Biodiversity Assessment of 7500 Acres in Marbletown Ulster County, NY

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The Result of Biodiversity Assessment Training
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The Marbletown Biodiversity Assessment Training Group Members

Jenn Cairo	Marbletown Environmental Conservation Commission
Mary Collins	Marbletown Planning Board
Amy Fradon	Rochester Environmental Commission
Stuart Greenfield	Marbletown Environmental Conservation Commission
Kathleen Nord (our photographer)	Community Volunteer
Steve Posner (our mapmaker)	Marbletown Environmental Conservation Commission
Patterson Schackne	Marbletown Environmental Conservation Commission

Our Group Members wish to thank our Hudsonia instructors:

Laura Heady	Director of Education
Gretchen Stevens	Director, Biodiversity Resources Center

And the Landowners who granted us permission to visit their properties.

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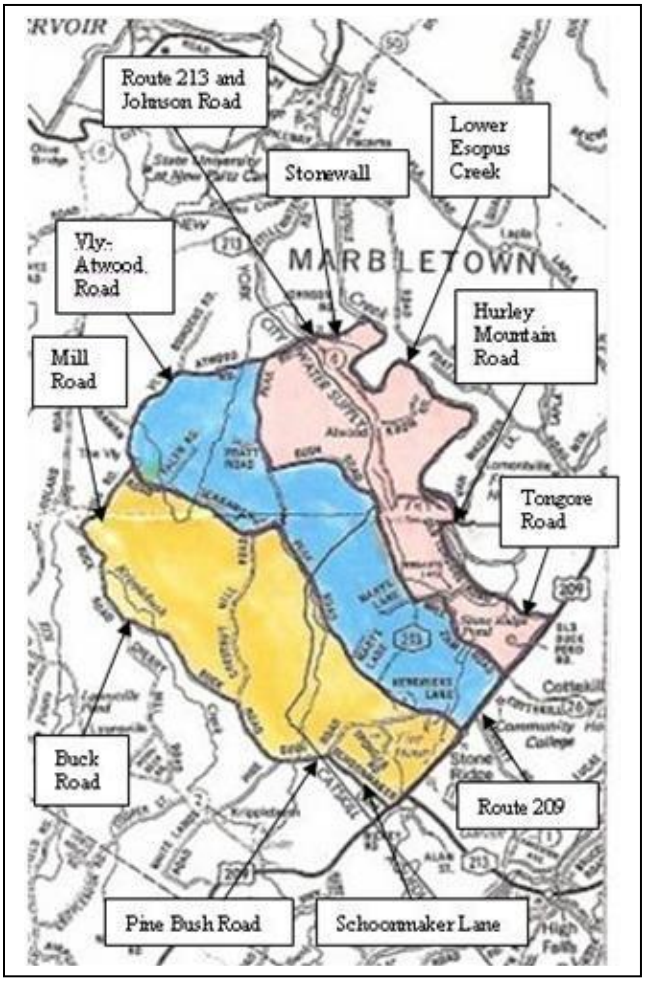
Introduction

"Throughout the world, the loss of species and ecosystems is occurring at an accelerating pace. ... We do not know which species are essential and which, if any, are expendable, or how much biodiversity is needed to maintain ecosystems." – Erik Kiviat and Gretchen Stevens[1*]

As environmental concerns and development pressures mount throughout the Hudson River Valley, many communities have taken the opportunity to participate in the 10-Month Biodiversity Assessment Training (BAT) offered by Hudsonia, Ltd. The Town of Marbletown applied and was selected to engage in the training during the first ten months of 2006.

Seven people (six residing within the Town of Marbletown and one from the nearby Town of Rochester) joined to form the Marbletown BAT group. Over the first ten months of 2006, the group was instructed in the technique of interpreting maps and "existing information for predicting the occurrence of ecologically significant habitats, and for identifying and assessing these habitats in the field."[2] The techniques learned were applied to a study area of approximately 7,500 acres within the Town of Marbletown.

The chosen study area offers a diverse landscape consisting of both uplands and areas of lower elevations near State Route 209 that includes a wide selection of habitat types. A few active farms dot the selected area, but it is mostly comprised of foothills lying to the northwest, the highest of which reaches over 900 feet. It also includes a portion of the Rondout Valley floor to the southeast, wherein lies part of the hamlet of Stone Ridge, on the northwest side of Route 209. The map to the right illustrates the extent of our study area; its division into three sections will be explained in the Methods section of this report.



The selected study area[3]

In addition to steep slopes, upland forests, meadows, wetlands, and the small hamlets of Atwood and The Vly, our study area includes two important aquifers, namely, The Vly Aquifer and the recently documented Elementary School Aquifer near the center of the township.[4]

* See the Notes section of the report to view the references indicated by superscripts

The products resulting from the BAT group's work include this report and a draft Habitat Map (see Appendix 3) showing the location and distribution of habitat types such as Upland Mixed Forest, Hardwood Swamp, and Emergent Marsh within the study area.

The BAT group's procedure for locating and analyzing various landscape features is outlined in the Methods section. Descriptions of each habitat type found in the study area appear in the Habitat Profiles section of this report.

The following three bedrock geologic types underlie our study area from the northwest to the southeast: Plattekill or Ashokan Formations, Hamilton Group, and Onondaga Limestone and Ulster Group. The primary derivation of the first pair of types is sedimentary with primary materials of shale and sandstone, along with a somewhat calcareous reaction. The bedrock of the southeast region of our study area also has a sedimentary primary derivation, with primary materials of shale, limestone, and siltstone, and a reaction that is potentially calcareous.[5,6]

Study area soils, along with characteristics helpful in predicting habitat types, are listed in Appendix 2. The distribution of the listed soils is found on maps in the Soil Survey of Ulster County, New York.[7]

Information obtained from the New York Natural Heritage Program (NYNHP)[8] indicates that a number of significant natural communities exist both within the study area and in surrounding parts of Marbletown. The information is based on sightings of threatened and endangered plants and animals that have been transmitted to the NYNHP in the past.

After ten months of detailed study and application of Hudsonia's procedure for identifying habitats remotely through maps and other reference sources, and with later "ground truthing", i.e., the field visit observations undertaken (see Appendix 1), our BAT group has acquired a far deeper knowledge of the study area.

In the Conclusions section of this report we have listed a number of points generated from our experiences performing the biodiversity assessment of the study area.

The Recommendations section offers our ideas for applying and building upon the findings of this study that we hope will benefit individual landowners and our community.

Definition of Terms Used in this Report

Adelgid – Any of various insects that form galls on conifers and feed on their bark and needles.

Aquifer – An underground bed or layer of rock capable of yielding quantities of groundwater to wells and springs.

Beaver pond – A pond created by beavers building dams across perennial streams.

Biodiversity – The variety of life and its processes. Refers to all the variation in nature, including ecosystems, biological communities, species, and their genes.

Buffer – A zone of a specified distance from a feature (for example, 300 feet from a stream) that is managed to screen a feature from an adverse effect.

Calcareous – Refers to soils or an area with soils containing large amounts of calcium carbonate, usually derived from limestone sediment.

Calcicole – A species that thrives in calcium-rich environments.

Canopy – The continuous cover formed by tree crowns in a forest.

Ecosystem – A system consisting of a community of animals, plants and microorganisms and the physical and chemical environment in which they live and react.

Endangered species – Plant or animal species that have declined so drastically that the United States Fish and Wildlife Service or State of New York has determined them to be in danger of becoming extinct and that federal action is necessary to protect them.

Eutrophied – Material in water, that has become oxygen depleted and rich in nutrients.

Fauna – The animal species of a region or a habitat.

Fen – An open, herb-dominated, calcareous, shallow wetland fed by groundwater seepage with a plant community typically including shrubby cinquefoil, grass-of-parnassus, and alder-leaf buckthorn.

Flora – The plant species of a region or a habitat.

Fragmentation – The breaking of forested areas into non-contiguous pieces.

Habitat – An area in which a specific plant or animal naturally lives, grows and reproduces; the area that provides a plant or animal with adequate food, water, shelter, and living space.

Habitat complex – An area of land that encompasses a variety of habitats.

Herbaceous plant – A plant that does not produce woody tissue.

Hummock – A raised woody pedestal (root crown) of a plant.

Indicator plant – A plant that is most useful for identifying a habitat type in the field.

Intermittent stream – A stream that carries water a considerable portion of the time, but ceases to flow occasionally or seasonally.

Invasive plant species – A species that rapidly populates and dominates an area it had not previously inhabited.

Invertebrate – An animal without a backbone, such as an insect.

Odonata – An insect group composed of dragonflies and damselflies.

Perennial stream – A stream that contains water at all times except during extreme drought.

Mesic forest – A forested habitat that is well-drained but usually moist through most of the growing season with relatively deep soils of moderate to high nutrient and organic content.

Riparian corridor – The zone along streams that includes the stream, its banks, and its floodplain and higher adjacent areas.

Rookery – A breeding or nesting place, or colony of animals (usually refers to birds or seals).

Sedimentary – Rocks formed by the accumulation of sediments (sandstone, shale) or the remains of products of animals or plants (limestone, coal).

Species of conservation concern – Species that are rare or declining in numbers, and deserve concerted efforts to ensure their survival. The condition of these species can serve as a measure of environmental quality or potential impact.

Tannin – An acidic substance, soluble in water, with a bitter taste, that is present in a number of plants, especially in the bark of Oak trees. It is used in tanning animal hides into leather, in medicine as an astringent, and is found as a natural constituent of wines, especially reds.

Threatened species – Plant or animal species that have declined so drastically that the US Fish and Wildlife Service or State of New York has determined them to be in danger of becoming endangered and that federal action is necessary to protect them.

Umbrella species – Species whose home ranges are large enough and whose habitat requirements are wide enough that, if they are given a sufficiently large area for their protection, will bring other species under that protection.

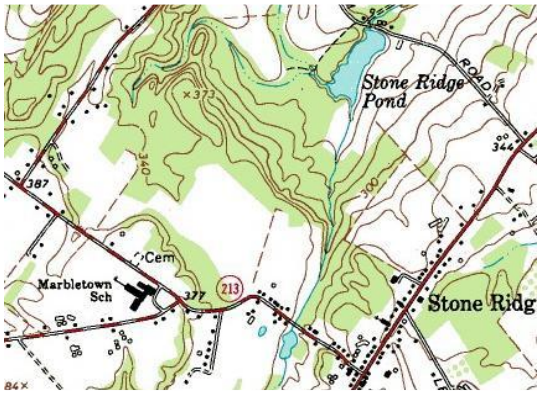
Upland – A term used in this report to define meadow or forest land that is not a wetland.

Xerophytic – Adapted to dry conditions.

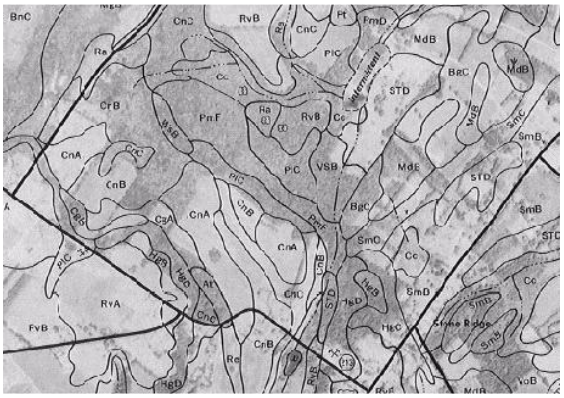
Methods

Biodiversity Assessment Training with the guidance and assistance of the non-profit organization, Hudsonia, follows a four step approach: *Step A*, predict habitat occurrences; *Step B*, perform field verification and assessment of the habitats; *Step C*, conduct rare species surveys if appropriate; and finally, *Step D*, recommend or define conservation planning and action. Our team of volunteers has worked on the first two steps, the result of which is the creation of a draft habitat map and this report. For the first three months, under the tutelage of Hudsonia Educator Laura Heady and Botanist Gretchen Stevens, map exercises were conducted using soil, topographic, wetland, and geology maps. A key tool for the training program was the comprehensive Biodiversity Assessment Manual, authored by Hudsonia Directors Erik Kiviat and Gretchen Stevens, and published by the New York State Department of Environmental Conservation (DEC) (2001 and 2005). The companion Guidebook for the Manual, by Laura Heady and Gretchen Stevens, outlined the program.

Samples of the types of maps employed, along with an aerial photograph of a portion of the southeastern part of our study area are given below.



Topographic map[1]



Soil map[2]

Wetland map[3]

Aerial photo image[4]

The target study area of 7,500 acres was first divided into the Salmon, Blue, and Yellow sections as previously shown on the map in the Introduction. Each of the sections was studied by a sub-group of two or three volunteers. Using the Ulster County Soil Survey,

soil types and numerous associated characteristics were mapped and inventoried for each of the sections (see Appendix 2). Next, the study area's topographic features and wetlands were inventoried and mapped.

The Aerial Stereoscopic Photographs of the study area were obtained. Examination of overlapping stereo photos allowed the landscape to be viewed with a 3-dimensional effect. These detailed stereoscopic images led to the prediction and mapping of habitats such as seasonal woodland pools, intermittent streams, etc. Steep terrain, with crests, ledges, and ravines, typically hidden by deciduous forest canopy during the growing season, was easily recognizable, as were wet soils and vegetative cover types.

The Geology and Topographic maps, Ulster County Soil Survey, and Infrared Color Aerial Photographs provided information that was combined to create a map of the occurrence, locations and boundaries of several habitat types. Subtle terrain features such as depressions, level terrain, and historic watercourses necessitated additional study.

A Rare Species Survey of the 7,500-acre study area was requested and obtained from the New York Natural Heritage Program. The materials we received from the DEC Hudson River Estuary Program in April 2006 provided a list of sensitive plant and animal species and their rankings in terms of conservation needs. The materials also included a review of the New York Reptile and Amphibian Atlas (1990-1999) and the New York State Breeding Bird Atlas (2000-2005). Finally, the materials from the Heritage database identified significant ecosystems located in Marbletown, such as Chestnut Oak Forest, Hemlock-Hardwood Swamp, Hemlock-Northern Hardwood Forest, and Red Maple-Tamarack Peat Swamp. The reader will not find these habitats, as such, profiled in this report, but they may exist in remote sections of the study area or in Marbletown outside the study area.

As the maps and aerial photographs were studied, field verification of some locations were planned and commenced by the sub-groups (Salmon, Blue, and Yellow). With the gracious cooperation of many landowners, field visits, by the entire BAT group with instructors, to selected habitats were arranged and conducted from May through October, in order to verify the group's habitat predictions.

In the study area we found a total of fifteen habitat types, which are described in eleven profiles found in the Habitat Profiles section of this report followed by Field Visit Notes for some of them. A draft version of the habitat map was prepared drawing on the remote sensing (maps and aerial photographs) materials, our field visits, and the communication between sub-group members. This report and draft habitat map will hopefully provide a foundation for future Marbletown Biodiversity Assessment efforts and be a tool for maintaining, protecting, and enhancing the valuable biodiversity in our community.

Habitat Profiles

The habitat mapping of our study area yielded fifteen habitat types described in the eleven profiles of this section. The profiles are:

Calcareous and Non-Calcareous Wet Meadows (CWM and WM)

Constructed Pond (CP)

Crest, Ledge, and Talus (CLT)

Emergent Marsh (EM)

Hardwood Swamp (HS)

Intermittent Woodland Pool (IWP)

Perennial and Intermittent Streams (PS and IS)

Shrubland (SH)

Springs and Seeps (SS)

Upland Deciduous, Mixed, and Conifer Forests (UDF, UMF, and UCF)

Upland Meadow (UM)

Calcareous and Non-Calcareous Wet Meadows

Wet meadows are wetlands where the soil is saturated for part or all of the growing season and are either shallowly or briefly inundated. The terms non-calcareous and calcareous refer to the chemistry of the related bedrock, soils, or water source, specifically whether or not they have a significant level of the mineral calcium. Non-calcareous wet meadows are more common than calcareous wet meadows. This pattern of distribution also pertains in the study area, where our BAT group identified numerous of the former but only one of the latter types. They are mapped as distinct habitats because they support different communities.

In July, the group visited a wet meadow off Tongore Road that was part of a former beaver pond. Though there has been an impact to the meadow in the form of agricultural run-off and the growth of invasive plant species, it still contains a variety of native plant species including lurid sedge, long hair sedge, bulrush and soft rush, blue and white vervains and rough-fruited cinquefoil. Numerous birds sang and a red-winged blackbird made territorial displays. A series of wet meadows between the ridge and corn fields on the west side of Tongore Road were also mapped on the same day. A green heron was observed and red-tailed hawks soared over the fields.

In August, the BAT group visited several wetland complexes near the intersection of Route 213 (Cooper Street) and Route 209 (Main Street) in Stone Ridge, west to Hendricks Lane. An overgrown field, with hummocky plant growth and wetland indicator plants, such as rush, purple loosestrife and jewelweed, was assessed to be small wet meadow.

A small calcareous wet meadow is located off Pratt Road, on a property that also contains upland forest, perennial streams, a constructed pond, and old field boundaries (e.g., stone walls and a farm road). The meadow contains a small stream with exposed clay on its banks, which bisects the field and flows into the Gladt Klipt Kill.

Ebony jewelwing laying eggs

Halberd-leaf tearthumb and jewelweed

The aforementioned meadow offered a lush assemblage of wetland ferns, sedges, herbs, and some wetland shrubs. A complete list of the species observed in that meadow can be found in Appendix 1. Noteworthy were many indicator plants of a calcareous environment such as halberd-leaf tearthumb, golden ragwort, and rue. Many calcareous wet meadows have ground water seepage or springs at their margins;[1] the water source at this site is quite abundant and may explain the lush condition even in mid-August.

The stream water flowing through this calcareous wet meadow was very clear and contained small minnows with black stripes. The stream still flowed in mid-August after a local dry spell. The habitat, visited a number of times, contained frog activity all summer and on two occasions red spotted newts were found. Debris and downed wood probably enhances the habitat for both creatures. Surprisingly, although there was considerable insect activity there were no noticeable mosquitoes. Odonata activity on one sunny day visit provided the chance to observe and photograph an ebony jewelwing laying eggs in the meadow's small stream. Preliminary map analysis had indicated that the site might be calcareous (the USDA Ulster County Soil Survey showed calcareous Scriba Morris soil near the meadow) and plant identification during the field visits confirmed the character of this habitat.

Calcareous wet meadows can support globally rare plants. Wet meadows, calcareous wet meadows and fens (another wetland habitat type) offer the environments that support diverse insect populations. There, butterflies, moths, and Odonata can find water, larval foods, flower nectar and other requirements for survival. Hopefully, biodiversity studies in progress will provide the data needed to evaluate these wetland habitats and suggest ways to protect and improve their quality and condition.

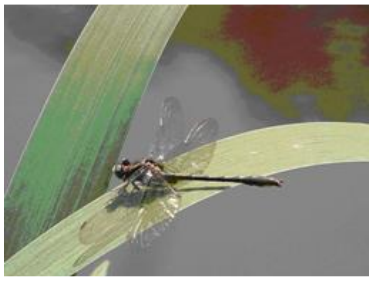
Constructed Pond

"They [constructed ponds] are often substituted for natural wetlands and other low-lying habitats that may be more valuable for biological diversity." – Erik Kiviat and Gretchen Stevens[1]

Within the Town of Marbletown, as elsewhere, constructed ponds are an increasingly common habitat type. Ponds have been constructed for such purposes as watering livestock and irrigation on farms, fishing, and storm water retention, as well as for use in conjunction with old mills. Many have been created simply for aesthetic purposes. Two of the better known Marbletown constructed ponds are the Stone Ridge Pond on Mill Dam Road with its collection of water fowl and the small pond locally called Walton's Colyck just off Cooper Street (Route 213) that has been used as a water source for the Stone Ridge Fire Department.

Constructed Ponds have been built by dredging existing wetlands and are also often built within low areas with impervious soils. When water is impounded from a perennial stream to create a pond it will change stream flow characteristics and water quality in the pond and downstream from the pond. Nonetheless, once constructed, these ponds, if not overly disturbed by human use, may become habitat for frogs, turtles, fish, and birds, along with dragonflies, damselflies, and other insects.

A constructed pond in Marbletown



Clubtail, a pond resident

Common whitetail, another resident

The constructed pond shown in the photograph above was visited and studied during four excursions to the area between the ends of Palen and Pratt Roads. The flora we encountered included harlequin blue flag, blue-eyed grass, water horehound, and many types of sedges. On one occasion a multitude of dragonflies were present – among them the clubtail and common whitetail shown above.

There is a fair amount of literature concerning the construction of ponds. If built correctly, a constructed pond can provide important habitats for a number of plants and animals, but it should be noted that any time soil is disturbed there is a risk that invasive plants will take over. One example is the non-native purple loosestrife plant we so often see in sunny, wet areas. When established, purple loosestrife tends to eliminate native plants that provide food, nesting, and shelter for wildlife[2].

Crest, Ledge, and Talus

The study area is bisected by the juncture of two main physiographic regions that make up the geology and relief of Marbletown: the Appalachian Plateaus province and the Hudson Lowland Valley and Ridge province. The northern section of the study area falls in the Catskill Mountains area of the former region while the southern section lies in the Rondout-Esopus Valley area of the latter region.[1] As evident on soil survey maps and aerial photos, shallow soils, exposed bedrock and uneven terrain are fairly common in the northern part of the study area; the steepest locations and some others that are very dry have the potential for containing crest, ledge, and talus (CLT) habitats, or at least aspects of this compound type.

Both carbonate and non-carbonate CLT habitats exist, depending on the character of the underlying bedrock; both types are home to sparse vegetation, which, due to the dry and shallow soils, is usually a combination of trees, shrubs, and herbaceous plants. These are habitats that may support rare plants and animals despite the harsh conditions.

Remote mapping techniques and field visits enabled us to identify two significant CLT habitats. One is located in the ridges north of the Gladt Klipt Kill's linear stream corridor, which provides a link to other habitats; the second is located in the gorge-like cliffs at the confluence of the Gladt Klipt Kill and Lower Esopus Creek.

At the first location, at the end of Pratt Road, sloping terrain parallels the western bank of the Gladt Klipt Kill. The landscape includes ledges with near vertical cliff faces, wooded at the crest, and an accumulation of rock and boulders at the base of the slope. The rocky accumulation is talus, for which the habitat type is named, and is caused by erosion.[2] Vegetation such as bloodroot colonies, maidenhair fern, and maidenhair spleenwort indicate a calcareous condition. The habitat is close to forest and to the high-quality Gladt Klipt Kill,

A northeast-facing CLT habitat overlooking the Lower Esopus Creek

Bloodroot in a bed of Talus

Ninebark, living on a ledge

most likely enhancing its biological diversity.

The second location in the study area also provides a CLT habitat close to a perennial water source: the Lower Esopus Creek, south of the New York City Department of Environmental Protection land. Our BAT group made April, July, and September visits to this area and were able to document seasonally changing conditions. The cliffs have zones based on location, type of rock, and exposure to wind and sun. Some zones are seepy and have fern "gardens," moss, and liverworts. Other areas have xerophytic herbaceous species, such as cresses and harebell *(see the Salmon Section Composite Field Visit Notes)*. Portions of the cliffs are undercut with shallow caves and chimneys. Shale talus, river cobble, and sand beaches are found at the cliff bottom. Blue herons, red-tailed hawks, osprey, salamanders, and wood turtles were observed in the gorge.

Both CLT habitats abut upland forests and perennial streams, creating a patchwork of habitats that probably add to their value for the mammals, reptiles, birds, and invertebrates found there. Exposure to seasonal extremes, high water events, and shallow soils in the vertical sections create an apparently harsh environment, but it is actually ideal for some species of plants and animals. Such habitats can even host rare plants that are relics of post-glaciation climates, such as Stonecrop.[3] A rare orchid was documented in a wet meadow adjacent to a CLT habitat this summer. These are rich communities providing nesting sites, foraging opportunities, and isolation from invasive species.

CLT habitats are vulnerable to changes to the crests of their cliffs. Some types of human uses may change the groundwater flowing into the system or introduce exotic plants or diseases. Fragmentation of the interconnected forest at the cliff summits and the riverbed corridors could threaten the sensitive combined habitats of crest, ledge, and talus.

At least one other significant CLT habitat exists in Marbletown, though outside of the study area: this in the uplands just south of the Ashokan Reservoir, where portions are viewable from Ashokan Road.

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Emergent Marsh

"The ultimate value in these marshes is wildness, and the crane is wildness incarnate. But all conservation of wildness is self-defeating, for to cherish we must see and fondle, and when enough have seen and fondled, there is not wilderness left to cherish." – Aldo Leopold[1]

Emergent marshes are a type of wetland dominated by herbaceous vegetation and often have standing water through most or all of the growing season. Like many other wetlands, emergent marshes are important habitat for wildlife including birds and amphibians. Sensitive species typically found in emergent marshes include northern cricket frog, northern leopard frog, spotted turtle, American bittern, least bittern, wood duck, American black duck, northern harrier, king rail, Virginia rail, sora, common moorhen, and marsh wren.

Emergent marshes in the study area are relatively uncommon and tend to be small. Near the northern-most section of the study area, off of Krom Road, is a small emergent marsh of about one-eighth acre. We were not able to enter the marsh, so we observed it from the road. The marsh is partly fed by an intermittent stream flowing in from the northwest via a culvert under Krom Road. The marsh features cattail and purple loosestrife around silky dogwood shrubs in the center. Floating or submerged vegetation may be present, but could not be observed from the road. Ringing the marsh is a hardwood swamp with red maple, yellow birch, hay scented-, ostrich- and sensitive ferns, jewelweed, and skunk cabbage. We observed a red-winged blackbird, green frog, and white-tailed deer. Soil types here are predominantly the moderately poorly to very-poorly drained and calcareous Canandaigua silt loam, along with a small area of well-drained Williamson silt loam on the east side of the marsh.

A Marbletown emergent marsh not far from our study area

In terms of hydrology, this marsh slows, filters, and contains the flow of an intermittent stream, which, after leaving the marsh, joins the Lower Esopus Creek about one-half mile to the east. While the small size of the marsh and presence of a high quantity of purple loosestrife (an invasive plant) detract from its value, the relatively remote location, contiguity with a hardwood swamp and upland forest, and its role as a feeder to the Lower Esopus Creek increase its value. In view of its connection with other habitats, its hydrological function and its remote location from most disturbances, this emergent marsh might be considered important for conservation.

Maintaining water volume and quality is of central importance in the conservation of this habitat type. Filling in portions of an emergent marsh or adjoining wetlands, or failing to maintain water sources and outlets, can drastically affect and even destroy the health of emergent marshes because their plant species are sensitive to water levels. Runoff from nearby roads and chemically-treated agricultural fields or lawns (pesticide-treated or fertilized) and introduction of human or livestock wastewater degrades marshes, as it does other wetland habitats. Road salt, pesticides and vehicle fluids can kill plant and animal species in emergent marsh habitats. Nutrients from fertilizers and sewage, such as nitrogen and phosphorus, can change the acidity and chemical make-up of marshes resulting in loss of habitat for marsh species. Avoiding disturbance and runoff, and maintaining buffer zones are ways to directly affect the quality of emergent marshes.

Hardwood Swamp

"Hardwood swamps dominated by deciduous trees are the most common wetland type in the Northeast…" – Ralph W. Tiner[1]

Hardwood swamps occur throughout Marbletown, comprising roughly five percent of our study area. Hardwood swamps are wetland areas dominated by woody vegetation, namely trees or shrubs. For mapping purposes, we included shrub-dominated wetlands as hardwood swamps.

The soils in hardwood swamps are "saturated or flooded for at least part of the growing season," and typically somewhat poorly to very poorly drained.[2] Our study area contains hardwood swamps with varying surface water conditions, ranging from standing water a couple of feet deep, to flowing water under one-half foot deep. In several instances, we found that perennial or intermittent streams flowed through the swamps, entering and/or leaving an expansive wet area as a distinct stream.

Typical hardwood swamp vegetation in the study area includes red maple, slippery elm, black tupelo, yellow birch, high bush blueberry, buttonbush, alder, and silky dogwood. The roots of these plants sometimes form pedestals, or hummocks, within the swamps, giving the ground a lumpy, mound-covered shape. Sedges, skunk cabbage, blue flag (iris), and jack-in-the-pulpit also grow around the edges of and within Marbletown's hardwood swamps.

A Marbletown hardwood swamp

A common characteristic of several of the hardwood swamps is standing dead wood, created by the flooding of tree-covered areas. These standing dead trees provide habitat for woodpeckers, tree frogs, and numerous insects; when conditions are right, they are also used as heron rookeries. Animals of conservation concern that could possibly use hardwood swamps include several species of rare dragonflies, red-shouldered hawk, spotted turtle, four-toed salamander, or blue-spotted salamander.[3] Of these, the red-shouldered hawk is considered an umbrella species.

Two large, undisturbed examples of this habitat lie within our study area. At one high, quality twenty-acre hardwood swamp, near the intersection of Scarawan and Peak Roads, we observed tupelo and black birch trees as well as a red-bellied woodpecker, red-winged blackbird, green frog, and bullfrog. We were unable to visit the other hardwood swamp, but

we can remotely predict a size of about one hundred and thirty acres and that it contains coniferous as well as deciduous trees.

Hardwood swamps are an important part of the wetland landscape of Marbletown. They provide habitat for a wide variety of flora and fauna, protect upland areas by mitigating flooding, and help maintain water quality through the filtering of pollutants such as sediment and nutrient runoff.[4] Their function of filtering pollutants is of added importance, given the occurrence of streams flowing through many of our hardwood swamps, since the swamps thereby benefit the remainder of the watershed. Human disturbance in the form of dumping, filling, draining, and logging threatens the quality of hardwood swamps and hinders their ability to provide these natural services. In order to ensure the ecological quality of this habitat, it is best to carefully monitor and minimize any alteration of hardwood swamps, as well as to maintain a minimum of one hundred feet of land surrounding the swamp as protection.

Intermittent Woodland Pool

"Many organisms have evolved to use a temporary wetland which will dry but where they are not eaten by fish." – Leo Kenney[1]

Intermittent Woodland Pools (IWPs) are small, seasonally flooded depressions usually situated within an upland forest. The pools typically have neither inlet nor outlet stream (either intermittent or perennial) and are filled with water for six to nine months of the year, usually drying up by midsummer. When these pools dry up completely, they can be difficult to identify. Observation during other times of the year can help to confirm their habitat role.

Frogs and salamanders, especially, make use of this unique habitat. These amphibians live in the surrounding forest, but also spend part of their life cycle in the water of woodland pools. During the aquatic egg and larval stages of their lives, they are vulnerable to predation by fish; however, the periodic dryness of IWPs make them unsuitable for fish, allowing the amphibians to breed safely in fish-free waters. The amphibians then move into the surrounding forest as they mature and the pool dries. In the following years, many amphibians return to breed in the same pools where they were born.[2]

An intermittent woodland pool surrounded by upland forest

Species of conservation concern that breed in IWPs include spotted salamander, marbled salamander, Jefferson salamander, and wood frog. Other animals that will use pools include spotted turtle, American black duck, wood duck, various invertebrates, and other amphibians.[3] While IWPs typically do not have tree canopy over the pool itself, they are surrounded by trees and woodland plants. Some of the wetland plants that grow in and around the pools include mosses, tussock sedge, spicebush, buttonbush, swamp azalea, highbush blueberry, red maple, and yellow birch.

There are several IWPs in the study area, and prime examples in other sections of Marbletown that lie outside of the scope of this project. Due to their small size, IWPs can be difficult to identify remotely and there are almost certainly pools in the study area that we missed. A one-half acre pool that we located off of Route 213 has a strong connection with the surrounding forests and supports amphibian breeding. Other pools that we identified are not naturally occurring depressions in the terrain, but have developed in a manmade swale or a ditch, for example, along the side of the Catskill Aqueduct. We still consider them IWPs because of their characteristics and the ecological functions they serve. They are not

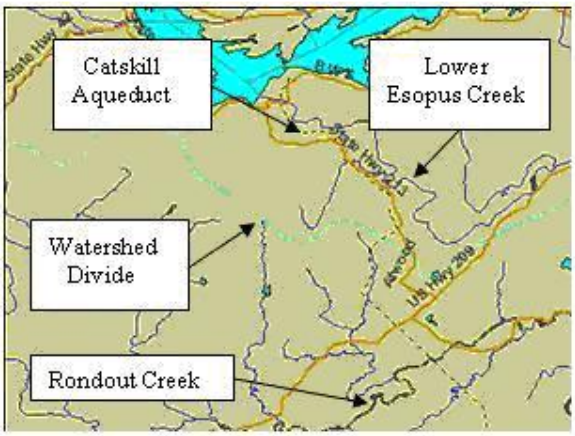
connected on the surface to streams or other water bodies and contain water for only part of the year.

IWPs are susceptible to many types of disturbances. They are often filled, drained, or fragmented, in order to make way for human land use. Since they can be small in size and are not connected on the surface to other wetlands, they are frequently overlooked by federal and state wetland protections.[4] Even if the pools themselves are protected, the upland area up to seven hundred and fifty feet from the pool's edge, which includes critical habitat value for pool-breeding amphibians, could be disrupted by development pressures.[5] For these reasons, it is vital that we recognize the importance of this habitat to the forest ecosystem and develop local measures to conserve IWPs, as well as their connections with the surrounding forest.

Perennial and Intermittent Streams

"... small streams are critical to the ecological health of the larger (watershed) system."
– Winsor H. Lowe[1]

The perennial and intermittent streams in our study area, along with the seeps, swamps, and other types of wetlands that accompany them, are divided between the watersheds of the Rondout and Lower Esopus Creeks, two important Hudson River tributaries (see map below). Many of the streams feed Kripplebush Creek and Gladt Klipt Kill, two of the larger streams that in turn flow into the Rondout and Lower Esopus Creeks, respectively.



Rondout-Lower Esopus watershed divide[2]

The Gladt Klipt Kill, dark from tannin

The Lower Esopus Creek, its water quality classified as good[3], has been stocked with Brown trout by the DEC. Within the study area the creek is bounded by upland conifer as well as deciduous forests, seeps, lowlands with alluvial soils, and cliffs, and is home to a wide variety of plants, including hemlock and sycamore, horsetail and blue flag (iris), and animals, including beaver, wood turtle, and great blue heron.

Flowing into the Lower Esopus Creek, in the northern part of the study area, are the Gladt Klipt Kill and Hendrick's Killitje. The streams seem to be in very good condition, though there has been no formal assessment of water quality. The apparently high quality Gladt Klipt Kill, dark with tannin, moves northeast, mostly through forest. One stretch, between the ends of Palen and Pratt Roads, was the site of a field visit (see Appendix 1). At the northwest part of this stretch, the Gladt Klipt Kill flows past a calcareous wet meadow and, at the southeast, past an upland conifer forest. Sightings were made of black-striped minnows, several fern species, and a number of flowering herbaceous plants[4].

Southwards, a separate pair of streams joins just east of Old Tongore Road and within four-tenths of a mile empties into the Lower Esopus Creek. Upstream, the more southerly branch, after passing through a pond, locally called Walton's Colyck, just southwest of Route213 (Cooper Street), continues onward to feed the Stone Ridge Pond (along with a pair of intermittent streams), and then, having grown a little in volume, wends into the Lower Esopus. The northerly branch begins as an intermittent stream. After passing on a direct

course through farm fields and forest, it meanders beside a number of active farm fields. There is some evidence that the habitats along both stream branches have deteriorated as a result of receiving high levels of nutrients due to runoff from the adjoining pastures and farm fields.

In general, higher quality streams such as the Gladt Klipt Kill have remained remote from excessive human disturbances. Such streams tend to receive clean runoff, have substantial vegetated buffer zones, and may host important species of conservation concern, such as wood duck and spring salamander[5].

Wood turtle on a bank of the of Lower Esopus Creek

Fish in the Lower Esopus after significant flooding

Our study area contains parts of a number of perennial streams within the Rondout Creek watershed. The headwaters of Kripplebush Creek can be found just north of where it crosses Buck Road, while the headwaters of Benjamin Brook, in the form of an intermittent stream, appear south of Fairview Cemetery. The most extensive headwaters of the Rondout watershed in the study area (they include swamp, wetlands, ponds and intermittent streams) flow essentially south from the hardwood swamp habitat of Cantine's Swamp and nearby wetlands, to eventually join Kripplebush Creek.

Healthy perennial and intermittent streams act as an important source of fresh surface water upon which many plants and animals depend. Furthermore, streams are one of the vehicles through which wetlands, which function to reduce mosquito populations and groundwater contamination, along with a number of other services, are recharged.

Only thoughtful husbandry can protect these streams from further detrimental impacts such as dams, water withdrawals, nutrient-loading from farm fields, and other long term and large disturbances. Such uses stress and could irremediably damage perennial and intermittent stream habitats. Some obvious signs of adverse impacts are declining fish and fly larva populations due to reduced oxygenation and raised water temperature[6]. Monitoring stream health is simple and low cost and could benefit our community. It should be considered as a measure to safeguard our water resources and their habitats.

Shrubland

"Of 40 bird species associated with shrubland habitats, 22 are undergoing significant population declines in eastern North America." – Brian C. Tefft[1]

Along with grasses and forbs, plants that dominate shrubland habitats include woody shrubs that branch at ground level to form several stems. As a habitat, shrubland can be either permanent or transitional, and is generally created when another habitat type faces disturbance by natural or human causes. Transitional shrubland might be farm fields no longer farmed, or forests that have undergone fire or extensive logging. Natural shrubland transitions take many years to complete as opposed to the fast transitions caused by human intervention. However shrubland comes about, it is habitat that can support a number of rare birds, butterflies, and other invertebrates.[2]

A shrubland near Tongore Road that may previously have been cropland is now dominated by goldenrods and other forbs, whereas an old pasture now in transition, not far from Johnson Road, includes grasses, forbs, eastern red cedars, and young white pines (see photos below).

A shrubland dominated by forbs

A transitional shrubland

One shrubland habitat investigated during a field visit is located not far from Route 209. The habitat was seepy and sloped down to a small conifer plantation. We encountered wetland indicators such as pale jewelweed (a calcicole), sensitive fern, arrow-leaf tearthumb, dark green bulrush, and red maple. Other plants noted included witch-hazel and rhododendron.

Shrublands in the study area may be inhabited by birds, butterflies, and plants of special conservation concern.[3] In view of the potential for harm to such species when there is disturbance to their habitat, alteration for development purposes should be preceded by a thorough investigation of a site's wildlife.

Springs and Seeps

Springs and seeps are habitat areas where groundwater is released through a specific emerging point in the earth or over broad areas of ground. While providing moisture to sustain plant and animal species, springs and seeps may also feed and replenish water sources such as ponds, lakes, and streams in times of infrequent rainfall therefore helping to sustain water supplies for many species including humans.

Springs may emerge with a constant year round flow and visible surface water whereas seeps may appear as wet or damp areas of spoil and rocks often found on the sides of steeper slopes.

In our study area we found two notable seepy areas. One found in the upper Atwood area rests on the side of a slope that reaches down to the Lower Esopus Creek. The other worth noting is located near the hamlet of Stone Ridge off of Route 209. Along with the abundance of plant species and the seep's proximity to a wet meadow, this seepy slope was interesting because it sustained a number of plants that are indicators of calcareous soil or bedrock. Because they support plants not normally found in other conditions, calcareous habitats are quite uncommon and therefore they have a high conservation value.

A seepy slope

Some examples of plants inhabiting springs and seeps are jumpseed, pale touch-me-not, jewelweed, Asiatic dayflower, bracken, lady fern, arrow-leaf tearthumb, dark green bulrush, sensitive fern, witch- hazel, and rhododendron. We also observed snails, which likewise indicate a calcareous habitat.

Upland Deciduous, Mixed, and Conifer Forests

"Forests are an important part of everyday life for most Americans. They provide timber, soil, wildlife, recreation, beauty, and relief within rural and urban environments." - Paul Ellefson[1]

Forest is a common type of ground cover on undeveloped land in our area, and is particularly common at moderate and high elevations where development is sparsest. This pattern of distribution exists in Marbletown, and is especially apparent in the northwest portion of the study area.

Three general forest types are used to signify three different woodland habitats. These are upland deciduous, upland mixed, and upland conifer (evergreen) forest. Upland forest has the potential to support a number of species of conservation concern, including American ginseng, silvery spleenwort, red baneberry, blue cohosh, leatherwood, northern goshawk, red-shouldered hawk, barred owl, eastern wood peewee, Acadian flycatcher, wood thrush, cerulean warbler, black-throated blue warbler, black-throated green warbler, ovenbird, marbled salamander, Jefferson salamander, and bog lemming.

In our study area, upland mixed forests, which contain evergreen and deciduous species in roughly equal proportions, are the most common of the three. Upland deciduous forests, which contain more than 75 percent deciduous or hardwood tree species (e.g., maple and oak), are slightly less common, and upland conifer forests, containing more than 75 percent evergreen tree species (e.g., eastern hemlock and white pine), are least common. The latter are generally of smaller size, and often occur along drainages. The three types are often found in adjacent areas in the study area.

An upland conifer forest within our study area

Forest floor residents:
Rattlesnake Plantain and Indian pipes

Upland Mixed Forests:

Some of the larger occurrences of upland mixed forests in the study area are: the approximately 200 acres around and including the knoll west of Tongore Road that extends westward to Route 213; around the upper part of Krom Road on both its north and south sides; behind and interspersed with the developed areas along northern Peak and Bush Roads; and around Johnson Road, excluding the coniferous perennial stream corridors.

Upland Deciduous Forest:

In the interior of the crest area circumscribed by Bush, Peak, Vly-Atwood, and Atwood (Route 213) Roads is a large, apparently contiguous, woodland of primarily deciduous forest interspersed with mixed forest and smaller stands of conifers. Other prominent deciduous forests occur on the slopes to the east of the perennial stream that runs under Tongore Road, east of Bogart Lane; on the lands northeast of Route 213, north of the Mill Dam Road intersection; and on the northeast side of Route 213, between the Tongore and Krom Road intersections.

Upland Conifer Forest:

Upland conifer forest is found on some steep areas adjacent to the Lower Esopus Creek, and in a large stand of about 80 acres covering the knoll between the upland meadows that are currently in corn on the south side of Tongore Road, and the upland meadows which are currently cattle pasture on the north side of Atwood Road. Common tree species include eastern hemlock, especially along steep drainages, and eastern white pine.

In some of the forested areas described above we observed white tailed deer, hairy, downy and pileated woodpecker, ovenbird, wood and hermit thrush, white-breasted nuthatch, eastern wood peewee, and black-throated green warbler. Soils vary, but some more common types are the well-drained Lordstown-Arnot rock complex in the Peak Road crest area; excessively-drained Hoosic gravelly loam in the wooded areas between Tongore and Krom Roads east of Route 213; and moderately well-drained Bath Mardin very stony soil, east of Route 213, south of Tongore Road and north of Bogart Lane. Except Bath-Mardin, all are non-calcareous whereas Bath-Mardin can be somewhat calcareous.

High quality forests are generally of larger size and have at least some mature tree specimens, although smaller forests with distinctive characteristics, such as uncommon species, or the absence of exotic invasive species, can also be of great conservation value. Larger forested areas have the greatest resilience to catastrophic changes (e.g., severe weather such as ice storms and high winds) offer habitat for forest mammals with larger territories (e.g., fishers, bobcats, and black bears) and provide the forest-interior habitat required by bird species such as thrushes and vireos.

Aside from their importance as animal habitat, large forests are an asset to the human population because of their role in groundwater recharge, climate control, sequestration of carbon dioxide along with the emission of oxygen, and decreased prevalence of Lyme disease which has been found to be significantly higher in small forest patches in Dutchess County.[2]

Large forests are also important for biodiversity because they contain intermittent woodland pools (see Intermittent Woodland Pool profile) where woodland amphibians breed. The forest adjacent to an Intermittent Woodland Pool makes up the rest of the amphibian non-breeding habitat. Without such forests amphibian populations are not sustainable.

The greatest threats to forest habitats in the study area are fragmentation, overbrowsing by deer, and pest infestation. Fragmentation, or the breaking of forested areas into non-contiguous pieces, results from building and clearing for development and roads. Overbrowsing by deer (where deer consume so many young trees that forest regeneration is threatened) is typically the result of deer over-population caused by the disappearance of deer predators such as wolves and hunters. Overbrowsing largely affects mixed and deciduous forests, as deer prefer browsing hardwood tree germinants and seedlings. Pest infestation can kill or weaken forest stands over extensive areas. Most pests, however, will affect only one tree species (e.g., beech bark blight affects primarily beech trees and hemlock woolly adelgid primarily hemlocks), with the result that diverse forests generally have better prospects.

Conservation of forests involves management of these primary threats. Contiguous woodlands can be maintained by avoiding road building and other construction that breaks up large and high-quality forests. Deer populations can be actively managed to keep their numbers in balance with their habitat. Finally, pests are best avoided by prevention, early detection and early elimination.

Upland Meadow

"Grassland birds are declining significantly in the northeast due to loss of suitable habitat…Livestock pastures can serve as a replacement habitat…while still meeting farm needs…hayfields and idle agricultural land can also present adequate habitats…"

– Cornell Cooperative Extension

Upland meadows by definition support herbaceous plants, rather than woody vegetation, and occur wherever soils deeper than 20 inches are fairly well-drained. Upland meadows are most common on farm fields since their soils often have these qualities. Upland meadows include crop fields, fallow crop fields, pasture, hayfields, herbaceous old fields (e.g., long-fallow, managed fields) and mowed grasslands. The Catskill Aqueduct, though long and narrow, could be classified as upland meadow also.

Within the study area there are a number of farm fields of all the types listed above. In the northwest portion of the study area, a triangle created by Vly Atwood, Scarawan, and Peak Roads, fallow fields and hayfields occur on either side of the road. Crop (e.g., corn and alfalfa) fields and pasture are quite extensive on either side of Route 213 (Cooper Street), south of its intersection with Peak Road. Other farm fields occur on Schoonmaker Road and along Route 209 in the southern portion of the study area.

One of Marbletown's upland meadows

In June, during a preliminary field visit to an upland meadow habitat near the intersection of Route 213 and Route 209, we observed Deptford pink, oxeye daisy, rough-fruited cinquefoil, timothy, red clover, spotted knapweed and Queen Anne's lace.

Fields full of the native bluestem grass are particularly striking in the fall when their russet color complements the changing leaf colors. Many of the meadows are managed (e.g., mowed) to maintain their aesthetic value, even if they are not good hayfields.

For wildlife, particularly songbirds, habitat value in pasture or other types of fields is improved when there is a variety of grass and vegetation stem heights and when meadows are between 10 and 15 acres. Much of the habitat value for nesting and breeding wildlife is retained by mowing later in the year.

Conclusions

Several conclusions can be drawn from our assessment of the study area:

- In general, the majority of in tact, larger natural habitats are to the north and west in the study area, where there are generally fewer roads and larger land parcels. Fewer and smaller natural habitats are found near the hamlet of Stone Ridge, along Route 209, and along other roadways including Route 213, Peak Road, Buck Road, etc.

- Large contiguous forest habitats exist in the northwestern parts of the study area, in the vicinity of Scarawan, Peak, and Buck Road areas.

- The Lower Esopus Creek riparian corridor in the study area features diverse habitats, many of them of high quality, such as springs and seeps, crest, ledge, and talus, perennial and intermittent streams, conifer forest pockets, and mixed deciduous and conifer forests that are home to some exceptional vegetation and animals of conservation concern.

- Three areas with large and/or contiguous high-quality sensitive habitats extend beyond the Marbletown study area into other municipalities. They include the Upper Esopus Creek corridor, the extensive upland forest in the Vly-Atwood Road and Peak Road areas, and a potential conservation connection of the Catskill Mountains and the Shawangunk Ridge.

- Water resources are present throughout the study area and occur in various habitat types, namely, wet meadow, emergent marsh, hardwood swamp, intermittent stream, perennial stream, intermittent woodland pool, springs and seeps, and constructed pond.

- Water resources near the hamlet of Stone Ridge and Route 209 are located mostly in more-developed areas, while those further north and west in the study area are generally in less-developed areas.

- Invasive plant species were found during most of the site visits conducted. These appeared to be most prevalent along roadways and near other disturbed or developed sites.

- Our use of 1994 stereo orthographic photographs to evaluate the areas for habitats and 2004 aerial orthographic photographs made us realize that the amount of disturbed and developed land in the study area had increased over the ten-year period and is continuing to be so. (It should be noted that this was not assessed systematically.)

Recommendations

- Landowners, town conservation and development programs, and government planners should be strongly encouraged to use this study to inform their land use decision-making, both within the study area and elsewhere in town. Elsewhere in town this study can offer examples and help identify habitats of significance that may be present.

- The unique, high-quality, large, or contiguous habitat areas identified in the study are of special value to our community. They warrant special attention. Conservation efforts should focus on these areas and any area land use changes that affect them should be carefully considered and planned. These areas include:
    - The large, high-quality forested areas such as those in the vicinity of The Vly and between Peak and Atwood Roads;
    - The Lower Esopus Creek riparian corridor with its diverse and high quality habitats, especially the streamside ledges supporting unusual plant communities, and the large forested areas along the Vly-Atwood, Scarawan, and Peak Roads are possibly valuable locations to promote wildlife and habitat connections between each other and the Catskill and Shawangunk mountain ranges;
    - Calcareous wet meadow, fen, and intermittent woodland pool habitats, which are relatively uncommon and therefore are of special value to the town. While some of these occur in the study area, they are also likely to occur elsewhere in the town and should be looked for;
    - Water resource networks, such as the Lower Esopus Creek and tributaries, and seeps, springs and wetland networks, including hardwood swamps, such as are found in The Vly and Scarawan Swamp areas.

- Where possible, expand areas of good habitat already conserved by permanent protections. These include those held in conservation easements by the Rondout-Esopus Land Conservancy, permanently-protected lands owned by the Mohonk Preserve and New York City Department of Environmental Protection or the State of New York.

- Promote connectivity of high-quality habitats. This entails considering the habitat function of areas within the context of the town and larger region. Two specific areas identified as being possible connection priorities are The Vly and Peak Road forests and Lower Esopus Creek riparian corridor. On a smaller scale, maintaining habitats across individual property lines, such as a hardwood swamp that extends into two or more holdings, should be made common practice.

- Established tools for conserving these and other habitats include:
    - Intermunicipal efforts for protection of resources that extend beyond town lines. Examples include programs to purchase lands or deeded rights for conservation purposes and “wildland” recreation in areas that are in two or more towns, matching site planning guidelines for areas of special interest that are shared across towns, and collaborating to identify areas most appropriate

for habitat protection and, conversely, site disturbance and build-up, across town lines. It is notable that many government grant funding programs favor intermunicipal projects over single-town projects.
    - Conservation-oriented planning on individual properties, such as placing buildings and high-use areas in locations that are outside of and buffered from valuable habitats.
    - Purchase of lands or deeded rights for conservation purposes, for example buying an area to create a birding preserve, or for resale after placing a conservation easement on it.
    - Landowner incentives for habitat protection such as tax breaks, rewards, or reimbursement for planning costs.
    - Site use guidelines to promote habitat-conscious use of lands.
    - Water protection overlays that plan and regulate land uses in areas identified as important to drinking water supplies and surface waters such as aquifer recharge areas.

- Identify areas of less-valuable or less-sensitive habitats, and direct activities that can negatively affect sensitive or high-quality habitats towards those areas and away from areas of conservation value. These could include existing hamlet areas, re-use and adaptation of already-disturbed sites, maintaining buffer zones between natural habitats and habitats of concern, and "fill-in" of areas already more densely developed and that lack sensitive habitats.

- Contain and eradicate invasive plant and animal species.

- Another habitat assessment in 5 or 10 years could provide a clearer picture of the changing landscape over time. This would help in understanding the direction of expanding human habitats and the shifting of wildlife habitats.

Each and all of the above recommendations will benefit dramatically from active and energetic outreach and education about habitats and their protection. This should be directed towards landowners and government decision-makers. We believe that nearly everyone in the Marbletown community (and surrounding towns) values nature, whether as a place to hike, bird, fish, learn about nature, enjoy a scenic view, or refresh themselves. Many will benefit from learning about the importance and complexity of the natural habitats in our community. The more we understand, the more likely it is we will think about our own land use decisions and act generously. Education initiatives are a task well-suited to the town's Environmental Conservation Commission and other interested residents, independently or in groups.

Appendix 1: Field Visit Notes

Various field visits were made during the course of the biodiversity assessment of our study area. Such field visits were effective in answering questions raised concerning particular locations as we did our remote mapping of habitats. No private property was entered unless we received permission to do so from the property owner. Some observations were made from public roadsides.

This section contains detailed notes about some of the specific habitats visited within the three study area subsections (Salmon, Blue, and Yellow (see the map in the Introduction section of this report)). More specifically the habitats covered from each subsection are:

Yellow Section Composite Field Visit Notes
- Shrubland (SH) with Seeps (SS)
- Non-Calcareous Wet Meadow (WM)
- Hardwood Swamp (HS)
- Constructed Pond (CP)

Blue Section Composite Field Visit Notes
- Upland Deciduous Forest (UDF)
- Constructed Pond (CP)
- Calcareous Wet Meadow (CWM)

Salmon Section Composite Field Visit Notes
- Crest, Ledge and Talus (CLT)
- Non-Calcareous Wet Meadow (WM)
- Hardwood Swamp (HS) and Non-Calcareous Wet Meadow (WM)
- Upland Forests (UDF, UMF) and Crest, Ledge, and Talus (CLT)

Scientific names listed within the notes have been obtained, for the most part, from the following websites: *http://plants.usda.gov/index.html* and *http://atlas.nyflora.org*
.

Images of the plants and animals named may be obtained by accessing Google's website, *http://www.google.com*, and clicking on Images.

Yellow Section Composite Field Visit Notes

The Yellow Section team visited several different properties during the summer of 2006. The entire BAT group made a visit to one area in the hamlet of Stone Ridge on August 12th. The notes below represent the composite observations made during field visits to this area, before, during, and after the entire BAT group field visit.

Shrubland (SH) with Seeps (SS) Habitat

Vegetation:

Pale jewelweed *(Impatiens)* (a calcicole)
Sensitive fern *(Onoclea)*
Arrow-leaf tearthumb *(Polygonum sagittatum)*
Green bulrush *(Scirpus atrovirens)*
Red maple *(Acer rubrum)*
Lady fern *(Athyrium)*
Brackenfern *(Pteridium)*
Black raspberry/Black cap *(Rubus occidentalis)*
Witch-hazel *(Hamamelis)*
Jumpseed *(Polygonum virginianum)*
Rhododendron *(Rhododendron)*
Asiatic dayflower *(Commelina communis)*

Wildlife Sightings:

Snails

Surface Water:

No surface water, but hillside was seepy in places, with several wetland indicator plants.

Invasive Species:

Japanese Barberry (*Berberis thunbergii*)
Poison Ivy (*Toxicodendron radicans*)

Evidence of Disturbance:

Mowed path nearby, close proximity to house and yard.

Other Observations:

none

Non-Calcareous Wet Meadow (WM) Habitat

Vegetation:

Dogbane (*Apocynum*)

Sensitive fern *(Onoclea)*
Cinnamon fern *(Osmunda cinnamomea)*
Interrupted fern *(Osmunda claytoniana)*
Royal fern (*Osmunda regalis*)
Grass-leaved goldenrod *(Solidago graminifolia)*
Boneset *(Eupatorium)*
Woolgrass *(Scirpus cyperinus)*
Groundnut *(Apios)*
Tussock sedge *(Carex stricta)*
Marsh fern *(Thelypteris)*
Joe-Pye weed (spotted and hollow) *(Eupatorium)*

Wildlife Sightings:
Monarch butterfly (*Danaus plexippus*)
Tiger swallowtail (*Papilio glaucus*)

Surface Water:
In some places, standing water about 4 inches deep.

Invasive Species:
Purple loosestrife (*Lythrum salicaria*)

Evidence of Disturbance:
Multiple paths mowed through the meadow, and a driveway built nearby disrupted the natural drainage of the area.

Other Observations:
none

Hardwood Swamp (HS) Habitat

Vegetation:
Pin oak (*Quercus palustris*)
Red maple (*Acer rubrum*)
Soft rush *(Jucus effusus)*
Burning bush (*Euonymus*)
Hogpeanut (*Amphicarpaea*)
American elm (*Ulmus americana*)
Catalpa *(Catalpa)*
Hickory (*Carya*)
Meadowsweet (*Spiraea*)
Sedge

Wildlife Sightings:
none

Surface Water:
None, soil was damp to the touch.

Invasive Species:
Poison ivy (*Toxicodendron radicans*)

Evidence of Disturbance:
A driveway built nearby disrupted the natural drainage of the area.

Other Observations:
none

Constructed Pond (CP) Habitat

Vegetation:
Blue flag *(Iris versicolor)*
Buttonbush *(Cephalanthus)*
Silky dogwood *(Cornus amomum)*
Winterberry holly *(Ilex verticillata)*
Shallow sedge *(Carex lurida)*
Green ash *(Fraxinus pennsylvanica)*
Weeping willow *(Salix)*
Red maple *(Acer rubrum)*
Eastern cottonwood *(Populus deltoides)*
Spiny coontail (spineless hornwort) *(Ceratophyllum echinatum)* (a calicole)
Brazilian watermeal *(Wolffia brasiliensis)* (a calcicole)

Wildlife Sightings:
American goldfinch *(Carduelis tristis)*
Green frog *(Rana clamitans)*

Surface Water:
A stream entered the pond on the south side and exited to the north, underneath of a road.

Invasive Species:
none

Evidence of Disturbance:
A driveway built nearby disrupted the natural drainage of the area.

Other Observations:
none

Blue Section Composite Field Visit Notes

The Blue Section subgroup made many field visits during the summer of 2006. Enumerated below are the findings while visiting three habitats within two adjacent properties in The Vly area on four different occasions. A preliminary review of the area was conducted in May, followed by a visit by the entire BAT group on June 2nd. Follow up visits took place the beginning of July and the middle of August. The notes below represent the composite observations of those visits.

Upland Deciduous Forest (UDF) Habitat

Vegetation:

Maidenhair fern *(Adiantum pedatum)*
Maidenhair spleenwort *(Asplenium trichomanes)*
Bloodroot *(Sanguinaria canadensis)* (a calcicole)
Jewelweed *(Impatiens)*
Wild columbine *(Aquilegia canadensis)* (a calcicole)
Eastern hay scented fern *(Dennstaedtia punctilobula)*
Dwarf ginseng *(Panax trifolius)*
Broadleaf helleborine *(Epipactis helleborine*)
Cup fungi *(Ascomycota)*
Common selfheal (a.k.a. healall) *(Prunella vulgaris)*
Snakeroot *(Ageratina)*
Watercress *(Nasturtium officinale)*
Clearweed *(Pilea)*
Christmas fern *(Polystichum acrostichoides)*
Wood geranium *(Geranium)*
Turtlehead *(Chelone glabra)*
Eastern marsh fern (dark-stemmed fern) *(Thelypteris palustris)*
Forget-me-not (spring) *(Myosotis)*
Laxiflorae sedge *(Carex)*
Partridgeberry *(Mitchella repens)*
Sweet woodruff *(Asperula)*
New York fern *(Thelypteris noveboracensis)*
Ironweed *(Vernonia noveboracensis)*
Slender blue iris *(Iris prismatica)*
Red cup fungus *(Plectania coccineo)*
Helleborine (non-native orchid) *(Epipactis)*
Ironwood (hornbeam)*(Carpinus caroliniana)*
Witch-hazel *(Hamamelis virginiana)*
Birch *(Betula)*
Ash *(Fraxinus)*
Eastern white pine *(Pinus strobus)*
Black cherry *(Prunus serotina)*

Tulip tree *(Liriodendron tulipifera)*
American basswood *(Tilia americana)*
White oak *(Quercus alba)*
Shagbark hickory *(Carya ovata)*
Red oak *(Quercus rubra)*
Sugar maple *(Acer saccharum)*

Wildlife Sightings:
Red spotted newt (juvenile, aka red eft) *(Notophthalmus viridescens)*
American toad *(Bufo americanus)*
Frogs
Deer scats

Surface Water:
Seeps along old farm road
Gladt Klipt Kill characteristics: tannin, rocky bottom, mossy banks, seepy bank on northwest side

Invasive Species:
Japanese barberry *(Berberis thunbergii)*
Garlic mustard *(Alliaria petiolata)*

Evidence of Disturbance:
Old washed out farm road, stonewalls, old mill ruin on southeast side – not visited

Other Observations:
Grape vines, Upland Conifer Forest (hemlock, white pine) on southeast side – not visited

Constructed Pond (CP) Habitat

Vegetation:
Harlequin blue flag *(Iris versicolor)*
Forget-me-not *(Myosotis)*
Blue-eyed grass *(Iris)*
Deptford pink *(Dianthus armeria)*
Water horehound *(Lycopus)*
Common selfheal (a.k.a. healall) *(Prunella vulgaris)*
Birdfoot trefoil *(Lotus corniculatus)*
Yarrow *(Achillea millefolium)*
St. Johnswort *(Hypericum)*
Timothy *(Phleum pratense)*
Clover *(Melilotus)*
Horsetail *(Equisetum)*
Marsh fern *(Thelypteris palustris)*
Soft rush *(Juncus effusus)*

Clearweed *(Pilea)*
Ironweed *(Vernonia noveboracensis)*
Halberd-leaf tearthumb *(Polygonum arifolium)* (a calcicole)
Forget-me-not (swamp var.) *(Myosotis)*
Sedges (many types)
Common daisy
Various grasses around periphery

Wildlife Sightings:
Pickerel frog *(Rana palustris)*
Crows *(Corvus brachyrhynchos)*
Garter snake *(Thamnophis sirtalis)*
Dragonflies:
Clubtail *(Gomphus)*
Common whitetail *(Libellula lydia)*
Eastern amberwing *(Perithemis tenera)*
Slaty skimmer *(Libellula incesta)*
Pumpkinseed sunfish *(Lepomis gibbosus)*
Other fish
Frog

Surface Water Characteristics:
Possibly spring fed, open, no floating vegetation

Invasive Species:
English plantain *(Plantago)*
Tartarian honeysuckle *(Lonicera tatarica)*

Evidence of Disturbance:
Small boat, lawn chairs

Other Observations:
Old planting of mock orange *(Philadelphus)*

Calcareous Wet Meadow (CWM) Habitat

Vegetation:
Eastern marsh fern *(Thelypteris palustris)* (dark-stemmed fern)
Jewelweed *(Impatiens)*
Sensitive fern *(Onoclea sensibilis)*
Forget-me-not *(Myosotis)*
Sedge (Owlfruit, Stalk-grain) *(Carex stipata)*
Golden ragwort *(Packera aurea)*
Water horehound *(Lycopus)*
Starflower *(Trientalis)*

Halberd-leaf tearthumb *(Polygonum arifolium)* (a calcicole)
Jack in the pulpit *(Arisaema triphyllum)*
Oyster mushroom *(Pleurotus ostreatus)*
Turkey tail mushroom *(Trametes versicolor)*
White turtlehead *(Chelone glabra)*
Crested woodfern *(Dryopteris cristata)*
Inflated sedge *(Carex intumescens)*
Swamp boneset *(Eupatorium)*
Blue-eyed star-grass *(Heteranthera)*
Wild strawberry *(Fragaria virginiana)*
Beech tree *(Fagus grandifolia)*
Red maple *(Acer rubrum)*
Common winterberry *(Ilex verticillata)*
Monkeyflower *(Mimulus)*
Asters
Various wetland sedges

Wildlife Sightings:

Red spotted newt *(Notophthalmus viridescens)*
Ebony jewelwing *(Calopteryx maculata)* (damselfly laying eggs in small stream)
Common slug *(Limax campestris)*
American toad *(Bufo americanus)*
Black striped minnow *(Galaxiella nigrostriata)*
Frog
Snail

Surface Water Characteristics:

Small possibly perennial stream emptying into the Gladt Klipt Kill with small fish, seepy areas

Invasive Species:

Poison ivy *(Toxicodendron radicans)*
Japanese barberry *(Berberis thunbergii)*

Evidence of Disturbance:

Wood cutting.

Other Observations:

Clayey soil near Gladt Klipt Kill, small stream source may be spring or overflow from the CP.

Salmon Section Composite Field Visit Notes

The BAT group made two formal field visits in the Salmon Section on July 8th and September 9th during the summer of 2006 to habitats off Tongore Road, Bogart Lane, Route 213, and a northwest-facing cliff on the Lower Esopus Creek. BAT group members made other visits to the Lower Esopus Creek cliff. On one occasion, a northeast-facing cliff was visited.

Crest, Ledge, and Talus (CLT) Habitat (the northwest-facing cliff)

Vegetation:

Bloodroot *(Sanguinaria canadensis)* (a calcicole)
Maidenhair spleenwort *(Asplenium trichomanes)*
Coltsfoot *(Tussilago)*
Yarrow *(Achillea millefolium)*
Harebell *(Campanula rotundifolia)*
Spikenard *(Aralia)*
Mountain maple *(Acer spicatum)*
Liverwort *(Conocephalum conicum)*
Rock cress *(Arabis)*
Violet wood sorrel *(Oxalis violacea)*
Asters
Ferns and mosses

Wildlife Sightings:

Eastern spotted newt *(Notophthalmus viridescens)*
Wood turtle *(Clemmys insculpta)*
Osprey *(Pandion haliaetus)*
American toads *(Bufo americanus)*
Hawks, various times during the summer

Invasive Species:

Poison ivy *(Toxicodendron radicans)*
Japanese barberry *(Berberis thunbergii)*

Evidence of Disturbance:

Survey marking tape. Flood damage tree snags and debris

Other Observations:

The Lower Esopus Creek area has the character of the streams and ravines and wilderness areas of the Catskill Mountains.

Non-Calcareous Wet Meadow (WM) Habitat (off Tongore Road)

Vegetation:

Reed canary grass (*Phalaris arundinacea)*
Soft-stemmed bull rush (*Tiburni Montanii)*
Soft rush (*Jucus effusus)*
Arrow-leaf tearthumb *(Polygonum sagitattum)*
Wintercress (*Barberia vulgara)*
Dodder (*Cuscuta gronovii)*
Cattail (*Typha)*
Shallow sedge *(Carex lurida)*
Longhair sedge *(Carex comosa)*
Whorled loosestrife *(Lysimachia quadrifolia)*
Common reed *(Phragmites australis)*
Fowl mannagrass *(Glyceria striata)*
Jewelweed *(Impatiens)*
Boneset *(Eupatorium)*
Blue vervain *(Verbena hastata)*
White vervain *(Verbena urticifolia)*
Common ragweed *(Ambrosia)*
Daisy fleabane *(Erigeron annuus)*
Clearweed *(Pilea)*
Rough-fruited cinquefoil (sulfur) *(Potentilla recta)*
Water horehound *(Lycopus)*

Wildlife Sightings:

Yellow warbler *(Dendroica petechia)*
Green frogs *(Rana clamitans)*
Red-winged blackbird *(Agelaius phoeniceus)*
Grey catbird *(Dumetella carolinensis)*
Garter snake *(Thamnophis sirtalis)*
Italian honeybee *(Apis mellifera)*
Damselflies
Dragonflies
Minnows

Surface Water Characteristics:

Perennial main channel and tributary are apparently eutrophied and contain filamenteous algae.

Invasive Species:

Purple loosestrife *(Lythrum salicaria)*
Multiflora rose *(Rosa multiflora)*
Lady's thumb *(Polygonum persicaria)*

Evidence of Disturbance:

Adjacent active cornfield to northwest.

Other observations:

Several standing dead snags used as nesting trees. Upslope to east is mature deciduous forest. Shrub swamp down stream and hardwood swamp believed upstream.

Hardwood Swamp (HS) and Non-Calcareous Wet Meadow (WM) Habitats

(alternating habitats moving north, off Bogart Lane)

Vegetation:

HS –

Red maple *(Acer rubrum)*
Boxelder *(Acer negundo)*
Alder *(Alnus)*
Swamp rose *(Rosa palustris)*
Buttonbush *(Cephalanthus occidentalis)*
Bur-reed *(Sparganium)*
Arrow-leaf tearthumb *(Polygonum sagitattum)*
Yellow iris *(Iris pseudacorus)*
Bulb-bearing water-hemlock
Water plantain *(Alisma)*
Virgin's bower *(Clematis virginiana)*
Jewelweed *(Impatiens)*
Sensitive fern *(Onoclea sensibilis)*
Lesser duckweed *(Lemna minor)*
Pondweed *(Potamogeton)*

WM –

Soft rush (*Jucus effusus)*
Yellowfruit sedge *(Carex annectens)*
Grass-leaved goldenrod *(Solidago graminifolia)*
Path rush *(Juncus tenuis)*
Rough-stemmed goldenrod *(Solidago rugosa)*

HS –

Lesser duckweed *(Lemna minor)*
Dogwood *(Cornus)*
Joe-Pye weed (spotted) *(Eupatorium)*
Dogbane *(Apocynum)*
Stinging nettle *(Urtica dioica)*
Ostrich fern *(Matteuccia struthiopteris)*

WM –

Fringed sedge *(Carex crinita)*
Rice cutgrass *(Leersia oryzoides)*

Cattail *(Typha)*
Sensitive fern *(Onoclea sensibilis)*
Halberd-leaf tearthumb *(Polygonum arifolium)*

Wildlife Sightings:
Green frog *(Rana clamitans)*
Red-winged blackbird *(Agelaius phoeniceus)*
Green heron *(Butorides virescens)*
Dragonflies

Surface Water Characteristics:
A drainage between a steep wooded slope and a farmed field.

Invasive Species:
HS &WM –
Purple loosestrife *(Lythrum salicaria)*
HS –
none
WM –
Purple loosestrife *(Lythrum salicaria)*

Evidence of Disturbance:
Farm field runoff.

Other Observations:
Heard wood thrush, common yellowthroat, and possibly American bittern. Grape vine.

Upland Forests (UDF, UMF), Crest, Ledge, and Talus (CLT) Habitats

(off Bogart Lane)

Vegetation:
UDF –
Bulblet fern *(Cystopteris bulbifera)* (a calcicole)
Canada moonseed *(Menispermum canadense)* (a calcicole)
Pale touch-me-not *(Impatiens pallida)* (a calcicole)
Bloodroot *(Sanguinaria canadensis)* (a calcicole)
Wake-robin (purple trillium) *(Trillium erectum)*
Stinging nettle *(Urtica dioica)*
Virginia creeper *(Parthenocissus quinquefolia)*
Kidney-leaved buttercup *(Ranunculus abortivus)*
Tall meadow rue *(Thalictrum pubescens)*
Enchanter's nightshade *(Circaea)*
White wood aster *(Eurybia divaricata)*
Marginal woodfern *(Dryopteris marginalis)*
Helleborine (non-native orchid) *(Epipactis)*

Lady fern *(Athyrium)*
Bracken *(Pteridium)*
White avens *(Geum canadense)*
Sweet cicely *(Osmorhiza)*
Herb-robert *(Geranium robertianum)*
Jewelweed *(Impatiens)*
White baneberry *(Actaea pachypoda)*
Slippery elm *(Ulmus rubra)*
Deer-tongue grass *(Panicum clandestinum)*
Virginia jumpseed *(Polygonum virginianum)*
Skunk cabbage *(Symplocarpus foetidus)*
Foamflower *(Tiarella cordifolia)*
Dames rocket *(Hesperis matronalis)*
Jack in the pulpit *(Arisaema triphyllum)*
American sycamore *(Platanus occidentalis)*

Ledge (seepy) –

Wild ginger *(Asarum canadense)*
False Solomon's seal *(Maianthemum racemosum)*
Purple-flowering raspberry *(Rubus odoratus)*
Ebony spleenwort *(Asplenium platyneuron)*
Clearweed *(Pilea)*

UMF & Crest –

Hemlock *(Tsuga canadensis)*
Chestnut oak *(Quercus prinus)*
Red baneberry *(Actaea spicata)*
Tall meadow rue *(Thalictrum pubescens)*
Jewelweed *(Impatiens)*
Wild lettuce *(Lactuca)*
Stinging nettle *(Urtica dioica)*

Wildlife Sightings:

none

Surface Water Characteristics:

A rocky-bottomed, clear perennial stream, that bisects the area, was fast flowing.

Invasive Species:

Multiflora rose *(Rosa multiflora)*
Poison ivy *(Toxicodendron radicans)*
Japanese barberry *(Berberis thunbergii)*
Garlic mustard *(Alliaria petiolata)*
Japanese stiltgrass *(Microstegium vimineum)*

Evidence of Disturbance:

Perennial stream crossing point.

Other Observations:

Grape vine. Waterfall.

Appendix 2: Study Area Soils

The soils within our study area are shown in table form below. Refer to the soils maps[1] for the locations of each soil type. A key to the codes such as NC, M, and SX is given below along with a few additional notes.

Symbol	*Soil Series & Phase*	*Reaction*	*Organic or Mineral*	*Depth to Bedrock*	*Parent Material*	*Drainage*
AA	Alluvial land					
Ac	Arnot channery silt loam	NC	M	<=20”	Till	MW-SX
AR	Arnot Lordstown Rock outcrop (complex)	NC NC	M M	<=20” 20”-40”	Till Till	MW-SX W
At	Atherton silt loam	C	M	>60”	Outwash	P-VP
Bg	Bath gravelly silt loam	SC,NC	M	>40”	Till	W
BH	Bath very stony	SC,NC	M	>40”	Till	W
Bn	Bath Nassau (complex)	SC,NC NC	M M	>40” <=20”	Till Till	W SX
BO	Bath Nassau Rock outcrop (complex)	SC,NC NC	M M	>40” <=20”	Till Till	W SX
BR	Bath Mardin very stony	SC,NC SC	M M	>40” >40”	Till Till	W MW
Cc	Canandaigua silt loam	C	M	>60”	Lacustrine	P-VP
Cg	Castile gravelly silt loam	SC,NC	M	>60”	Outwash	MW
Cn	Chenango gravelly silt loam	SC,NC	M	>60”	Outwash	SX-W
Hg	Hoosic gravelly loam	NC	M	>60”	Outwash	X-W
HS	Hoosic soils	NC	M	>60”	Outwash	X-W
LC	Lackawanna Swartswood very bouldery	NC NC	M M	>60” >60”	Till Till	W MW-W
LE	Lackawanna Swartswood extremely bouldery	NC NC	M M	>60” >60”	Till Till	W MW-W
Ln	Lordstown channery silt loam	NC	M	20”-40”	Till	W
LO	Lordstown Arnot Rock outcrop (complex)	NC NC	M M	20”-40” <=20”	Till Till	W MW-SX

Md	Mardin gravelly silt loam	SC	M	>40”	Till	MW
Mg	Mardin Nassau (complex)	SC NC	M M	>40” <=20”	Till Till	MW SX
Mn	Menlo silt loam	NC	M	>60”	Till	VP
MO	Menlo very bouldery	NC	M	>60”	Till	VP
Mr	Unadilla silt loam	(variable)	M	>60”	Lacustrine, Alluvium	W
MT	Morris Tuller (complex) very bouldery	NC NC	M M	>60” <=20”	Till Till	SP SP-P
NB	Nassau Bath Rock outcrop (complex)	NC SC,NC	M M	<=20” >40”	Till Till	SX W
Ol	Oquaga Lordstowm channery silt loam	NC NC	M M	20”-40” 20”-40”	Till Till	W-X W
Pa	Palms muck	C	O	>60”	Organic	VP
Pb	Palms muck bedrock variant	C	O	>60”	Organic	VP
PI	Plainfield loamy sand	SC	M	>60”	Outwash	X
Pm	Plainfield Riverhead (complex)	SC SC,NC	M M	>60” >60”	Outwash Outwash	X W
Pt	Pompton fine sandy loam	NC	M	>60”	Outwash	MW-SP
Ra	Raynham silt loam	C	M	>60”	Lacustrine	SP-P
Re	Red Hook gravelly silt loam	C	M	>60”	Outwash	SP
Rv	Riverhead fine sandy loam	SC,NC	M	>60”	Outwash	W
Sd	Scriba Morris	C NC	M M	>60” >60”	Till Till	SP SP
SE	Scriba Morris very bouldery	C NC	M M	>60” >60”	Till Till	SP SP
SG	Scriba Morris extremely bouldery	C NC	M M	>60” >60”	Till Till	SP SP
Sm	Stockbridge Farmington (complex)	C C	M M	>40” <=20”	Till Till	W SX-W
ST	Stockbridge Farmington Rock outcrop (complex)	C C	M M	>40” <=20”	Till Till	W SX-W

Su	Suncook loamy fine sand	NC	M	>60”	Alluvium	X
Tg	Tioga fine sandy loam	C	M	>60”	Alluvium	W
Un	Unadilla silt loam	(variable)	M	>60”	Lacustrine, Alluvium	W
VA	Valois very bouldery	SC	M	>60”	Till	W
Vo	Volusia gravelly silt loam	SC	M	>60”	Till	SP
VS	Volusia very stony	SC	M	>60”	Till	SP
Wb	Wayland silt loam	C	M	>60”	Alluvium	P-VP
WL	Wellsboro Wurtsboro very bouldery	NC NC	M M	>60” >60”	Till Till	MW MW-SP
WO	Wellsboro Wurtsboro extremely bouldery	NC NC	M M	>60” >60”	Till Till	MW MW-SP
Ws	Williamson silt loam	SC	M	>60”	Lacustrine	MW

Key

Reaction:
C = calcareous
SC = somewhat calcareous
NC = non-calcareous
(variable)[2]

Drainage:
X = excessively drained
SX = somewhat excessively drained
W = well drained
MW = moderately well drained
SP = somewhat poorly drained
P = poorly drained
VP = very poorly drained

Parent Material:[3]
Till (glacial till)
Outwash (glacial outwash)
Lacustrine (glaciolacustrine)
Alluvium
Organic

Notes:

1. Total number of soils = 49.

2. The specific locations of these soils may be found in the Soil Survey of Ulster County

3. A Soil’s clay content is not available in the Soil Survey of Ulster County.

4. The soil found on Alluvial land is a fine-grained fertile soil deposited by water flowing over flood plains or in river beds. It is composed of gravel, sand, silt, clay, and all variations and mixtures of these.

Appendix 3: Habitat Map

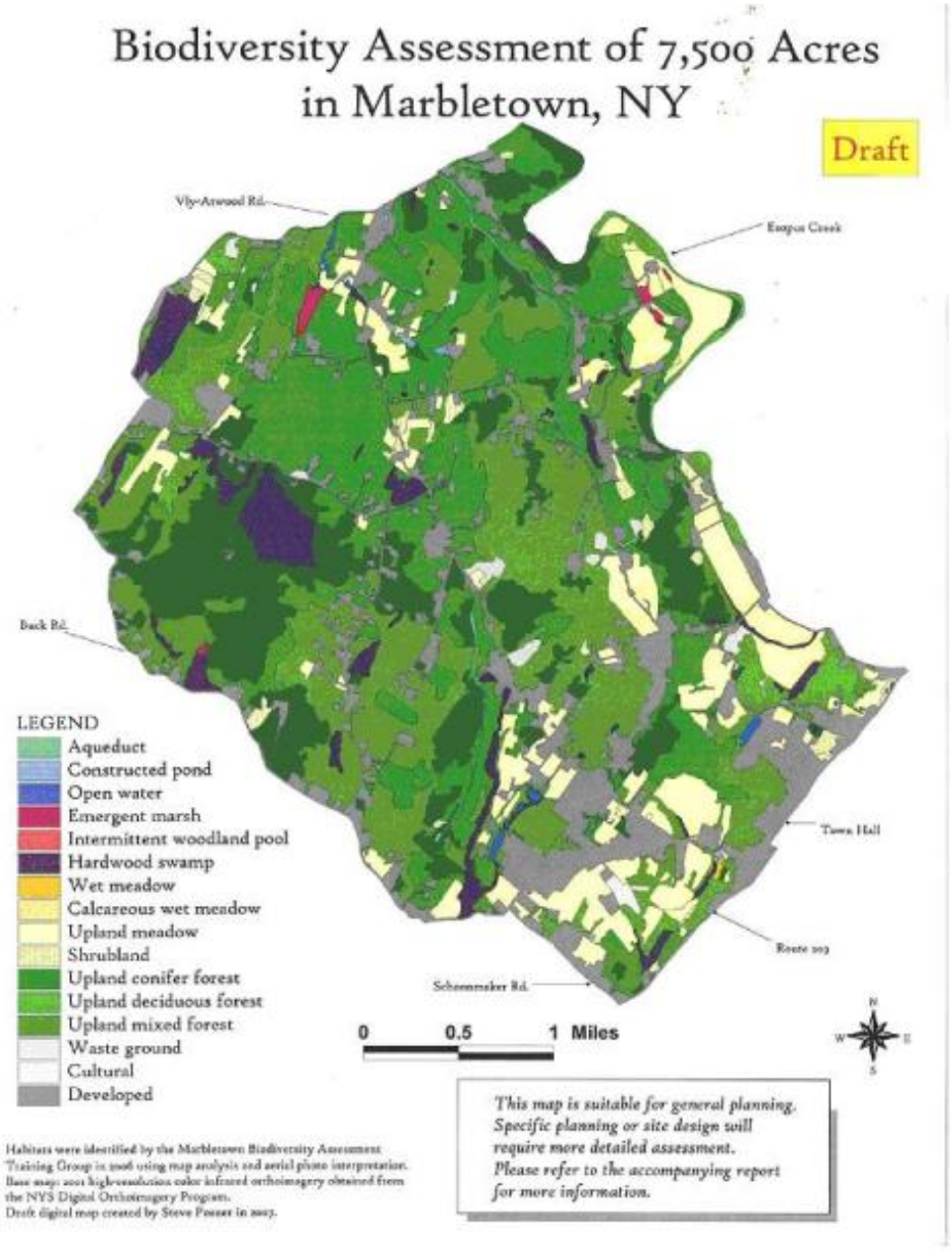
The map, found on the next page, has been copied from a digital version of the draft habitat map that was created using Geographic Information Systems (GIS). GIS is a type of computer program that allows a user to view, create, and manage spatial and other data. In this case, an incomplete draft of the habitat map has been created showing a number of the different habitats assessed by the Marbletown BAT group. An enlarged hardcopy of this draft habitat map is included separately and may be found in the Marbletown Town Hall.

Color infrared aerial photographs from 2004 were used as a base layer for the map. Next, each habitat was designated on the map and filled with a particular color. The colors are standardized so that all habitats of one type are the same color. For example, all hardwood swamp habitats on the map are purple, all upland meadow habitats are light yellow, etc.

The value of having a digital, GIS version of a habitat map can be appreciated when considering land use decisions and community planning. The habitat map exists as one tool that can be used to remotely assess an area of interest, without actually making a visit to the land. A GIS habitat map is a layer that can be overlaid on top of other GIS layers of map information. For instance, GIS can be used to display county roads as one layer, state-mapped wetlands as a second layer, and habitats as a third layer, all on the same map. In this way, an area of land can be viewed through different lenses to gauge its ecological, commercial, or residential significance, as well as its relationship to the surrounding land and provide the size in acreage of the various habitat types.

It would certainly be to Marbletown's benefit to have someone, well versed in creating GIS maps, complete the draft habitat map. All the information necessary for doing so may be found on a large black and white aerial photograph of our study area that has been placed in the Marbletown Town Hall. This aerial photograph includes all the individual habitats delineated and labeled with the abbreviations of the various habitat types (e.g., UM, HS, IWP, etc.) within each closed region.

The Draft Habitat Map



There are five regions delineated on this draft Habitat Map that do not appear in the Habitat Profiles section. They are Aqueduct, Open water, Waste ground (quarries and abandoned disturbed ground), Cultural (schools and their playing fields, churches, and cemeteries), and Developed (Other buildings with their accompanying lawns, gardens, parking areas, and driveways).

It should also be noted that the following habitat types, found in the Habitat Profiles section of this report, have not been delineated in the above draft Habitat Map, namely, Crest, Ledge, and Talus, Perennial Stream, Intermittent Stream, and Springs and Seeps.

Notes

Introduction

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2. Biodiversity Assessment Training Application Guidelines, Hudsonia Ltd. 2006.
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7. Soil Survey of Ulster County, USDA Soil Conservation Service.
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Methods

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Constructed Pond

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