Northern Wallkill Biodiversity Plan

Balancing Development and Environmental Stewardship in the Hudson River Estuary Watershed

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Northern Wallkill Biodiversity Plan

Balancing Development and Environmental Stewardship in the Hudson River Estuary Watershed

by

Danielle T. LaBruna, M.A.

and

Michael W. Klemens, Ph.D.

Metropolitan Conservation Alliance
Wildlife Conservation Society
Bronx, New York

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Table of Contents

Introduction

Project Background

The Wildlife Conservation Society's Metropolitan Conservation Alliance (WCS/MCA) initiated the Northern Wallkill Biodiversity Plan (NWBP) project with the goal of establishing a regional approach to land use planning to promote conservation of wildlife and wildlife habitat. The region at the northern stretches of the Wallkill River was chosen due to the richness of wildlife and unfragmented habitat found there, characteristics that are increasingly rare in more southern portions of New York State due to sprawling development. A project with a regional scope such as this necessitates the participation of multiple municipalities. To this end, WCS/MCA formed a partnership with the Town of Lloyd, the Town of New Paltz, and the Village of New Paltz to guide and facilitate this project, including biodiversity field surveys, data analysis, report production, and implementation of recommendations. This report, the Northern Wallkill Biodiversity Plan, contains the summarized results and analysis of biodiversity field surveys and provides recommendations on how to best conserve these biodiverse areas through both land preservation and biodiversity-friendly land use planning. This project builds upon a regional, inter-municipal conservation model created by MCA in other regions and states; this report is the fifth such intermunicipal biodiversity strategy published by MCA.

This project began as a four-municipality initiative which included the Town of Esopus. However, the Esopus Town Board was unable to commit to assist in requesting site access for biodiversity surveys. MCA was, therefore, not able to survey sufficient land area to warrant the inclusion of Esopus in this report. Due to Esopus' rich biological resources, future cooperation with Esopus would enhance the Northern Wallkill Biodiversity Plan and should remain an option.

The NWBP project commenced in 2002 when MCA began to conduct biodiversity field surveys. In early 2003, as field studies continued, MCA attended meetings and conducted workshops with town staff and citizens to communicate the purpose of the project and engender support. In early 2004, MCA met with Lloyd and New Paltz representatives to assess progress and chose to put biodiversity surveys on hold until 2005 due to staff capacity issues. In 2005, field surveys resumed and were completed. In 2006, MCA again met with Lloyd and New Paltz representatives to discuss progress and form a timetable for report publication.

Northern Wallkill Region Overview

The portion of the Northern Wallkill region included in this biodiversity plan includes the Town of Lloyd, the Town of New Paltz, and the Village of New Paltz in Ulster County. It lies between the Shawangunk Mountains to the west and the Hudson River to the east. The Wallkill River is the largest of several water bodies that run through these two towns; from east to west are the Kleine Kill, Wallkill River, Swarte Kill (the dividing line between New Paltz and Lloyd), Black Creek, and Twaalfskill Creek.

These water bodies are part of a hydrologic system that provides habitat in the form of streams, rivers, ponds (including beaver ponds), lakes, vernal pools and freshwater

wetlands (both marsh and swamp). The region's diverse topography further contributes to the array of habitat types which also include mixed secondary forest (both young and mature), shrubland, rocky outcrops, rocky ridgelines, and surrogate grasslands in the form of agricultural fields.

This region, once containing a pastoral mix of forest, agriculture, hamlets, and villages, is experiencing rapid change. A wave of sprawl is pulsing through the region, altering historic landscapes and putting its natural resources at risk.

But vibrant habitats and diverse assemblages of wildlife are still found in the region. There is still time to minimize and contain the effects of sprawl, but this can only be achieved by finding alternative development patterns that can strike a better balance between economic growth and environmental integrity. This balance is necessary, not only to maintain biodiversity, but to retain the diverse and scenic landscapes that are at the very core of the "sense of place" characterizing each town.

Concepts and Issues

Biodiversity in the Northern Wallkill Region

The rich tapestry of genes, species, ecosystems, and their interactions are collectively referred to as "biological diversity," often shortened to "biodiversity." Northern Wallkill towns are home to significant habitats and rich assemblages of wildlife due to a unique convergence of factors:

1. The diverse geological variation within these towns serves as a foundation for a wide variety of habitats. Features such as limestone outcroppings, glacial till, and granite escarpments all give rise to distinctive habitat types, which in turn support many unique and rare species.

2. The geographic position of the Northern Wallkill region is at an ecological crossroads, which contributes to the diversity of plants and animals found here. At the close of the Wisconsin glaciation (ca. 15,000 years ago) plants and animals moved into and repopulated southern New York from a variety of routes, including the Wallkill Valley, the Atlantic Coastal Plain, and from the Midwest via the Mohawk Valley. These routes converged in southeastern New York's lower Hudson Valley.

3. The historic development pattern of small rural villages with intervening open space has fostered both the scenic and biodiversity values of the area. This type of development – intensive but limited in scope – has preserved many of the ecological treasures of the region. Although sprawl is changing this rapidly in some areas, large tracts of relatively undeveloped land remain in the region.

4. The tradition of farming in the region has benefited biodiversity. The presence of active agriculture has maintained many of the important grassland and shrubland habitats within the Northern Wallkill region. Fire suppression, the loss of beaver dams with the near-eradication of the beaver, and allowing much of our agricultural land to revert to forest has made grassland and shrubland habitats and their associated fauna (particularly grassland dependent birds) increasingly scarce. Maintaining farming landscapes acts as a surrogate for these lost ecological processes which not only conserves community character, but also conserves wildlife habitat.

5. Biodiversity within the two towns is represented by both widespread species and species that are declining in the Wallkill Valley and throughout the Northeast, including many that are on state and federal lists of endangered, threatened, and special concern wildlife. Species such as the bog turtle, marbled salamander and box turtle are near the northern limit of their natural range in the lower Hudson Valley. The stewardship of such species becomes increasingly important as the world's climate changes, potentially causing their ranges to expand northward. Stewardship of all of the region's biodiversity has conservation value that extends

far beyond the towns, adding value to broader conservation efforts in New York State and throughout the Northeast.

Importance of Biodiversity to the Northern Wallkill Region

It is often argued that biological diversity has its own inherent value, that it is our obligation to preserve biodiversity for its own sake. However, when development and sprawl collide with biodiversity concerns, land use practitioners need more than ethical arguments based on inherent value to make a decision in favor of biodiversity. Therefore, it is important to note that communities directly benefit in many ways from their biological resources and that these services can often be measured in tangible terms, including those of economics and human welfare. The following paragraphs provide a rationale for including biodiversity as one of the fundamental foundations of sound land use decisions.

- A major benefit of biodiversity is its direct impact on human health, including the prevalence of Lyme disease. Research conducted in southeastern New York has revealed that the diversity of small mammals (e.g., mice, moles, voles, shrews) is reduced by forest fragmentation. The small mammal that ends up dominating these isolated fragments—the white-footed mouse—is the primary reservoir (or "carrier") of the Lyme bacterium. The risk of Lyme disease is much lower in intact forest ecosystems where the infection rate is suppressed by a diversity of small mammals. By maintaining larger tracts of interconnected forest habitat, we can maintain high biodiversity levels and simultaneously reduce human health risks (Allan et al. 2003).

- Biodiversity provides important recreational opportunities, including hunting, fishing, hiking, bird watching, and photography. Recreation opportunities often directly translate into economic gain for communities; businesses that cater to outdoor enthusiasts (equipment suppliers, canoe/kayak rental outlets, etc.) will likely see increased sales while local restaurants, grocery stores, gas stations and other businesses will likely see increased patronage as more people travel to the region to take advantage of recreational opportunities.

- Biodiversity provides a scenic backdrop to the daily activities of the people of the Northern Wallkill region. Rocky ridgelines cloaked in green forests, maple swamps glowing red as their leaves turn in autumn, grassy fields shining with dew on spring mornings—these are the stages on which we act out our daily routines. These settings can reduce stress and bring peace of mind back into our busy lives.

- Bees, butterflies, and other pollinators have a direct influence on agricultural crop yields and the vitality of gardens. These factors benefit the economy and human welfare. Bee pollination alone is required for an estimated $14 billion of agricultural production in the United States (Morse & Calderone 2000). Bees are also essential for pollinating some of our favorite local garden produce such as apples, plums, cherries, blueberries, raspberries, squashes, melons, and pumpkins (Cane 2005).

- ✍ Forests, wetlands, fields, and associated wildlife and plant communities serve as important outdoor laboratories used by schools and nature centers.

- ✍ Research goals of the scientific community have begun to shift. Rather than focusing on the negative impacts that humans have on the environment, researchers are beginning to ask more pertinent and useful questions such as "do people benefit when they protect and maintain the environments in which they live?" Wetlands provide an excellent case study of how, by maintaining biodiversity, humans can reap substantial benefits. Many wetlands are extremely biologically diverse, which is sometimes a rationale provided for their protection. But wetlands protected for their biodiversity also provide a variety of ecological services to people (Smith et al. 1995). Because of their ability to temporarily store floodwaters during storms, they help to reduce and eliminate damaging floods. Wetlands uptake and store pollutants, resulting in cleaner, safer water. Their dense vegetation and unique soils store carbon, reducing global warming. Some wetlands recharge groundwater aquifers and maintain base flow in streams and rivers during drought. Wetlands and waterways also provide corridors for flora and fauna to disperse and alter distributions in response to global warming. Forests ecosystems provide multiple services to people; they stabilize stream banks, allow rain to infiltrate groundwater aquifers, and retain and transform lawn and agricultural fertilizers, to name a few.

- ✍ Actions to protect and plan for biodiversity in the Northern Wallkill Region will aid in major, ongoing efforts to improve water quality in the Hudson River and throughout the river's watershed. For example, maintaining the ecological integrity of wetlands allows them to continue filtering water of pollutants, water that eventually flows to the Hudson River.

The diversity of wildlife populations within a town or region is a direct measure of ecosystem health; therefore, it is also a measure of the ability of these ecosystems to provide important and cost-effective services to our communities. The benefits of maintaining the Northern Wallkill region's biodiversity are far-reaching. Issues of water quality, water quantity, rural aesthetics, community character, and human health are all closely intertwined with biodiversity. A biologically diverse landscape is resilient to change and provides an "insurance policy" that the ecological services in our communities will continue, now and into the future.

Biodiversity and Local Land Use Planning

Biodiversity receives some protection through state and federal regulations. These laws, however, are not designed to protect the ecological function of the Northern Wallkill Region. Federal and state species protection encompasses a small subset of biodiversity—only those species that are at greatest risk of disappearing. These threatened and endangered species are akin to critically ill patients in a hospital who require an extraordinary allocation of resources in order to recover. Work by MCA has demonstrated that as much as 75% of the region's reptiles and amphibians (far more than

are on state or federal lists) are in long-term, non-cyclical declines (Klemens 2000). Reliance on regulations is insufficient to protect these species and increased regulatory strictures are often politically unpalatable. In addition, it is not feasible to preserve (through land acquisition or easement) the entire network of extensive, interconnected habitats that would be necessary to maintain the region's biodiversity.

We discard the premise that municipalities have merely one tool—land preservation—to conserve biodiversity. The idea that properties must either be completely preserved or completely destroyed through development is overly simplistic. This premise must be replaced by one which recognizes that thoughtful development adds value to and interconnects protected areas. Even large protected areas, such as the 565-acre Shawangunk Grassland National Wildlife Refuge, cannot survive without appropriate planning in the surrounding privately held, developable lands.

Therefore, protection of the Northern Wallkill region's biodiversity will require proactive action at the local land use decision-making level. Apart from sustaining biodiversity at the local level, a scientifically informed, landscape-scale approach to biodiversity management will prevent site-by-site conflicts over the ecological value of lands. This approach will help focus development into areas where it will have less impact on the ecological fabric and function of the region. By planning with nature in mind, Northern Wallkill municipalities can create quality communities for future generations where human progress is in greater harmony with the natural world.

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 the planning process. 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:

1. *Baseline data are generally not available.* Without such 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 more ecologically-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 greatest importance for biodiversity within the Northern Wallkill region (see Appendix A).

2. *Even where data are already available, mechanisms rarely exist to translate the information into policy.* To address this problem, WCS/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, which include this report, are published as the WCS/MCA Technical Paper Series, and are

targeted at a broad constituency to address land use issues within the tri-state region. A list of available tools is provided in Appendix D.

3. *Biological data and conservation tools are ineffective unless they are accepted as part of a community's goals and integrated consistently into land use planning practices.* Those concerned with the protection of biodiversity need to more fully embrace the legitimacy of competing goals and uses on the land. Environmental advocates are often very good at saying "no," but much less adept at asking "how?" How can we work together to create patterns of development that are more biologically sensitive and sustainable? MCA strives to raise awareness and understanding of biodiversity concerns among land use decision-makers, including municipal staff and volunteers, land trust personnel, landowners, and others who influence the patterns of development upon our landscapes. We accomplish this by serving in an advisory capacity to planning boards, conservation boards and other entities, providing workshops that focus on the relationship between biodiversity and land use planning, 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 tools that translate information into policy, and (3) integrating those elements into the land use decision-making process. These steps will create a platform for more thorough municipal and intermunicipal discussions of opportunities and challenges.

Land Use Changes and Biodiversity

Changing Patterns of Land Use

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 fire. By the 18th and 19th centuries, most of the forested habitat had been converted to agricultural lands, and the beaver, a landscape architect, was nearly extinct. 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 meadow or shrubland habitat.

The key element that allowed wildlife to survive these changing land use patterns was habitat connectivity. As land uses changed over time, many wildlife species 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 dependent birds, such as the bobolink and the eastern

meadowlark, made use of hayfields as a surrogate for their native grassland breeding habitats.

However, today's land use patterns are entirely different from those of historic times. In the current wave of sprawl, permanent structures are erected. Highways, parking lots, and subdivisions fence in remaining tracts of habitat, fragment them into smaller pieces, and isolate them from other tracts. These permanent land use changes that sever habitat connections make it difficult, if not impossible, for wildlife to adapt in the face of changing land use, increasing the likelihood of extirpations (i.e., local extinctions) of species in the near-term. Compounding the problem for wildlife is that at the same time that habitat connectivity is diminishing, it will become increasingly important in the long-term, as global warming proceeds. Species will need to migrate northward to adapt to new temperature regimes and resulting changes in habitat structure and composition; where sprawl blocks this migration, species are likely to face extirpation. The transitions that are occurring within our landscape today are 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 invasive species that thrive at the expense of a more diverse and balanced biological community (e.g., white-tailed deer, Canada geese, snapping turtles).

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 to allow dispersal of animals across the landscape*. Although careful planning can mitigate some of the adverse impacts of sprawl, most planning occurs on a site-specific scale, and does not consider much larger landscape-scale ramifications. Ironically, the land review process, as practiced in the Northern Wallkill towns and as required by the New York State Environmental Quality Review Act (SEQR), may actually foster fragmentation by considering too small an area in the review process.

To ensure that development is compatible with biodiversity, core wildlife habitat areas and the corridors that connect them must be accommodated. In general, larger core areas are better able to support healthy, viable wildlife populations than smaller areas. The connections between core areas are of paramount importance as they enable dispersal of animals among the core areas, maintaining gene pools and preventing extirpations. 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 can 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 core habitat areas. 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. The movement of wildlife across the landscape can be likened to the sheet flow of water across land during

a flood. Development should be located so that there are sufficient spaces for wildlife to move through and around development nodes, rather than attempting to force wildlife movements into human-created linear configurations.

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 be beneficial to wildlife. Instead, we must discover where species already occur (i.e., which habitats are most valuable) and use this information as a template for making future land use decisions. If we apply this 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.

This approach may sound simple, but it constitutes a 180-degree shift from the way development has been planned for to-date. Instead of erroneously assuming that natural resources will rearrange themselves around a development, we must understand the resources by gathering data and then fit the development in appropriate places. This approach is not only logical but is also cost-effective in the short- and long-term. In the short-term, it provides transparent, easily accessible information upon which to base land use decisions. By having an agreed-upon set of data, the conversation shifts from lengthy, contentious discussions about the quality of the data to a much more useful planning discussion about the implications of the data. This results in better, more ecologically sound projects and avoids protracted and costly arguments between opposing viewpoints concerning the impacts of development. In the long-term, ecosystems are protected in their entirety because decisions are made with a regional ecological context in mind, which prevents fragmentation of the ecosystem into smaller, dysfunctional units, avoiding mitigation that is both costly and, often, ineffective.

Agriculture and Biodiversity

While a region's ridgelines generally receive a great deal of attention from the conservation community, the valleys between the ridges receive much less recognition. This relative lack of conservation engagement in the lowland, working landscapes of the Wallkill Valley can be attributed to numerous and complex challenges. The land is divided into multiple ownerships, has increasingly high economic value, and is subject to a wide variety of competing land uses. However, conservation efforts in these agricultural lands are vital to achieve both ecological integrity and economic stability across the entire region.

The Wallkill Valley is critical for dispersal of wildlife, including area-sensitive mammals such as bear and bobcat, moving between ridgelines. But these valleys, because of their agricultural land use history, also support a unique assemblage of wildlife dependent on early-successional habitats (i.e., grassland, shrubland). Examples include spotted turtles, grassland songbirds (e.g., eastern meadowlark, bobolink, savannah sparrow, and vesper sparrow), ribbon snakes, blue-spotted salamanders, and a host of other species that are disappearing as large blocks of land, formerly kept open by agriculture, give way to sprawling subdivisions. While some farms and farming practices (e.g., large-scale agro-

industry operations) cause damage to habitats and ecosystems, other farms (e.g., small-scale family and artisanal farms) support species that are disappearing as urban areas sprawl into rural countryside.

Traditional conservation practices that focus exclusively on land preservation are ineffective at maintaining the biodiversity of working, agricultural landscapes. The unique suite of species associated with agriculture disappears as fields succeed to second-growth forest. To conserve the Wallkill Valley's biodiversity, we must look beyond preservation and employ a broader range of conservation techniques to ensure that farming continues. In the Wallkill Valley, a working landscape is a healthy landscape. Potential solutions include Purchase of Development Rights (PDR) programs, finding new and sustainable markets for local, biodiversity-friendly farms, and outreach programs that demonstrate the link between agriculture and biodiversity (e.g., the partnership between WCS/MCA and Glynwood Center, see www.wcs.org/mca/moveable feast).

Methods

Site Selection and Access

MCA selected sites for field surveys based on a number of criteria. Existing landscape configuration is of utmost importance in the site selection process. Sites were selected based on their size, potential habitat quality, and potential as main or connective habitat. Another primary criterion is the probability that a given site will be developed; that is, the "at-risk" status of a site. Baseline biological information is needed at the at-risk sites, more so than at other sites.

The site selection process was greatly enhanced by the availability of Geographic Information System (GIS) spatial datasets. Datasets that aided in site selection contained information about soil types, distribution of wetlands and water bodies, land use/land cover, existing open space coverage, density of development, locations of roads, elevation, and others. Digital aerial photography (orthoimagery) was also crucial for selecting sites and for later analysis of data.

Once sites are selected, obtaining permission for site access to private lands is the next challenge, and requires coordination with town staff to validate MCA requests for access. Both towns assisted us in gaining site access, and we appreciate their efforts in doing so. However, as a caveat, there remain some large areas in both towns that we were not able to access that have great potential for high-quality habitat. We recommend that most of these areas be examined further (details to follow in Biodiversity Areas section; see yellow hatched areas on map in Appendix A).

Field Data Collection

Three seasons of MCA field surveys are the source of the bulk of the data used for this project. Fields surveys began in May 2002, continued in 2003 and ended in June 2005 (surveys were temporarily suspended during 2004). Auxiliary data sets provided by the New York State Department of Environmental Conservation (Natural Heritage Program and Amphibian and Reptile Atlas Project) provided additional data points which complement MCA data.

Breeding bird surveys occurred during the breeding season (mid-May through early July) in the early morning hours (commencing within a half hour of dawn) under relatively fair weather conditions (winds less than 10 m.p.h., no rain). Species detection rates are maximized at these times and under these conditions.

MCA field herpetologists conducted surveys between March and October with concentrations on: adult amphibians in March-April, larval amphibians in July, reptiles in May-June, and both amphibians and reptiles in September. Survey techniques consisted primarily of visual searches and the turning over of cover objects (logs, rocks, and other debris). Dip-netting was employed to detect larval amphibians and, in some cases, adult amphibians and reptiles. Baited Fyke turtle traps (three metal hoops covered in nylon mesh) were used to live-trap aquatic turtles. Additionally, field herpetologists conducted

searches for amphibians along roads ("road-running") during their migrations on warm, rainy nights in the early spring.

The Focal Species Approach

MCA concentrates survey efforts on wildlife species which respond specifically to development impacts including 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 species, referred to as "development-sensitive" focal species, are usually habitat specialists with relatively narrow ecological requirements and/or complex life-history requirements that involve use of multiple, interconnected habitat types. These specialized habitats and interconnections are often compromised by development. Examples include Neotropical migrant bird species, vernal pool-breeding amphibians, and long-lived species such as box turtles. Because of poor dispersal abilities, herpetofauna (amphibians and reptiles) are initially more affected by fragmentation than birds (see LaBruna, et al. 2006). Such taxa tend to disappear from the landscape as their habitats are altered or fragmented. Populations of other focal taxa increase in response to urbanization. These species, referred to as "development-associated" focal species, are usually habitat generalists, with much less-specific habitat requirements. Human alterations to landscapes favor, or "subsidize" (see Mitchell and Klemens 2000), these generalists which tend to be found in areas that have already been degraded or along habitat edges, such as highway right-of-ways. Examples of such species include Corvids (crows and jays), Canada geese, bullfrogs, snapping turtles, raccoons, and white-tailed deer. As urbanization proceeds, development-sensitive species are out-competed by development-associated species which tend to increase and, over time, replace development-sensitive species, resulting in an overall reduction of biodiversity.

MCA refers to the process of evaluating the mix of focal taxa, and its implications for ecosystem health and land use, as the "Focal Species Approach," or "FoSA." The results of FoSA analysis can enhance planning efforts by assessing the importance of individual sites for conservation. For example, development should be discouraged within areas that support healthy populations of development-sensitive focal species, and redirected toward sites that are already degraded (i.e., those that are dominated by development-associated species).

FoSA represents an innovative departure from traditional conservation efforts. By expanding the scope of investigation beyond federal or state listed threatened and endangered species, we are able to more proactively conserve natural resources. There are many species, currently unlisted and unprotected, whose populations are declining in response to sprawl. At the current pace of exurbanization (sprawl development outside of urban and suburban areas), 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 is wiser to attempt to address their habitat requirements and to stabilize their populations now. In addition, ecosystems contain complex interactions among many species. FoSA evaluates systems more reliably by considering a much broader suite of species and their

relative abundances, as opposed to basing land use recommendations on a single threatened or endangered species. The FoSA method is not intended to replace the existing and necessary efforts to conserve threatened and endangered species; instead, it complements ongoing conservation efforts.

Lists of development-sensitive focal species vary from region to region because species ranges, habitat requirements, and responses to development also vary. The creation of the NWBP focal species list (see Appendix B) was based on a review of literature that addressed development-sensitivity within the New York/New England region (e.g., Andrle and Carroll 1988, Klemens 1990, Klemens 1993, Bull 1998, Klemens 2000) and on observations of species distribution trends in the field. WCS/MCA focused, in particular, on birds and herpetofauna. Besides being particularly "reactive" to development pressures (and therefore good indicators of ecosystem condition), the presence and status of these taxa can be rapidly assessed in a relatively cost-efficient manner using established field techniques. These two groups (birds and herpetofauna) also show differing responses to fragmentation. When used in tandem, they provide a robust evaluation of ecosystem integrity.

In order to determine the relative quality of an area's habitat, we normally compare the proportion of development-sensitive to development-associated species. However, because development-sensitive species were so abundant throughout the two towns, we were required to devise a more refined method. To identify the very highest quality habitat, we further divided the development-sensitive species category into three sub-categories: high development-sensitivity (HDS), medium development-sensitivity (MDS), and low development-sensitivity (LDS) (see Appendix B for species designations). This allowed us to differentiate between degrees in the development-sensitivity spectrum. We should note that, because grassland dependent birds and their habitat in the northeastern U.S. are declining (for reasons already discussed, see "Biodiversity in the Northern Wallkill Region"), we gave special consideration to all grassland bird species, equivalent to that of HDS birds.

Data Management

Field survey data were stored in a Microsoft Access relational database, while spatial data, both species location and survey site location, were stored in shapefiles created in ArcGIS 9.0.

Data Analysis

The data was analyzed and the Biodiversity Areas Map was created using ArcGIS 9.0.

Step 1 – FoSA Designation

Using both MCA and auxiliary data sets, for each point observation of a bird, amphibian, or reptile we attributed the appropriate FoSA category for that species, either: Development-Associated (DA), Development-Neutral (DN), Low Development-Sensitivity (LDS), Medium Development-Sensitivity (MDS), and High Development-Sensitivity (HDS). We found that the number and spatial layout of the HDS points for both birds and herpetofauna was sufficient to allow us to identify the areas most

important for supporting biodiversity. Therefore, we relied heavily on presence of HDS points when designating Biodiversity Areas, and also considered MDS points. LDS points were not considered.

Step 2 – Habitat Area Mapping
Mapping Biodiversity Areas for herpetofauna required a somewhat different approach than doing so for birds due to behavioral differences between these two groups of animals.

Herpetofauna
An animal's "home range" is the habitat area it needs in order to fulfill its life requirements such as obtaining food, water, and shelter. For most herpetofauna, home range size tends to be restricted and therefore a useful tool for mapping herpetofauna biodiversity areas. To approximate the habitat area used by observed individuals, using the ArcGIS 9.0 "buffer" function, we mapped a circular area around each HDS herpetofauna point, equal to that species' home range (buffer radius equal to home range radius). For three reptile species, the five-lined skink (*Eumeces fasciatus*), the northern copperhead (*Agkistrodon contortrix mokasen*), and the timber rattlesnake (*Crotalus horridus*), several data sources provided no consensus on home range size. For these species, we mapped the habitat area likely used by observed individuals based on that species' preferred habitat type (i.e., rocky outcrops and ridgelines).

Birds
Birds tend to have large home ranges. Considering the number of HDS birds observed in the Northern Wallkill region, mapping by home range size would not have helped us to pinpoint the most biodiverse areas for birds. Thus, mapping habitat areas for birds required a different approach than for herpetofauna. We chose to map biodiversity areas for birds (both HDS and grassland species) according to how they were spatially clustered. Rather than mapping individual circles around each point, we mapped the area immediately surrounding the cluster of bird points, and contiguous habitat of similar type.

Development-associated bird and herpetofauna species were observed regularly at nearly every site surveyed in both towns. Therefore, presence of DA species was not used heavily as a rationale to exclude an area from the Biodiversity Areas map, nor was lack of DA species used heavily as a rationale to include an area in the Biodiversity Areas map.

Step 3 – Editing & Extrapolation
To further refine the map and avoid unnecessarily including low quality habitat areas, we made changes informed by additional GIS layers such as hydrography, wetlands, road networks, tax parcels, topography, and orthoimagery. We excluded from Biodiversity Areas those areas that were already heavily fragmented (i.e., subdivisions and densely populated areas such as the Village of New Paltz and the hamlet of Highland), and included areas that either connected existing mapped areas or were both adjacent to existing mapped areas and of high habitat quality (i.e., not fragmented by development). There may be high quality habitat in the more densely developed portions of the towns,

but including those small areas was beyond the scope of this landscape-scale project (see "Important Considerations and Caveats," letter "c" for further discussion).

Step 4 – Buffer Riparian Corridors
In recognition of the important role that rivers and their riparian corridors play as habitat and dispersal routes for wildlife, we mapped a 1000-foot-wide riparian corridor (500 feet from each side) along each river and major stream (Kleine Kill, Wallkill River, Swarte Kill, Black Creek, and Twaalfskill Creek), as well as a 500-foot-wide corridor along the western bank of the Hudson River.

Step 5 – Synthesis
All mapped layers were merged to form the final map of Northern Wallkill Biodiversity Areas (see Appendix A).

Results & Discussion

Overview

There is a wealth of biodiversity in the Northern Wallkill towns of Lloyd and New Paltz. Development-sensitive species of birds and herpetofauna were so prevalent that it necessitated that we fine-tune our normal method of data analysis (described in previous section), making it more challenging for an area to qualify as a "Biodiversity Area." Development-sensitive species, such as the spotted salamander and wood frog, which are now rare in more southerly New York locations, are still abundant in the Northern Wallkill region. However, at the same time that highly development-sensitive species were observed, many development-associated (i.e., "weedy") species were observed as well. This indicates that this landscape, although still rural, is showing the signs of degradation from sprawl's influence.

Biodiversity Areas

Note: Biodiversity Area numbering does not indicate a hierarchy of importance. Some species that were observed in the field are not named in this section due to the concern that collecting could further jeopardize these populations. HDS = High Development-Sensitivity, MDS = Medium Development-Sensitivity.

New Paltz

*1-Libertyville Road Grassland Biodiversity Area**

The Libertyville Road Grassland Biodiversity Area offers grassland birds surrogate habitat in the form of agricultural fields. Although this area is small in size, we observed a high concentration of grassland birds here, including bobolink (*Dolichonyx orizivorous*), eastern meadowlark (*Sturnella magna*), and field sparrow (*Spizella pusilla*). Similar to Humpo Marsh Biodiversity Area (see below), this area offers the potential for collaboration between New Paltz and Gardiner as grassland bird species may occur on the Gardiner side of the border.

2-Humpo Marsh Biodiversity Area

For a small area, and possibly owing to its proximity to Mohonk Preserve, the Humpo Marsh Biodiversity Area contains a high amount of bird diversity representing a variety of habitat types. In this area we observed: MDS species such as American redstart (*Setophaga ruticilla*), eastern bluebird (*Sialia sialis*), great crested flycatcher (*Myiarchus crinitus*), pied-billed grebe (*Podilymbus podiceps*) (a state-listed species), swamp sparrow (*Melospiza georgiana*), warbling vireo (*Vireo gilvus*), wood duck (*Aix sponsa*), wood thrush (*Hylocichla mustelina*), and yellow-throated vireo (*Vireo flavifrons*); the grassland bird species bobolink, eastern meadowlark, field sparrow, and vesper sparrow (*Pooecetes gramineus*) (a state-listed species); and several HDS bird species including least bittern (*Ixobrychus exilis*) (a state-listed species), willow flycatcher (*Empidonax traillii*), pileated woodpecker (*Dryocopus pileatus*), scarlet tanager (*Piranga olivacea*), and northern waterthrush (*Seiurus noveboracensis*). We recommend that New Paltz consider collaborating with Gardiner, its neighbor to the south, to encourage them to survey the portion of the marsh that extends into Gardiner with the potential for intermunicipal collaboration to protect this marsh and its wildlife.

*3-Kleine Kill Grassland Biodiversity Area **

As previously discussed (see "The Focal Species Approach"), grassland dependent birds received special attention in this analysis due to their overall decline in the region. The Kleine Kill Grassland Biodiversity Area is important because it consists of agricultural field habitat that grassland birds utilize in the absence of natural grasslands. This area contains several grassland bird species, including bobolink, eastern meadowlark, field sparrow, savannah sparrow (*Passerculus sandwichensis*), and eastern kingbird (*Tyrannus tyrannus*), found in abundance, as well as over a dozen MDS bird species including the American kestrel (*Falco sparverius*), and prairie warbler (*Dendroica discolor*), among others. Additionally, this biodiversity area provides habitat for the MDS eastern box turtle (*Terrapene carolina*) the HDS wood turtle (*Clemmys insculpta*), both of which are state-listed.

4-Mohonk Uplands Biodiversity Area

This Biodiversity Area consists of uplands in the Mohonk Preserve region of the Shawangunk Mountains. It contains habitat for three HDS herpetofauna species (northern spring salamander (*Gyrinophilus porphyriticus*), Jefferson salamander complex (*Ambystoma jeffersonianum* complex), and wood turtle) the latter two of which are state-listed. Two MDS herpetofauna species were found here, the northern red salamander (*Pseudotriton ruber*) and northern black racer (*Coluber c. constrictor*). This area also contains quality habitat for several HDS bird species including Louisiana waterthrush (*Seiurus motacilla*), pileated woodpecker, scarlet tanager, and worm-eating warbler (*Helmitheros vermivorum*). The MDS bird species found here numbered over a dozen and include yellow-billed cuckoo (*Coccyzus americanus*), brown thrasher (*Toxostoma rufum*), and yellow-throated vireo (*Vireo flavifrons*), among others. The Mohonk Uplands Biodiversity Area is strategically located adjacent to the Mohonk Preserve. As such, it serves as the ecological "gateway" to the Preserve, providing an important habitat connection function that links the wildlife of Mohonk Preserve to the rest of New Paltz and Lloyd.

5-Springtown Biodiversity Area

The complex of wetlands and uplands in the Springtown Biodiversity Area provides habitat to several HDS birds, including the black-billed cuckoo (*Coccyzus erythropthalmus*), pileated woodpecker, scarlet tanager, willow flycatcher, and worm-eating warbler. Amongst the nearly twenty MDS birds species it hosts are the barred owl (*Strix varia*), eastern wood-pewee (*Contopus virens*), and rose-breasted grosbeak (*Pheucticus ludovicianus*). This area also provides habitat for three HDS herpetofauna species (wood turtle, spotted turtle (*Clemmys guttata*), and Jefferson salamander complex), as well as three MDS herpetofauna species (box turtle, marbled salamander (*Ambystoma opacum*), and northern red salamander). All of these herpetofauna species are state-listed, with the exception of the last. This biodiversity area encompasses a portion of the Kleine Kill and abuts the Wallkill River. Situated as the central area connecting Bonticou Crag, Wallkill River Oxbow Grassland, and the Mohonk Uplands Biodiversity Areas, it serves an important role in maintaining habitat connections between them.

6-Bonticou Crag Biodiversity Area
The ridgelines along Bonticou Crag offer high quality habitat to several herpetofauna species including the HDS species the timber rattlesnake (*Crotalus horridus*) and Jefferson salamander complex, as well as the MDS eastern box turtle, marbled salamander, and northern black racer. All of these species are state-listed with the exception of the last. As many reptiles are known to travel along ridgelines, and because these ridgelines run north into Rosendale, we suggest to New Paltz the possibility of a future partnership with this neighbor to the north to maintain habitat connections for these development-sensitive species.

*7-Wallkill Oxbow Grassland Biodiversity Area **
Where the Wallkill River forms an oxbow in northwestern New Paltz, the Wallkill Oxbow Grassland Biodiversity Area consists of agricultural field habitat that grassland bird species, including bobolink, eastern kingbird, eastern meadowlark, field sparrow, savannah sparrow, and vesper sparrow (a state-listed species), utilize in the absence of natural grasslands. Because grassland-surrogate agricultural fields extend past the town line into Rosendale, an opportunity exists to extend habitat protection across the border. As birds do not observe such political boundaries, and because grassland habitat is lacking in the region, an intermunicipal collaboration could be of great benefit to grassland birds. In addition to grassland birds, six HDS bird species were observed, including: American bittern (a state-listed species), Canada warbler, northern waterthrush, pileated woodpecker, scarlet tanager, and worm-eating warbler. Twenty MDS bird species were also observed, including bank swallow (*Riparia riparia*), spotted sandpiper (*Actitis macularia*), and tree swallow (*Tachycineta bicolor*), among others. In addition, two state-listed, HDS herpetofauna species were observed in this biodiversity area -- the wood turtle and Jefferson salamander complex.

8-Cameo Lake Biodiversity Area
This biodiversity area offers a large swath of relatively unfragmented habitat. Here we observed: six HDS bird species, including the black-billed cuckoo, Louisiana waterthrush, pileated woodpecker, red-shouldered hawk (a state-listed species), scarlet tanager, and worm-eating warbler; nineteen MDS bird species, including Swainson's thrush (*Catharus ustulatus*), swamp sparrow (*Melospiza georgiana*), and veery (*Catharus fuscescens*), among others; as well as two grassland bird species, the eastern kingbird and field sparrow. In addition, this area provides habitat for two state-listed reptiles, the eastern box turtle and the wood turtle, MDS and HDS species, respectively. Extending north to the New Paltz town boundary, bordered on the east by I-87 and on the west by State Route 32, is an area that may have quality bird habitat but which MCA was unable to access. New Paltz should consider it for future biodiversity study, with the possibility of extending the Cameo Lake Biodiversity Area to include all or part of it.

New Paltz & Lloyd
9-Northern Swarte Kill Biodiversity Area
The Swarte Kill is the dividing line between New Paltz and Lloyd. At the northern end of this dividing line, mainly on the New Paltz (western) side but also including a portion of

the Lloyd (eastern) bank, is the Northern Swarte Kill Biodiversity Area. Despite being fragmented by several roads (North Ohioville Road, Van Nostrand Road, Burleigh Road, Plutarch Road, and Elting Corners Road), this area has retained much bird biodiversity, perhaps due to a low incidence of subdivision-style sprawl development. The HDS bird species observed here include the Louisiana waterthrush, magnolia warbler, pileated woodpecker, red-shouldered hawk (a state-listed species), scarlet tanager, and willow flycatcher. Nearly a dozen MDS bird species were also observed, including American woodcock (*Scolopax minor*), ovenbird, and wood duck, among others. Two grassland species were also observed, the eastern kingbird and field sparrow. In addition, the state-listed, HDS Jefferson salamander complex was observed here, as well as the MDS northern red salamander and MDS, state-listed marbled salamander. Because it encompasses land of both New Paltz and Lloyd, this biodiversity area offers an opportunity for intermunicipal collaboration. To maintain habitat connections to the north where potentially high quality forest habitat exists in Esopus, we recommend that Lloyd and New Paltz begin a dialogue with Esopus to explore this possibility. If neighboring Hawley's Corners Wetland Biodiversity Area (No.11) is expanded to include a larger surrounding area, this would make a more secure habitat link between the Northern Swarte Kill Biodiversity Area and the Chodikee Lake Biodiversity Area (No. 12).

10-Central Swarte Kill Wetland Biodiversity Area

Like the Northern Swarte Kill Biodiversity Area, the Central Swarte Kill Wetland Biodiversity Area encompasses land in both New Paltz and Lloyd and, as such, provides another opportunity for intermunicipal cooperation in conservation and land use planning. Despite the influences of being adjacent to or intersected by several major roads, (including Route 299, New Paltz Road, I-87, Ohioville Road, and South Street), this wetland provides habitat for the Jefferson salamander complex and the spotted turtle, both of which are HDS, state-listed species. In addition to three grassland species found here (eastern kingbird, field sparrow, and savannah sparrow), multiple HDS bird species were observed, including Canada warbler, Louisiana waterthrush, pileated woodpecker, scarlet tanager, and willow flycatcher. The MDS bird species observed here number over a dozen and include spotted sandpiper, blue-headed vireo (*Vireo solitarius*) and swamp sparrow (*Melospiza georgiana*), among others.

Lloyd

11-Hawleys Corners Wetland Biodiversity Area

According to auxiliary data sets, this wetland contains the HDS, state-listed northern cricket frog (*Acris crepitans*). It likely contains other development-sensitive species as well; however, MCA was not able to gain access to this site in order to determine this. Considering the size and unfragmented nature of the broader area surrounding this wetland, it has great potential for high value wildlife habitat. We strongly suggest that biodiversity studies be conducted as soon as possible in order to determine if the Hawleys Corners Wetland Biodiversity Area should be expanded to include a broader area (see yellow hatched area on map in Appendix A). If it is expanded, it would not only benefit the Hawleys Corners Wetland Biodiversity Area, but would help to secure the habitat link between the Northern Swarte Kill Biodiversity Area (No. 9) and the Chodikee Lake & Vicinity Biodiversity Area (No. 12).

12-Chodikee Lake & Vicinity Biodiversity Area
Chodikee Lake and its surrounding area host seven HDS bird species: black-billed cuckoo, Louisiana waterthrush, northern waterthrush, pileated woodpecker, red-shouldered hawk (a state-listed species), scarlet tanager, and willow flycatcher; as well as twenty MDS bird species, including Cooper's hawk (*Accipiter cooperii*) (a state-listed species), Virginia rail (*Rallus limicola*), and marsh wren (*Cistothorus palustris*), among others. Two grassland dependent bird species were also observed, the field sparrow and eastern kingbird. This biodiversity area hosts two HDS herpetofauna species, the northern cricket frog and spotted turtle, both of which are state-listed, as well as the MDS marbled salamander, also a state-listed species. This high level of biodiversity is likely due to the mixture of habitat types in the area including lake, upland mixed forest, marshland, vernal pools and swamp. If neighboring Hawley's Corners Wetland Biodiversity Area (No. 11) is expanded to include a broader surrounding area, this would help to secure the habitat link between the Northern Swarte Kill Biodiversity Area (No. 9) and the Chodikee Lake & Vicinity Biodiversity Area. The region just north of Chodikee Lake & Vicinity Biodiversity Area in Esopus is a large swath of forest unfragmented, thus far, by sprawl or roads, and therefore has the potential to contain high quality habitat. We suggest that Lloyd consider beginning a dialogue with Esopus about the possibility of an intermunicipal collaboration to protect this habitat connection to the north.

13-Lily Lake Biodiversity Area
Lily Lake and its surrounding area provides habitat for seven HDS bird species: Louisiana waterthrush, magnolia warbler, northern waterthrush, pileated woodpecker, scarlet tanager, willow flycatcher, and worm-eating warbler; as well as seventeen MDS bird species, including American woodcock, blue-winged warbler (*Vermivora pinus*), and broad-winged hawk (*Buteo platypterus*), among others; and two grassland dependent bird species: eastern kingbird and field sparrow. This biodiversity area also provides habitat for the HDS northern cricket frog (a state-listed species), and three MDS herpetofauna species: northern black racer, northern red salamander, and marbled salamander, the last of which is also state-listed. We suggest that the stream corridor between Lily Lake and Chodikee Lake & Vicinity Biodiversity Areas be examined further to determine its conservation value.

14-Illinois Mountain Biodiversity Area
The Illinois Mountain Biodiversity Area has the greatest species richness of any of the biodiversity areas. This is partly due to its large size, but also due to the low degree of fragmentation and the diversity of habitat types it contains. These habitat types include ridgelines, riparian areas, coniferous forest, and deciduous forest. The mountain's varied topography creates miniature ridgelines and valleys that many species can utilize. Its large size also makes it valuable stopover habitat for migrating raptors and songbirds. Despite the fragmentation caused by Route 299, Riverside Road, and New Paltz Road, Illinois Mountain Biodiversity Area remains important habitat for three HDS herpetofauna species (spotted turtle, wood turtle, and Jefferson salamander complex), all of which are state-listed, and for four MDS herpetofauna species (northern black racer, northern red salamander, eastern box turtle, and marbled salamander), the latter two of

which are also state-listed. In part, the high level of herpetofauna diversity is due to the fact that this area includes both uplands and lowlands, both of which certain herpetofauna species require as they proceed through seasonal cycles. This biodiversity area also hosts twelve HDS bird species (black-billed cuckoo, black-throated blue warbler, Blackburnian warbler, Canada warbler, hooded warbler, Louisiana waterthrush, magnolia warbler, northern waterthrush, pileated woodpecker, red-shouldered hawk (a state-listed species), scarlet tanager, and worm-eating warbler), and twenty-two MDS bird species including yellow-billed cuckoo (*Coccyzus americanus*), great-crested flycatcher, and black-throated green warbler (*Dendroica virens*), among others. MCA supports the Town of Lloyd's efforts to designate Illinois Mountain a Critical Environmental Area under SEQRA.

15-Pine Hole Bog Biodiversity Area

Although Pine Hole Bog Biodiversity Area and its immediate vicinity contain several HDS and MDS bird species, its real value lies in its herpetofauna habitat. This area is home to two HDS herpetofauna species that are listed as "endangered" in New York State. The area surrounding Pine Hole Bog (see yellow hatched area on map in Appendix A) is a large block of unfragmented upland forest with promising habitat. However, MCA was unable to gain site access for field surveys and, therefore, we are unable to determine if this surrounding upland forest is biodiverse. We strongly recommend that it be surveyed in the near future, as a possible extension, either whole or in part, to the Pine Hole Bog Biodiversity Area.

16-Twaalfskill Creek Biodiversity Area

Along Vineyard Avenue in southern Lloyd, this small biodiversity area hosts several wood turtles, an HDS, state-listed species. It is also home to four HDS bird species (scarlet tanager, willow flycatcher, Louisiana waterthrush, black-billed cuckoo) and fifteen MDS bird species, including the orchard oriole (*Icterus spurious*) and white-eyed vireo (*Vireo griseus*), among others.

17-Blue Point Biodiversity Area

Blue Point was designated a biodiversity area due to the large number of woodland warbler species found here, especially considering the small size of this area. Surprisingly, in the northern part of this area we observed no development-associated bird species. While some development-associated species likely do live in this area, such a low observance rate suggests that this habitat is of very high quality. The southern part of this area contains several observations of a state-listed, HDS bird species, the yellow-breasted chat (*Icteria virens*), that is at the northern limit of its range here, an indication of high quality successional habitat. Other HDS bird species observed here include: alder flycatcher (*Empidonax alnorum*), black-billed cuckoo, black-throated blue warbler, magnolia warbler, scarlet tanager, willow flycatcher, and worm-eating warbler. Sixteen MDS bird species were also observed, including the brown thrasher and blue-winged warbler, among others. One MDS reptile, the northern black racer, was also observed here. The fact that this region is adjacent to the Hudson River is another strong reason for its designation as a Biodiversity Area, as quality riverside habitat is important for many species yet increasingly rare due to development.

Rivers & Major Streams
The Kleine Kill, Wallkill River, Swarte Kill, Black Creek, and Twaalfskill Creek are all major waterways and, as such, play an important role in maintaining ecological connectivity in the region by providing habitat and dispersal routes for many types of wildlife. A riparian corridor along each is included as part of the mapped Biodiversity Areas, though, due to their nature as "connectors" it was impractical to designate each as a separate, discrete Biodiversity Area unto itself. MCA supports the Lloyd Environmental Conservation Council's ongoing efforts to create a water/land trail along Black Creek as this effort should result in increased wise recreational use, educational opportunities, community awareness, and protection of this waterway both in Lloyd and Esopus.

Please note that Biodiversity Areas were designated based on MCA biodiversity surveys and analysis and limited data from NYSDEC. Land use decision-makers may also want to consider and integrate data from other sources when making planning decisions for Biodiversity Areas.

**For all Biodiversity Areas containing grassland birds and the grassland-substitute agricultural fields they utilize, it is important that the fields be maintained as fields. If fields were allowed to revert to forest, these birds would no longer have appropriate habitat at this location and towns would lose grassland birds from these areas. We suggest mowing every one to three years, after the first frost (roughly late November-early December, depending on weather conditions) to avoid interfering with both the height of the bird breeding season from May-July and to avoid injuring herpetofauna during the months when they are active. For private landowners who would like to improve grassland habitat on their property, the United States Department of Agriculture's Natural Resource Conservation Service's Wildlife Habitat Incentive Program (http://www.nrcs.usda.gov/Programs/whip) may be able to provide cost-sharing assistance.*

Opportunities in Gardiner
In the initial stages of this project, WCS/MCA conducted scattered biological surveys in the Town of Gardiner on a limited, trial basis. The initial data from those surveys indicates that there are some biodiverse areas in Gardiner that merit further investigation and/or special protection. Those areas are:

A-The forest southwest of Wawarsing Road
Development-sensitive (LDS, MDS, and HDS) reptile and amphibian species were observed here, including Jefferson salamander complex, spotted salamander (*Ambystoma maculatum*), marbled salamander, gray treefrog (*Hyla versicolor*), wood frog (*Rana sylvatica*), and eastern box turtle. The development-sensitive (LDS, MDS, and HDS) bird species observed here include: wood thrush, scarlet tanager, red-eyed vireo (*Vireo olivaceus*), common raven (*Corvus corax*), eastern wood-pewee, American redstart, ovenbird, pileated woodpecker, and worm-eating warbler. Much, but not all, of this area is already protected within Mohonk Preserve. It would be advisable to afford this area special protection and to determine ways to maintain habitat connectivity between Mohonk Preserve and land in Gardiner outside the Preserve.

B-The southern extension of Humpo Marsh
Although MCA did not survey the marsh on the Gardiner side of the town border, we found many HDS species on the New Paltz section of this marsh, and therefore we recommend that this area be surveyed to evaluate biodiversity levels.

C-The southern extension of Libertyville Road Grassland
The Libertyville Road Grassland extends south from New Paltz into Gardiner. Because ornithologists observed a concentration of grassland bird species the New Paltz side of the town border, it is possible that further investigation will reveal similar results on the Gardiner side of the border. We suggest that this area be considered for further investigation.

D-The woodland/wetland/agricultural field complex north of Phillies Bridge Road
Observations of development-sensitive (LDS, MDS, and HDS) bird species here include eighteen species: northern flicker (*Colaptes auratus*), Baltimore oriole (*Icterus galbula*), blue-winged warbler, eastern towhee (*Pipilo erythrophthalmus*), wood thrush, savannah sparrow, rose-breasted grosbeak, ovenbird, eastern wood-pewee, field sparrow, red-eyed vireo, Canada warbler, scarlet tanager, Swainson's thrush, eastern bluebird, eastern kingbird, American woodcock, and field sparrow. This small area also is habitat for four development-sensitive reptile species, all of which are also state-listed. We suggest that this area be considered for special protection.

E-The area adjacent to Route 32
Development sensitive (LDS, MDS, and HDS) birds observed here include the field sparrow, willow flycatcher, tree swallow, blue-winged warbler, veery, wood duck, American woodcock, wood thrush, alder flycatcher, rose-breasted grosbeak, eastern wood-pewee, Canada warbler, red-eyed vireo, eastern towhee, and Louisiana waterthrush. Although herpetofauna were observed here, all were development-associated species, indicating that this area, although quality habitat for birds, does not contain quality herpetofauna habitat. We suggest that this area be considered for special protection for birds. Because of the importance of stream corridors to wildlife, this area also encompasses a tributary, known locally as the Platte Kill Brook Gorge, that connects to the Wallkill River. This tributary, part of which lies in Gardiner and part of which lies in New Paltz, deserves further study to determine its conservation importance.

MCA surveys in the Town of Gardiner were very limited, so there are likely additional areas that should be surveyed for biodiversity. The development-sensitive species found in areas delineated above suggest that quality wildlife habitat still exists in Gardiner. These areas may serve as starting points from which to expand future biological surveys.

Recommendations for Implementation

The following sections outline tools and techniques that can be employed to achieve the goal of this biodiversity plan—a sustainable balance between development and conservation within Northern Wallkill towns. To maximize conservation effectiveness at a regional scale, we recommend that both towns adopt similar tools and techniques.

Important Considerations and Caveats

a. Mapped areas are not being recommended solely for land preservation.

Preservation of all Biodiversity Areas through purchase or easement is not feasible, nor do we recommend such measures. Many of the mapped areas contain privately owned lands with homes and contribute, through taxes, to the economic health and sustainability of the towns. Instead, within the mapped areas, we propose a balanced approach to conservation and development that incorporates the diverse suite of land use planning and conservation tools and incentives presented below.

b. Development outside of the delineated Biodiversity Areas on the maps needs to remain mindful of environmental and land use issues.

Exclusion from a mapped zone does *not* provide "carte blanche" for development activities. The map is intended for broad-scale planning efforts by both towns, both individually and collectively. They are not intended for development planning and review at a site-specific scale. Regardless of location, individual development proposals—both inside and outside of the mapped areas—should undergo careful review and consideration of potential biological impacts.

c. Conservation opportunities may occur outside of Biodiversity Areas.

Small or isolated habitats outside of the mapped areas may contain significant species or natural communities that have high conservation value (e.g., a fen, bog, or remnant patch of old-growth forest). They may have been excluded from our maps because (1) they were not detected during surveys and analyses, or (2) no connectivity could be established with a larger ecological corridor or system. While careful planning within the mapped areas will contribute significantly to the long-term maintenance of biodiversity at a regional scale, additional conservation opportunities throughout both towns should be considered.

Recommendations for Future Development and Economic Growth

To balance development with the conservation goals of this project, we propose that it continue to be concentrated in areas outside of those identified as Biodiversity Areas. In particular, we recommend encouraging new development in and around existing development nodes (i.e., the Village of New Paltz, the hamlet of Highland, and other hamlets). By doing this, it may be possible to alleviate development pressures in areas that are critical for biodiversity. Previously developed areas contain the infrastructure (roads, water lines, sewage lines, etc.) and services (schools, hospitals, stores, etc.) to

support further development in a cost-effective manner. Conversely, development that sprawls into Biodiversity Areas would have both ecological and economic costs for each town. We must reiterate that development does not necessarily need to be excluded from Biodiversity Areas; instead, the towns should attempt to focus development in areas that have already experienced such growth and simultaneously reduce the "ecological footprint" of development in Biodiversity Areas. Recommendations to achieve these goals are made in the following two sections.

Recommendations for Land Preservation

Although the focus of the NWBP is on conservation through an expanded scale and scope of local land use planning, under certain circumstances land preservation remains the best route to maintaining biodiversity on select parcels.

a. Attempt to add area (through acquisition or easement) to existing protected areas.

This buffers the existing protected habitat from externally caused degradations (e.g., runoff of polluted water from roads and parking lots, noise pollution). It also reduces "edge effects," (e.g., changes in vegetation structure, temperature, predation levels, parasitism levels, and other factors near habitat edges), which can negatively impact area-sensitive species. In addition, the buffers will often serve as additional habitat.

b. Attempt to preserve (through acquisition or easement) areas that are currently unprotected and have significant levels of biodiversity, or that contain populations of imperiled species.

c. Partner with local and regional land trusts (e.g., Wallkill Valley Land Trust), Cornell University Cooperative Extension, the Ulster County Environmental Management Council, the Ulster County Soil & Water Conservation District, and others to protect areas identified in this report.

d. Develop an open space preservation plan for your town that incorporates biodiversity issues or integrate biodiversity criteria, through amendments, into your existing open space plan.

As Lloyd does not yet have an open space plan, to begin the process, the town should consider seeking partnerships with land trusts. New Paltz's Open Space Plan, adopted in May of 2006, accounts for biodiversity issues (Behan Planning Associates, 2006). To encourage the preservation of land within Biodiversity Areas, New Paltz should consider adopting the Northern Wallkill Biodiversity Areas map (see Appendix A) into its Open Space Plan. While Biodiversity Areas are not to be considered for preservation alone, the map will help to prioritize areas for preservation.

e. When considering proposals to subdivide and develop parcels, always opt for conservation easements and open space reservations instead of fee-in-lieu payments or other buyouts.

Choose conservation easements before open space reservations and have those easements held by a land trust or municipality instead of a homeowner's association. As part of the approval process, towns should consider requiring applicants to set aside funds in escrow or in a small endowment to cover the costs of monitoring the conservation easement. Attempts should be made to consolidate the portions under easement, because one large protected area is more valuable from a conservation standpoint than numerous small, fragmented protected areas. If possible, the portion of a property to be protected in this manner should be selected based on its biodiversity value in relation to other portions. All of these protections are best considered and implemented as part of the approval process, rather than after the fact.

Recommendations for Local Land Use Planning

The following recommendations (including procedures, steps, and tools) can help to maintain biodiversity in areas where land preservation is not feasible or desirable. These recommendations are not listed in order of priority.

a. Avoid large-lot zoning, including "upzoning."

Increasing the size of buildable residential lots, or "upzoning," is often perceived as a "quick fix" to sprawl. These zoning changes result in development patterns that appear to be "green," with fewer houses and more trees visible. In reality, however, upzoning encourages sprawl by spreading the impacts of development across a much larger area, destabilizing and often eliminating local populations of development-sensitive wildlife species. Statistics show that while the human population in the New York metropolitan region increased by only 8% between 1970 and 1990, land consumption during the same period increased by 65% (Diamond and Noonan, 1996). It is no surprise that wildlife, habitats, and ecosystem integrity are disappearing. A shift from large-lot zoning to a more centralized, compact pattern of development is critical to maintain the biodiversity and ecological health of our region. From an ecological standpoint, upzoning is only acceptable when accompanied by a *mandatory* cluster requirement (see next section and Klemens et al., 2006, section 3).

b. Consider novel types of development, including conservation subdivisions and Traditional Neighborhood Designs (TNDs).

Conservation subdivisions cluster housing, making it is possible to reduce the amount and impact of associated infrastructure, such as roads, reducing the "ecological footprint" of development to more closely match the "built footprint." This has ecological as well as economic benefits. To maximize the ecological benefits, siting of clusters should be based on knowledge of relative biodiversity levels and proximity to other developments. It is imperative that housing clusters take up no more than 25-50% of the parcel being considered for development. This allows 50-75% of the parcel to remain free of development, providing ecological connection to adjacent parcels. See Arendt (1999) for further details and suggestions about conservation subdivisions.

TNDs consist of developed nodes combined with large areas of open space that enable wildlife to circumvent developed areas. Creating TNDs with real conservation value may require modification of existing municipal regulations, zoning codes, and procedures in order to harmonize the goals of tight clusters with existing municipal standards. Making incentives available to developers who build these types of eco-appropriate developments is an important consideration. Density bonuses (permitting a developer to build additional units of clustered housing), fast-tracking of the permitting process, and easing of other building standards are examples of incentives that municipalities may opt to use.

c. Pass a conservation overlay district ordinance (e.g., WCS/MCA Technical Paper No. 3, see Appendix D).

A conservation overlay district ordinance will minimize and mitigate the impacts of development within the conservation overlay district. It is valuable, in particular, for maintaining wildlife habitat connectivity in developable parcels located within biodiversity areas. 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.

As MCA recognizes Illinois Mountain as a Biodiversity Area (see map, Appendix A), MCA supports the Town of Lloyd's intention to designate Illinois Mountain a Critical Environmental Area and to adopt a conservation overlay district encompassing Illinois Mountain, as expressed in its Comprehensive Plan, Section 7.2 (Town of Lloyd Comprehensive Plan Study Committee, 2005). The Town should also consider expanding the conservation overlay district to include additional Biodiversity Areas delineated in this report.

d. Integrate the recommendations and maps in this report into your town's Master/Comprehensive Plan.

MCA staff would welcome the opportunity to work with individual towns in this regard. We have assisted other New York towns with their Comprehensive Plan updates. It is important to note that Comprehensive Plans can be amended at any point, even after an update has occurred, so it is possible to incorporate the findings and recommendations of this report into the plans of both towns.

Comprehensive Plans need to be more than a "shopping list" of community desires; for each goal, a clear pathway to attaining that goal must be laid out. For example, if a community desires to encourage TNDs, it must amend many of its regulations and procedures. The specifics of these changes should be detailed in the Comprehensive Plan.

e. Formalize the intermunicipal relationship between the Village of New Paltz and the Towns of New Paltz and Lloyd by:

- adopting an intermunicipal agreement, and
- establishing an intermunicipal council.

This intermunicipal council should focus on a broad array of land use issues (affordable housing, transportation, economic development, recreation opportunities, tourism, and others). Biodiversity conservation will not be successful unless it is carefully woven into a broader tapestry of land use issues, approaches, and solutions.

f. Encourage the extension and application of biodiversity and planning concepts, tools and mapped areas into towns adjacent to the Northern Wallkill communities.

Conservation efforts in neighboring towns can add value to those in the NWBP. This is particularly important for adjacent towns that share ecological linkages (e.g., Rosendale, Esopus, Gardiner, Plattekill, and Marlborough; see "Biodiversity Areas" and "Opportunities in Gardiner" for details). Some of these efforts are ongoing; Rosendale and Gardiner are already engaged in the Shawangunk Ridge Biodiversity Partnership's Green Assets program and the Shawangunk Regional Partnership's open space planning process, and both have completed habitat mapping through Hudsonia's Biodiversity Assessment Training.

g. Encourage better SEQRA reviews by:

- Considering impacts beyond individual project sites (that is, consider cumulative impacts of individual development proposals on town- and region-wide scales).

- Encouraging use of the Generic Environmental Impact Statement (GEIS) process. This is a planning process wherein 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.

- Requiring standards for wildlife surveys to ensure that adequate effort is being expended—at appropriate times of year and using established techniques—to assess wildlife resources for preparation of development proposals at specific sites. MCA has prepared standards to this effect that have already been adopted by towns in New York.

h. Seek out biodiversity training workshops and other educational forums for your town's land use decision-makers.

An informed group of decision-makers is empowered and motivated to ensure that their town's natural resources are maintained. Training and educational programs available in this region are offered by MCA and by our partner organizations, such as Hudsonia, Ltd., Glynwood Center, and Pace University's Land Use Law Center. NYS DEC's Hudson River Estuary Program coordinates a variety of training and educational opportunities. A new resource is WCS/MCA Technical Paper No. 10, "From Planning to Action:

Biodiversity Conservation in Connecticut Towns" (Klemens et al., 2006) which contains guidance for land use planners and has direct applicability to New York towns.

i. Develop and support programs to educate citizens in your town about the importance of biodiversity.

An informed citizenry is a constituency that can empower elected officials to make decisions that benefit both people and the environment.

j. Adopt a strong local wetlands ordinance or amend your existing ordinance to better protect wetland biodiversity.

Many of the wetlands within this region, along with the uplands adjacent to them, tend to be biodiversity hotspots. However, they often are not adequately protected in New York where, typically, wetlands smaller than 12.4 acres are not under the State's regulatory jurisdiction. In addition, wetland regulations are usually written to protect water quality, among other issues, but rarely include language to protect the wildlife that require wetland habitats. As such, Lloyd should consider revising its wetlands ordinance (Town of Lloyd, 1976), as recommended in Lloyd's Comprehensive Plan, Section 7.4.1 (Town of Lloyd Comprehensive Plan Study Committee, 2005). Similarly, because it is now a year after the revision of New Paltz's wetlands ordinance (Town of New Paltz, 2005), the town may want to review the ordinance to determine if it is allowing New Paltz to meet its conservation goals.

k. Map vernal pools and other small wetlands within your town.

Because these wetlands are small, broad-scale wetlands maps often fail to identify them and they tend to "slip" through regulatory "cracks." However, these wetlands often support a unique assemblage of biodiversity that cannot be found in larger wetlands. To protect these resources, it is important to first understand where they occur on the landscape. Mapping small wetlands proactively is preferable to identifying wetlands reactively (as development proposals are submitted) because it provides town staff with a regional context which will assist them in making informed planning choices. New Paltz's wetland ordinance, revised in 2005, will make great progress toward this end in that it undertakes to map regulated areas, which include vernal pools greater than 100 square feet in area. As of the printing of this publication, New Paltz's wetlands mapping has not progressed. MCA encourages New Paltz to undertake this endeavor as it is a critical step in protecting smaller wetlands. MCA also encourages Lloyd to map its smaller wetlands, in accordance with Lloyd's Comprehensive Plan section 7.4.1 (Town of Lloyd Comprehensive Plan Study Committee 2005), noting that the town need not wait for revision of its wetland ordinance to do so. Procedures and considerations for mapping vernal pools on a town-wide basis are provided in WCS/MCA Technical Paper No. 5 (Calhoun and Klemens 2002).

l. Formally adopt and apply "Best Management Practices" and "Best Development Practices" that can help to reduce impacts to biodiversity during both town-wide planning and individual site review processes.

An example of such a manual is WCS/MCA Technical Paper No. 5**, "**Best Development Practices: Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States" (Calhoun and Klemens 2002), which provides guidelines for protecting vernal pool species in areas being developed. Additional BMPs from other organizations and agencies may also prove to be useful.

m. Develop and adopt a Rare, Threatened, and Endangered species list that is specific to your town.

Federal and state lists do not take into account the decline or extinction of species at the scale of individual towns, groups of towns, watersheds, or counties. Some counties in New York have developed lists, but they have no jurisdiction outside of county parks. We recommend that towns develop and adopt their own lists (in consultation with conservation organizations and local naturalists), and that towns require listed species to be considered during review of development proposals. Town lists would not be regulatory in nature but would instead help to guide discussions and generate options in development proposals (e.g., where to locate open space areas created as part of the site approval process).

n. Ensure that all environmental regulations within your town are adequately enforced.

Lack of enforcement undermines the effectiveness of environmental regulations. Enforcement should be a major focus of communities attempting to preserve their biodiversity resources. However, enforcement can be expensive and time-consuming, therefore, communities with limited funds and time should consider hiring enforcement officers on cost-share and time-share bases with neighboring communities (this position could be administered through an intermunicipal council – see recommendation "e" earlier in this section). Also, municipalities should not overextend their commitments to monitor by placing multiple conditions on a development project while approving it (see Klemens, et al., 2006, section 11). It is better to deny an application and provide clear guidance to the applicant on how to remedy deficiencies in the next application rather than permit the application with numerous conditions.

o. Revise the formula used by your town to calculate housing density yields.

Residential housing density yields for subdivisions are typically calculated by dividing total property acreage by lot size, as established in zoning codes. However, this formula does not account for areas within properties that are not buildable due to environmental constraints. To ascertain the ecologically appropriate number of lots that a property can support, density yields should be calculated only after subtracting wetland area and other non-buildable areas (such as steep slopes) from the total property acreage. Of the resulting lots, a subset should be perc-tested to see if they can support septic systems. The

final yield of a site should include only those lots that can be sustained via septic and other services. Subdivision regulations should stipulate these procedures. See Arendt (1999) for further details. This recommendation is particularly pertinent to towns that have not adopted wetland and steep slope ordinances.

p. Strive to make the land use planning and review processes as inclusive and transparent as possible.

Land use planning and review procedures are often fraught with mistrust and tension, resulting in decisions that satisfy few or none. All interested parties should be included as early as possible in this process, preferably at a "pre-application" meeting, to incorporate the needs and goals of developers, landowners, local governments, agencies, environmental advocates, affordable housing advocates, and private citizens. Through inclusiveness and transparency, irresolvable differences may be avoided and acceptable solutions can be achieved.

q. Include the maintenance of biodiversity as a major goal in the management plans of parks, preserves, and other protected areas within biodiversity areas.

Most parks and preserves are protected for a variety of reasons, including recreation, aesthetics, protection of water supplies, and biodiversity, among others. Park development and management activities that target one of these goals may come at the expense of the others. For instance, clearing shrubs and ground layer vegetation to improve views within a park will negatively impact water quality and biodiversity. Such clearing may be appropriate for a small park within an urbanized area, where primary goals include picnicking and walking. However, parks and preserves within Biodiversity Areas should be carefully managed to ensure that biodiversity can persist. With careful planning, biodiversity conservation can be accomplished in harmony with other goals.

r. Consider opportunities for restoration of ecological connectivity when upgrading and maintaining roads and highways.

Roads and highways sever ecological connections. Where they cross Biodiversity Areas, these ecological connections should be improved during the upgrading and maintenance of the roads. For example, to enhance amphibian passage across roads, it is possible to build an underpass. To ensure that the passage is used by wildlife, it should meet certain specifications. Stream corridors can form natural connectivity across roads; culverts should be designed and installed to maximize this connectivity potential. For a complete discussion of road impacts on wildlife, along with potential solutions, see Forman et al. (2003).

s. Conserve farms that contribute to biodiversity, using innovative approaches.

Farms often provide quality habitats for wildlife and are also attractive alternatives to other land uses, such as sprawl development. To maintain farm-related biodiversity, preservation alone is an insufficient conservation tool. Purchase of Development Rights

(PDR) programs are already active in some towns of the Wallkill Valley. They should be initiated, funded, and applied in both Northern Wallkill towns. PDR programs should, in particular, target farms that demonstrate a high level of biodiversity; such farms may occur inside or outside of the mapped Biodiversity Areas. MCA supports the Wallkill Valley Land Trust's "Two Farms" PDR initiative in the Village of New Paltz and Town of New Paltz as portions of both farms are located within the mapped Biodiversity Area along the Wallkill River.

Complementary Partnerships

The Corridor Management Plan (Shawangunk Mountains Scenic Byway Steering Committee, 2005) for the Shawangunk Regional Partnership, of which the Town of New Paltz and Village of New Paltz are members, contains many strategies that align with our recommendations, including conservation subdivisions and farmland conservation, among others. New Paltz's participation in the Shawangunk Regional Partnership need not compete with its partnership with Lloyd in the Northern Wallkill Biodiversity Plan, rather, the two partnerships should serve to inform and complement one another.

Literature Cited

Allan, B.F., F. Keesing, and R.S. Ostfeld. 2003. Effect of forest fragmentation on Lyme disease risk. Conservation Biology 17:267-272.

Andrle, R.F. and J.R. Carroll, editors. 1988. Atlas of breeding birds in New York State. Cornell University Press, Ithaca, NY.

Arendt, R. 1999. Growing greener: Putting conservation into local plans and ordinances. Island Press, Washington, D.C.

Behan Planning Associates, LLC. 2006. New Paltz open space plan: A framework for conservation. (PDF downloaded 20 Dec 2006 from http://www.townofnewpaltz.com/OpenSpacePlan.htm).

Bull, J.L. 1998. Bull's birds of New York State. E. Levine, editor. Cornell University Press, Ithaca, NY.

Calhoun, A.J.K. and M.W. Klemens. 2002. Best development practices: Conserving pool-breeding amphibians in residential and commercial developments in the northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, NY.

Cane, J. H. 2005. Bees, pollination, and the challenges of sprawl. Pages 109-124 in E. A. Johnson and M. W. Klemens, editors. Nature in fragments: The legacy of sprawl. Columbia University Press, New York.

Diamond, H.L. and P.F. Noonan. Land use in America. Island Press, Washington, D.C.

Forman, R. T. T, D. Sperling, J. A. Bissonette, A. P. Clevenger, C. D. Cutshall, V. H. Dale, L, Fahrig, R. France, C. R. Goldman, K. Heanue, J. A. Jones, F. J. Swanson, T. Turrentine, T. C. Winter. 2003. Road ecology: Science and solutions. Island Press, Washington, D.C.

Klemens, M.W. 1990. The herpetofauna of southwestern New England. Ph.D. dissertation, University of Kent, Canterbury, UK.

Klemens, M.W. 1993. Amphibians and reptiles of Connecticut and adjacent regions. State Geological and Natural History Survey of Connecticut, Bulletin 112.

Klemens, M.W. 2000. Amphibians and reptiles in Connecticut: A checklist with notes on conservation, status, identification, and distribution. Connecticut Department of Environmental Protection, Bulletin 32.

Klemens, M. W. 2001. Bog turtle (*Clemmys muhlenbergii*), northern population, recovery plan. U.S. Department of the Interior, Fish and Wildlife Service, Hadley, Massachusetts.

Klemens, M. W., M. F. Shansky and H. J. Gruner. 2006. From planning to action: Biodiversity conservation in Connecticut towns. MCA Technical Paper No. 10, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

LaBruna, D. T., M. W. Klemens, J. D. Avery and K. J. Ryan. 2006. Pocantico Hills biodiversity plan, Rockefeller State Park Preserve and associated private lands: A public-private land stewardship initiative. MCA Technical Paper No. 12, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Miller, N. A., M. W. Klemens, and J. E. Schmitz. 2005. Southern Wallkill biodiversity plan: Balancing development and the environment in the Hudson River Estuary Watershed. MCA Technical Paper No. 8, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York.

Mitchell, J. C., and M. W. Klemens. 2000. Primary and secondary effects of habitat alteration. Pages 5-32 in M. W. Klemens, editor. Turtle Conservation. Smithsonian Institution Press, Washington, D.C.

Morse, R. A. and N. W. Calderone. 2000. The value of honey bees as pollinators of U. S. crops in 2000. Bee Culture 128:1-15.

Shawangunk Mountains Scenic Byway Steering Committee, 2005. Shawangunk Mountains scenic byway: Corridor management plan.

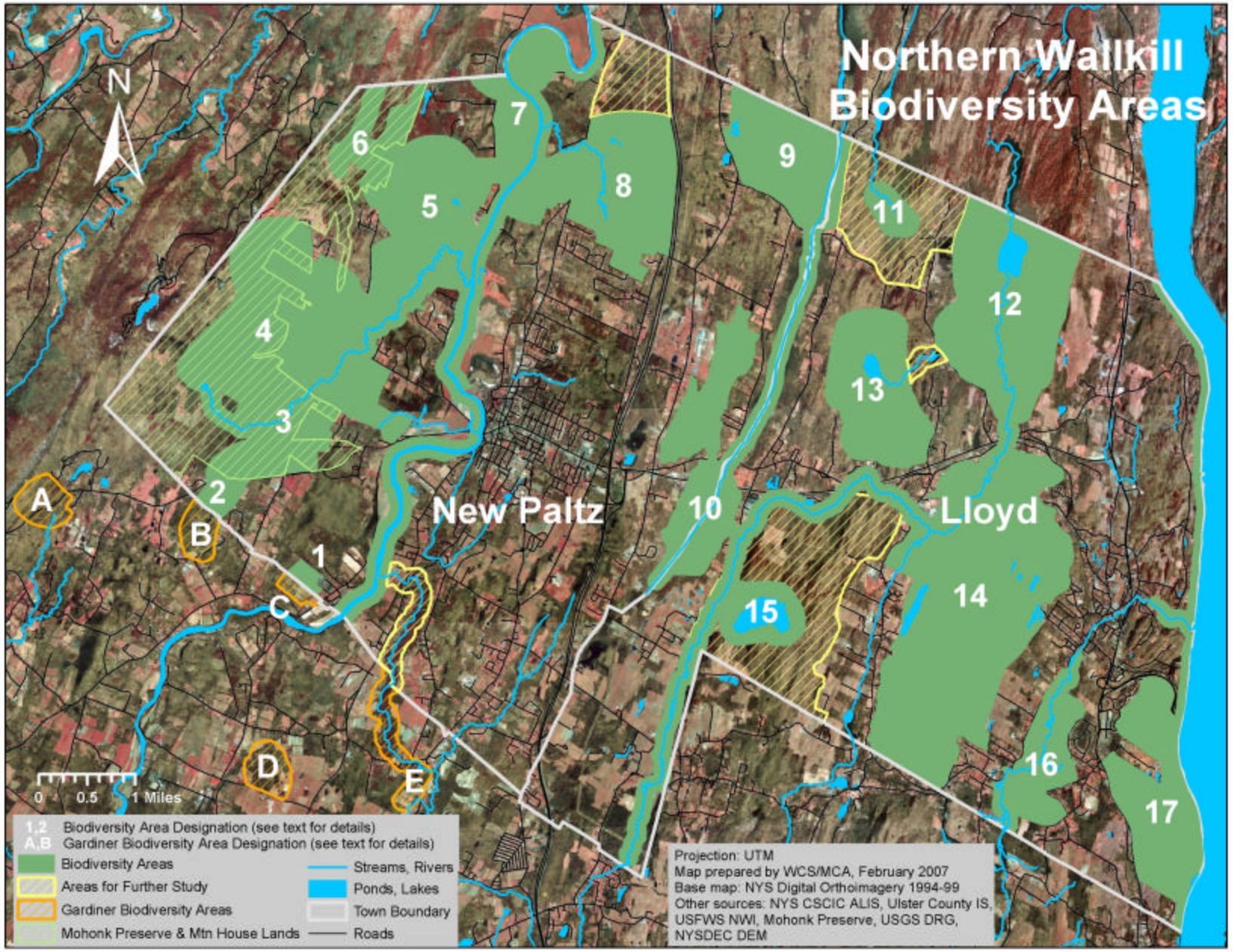
Smith, R. D., A. Ammann, C. Bartoldus, and M.M. Brinson. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Army Corps of Engineers. Washington, D.C.

Town of Lloyd. 23 Aug 1976. Code of the Town of Lloyd, New York, chapter 62: Freshwater wetlands. General code. Available from http://www.e-codes.generalcode.com/codebook_frameset.asp?t=tc&p=0645%2D001%2Ehtm&cn=3&n=[1][2]. (Accessed 6 Dec 2006).

Town of Lloyd Comprehensive Plan Study Committee. 2005. A comprehensive plan for the Town of Lloyd. (PDF downloaded 28 Nov 2006 from http://www.townoflloyd.com/pages/Master_Plan.php).

Town of New Paltz. 15 Sept 2005. Code of the Town of New Paltz, New York, chapter 139: Wetlands and watercourses. General code. Available from http://www.e-codes.generalcode.com/codebook_frameset.asp?t=tc&p=1058%2D139%2Ehtm&cn=491&n=[1][111]. (Accessed 29 Nov 2006).

Appendix A


Northern Wallkill
Biodiversity Areas
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1,2 Biodiversity Area Designation (see text for details)
A,B Gardiner Biodiversity Area Designation (see text for details)
Biodiversity Areas
Areas for Further Study
Gardiner Biodiversity Areas
Mohonk Preserve & Mtn House Lands
Streams, Rivers
Ponds, Lakes
Town Boundary
Roads
Projection: UTM
Map prepared by WCS/MCA, February 2007
Base map: NYS Digital Orthoimagery 1994-99
Other sources: NYS CSCIC ALIS, Ulster County IS, USFWS NWI, Mohonk Preserve, USGS DRG, NYSDEC DEM

Appendix B
Focal Species of the Northern Wallkill Region
Development-Associated Focal Species

Amphibians	
Northern two-lined salamander	*Eurycea bislineata*
Redback salamander	*Plethodon cinereus*
American toad	*Bufo americanus*
Northern spring peeper	*Pseudacris crucifer*
Bullfrog	*Rana catesbeiana*
Green frog	*Rana clamitans*
Reptiles	
Common snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta species*
Northern water snake	*Nerodia sipedon*
Northern brown snake	*Storeria d. dekayi**
Eastern garter snake	*Thamnophis s. sirtalis*
Birds	
Canada goose	*Branta canadensis*
Mute swan	*Cygnus olor*
Cattle egret	*Bubulcus ibis*
Killdeer	*Charadrius vociferus*
Rock dove	*Columba livia*
Blue jay	*Cyanocitta cristata*
American crow	*Corvus brachyrhynchos*
European starling	*Sturnus vulgaris*
Brown-headed cowbird	*Molothrus ater*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
Northern mockingbird	*Mimus polyglottos*
House wren	*Troglodytes aedon*

This species from NYS DEC data only; all others recorded by MCA only or by both MCA and NYS DEC.

Appendix B (continued)
Focal Species of the Northern Wallkill Region
Development-Sensitive Focal Species

		Federal Status	State Status	WCS/MCA Development-Sensitivity Level	Grassland Dependent
Amphibians					
Jefferson salamander complex	*Ambystoma jeffersonianum complex*†		SC	HDS	
Spotted salamander	*Ambystoma maculatum*			LDS	
Marbled salamander	*Ambystoma opacum*		SC	MDS	
Northern dusky salamander	*Desmognathus fuscus*			LDS	
Mountain dusky salamander	*Desmognathus ochrophaeus*			LDS	
Northern spring salamander	*Gyrinophilus porphyriticus*			HDS	
Northern slimy salamander	*Plethodon glutinosus*			LDS	
Northern red salamander	*Pseudotriton ruber*			MDS	
Northern cricket frog	*Acris crepitans*		E	HDS	
Gray treefrog	*Hyla versicolor*			LDS	
Wood frog	*Rana sylvatica*			LDS	
Reptiles					
Spotted turtle	*Clemmys guttata*		SC	HDS	X
Wood turtle	*Clemmys insculpta*		SC	HDS	
Bog turtle	*Clemmys muhlenbergii**	T	E	HDS	X
Eastern box turtle	*Terrapene carolina*		SC	MDS	
Northern five-lined skink	*Eumeces fasciatus**			HDS	
Northern black racer	*Coluber c. constrictor*			MDS	
Black rat snake	*Elaphe obsoleta*			LDS	
Eastern ribbon snake	*Thamnophis s. sauritus*			HDS	X
Northern copperhead	*Agkistrodon contortrix mokasen**			HDS	
Timber rattlesnake	*Crotalus horridus**		T	HDS	

Appendix B (continued)
Focal Species of the Northern Wallkill Region
Development-Sensitive Focal Species

		Federal Status	State Status	Audubon Watchlist Status	WCS/MCA Development-Sensitivity Level	Grassland Dependent
Birds						
Pied-billed grebe	*Podilymbus podiceps*		T		MDS	
American black duck	*Anas rubripes*			D	MDS	
Wood duck	*Aix sponsa*				MDS	
American bittern	*Botaurus lentiginosus*		SC		HDS	
Least bittern	*Ixobrychus exilis*		T		HDS	
Green heron	*Butorides virescens*				LDS	
Virginia rail	*Rallus limicola*				MDS	
Common moorhen	*Gallinula chloropus*				LDS	
American woodcock	*Scolopax minor*			D	MDS	
Spotted sandpiper	*Actitis macularia*				MDS	
Sharp-shinned hawk	*Accipiter striatus*		SC		MDS	
Cooper's hawk	*Accipiter cooperii*		SC		MDS	
Red-shouldered hawk	*Buteo lineatus*		SC		HDS	
Broad-winged hawk	*Buteo platypterus*				MDS	
Peregrine falcon	*Falco peregrinus*		E		LDS	
American kestrel	*Falco sparverius*				MDS	
Barred owl	*Strix varia*				MDS	
Yellow-billed cuckoo	*Coccyzus americanus*				MDS	
Black-billed cuckoo	*Coccyzus erythropthalmus*				HDS	
Pileated woodpecker	*Dryocopus pileatus*				HDS	
Northern flicker	*Colaptes auratus*				LDS	
Eastern kingbird	*Tyrannus tyrannus*				MDS	X
Great crested flycatcher	*Myiarchus crinitus*				MDS	
Least flycatcher	*Empidonax minimus*				LDS	
Eastern wood-pewee	*Contopus virens*				MDS	
Willow flycatcher	*Empidonax traillii*			D	HDS	
Alder flycatcher	*Empidonax alnorum*				HDS	

Appendix B (continued)
Focal Species of the Northern Wallkill Region
Development-Sensitive Focal Species

		Federal Status	State Status	Audubon Watchlist Status	WCS/MCA Development-Sensitivity Level	Grassland Dependent
Birds (continued)						
Common raven	*Corvus corax*				MDS	
Bobolink	*Dolichonyx oryzivorus*				HDS	X
Eastern meadowlark	*Sturnella magna*				MDS	X
Orchard oriole	*Icterus spurius*				MDS	
Baltimore oriole	*Icterus galbula*				LDS	
Vesper sparrow	*Pooecetes gramineus*		SC		MDS	X
Savannah sparrow	*Passerculus sandwichensis*				MDS	X
Field sparrow	*Spizella pusilla*				MDS	X
Swamp sparrow	*Melospiza georgiana*				MDS	
Eastern towhee	*Pipilo erythrophthalmus*				LDS	
Rose-breasted grosbeak	*Pheucticus ludovicianus*				MDS	
Indigo bunting	*Passerina cyanea*				LDS	
Scarlet tanager	*Piranga olivacea*				HDS	
Tree swallow	*Tachycineta bicolor*				MDS	
Bank swallow	*Riparia riparia*				MDS	
Red-eyed vireo	*Vireo olivaceus*				LDS	
Warbling vireo	*Vireo gilvus*				MDS	
Yellow-throated vireo	*Vireo flavifrons*				MDS	
Blue-headed vireo	*Vireo solitarius*				MDS	
White-eyed vireo	*Vireo griseus*				MDS	
Black-and-white warbler	*Mniotilta varia*				LDS	
Worm-eating warbler	*Helmitheros vermivorum*			D	HDS	
Blue-winged warbler	*Vermivora pinus*			D	MDS	
Northern parula	*Parula americana*				MDS	
Black-throated blue warbler	*Dendroica caerulescens*				HDS	
Magnolia warbler	*Dendroica magnolia*				HDS	
Chestnut-sided warbler	*Dendroica pensylvanica*				MDS	

Appendix B (continued)
Focal Species of the Northern Wallkill Region
Development-Sensitive Focal Species

		Federal Status	State Status	Audubon Watchlist Status	WCS/MCA Development-Sensitivity Level	Grassland Dependent
Birds (continued)						
Blackburnian warbler	*Dendroica fusca*				HDS	
Black-throated green warbler	*Dendroica virens*				MDS	
Prairie warbler	*Dendroica discolor*			D	MDS	
Ovenbird	*Seiurus aurocapilla*				MDS	
Northern waterthrush	*Seiurus noveboracensis*				HDS	
Louisiana waterthrush	*Seiurus motacilla*				HDS	
Yellow-breasted chat	*Icteria virens*		SC		HDS	
Hooded warbler	*Wilsonia citrina*				HDS	
Canada warbler	*Wilsonia canadensis*			D	HDS	
American redstart	*Setophaga ruticilla*				MDS	
Brown thrasher	*Toxostoma rufum*				MDS	
Winter wren	*Troglodytes troglodytes*				MDS	
Marsh wren	*Cistothorus palustris*				MDS	
Blue-gray gnatcatcher	*Polioptila caerulea*				LDS	
Wood thrush	*Hylocichla mustelina*			D	MDS	
Veery	*Catharus fuscescens*				MDS	
Swainson's thrush	*Catharus ustulatus*				MDS	
Eastern bluebird	*Sialia sialis*				MDS	

Federal and State Status: E=Endangered, T=Threatened, SC=Special Concern
Audubon Watchlist Status: D=Declining
WCS/MCA Development-Sensitivity Level: LDS=Low Development-Sensitivity, MDS=Medium Development-Sensitivity, HDS= High Development-Sensitivity
[†]*Includes hybrids of this species with blue spotted salamander (Ambystoma laterale). The single Ambystoma laterale record from NYS DEC data is questionable and most likely a juvenile Ambystoma jeffersonianum complex as the closest confirmed Ambystoma laterale are in Green County and the Stewart Airport vicinity in Orange County.*
***This species from NYS DEC data only; all others recorded by MCA only or by both MCA and NYS DEC.*

Appendix C
Glossary of Terms

Biodiversity	Short for "biological diversity," this term refers to the diverse forms of life on Earth at all scales of organization, from genes to species to ecosystems.
Built footprint	The area of land that is covered by built structures, including houses, garages, driveways, pools, roads, and other structures.
Conservation	Protection of wildlife and nature that emphasizes human use of nature in a manner that allows other species to continue to exist and allows ecological processes to be maintained (in contrast to "Preservation").
Ecological footprint	The impact on the ecological function of the area surrounding built structures. This is a larger area than the "built footprint" and results from the effects of lighting, sound, fragmentation and other human activities on wildlife habitat.
Ecosystem	Short for "ecological system," this term refers to organisms (plants, animals, fungi, etc.) interacting with their non-living environment (water, soil, light, etc.). Ecosystems can be of any size, from a log to a stand of trees to an entire forest, but this term often refers to large-scale systems such as a "forest ecosystem" or "grassland ecosystem."
Exurban sprawl	Sprawl development that occurs outside of urban and suburban areas, often near national parks, ski resorts, and other vacation destinations.
Fauna	Animal life.
Federally listed	A species that is listed by the U.S. Fish & Wildlife Service as either Endangered or Threatened.
Herpetofauna	A term used to refer to reptiles and amphibians collectively.
Preservation	Protection of wildlife and nature that emphasizes limiting or eliminating human use of nature (in contrast to "Conservation").
Riparian	A term that refers to the banks of streams and rivers. Riparian habitats are important in that they tend to be biodiverse, biologically productive, and serve as dispersal corridors for wildlife.
Sprawl	Low-density, automobile-dependent development characterized by a dispersed pattern of single-use and low-density uses. Sprawl typically consists of large-lot, single-family homes, office campuses, and strip malls. Sometimes described as "suburban sprawl," "urban sprawl" or "exurban sprawl," sprawl need not be defined by proximity to an urban center but by type of development, regardless of where it occurs.
State listed	A species that is listed by New York State Department of Environmental Conservation as Endangered, Threatened, or Special Concern.
Succession	The process by which a disturbed area (such as an old agricultural field or burned forest) progresses through the following ecological stages in sequence: grassland, shrubland, young forest, mature forest.

Appendix D
WCS/MCA Technical Paper Series

To download PDFs or to order hard-copy publications, go to www.wcs.org/mca.

Pocantico Hills Biodiversity Plan, Rockefeller State Park Preserve and Associated Private Lands: A Public-Private Land Stewardship Initiative, WCS/MCA Technical Paper No. 12 The Pocantico Hills Biodiversity Plan is the result of a public-private partnership between WCS/MCA, the New York State Office of Parks, Recreation and Historic Preservation, Rockefeller family members, Friends of the Rockefeller State Park Preserve, and the Rockefeller Brothers Fund. This report provides conservation, management, restoration, and public education recommendations to maintain and increase the wildlife biodiversity on Rockefeller State Park Preserve and surrounding Rockefeller family lands. Includes map highlighting areas of significant biodiversity. Ideas presented apply to any North American suburban park containing temperate ecosystems. By Danielle T. LaBruna, Michael W. Klemens, Julian D. Avery and Kevin J. Ryan, MCA 2006. *$10.00*

The Farmington Valley Biodiversity Project: A Model for Intermunicipal Biodiversity Planning in Connecticut. MCA Technical Paper No. 11 The Farmington Valley Biodiversity project presents a model for Connecticut towns to establish intermunicipal collaborations to prioritize and map areas important for the conservation of regional biological diversity. The model integrates biological data sets with land use and habitat maps utilizing GIS applications. Information produced is designed to be incorporated within each town Plan of Conservation and Development. A community outreach component to promote the awareness of regional biodiversity is also included. By Henry J. Gruner, Michael W. Klemens, and Alexander Persons. MCA 2006. *PDF available on www.wcs.org/mca.*

From Planning to Action: Biodiversity Conservation in Connecticut Towns, WCS/MCA Technical Paper No. 10 To counteract sprawl development and protect biodiversity, local land use decision-makers need three items: the scientific information to identify problems, the technical solutions to those problems, and the legal authority to implement those solutions. This resource provides guidance on all three. The twelve primary challenges facing land use decision-makers identified in this publication arose out of the authors' collective experience working with municipal officials, and is a practical guide to making ecologically- and legally-informed development decisions. Although this report focuses on towns in Connecticut, the guidance here applies to other "home-rule" states such as New York. By Michael W. Klemens, Marjorie F. Shansky and Henry J. Gruner, MCA 2006. *$10.00*

Biodiversity Planning through Local Land Use Planning: An Assessment of Needs and Opportunities in the New Jersey Townships of Chester, Lebanon, and Washington, WCS/MCA Technical Paper No. 9 Biodiversity Planning through Local Land Use Planning is an assessment of needs and opportunities for New Jersey townships (in particular, Chester, Lebanon and Washington). This assessment is intended to serve as a foundation for adopting and adapting the Biotic Corridor approach which employs wildlife surveys as a baseline layer in the planning process and informs policy and land use decision-making. By Nicholas A. Miller, Michael W. Klemens and Jennifer E. Schmitz, MCA 2005. *PDF available on www.wcs.org/mca.*

Southern Wallkill Biodiversity Plan: Balancing Development and the Environment in the Hudson River Estuary Watershed, WCS/MCA Technical Paper No. 8 The Southern Wallkill Biodiversity Plan emerged from a partnership between WCS/MCA, the NYS DEC Hudson River Estuary Program, and the towns of Chester, Goshen and Warwick, including villages and hamlets within these towns. This report provides policy and planning recommendations to support the establishment of a regional, multi-town approach to the conservation of wildlife and habitats. It includes a map highlighting priority areas for conservation efforts across the three towns. By Nicholas A. Miller, Michael W. Klemens and Jennifer E. Schmitz, MCA 2005. *$8.00*

Croton-to-Highlands Biodiversity Plan: Balancing Development and the Environment in the Hudson River Estuary Catchment, **WCS/MCA Technical Paper No. 7** The Croton-to-Highlands Biodiversity Plan was developed out of a partnership between WCS/MCA and the four contiguous New York towns of Cortlandt, New Castle, Putnam Valley, and Yorktown. The report provides policy and planning recommendations to support a multi-town approach to conserve wildlife and habitats and includes a map highlighting priority areas for conservation. By Nick Miller and Michael W. Klemens, MCA, 2004. *PDF available on www.wcs.org/mca.*

Habitat Management Guidelines for Vernal Pool Wildlife, WCS/MCA Technical Paper No. 6 This document provides habitat management guidelines for maintaining vernal pool biodiversity in forested landscapes, especially in the commercially-harvested forests of northern New York and New England. By Aram J. K. Calhoun and Phillip deMaynadier, MCA, 2004. *$8.00*

Best Development Practices: Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States, WCS/MCA Technical Paper No. 5 This paper contains techniques to guide local and state 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 exemplary pools worthy of protection efforts, and develop strategies to protect them. By Aram J. K. Calhoun and Michael W. Klemens, MCA, 2002. *$10.00*

Eastern Westchester Biotic Corridor: Bedford Addendum, WCS/MCA Technical Paper No. 4-A The research conducted for this volume, an addendum to the original Eastern Westchester Biotic Corridor report, extends the biotic corridor discovered in the original EWBC towns to the neighboring town of Bedford, New York. Map of Bedford's extensions to the biotic corridor are included. By Danielle T. LaBruna and Michael W. Klemens, MCA, 2007. *PDF available on www.wcs.org/mca.*

Eastern Westchester Biotic Corridor, WCS/MCA Technical Paper No. 4 The Eastern Westchester Biotic Corridor (EWBC) is a partnership between MCA and the three contiguous New York towns of North Salem, Lewisboro, and Pound Ridge. This report provides science-based information and tools to support a regional, multi-town approach to conserve wildlife and habitats. By Nick Miller and Michael W. Klemens, MCA, 2002. *PDF available on www.wcs.org/mca.*

Conservation Area Overlay District: A Model Local Law, WCS/MCA Technical Paper No. 3 This document provides an innovative tool for improved land use planning—a model ordinance that can be adopted by municipalities to delineate a conservation area overlay district. The ordinance seeks to reduce habitat fragmentation, maintain biodiversity, and protect significant natural features across ecologically sensitive areas. It is based upon New York State law, but can be adapted for use in other states that have strong home rule authority. Prepared for MCA by Pace University, 2002. *PDF available on www.wcs.org/mca.*

Open Land Acquisition: Local Financing Techniques Under New York State Law, WCS/MCA Technical Paper No. 2 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) and to decide which of several potential funding mechanisms would be most appropriate. Prepared for MCA by Pace University, 2000. *PDF available on www.wcs.org/mca.*

A Tri-State Comparative Analysis of Local Land Use Authority: NY, NJ, & CT, WCS/MCA Technical Paper No. 1 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 intermunicipal basis. The document 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 environmentally-sound development patterns. Prepared for MCA by Pace University, 1999**.** *PDF available on www.wcs.org/mca.*

The Metropolitan Conservation Alliance, a program of the Bronx Zoo-based Wildlife Conservation Society, conserves wildlife and habitats in the tri-state New York City metropolitan region. Rare species and healthy ecosystems abound within a mere 50 to 100 miles of Manhattan, but the ever-expanding suburbs radiating outward from the city threaten these resources. WCS/MCA has developed a unique approach to conservation in this context of sprawl, one that bridges the gap between science and land use practice. We translate biological data and conservation concepts into planning tools, creating a new land use planning paradigm for local decision-makers that influences the location, extent, and impact of development. Through our Technical Paper Series, we disseminate these planning tools to our partners and the public. Our goal is to help safeguard our region's biodiversity while respecting the rights of the region's communities to prosper.