

Biodiversity Assessment of the North Highlands,
Philipstown, Putnam County

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Introduction

Our study area of 5,000 acres covers the northern part of the Town of Philipstown that lies within the West Point Quadrangle of New York State. We live in a region that is rich with a variety of natural habitats, many of which support rare and endangered species, both plant and animal. Our study area was chosen primarily because the threat of development to this area is very high, putting these delicate natural communities at risk. A major commercial corridor bisects the area.

We feel our study area is particularly significant because it is part of one of the largest swaths of forest that remain in the entire Northeast – the Highlands Region. The Highlands Region provides drinking water sources for 4 million New York and New Jersey residents, sustains animals that require large undisturbed areas as well as the “umbrella species” that have smaller habitat requirements, contributes greatly to our air quality, and provides many recreational opportunities to millions each year. Over 40% of Philipstown’s land is protected, either as state park or through conservation easements or outright purchase of land for conservation. Most of this land is part of a significant healthy, sustainable and intact forest that stretches far beyond our Town’s boundaries. This forest is categorized as a matrix forest by the Nature Conservancy because of its size and scope.

Our Philipstown study group is a collaboration of public and private groups: the Hudson Highlands Land Trust, Constitution Marsh Audubon Center and Sanctuary, Philipstown Comprehensive Plan Board and Putnam County Soil and Water District. Our team has joined the ranks of other Hudsonia Biodiversity Assessment training groups in our immediate region. Among the groups that have completed or are about to complete relevant biodiversity work are East Fishkill, Fishkill, Cortlandt and Yorktown. The results of this map work, these habitat predictions and biodiversity assessments will augment work performed by the New York Natural Heritage Program, Metropolitan Conservation Alliance, Hudsonia and the Highlands Regional Coalition. The combined efforts greatly expand the available information on the health of our local habitats. A large-scale picture is taking shape and will assist in making present and future land-use decisions.

The purpose of our study is to apply what we learn to our Town as a whole, raising awareness of our natural assets to its residents and decision-makers. As we study this area, we raise questions as to the impact that existing human habitation has had on these natural habitats. Even greater questions arise as to the impact of any further development.

Our study area abuts the north and western boundaries of Fahnestock State Park, approximately 13,000 acres of woods, wetlands, rock outcrops, stands of mountain laurel, many lakes and streams. Much of our study area is a continuation of this terrain, but then becomes residential, especially as we move north and west of the park. Residential density increases as we move toward Route 9, becoming a predominantly commercially zoned corridor. Gravel mining, businesses catering to automobiles and several small strip malls are among the commercial businesses that exist today. Clove Creek, a significant water source to the region, runs through the area and though much of where it winds is relatively undisturbed, much of it is prone to the toxicity of the commercial zone.

Data received from the NY Natural Heritage Program tell us there are many significant ecological communities that exist within our region. Examples of chestnut oak forest, Appalachian oak-hickory forest, oak-tulip tree forest and red cedar rocky summit occur locally. A number of fish, reptiles, birds and plants, many of which are threatened and endangered, are supported by these communities.

As we have accumulated and studied our data, the significance of what we found exists here in Philipstown will motivate us to continue to inform and educate both ourselves and our Town to become the best possible stewards of our land. We are aware of large landholders who do not reside in Philipstown whose decisions would greatly impact our environment, but not theirs. If we can alert those who do live here as to what the potential losses might be, then perhaps we can make a difference in preserving our precious landscapes.

Methods

Several techniques of evaluating the landscape were utilized to create the final habitat map and report. By combining information from existing resource maps, aerial photograph analysis and field assessment, the location of specific habitats can be determined on a particularly fine scale. Map and photograph interpretation were used to reliably predict the presence of habitats through most of the entire 5000 acre study site, as field verification over such a large area is impossible. A rare species survey of the study area was obtained from the New York Natural Heritage Program.

Map analysis consisted of the interpretation of topographic, bedrock geology and county soil maps. Inspection of the 1956 United States Geographic Survey Topographic Map, West Point Quadrangle (revised and updated 1981, 1:24,000 scale, 20 ft. contour interval), revealed landscape features such as steep slopes, depressions, level terrain, ravines, water bodies and watercourses. The potential location of more subtle terrain features such as intermittent streams, ground seeps, seasonal wetlands were determined as well.

Soil chemistry, type and depth can also be reliable indicators of habitat. This information was obtained from the 1994 Soil Survey of Putnam and Westchester Counties, New York (United States Department of Agriculture Soil Conservation Service), and 1983 bedrock geology maps obtained from New York State Museum Geographic Information Systems. Infrared color aerial photographs obtained from the USGS (taken in 1994) were also utilized to further verify habitat locations and characteristics. When viewed through a stereoscope, overlapping photographs will produce a three-dimensional image. Water bodies, wet soils and different vegetative cover types are displayed in distinctive colors that can reveal the precise locations and sizes of different landscape features.

These multiple sources of information were overlaid to help confirm suspected habitat locations, types and boundaries and were transferred to the habitat map by hand.

Field visits verified the presence of suspected habitat types and the occurrence of individual species. After obtaining landowner permission, three field outings were conducted on March 20, April 4 and May 12, 2003. Each field outing lasted approximately two hours.

March 20 was cold and overcast, with 4-6 inches of snow cover. Habitat verification took place off of East Mountain Road South, behind Carlson's Greenhouse. Second growth deciduous woodlands dominated the site. The area contained a pond with associated shrub swamp wetlands and small phragmites patches. Previously disturbances were evident, as the perennial stream draining the wetland was channelized. Red maple/hardwood swamps flanked the old dirt road that provided foot access. Other specimens included winterberry holly, witch hazel and spicebush. The surrounding small hills were strewn with boulders.

April 4 was raw and cold. Habitat verification took place off of East Mountain Road North, near the Beacon Reservoir. An adjacent wetland south of the reservoir held wood frog and spotted salamander eggs. A seep northeast of the reservoir was persistent enough to support soft-

stemmed bulrush and other obligate wetland plant species. Waste ground, presumably an old dump, east of the reservoir, was also examined.

May 12, in the Lake Surprise area, was overcast with rain showers, and approximately 60F. The west-facing slope was deciduous upland forest dominated by chestnut oak, with a rocky understory primarily of black huckleberry and blueberry. The exposed crests were disturbed by campfires, and contained shadbush, chokecherry, black cherry and scrub oak. Rock tripe lichen grew on many of the bare rock surfaces. Other habitats in the area included dense mountain laurel stands and small wetlands that contained skunk cabbage, tussock sedge, and sphagnum moss. Spotted salamander eggs and spring peepers were observed, along with a medium-sized snapping turtle.

Resident and migratory birds that were observed during the field outing included house finch, Baltimore oriole, yellow-billed cuckoo, American redstart, black and white warbler, worm-eating warbler, ovenbird, prairie warbler, black-throated green warbler, red-eyed vireo and wild turkey. Fresh water mussel shells and a painted turtle were observed in the lake.

More detailed information on specific habitats and associated wildlife communities are provided by Hudsonia's Biodiversity Assessment Manual and through the consultation of local naturalists. Field guides and other references can also provide considerable additional information.

Results

Habitat Descriptions

Upland Deciduous Forest

Of the 5,000 acres in this study area, approximately 70%, or 3,500 acres can be characterized as upland deciduous forest. This dominant habitat envelops and/or overlaps all other habitats in the study area. Several forest communities make up this habitat, including the following New York Natural Heritage (NYNHP) designated communities: Chestnut Oak Forest, Appalachian Oak-Hickory Forest, Oak-Tulip Tree Forest, and High Forest/Shrubland (Strong, 2003). In addition to Red, White and Chestnut Oaks, other dominant tree species include Tulip Tree, White Ash, Red and Sugar Maple, Black Birch, and Shagbark Hickory. Representative understory species vary from Low-bush Blueberry and Black Huckleberry in areas with shallow soils to Flowering Dogwood and Shadbush in areas with rich, well drained soils. Many bird species depend upon the mature forests found in this habitat, including Eastern Wood-Pewee, Wood Thrush, Worm-eating and Black-and-white Warblers, American Redstart, Ovenbird, Scarlet Tanager, Rose-breasted Grosbeak and Baltimore Oriole (Anderle and Carroll, 1988). Recent sightings of Fisher, a large member of the weasel family, and Porcupine (Kuznia, Mastrantuono, personal communications and Anderson, Lind, personal observation) are most likely attributed to the continuity of this habitat.

Like much of New England, miles of stone walls line the forests in this area, and offer an indication of its past use. Though much of the study area was, at one time, cleared for agriculture and charcoal production, much of this habitat has recovered to second and third-growth mature forest. In the Nature Conservancy report, M5: Chesapeake Bay Lowlands Ecological Planning, Samson identifies this area as part of the "Philipstown Matrix Forest", an important source of regional biodiversity. The contiguous expanse of this forest habitat maintains wildlife corridors between the protected areas of Hudson Highlands and Fahnestock State Parks. Of the 16 habitat types identified in this report, the Upland Deciduous Forest is most at risk from development pressure, because of topography and relative accessibility. Fragmentation, through development, is a serious threat to the integrity of this habitat, as are over- and malignant recreational uses.

Upland Mixed Forest

This subordinate forest habitat comprises approximately 1% (50 acres) of the study area, with the largest example located between the Philipstown Industrial Park and East Mountain Road, just east of the Clove Creek flood plain. This habitat is generally surrounded by upland deciduous forest. The species composition includes various deciduous forest species as well as conifer species including, Eastern Hemlock, White Pine and Eastern Red Cedar. These habitats are possible breeding locations for Red-shouldered Hawk, a NYS species of special concern, and Barred Owl, particularly in areas adjacent to flood plains (Bull, 1985). Because of its vicinity to East Mountain Road, this habitat too is at risk from development pressure and subsequent fragmentation. This habitat and others are vital to the health of Clove Creek and is an integral part of its riparian corridor (Kiviat and Stevens, 2001).

Upland Conifer Forest

In the study area, this habitat type is dominated by Eastern Hemlock and to lesser extents, White Pine and Eastern Red Cedar, and amounts to approximately 2% (100 acres) of the land area. The best examples of this habitat are west of Route 9 in the vicinity of the Old Beacon Reservoir and east of Route 9 along East Mountain Road North, southwest of the New Beacon Reservoir. Striped Maple and With Hazel are common in the understory of this habitat along with Christmas Fern. Conifer Forests are important roost sites for owls (Stevens and Broadbent, 2002) and in this study area are important for a New York State endangered, Federally threatened species (NYNHP, 2003 and Anderson, Lind, personal observation). The aforementioned examples of this habitat, or portions thereof, could be classified as cool ravines (Kiviat and Stevens, 2001), which often host plant and animal species, such as Winter Wren (Anderson and Lind, personal observation) that are typically found in northern climates. The shade from conifers in these ravines plays a critical role in maintaining the water temperature of the streams that flow through them (Kiviat and Stevens, 2001), which are part of the Clove Creek watershed. The largest example of this habitat in the study area is currently being threatened by development along East Mountain Road North. The integrity of this one conifer forest and the health of Clove Creek are at risk. The conifer forest west of Route 9 is on private, currently undeveloped land. It too is important to the health of Clove Creek, and should be under consideration for protection as open space.

Crest, Ledge and Talus

This habitat is characterized as exposed rocky outcrops and knobs along the ridge summit and shoulder slopes, or as shallow soils and sparse vegetation with scattered trees. They offer outstanding views of the Hudson Highlands. Talus is defined as “an accumulation of large rock fragments, blocks, or boulders on a steep slope or at the base of a slope or cliff.” (Biodiversity Assessment Manual, Kiviat & Stevens 2001).

Some of the Crest, Ledge and Talus (CLT) habitats that are mapped are predictions only because they could not be field checked. We were able to visit an area known as “The Hinderlands” at Surprise Lake Camp on 12 May 03. We observed shadbush and chokecherry in bloom, as well as black cherry, scrub oak, a species of *Leontodon* (small yellow composite, common in “party places,” i.e., campfire sites), pale corydalis, and rock tripe. (L. Heady, personal communication).

In general, CLT habitats support a diversity of animal and plant species of conservation concern, such as eastern fence lizard, timber rattlesnake, northern copperhead, five-lined skink and eastern box turtle. Birds included on the national list of species of conservation concern include Blackburnian warbler, cerulean warbler, and worm-eating warbler. (Biodiversity Assessment Manual, Kiviat & Stevens 2001). “Because these habitats are often physically inaccessible to humans, they provide undisturbed refugia for many species.” (L. Heady & G. Stevens personal communication)

Within a CLT habitat in the extreme northwestern portion of our town and study area is a Natural Heritage Program significant community “Red Cedar Rocky Summit”. The Natural Heritage

Program characterizes these as excellent quality occurrences because it is contiguous with large intact forest with moderate to low levels of vegetation cover. This connection with open lowlands is important for the movement of large mammals, and we need to insure that development pressures do not fragment this habitat and turn the crests and ledges into 'islands'. (L. Heady & G. Stevens personal communication)

Emergent Marsh

Emergent marshes are characterized by deep hydric soils and a plant community dominated by grasses, wildflowers and other non-woody vegetation. Often, patches of marsh can be found in a mosaic of other wet habitats that comprise a larger wetland complex. Cattails, bulrushes, pickerelweed, arrowhead and sweetflag are typical species that grow in the wet and muddy conditions. Disturbed sites may be dominated by common reed and purple loosestrife. Seasonal water level fluctuations can occur, but these areas are usually permanently flooded.

Wildlife supported in marsh habitats is diverse. Many species of birds, mammals, reptiles, amphibians, invertebrates, and flowering plants are entirely dependant on healthy marsh habitats. American and least bittern, pied-billed grebe and American black duck, spotted turtle and winged monkey flower examples of species of conservation concern. Marshes provide other very important functions to the landscape, including floodwater control, contaminant removal and groundwater recharge. Emergent marsh comprises approximately 10- 20 acres of the study area.

Hardwood Swamp

Wetlands dominated by trees or shrubs fall under this habitat type and comprise about 10 percent of the study area, or approximately 400 acres. An example can be found near the edge of the study area on both the north and south sides of Fishkill Road. Characteristic plants include red maple, black birch, swamp white oak, and tupelo. Common shrubs include silky dogwood, arrowwood, spicebush, winterberry holly and alder. Tussock sedge, skunk cabbage, sensitive fern and blue flag iris can be found within the herbaceous layer.

Standing dead wood with cavities provide important nesting and roost sites for bats, owls, woodpeckers and other wildlife. Red-shouldered hawk and Barred Owl need relatively large complexes of hardwood swamp and forest to breed successfully. Like most wetlands, a diverse array of species are found in hardwood or shrub swamp areas. Often tied to local hydrology, swamps and other wetlands can be adversely affected by changes to the surrounding watershed.

Intermittent Woodland Pool

Intermittent Woodland Pools (IWPs) are scattered throughout the study area. The Biodiversity Assessment Manual defines them as shallow pools, "surrounded by upland forest, usually retaining standing water during winter and spring but drying up by mid-summer of most years." The manual goes on to point out that "these small habitats are often damaged because their values are not appreciated by landowners, or because they are overlooked in the environmental reviews of development projects." (Kiviat and Stevens 2001)

IWPs were not visited during our site visits and so no direct findings can be given. We know from the Biodiversity Assessment Manual that we would likely see wood plant 'hummocks' at pool edges or in mid-pool. Common resident animals include caddisfly larvae, water striders and mosquito larvae. These pools are breeding places for several amphibian species including spotted salamander, red-spotted newt, spring peeper, wood frog, green frog and spotted turtle. (Biodiversity Assessment Manual, Kiviat & Stevens 2001)

"Standing water is about 10-50 in deep at highest water levels and in the deeper parts of the pools and is present from about November to June or longer. Inlets and outlets are very small or absent, and surface water throughflow is generally absent or negligible." Biodiversity Assessment Manual) They are usually small, from well under 2/10 of an acre and are typically not connected to wetlands, lakes or streams. This ensures their value as a breeding ground, because if they are isolated then it is likely there won't be any fish to prey on amphibian eggs. (Heady and Stevens personal communication) The surrounding woodland is also a component in the quality of the IWP; it is important to the habitat value for amphibians that there is an intact forest habitat surrounding the pool. (deMaynadier and Hunter 1999).

Species of conservation concern include false hop sedge, mulberry wing butterfly, Jefferson salamander, marbled salamander, Blanding's turtle, spotted turtle and American black duck. (Biodiversity Assessment Manual)

Mountain Laurel

Mountain laurel occurs in scattered stands throughout the study areas, typically observed in the understory of upland deciduous forest. Mountain laurel is present on all types of terrain from gently sloping to very steep, frequently occurring along the steep banks of reservoirs and lakes.

Underlying soils in areas of mountain laurel are mapped as Chatfield Hollis and Charlton-Chatfield complexes, which are well to excessively drained areas of bedrock outcrop and very rocky soils with 2- 35% slope (Putnam and Westchester County Soil Survey 1994.)

The potential importance of this habitat warrants further study and observation; discussions with Hudsonia staff, L. Heady and G. Stevens highlight that these stands are fairly unique to this portion of the Highlands. Our observations of significant stands of mountain laurel raises questions such as: What species does this habitat support? Can mountain laurel be used as an indicator of the ecological health of an area? What is the relationship between these this habitat and contiguous habitats?

"Some of these can be addressed. For example, mountain laurel may play a significant ecological role in the forest under story because it is evergreen, thereby providing shelter for some wildlife during the winter when deciduous plants are leafless. Although mountain laurel foliage is toxic, it is a component of the winter forage of white-tailed deer, and is the primary winter food of ruffed grouse. In the spring, its blossoms may support a diversity of invertebrates, and different species of birds may use mountain laurel for insect-foraging opportunities."(L. Heady & G. Stevens personal communication) Breeding habitat of regionally rare hooded warbler near the study area has been described as extensive, mature oak-hickory or oak-maple forest with well-developed shrub layers of mountain laurel or brambles (Barbour 1998). There are likely other wildlife benefits that have yet to be well documented. "Threats to this habitat-

type include many of the same threats to the forest communities such as clearing and unsustainable logging. Mountain laurel may also be vulnerable to collection because of its appeal for landscape gardening.” (L. Heady & G. Stevens personal communication)

Seep

Seeps are areas where groundwater is released over a broad section of the ground surface. This habitat type makes up less than 1% of the study area. A fine example of a seep exists near the northwest shore of the New Beacon Reservoir. In this area, wetland plant species such as Skunk Cabbage, Marsh Marigold, and a variety of sedges, grasses and rushes, including Soft-stemmed Bulrush were found. Red Maple and Green Ash are the common canopy trees here. Because the water temperature is moderated at 50-55 *F throughout the year, seeps are important water sources for wildlife, particularly during the freezing winter months (Kiviat and Stevens, 2001) Two rare dragonfly species, a damselfly and two salamander species have been associated with the cold water discharges at seeps (Kiviat and Stevens, 2001). At least one seep in the study area is a significant source of drinking water for the people of the City of Beacon. Because habitats like seeps are not on a grand scale, they are often overlooked, and subsequently are damaged by building and recreational activities. Care should be taken in the planning process when dealing with habitats of this type.

Stream Corridor

“For the purposes of this project, the ‘stream corridor’ was defined as the stream channel, the estimated floodplain as interpreted from the topographic map or by field observations, and steep slopes or other higher areas directly adjacent to the stream or floodplain. The stream corridor was mapped as an overlay on the various habitats that occur within the corridor, such as perennial stream, intermittent stream, upland deciduous forest, hardwood swamp, wet meadow, and upland meadow.” (L. Heady & G. Stevens personal communication)

Clove Creek is a significant stream corridor habitat in this study area. It is a perennial stream classified as a trout spawning stream (C(t)) which “is an important indicator of good stream quality, and suggests that Clove Creek may also support diverse populations of invertebrates; other fish species’ breeding or larval stages of amphibians such as northern dusky salamander; reptiles such as wood turtle; and birds such as Louisiana waterthrush.” (L. Heady & G. Stevens personal communication).

The surrounding upland deciduous forest is included in this habitat because as it states in the Biodiversity Assessment Manual they are intimately connected with the integrity of the stream. Each component of the habitat is dependent on the other for its ecological health and sustainability. For example, the trees along the slopes above Clove Creek shade it and keep the water temperature cool enough for trout spawning.

In general, streams are an important water and foraging resource for many wildlife species. In addition, some rare plants are associated with perennial and intermittent streams, such as goldenesal or winged monkey-flower. (L. Heady & G. Stevens personal communication) One

of the important functions of the Clove Creek corridor is allowing mammals to travel between different portions of the matrix forest.

It is important to protect this habitat because of its connection to the underlying aquifer that supplies towns to the north of Philipstown. Clove Creek is a tributary of the Hudson. Because this creek generally flows parallel and close to Route 9, our major commercial corridor, it is especially vulnerable to pollution and other damage, and will require extra vigilance to protect it.

Waste Ground – (A)ctive or (N)on-active

The area of the North Highlands has historically been the site of extraction industries, both bedrock quarrying and soil mining. These sites are located up the central corridor of the study area along Route 9 and Clove Creek. Some sites are still active, in particular Philipstown Industrial Park, an 80 + acre site on the east side of Route 9 that abuts Clove Creek. This site includes a sizable quarry pit of several acres. Another soil mining site covering several acres on the west side of Route 9 appears to be winding up, having removed most of the available material, and grass has been planted along the slopes as a first step in reclamation.

As the Biodiversity Assessment Manual for the Hudson River Estuary Corridor (Kiviat and Stevens 2001) indicates we expect weeds and invasive species to be present in these waste grounds. A number of rare plant species may also be present such as hair rush, toad rush, orangeweed, field dodder, slender pinweed, rattlebox, blunt mountain-mint, slender knotweed and river birch. (Biodiversity Assessment Manual). Two types of birds are sometimes found in waste grounds – killdeer and nighthawks. (Bull 1985).

Little information is available on rare communities on waste grounds. “Management decisions should be evaluated on a site-by-site basis, as different factors may influence the sites’ ecological value, such as surrounding habitat, level of extraction activity, hydrology, etc. Different species of insects, birds, and reptiles, some of conservation concern, are expected to utilize some waste grounds depending on these factors.” (L. Heady & G. Stevens personal communication) It is important for the community to understand the evolution of these waste grounds when they are no longer active.

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Conclusions and Conservation Recommendations

This report begins to catalog the rich diversity of habitats in the North Highlands of Philipstown, Putnam County, New York. It also highlights the interdependence of these habitats and is another step in making the case that altering one piece of the landscape can have far reaching impacts on other landscapes and natural processes. This report is the foundation for forming a variety of questions that need to be posed to our local and regional planning bodies and local officials. These questions should help to inform their decisions on current and future development projects as well as for revising zoning and land use regulations through the comprehensive planning process. Some of the recommendations below are specific to the study area, but many of the recommendations should also be considered on a townwide and regional basis.

Our conservation recommendations fall into three categories: 1) planning measures, 2) public outreach and education, and 3) further work by this team.

1) Planning measures

Comprehensive Plan Goals and Actions

Philipstown is currently preparing its comprehensive plan. Extensive work has been done in identifying natural resource protection goals. This report supports these goals and should inform the discussion of what actions should be recommended to carry out these goals as described below.

One of the foremost goals is protecting the quality and quantity of our water supply. (Outside of the Villages of Cold Spring and Nelsonville, Philipstown relies on solely on well water.) Working towards this goal will also benefit preservation of species habitat - a healthy forest is good for all species. Protecting our water supply calls for maintaining the physical processes that recharge aquifers and fill waterbodies. This requires protecting steep slopes, keeping forests intact and preserving buffers around waterbodies to protect them from runoff. All of these measures will also promote high habitat value for the forest types outlined above, as well as the habitats within the forests such as Intermittent Woodland Pools, Emergent Marsh and Crest, Ledge and Talus.

Other natural resource protection goals in the current plan draft include protecting stream corridors, steep slopes and the matrix forest. Recommended actions to accomplish these are currently being prepared. We suggest the following measures:

- establish buffers along streams, wetlands and intermittent woodland pools to protect surrounding habitat
- establish stormwater management standards to protect streams, wetlands and waterbodies from runoff
- develop subdivision regulations that support compact development thus minimizing forest fragmentation
- guard against disturbance of steep slopes

There are other community goals in the plan draft that also promote maintaining high habitat value though not obviously addressing natural resource protection. These include the strategy of focusing development in areas where there are existing roads and encouraging when possible development on already disturbed sites.

The plan draft also calls for creation of an open space plan that will not only identify high priority lands for natural resource protection, but also the means to protect the open space. The open space plan goals should consider biodiversity. As the community sets criteria there should be more public education about the importance of biodiversity as outlined below in the next subsection. Suggested measures for preserving open space include conservation easements, cluster or conservation development, and outright purchase for permanent protection.

Planning process

We recommend that the planning process call for species surveys to further the work of this assessment when appropriate. Development that will effect Crest, Ledge and Talus habitat should require a rare plant, lepidopteran and herp survey. Development within the three forest types should require a breeding bird and herp survey.

For development proposals outside of this study area we recommend that the Town ask for a biodiversity assessment.

Clove Creek and Valhalla Highlands in particular

Two areas in our study area require particular scrutiny – the Clove Creek stream corridor and the upland forest area that extends from Lake Valhalla to the Fishkill Ridge.

Clove Creek is especially vulnerable to pollution and other damage because of its proximity to State Highway Route 9 and Philipstown's major commercial corridor. This is no accident since the forces of nature that made Clove Creek also deposited the soil and rock that is the focus of the traditional extraction based industries in the Route 9 corridor. In addition to the threat from general development there is a single large-scale development in the planning stages along Route 9. Known as Quarry Pond or Philipstown Industrial Park this is a project to develop an 80 acre tract that is currently a soil and gravel mine. The standard thinking is that it is sufficient to protect Clove Creek's water quality by maintaining the 100-foot buffer as called for in Philipstown's wetlands ordinance. The importance of a more sizable buffer to preserve the associated habitat and floodplain needs to be communicated to local planning authorities and the public at large.

Other measures to protect Clove Creek, and other streams in town should include adopting stormwater management practices to control surface runoff. Drainage from homes and the effects of our dirt roads also need to be studied. A Hudson River Estuary grant, "Taking Stock" was recently awarded to the Hudson Highlands Land Trust and Putnam County Soil and Water Conservation District to study the five major streams in Philipstown that are tributaries of the Hudson. Educating adjoining landowners and educating the public is a major focus of this project.

The second area needing particular attention, which we will refer to as the Valhalla Highlands, is almost 1000 acres under the ownership of one individual. It stretches from Lake Valhalla up to the Scofield Ridge. This area is significant for both its high habitat value – it contains several rare occurrences - as well as its scenic value. It can be better protected by introducing both more stringent steep slopes legislation as well as conservation development guidelines that will discourage forest fragmentation. These measures could include upzoning to decrease the permitted density and implementing cluster developments. It should also be noted that the Cold Spring Village reservoir is within this area.

2) Public outreach and education

There has been a slow and steady public education process that needs to continue to make the community aware of the importance of habitat protection in its own right. The public needs to understand why particular zoning and land use guidelines are being suggested. Landowners also need to better understand the impact they have on habitat, both on their property and adjacent properties.

To help make the case for habitat preservation to the public as well as local officials there is a newly released study that suburban lots of three acres or less “is the worst possible landscape for Lyme disease.” (Dr. Keesing, professor of biology at Bard College, quoted in NY Times article ‘3 BR, Forest Vu’ May have Added Feature: Lyme Disease Risk)

3) Further work of this team

We recommend continuing the public/private partnerships that made this study possible, tapping the resources of private agencies such as Constitution Marsh Audubon Center, the Hudson Highlands Land Trust, Metropolitan Conservation Alliance and Hudsonia to work with local, county and regional agencies to further the goals of habitat protection.

The members of this team need to use the knowledge and awareness that we have developed through this project to continue to advocate for the importance of maintaining biodiversity in our community and region. We recommend the following specific actions for team members or other interested parties:

- issue a press release outlining what we have accomplished as a first step,
- make a brief presentation to our Town Board and Planning Board about this project,
- appear at planning meetings to voice the questions we have learned to raise through this study,
- continue to refine this report to get it in better shape to present to the Planning Board,
- continue our study of the area around the Cold Spring Reservoir. This is an important resource to protect and is solid issue to which the public and local officials can relate,
- work on the Hudson River Estuary Grant, “Taking Stock” to add biodiversity information to the stream study,

- sponsor forums in the community to educate the public,
- sponsor community hikes to get people out into the field to learn more about these habitats,
- identify other potential local partners with an interest in biodiversity such as Manitoga and The Glynwood Center, and
- join with other community teams in our region to share information on biodiversity assessment and planning issues.