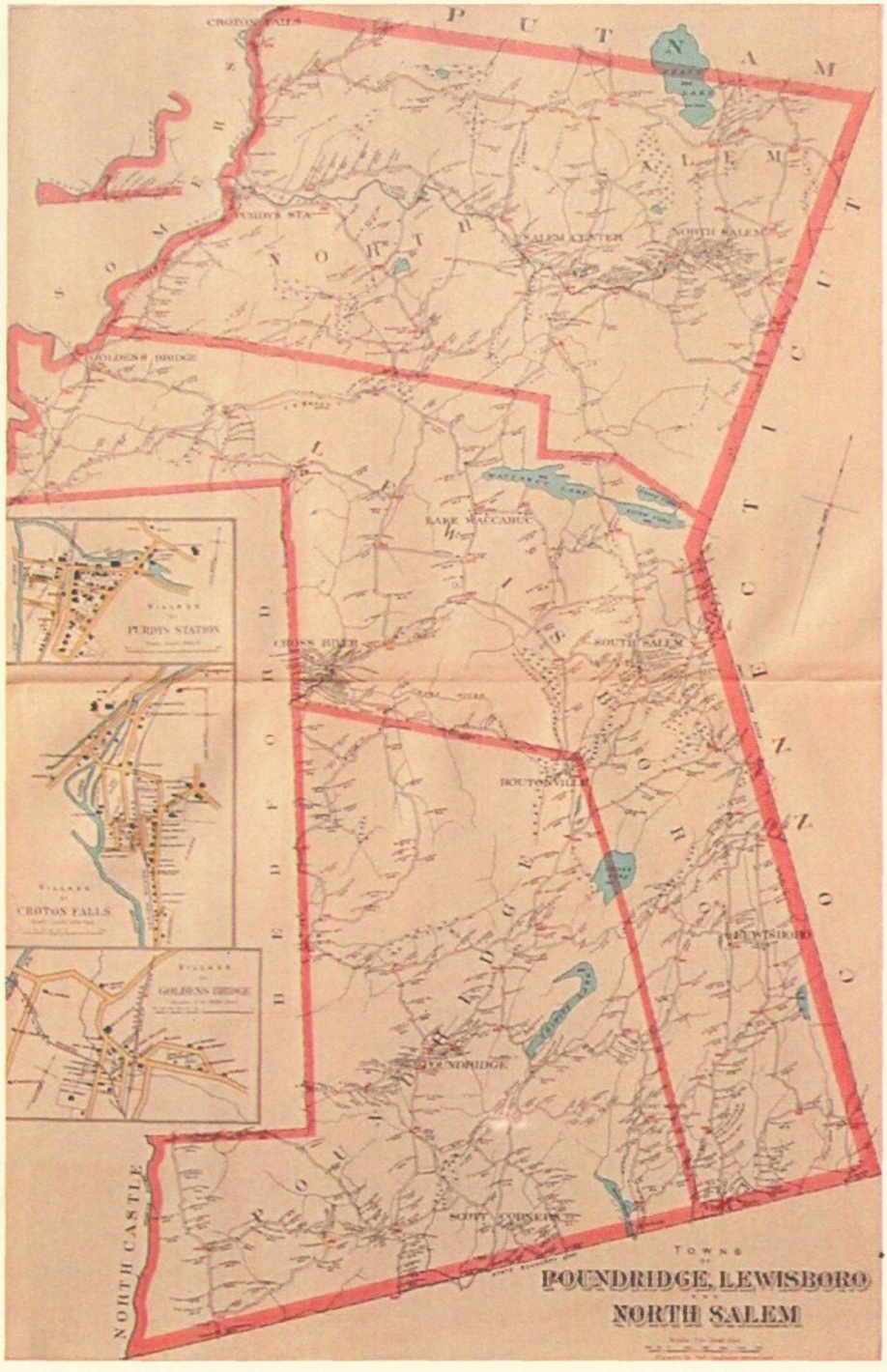
Eastern Westchester Biotic Corridor



New York State
Department of Environmental Conservation
Hudson River Estuary Program
21 South Putt Corners Road
New Paltz, NY 12561-1696

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TECHNICAL PAPER SERIES: N

Eastern Westchester Biotic Corridor

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Literature citations should read as follows:

Miller, N. A. and M. W. Klemens. 2002. Eastern Westchester Biotic Corridor. MCA Technical Paper No. 4, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Additional copies of this document can be obtained from:

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Wildlife Conservation Society
68 Purchase Street, 3rd Floor
Rye, New York 10580
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printed on partially recycled paper

Acknowledgements

The Eastern Westchester Biotic Corridor Project was initiated in 1998 as a partnership between the towns of North Salem, Lewisboro, and Pound Ridge. The Metropolitan Conservation Alliance (MCA) acknowledges the encouragement that we received from elected and appointed municipal officials within these towns. We especially thank our project steering committee for their efforts. Committee members include: Brian Bartsch, Stephen Bobolia and Cynthia Curtis (North Salem); Jim Nordgren and Debra Sourby (Lewisboro); and John R. W. Bria (Pound Ridge).

Initial financial support for this project was received from the Westchester Community Foundation. Subsequent support was provided by the Doris Duke Charitable Trust, the Surdna Foundation, and the Wildlife Conservation Society.

MCA full time and seasonal staff collected much of the field data used in the analysis and design of the corridor. Field biologists included Andrew Block, Henry Burke, Michael Klemens, Kristi MacDonald, Jim McDougal, Diane Murphy, and Damon Oscarson. Scott Sharlow provided extensive GIS support.

Tom Andersen of the Westchester Land Trust provided assistance and advice on various phases of the project.

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Introduction

Located less than 45 miles from Times Square, the towns of North Salem, Lewisboro, and Pound Ridge form an oasis of rolling forested hills and meadows, rocky ravines, and wooded swampland, at the northeastern edge of the ever-expanding New York Metropolitan region. Bounded by the Interstate 684 corridor to the west and the Connecticut state line to the east, these three towns have retained much of their rural flavor. Dirt roads bordered by ancient sugar maples wind through shaded forest, lichen-covered stone walls border grassy pastures, and small hamlets still retain much of the ambiance and vitality of a slower, gentler time. A rich diversity of wildlife remains in these towns because, despite recent and increased development, large tracts of unfragmented open space still remain. These are a legacy of relatively compact settlement patterns, rural land use practices, and protected areas, including county parkland as well as watershed buffer lands surrounding the numerous public water supply reservoirs located within these towns.

In 2000, the New York State Department of Environmental Conservation released its draft Wildlife and Habitat Diversity Conservation Plan for the Hudson River Estuary. This plan identified twenty-five Significant Biodiversity Areas (SBA's) located from the Rensselaer Plateau east of Albany, southward to the Arthur Kill on Staten Island. The Ward Pound Ridge Reservation (WPRR), a 4,700-acre county park located in the towns of Lewisboro and Pound Ridge, was included in this list of SBA's. The plan also recognized that core protected areas, alone, are insufficient to protect the rich biodiversity of the Hudson Valley region.

The Eastern Westchester Biotic Corridor (EWBC) builds upon the 4,700-acre core protected area of the WPRR. The EWBC adds value to that resource by outlining strategies to protect biodiversity in ecologically contiguous lands to the north and south of the WPRR. Unlike traditional conservation strategies that rely on land acquisition solely through purchase or easement, the EWBC draws upon a rich array of tools available through the local planning and land use decision-making process to achieve conservation objectives. These include overlay zones that provide incentives for conservation planning while achieving economic equity, strategies to develop intermunicipal compacts to achieve mutually beneficial land use objectives while strengthening home rule, as well as standards and guidelines to achieve a deeper and broader review of the biological issues that are presented by individual development applications.

In summary, the EWBC not only provides a framework for conservation planning within the towns of North Salem, Lewisboro, and Pound Ridge, but also creates a model that has far broader applications. This model, as described in the EWBC, links traditional land protection efforts with the rich and often untapped conservation potential presented by strategic engagement of the local land use decision making process.

Project Initiation

The Eastern Westchester Biotic Corridor (EWBC) project is a partnership between the Metropolitan Conservation Alliance (a program of the Wildlife Conservation Society) and the three contiguous towns of North Salem, Lewisboro, and Pound Ridge in northeastern Westchester County, New York. The goal of the project is to establish a regional, multi-town approach to the conservation of wildlife and habitats. These towns were selected because they contain an impressive diversity of wildlife and habitats, because they are under development pressures which threaten those natural resources, and because there is a growing awareness within the towns of a need to address these issues. The project commenced in late 1998 when formal agreements were entered into with the towns of Lewisboro and Pound Ridge. Those towns committed to the project after MCA staff gave presentations to officials at town board meetings. Due to strong local interest, North Salem was included in the project, although without a formal agreement. Project activities began in the winter of 1999.

Project Premises and Goals

All too often, land use decisions are made at the municipal level without the benefit of baseline biological information, or without any mechanisms to integrate such information into planning processes. This occurs despite significant efforts of concerned citizens and municipal officials. The gap between information providers (scientists) and information users (local decision-makers) creates a major obstacle. MCA has identified three fundamental challenges that lead to this situation:

Baseline data are generally not available: Without those data, it is impossible to plan for economic growth while simultaneously ensuring environmental integrity. Baseline ecological data can be used to identify areas of biological significance worthy of protection, and to identify areas of lesser significance. Development could be channeled toward the latter areas, thus reducing the level of impact on ecologically more sensitive areas. For these reasons, one of the project goals was to collect new biological data. These data have been used to generate a map, indicating areas of importance for wildlife within the three towns (see Results & Discussion).

Even where data are already available, mechanisms rarely exist to translate the data into policy: To address this problem, MCA has been developing a set of tools—a "conservation toolbox"—that will aid planners and other decision-makers in the application of biological data. These tools are targeted at a broad constituency, to address land use issues within the tri-state region. A list of available tools and tools we are developing is provided in Appendix A.

Biological data and conservation tools are ineffective unless they are accepted as part of a community's goals and integrated into land use practices: MCA strives to raise awareness and understanding of biodiversity concerns among municipal officials, land trust personnel, and others who influence the patterns of development upon our landscapes. This is accomplished by serving in an advisory capacity to planning boards and other entities; raising awareness of

biodiversity by conducting informative "survey walks;" and promoting inter-municipal, cooperative efforts to plan for biodiversity.

To summarize the above statements, a primary goal of this project was to address the impacts of sprawl on natural ecosystems by: (1) providing baseline scientific information, (2) developing innovative tools, and (3) integrating those elements into the land use decision-making process. As indicated above, MCA's original intent was to address both sides of the economic growth/biodiversity issue; that is, to identify areas worthy of protection or better management *and* to identify those areas more suitable for development. *Responding to the requests of our partner towns, this report is limited to only the conservation aspects of these data.*

Land Use Changes and Biodiversity

Transitions

The tri-state region surrounding New York City has undergone substantial and widespread land use changes over the past several hundred years. Before settlement by European immigrants the landscape was primarily composed of extensive, unfragmented forests, interspersed with open habitats (such as coastal plains, beaver-created wet meadows, and forest gaps created by wildfires). By the 18th and 19th centuries, most of the forested habitat had been converted to agricultural lands. During this agricultural period, areas unsuitable for farming (e.g., wetlands and very steep slopes) served as "refugia" for much of the region's wildlife communities. Although current development pressures impinge on such areas, they remain some of our most biologically rich and unique habitats. More recently, farms have been abandoned as agricultural land uses shifted to states further west. Through natural successional processes, most former farm fields have reverted back to forests; some are still in a transitional state, consisting of old field/shrubland habitat.

The key elements in the above transitions are resiliency and connectivity. As land uses changed over time, many wildlife species and other components of the natural environment were able to adapt and even thrive. For instance, with the onset of agriculture bog turtles began to make use of wet meadows maintained as open habitat through the light grazing of domestic cattle, rather than their traditional wildfire-created or beaver-maintained habitats. Certain grassland-associated birds, such as the bobolink and the eastern meadowlark, make use of hayfields as a surrogate for their native grassland breeding habitats.

Today's land use patterns are entirely different from those of historic times. Resiliency is not an option for most species. In the current wave of sprawl, permanent structures are erected. Highways, parking lots, and subdivisions fence in remaining tracts, fragment them into smaller pieces, and isolate them from other tracts. The impervious surfaces created through such development degrade the last parcels of habitat by drastically altering hydrologic conditions and impacting water quality. Although careful planning can mitigate some of the adverse impacts of such development, most planning occurs on a site-specific scale, and does not consider the much larger landscape-scale picture. Ironically, the land review process as

practiced in the towns of the EWBC may actually foster fragmentation by taking a "hard look" at too small of an area, as required by the NY State Environmental Quality Review Act (SEQRA). The transitions that are occurring within our landscape today are much more permanent than past changes, and they do not accommodate our native biodiversity. The few wildlife species that have adapted to such changes are opportunistic and/or invasive species, which thrive at the expense of a more diverse and balanced biological community.

Landscape configuration: Planning at the landscape level

As sprawl proceeds, large tracts of habitat within our landscape are fragmented into ever smaller components. To maintain biodiversity, we must ensure that remaining habitats are of sufficient acreage to support viable wildlife populations, *and* that they are arranged in such a way that allows dispersal of animals across the landscape. The following paragraphs define those landscape components, and discuss how ecological functionality can be maintained through better planning.

To ensure that development occurs in a manner that is compatible with biodiversity, core wildlife habitat areas and the corridors that connect them must be accommodated. In general, larger core areas (i.e., hubs) are better able to support healthy, viable wildlife populations than smaller areas. Ward Pound Ridge Reservation, the largest and perhaps the most biologically diverse of Westchester County's protected areas, is an excellent example of a hub. The connections between hubs are of paramount importance; they enable dispersal of animals among the hubs, maintaining gene pools and preventing extirpations (i.e., localized extinctions). Such connections have traditionally been referred to as "corridors." Corridor is an appropriate name, because it implies movement from one area to another. However, that name may also be misleading. A wildlife corridor is not a narrow, linear green strip between habitats. It is highly unlikely that such strips, which are often associated with walking paths or bike trails, would be used by most wildlife. Instead, MCA's definition of a corridor is a broad swath of habitat that connects habitat hubs. Although these swaths may not be as pristine as the parks or the hubs that they connect, they do provide secondary habitat (in addition to their role as dispersal corridors).

Because we are making permanent changes to our landscape, it is imperative to carefully identify where the matrix of wildlife habitats and corridors occurs. It is not sufficient to randomly protect small parcels of habitat across the region in the hope that they will provide viable wildlife habitat. Instead, we must discover where species already occur (i.e., which habitats are best), and use the results of those inquiries as a template for making future land use decisions. If we apply this conceptual template to guide development patterns, it may be possible to maintain biodiversity and ecological health. Without this template to guide us, loss of biodiversity is a certainty.

Focal Species Analysis (FoSA)

MCA concentrates survey efforts on those species, or species assemblages, that respond specifically to development, habitat loss, and habitat fragmentation. Such species are termed

"focal taxa," and can be further divided into two broad categories. Many focal taxa experience population declines as a result of urbanization. These focal taxa, henceforth referred to as Category I focal species, are usually habitat specialists, with very specific habitat requirements that are compromised by development. Examples include many of the Neotropical migrant bird species and many of the vernal pool-breeding amphibians. Such taxa tend to disappear from the landscape as their habitats are altered. Populations of other focal taxa increase in response to urbanization. These species, henceforth referred to as Category II focal species, are usually habitat generalists, with much less specific habitat requirements. They tend to occur in areas that have already been degraded; often, human alterations to landscapes favor, or subsidize, these generalists. Avian examples of such species include Corvids (crows and jays); an amphibian example is the bullfrog. As urbanization proceeds, such taxa tend to increase and replace the habitat specialists, resulting in an overall loss of biodiversity (i.e., species richness).

Both of these focal taxa categories provide valuable information about ecosystem health. It is the relative proportion, or "mix," of these two categories that reveals the most about the ecological integrity of any given site. MCA refers to the process of evaluating this mix, and its implications for ecosystem health and land use, as a "Focal Species Analysis," or "FoSA." The results of a FoSA can enhance planning efforts and assess the importance of individual sites for conservation. For example, development should be discouraged within areas that support healthy populations of Category I focal species, and redirected toward sites that are already degraded (as evidenced by the presence of mostly Category II focal species).

The FoSA approach represents an innovative departure from traditional conservation efforts. By expanding the scope of investigation beyond State or Federally listed threatened and endangered species, we are able to take a more proactive view toward species and habitat conservation. There are many species, currently unlisted and unprotected, whose populations are declining in response to urban sprawl. At the current pace of urbanization, these species are highly likely to be candidates for official listing in the near future. Rather than waiting until they are on the brink of extinction (when recovery efforts are not only dangerously uncertain, but also very expensive), it makes better sense to attempt to address their habitat requirements and to stabilize their populations now. In addition, ecosystems contain complex interactions among many species. The FoSA approach evaluates systems more reliably by considering a broad range of species and their relative abundances, as opposed to basing land use recommendations on a single threatened or endangered species. The FoSA approach should not replace existing efforts to conserve threatened and endangered species; instead, it adds value to other ongoing conservation efforts.

Project Activities and Methods

Use of existing datasets

Certain pre-existing data were already available at the inception of this project. For example, extensive wildlife surveys had already been conducted at the Ward Pound Ridge Reservation. These data were incorporated into our analyses. The NYS Natural Heritage Program has

assembled an extensive database; however, access to the details of those data is restricted. It is MCA's policy to make the results of field investigations available to all parties interested in reducing the impacts of development on the environment; those parties may include concerned citizens, the business community, municipal officials, land trusts, and developers, among others. It is only through transparent, cooperative processes such as this that conservation efforts can be effectively conducted. See Appendix B for MCA's official policy in this regard. Besides limited availability, Heritage data are limited in scope to only the most imperiled species and communities (e.g., species officially listed as threatened or endangered). As discussed above, in the section describing the focal species analysis process, it is imperative to consider a broader range of species as we continue to re-shape our landscapes. Therefore, a primary focus of this project was to generate original field data that can serve as the basis for making better land use decisions.

Site selection

MCA selects sites for field surveys based on a number of criteria. Existing landscape configuration (see previous section entitled "Landscape Configuration") is of utmost importance in the site selection process. Sites are selected based on their potential to function as habitat hubs, and based on their ability to serve as ecological connectors between those hubs. Many of the major hubs in the project area are already well-protected (e.g., Ward Pound Ridge Reservation); however, the future of other major hubs—such as the reservoir lands currently owned by Bridgeport Hydraulic Company (BHC) in Pound Ridge—remain uncertain. Regardless of their protection status, hubs are surveyed to determine their effectiveness as source areas for maintaining viable wildlife populations. Another primary criterion is the probability that a given site will be developed; that is, the "at-risk" status of a site. Obviously, baseline biological information is needed at the at-risk sites, more so than at any other sites. One obstacle is that it is often difficult to obtain permission to access at-risk areas and other privately owned lands. The towns were contacted to gain assistance in accessing such properties. However, we were unable to survey many privately owned sites due to a lack of permission. Those general areas have been designated as "areas that merit further investigation" (see blue crosshatched areas on Figure C).

Sites are also selected on the basis of the habitat types they contain. Areas rich in wetlands (whether they contain numerous small wetlands or fewer larger wetlands) receive priority for surveying. These areas are usually structurally and hydrologically diverse, which translates into a diverse wildlife community. In addition, wetlands serve other functions beneficial to the region's communities; they abate flooding, purify our waters, and provide recreational opportunities. Areas of extensive, contiguous forests are selected because they provide habitat for forest-interior, area-sensitive species, including many Neotropical migrant warblers. Many grassland habitats have succeeded to forest with the decline of agriculture. The remaining grasslands in the region are abandoned agricultural fields or active hay fields and pastures; those areas are targeted for surveys.

The site selection process is greatly enhanced in Westchester County by the availability of spatial datasets that can be displayed and analyzed using a Geographic Information System (GIS). Datasets that aided us in selecting sites contained information about soil types,

distribution of wetlands and waterbodies, existing open space coverage, density of development, bedrock geology, and elevation. Digital aerial photography was also crucial for selecting sites and for later analysis of data. See Figure A for a few examples of these datasets.

Field data collection

Bird data were collected during the breeding seasons (late spring and early summer) of 1999 and 2000. Surveys conducted during 1999 were point-counts of all birds seen or heard at predetermined stations. Stations were located along roads throughout the tri-town area. Although road-based surveys did not adequately sample forest interiors or other remote habitats, they supplied the only method for conducting surveys uniformly throughout the tri-town region, and were not constrained by land ownership or access issues. Bird surveys conducted during 2000 consisted of transect surveys and general site visits. Because these surveys were targeted at specific tracts of habitat, we were able to sample habitats further from roads, and thereby determine the distribution of fragmentation-sensitive species (which tend to avoid roads). During both years, locations of all species seen or heard were recorded on a USGS 7.5-minute topographic map. Bird surveys were scheduled for early morning hours, during peak activity times, but incidental observations of birds were also recorded during field visits at other times of day (e.g., during herpetological surveys). All species were recorded, but data analyses were limited to fragmentation- and development-sensitive focal species.

Herpetological data were also collected over a two-year period, from 1999 through 2000. Surveys occurred from mid-March through early autumn in each year, corresponding to peak amphibian and reptile activity periods. Site visits were conducted to determine the distribution of all reptile and amphibian species. Survey techniques include night searches, minnow/turtle traps, turning of cover objects, and larval dip-netting and identification. A significant number of herpetological observations had been made in recent years as part of other research initiatives by Michael W. Klemens; these data were included in the analyses.

Systematic surveys for mammal species requires methodologies that were beyond the scope of this project. However, incidental observations of area-sensitive mesocarnivores were included in the analyses.

Data management and analysis

Much information is gained from site-specific, on-the-ground surveys. However, the purpose of this project was to plan for biodiversity at a scale that transcends individual sites—by evaluating conditions at a landscape scale. To accomplish this we developed a Geographic Information System (GIS). All observations of sensitive (Category I) focal species were located on USGS 7.5-minute topographic maps. This information was then entered into our GIS and stored as an ArcView point shapefile. Species distribution patterns were then compared to various pre-existing spatial data layers. Special attention was paid to community composition within significant habitat hubs, the landscape-scale requirements of species

within those communities, the condition of the landscape between the hubs, and the overall juxtaposition of habitats and species.

Outreach and municipal/intermunicipal implementation

Throughout the course of this project, "municipal walks" occurred within each of the three towns. These outreach activities, also known as "survey walks" were targeted at local land use decision-makers (e.g., municipal staff and elected officials, land trust personnel, non-governmental conservation organizations, and concerned citizens). Attendees accompanied MCA staff to local sites and participated in field surveys. Species observed during these surveys were added to the overall project database. Those observations also served as a springboard for discussions about species' habitat and landscape requirements, and how various human land uses affect wildlife populations. The positive impact of better planning was discussed, in particular. The intent of these walks was to introduce biodiversity concepts to people whose decisions have a direct influence on that biodiversity. Because these survey walks were met with enthusiasm, it has become evident that this targeted, hands-on approach to outreach is successful. This model has already been replicated in other project areas of MCA.

MCA staff has also had the opportunity to provide advice and biological data for various land use issues within the tri-town area (e.g., to conservation boards and to land trust personnel). As mentioned previously, baseline biological data are crucial for making better, more informed land use decisions. We hope to continue to serve in this capacity as land use issues unfold in the project area. We also strongly encourage the towns to incorporate the results of our investigations into updates of their Master Plans. Finally, the tools that we have developed (see Appendix A) will assist in integrating biological information into municipal processes and practices.

Results and Discussion

The regional, intermunicipal perspective

The Eastern Westchester Biotic Corridor (EWBC) was delineated based on the results of our data and map analyses (see the dark blue stippled area in Figure C). This corridor constitutes a broad swath of habitat that trends, primarily, from south to north within the three towns. The light blue crosshatched areas in Figure C indicate portions of the tri-town region that were, for the most part, privately owned and inaccessible for surveys; these areas should be evaluated. Town-by-town details of the corridor's configuration are provided in the following sections.

At the heart of this corridor lies the Ward Pound Ridge Reservation (WPRR), which has the potential to act as source habitat for wildlife over the entire corridor. In the overall effort to maintain regional biodiversity, the preservation of this significant tract constitutes a critical first step. But it is not the only step that must be taken. The potential for WPRR to function as source habitat can be met only if ecological connections are maintained between it and other habitat hubs—that is, if land between the hubs remains relatively unfragmented by

development and heavily-trafficked roads. In addition, other habitat hubs must be protected or actively managed for wildlife; in other words, good habitats must be available for wildlife dispersing from WPRR. Areas critical for the dispersal of wildlife between hubs are discussed in greater detail below, in the town-specific discussions. In those discussions, particular attention is paid to constrictions in the EWBC.

Perhaps the most significant aspect of the EWBC, as delineated in Figure C, is that it forms a continuous band across all three of the region's towns. The patterns that occur within the natural environment do not coincide with political boundaries. Since it is neither possible nor desirable to redistribute wildlife and habitats to match those boundaries, we (that is, town governments, land trusts, conservation organizations, and other concerned parties) must re-shape how we view the landscape. To ensure that wildlife corridors carefully maintained by individual towns do not abruptly end at town borders, a dialog must be established among neighboring towns. This is best achieved through the establishment of an intermunicipal council (via a formalized Intermunicipal Agreement), which can address overall planning efforts on a regional basis. However, towns can, individually, make significant contributions to the greater landscape through careful planning within their own borders. Examples are provided below.

Pound Ridge

The Town of Pound Ridge, which lies at the southwestern end of the tri-town region, has one of the lowest development densities of any town in Westchester County. This is reflected in the diversity of wildlife the town contains. Although portions of Pound Ridge are developed and roads have fragmented much of the land, a large percentage of the town remains heavily forested. Much of this can be attributed to the presence of Ward Pound Ridge Reservation (WPRR), the bulk of which is located within this town. The Honey Hollow section of WPRR contains the only extant populations of dusky salamanders and ribbon snakes in Westchester County.

However, there are other large expanses of quality habitat within the town. The most significant of these are the lands surrounding Trinity Lake and Mill River Reservoir, currently owned by Bridgeport Hydraulic Company (BHC). There are currently no blanket prohibitions that, over the long term, would prevent development of this site. Based on MCA surveys on this property, it is one of the most biologically diverse areas for birds in the tri-town region. In addition, approximately 1,000 acres of mostly undeveloped land connect BHC properties with the land surrounding the Siscowit Reservoir. Although MCA did not conduct extensive surveys in this area, the habitats appear to be of high quality. In addition to their potential as wildlife habitat, they buffer and connect the important habitats of the BHC properties and the land surrounding the Siscowit Reservoir.

A number of significant focal species occur on the BHC properties and associated habitats within the town. Neotropical migrant warblers are abundant in this large expanse of contiguous forest. Examples include the Canada warbler, which occurs in forested swamps surrounded by relatively unfragmented upland forests. The worm-eating warbler, another forest-interior species, selects steep forested slopes of the area for its breeding habitat. The

cerulean warbler, a species that has some of the most demanding area requirements (in terms of contiguous forest) of northeastern songbirds, was also observed on BHC property. There is no doubt that this species is on the property because its large tracts of forest have remained relatively unaltered for such a long period of time. There is also no doubt that, if the BHC property is subdivided and developed, the cerulean warbler and other forest-interior, area-sensitive species will disappear from the this property, and perhaps from the entire corridor.

Table 1. Species of conservation concern observed in Pound Ridge*

Mammals	Reptiles and Amphibians	Birds
River Otter	Black Rat Snake	American Redstart
Bobcat	Bog Turtle	American Woodcock
	Eastern Box Turtle	Baltimore Oriole
	Eastern Hognose Snake	Barred Owl
	Eastern Ribbon Snake	Black-and-white Warbler
	Eastern Worm Snake	Black-throated Blue Warbler
	Four-toed Salamander	Black-throated Green Warbler
	Fowlers Toad	Blue-gray Gnatcatcher
	Gray Treefrog	Bobolink
	Marbled Salamander	Brown Thrasher
	Northern Black Racer	Canada Warbler
	Northern Copperhead	Cerulean Warbler
	Northern Dusky Salamander	Eastern Bluebird
	Spotted Salamander	Eastern Kingbird
	Spotted Turtle	Eastern Towhee
	Wood Frog	Eastern Wood-pewee
	Wood Turtle	Indigo Bunting
		Ovenbird
		Pileated Woodpecker
		Rose-breasted Grosbeak
		Scarlet Tanager
		Veery
		Warbling Vireo
		Wood Thrush
		Worm-eating Warbler
		Yellow-billed Cuckoo
		Yellow-throated Vireo

*Data derived from two sources: (1) MCA field surveys and (2) other fieldwork conducted by Michael W. Klemens.

The BHC properties contain significant populations of amphibians and reptiles. These species flourish because this is a large expanse of interconnected, unfragmented wetland and upland habitat. The most fragmentation-sensitive reptile reported from this site is the wood turtle, a species that is functionally extinct in most of Westchester County and listed as "endangered" by the County. Box turtles also occur at this site and, although they are less-sensitive to habitat fragmentation than the wood turtle, this species has declined precipitously in Westchester County. Box turtles are listed as "threatened" by the County.

Significant amphibians reported from the BHC property include the gray treefrog, a species that relies on shrub swamps, and vernal pool-dependent species including the spotted

salamander and wood frog. These amphibians require not only specialized wetland breeding habitats, but also extensive tracts of upland forest surrounding these wetlands, where they spend the non-breeding portions of their life cycle.

Mesocarnivores, such as the river otter and the bobcat, also rely on clean waters and extensive forests such those found on the BHC property. Although surveys were not specifically conducted for mammals in this project, both river otters and bobcats have been observed in the general vicinity (T. Andersen, pers. comm.). Due to their large home ranges and other habitat requirements, it can be safely assumed that mesocarnivore populations would be negatively impacted if the BHC property were to be subdivided.

As stated previously, it is crucial that habitat hubs remain connected by relatively viable habitats. Although some degree of development can potentially be tolerated by dispersing wildlife, and some degree of development in such areas is to be expected, it is important that such areas do not become impermeable to animal movements. The land between BHC properties and WPRR serves as a conduit for animal movement, but with further development it could become a barrier. This land is bounded, approximately, by Kitchawan Road and Stone Hill Road (Route 137); it spans Route 124 and Old Stone Hill Road. Innovative tools should be sought to protect this constriction in the Eastern Westchester Biotic Corridor. The same considerations should be made for the lands between BHC properties and the Siscowit Reservoir.

Lewisboro

Of the three towns in the project area, Lewisboro has been developed to the greatest extent. Despite this, the town contains critical habitats that contribute to the biological diversity of the EWBC. The Lewisboro Conservation Advisory Council has assembled a comprehensive open space inventory of their town, which delineates greenways based, in part, on wildlife data. This carefully prepared and very useful inventory draws valid conclusions that can guide future land use decisions. Many of the conclusions in the inventory corroborate MCA findings. The inventory also identifies greenways outside of the EWBC delineated in this report; those greenways comprise additional wildlife corridors and hubs, and should be viewed as complementary to our results.

Perhaps the most significant habitat hub that the town contains is the northern portion of Ward Pound Ridge Reservation (WPRR). Connectivity of the EWBC is threatened at several constriction points north of WPRR. The first, and perhaps the most formidable, barrier is the development associated with Route 35/Old Post Road. Developments along this road could functionally sever WPRR habitats from heavily forested parcels to the north. MCA recommends that careful planning occur in this area, to avoid exacerbating the problem. The area is a prime candidate for designation as a Conservation Area Overlay Zone (see Appendix B for a model ordinance that addresses this issue).

There are many parcels to the north and east of WPRR (between WPRR and Lake Waccabuc) that could serve as habitat for grassland bird species (e.g., eastern meadowlarks and bobolinks). Since the succession of abandoned agricultural fields to forests in this region,

grassland bird populations have been rapidly declining. Their persistence can be ensured only by actively managing their habitats. Although no eastern meadowlarks or bobolinks were detected within Lewisboro during MCA surveys, both species were observed in North Salem and bobolinks were observed in Pound Ridge. The species may occur within Lewisboro, but went undetected due to an inability to access private properties. Restoration and management of suitable grassland habitat in portions of Waccabuc Country Club and surrounding parcels (some of which have undergone low-density residential development) would likely result in attracting both of these species. To make grasslands attractive to these species, they should be kept relatively free of woody vegetation via a mowing regime. However, the timing of mowing is critical; mowing during the breeding season will destroy nesting attempts. MCA recommends mowing in November, which would not only avoid the breeding bird season, but also would avoid the activity periods of many other taxa, such as reptiles and small mammals. Of course, there is extreme difficulty in establishing such mowing regimes on private properties. These activities would have to be performed on a strictly voluntary basis; thus, they could only be enacted through careful outreach to area residents.

This area contains an impressive concentration of amphibians and reptiles. The only site for the Jefferson salamander in the tri-town area was documented here, on what is now the Frederick P. Rose Preserve. A rich variety of amphibians and reptiles that have extensive wetland and upland habitat requirements occur here. These include vernal pool breeding amphibians (spotted and marbled salamanders, wood frogs) as well as spotted turtles. The latter use a mosaic of small wetlands within a landscape, often moving extensive distances overland between these wet pockets. Slimy salamanders were also found, indicating stable "old growth" mature second-generation forest.

Table 2. Species of conservation concern observed in Lewisboro

Reptiles and Amphibians	Birds
Black Rat Snake	American Redstart
Bog Turtle	Baltimore Oriole
Eastern Box Turtle	Black-throated Green Warbler
Eastern Hognose Snake	Blue-gray Gnatcatcher
Eastern Worm Snake	Eastern Bluebird
Four-toed Salamander	Eastern Kingbird
Gray Treefrog	Eastern Towhee
Jefferson Salamander	Eastern Wood-pewee
Marbled Salamander	Ovenbird
Musk Turtle	Pileated Woodpecker
Northern Black Racer	Rose-breasted Grosbeak
Northern Slimy Salamander	Scarlet Tanager
Spotted Salamander	Veery
Spotted Turtle	Wood Thrush
Wood Frog	Worm-eating Warbler
Wood Turtle	

*Data derived from two sources: (1) MCA field surveys and (2) other fieldwork conducted by Michael W. Klemens.

An opportunity also exists for Lewisboro to contribute to regional biodiversity in the southern portion of the town. BHC, Inc., lands surrounding Trinity Lake (see Results and Discussion: Pound Ridge) provide significant habitat for a number of area-sensitive forest species. The heavily forested lands to the east and northeast of BHC property are located in Lewisboro (indicated in light blue crosshatch in Figure C). Although MCA biologists were unable to survey these forests, they are contiguous with the BHC properties and thus, undoubtedly, increase the value of that block of habitat. It is entirely possible that extremely area-sensitive species, such as the cerulean warbler, may disappear from BHC land in Pound Ridge if the contiguous forests of Lewisboro were developed. MCA recommends that this area be targeted for further surveys, and that these forests be considered for preservation—whether through easement or outright purchase. This area provides a prime example of how necessary it is for neighboring towns to work together. Such collaboration would have a measurable impact on regional wildlife populations.

North Salem

The Town of North Salem makes a unique contribution to the biodiversity of the tri-town area, in the form of grassland habitat associated with agricultural lands. During MCA's surveys, all of the eastern meadowlarks and most of the bobolinks were detected within North Salem's borders. As mentioned in the Lewisboro discussion, some very simple steps can be taken to ensure that grassland bird species can persist. Grasslands should be kept relatively free of woody vegetation through annual mowing regimes. However, mowing should be limited to the non-breeding season. Mowing in November would avoid disturbance to nesting grassland birds, and would also avoid peak activity times of many other species, such as small mammals and reptiles. As stated previously, most of the grasslands occur on privately owned property; therefore, proper management of grassland habitat can only be achieved through careful and extensive outreach to local landowners. By actively managing for grassland species, North Salem's populations will be bolstered. Healthy grassland bird populations in North Salem could serve as source populations that could disperse into grassland habitats of Lewisboro. This is another example of how conservation initiatives within one town can contribute to regional biodiversity.

Two clusters of amphibian and reptile biodiversity were identified within North Salem. The Crook Brook wetlands and Turkey Hill contain a rich diversity of turtles, including many species considered threatened or endangered within Westchester County, as well as historic records of the Federally-listed bog turtle. The majority of bog turtle records from the County were from North Salem, and undoubtedly reflect the abundance of wet meadows and grasslands that occur here. Many of these meadows have groundwater fed hillside seeps, which are used extensively by wood turtles; our single observation of a bobcat in North Salem occurred in such habitat. This complex of fields, rocky slopes, and forest edges serves as prime habitat for black racers. This large, terrestrial, fast moving snake has become quite scarce in the County due to the succession of its preferred grassland habitat into forest. A secondary area of herpetological diversity lies to the south of Peach Lake, and includes large landscape species such as the wood turtle, as well as a diversity of amphibian species.

The EWBC, as delineated, encompasses most of the eastern portion of the Town of North Salem. Potentially viable habitats also exist in many other portions of the town, particularly north and south of Titicus Reservoir (indicated in light blue crosshatch on Figure C). The majority of those habitats were unexplored during MCA surveys, because they are under private ownership. We strongly recommend that further wildlife investigations occur in those areas to assist in local land use planning. It should be noted that the lands south of the Titicus reservoir are contiguous with the "Titicus Greenway" of Lewisboro, identified and described in that town's open space inventory. This represents an opportunity for intermunicipal conservation efforts.

Table 3. Species of conservation concern observed in North Salem

Mammals	Reptiles and Amphibians	Birds
Bobcat	Black Rat Snake	American Redstart
	Bog Turtle	Baltimore Oriole
	Eastern Box Turtle	Black-and-white Warbler
	Four-toed Salamander	Bobolink
	Gray Treefrog	Brown Thrasher
	Musk Turtle	Canada Warbler
	Northern Black Racer	Chimney Swift
	Northern Slimy Salamander	Eastern Bluebird
	Spotted Salamander	Eastern Kingbird
	Spotted Turtle	Eastern Meadowlark
	Wood Frog	Eastern Towhee
	Wood Turtle	Eastern Wood-pewee
		Field Sparrow
		Hooded Warbler
		Least Flycatcher
		Ovenbird
		Rose-breasted Grosbeak
		Scarlet Tanager
		Veery
		Warbling Vireo
		Wood Thrush
		Worm-eating Warbler
		Yellow-billed Cuckoo

*Data derived from two sources: (1) MCA field surveys and (2) other fieldwork conducted by Michael W. Klemens.

Recommendations

General recommendations

- *Attempt to add area—through fee simple purchase or easement—to existing protected areas.*

  This buffers the existing habitat hubs from externally caused degradations. It also reduces "edge effects," which negatively impact forest-interior and area-sensitive species. In addition, the buffers will often serve as additional habitat.

- *Consider passing a conservation area overlay ordinance (see Tech Paper #3).*

  Although this is not as effective as purchasing land (or obtaining easements to land) it does minimize and mitigate the impacts of development within designated zones. It is valuable, in particular, for maintaining wildlife habitat connectivity in developable parcels located between habitat hubs. It is a useful tool that allows towns, through home rule authority, to influence patterns of development within their borders in a way that minimizes impacts to wildlife and habitats.

- *Integrate the recommendations in this report into your town's Master Plan.*

  MCA staff would welcome the opportunity to work with individual towns in this regard.

- *Consider formalizing intermunicipal relationships with other towns in the Eastern Westchester Biotic Corridor (and beyond) by:*

  a. establishing an intermunicipal council, and

  b. adopting an intermunicipal agreement.

- *Consider extending the EWBC into Connecticut, joining with conservation initiatives in adjacent towns (Ridgefield, Wilton, New Canaan, and Stamford) and shared watersheds (e.g., Titicus and Norwalk rivers).*

- *Encourage better SEQRA reviews by:*

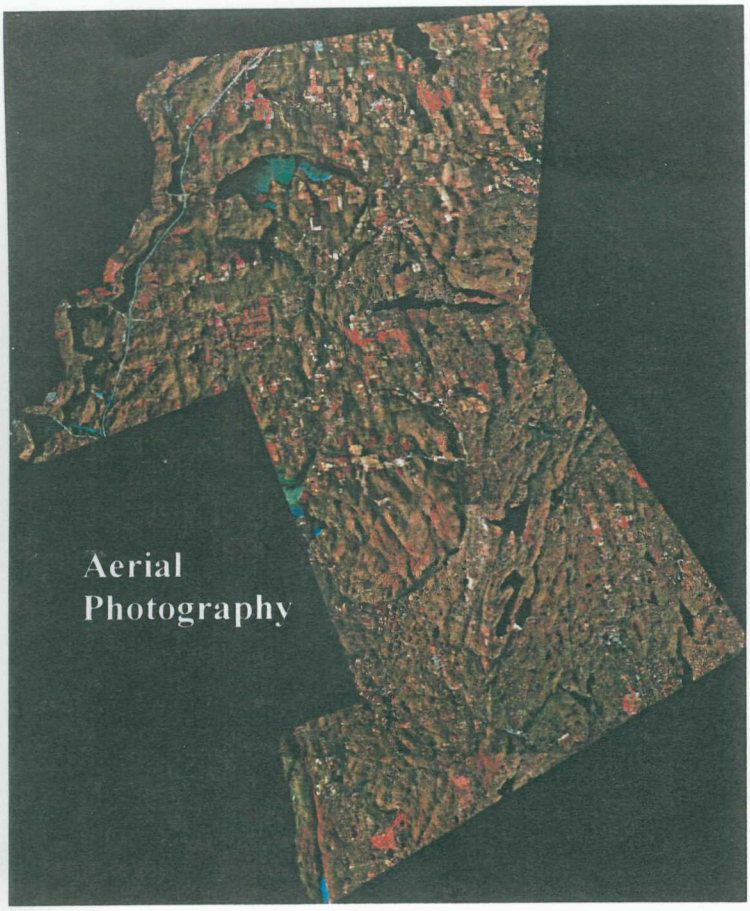
  a. Taking a hard look at impacts beyond individual project sites (that is, considering cumulative impacts on town- and region-wide scales).

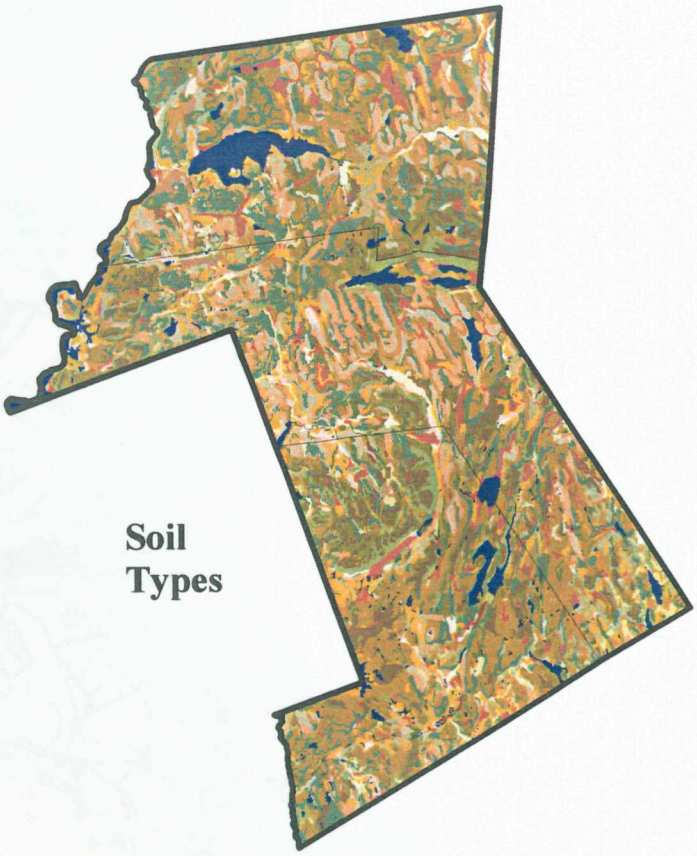
  b. Encouraging use of the GEIS process. This is a planning process where the town creates an environmental impact statement for a large block of land. Then, as individual development projects are proposed, they are evaluated against the findings of the GEIS. The town recovers the costs of the GEIS through a pro-rated fee assigned to each development project.

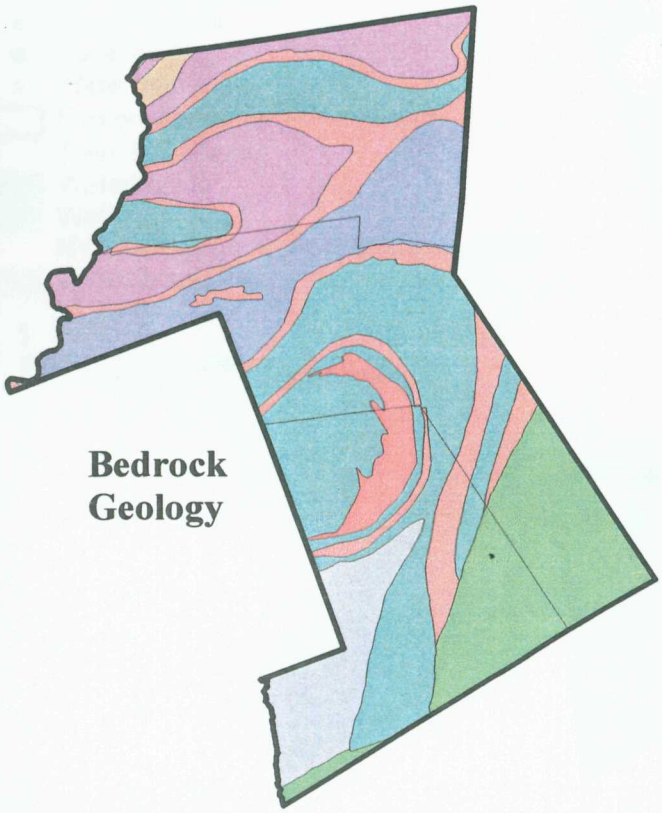
  c. Requiring standards for wildlife surveys to ensure that adequate effort is being expended, at appropriate times of year, to assess on site wildlife resources. Appendix C contains an example of these standards prepared by MCA for our Croton to Highlands Corridor project. Appendix D also contains the standards for surveying bog turtle habitats, excerpted from the Federal Recovery Plan. These standards should be employed for development projects in those wetlands of the EWBC that have been identified as bog turtle habitat.

Town-specific recommendations

Recommendations specific to individual towns within the EWBC can be found in the Results and Discussion section.







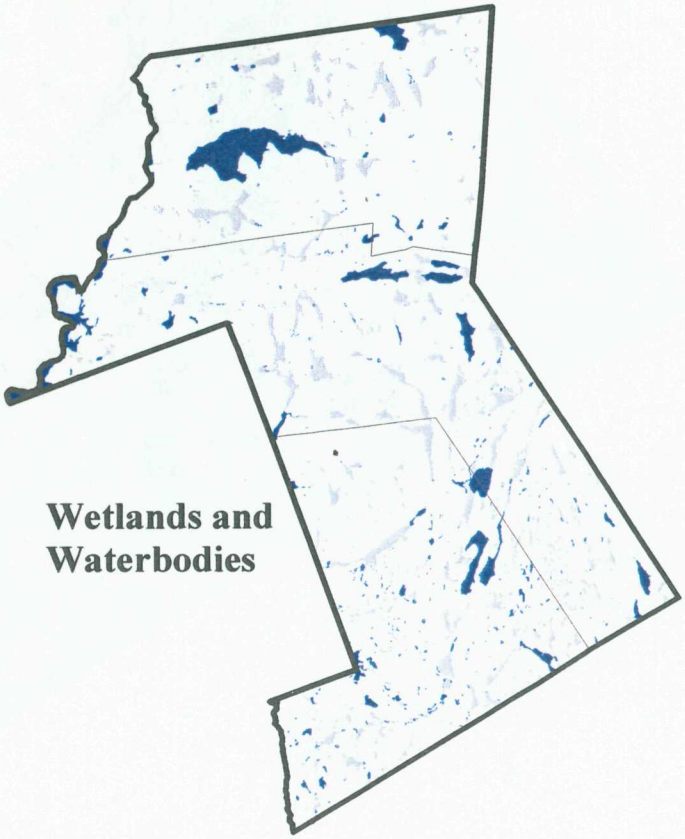


Figure A. Data layers used in the site selection process and during data analysis.

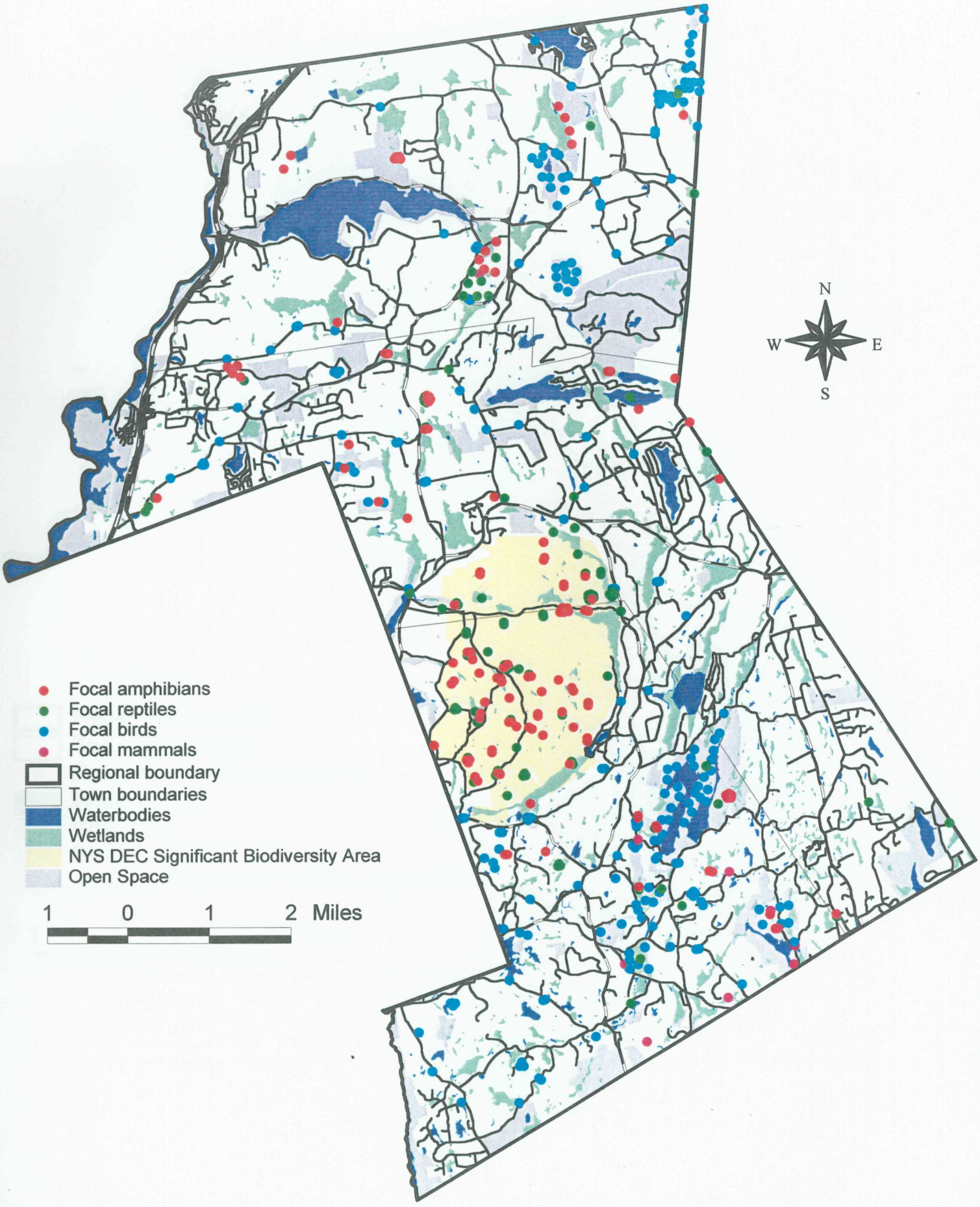


Figure B. Distribution of focal species in the three towns of the Eastern Westchester Biotic Corridor.

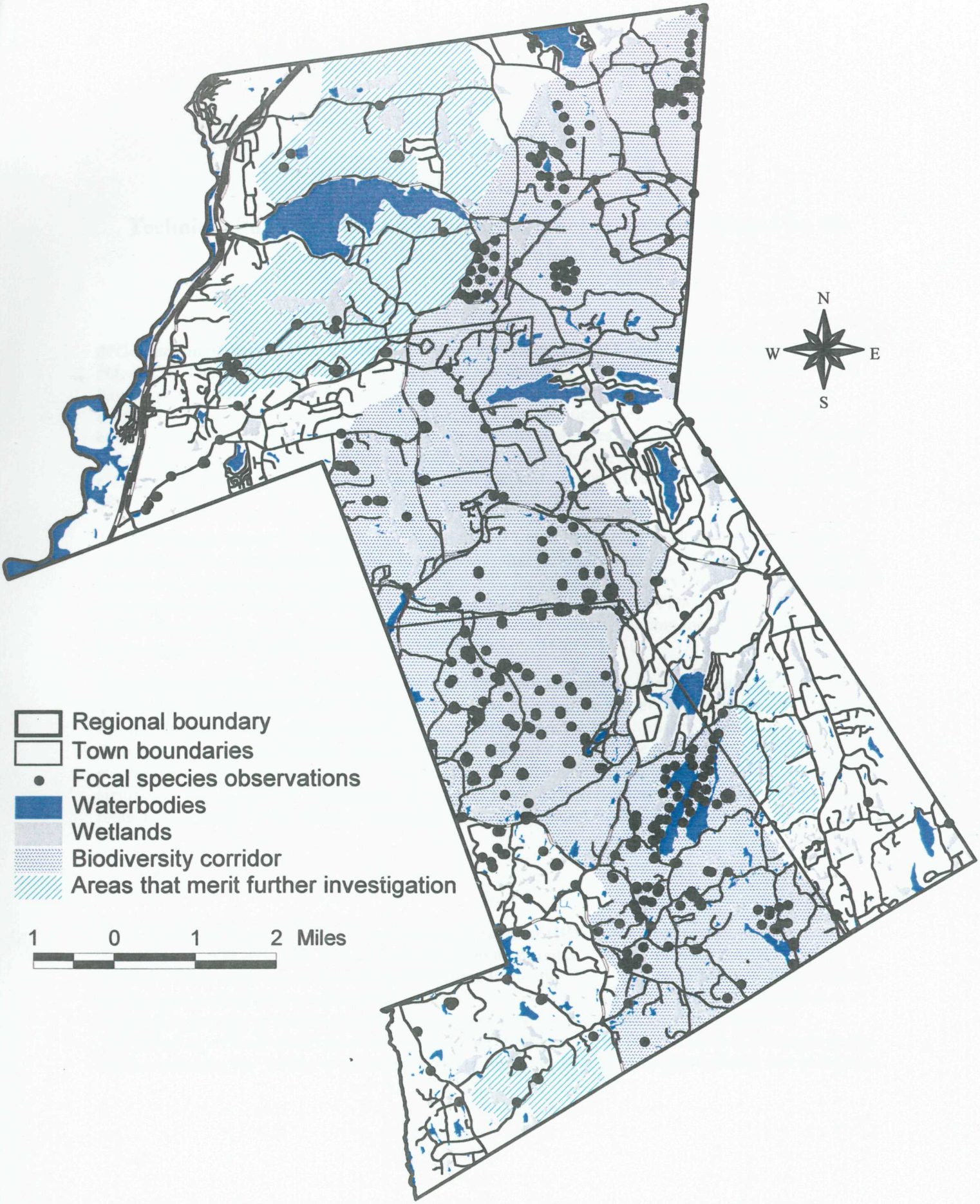


Figure C. Biodiversity corridor and areas that merit further investigation.

Appendix A

Technical Publications and Land Use Planning Tools produced by the Metropolitan Conservation Alliance

MCA Technical Paper #1: **A Tri-State Comparative Analysis of Local Land Use Authority: NY, NJ, & CT.** This paper investigates the local land use authority that towns within the tri-state region have to protect natural landscapes while making land use decisions, and to collaborate with one another on an inter-municipal basis. For example, it lists and describes statutes and cases that empower municipalities to plan and regulate across municipal lines; to adopt floating zones, overlay districts, and natural resource protection ordinances; and to provide incentives to encourage cost-effective and environmentally sound development patterns. Prepared for MCA by Pace University, 1999. $12.50

MCA Technical Paper #2: **Open Land Acquisition: Local Financing Techniques Under New York State Law**. This paper describes the authority that local governments have to raise revenues to purchase or otherwise protect open space. It explores the types of programs that have been established using these techniques. It is intended to assist communities interested in PDR (purchase of development rights), to help them decide which of several potential funding mechanisms would be most appropriate. Prepared for MCA by Pace University, 2000. $5.50

MCA Technical Paper #3: **Conservation Area Overlay District: A Model Local Law**
This document is a creative tool for improved land use planning—a model ordinance that can be adopted by municipalities to delineate conservation area overlay districts. The ordinance is based upon New York State law, but can be adapted for use in other states that have strong home rule authority. Within ecologically sensitive areas, it seeks to reduce habitat fragmentation, maintain biodiversity, and protect significant natural features. This model law enables towns to develop a template not only for ecological protection, but also for the siting of future development. Prepared for MCA by Pace University, 2002. $7.50

Coming soon...

MCA Technical Paper #5: **Best Development Practices (BDPs) for Conserving Pool-Breeding Amphibians in Residential and Commercial Developments.** Aram J. K. Calhoun, Michael W. Klemens. This paper contains techniques to guide local and state planners, officials, and other land use decision makers as they attempt to conserve vernal pool habitats and wildlife. It provides a pragmatic approach to conservation that encourages communities to attain a more complete understanding of their vernal pool resources, gather information that enables them to designate pools that are exemplary or worthy of protection efforts, and then develop strategies to fulfill that protection.

Appendix B

Metropolitan Conservation Alliance
(a program of the Wildlife Conservation Society)

Equal Access to Information Policy Statement

The development of innovative and effective conservation strategies by the Metropolitan Conservation Alliance is based upon up-to-date information on the ecology of the New York Metropolitan region, on the presence, absence, and long-term population trends of focal species, and is integrated with regional patterns and projections of development.

To make better, and more ecologically informed land use planning decisions, scientific information is essential. That information must be clearly interpreted by conservation professionals to ensure that it is both accessible to the user community, as well as credible.

To further our mission of encouraging and enabling effective conservation efforts (at all levels) in the New York Metropolitan region, it is the stated policy of the Metropolitan Conservation Alliance to provide scientific information we collect*, and any analyses of this information that we complete, to interested parties. These parties may include, but are not limited to, municipal planners, developers, federal, state, and local governments, and conservation and other non-governmental organizations, who show an interest in incorporating ecological sustainability into planning and other aspects of development design.

Equal access to information should lead to more ecologically-informed planning that will in turn, foster increasingly effective, long-term conservation of biological diversity and ecosystem function, and reduce the confrontation and controversy that so often accompanies the review of land-use proposals.

* *An exception to this statement is: Specific site locations of endangered and threatened species, or species we consider vulnerable to exploitation if site locations are easily available, will not be reported except to the federal and state agencies that are responsible for the protection of such species, or conservation organizations working in cooperation with such agencies.*

Appendix C

DRAFT

Wildlife Biodiversity Assessment Guidelines
Town of _____

PURPOSE

The Town of _____ exhibits a remarkable diversity of animal and plant species. Yet today we are facing the bleak prospect of losing much of our rich biological heritage to suburban sprawl, fostered by a lack of informed land-use decisions. In Westchester County as a whole, nearly 40 percent of native wetland vertebrate species have been lost over the past 30 years. Biodiversity assessments will provide the Town with baseline, site-specific biological information, and will enhance the Town's ability to make better planning decisions, fulfill our legal obligations under SEQRA, and maintain biodiversity as economic growth proceeds.

Development (including residential, commercial, industrial, and infrastructure development) impacts wildlife species in many ways. For example, direct loss of natural habitats eliminates some species and reduces population sizes of others. Fragmentation of remaining habitats leads to isolation of remnant populations, reduced dispersal capabilities, and increased edge effects (such as increased predation and parasitism, and decreased breeding success). Site-specific designs, such as curbing and catch-basins, can have dramatic effects on the survival and movement patterns of amphibians and reptiles.

TARGET AREAS

Surveys are required for development applications located along river and stream corridors; in the vicinity of lakes, ponds, and wetlands; adjacent to areas of existing open space; and within areas that, due to their acreage or proximity to other habitats, could serve as habitat hubs or corridors. General biodiversity surveys, described below, must occur in these areas. Some sites may require additional investigations. For example, where bog turtles (*Clemmys muhlenbergii,* State-listed as endangered and Federally-listed as threatened) have the potential to occur, a Phase 1 survey (habitat identification by a State-licensed biologist) should be required on all development applications in the surrounding area (see the USFWS's 2001 document, *Bog Turtle (Clemmys muhlenbergii) Northern Population Recovery Plan*, by M.W. Klemens). A Phase 2 survey should also be required when indicated by Phase I results.

SPECIES TO BE ASSESSED

Surveys must be conducted for the entire range of species that are known to respond to development. At a minimum, surveys should be conducted for amphibians, reptiles, and birds. These taxa contain species that respond measurably to development-related impacts at varying landscape scales. As time and resources allow, surveys should also be conducted for additional taxa (e.g., benthic macroinvertebrates, area-sensitive mammals, plant species). Although this includes State- and Federally-listed threatened and endangered species, it also

includes a wide array of currently unlisted, "focal" species that indicate habitat quality. The presence of habitat specialists (e.g., wood frogs, spotted salamanders, box turtles, wood turtles, ovenbirds, Canada warblers) may indicate high-quality habitats where development-related impacts should be avoided, minimized, or mitigated. The presence of certain "subsidized" species (i.e., those that are often affiliated with landscape disturbances), coupled with the absence of more specialized taxa, indicates previously disturbed habitats that may be more suitable for development.

METHODS

Biodiversity assessments must be conducted and interpreted by biologists trained in the concepts of conservation biology and landscape ecology, and who have a demonstrated competence in surveying target species within Westchester County. They will be paid for by the applicant and contracted as consultants to the Town of _____ Planning Department, in the same manner that the department contracts with other consultants (e.g., wetland consultants).

Surveys must be conducted during appropriate seasons, according to the life cycles of the surveyed taxa. Surveys must also follow standardized protocols, to ensure that detectability is maximized and results are reliable. For example, bird surveys must occur during the spring breeding season (mid-May through early July) in the early morning hours (within 1/2 hour of dawn through 9:30am) under relatively fair weather conditions. Results of such breeding bird surveys reveal the suitability of on-site habitat: surveys conducted at other times or in poor weather conditions are much less informative. Reptile and amphibian surveys must be conducted between March and October, with concentrations in March-April, May-June, mid-summer, and September. Survey techniques include night searches, minnow/turtle traps, turning of cover objects, and larval dip-netting and identification. For all taxa in question, surveys must be conducted within all habitats on site (e.g., grasslands, vernal pools, forested uplands, forested wetlands), regardless of where proposed construction activities would take place. Many species utilize a complex of habitats within the course of their life cycles; therefore, developments may attempt to avoid disturbance of breeding habitat, but destroy foraging, roosting, or wintering habitat.

REPORTS

A final report must be submitted containing a description of current on-site habitats, the value and condition of those habitats for wildlife, and a discussion of the potential impacts of the proposed development on wildlife resources. Data collection and documentation methods (e.g., photos or voucher specimens) should be detailed in the report. Wildlife occurrence data must be location-specific; lists of probable species occurrence, alone, are not acceptable. Alternatives should be recommended where proposed alterations to habitats place wildlife resources in jeopardy. The report should also discuss site context (e.g., proximity and connectivity to other habitats), and should relate the importance of on-site habitat relative to other habitats within the Town. The report should contain detailed maps compatible with the Town's GIS system so that the survey information may be quickly incorporated into a Town-wide wildlife habitat database.

Appendix D

[excerpted from the USFWS 2001 document, "Bog Turtle (*Clemmys muhlenbergii*) Northern Population Recovery Plan," by M.W. Klemens]

GUIDELINES FOR BOG TURTLE SURVEYS[1]

(revised May 2001)

RATIONALE

A bog turtle survey (when conducted according to these guidelines) is an attempt to determine presence or probable absence of the species; it does not provide sufficient data to determine population size or structure. Following these guidelines will standardize survey procedures. It will help maximize the potential for detection of bog turtles at previously undocumented sites at a minimum acceptable level of effort. Although the detection of bog turtles confirms their presence, failure to detect them does not absolutely confirm their absence (likewise, bog turtles do not occur in all appropriate habitats and many seemingly suitable sites are devoid of the species). Surveys as extensive as outlined below usually suffice to detect bog turtles; however, there have been instances in which additional effort was necessary to detect bog turtles, especially when habitat was less than optimum, survey conditions were less than ideal, or turtle densities were low.

PRIOR TO CONDUCTING ANY SURVEYS

If a project is proposed to occur in a county of known bog turtle occurrence (see attachment 1), contact the U.S. Fish and Wildlife Service (Service) and/or the appropriate State wildlife agency (see attachment 2). They will determine whether or not any known bog turtle sites occur in or near the project area, and will determine the need for surveys.

- If a wetland in or near the project area is *known* to support bog turtles, measures must be taken to avoid impacts to the species. The Service and State wildlife agency will work with federal, state and local regulatory agencies, permit applicants, and project proponents to ensure that adverse effects to bog turtles are avoided or minimized.

- If wetlands in or adjacent to the project area are *not* known bog turtle habitat, conduct a bog turtle habitat survey (Phase I survey) if

  1. The wetland(s) have an emergent and/or scrub-shrub wetland component, and

  2. Direct and indirect adverse effects to the wetland(s) cannot be avoided.

  See *Bog Turtle Conservation Zones* for guidance regarding activities likely to affect bog turtles and their habitat. In addition, consult with the Fish and Wildlife Service and/or appropriate State wildlife agency to definitively determine whether or not a Phase I survey will be necessary.

BOG TURTLE HABITAT SURVEY (= Phase 1 survey)

The purpose of this survey is to determine whether or not the wetland(s) are *potential* bog turtle habitat. These surveys are usually performed by someone who is either: (1) qualified to conduct bog turtle surveys (i.e., Phase II surveys) or (2) qualified to identify and delineate wetlands. The following conditions and information apply to habitat surveys.

- Surveys can be performed any month of the year (except when significant snow cover is present). This flexibility in conducting Phase I surveys allows efforts during the Phase 2 survey window to be spent on wetlands most likely to support bog turtles (i.e., those that meet the criteria below).

- Potential bog turtle habitat is recognized by three criteria (not all of which may occur in the same portion of a particular wetland):

  1. **Suitable hydrology**. Bog turtle wetlands are typically spring-fed with shallow surface water or saturated soils present year-round, although in summer the wet area(s) may be restricted to near spring head(s). Typically these wetlands are interspersed with dry and wet pockets. There is often subsurface flow. In addition, shallow rivulets (less than 10 cm deep) or pseudo-rivulets are often present.

  2. **Suitable soils.** Usually - a bottom substrate of soft muck or mucky-like soils (this does not refer to a technical soil type); you will usually sink to your ankles or deeper in muck, although in summers of dry years this may be limited to areas near spring heads. In some portions of the species' range, the soft substrate consists of scattered pockets of peat (6+ inches deep) instead of muck. Suitable soils are the critical criterion.

  3. **Suitable vegetation.** Dominant vegetation of low grasses and sedges (emergent wetland), often with a scrub-shrub wetland component. Common emergent vegetation includes: tussock sedge (*Carex stricta*), soft rush (*Juncus effusus*), rice cut grass (*Leersia oryzoides*), sensitive fern (*Onoclea sensibilis*), tearthumbs (*Polygonum* spp.), jewelweed (*Impatiens* spp.), arrowheads (*Saggittaria* spp.), skunk cabbage (*Symplocarpus foetidus*), Panic grasses (*Panicum* spp.), other sedges (*Carex* spp.), spike rushes (*Eleocharis* sp.), grass-of-Parnassus (*Parnassia glauca*), shrubby cinquefoil (*Potentilla fruticosa*), sweet-flag (*Acorus calamus*), and in disturbed sites, reed canary grass (*Phalaris arundinacea*) or purple loosestrife (*Lythrum salicaria*). Common scrub-shrub species include alder (*Alnus* spp.), red maple (*Acer rubrum*), willow (*Salix* spp.), tamarack (*Larix laricina*), and in disturbed sites, multiflora rose (*Rosa multiflora*).

- Suitable hydrology, soils and vegetation are necessary to provide the critical wintering sites (soft muck, peat, burrows, root systems of woody vegetation) and nesting habitats (open areas with tussocky or hummocky vegetation) for this species. It is very important to note, however, that one or more of these criteria may be absent from portions of a wetland or wetland complex supporting bog turtles. Absence of one or more criteria does not preclude bog turtle use of these areas to meet important life functions, including foraging, shelter and dispersal.

- If these criteria (suitable soils, vegetation and hydrology) are present in the wetland, then the wetland is considered to be potential bog turtle habitat, regardless of whether or not that portion of the wetland occurring within the project boundaries contains all three criteria. If the wetland is determined to be potential habitat and the project will directly or indirectly impact any portion of the wetland, then either:

  - Completely avoid all direct and indirect effects to the wetland, in consultation with the Service and appropriate State wildlife agency, *OR*

  - Conduct a Phase 2 survey to determine the presence of bog turtles.

- The Service and appropriate State agency (see list) should be sent a copy of survey results for review and comment including: a USGS topographic map indicating location of site; project design map, including location of wetlands and streams; color photographs of the site; surveyor's name; date of visit, opinion on potential/not potential habitat; a description of the hydrology, soils, and vegetation.

BOG TURTLE SURVEY (= Phase 2 survey)

If the wetland(s) are identified as potential bog turtle habitat (see Phase I survey), and direct and indirect adverse effects cannot be avoided, conduct a bog turtle survey in accordance with the specifications below. Note that this is *not* a survey to estimate population size or structure; a long-term mark/recapture study would be required for that.

Prior to conducting the survey, contact the appropriate State agency (see attached list) to determine whether or not a scientific collector's permit valid for the location and period of the survey will be required.

1. Surveys should only be performed during the period from April 15-June 15. This coincides with the period of greatest annual turtle activity (spring emergence and breeding) and before vegetation gets too dense to accurately survey. While turtles may be found outside of these dates, a result of no turtles would be considered inconclusive. Surveys beyond June also have a higher likelihood of disruption or destruction of nests or newly hatched young.

2. Air and water temperatures should be a minimum of 55° F.

3. Surveys should be conducted during the day, at least one hour after sunrise and no later than one hour before sunset.

4. Cloud cover should be <50 percent, and surveys should not be conducted during or immediately following rain events, unless it clears rapidly and is sunny.

5. One (1) to three (3) people should survey each wetland together. At least one (1) of these must be a recognized qualified bog turtle surveyor[2], and the others should have at least some previous experience conducting bog turtle surveys. To maintain survey effort consistency and increase the probability of encountering turtles, it is recommended that the same surveyors be used for each wetland.

6. A minimum of four (4) surveys per wetland site are needed to adequately assess the site for presence of bog turtles. At least two of these surveys must be performed in May. From mid-April to mid-May, surveys should be separated by six or more days. From mid-May to mid-June, surveys should be separated by three or more days. The shorter period between surveys during late May and June is needed to ensure that surveys are carried out during the optimum window of time (i.e., before wetland vegetation becomes too thick).

   Note that bog turtles are more likely to be encountered by spreading the surveys out over a longer period. For example, erroneous survey results could be obtained if surveys were conducted on four successive days in late April due to possible late spring emergence, or during periods of extreme weather because turtles may be buried in mud and difficult to find.

   If bog turtles are found on the first, second or third visit, the site does not need to be revisited. Because this is solely a presence/absence survey, survey efforts at a particular wetland may cease once a bog turtle has been found.

7. Survey time should be three (3) to six (6) person-hours per acre of wetland per visit. Both random opportunistic searching and transect surveys should be used at each wetland.

8. Walk quietly through the wetland. Bog turtles will bask on sedge tussocks and mossy hummocks, or be half-buried in shallow water or rivulets. Walking noisily through the wetland will often cause the turtles to submerge before they can be observed. Be sure to search areas where turtles may not be visible, including shallow pools, underground springs, open mud areas, vole runways and under tussocks. Do not step on the tops of tussocks or hummocks because turtle nests, eggs and nesting microhabitat may be destroyed.

9. Photo-documentation of each bog turtle located will be required; a macro lens is highly recommended. The photos should be in color and of sufficient detail and clarity to identify the bog turtle to species and individual. Therefore, photographs of the carapace, plastron, and face/neck markings should be taken of each individual turtle. Do not harass the turtle in an attempt to get photos of the face/neck markings; if gently placed on the ground, most turtles will slowly extend their necks if not harassed. If shell notching is conducted, do the photo-documentation after the notching is done.

10. The following information should be collected for each bog turtle: sex, carapace length-straight line, carapace width, weight, and details about scars/injuries. Plastron length-straight line information should also be collected to differentiate juveniles from adults (> 70 mm; Ernst 1977) as well as to obtain additional information on recruitment, growth, and demography.

11. Each bog turtle should be marked (e.g., notched, PIT tagged) in a manner consistent with the requirements of the appropriate State agency and/or Service. Contact the appropriate State agency prior to conducting the survey to determine what type of marking system, if any, should be used.

12. All bog turtles must be returned to the point of capture as soon as possible on the same day as capture. They should only be held long enough to identify, measure, weigh, and photograph them, during which time their exposure to high temperatures must be avoided. No bog turtles may be removed from the wetland without permission from the Service and appropriate State agency.

13. The Fish and Wildlife Service and appropriate State agency should be sent a copy of survey results for review and concurrence, including the following: dates of site visits; time spent per wetland per visit-, names of surveyors; a site map; a description of the wetlands within the project area (e.g., acreage, vegetation, soils, hydrology), an explanation of which wetlands or portions of wetlands were or were not surveyed, and why; survey methodology; weather per visit at beginning and end of survey (air temperature, water temperature, percent cloud cover, wind, and precipitation); presence or absence of bog turtles, including number of turtles found and date, and age/sex of turtles found; and other reptile and amphibian species found and date.

ADDITIONAL SURVEYS / STUDIES

Proper implementation of the Phase 2 survey protocol is usually adequate to determine species presence or probable absence. Additional surveys, however, may be necessary to determine whether or not bog turtles are using a particular wetland, especially if the Phase 2 survey results are negative but the quality and quantity of habitat are good and in a watershed of known occurrence. In this case, additional surveys (Phase 2 and/or trapping surveys), possibly extending into the following field season, may be recommended by the Service or appropriate State agency.

If bog turtles are documented to occur at a site, additional surveys/studies may be necessary to characterize the population (e.g., number, density, population structure, recruitment), identify nesting and hibernating areas, and/or identify and assess adverse impacts to the species and its habitat, particularly if project activities are proposed to occur in, or within 300 feet of, wetlands occupied by the species.

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[1] As additional information becomes available regarding survey techniques and effectiveness, these survey guidelines may be updated and revised. Contact the Fish and Wildlife Service or one of the state agencies listed below for the most recent version of these guidelines.

[2] Searching for bog turtles and recognizing their habitat is a skill that can take many months or years of field work to develop. This level of expertise is necessary when conducting searches in order to ensure that surveys are effective and turtles are not harmed during the survey (e.g., by stepping on nests). Many individuals that have been recognized as qualified to conduct bog turtle surveys obtained their experience through graduate degree research or employment by a state wildlife agency.