
Total	33	3	30	40	0	35	140

East Rock Park, New Haven (Stand-2, 21 acres, Mixedwood)

Habitat features

	Absent	Low	Medium	High
Coarse woody material	0%	100%	0%	0%
Leaf litter	0%	50%	50%	0%
Soft mast	50%	50%	0%	0%



Nesting features

	Inside	Outside	Absent
Brush piles or tops	50%	0%	50%
Cavities	25%	25%	50%
Snags	75%	0%	25%



Wetland features

	Inside	Outside	Absent
Rocky stream	0%	0%	100%
Wetland	0%	0%	100%



Category criteria for 1/20 acre plots (26.33 ft or 8.03 m radius)

Vegetation cover, canopy closure, soft mast

Absent - covered <5% of plot
Low - covered 5-30% of plot
Medium - covered 30-70% of plot
High - covered >70% of plot

Canopy height

Short - trees <20 ft tall
Medium - trees 20-60 ft tall
Tall - trees >60 ft tall

Nesting and wetland features

Absent - not found within plot
Inside - observed within plot
Outside - observed outside of plot

Habitat features

Absent - not found within plot
Low - few leaves / one or two pieces of coarse woody debris
Medium - average leaf litter/several pieces of coarse woody debris
High - thick leaf litter / many pieces of coarse woody debris



East Rock Park, New Haven (Stand-3, 79 acres, Riparian)

Groundlayer vegetation cover (0-5 feet tall)

	Absent	Low	Medium	High
Native herbaceous	20%	60%	20%	0%
Native shrubs	0%	80%	0%	20%
Non-native species	20%	40%	20%	20%
	Hardwood	Mixed	Conifer	
Species mix	100%	0%	0%	



Midcanopy vegetation (5-30 feet tall)

	Absent	Low	Medium	High
Midcanopy cover	0%	20%	60%	20%
	Hardwood	Mixed	Conifer	
Species mix	100%	0%	0%	



Upper canopy vegetation (>30 feet tall)

	Absent	Low	Medium	High
Upper canopy cover	0%	20%	40%	40%
	Short	Medium	Tall	
Canopy height	0%	20%	80%	
	Hardwood	Mixed	Conifer	
Species mix	100%	0%	0%	



Forest composition - basal area (feet²/acre)

	Hard mast		Dry seeds		Soft	Conifer	Total
	Oak	Beech	Maple	Other			
Pole (5-11" diameter)	10	4	14	0	0	0	28
Saw (>11" diameter)	48	10	10	2	0	0	70
Total	58	14	24	2	0	0	98

East Rock Park, New Haven (Stand-3, 79 acres, Riparian)

Habitat features

	Absent	Low	Medium	High
Coarse woody material	60%	40%	0%	0%
Leaf litter	0%	60%	0%	40%
Soft mast	20%	0%	60%	20%



Nesting features

	Inside	Outside	Absent
Brush piles or tops	40%	20%	40%
Cavities	20%	60%	20%
Snags	20%	40%	40%



Wetland features

	Inside	Outside	Absent
Rocky stream	0%	0%	100%
Wetland	60%	40%	0%



Category criteria for 1/20 acre plots (26.33 ft or 8.03 m radius)

Vegetation cover, canopy closure, soft mast

- Absent - covered <5% of plot
- Low - covered 5-30% of plot
- Medium - covered 30-70% of plot
- High - covered >70% of plot

Canopy height

- Short - trees <20 ft tall
- Medium - trees 20-60 ft tall
- Tall - trees >60 ft tall

Nesting and wetland features

- Absent - not found within plot
- Inside - observed within plot
- Outside - observed outside of plot

Habitat features

- Absent - not found within plot
- Low - few leaves / one or two pieces of coarse woody debris
- Medium - average leaf litter/several pieces of coarse woody debris
- High - thick leaf litter / many pieces of coarse woody debris



East Rock Park, New Haven (Stand-4, 31 acres, Cliff faces)

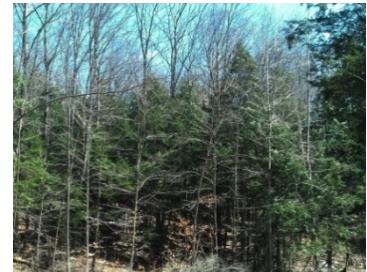
Groundlayer vegetation cover (0-5 feet tall)

	Absent	Low	Medium	High
Native herbaceous	80%	20%	0%	0%
Native shrubs	40%	60%	0%	0%
Non-native species	20%	60%	0%	20%
	Hardwood	Mixed	Conifer	
Species mix	100%	0%	0%	



Midcanopy vegetation (5-30 feet tall)

	Absent	Low	Medium	High
Midcanopy cover	0%	20%	80%	0%
	Hardwood	Mixed	Conifer	
Species mix	100%	0%	0%	



Upper canopy vegetation (>30 feet tall)

	Absent	Low	Medium	High
Upper canopy cover	0%	0%	80%	20%
	Short	Medium	Tall	
Canopy height	0%	20%	80%	
	Hardwood	Mixed	Conifer	
Species mix	100%	0%	0%	



Forest composition - basal area (feet²/acre)

	Hard mast		Dry seeds		Soft	Conifer	Total
	Oak	Beech	Maple	Other			
Pole (5-11" diameter)	4	0	8	12	0	0	24
Saw (>11" diameter)	24	0	18	30	0	0	72
Total	28	0	26	42	0	0	96

East Rock Park, New Haven (Stand-4, 31 acres, Cliff faces)

Habitat features

	Absent	Low	Medium	High
Coarse woody material	60%	40%	0%	0%
Leaf litter	0%	60%	40%	0%
Soft mast	40%	60%	0%	0%



Nesting features

	Inside	Outside	Absent
Brush piles or tops	20%	20%	60%
Cavities	20%	20%	60%
Snags	60%	0%	40%



Wetland features

	Inside	Outside	Absent
Rocky stream	0%	0%	100%
Wetland	0%	0%	100%



Category criteria for 1/20 acre plots (26.33 ft or 8.03 m radius)

Vegetation cover, canopy closure, soft mast

Absent - covered <5% of plot

Low - covered 5-30% of plot

Medium - covered 30-70% of plot

High - covered >70% of plot

Canopy height

Short - trees <20 ft tall

Medium - trees 20-60 ft tall

Tall - trees >60 ft tall

Nesting and wetland features

Absent - not found within plot

Inside - observed within plot

Outside - observed outside of plot

Habitat features

Absent - not found within plot

Low - few leaves / one or two pieces of coarse woody debris

Medium - average leaf litter/several pieces of coarse woody debris

High - thick leaf litter / many pieces of coarse woody debris