



# Bear Hill Nature Preserve Ecological Management Plan

JOHN THOMPSON

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## Introduction

Bear Hill Nature Preserve is a conservation area located in the hamlet of Cragmoor, New York. The protection of the Bear Hill Nature Preserve occurred due to the actions of the Cragmoor community. In the late 1970's, the former Cragmoor Inn property, which included Bear Hill, was purchased by a real estate developer to build a housing subdivision. Bear Hill, treasured by the residents of Cragmoor and surrounding communities, was closed to the public. Limited and conditional access was offered to Cragmoor residents, but the community foresaw that this integral component of the community would be changed forever.

In 1980 the community had the opportunity to purchase the 51.5 acres of wild land which made up the Bear Hill cliffs and plateau. David Croyder, a prominent resident, agreed to buy the land with his own funds provided that the community would make a sincere effort to raise and repay half the amount over a period of 3 years. By 1983, the community had succeeded in raising half the purchase price and repaid their benefactor. The property was deeded over to the Cragmoor Free Library while the Cragmoor Association was tasked with full management responsibility (<https://www.cragmoorassociation.com/about>).

In 1995-96, an additional 1.9 acres of undeveloped land was added to the Preserve as a result of gifts of land from the neighboring Gage-Lanza housing development by Sharon Gage Tarolli and John Tarolli of Pine Bush (J. Grifo, personal communication, October 19, 2024).

The nature preserve is accessed by a parking area on Dellenbaugh Road. There are three named trails on the preserve, Main Trail, which is a 0.42 mile out-and back trail that leads from the parking area to the junction with Old Trail and Cliff Trail. Cliff Trail extends from this intersection for 0.15 miles to a vista near the southern boundary of the preserve. Old Trail forms a 0.2 mile loop, from the intersection of Cliff and Main Trails, back to the Main Trail. There is an unmarked rock scramble that begins near the cliff vista and descends to the base of the cliff. Allowed uses on the preserve include hiking, snowshoeing, skiing, environmental education and research.

The preserve's rules are posted at the beginning of the Main Trail and "All Dogs Must Be On a Leash" is posted at the beginning of the Cliff Trail. The preserve's rules are the following:

- The preserve is open year-round from ½ hour before sunrise to ½ hour after sunset

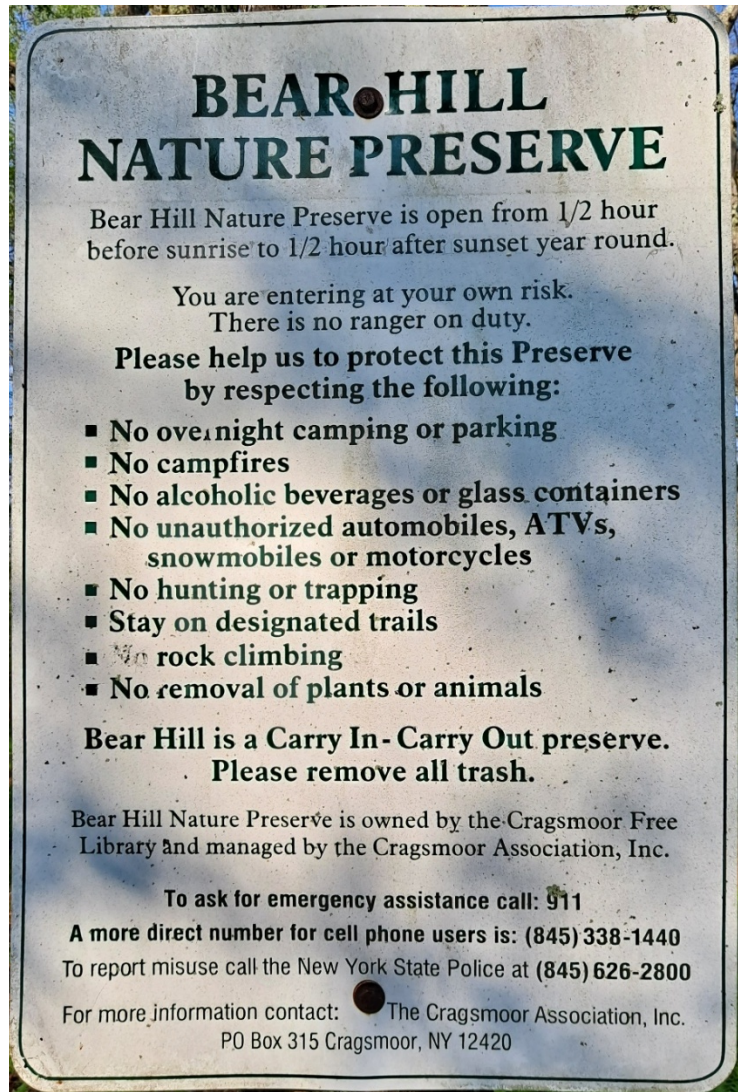




*Bear Hill Nature Preserve Map.*

- No overnight camping or parking
- No campfires
- No alcoholic beverages or glass containers
- No unauthorized automobiles, ATVs, snowmobiles or motorcycles
- No hunting or trapping
- Stay on designated trails
- No rock climbing
- No removal of plants or animals
- The preserve is Carry In-Carry Out
- All dogs must be on leash

In addition, the preserve does not permit hang-gliding, mountain biking, or ice climbing.



### *Bear Hill Nature Preserve Rules*

The three designated trails of the preserve, Main, Old, and Cliff are labeled with signage at intersections.





*Signage at Intersection: Main and Old Trail*



*Signage at Intersection: Main, Cliff and Old Trail*



The preserve has implemented other actions to protect resources. For example, on the Main Trail, planks have been put over the wet areas and ditching has been performed to reroute runoff off the trail. This is helping to protect the soil by carrying the hikers over the wet areas (hikers not walking through mud) and prevent braiding of the trail (hikers walking around the mud).

Geologically, the preserve occurs on the Shawangunk Formation, white to light gray quartzitic conglomerate and sandstone that form the Shawangunk Ridge. The acidic bedrock is exposed at the surface in some places, is covered with shallow soil in some areas and forms cliffs in other places. Shallow soils that were deposited on the bedrock are of glacial origin. The Shawangunk Mountains are in the Allegheny Plateau physiographic region. The highest elevation on the Bear Hill Nature Preserve is 1,949 ft.

The goal of this project is to identify key conservation targets, identify the critical threats to those targets, and assemble management recommendations.

### Existing Electronic Records

A first step to understand the area was to collect online digital information that has been contributed from both professional and community scientists and was available in online datasets and databases. Information is available for soils and different aspects of both flora and fauna. Spatial data was assembled and analyzed in QGIS 4.40.6.

The boundaries of the Bear Hill Nature Preserve were downloaded from the Ulster County Parcel Viewer. All analyses of the Bear Hill Nature Preserve were clipped based on this layer and their acreages and percent of area were calculated based on that boundary overlay.

Soil information is available in the Soil Survey Geographic Database in the Cornell University Geospatial Information Repository. There are five soil types on the preserve: Rock outcrop-Arnot complex, sloping; Rock outcrop-Arnot complex, sloping (RXC); Rock outcrop-Arnot complex, very steep (RXF); Bath-Nassau complex, 8 to 25 percent slopes (BnC), Bath and Mardin very stony soils, sloping (BRC) and Nassau-Bath-Rock outcrop complex, very steep (NBF). Soil unit descriptions are from the Soil Survey of Ulster County, New York (Tornes, 1979). Rock outcrop-Arnot complex,

sloping is by far the predominant soil type on the preserve, covering 35.8 acres. Rock outcrop-Arnot complex, very steep covers 7.4 acres of the preserve and Bath-Nassau complex, 8 to 25 percent slopes covers 7.0 acres of the preserve. The remaining 2.8 acres are covered by either Bath and Mardin very stony soils, sloping or Nassau-Bath-Rock outcrop complex, very steep. A soil “complex” is a unit of two or more soils that are tightly mixed and were undifferentiated in soil mapping. The Rock outcrop-Arnot complex, sloping is an area of exposed bedrock and somewhat excessively drained to moderately well drained Arnot soils formed in glacial till. Slopes in this type range from 8 to 15 percent. The makeup of this type is 45% rock outcrop, 30% Arnot channery silt loam or channery loam, and 25% other soils. There is more Arnot soil on benches and the lower part of slopes. The RXF soil unit is similar to the RXC unit but is described as extremely bouldery and is on slopes from 35 to 90%. The Bath-Nassau complex, 8-25 percent slopes is a combination of deep, well drained Bath soil, 50%, with shallow, somewhat excessively drained Nassau soil, 30%, and 20% other soils.

iNaturalist is a website and mobile phone application that allows users to record nature observations and make them available to community and professional scientists. As of the start of this project, a total of 86 observations were recorded in iNaturalist. Only 54 of those records had been confirmed as research grade with verified species identifications by other iNaturalist users. These 54 records comprised a total of 42 species (Appendix A).

iMapInvasives is a mobile phone application that allows community scientists to record invasive species observations. Prior to fieldwork for this project, only two records of invasive species were documented in iMapInvasives within the preserve boundaries, Japanese barberry (*Berberis thunbergii*) and common speedwell (*Veronica officinalis*). Both observations were made by the author on June 26, 1996.

The New York Natural Heritage Program (NYNHP) tracks New York State rare species. NYNHP has records of only one listed New York State rare plant on the Bear Hill Nature Preserve. A request to NYNHP confirmed that mountain spleenwort (*Asplenium montanum*) is the only state rare species recorded on the preserve. Mountain spleenwort grows on cliffs and ledges. The only Natural History Program-listed natural community found

on the preserve is part of a 39,871 acre chestnut oak forest community in the northern Shawangunk Mountains.

eBird is a website and application that allows birders to record their bird observations. All eBird records were collected by the author since 2023, as part of the New York State Breeding Bird Atlas, and are summarized and reported on below. All eBird records cited in this report were located in the Ellenville CE map block of the New York Breeding Bird Atlas III.

### Field Survey of Plants, Animals and Ecological Communities

In order to properly manage the Bear Hill Nature Preserve, it is important to understand the makeup of the natural communities that occur on the preserve and the flora and fauna that use those habitats.

Nine field visits were made to the Preserve, between May 25 through October 26, 2024, to document flora, fauna, and ecological communities that inhabit the preserve. The goal of each field visit was to collect information on dominant plants for each ecological community and record observations of native species, rare species, and invasive species on the preserve.

### ECOLOGICAL COMMUNITIES

Ecological communities found on the preserve included: Appalachian oak-hickory forest, chestnut oak forest, red maple-hardwood-heath forest, pitch pine-oak-heath rocky summit, cliff, and red maple-hardwood swamp. This diversity of communities provides habitat for a corresponding diversity of flora and fauna. The ecological community classification follows Edinger et al. 2014 and Thompson 1996 and the preserve and the surrounding area were included in the mapping done by Thompson 1996. Communities were classified by physiognomic types as 1) **forest** — community in which the canopies of trees over 5m (16 ft) tall cover greater than 60% of the surface, 2) **woodland** — trees (>5 m tall) cover 25-60% of the surface, or 3) **sparsely vegetated**— cover of each of the vascular plant strata (trees, tall shrubs, dwarf shrubs and herbs) is less than 10% of the surface. Non-vascular plants may be present at any cover value.

The amount of area covered by ecological types was determined using QGIS by overlaying the Bear Hill Preserve boundaries with the Thompson 1996 vegetation shapefile. Fieldwork was conducted to verify the boundaries and composition of types found within the preserve. The definitions of the vegetation types were refined based on the species



found in 2024 fieldwork. One forest patch on the east side of the preserve was mapped by Thompson 1996 as red maple hardwood heath forest. Fieldwork in 2024, showed this to be more reflective of an Appalachian oak-pine forest and that is how the community will be identified and analyzed in this report. Over the 30 year interval between the original mapping project and now, the forest has matured and the composition may have changed to some degree. The definitions of vegetation types of Bear Hill Nature Preserve's communities found in 2024 are as follows:

- **Red maple hardwood swamp** – a forested mineral soil wetland occurring in a poorly drained depression that is seasonally flooded, with greater than 50% cover of trees. The dominant tree is red maple (*Acer rubrum*). Eastern hemlock (*Tsuga canadensis*) is a component species. Tall shrubs include highbush blueberry (*Vaccinium corymbosum*). Herbaceous species include evergreen wood fern (*Dryopteris intermedia*), sedges (*Carex* spp.), swamp dewberry (*Rubus hispidus*), goldthread (*Coptis trifolia*), and grasses. Mosses are abundant on the forest floor including sphagnum mosses (*Sphagnum* spp.), haircap moss (*Polytrichum commune*), broom moss (*Dicranum* spp.), pincushion moss (*Leucobryum* spp.), and brocade moss (*Callicladium imponens*). This wetland patch is periodically flooded and overflows to the north, creating an intermittent stream. The red maple hardwood swamp is 1.30 ac., only 2.48% of the preserve. This is the only wetland community mapped within the boundary of the preserve.
- **Cliff** – a community characterized by vertical exposures of Shawangunk conglomerate. The area mapped as this community includes ledges and areas of talus. There is minimal soil development and vegetation is relatively sparse. Cover of each vascular life-form (trees, shrubs and herbs) is less than 10%. Non-vascular plants may cover extensive areas of both vertical and horizontal rock exposures. Many species of lichens and bryophytes are present on cliffs. Some of the most notable lichens include smooth rock tripe (*Umbilicaria mammulata*) and blistered rock tripe (*Umbilicaria hyperborea*). As mentioned above, the rare mountain spleenwort, is only found on cliffs and ledges.
- **Acidic talus slope woodland** - An open woodland to closed canopy forest that occurs on Shawangunk conglomerate talus. This community is quite variable and a mixture of evergreen conifers to a forest of deciduous angiosperms. Characteristic tree species are black birch (*Betula lenta*), hemlock (*Tsuga canadensis*), and white pine (*Pinus strobus*). Individuals of pitch pine (*Pinus rigida*) often are

scattered throughout the talus. The understory includes striped maple (*Acer pensylvanicum*) and mountain laurel (*Kalmia latifolia*). Herbaceous layer includes evergreen wood fern (*Dryopteris intermedia*). Various mosses (e.g. *Hypnum imponens* and *Dicranum* spp.) and fruticose (*Cladonia* spp.), foliose (*Umbilicaria* spp.), and crustose lichens occur on the talus. Acidic talus slope woodland covers 0.62 acres of the preserve below the cliff, at the southern end of the preserve.

- **Exposed talus** – is a sparsely vegetated community at the base of the cliff in which the cover of each vascular lifeform is less than 10%. Non-vascular plants range from being scattered to nearly completely covering the rock surfaces. Various mosses (e.g. *Polytrichum* spp., *Leucobryum* spp., and *Dicranum* spp.) and fruticose (*Cladonia* spp.), foliose (*Umbilicaria* spp.), and crustose lichens occur on rock surfaces. Exposed talus covers 0.27 acres of the preserve.
- **Pitch pine-oak-heath rocky summit** – occur on shallow soils and there are some openings of exposed bedrock within the community. Tree cover is less than 60% in this community and the most abundant tree is pitch pine (*Pinus rigida*). Other scattered tree species may include red maple (*Acer rubrum*) sassafras (*Sassafras albidum*), and shadbush (*Amelanchier arborea*). Characteristic species include scrub oak (*Quercus ilicifolia*), black huckleberry (*Gaylussacia baccata*), low-bush blueberry (*Vaccinium angustifolium*), mountain laurel (*Kalmia latifolia*), sheep laurel (*Kalmia angustifolia*), wintergreen (*Gaultheria procumbens*), cow-wheat (*Melampyrum lineare*), and common hair grass (*Avenella flexuosa*). There are some openings of exposed bedrock within the community. Characteristic lichens may include *Cetraria arenaria* and *Cladonia* spp. The pitch pine-oak-heath rocky summit community is the most widespread ecological community found on the preserve, covering 22.76 acres, 43.1% of the preserve. This type is primarily on the “plateau” area of the preserve, the spine of which runs nearly the length of the preserve, north to south. This community is maintained by severe growing conditions, such as shallow, low nutrient soils. The dominant plants are fire-adapted and fire may play an important role in maintaining these communities.
- **Red maple hardwood heath forest** – a relatively open-canopied forest with a nearly continuous layer of dwarf shrubs. The dominant tree is red maple (*Acer rubrum*) and may also include black tupelo (*Nyssa sylvatica*), sassafras (*Sassafras albidum*), and gray birch

(*Betula populifolia*). Pitch pine (*Pinus rigida*) may appear in the canopy or subcanopy. Associated tall shrubs, which may be numerous, include scrub oak (*Quercus ilicifolia*), and mountain laurel (*Kalmia latifolia*) and shadbush (*Amelanchier arborea*). Dominant dwarf shrubs are black huckleberry (*Gaylussacia baccata*), sheep laurel (*Kalmia angustifolia*), and lowbush blueberry (*Vaccinium angustifolium*). Herbaceous species include bracken fern (*Pteridium aquilinum*). The red maple hardwood heath community covers 7.22 acres, 13.7%, of the preserve. This type runs along the western boundary of the pitch pine-oak-heath rocky summit and shows its close relationship with that type.

- **Appalachian oak-hickory forest** – a hardwood forest that occurs on well-drained loam or sandy loam. The dominant trees are white oak (*Quercus alba*) and red oak (*Quercus rubra*). Associated species are hickories (*Carya ovata* and *C. glabra*), white ash (*Fraxinus americana*), and red maple (*Acer rubrum*). American beech (*Fagus americana*) and eastern hemlock occur in the forest on the preserve. Tall shrubs include eastern hop-hornbeam (*Ostrya virginiana*) and witch hazel (*Hamamelis virginiana*). Characteristic low shrubs include lowbush blueberry (*Vaccinium angustifolium*). Herbaceous plants may include hog-peanut (*Amphicarpaea bracteata*) and starflower (*Trientalis borealis*). Appalachian oak-hickory forest covers 8.49 acres, 3.4%, of the preserve, primarily in the northeastern part of the preserve.
- **Appalachian oak-pine forest** – A mixed evergreen-deciduous forest that occurs on well-drained soils. A mixture of oaks (*Quercus* spp.) and pines (*Pinus* spp.) dominate the canopy. The shrublayer is predominately ericaceous. The groundlayer is sparse. Dominant trees include one or more of the following oaks and one or more pines: chestnut oak (*Quercus prinus*), red oak (*Q. rubra*), or white oak (*Q. alba*), and pitch pine (*Pinus rigida*) or white pine (*P. strobus*). Associated trees include hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), and black cherry (*Prunus serotina*). Dominant shrubs may include black huckleberry (*Gaylussacia baccata*), and low-bush blueberry (*Vaccinium angustifolium*). Groundcover includes Pennsylvania sedge (*Carex pensylvanica*), wintergreen (*Gaultheria procumbens*), and Canada mayflower (*Maianthemum canadense*). Appalachian oak-pine forest covers 2.81 acres, 5.3%, of the preserve, on the east side of the preserve.
- **Chestnut oak forest** – a hardwood forest that occurs on well-drained sites. Dominant trees are chestnut oak (*Quercus prinus*) and red

oak (*Q. rubra*). Associated trees include red maple (*Acer rubrum*). Common shrubs include mountain laurel (*Kalmia latifolia*). Characteristic groundlayer species include lowbush blueberry (*Vaccinium angustifolium*), pin cushion moss (*Leucobryum glaucum*) and various bryophytes. Chestnut oak forest is the dominant forest in the northern Shawangunks and covers 9.07 acres, 17.2%, of the preserve, primarily in a patch in the northern part of the preserve, but also along other margins of the preserve.

## RARE PLANTS

Field surveys on the preserve found only one New York State rare species, mountain spleenwort (*Asplenium montanum*), however one population is very dense, with a high number of individual plants, so it should be considered significant. Mountain spleenwort is listed by the New York State Natural Heritage Program as Threatened and S2S3 (Ring 2023). Plants designated as Threatened in New York State have: 1) 6-20 sites in the State, 2) 1,000-3,000 individuals, or 3) restricted to 4-7 U.S.G.S. 7 ½° topographical maps, or 4) "listed as threatened by the U. S. Department of Interior as enumerated in the Code of Federal Regulations 50 CFR 17.11. Mountain spleenwort is protected by New York State Environmental Conservation Law section 9-1503 which states It is a violation for any person, anywhere in the state to pick, pluck, sever, remove, damage by the application of herbicides or defoliants, or carry away, without the consent of the owner, any protected plant. Each protected plant illegally damaged can be a violation and subject to a \$25 fine.

The New York Natural Heritage Program ranking of S2S3 indicates that the plant is, "Imperiled or Vulnerable in New York - Very vulnerable, or vulnerable, to disappearing from New York, due to rarity or other factors; typically 6 to 80 populations or locations in New York, few individuals, restricted range, few remaining acres (or miles of stream), and/or recent and widespread declines." Documentation shows this species to be imperiled in New York State because of rarity (6-20 sites) or highly vulnerable to extirpation due to biological or human factors. The S2S3 double rank indicates that more field surveys are needed to assign either an S2 or S3 rank for New York State.

Mountain spleenwort is a small, evergreen fern that grows in the Shawangunks in small crevices of the conglomerate cliffs and ledges. In the Bear Hill Nature Preserve, mountain spleenwort primarily occurs in a dense population on the southwesterly-facing cliffs along the southern boundary of the preserve.

## ANIMALS

Bird surveying was performed by traveling the same route on each visit: Main Trail, Cliff Trail, and Loop Trail. Locations for bird observations within the Bear Hill Nature Preserve were divided into two categories based on general habitat. Observations were recorded in the eBird app as either occurring in the "Bear Hill Nature Preserve - forest" or "Bear Hill Nature Preserve -pine barrens." Forest included forested areas adjacent to the Main Trail, a sampling of the following types: Appalachian oak-hickory forest, Appalachian oak-pine forest, chestnut oak forest, and red maple-hardwood swamp. Pine barrens include pitch pine-oak-heath rocky summit and red maple-hardwood-heath forest. In the "forest" communities the following ten bird species were confirmed as breeding: black-capped chickadee, black-throated blue warbler, eastern phoebe, American crow, blue-headed vireo, blue jay, tufted titmouse, American robin, white-breasted nuthatch, and dark-eyed junco. In the "pine barrens" the following seven bird species were confirmed as breeding: black-capped chickadee, chipping sparrow, eastern towhee, black and white warbler, common raven, blue-gray gnatcatcher, and ovenbird.

A total of seven amphibians and one reptile species were observed during field visits. Amphibians included the eastern (red-spotted) newt (*Notophthalmus viridescens*) red-backed salamander (*Plethodon cinereus*), northern slimy salamander (*Plethodon glutinosus*), wood frog (*Lithobates sylvaticus*), spring peeper (*Pseudacris crucifer*), gray treefrog (*Hyla versicolor*), and American toad (*Anaxyrus americanus*). The eastern garter snake (*Thamnophis sirtalis*) was the only reptile observed in this time frame. Amphibian records were primarily centered around the red maple-hardwood swamp and in the forested areas of the preserve. The one exception is American toad, which was observed in the pine barrens. The garter snake was also observed in the pine barrens.

The following mammals were observed during fieldwork for this project: red squirrel (*Tamiasciurus hudsonicus*), gray squirrel (*Sciurus carolinensis*), eastern cottontail (*Sylvilagus floridanus*), porcupine (*Erethizon dorsatum*), and white-tailed deer (*Odocoileus virginianus*).

New York State has designated a list of Species of Greatest Conservation Need (SGCN) as those species with declining populations that need conservation actions to maintain their populations ([https://extapps.dec.ny.gov/docs/wildlife\\_pdf/sgnc2015list.pdf](https://extapps.dec.ny.gov/docs/wildlife_pdf/sgnc2015list.pdf)). Seven birds that were observed at the preserve are on the SGCN list:

- Black-throated blue warbler
- Wood thrush
- Red-shouldered hawk – observed circling over

- Scarlet tanager
- Black-billed cuckoo
- Worm-eating warbler
- Prairie warbler

## INVASIVE SPECIES

Invasive species found on the site included forest pests, such as spongy moth (*Lymantria dispar*), beech leaf disease nematode (*Litylenchus crenatae mccannii*), hemlock woolly adelgid (*Adelgis tsugae*), and emerald ash borer (*Agrilis planipennis*). Invasive plants include: Japanese barberry (*Berberis thunbergii*), honeysuckle (*Lonicera* spp.), Japanese stiltgrass (*Microstegium vimineum*) and garlic mustard (*Alliaria petiolata*). At the entrance to the parking area along Dellenbaugh Road, other invasive plants are growing, such as: multiflora rose (*Rosa multiflora*) and coltsfoot (*Tussilago farfara*) along with several additional Japanese barberry plants.

## Identify Key Conservation Targets

For place-based conservation, such as conservation of the Bear Hill Nature Preserve, it is important to select conservation targets that are specific entities that the preserve is working to conserve and that encompass the aims of the preserve. Conservation targets are habitats and species that “represent and encompass the full suite of biodiversity in the scope” of the project (Conservation Measures Partnership 2020). In theory, the conservation of chosen targets should ensure the conservation of the ecosystems and component species within the project scope. In order to simplify the process it is important to limit the number of targets. At Bear Hill Nature Preserve, ecological communities that share ecological processes were grouped. Management that addresses this suite of communities can focus on the ecological processes they have in common. The conservation targets could be grouped as follows:

- **Oak Forests** (Appalachian oak-hickory forest, Appalachian oak-pine forest, and chestnut oak forest)
- **Barrens** (Pitch pine-oak-heath rocky summit and red maple-hardwood-heath forest)
- **Cliff and talus** (cliff, acidic talus slope woodland, and exposed talus)
  - mountain spleenwort is a nested target within the cliff and talus communities.
- **Wetland** (Red maple-hardwood swamp)



In order to preserve conservation targets over the long term, it is important to 1) define what the characteristics of a healthy target are, 2) determine how to measure those characteristics, 3) determine the current status of the target and set future goals for those characteristics so that the target is viable over time.

## KEY ECOLOGICAL ATTRIBUTES OF CONSERVATION TARGETS

For each conservation target, key ecological attributes were identified. A key ecological attribute is a condition that the conservation target must meet to be considered healthy.

### **Oak Forests key ecological attributes**

Forest community architecture is an important aspect of the oak forest. Architecture refers to the structure of the forest including the canopy layer, shrub layer, and ground layer vegetation. A healthy oak forest is assessed over a landscape and oak forests over a landscape would include a variety of mature and regenerating patches of forests.

Population structure and recruitment of canopy trees including regeneration of dominant canopy species (oaks) is very important to these forests so it is important to have not only have abundant oaks in the canopy and subcanopy, but advanced oak regeneration is critical to replace canopy oaks that may succumb to disturbance.

Oaks can reproduce by acorns and by resprouting. Chestnut oaks typically begin producing acorns at 20 years old. Acorn crops are cyclical with large acorn crops happening every four or five years and acorns maturing in one year. Acorns are dispersed by wildlife and gravity. To regenerate the forest, enough of these acorns must regenerate into seedlings and the seedlings must have favorable conditions to grow into trees. Chestnut oak trees may also resprout from the base.

### **Barrens key ecological attributes**

Important aspects of barrens are open canopy, shallow soil, and fire regime on deeper soils. Barrens on shallow soils are more persistent than barrens on deeper soils.

### **Cliff and Talus key ecological attributes**

Important aspects of cliff and talus communities are that they include very fragile areas of very thin soils and areas completely lacking soil. This is the only habitat on the preserve of the rare species, mountain spleenwort.

### **Wetland key ecological attributes**

Hydrology is a critically important attribute for a wetland as is the water quality. The wetland on the preserve is periodically flooded during the spring and times of high precipitation.

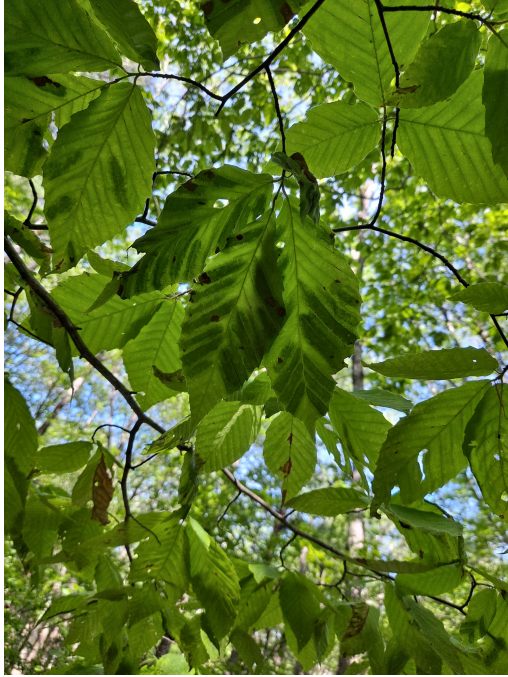
### Identify Critical Threats to Conservation Targets

Critical threats are those stresses that degrade a conservation target. The following have been identified as critical threats to key conservation targets:

- Invasive species
- Deer browse
- Recreation overuse
- Climate change

### INVASIVE SPECIES

Invasive species are defined by New York State Environmental Conservation Law Title 17, Article 9, 2008 as having two attributes 1) not native to an ecosystem and 2) causes harm to the economy, human health, or the environment. Invasive species mentioned in this report meet both of those criteria. Invasives found on the preserve are generally assessed as having high to very high ecological impact. A number of forest pests found on the preserve are especially impactful to the ecological communities that they are found in: beech leaf disease nematode (*Litylenchus crenatae mccannii*), emerald ash borer (*Agrilus planipennis*), hemlock woolly adelgid (*Adelges tsugae*), and spongy moth (*Lymantria dispar dispar*). Invasive plants found on the preserve were Japanese barberry (*Berberis thunbergii*), honeysuckle (*Lonicera* spp.) Japanese stiltgrass (*Microstegium vimineum*), multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*), and coltsfoot (*Tussilago farfara*). On the preserve, nearly all of the invasives were found and documented in the Appalachian oak-hickory forest. This is the area of deeper soils (relatively speaking), near the trailhead, and may be more vulnerable to invasion for those reasons.



*Leaf banding caused by beech leaf disease*



*Sign of emerald ash borer – “ash blanding”  
– inner bark exposed, 5/25/224*

### Beech leaf disease nematode

American beech is an important component of hemlock-northern hardwood forests in the Shawangunks and is often scattered in other forest types. Beech is an important food source for wildlife. Beechnuts provide a food source rich in fats and protein for blue jays, white breasted nuthatches, wild turkeys, ruffed grouse, black bears, deer, squirrels, chipmunks, and opossums. Beech snags provide habitat for cavity-dwelling birds such as black-capped chickadees and tufted titmice. Beech is under threat from beech leaf disease (BLD) nematode (*Litylenchus crenatae mccannii*) and it is expected that many beech trees in our region will succumb to BLD. BLD nematode was first discovered in Ohio in 2012. Symptoms of BLD include striping, curling and leathery texture of leaves, with trees dropping leaves in severe infestations. This disease leads to branch dieback and eventually tree mortality. Over 90% of saplings may die within two to five years, while mortality of mature trees may take seven years. Beech trees on the preserve are also showing symptoms of a second disease, beech bark disease – the result of a non-native scale insect and a canker fungus.

### Emerald ash borer

Emerald Ash Borer (EAB), *Agrilus planipennis*, is an invasive beetle,



native to Asia. It was accidentally transported in infested wooden crates and pallets and first found in North America in southeastern Michigan.. The larvae feed on the inner bark of ash trees, disrupting the vascular tissue of the tree. Leaves will begin to die back and discolor as EAB kills their host tree. Trees also exhibit “blonding” when woodpeckers searching for emerald ash borers remove the outer bark of the ash tree, revealing the lighter-colored inner bark.

### Hemlock woolly adelgid

Hemlock Woolly Adelgid (HWA), *Adelgis tsugae*, is an invasive pest native to Japan. HWA was first observed in the eastern US in 1951 near Richmond, Virginia. HWA spread into the northern Shawangunks in the early 1990's. This aphid-like insect feeds on hemlock by inserting its mouthparts into the twig. HWA damages hemlock trees by wounding the twig and interfering with the tree's ability to take up water and nutrients. The result is needle drop, branch dieback and the eventual death of the tree. HWA feeds through the fall winter and spring. As it's feeding, it produces a white “wool” that insulates it from cold temperatures. Adults are very small, about 1.5 mm, and purple-black. Adults create an ovisac and lay 100-300 eggs in the spring. HWA is parthenogenetic (all female), have two generations per year and have the potential for populations to grow very quickly.



*Hemlock woolly adelgid,*  
5/25/2024



*Spongy moth defoliating scrub*  
oak, 5/25/2024

### Spongy moth

Spongy moth (*Lymantria dispar dispar*) is an invasive insect from France introduced to the United States in 1869. Larvae defoliate trees, especially their preferred tree, oak. Defoliation reduces a tree's health, but deciduous trees can releaf in the same season. During high population cycles, spongy moths may eat the needles of pine and hemlock and those trees may

die as the result of complete defoliation. The combination of spongy moth defoliation and drought could cause much mortality. Regional outbreaks are common with spikes in populations every 10-15 years.

### Japanese barberry



*Japanese barberry in a sea of stiltgrass,*  
6/29/2024

Japanese barberry (*Berberis thunbergii*) shrubs are scattered through the Appalachian oak-hickory forest. Japanese barberry was introduced into the United States in 1875 in Boston, when it was shipped from Russia to the Arnold Arboretum. Japanese barberry was popular in the ornamental industry, but since 2014 (with the exception of sterile cultivars) is prohibited for sale in New York State under NYCRR Part 575. Japanese barberry is tolerant of a wide variety of conditions, from full sun to full shade allowing it to invade a wide variety of habitats. Barberry can grow in dense thickets, especially in areas where the overstory opens up (e.g. due to ash mortality from emerald ash borer, or forests defoliated by spongy moth). Japanese barberry

can alter soil pH and nitrogen. In dense thickets of Japanese barberry there may be a 90% increase in ticks carrying Lyme disease compared to areas with native shrubs. Barberry creates a microclimate that is ideal for ticks and is excellent cover for mice, the larval tick's host. Japanese barberry has also been linked to increases in invasive earthworm populations and in soil erosion. Barberry plants can be prolific seed producers, producing up to 12,000 seeds per plant. Spread is by seed dispersal by birds and mammals and by vegetative propagation via



rhizomes and layering (branches will arc back to the ground and root when they contact the soil).

### Bush honeysuckle



*Invasive honeysuckle,*  
6/10/2024

A single clump of bush honeysuckle (*Lonicera* spp.) was found along the Main Trail, close to the parking area. The plant found was not mature enough to identify to species. Honeysuckle grows in a variety of habitats, but does best in full sun. It can form dense stands that shade out native plants. Its berries are attractive to birds which aid in their dispersal. However, these berries are less nutritious than native berries and don't provide the needed carbohydrates and calorie content that migrating birds need and the consumption of these berries can negatively impact birds' vigor during migration.

### Japanese stiltgrass



*Japanese stiltgrass,* 6/29/2024

Japanese stiltgrass (*Microstgium vimineum*) is native to Asia. It is believed that it was accidentally introduced to Tennessee in 1919 as packing material from porcelain imported from China. Stiltgrass is commonly found on roadsides and ditches and often thrives in soils that are moist, acidic to neutral, and fertile. Stiltgrass flourishes on moderate-to-densely shaded forest floors subject to regular soil disturbances, which could

include high foot traffic. Stiltgrass grows rapidly and is a prolific seed producer – each plant can produce from 100 to 10000 seeds. Seeds readily germinate after a disturbance. It also spreads by layering. It can change soil nutrient cycling and form dense mats outcompeting other plants. Dead stems form a thick layer of slowly-decomposing thatch that further inhibits the growth of other plants. Deer do not graze on stiltgrass,



but do graze on many native plants, further giving an advantage to the invasive plant. Stiltgrass threatens forests where tree canopies are defoliated events such as outbreaks of spongy moths or emerald ash borer.

### Multiflora rose

Multiflora rose (*Rosa multiflora*) is a perennial shrub that grows to a height of 10-15 feet and a width of 9-13 feet. It is a generalist and can grow in a wide range of soils. It thrives in full sun but can tolerate partial shade. It spreads quickly by several methods, producing thousands of seeds each season, resprouting and layering. Birds and other wildlife eat the rose hips and disperse the seeds. Seeds may remain viable in the soil for over 20 years.

### Garlic mustard



Garlic mustard, 5/25/2024

Garlic mustard (*Alliaria petiolate*) takes two years to mature. In the first year of this biennial lifecycle, it produces basal leaves. Leaves are dark green and kidney-shaped with scalloped margins. In its second year, plants may grow to 3.5 feet tall. Stem leaves become triangular shaped, with sharp teeth. Garlic mustard flowers April to June. Flowers have 4 small white, 3-6mm petals. Garlic mustard thrives in wooded areas and can germinate before native trees leaf-out. Each garlic mustard plant can produce over 600 seeds, before dying in June. The seeds may remain viable in the soil for five years. Seed dispersal is mainly by humans or wildlife carrying seeds.

### Coltsfoot

Coltsfoot (*Tussilago farfara*) is a perennial herb native to Europe that may have been introduced by colonists for its medicinal properties. Dandelion-like flowers emerge before the leaves in early spring and grow to 3-12 inches in height. Leaves are 3-7 inches wide, slightly toothed and whitish underneath. Coltsfoot reproduces both by seeds and rhizomes and can form large colonies. One plant can produce thousands of seeds. Coltsfoot thrives in moist soils, ditches, roadsides, and disturbed areas. It is intolerant of shade.

## Invasive Species Threats to Oak Forests Target

Invasive species were especially abundant and impactful in the oak forests. Some species of trees are declining due to forest pests. Invasive plants were only found at the entrance to the parking area and in the area mapped as oak forests. As trees (e.g. beech) are killed by forest pests, more light is available for invasive plants to take advantage of, and spread. This could lead to a shift away from native trees in the oak forest and towards invasive plants. Impacts of observed invasive species include:

- Beech leaf disease nematode is defoliating both mature and sapling beech trees along the Main Trail. Tree bud infected with the nematode may not produce new leaves the following year. It is expected that younger trees will die more quickly due to this defoliation.
- Emerald ash borer has killed some of the white ash trees and will continue to cause mortality of ash over time.
- Spongy moth defoliated many of the oaks and many other deciduous trees during the 2024 growing season. Spongy moth caterpillars were infected by both nucleopolyhedrosis virus (NPV) and the fungus, *Entomophaga maimaiga* by early June. The combination of the two diseases killed many of the caterpillars and trees subsequently re-foliated. In most years, oaks are able to releaf, but the coincidence of a gypsy moth defoliation and drought could cause much tree mortality.
- Hemlock trees are scattered in the Appalachian oak hickory forest. Hemlock woolly adelgid has killed some of the hemlock trees on the preserve and the remaining trees show defoliation due to hemlock woolly adelgid.
- Chestnut blight (*Cryphonectria parasitica*) infects American chestnuts that are found in both the Appalachian oak hickory and red maple hardwood forest. Chestnut blight was introduced to the Shawangunks in the early 20<sup>th</sup> century and generally limits chestnuts to small trees or tall shrubs.
- Invasive plants were only observed and documented in the oak forests. Japanese stiltgrass has the most cover of any invasive plants on the site and grows very densely near the beginning of the Main Trail. Japanese barberry is also scattered in the oak forest near the beginning of the Main Trail. Honeysuckle was only found near the beginning of the Main Trail. In addition, multiflora rose, coltsfoot and Japanese barberry occur along Dellenbaugh Road, at the entrance to the parking area.

## DEER BROWSE

Oak regeneration depends on both abiotic and biotic factors. An important abiotic factor is the amount of sunlight available on the forest floor. Oaks and shagbark hickory need an intermediate amount of sunlight available on the forest floor to regenerate. Obstacles to oak forest regeneration include white-tailed deer, interfering vegetation and overstory shade. White-tailed deer browsing is the major factor affecting forest regeneration. Deer have both direct and indirect effects on forest regeneration. Deer consumption impacts forest species composition, abundance and growth. Over time, selective deer browsing on preferred species reduces species richness and shifts species composition towards unpreferred and browse-resilient species. Oaks are very vulnerable to deer browse because they are highly preferred by deer and have low resilience to deer browse. An indirect effect of deer browse is an increase in browse-tolerant understory species that have an increased advantage over other plants (i.e. browse-tolerant herbs and shrubs will outcompete regeneration of forest canopy species). The region's forest history and decades of deer browsing has resulted in a failure of forest regeneration in this southeastern New York State (Zimmerman et al. 2020).

## CLIMATE CHANGE

Climate change is a long-term shift in temperatures and weather patterns that have come to define Earth's local, regional and global climate. These changes have been driven by human activity, especially the burning of fossil fuels, which have resulted in an increase in heat-trapping gases in the Earth's atmosphere. Forests in this region are facing increased vulnerability due to the changing climate. Analysis of climate records for this region show that temperatures and precipitation amounts are increasing. Forest impact models suggest that these changes will lead to long-term declines in many of the tree species on the preserve including American beech, eastern hemlock and eastern white pine; while other species will persist or increase such as black oak, northern red oak, pignut hickory and white oak (Butler-Leopold et al. 2018). Disturbances such as wildfire, hurricanes, and pest outbreaks are expected to increase. There are synergistic effects of the threats to the conservation targets of the preserve, the combination of climate change, invasive species, and deer browsing is leading to increased vulnerability of those ecosystems.

### Climate Change Impacts to Oak Forests Target

As a system over our region, oak forests are generally anticipated to be less vulnerable to climate change impacts (Butler-Leopold 2018). However, since there is very little regeneration of canopy tree species on the preserve, the loss of canopy trees could drive the forests to be a completely different type. Extreme weather events, such as an ice storm or drought could cause tree mortality and change key ecological processes within this conservation target. Severe wildfires that kill canopy trees could disrupt the oak forests if the fires are more severe than the oak trees are adapted for. The changing climate may allow invasive species to expand their range or change their life cycles to expand to new areas. Many invasive species are able to take advantage of longer growing seasons, giving them an additional advantage over our native species.

### Climate Change Impacts to Barrens Target

Barrens are also generally anticipated to be less vulnerable to climate change impacts (Butler-Leopold 2018). However, the barrens target has some of the same vulnerabilities as the Oak Forests in areas where there isn't reproduction of pitch pine. The changing climate may allow invasive species to expand their range or change their life cycles to expand to new areas and become more of an issue in the barrens target. This may have already contributed to the range expansion of southern pine beetle into this region.

### Climate Change Impacts to Cliff and Talus Target

Though the vegetation of cliff and talus communities is adapted to extreme dry conditions, it is possible that plants could succumb to severe drought conditions, especially in the talus communities where there is little soil to retain water. Increasing temperatures could exceed the tolerance of some plants to persist on the cliffs or in the talus communities. This could lead to erosion of the small amounts of soil that is there and drastic changes to these future habitats. Invasive pests or diseases could greatly impact these communities. The expansion of invasive vines could be especially impactful to these communities if they established themselves nearby and grew over these slow growing plants.

### Climate change impacts to Wetland Target

The wetland community on the preserve is small, 1.3 acres, and would be especially vulnerable to drought, or other alterations to the hydrologic regime. Another vulnerability of this system is that one tree species, red maple, dominates the forest canopy. A disease or forest pest that decimates maples would have a profound impact on this target.

## Management Actions and Considerations

Before taking any management action on the preserve, it's important to establish goals for the site, and the resources (time, labor, funding) that the preserve is able to dedicate to further sustained management. Recommendations recognize the limited resources available to the organization and volunteers may have to play a significant role in taking meaningful actions to protect the preserve.

### INVASIVE SPECIES MANAGEMENT

To address invasive species, the identified resources needed to achieve management goals will inform which type of management strategies could be employed. When considering invasive species management, the invasive species present and the desired outcomes are critical to determine what your feasible control strategy might be. Control strategies for invasive species may be one of the following: 1) eradication where all individuals and propagules can be eliminated from an area 2) containment where an infestation can be limited from spreading to uninfested areas and 3) suppression to reduce the density and protect targeted areas, but not necessarily remove the invasive from a region. 1) **eradication** – eliminate all invasive plants and the seed bank from an area. 2) **containment** – prevent infestations of invasive species from spreading to uninfested areas. 3) **suppression** – reduce the size, abundance, and/or reproductive output of an invasive plant population below the threshold needed to maintain native species or ecosystem functions.

### Invasive Species Found on Preserve

The combination of beech leaf disease (BLD) and beech bark disease is likely to kill beech trees on the preserve. Beech trees are scattered through the preserve and there will be small forest gaps created when

they die. Currently there are no feasible forest-scale treatments for BLD. There are several experimental options that may be beneficial for individual trees that are just showing signs of infection include thiabendazole and potassium phosphite. Thiabendazole may be the most effective treatment as it works as a nematicide to kill the BLD nematode (Lloyd et al. 2025). Foliar spray of fluopyram may also reduce BLD nematodes, but full foliar coverage would not be likely to be achieved in a forested setting where tree branching overlaps with surrounding trees. Potassium phosphite is a fertilizer that may help the tree to fight off the infection. Due to the cost of these treatments and possible ecological concerns, the recommendation would be to take no action.

Hemlock woolly adelgid can be treated by a licensed pesticide applicator using a mix of dinotefuran and imidacloprid. Both are systemic insecticides that have been shown to be effective in combination, even in forests. Dinotefuran is fast acting and imidacloprid is long lasting. The combination can provide seven years of protection against hemlock woolly adelgid. If resources are available and hemlocks on the site were deemed valuable enough for this to happen, then this could be an action that is taken.

Dead and dying ash trees on the preserve show signs of Emerald ash borer. EAB will continue to cause mortality of ash over time. Because ash trees die so quickly and the trees break down quickly, it is important to assess if additional ash mortality is likely to cause hazard trees in areas that are close to the parking area or trails. Systemic insecticides, such as dinotefuran, can be effective in treating individual ash trees. A professional arborist would need to be hired to treat trees. The cost to treat each tree depends on the tree size.

Spongy moth defoliated many of the oaks and many other deciduous trees during the 2024 growing season. In summer of 2024, spongy moth later instar caterpillars were infected by both nucleopolyhedrosis virus (NPV) and the fungus, *Entomophaga maimaiga* by early June. The combination of the two diseases killed many of the caterpillars and trees subsequently re-foliated. Over the long-term, spongy moth populations have been cyclic. Some evergreen trees may not be able to withstand total defoliation and even can succumb with a 50% loss of needles. Oaks are tolerant of defoliation and can leaf out in the same season. They even withstand several years of defoliation. However, defoliation does stress the



trees and makes them vulnerable to other pests, diseases and competition. Oaks have suffered the highest mortality during times of spongy moth outbreaks and drought, such as happened in the Shawangunks in the early 1980's.

Hemlock trees are scattered in the Appalachian oak-pine forest, Appalachian oak hickory forest, and the ledge rifts near the northern boundary of the preserve. Hemlock woolly adelgid has killed some of the hemlock trees on the preserve and the remaining trees show dead branches and some defoliation due to hemlock woolly adelgid.

Chestnut blight (*Cryphonectria parasitica*) infects American chestnuts that are found on the preserve in both the Appalachian oak hickory and red maple hardwood forest. Chestnut blight was introduced to the Shawangunks in the early 20th century and decimated the population of one of the most abundant trees in the forest (Thompson 2011). American chestnut on the preserve is now generally limited in size by the blight to small trees or tall shrubs.

Japanese barberry shrubs can be managed by manual removal – digging up by the roots before plants set fruit. Considering that a number of the barberry on the preserve are smaller plants, this could be done with relatively small effort and could be effective in suppressing this plant.

Japanese stiltgrass thrives in forested areas with moist soils and this is the habitat that it is found in at the preserve. Plants are weakly rooted annuals that set seed in late-summer. Seeds are born on delicate stalks and have closed cleistogamous flowers occurring in short branches low on the stems. Each plant can produce 1,000 seeds annually. Seeds remain viable in the soil for five years. Seeds may be moved by water, humans and wildlife. Stiltgrass can be pulled by hand or mowed to slow spreading. Plants should be removed from areas near trail.

Garlic mustard is a biennial (two year life cycle), a basal year of ground-level leaves and a bolt year, where seed-producing plants can grow to 3 feet tall. Propagation is entirely through seed. Each plant may produce thousands of seeds. Garlic mustard forms dense stands and crowds out native herbaceous understory plants. Garlic mustard is allelopathic and inhibits the growth of other plants. Persistence of this plant may impact the growth of spring ephemerals in the forest understory, decreasing species richness. Seeds can be dispersed by wind, water, or soil movement. The

seeds may remain viable in the soil for five years. It can be controlled by manual pulling in spring, but caution should be taken to bag plants as even early pulling treatments may include plants that have viable seeds.

Seedlings can easily be pulled by hand and larger plants can be dug up. Manual removals may need to be repeated for multiple years (possibly over a decade) to exhaust the seed bank. Any mature plants outside the preserve boundaries could be propagule sources and could extend the need for management.

Coltsfoot can be competitive and invade natural communities along a disturbed corridor. Small infestations may be controlled by hand pulling when soil is moist to remove the entire plant.

Boot brushes have been shown to be effective in removing garlic mustard, Japanese stiltgrass and many other species from boots (<https://naisma.org/2020/03/12/boot-brush-stations-are-they-effective/>). A boot brush station to clean footwear before or after a hike can prevent the spread of invasive species. A boot brush station includes a large brush to clean dirt and debris from shoes before or after a hike. An interpretive panel is another component of the boot brush station that educates visitors about the importance of cleaning their footwear and may include interpretive information about invasive species. Mud and dirt attached to shoes can carry seeds and eggs of invasive species. Boot brushes can be constructed at a relatively low cost and there are instructions online for necessary materials and construction (e.g., <https://fingerlakesinvasives.org/bootbrush-stations/>). In order for boot brushes to remain effective they need regular maintenance, signage must be kept clean, worn bristles must be replaced as needed and the area around the boot brush station should be periodically cleared of weeds.



*Boot Brush Station, NAISMA.*

The preserve could organize volunteer workdays to remove invasives and provide outreach on invasive species to minimize the spread of invasive plants. To help decrease the threat of invasive species on the preserve, Cragmoor residents could remove invasive plantings on their own properties and further enhance the ecological functions of habitats on the preserve by planting native plants.

Unfortunately, many invasive plants were introduced as ornamentals and 61 percent of plants identified as invasive are still available for sale in the plant trade (Beury et al. 2021). Even though New York State has enacted regulations that prohibit and regulate the movement of invasive species in New York State, there are many invasive species that are not covered in this list. In addition, lists of regulated plants vary by state, so plants restricted in New York may be available for sale in other states and brought to the area.

It would be a benefit to the wildlife that inhabits the preserve to increase the connectivity of the preserve with surrounding protected lands. To facilitate this, Cragmoor homeowners could join some of the grassroots organizations such as Homegrown National Park (<https://homegrownnationalpark.org/>) or Pollinator Pathway (<https://www.pollinator-pathway.org/>) to minimize the use of ornamental invasives and encourage natives. For example, planting trees such as oaks support caterpillars that provide an important food source for birds when they are raising their young. Exotic plants are not as valuable a food source for native wildlife.

### Nearby Invasive Species Threats to Monitor

Southern pine beetle (*Dendroctonus frontalis*) is a bark beetle that infests pitch pine and white pine. The small beetle is 2-4mm in length. Adult beetles tunnel through tree's cambium tissue, disrupting the vascular tissue and killing the tree within 2-4 months. Southern pine beetle Signs of infestation include, pitch tubes of resin on exterior of tree trunks, shotgun patterned holes in the bark. S-shaped tunnels under the bark and reddish-brown needles on recently killed trees. The beetle was first found in New York, on Long Island, in 2014. It has now spread to Minnewaska State Park. Collaborating with Minnewaska State Park Preserve staff and other Shawangunk land managers to develop an early detection and rapid response for this species is important.

Jumping worms (*Amyntus* – *Metaphire* spp.)– though jumping worms were not observed on the site, sampling wasn't performed to specifically target worms. Jumping worms consume and degrade soil and alter nutrient cycling. Monitoring for jumping worms includes looking for their castings, which look like coffee grounds. If jumping worms are not on the site, great care should be taken to prevent their spread, including not bringing in topsoil or compost. More information about minimizing the spread of jumping worms can be found on this homeowners guide:

<https://ecommons.cornell.edu/items/bc560004-4c34-45df-86eb-d5f074233b0d>

### Invasive Species Horizon Scanning

Horizon scanning for invasive species is a process to help identify potential significant threats that are not currently nearby but would have significant negative impacts if they were to spread to a focal area. It is important to monitor for these species to occur and report them if they are found.

Invasive vines could be a direct threat to the preserve's conservation target. Oriental bittersweet (*Celastrus orbiculatus*) is a woody vine that can grow to 60 feet long. It aggressively climbs and twines around trees



and can strangle trees that it climbs on. Oriental bittersweet has been documented within 3 miles of the preserve. Mile-a-minute (*Persicaria perfoliata*) is an annual vine that can grow to up to 30 feet in a year. It quickly covers and smothers native vegetation. Kudzu (*Pueraria montana*) has been documented within 20 miles of the preserve. It is a semi-woody vine that is tolerant of droughty conditions and can grow up to 60 feet in a single season and vines can extend up to 100 feet. These and other invasive vines can be reported through [iMapInvasives.org](http://iMapInvasives.org).

Oak wilt disease (*Bretziella fagacearum*) was first found in New York in 2008. It has been found in the following locations in New York: Long Island, Glenville, Canandaigua, and South Bristol. Oak wilt is a fungus infecting oak trees that develops in the conductive tissue of the trees and can kill oaks in the red oak group (e.g. red, black, and scrub oak) within six months, while oaks of the white oak group (e.g. white and chestnut oak) often take years to die. There are two main ways that oak wilt is spread, above ground by beetles and below ground through root connections. Fungal spore mats grow under the bark of oaks and emit a sweet odor during the growing season that attracts sap-feeding and bark beetles. These beetles are also attracted to fresh tree wounds and spread the spores from infected trees to uninfected trees, which may be miles away. Infected firewood may also harbor the fungus and spread the disease. Roots of the red oak group fuse together and the fungus can move through the network of interconnected roots to infected patches of trees. White oak group oaks are less likely to form root grafts and spore mats, therefore spread is not as likely in the white oak group as it is in the red oak group. Symptoms of oak wilt include brown coloration on leaves, starting at the outer edge and progressing inward towards the mid-vein. Branch dieback may begin towards the top of the tree and progress downward. Leaves suddenly wilt in the spring and summer and fall while they still have some green coloration on them. The most important action that can be taken is to learn how to recognize the symptoms of oak wilt: leaf discoloration, rapid leaf loss during the growing season, and fungal spore mats. If found, report oak wilt to [foresthealth@dec.ny.gov](mailto:foresthealth@dec.ny.gov). One spread vector for invasive forest pests is firewood. Pests can survive in firewood produced from either healthy or diseased trees. In New York, it is illegal to move firewood. Campaigns such as “don’t move firewood” and “burn it where you buy it” encourage the public to purchase firewood locally and not move it for long distances. Oaks are a keystone species on the preserve. Oaks are dominant in the chestnut oak forest, the Appalachian oak-hickory forest, and the Appalachian oak-pine forest. In addition, scrub oaks are an important component of the pitch pine-oak-heath

rocky summit community, a decline in oaks would greatly impact these habitats.

Asian longhorned beetle (*Anoplophora gabripenis*) is an invasive wood-boring insect that feeds on a variety of hardwoods including, 13 different genera of host trees, with a preference for maples. It is a threat to the region's hardwood forests. The beetles are approximately 1.5 inches long and colored black with white spots on their wing cases. Native to eastern Asia, the Asian longhorned beetle (ALB) is currently found in four states in the United States, New York, Massachusetts, Ohio, and South Carolina. There are federal ALB quarantines in central Long Island, New York; Worcester County, Massachusetts; Clermont County, Ohio; and Charleston and Dorchester Counties, South Carolina. Signs of ALB include 1/4-1/2 inch diameter exit holes in bark, oval-shaped oviposition pits, yellowing or dropping leaves and branch dieback. As noted above, firewood could be a vector for this species and encouraging firewood to be purchased locally is important.

Bsal *Batrachochytrium salamandrivorans* is an emerging salamander and frog pathogen that causes significant morbidity and mortality. It was first observed in Europe in 2013. Likely endemic to Asia, it is suspected to have spread to Europe through the global pet trade and was transmitted from captive to wild populations. It has not yet been detected in North America, but its introduction is likely with the volume of the pet trade. From 2010-2014, over 750,000 salamanders were imported into the United States. Monitoring is currently being conducted by the North American Bsal Task Force using molecular techniques such as PCR to detect Bsal from skin swabs. Salamanders may show symptoms such as lethargy and skin lesions.

## DEER BROWSE AND CLIMATE CHANGE

The problem of oak forest regeneration is an issue across southeastern New York State. Because the vulnerability of oak forests is primarily due to lack of regeneration, promoting oak regeneration could help build resilience in this target. This can even be encouraged on a smaller scale with deer exclosures. The Beech Leaf Disease Coalition is a group of environmental organizations that are attempting to address forest degradation caused by beech leaf disease (the loss of beech). One strategy that is being attempted is actively manage forest stands by building deer exclosures ([www.teatown.org/bld/](http://www.teatown.org/bld/)). Relatively low cost fencing methods are being developed. This would require some funding and labor to install the fencing and would require monitoring and irregular maintenance. As the forest canopy on the preserve is opening up due to

the loss of trees because of emerald ash borer, beech leaf disease, and hemlock woolly adelgid; deer exclosures could be in place to protect native tree seedlings.

## RECREATIONAL OVERUSE

All wildland recreation activities cause some disturbance of the natural environment including impacts to soil, vegetation and wildlife.

Recreational use of the Bear Hill Preserve can be a significant threat to its vulnerable ecosystems through impacts such as trampling vegetation, disturbing wildlife and littering. Trampling of vegetation can lead to exposed soils, loss of organic matter, and soil compaction. Soil compaction alters basic characteristics of soil such as aeration, temperature, moisture, nutrition, and the organisms that inhabit the soil. These changes in soil condition inhibit the establishment of plants and may adversely affect the growth of existing vegetation.

At the Bear Hill Nature Preserve, the number of recreational visitors that can visit the preserve at one time are limited, to some extent, by the size of the parking area. Group sizes at the preserve are also limited to 15 people.

Despite these constraints, there is some evidence of overuse of the preserve that should be addressed and monitored. Evidence of overuse observed on the preserve included, severe trail incision and social trails. The worst example is the entrance to the rock scramble. The trail is deeply incised to a depth of 27 ½ inches below the soil surface. Incision occurred there due to a combination of trampling vegetation, which led to creating a deep rut below the surrounding soil level, and runoff is likely to continue to erode that area.



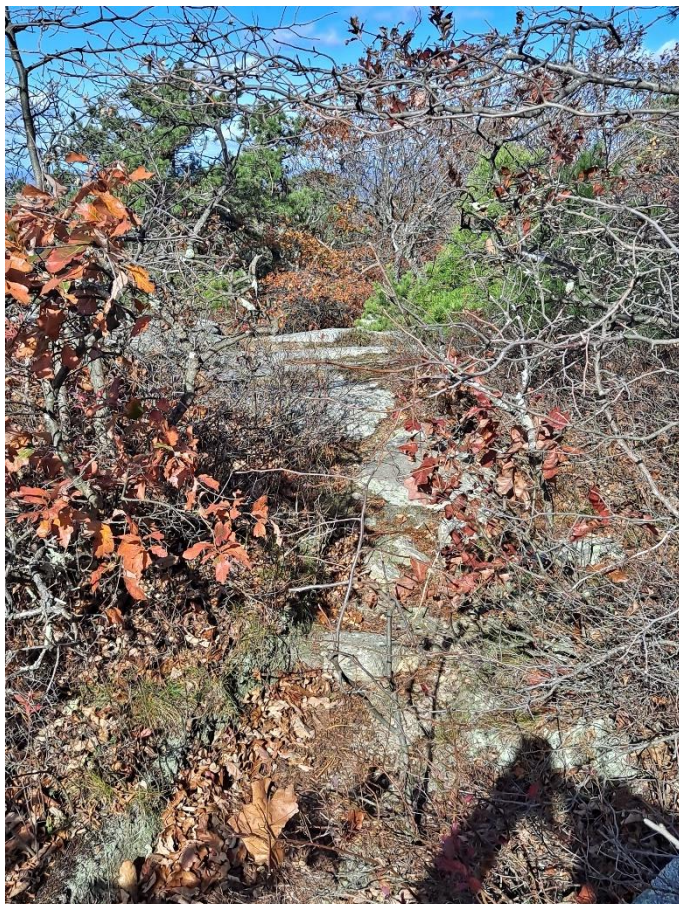


*Deep soil incision at entrance to Crevice*

The trail incision should be corrected with some hardened steps and possibly with a water diversion. See example here:

[www.greenmountainclub.org/the-fight-against-trail-erosion/](http://www.greenmountainclub.org/the-fight-against-trail-erosion/)

Trails and the presence of visitors on them can impact wildlife by fragmenting habitat and causing avoidance behavior in some animals. Recreationists that don't stay on trails trample plants – reducing the vigor and density of plants –and compact soil. Bare soils exposed by trampling could be vulnerable to erosion and also to invasion by problematic plants.



*Trampled area near top of cliff*



*Thin soils surrounding open rock are vulnerable to trampling and erosion*



Social trails – unofficial, unauthorized, visitor-created paths off designated trails - are a management challenge on the preserve. Social trails can have negative impacts on plants, animals and the habitats that they depend on. These trails may present risks to the recreationist in that recreationists could become disoriented and exposed to hazards and dangers on paths that are not patrolled, monitored, or maintained. Designated trails were built to minimize erosion, provide scenic views, and avoid sensitive plants and animals. These social trails could lead to trampling of small plants, compaction of soils, soil erosion and tree root exposure – which damages trees. A number of social trails were observed branching off of the authorized trails on all of the trails on the preserve.

Encourage hikers to stay on trail by using physical barriers - block social trails with brush or line trail edge with rocks or logs. Brushing out the trail further down could help hide the route and discourage hikers from leaving the designated trail. Monitor these physical barriers frequently and if frequent brushing out doesn't work, install signage to encourage hikers to stay on designated trail.

Encouraging "Leave No Trace" principles would help to promote the "Please Do Not Litter Carry In Carry Out" messaging and corresponds with the PlayCleanGo messaging. Leave No Trace" is a national educational program to raise awareness about minimizing the impacts of outdoor recreation (<https://lnt.org/>). The seven principles of Leave No Trace are the following:

1. Plan ahead and prepare
2. Travel and camp on durable surfaces
3. Dispose of waste properly
4. Leave what you find
5. Minimize campfire impacts
6. Respect wildlife
7. Be considerate of other visitors

Neither camping or fires are allowed on the preserve, but the remaining principles apply. Leave no trace messaging on the preserve could help promote minimum impact practices by visitors and the messaging is complementary to invasive species spread prevention (e.g. PlayCleanGo).

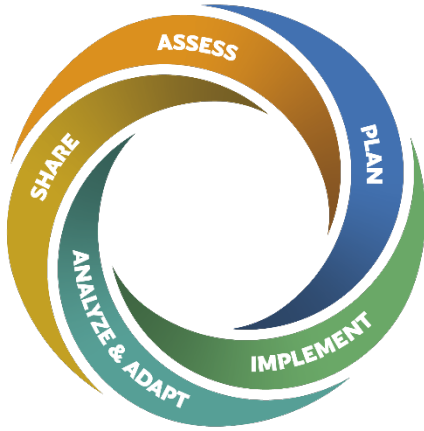
## RECOMMENDED MANAGEMENT ACTIONS

Conservation Target	Threat	Action
Oak Forests	Honeysuckle sp.	Dig up by the roots
Oak Forests	Japanese barberry	Dig up plants by the roots before they set fruit.
Oak Forests	Japanese stiltgrass	Hand pull or mow to slow spreading before late summer when it sets seed. Remove plants near trails.
Oak Forests	Garlic mustard	Hand pull or dig up plants in spring, taking care to bag plants to prevent spreading viable seeds.
Oak Forests	Coltsfoot	Hand pull when soil is moist.
Oak Forests	Invasive species	Install boot brush station.
Oak Forests	Invasive species	Provide outreach on invasive species to visitors and Cragmoor residents and encourage residents to remove invasive species
Oak Forests	Jumping worms	Monitor for presence

Oak Forests	Emerald ash borer	Survey for ash trees that may become hazard trees.
Oak Forests, Barrens, Cliff and Talus, Wetlands	Habitat fragmentation	Encourage residents to join habitat connectivity organizations like Homegrown National Park or Pollinator Pathway
Barrens, Cliff and Talus	Southern Pine Beetle	Collaborate with Minnewaska State Park Preserve staff and other Shawangunk land managers to develop early detection and rapid response if found.
Cliff and talus	Recreational overuse	Harden entrance to the rock scramble with stone steps and provide a runoff diversion.
Oak Forests, Barrens, Cliff and Talus	Recreational overuse - social trails	Mark designated trail more clearly near social trails.
Oak Forests, Barrens, Cliff and Talus	Recreational overuse - social trails	Block social trails with brush or line the trail with rocks.
Oak Forests, Barrens, Cliff and Talus	Recreational overuse - social trails	Install signage to encourage hikers to stay on designated trails.



## Conclusion



The vision and goals for the Bear Hill Nature Preserve should be clearly identified and management actions can be tailored to meet those priorities. Managing a nature preserve is complex considering that the area being protected is providing for the needs of wildlife while managing people that are seeking a place to connect with nature. The Open Standards for the Practice of Conservation (Conservation Standards) offer a decision-making

framework that could be very valuable to determine the management priorities of the Bear Hill Nature Preserve. The Conservation Standards provide a globally recognized systematic approach to planning, managing and monitoring the preserve to offer the best practices in management. The steps in the Conservation Standards cycle are the following:

1. Assess
  - a. Define purpose and identify project team
    - i. Project team
  - b. Define scope, vision, and conservation targets
    - i. Scope
    - ii. Vision
    - iii. Conservation Targets
    - iv. Human well-being targets
  - c. Identify critical threats
  - d. Assess the conservation situation
2. Plan
  - a. Develop a formal action plan: goals, strategies, assumptions and objectives
  - b. Develop a formal monitoring, evaluation, and learning plan
  - c. Develop an operational plan
3. Implement
  - a. Develop a detailed short-term work plan and timeline
  - b. Develop and refine your project budget

- c. Implement your plans
- 4. Analyze and adapt
  - a. Prepare your data for analysis
  - b. Analyze and reflect on results
  - c. Adapt your strategic plan
- 5. Share
  - a. Document what you learn
  - b. Share what you learn
  - c. Foster a learning environment
- 6. Close the loop

This report focuses on Steps 1 and 2, but as you can see from the descriptions of those two steps, more could be done to define the vision of the preserve; define goals, develop a monitoring evaluation and learning plan; develop an operational plan; and then proceed to the remaining steps. Completing the loop could be a long and involved process but could help to define a clear vision that could be reevaluated based on changing situations and lessons learned in completing the cycle.

Managing the Bear Hill Nature Preserve is a significant and important undertaking. It is a beautiful area that faces significant threats. Some of these threats could be addressed in the near future and some will depend on long-term collaboration with neighbors and nearby land managers. The Cragmoor community stepped up to protect the Bear Hill Preserve. The Cragmoor Association has limited resources to manage the preserve but can still make informed and effective conservation decisions to improve management over time.

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## Appendices

### APPENDIX A: INATURALIST SPECIES LIST

Downloaded 24 March, 2024

Research grade observations within 50 meters of the Preserve boundary.

<b>Taxon</b>	<b>Scientific Name</b>	<b>Common Name</b>
Amphibia	American Toad	Anaxyrus americanus
Amphibia	Eastern Newt	Notophthalmus viridescens
Arthropoda	Common Shiny Woodlouse	Oniscus asellus
Aves	Cooper's Hawk	Accipiter cooperii
Aves	Pileated Woodpecker	Dryocopus pileatus
Aves	Barred Owl	Strix varia
Fungi	Tawny Grisette	Amanita fulva
Fungi	Pear-shaped Puffball	Apioperdon pyriforme
Fungi	Dryad's Saddle	Cerioporus squamosus
Fungi	Golden Spindles	Clavulinopsis fusiformis
Fungi	Viscid Violet Cort	Cortinarius iodes
Fungi	Eastern Black Trumpet	Craterellus fallax
Fungi	Yellowfoot	Craterellus tubaeformis
Fungi	birch polypore	Fomitopsis betulina
Fungi	Weeping Milk Cap	Lactifluus volemus
Fungi	Pennsylvania Toadskin Lichen	Lasallia pensylvanica
Fungi	Ochre Jelly Club	Leotia lubrica
Fungi	common puffball	Lycoperdon perlatum

Fungi	Parasitic Bolete	Pseudoboletus parasiticus
Fungi	blood red russula	Russula rosacea
Fungi	common earthball	Scleroderma citrinum
Fungi	jellied false coral fungus	Sebacina schweinitzii
Fungi	Painted Suillus	Suillus spraguei
Fungi	Smooth Rock Tripe	Umbilicaria mammulata
Insecta	Hickory Tussock Moth	Lophocampa caryae
Insecta	Spongy Moth	Lymantria dispar
Insecta	Oak Leaf Gall Midge	Polystepha pilulae
Plantae	striped maple	Acer pensylvanicum
Plantae	wild sarsaparilla	Aralia nudicaulis
Plantae	American Chestnut	Castanea dentata
Plantae	striped wintergreen	Chimaphila maculata
Plantae	bastard toadflax	Comandra umbellata
Plantae	sweet-fern	Comptonia peregrina
Plantae	intermediate wood fern	Dryopteris intermedia
Plantae	mountain laurel	Kalmia latifolia
Plantae	northern starflower	Lysimachia borealis
Plantae	Ghost Pipe	Monotropa uniflora
Plantae	whorled wood aster	Oclemena acuminata
Plantae	pitch pine	Pinus rigida
Plantae	eagle fern	Pteridium aquilinum latiusculum

Plantae	bear oak	Quercus ilicifolia
Plantae	early azalea	Rhododendron prinophyllum

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## APPENDIX B: BIRD SPECIES LIST

Common Name	Scientific Name
Wild Turkey	<i>Meleagris gallopavo</i>
Mourning Dove	<i>Zenaida macroura</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>
Double-crested Cormorant	<i>Nannopterum auritum</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Barred Owl	<i>Strix varia</i>
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>
Downy Woodpecker	<i>Dryobates pubescens</i>
Hairy Woodpecker	<i>Dryobates villosus</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Northern Flicker	<i>Colaptes auratus</i>
Eastern Wood-Pewee	<i>Contopus virens</i>
Eastern Phoebe	<i>Sayornis phoebe</i>
Great Crested Flycatcher	<i>Myiarchus crinitus</i>
Blue-headed Vireo	<i>Vireo solitarius</i>
Blue-headed Vireo	<i>Vireo solitarius</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Blue Jay	<i>Cyanocitta cristata</i>
American Crow	<i>Corvus brachyrhynchos</i>
Common Raven	<i>Corvus corax</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>
Tufted Titmouse	<i>Baeolophus bicolor</i>
Ruby-crowned Kinglet	<i>Corthylio calendula</i>



White-breasted Nuthatch	<i>Sitta carolinensis</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
Brown Creeper	<i>Certhia americana</i>
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>
Winter Wren	<i>Troglodytes hiemalis</i>
Gray Catbird	<i>Dumetella carolinensis</i>
Eastern Bluebird	<i>Sialia sialis</i>
Veery	<i>Catharus fuscescens</i>
Hermit Thrush	<i>Catharus guttatus</i>
Wood Thrush	<i>Hylocichla mustelina</i>
American Robin	<i>Turdus migratorius</i>
Cedar Waxwing	<i>Bombycilla cedrorum</i>
House Finch	<i>Haemorhous mexicanus</i>
American Goldfinch	<i>Spinus tristis</i>
Chipping Sparrow	<i>Spizella passerina</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
White-throated Sparrow	<i>Zonotrichia albicollis</i>
Song Sparrow	<i>Melospiza melodia</i>
Eastern Towhee	<i>Pipilo erythrophthalmus</i>
Baltimore Oriole	<i>Icterus galbula</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Ovenbird	<i>Seiurus aurocapilla</i>
Worm-eating Warbler	<i>Helmitheros vermivorum</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
American Redstart	<i>Setophaga ruticilla</i>
Blackburnian Warbler	<i>Setophaga fusca</i>
Yellow Warbler	<i>Setophaga petechia</i>
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>
Blackpoll Warbler	<i>Setophaga striata</i>

Black-throated Blue Warbler	<i>Setophaga caerulescens</i>
Pine Warbler	<i>Setophaga pinus</i>
Yellow-rumped Warbler	<i>Setophaga coronata</i>
Prairie Warbler	<i>Setophaga discolor</i>
Black-throated Green Warbler	<i>Setophaga virens</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Northern Cardinal	<i>Cardinalis cardinalis</i>
Indigo Bunting	<i>Passerina cyanea</i>

## APPENDIX C: