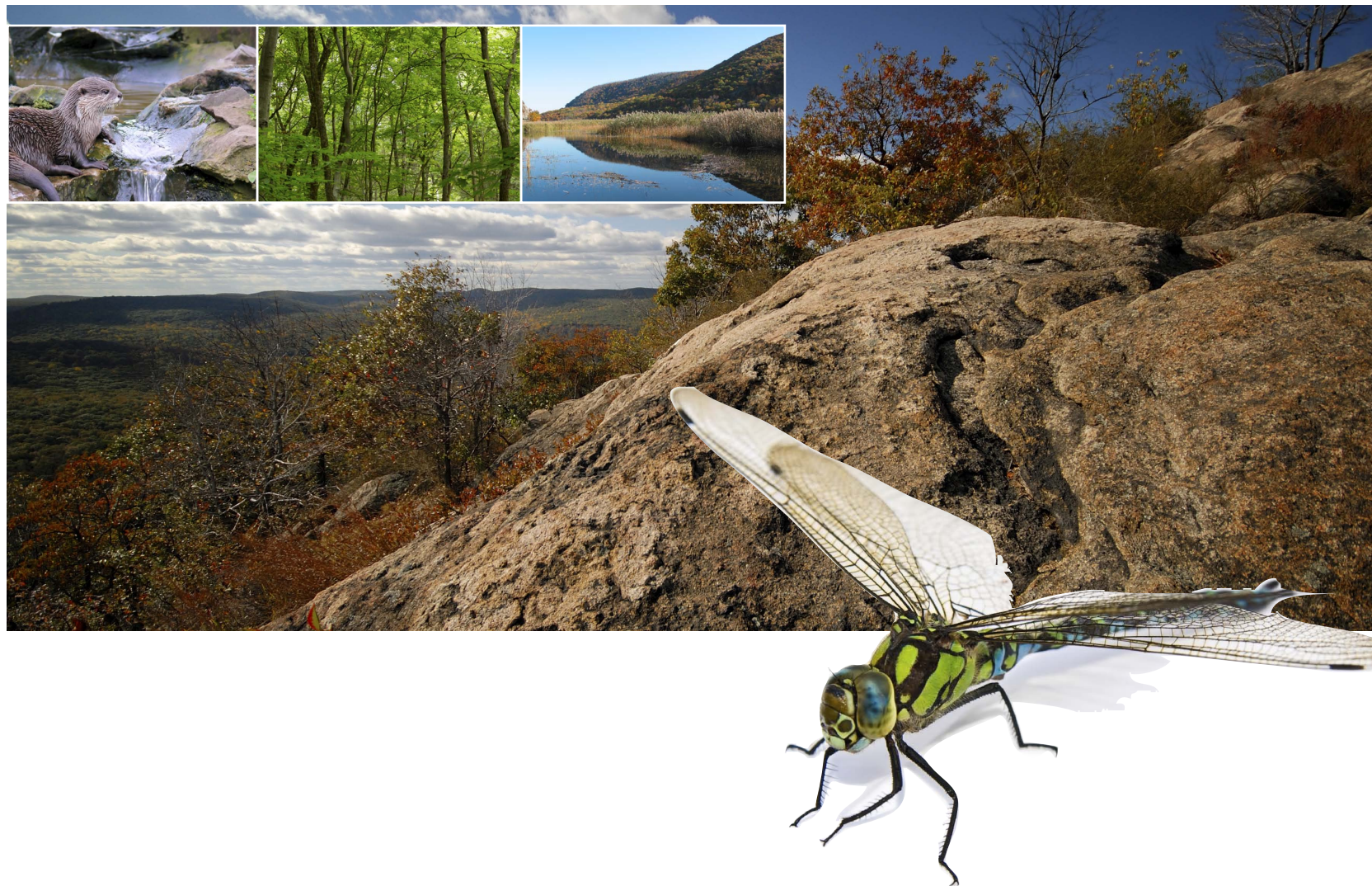


Conserving Natural Areas and Wildlife in Your Community:

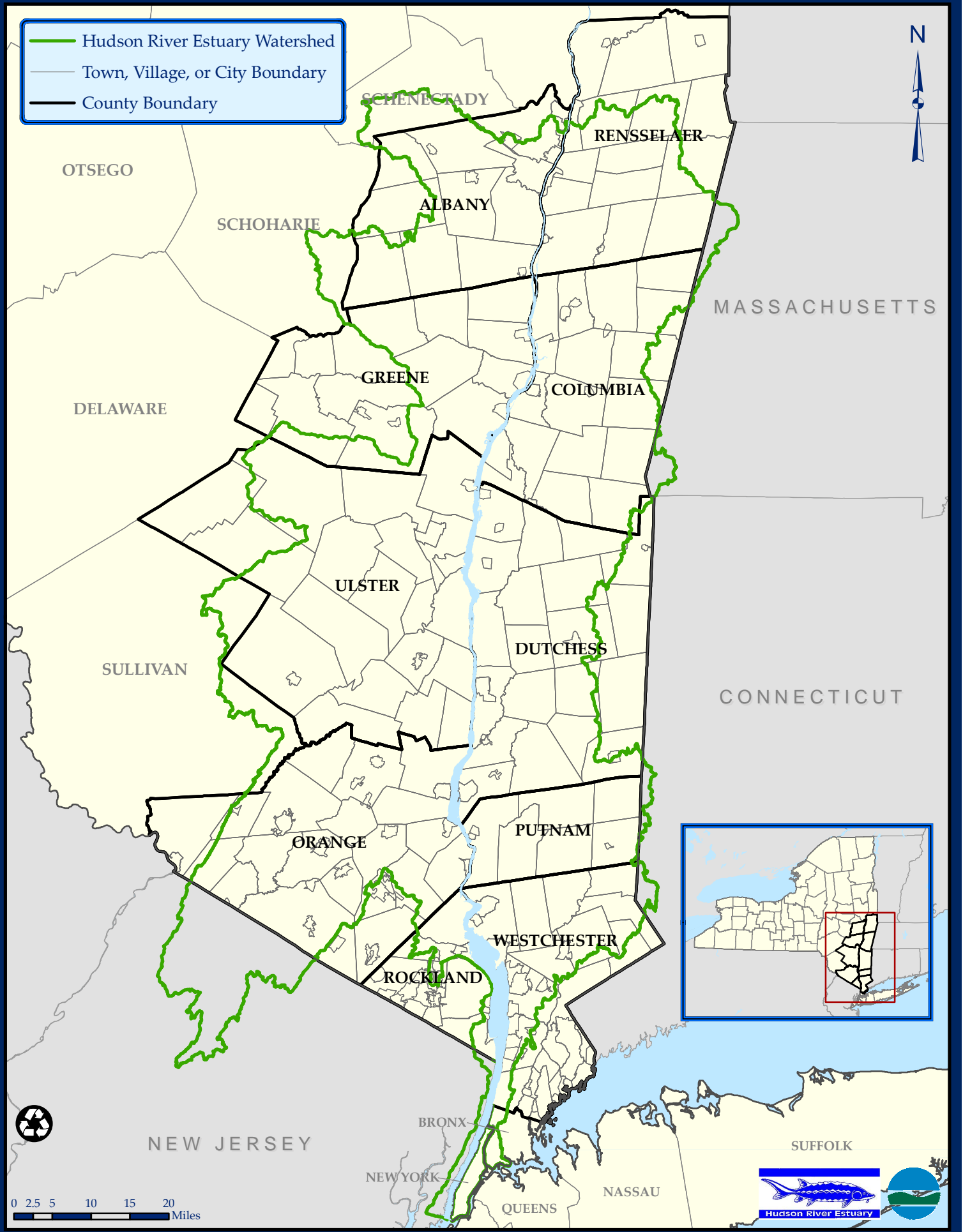
Smart Growth Strategies for Protecting the Biological Diversity
of New York's Hudson River Valley



New York State Department of Environmental Conservation



New York State Municipalities in the Hudson River Estuary Watershed



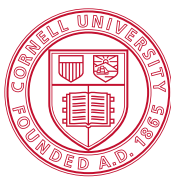


Conserving Natural Areas and Wildlife in Your Community:

Smart Growth Strategies for Protecting the
Biological Diversity of New York's Hudson River Valley

2008

Karen Strong, New York Cooperative Fish and Wildlife
Research Unit at Cornell University for New York State
Department of Environmental Conservation's
Hudson River Estuary Program



Cornell University



New York State Department of Environmental Conservation

The NYSDEC provided support to the New York Cooperative Fish and Wildlife Research Unit at Cornell University for the development of this handbook, which implements the 2005 Hudson River Estuary Action Agenda. The Hudson River Estuary Program is a unique regional partnership leading the restoration of the Hudson through implementation of the Hudson River Estuary Action Agenda. Founded on the principles of ecosystem management and implemented in ways that support the quality of life so valued by Hudson Valley residents, the mission of the program is to conserve the natural resources for which the Hudson is legendary, promote full public use and enjoyment of the river, and clean up the pollution that affects our ability to use and enjoy it. For more information, visit www.dec.ny.gov.

For additional copies, contact:

*New York State Department of Environmental Conservation
Hudson River Estuary Program
21 South Putt Corners Road
New Paltz, NY 12561-1696
hrep@gw.dec.state.ny.us*

Library of Congress Control Number: 2008931017

Recommended Citation:

Strong, K. 2008. Conserving Natural Areas and Wildlife in Your Community: Smart Growth Strategies for Protecting the Biological Diversity of New York's Hudson River Valley. New York Cooperative Fish and Wildlife Research Unit, Cornell University, and New York State Department of Environmental Conservation, Hudson River Estuary Program. Ithaca, N.Y.

Cover photography: Iona Island Marsh by S. Stanne, all others: IstockPhoto

Map by Clare Dunn

Illustrations by Kathleen Comfort-Hamilton

Graphics by Jim Houghton



Printed on recycled paper.

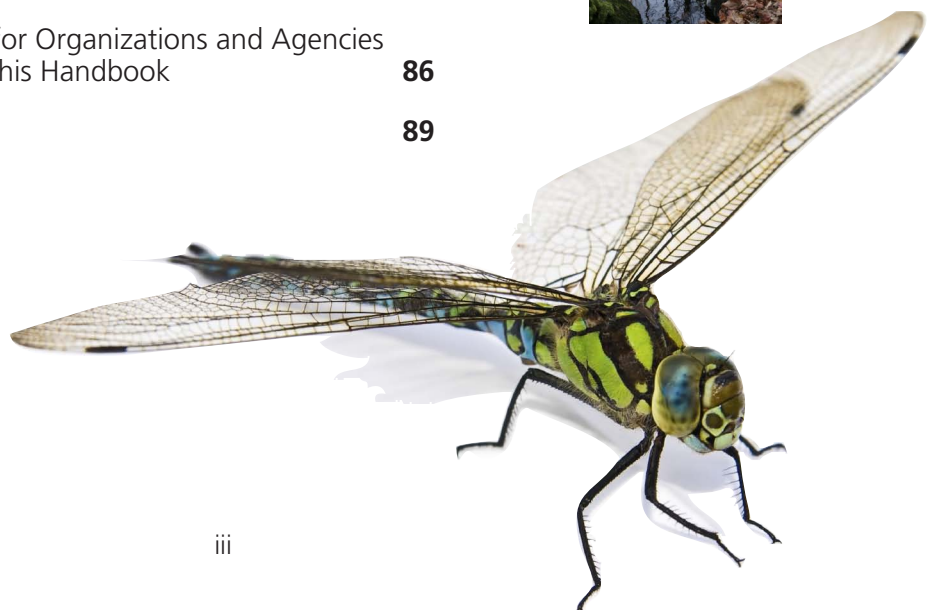
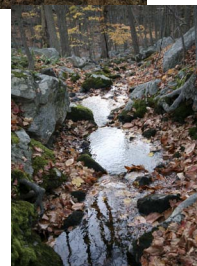
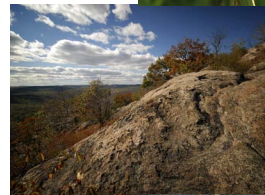
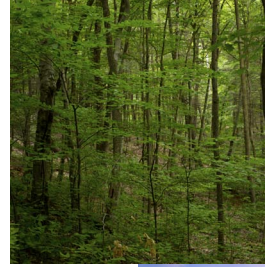
Produced by the Office of Publications and Marketing at Cornell University.

Cornell University is an equal-opportunity, affirmative-action educator and employer.

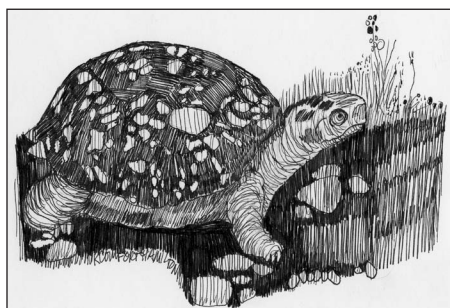
11/08 600 FLP 080243

Contents

Foreword	iv
Preface and Acknowledgements	iv
Chapter 1. Introduction	1
Chapter 2. How To Use This Handbook	7
Chapter 3. Natural Areas and Wildlife Habitat of the Hudson Valley	11
Chapter 4. Natural Area and Wildlife Inventory	19
Chapter 5. How to Conserve Habitats	25
Chapter 6. Public Outreach and Education	39
Chapter 7. Building Support for Conservation: Public Participation	45
Chapter 8. Comprehensive Land-Use Planning	49
Chapter 9. Zoning and Project Review	55
Chapter 10. Stormwater Management for People and Wildlife	61
Chapter 11. Local Open Space Planning and Conservation	67
Chapter 12. Intermunicipal Approaches	71
Chapter 13. Natural Landscaping	75
Sources Cited	79
Appendices	
1. Glossary	82
2. Additional Habitat Information	85
3. Contacts for Organizations and Agencies Listed in This Handbook	86
Index	89



Foreword



Home of the turtles?
Land of the dragonflies?
Animal migration
highway? The Hudson
Valley is known for
many things—scenery,
history, and art to name
a few—but the land that
feeds the Hudson River
Estuary also harbors a
remarkable diversity

of plants, animals, and habitats that contributes to the region's well-being, quality of life, and economy.

This handbook was designed for local governments that want to use their local home-rule authority to conserve the Hudson Valley's natural heritage. Local governments often rely on state agencies and nonprofit conservation groups to conserve this diversity of natural areas and wildlife. But regulatory and acquisition programs address only a few of the valuable natural assets in a community. Municipalities have at their disposal many tools that complement and augment the efforts of other agencies to conserve a wide variety of beneficial natural areas and wildlife which would otherwise go unprotected. This handbook encourages

municipalities to develop strategies for protecting nature by stressing the importance of nature conservation to human communities, indicating sources of information about natural areas and wildlife, outlining the smart growth strategies that can be used to conserve natural assets, and giving examples of how some Hudson Valley municipalities are conserving their resources.

This handbook was created for the Hudson River Estuary Biodiversity Outreach Program, which began in 2001 as a partnership between the New York State Department of Environmental Conservation (NYSDEC) and Cornell University. Regardless of experience, knowledge, or expertise, all Hudson Valley municipalities can receive assistance in conserving their plants, animals, and habitats. This program is entirely voluntary and available to any town, village, or city in the Hudson River Valley.

Although this handbook focuses on the Hudson River Valley, the tools and techniques it describes are applicable across New York State and any state in the country where land-use planning decisions are made by towns, cities, or villages. Please note that for use outside New York State, specific laws regarding land use and planning should be consulted.

Preface and Acknowledgements

The concept of this handbook came from *Protecting Nature in Your Community: A Guidebook for Preserving and Enhancing Biodiversity* by Jason Navota and Dennis Dreher of the Northeastern Illinois Planning Commission (NIPC). In the spirit of conservation, the authors and NIPC graciously gave me permission to use the model and the text of their local government handbook, for which I sincerely thank them. Chapters 8, 9, 10, and 13 are based on the NIPC document and borrow language from that text. The text has been extensively rewritten in Chapters 1, 6, and 11. Chapters 2, 3, 4, 5, 7, and 12 are original to the present handbook. *Protecting Nature in Your Community: A Guidebook for Preserving and Enhancing Biodiversity* is available online at www.nipc.org/environment/sustainable/.

Special thanks go to Ted Kerpez, Region 3 Wildlife Manager for the New York State Department of Environmental Conservation; Biodiversity Project Manager Frances Dunwell, Director of the Hudson River Estuary Program for Department of Environmental Conservation; and Milo Richmond, Unit Leader and Associate Professor, New York Cooperative Fish and Wildlife Research Unit at Cornell University. All three provided support, guidance, and many suggestions over the years of this project that made this handbook possible.

Many other people involved in the development of this handbook provided comments and advice that greatly improved it. The author gratefully acknowledges the feedback and support of the following NYS Department of Environmental Conservation staff members: Betsy Blair, Debra Dunbrook, Bob Ewing, Barbara Kendall, Chuck Nieder, Patricia Riexinger, Jeffery Sama, Francis Sheehan, and Doug Sheppard. Other knowledgeable and talented individuals from a variety of public and private agencies reviewed, edited, provided constructive criticism, and encouraged me along the way: Beth Campochario, Scott Cuppett, John Clarke, Bob Elliot, Carl Etiner, Simon Gruber, Emilie Hauser, Laura Heady, Rebecca Johnson, David Kvinge, Andrew LaBruzzo, Nicholas Miller, Sean Nolon, Jaime Reppert, Karen Schneller-McDonald, Sarah Shute, Stephen Stanne, Amanda Stein, Nan Stolzenburg, Holly Sullivan, Al Wegener, and Leslie Zucker.

Finally, I'd like to thank Peter Hoover, editor, and Laurie Ray, graphic designer, of Cornell University's Office of Publications and Marketing, for their patience and talents. Their contributions greatly improved this book.

Karen Strong, New York Cooperative Fish and Wildlife Research Unit at Cornell University

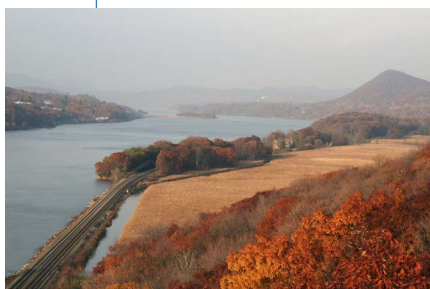
The New York Cooperative Fish and Wildlife Research Unit, located in the Department of Natural Resources at Cornell University, is one of fifty such units nationwide established for the purpose of enhancing the management of this nation's renewable resources. The unit conducts fish and wildlife research throughout the northeastern U.S. and works closely with resource managers and information transfer and education specialists to ensure that the research results are used in practice. For more information, visit www.dnr.cornell.edu. Primary cooperators include the United States Geological Survey, the New York State Department of Environmental Conservation, the United States Fish and Wildlife Service, and the Wildlife Management Institute.

Chapter 1:

Introduction

The Hudson River Valley

The Hudson River Valley and its dramatic vistas, healthy forests, and cool headwater streams have been called the landscape that defined America. Nineteenth-century painters Thomas Cole and Frederic Church, poet Walt Whitman, and early twentieth-century writer John Burroughs translated the beauty



of the river and its shores into art and literature. The unparalleled scenery of the Hudson Valley comes from its remarkable diversity of plants, animals, and natural areas.

The Hudson is a tidal river where salt and fresh water mix to form an estuary with a watershed that comprises four million acres. More than 600,000 acres of protected woodlands, wetlands, grasslands, and streams, about 16 percent of the watershed, provide refuge to thousands of plants and animals, many of them at risk. The remaining 84 percent of the Hudson Valley—privately owned land, including our own backyards—provides essential habitat for fish and wildlife (Smith et al. 2001). The total variety of native plants, animals, and habitats in the Hudson Valley is part of what scientists call biodiversity.

While of clear scientific interest and importance, natural areas and wildlife are also valued by the region's residents for aesthetic, recreational, and historical values. The estuary and its diverse watershed of mountains, forests, wetlands, and streams create a rich sense of place that is steeped in human history. Native Americans have lived in the valley for thousands of years. Henry Hudson sailed up the river that bears his name in 1609.

In 1749, Swedish botanist Peter Kalm observed the wonder of the river and the diversity of the coastline (Benson 1937):

“ . . . it seems that some rivers derive their first origin from the creation itself, and that Providence then pointed out their course; for existence can, in all probability, not be owing to the accidental eruption of water alone. Among these rivers we may rank the river Hudson: I was surprised on seeing its course, and the variety of its shores.”

What Is Biodiversity?

Biodiversity is also known as biological diversity. Some people associate the term with endangered species, while others consider it a measure of the number of kinds of animals found within a given area. Both are correct, but each is only part of the concept.

Biodiversity is a natural system of all species—plants, animals, fungi, and microorganisms—the habitats where they live, and the broader landscape. Living organisms interact with the nonliving environment to create the self-sustaining system, which will continue to work and provide beneficial services to human communities as long as its components—the species, habitats, and landscapes—are healthy.

The Hudson River Estuary Action Agenda

The New York State Department of Environmental Conservation's Hudson River Estuary Program seeks to restore and maintain the Hudson's extraordinary natural heritage through programs that conserve natural resources, clean up pollution, and promote public use and enjoyment of the river. One goal of the program is to help communities manage native plants, animals, and habitats in ways that prevent degradation of the Hudson River Estuary ecosystem while supporting human communities. To achieve this goal, the estuary program works with public and private organizations, including dozens of municipalities, conservation groups, universities, and other state agencies.

The estuary program emphasizes public-private partnerships to meet the needs of people as well as natural resource conservation. Recognizing the importance of local decision-makers in conserving the region's natural heritage, the program helps local governments and organizations incorporate biological information into their planning and decision-making. This handbook was created as part of that program to help Hudson Valley communities understand the issues; know their plants, animals, and habitats; and identify tools to conserve natural areas that will work in their communities.

Purpose and Objectives of This Handbook

The first objective of this handbook is to share information with local government agencies about the relevance and importance of natural areas in their communities and throughout the Hudson Valley region. The second is to identify and point municipalities to local tools and techniques that enable protection of important habitats in Hudson Valley communities.

By implementing some of the tools in this handbook, Hudson Valley communities can become models for communities across the country that are seeking to balance growth with conservation.

Nature Is Vital

Tidal shores, lowland wetlands, and upland forests provide shelter to thousands of plant and animal species in the Hudson Valley—creating the scenic vistas, fields of fragrant wildflowers, and songs of migrating birds that can be enjoyed in the region. Healthy habitats sustain human communities as well, contributing to our quality of life, our economy, and our health.

When speaking to your community about natural-resource issues, particularly about natural areas and wildlife, it is important to talk about why it matters. This section covers some of the reasons that local biodiversity is important. Use them as appropriate. See Chapter 6 for more communication tips.

Why Should I Care about Natural Areas and Wildlife?

Diverse natural ecological systems provide a number of beneficial services to human health and our communities.

- Forests, wetlands, and stream corridors work together to keep our water supply clean and abundant.
- Natural areas and open spaces can provide economic benefit through increased tourism and reduced cost of town services.
- Nature keeps your family healthy—by cleaning the air and water, lowering stress, and lessening the risk of disease.
- Plants and animals and the intact natural areas that support them are important parts of community character and local quality of life.
- Protected natural areas and associated wildlife provide vital recreational opportunities.



Keeping Water Clean and Abundant

Wetlands, stream corridors, and forests work together to clean and store our water. If these natural areas are healthy, they clean our water at no cost to us.

That is why New York City was willing to spend \$1 billion on watershed protection rather than spend \$3 to \$8 billion on building a filtration plant. Watershed protection is also the reason New Jersey

helped pay for a New York State Park, contributing \$10 million to the \$55 million purchase of Sterling Forest State Park in 1997. The other option was spending \$100 million on a water-treatment plant. Similarly, in the late nineteenth century, New York State lawmakers had the foresight to create the Adirondack Park, thereby protecting the Hudson's northern watershed. At that time, the lawmakers recognized how important the Hudson River was to commerce in New York; therefore, protecting its watershed was an economic decision.

Quality of Life

For those of us who live here, we know firsthand the high quality of life in the Hudson Valley. Quality of life is one reason this is the fastest growing region in upstate New York. But what makes the Hudson Valley such a great place to live? Perhaps it is scenic beauty. The innumerable scenic vistas throughout the Hudson Valley instill a sense of awe whenever you stop to look. Upon closer inspection, the vistas reveal an incredible diversity of wildlife habitats. Natural areas, whether public or private, also help define community identity by connecting residents to the natural setting in which they live. A recent national survey of homebuyers found that natural open space, walking and bicycle paths, and gardens with native plants were the three most desirable amenities for residential areas (Lerner and Poole 1999). Hiking, hunting, bird-watching, fishing, and photography are enjoyed by many of the region's residents who use natural areas, whether publicly accessible or in their own backyards.

For some, the mere idea of wildlife in our midst is valuable and contributes to our quality of life. Many people feel a moral and ethical imperative to protect wildlife and the diversity of life from the impacts of development. Reasons for this include a desire to protect other species from extinction, moral values associated with cherishing the earth and its inhabitants, and the desire to leave for future generations that which we are able to enjoy.

“If I were to name the three most precious resources of life, I should say books, friends, and nature; and the greatest of these, at least the most constant and always at hand, is nature. Nature we have always with us, an inexhaustible store-house of that which moves the heart, appeals to the mind and fires the imagination—health to the body, a stimulus to the intellect, and joy to the soul.”

(Burroughs 1908)

Economics

Natural habitats and wildlife benefit the economy by attracting both visitors and residents who patronize local businesses. Throughout New York, the economic value of wildlife-related recreation, including trip and equipment costs for hunting, fishing, and wildlife observation was about \$3.5 billion in 2001 (U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce 2003). The total value of New York’s forest economy is \$8.8 billion, including fall foliage viewing, timber harvesting, and the paper and furniture industries (North East State Foresters Association 2007).

For the Shawangunk Mountains alone, 500,000 annual visitors contribute more than \$10 million in revenue to local restaurants, hotels, and other area businesses (Kerlinger 1996). Fourteen million people visit the New York/New Jersey Highlands Region each year (Phelps and Hoppe 2002). The Hudson Valley’s natural open spaces make the region an attractive place to live and work, and enhance the economic and development value of the region.

“Natural areas, parks, and open space create a high quality of life that attracts tax-paying businesses and residents to communities.”

(Lerner and Poole 1999)

Keeping open spaces open may also have more favorable property tax impacts than once thought. Studies of the cost of community services from the Hudson Valley have shown that open space and commercial development cost towns and school districts less in services than they pay in taxes, while single-family detached housing costs towns and school districts more in services than it pays (Freegood 2002). These results

Table 1-1. Cost of Community Services Studies in the Hudson Valley

Revenue-to-expenditure ratios are expressed in dollars. The table compares how much residential, commercial, and open space cost the town in services for every dollar in taxes received. (Amenia, Beekman, Fishkill, and Northeast data extracted from Freegood 2002).

community	residential, including farm houses	commercial and industrial	working and open land	source
Amenia	1 : 1.23*	1 : 0.25	1 : 0.17	Bucknall 1989
Beekman	1 : 1.12	1 : 0.18	1 : 0.48	American Farmland Trust and Cornell Cooperative Extension 1989
Coxsackie (town)	1 : 1.21	1 : 0.29	1 : 0.30	River Street Planning and Development 2007
Coxsackie (village)	1 : 1.18	1 : 0.47	1 : 0.38	River Street Planning and Development 2007
Fishkill	1 : 1.23	1 : 0.31	1 : 0.74	Bucknall 1989
Northeast	1 : 1.36	1 : 0.29	1 : 0.21	American Farmland Trust and Cornell Cooperative Extension 1989
Red Hook	1 : 1.11	1 : 0.20	1 : 0.22	Bucknall 1989

*This means that in 1989, residential development cost Amenia and its school district \$1.23 in services for every tax dollar received, whereas commercial development cost \$0.25 and open space cost only \$0.17.

counter the notion that all new development will reduce the tax burden of residents. It is important to note that studies of the cost of community services look at current and past land use and tax revenue that may not apply to the future. Local tax burden can shift based on a variety of factors, including the mix of development and state aid. Fiscal impact analysis looks toward the future, projecting the tax rates for different growth scenarios over time. A fiscal-impact analysis is based on assumptions including population change, future costs, and local investment in open space. Neither type of study can predict the future, but they may be useful in showing how open space conservation can affect local taxes. The results of several Hudson Valley studies of the cost of community services are shown in Table 1-1. Though study results have been generally consistent across the country, a local study may be required to determine how open space affects taxes in your community. Note that these studies generally exclude economic factors beyond property tax rates, such as tourism, job creation, sales tax revenue, and increased property values.

Ensuring the Health of Your Family

Healthy habitats, and growth that allows those habitats to stay healthy, lead to healthy human communities. Studies have shown that natural areas reduce stress in children and that car-dependent sprawl is contributing to our nation's obesity problem. But did you know that biodiversity helps to keep Lyme disease at bay? Researchers at the Cary Institute of Ecosystem Studies in Dutchess County have found a connection between healthy forests and Lyme disease in people (Allen et al. 2003; LoGiudice et al. 2003; Ostfeld and Keesing 2000; Ostfeld and LoGiudice 2003). When forests have greater small mammal diversity, there tends to be less Lyme disease in humans. When black-legged ticks hatch, they are not carrying the microorganism that causes Lyme disease. They get it from feeding on a mammal host, usually the white-footed mouse. Other small animal species aren't as likely to carry the microbe, and therefore are not as likely to pass it on to ticks. Where there are fewer white-footed mice, chances are lower that any individual tick has the Lyme disease-causing agent, and is therefore less likely to pass it to people. Larger forests with high small mammal diversity have fewer white-footed mice than fragmented landscapes in suburban areas.



Letting Nature Do the Work

We depend on nature for many things. Healthy, naturally vegetated natural areas—including forests, stream corridors, and wetlands—provide a number of services that are highly beneficial to humans and ecosystems. Some of the key benefits include cleaner air, cleaner water, pollination of our crops, and productive soil. Best of all, these services are provided for free. These services depend on properly functioning ecosystems, which in turn depend on the diversity of the plants, animals, and microorganisms—biodiversity—that make up those ecosystems. If these services are lost, replacing them with human-made substitutes requires the enormous cost of designing, building, maintaining, and improving these services. And no matter how much time and money is spent on them, engineered systems are rarely as efficient as natural ones.

Nature Under Pressure

The greatest threat to Hudson Valley biodiversity today is habitat loss and fragmentation. The direct loss of habitat through clearing and paving is obvious, but the effects of fragmenting natural areas into smaller, isolated patches are more subtle. Fragmentation is a result of land consumptive development, also called sprawl.

A healthy economy and high quality of life in the Hudson Valley have created a rapidly developing region. According to a study by Cornell University, most new housing units in the Hudson Valley are expected to be built outside of traditional population centers (Smith et al. 2004), typically resulting in rural and suburban sprawl. The study also showed that future growth will occur in areas that have high reptile, amphibian, and mammal diversity (Smith et al. 2004). Though building is part of a growing population and economy, most of this new development is using up land much faster than the population is growing. Between 1982 and 1997, the Hudson Valley's human population grew about 9 percent, yet urbanized land increased 29 percent (Pendall 2003). Land consumptive development patterns not only threaten habitats on developed lands, but on conserved lands as well, due to the effects of fragmentation. Sprawl-type development can also disrupt groundwater flow and spread invasive species, adding more stress to the ecosystem. As more healthy habitats are lost, the many benefits natural ecosystems provide may be lost as well. Despite these pressures, it is possible to sustain a healthy

economy and a healthy environment by growing and planning with nature in mind.

The region's biological diversity is also threatened by pollution after centuries of industrial production near the Hudson River. The New York State Department of Environmental Conservation's Hudson River Estuary Program is addressing pollution by supporting several studies and cleanup projects. One of these projects locates sources of pollution to the estuary and New York Harbor. Today, the Hudson's water quality is threatened by urban runoff and outdated sewer systems. To address these problems, New York State has invested \$50 million in upgrading sewage treatment plants, through the estuary program, to improve water quality, which improves recreational access to the Hudson. The Hudson River Estuary Program's Watershed Project is working with local governments to reduce and treat urban runoff.

"The diversity of local conditions [in the Hudson Valley]—climate, terrain, hydrology, and biodiversity—suggests that centralized approaches to environmental protection are not necessarily desirable when dealing with environmental problems. By supporting innovation at the local level, citizens are encouraged to define for themselves what is acceptable in their communities."

(Van Tine 2003)

A Critical Role for Local Governments

State and federal laws alone can not protect all of the region's diversity—nor were they intended to. Many important species and habitats are not protected by these laws. The actions of the Hudson Valley's municipalities are critically important for biological conservation because local governments will decide how 85 percent of the land and water resources in the region will be used. Conserving natural resources while growing is a challenge, but one that can be met as long as communities plan for the conservation of fish, wildlife, and plant habitat, and recreation in addition to growth. Conservation of these resources is compatible with other community goals, including smart growth and quality communities, water resource conservation, open space planning, and farmland protection.

This handbook was designed for local land-use decision-makers who want to make better decisions for natural areas and wildlife. All levels of local government—towns, villages, cities, and counties—have an important role in protecting natural areas and wildlife. Coordination among local governments is critical to achieving conservation goals.

Resources

- Johnson, E. A., and D. Smith. [eds.] 2006. *Legacy: Conserving New York State's Biodiversity*. American Museum of Natural History, New York State Biodiversity Research Institute, New York State Department of Environmental Conservation, New York Natural Heritage Program, and The Nature Conservancy, Albany, N.Y.
- Johnson, E. A., and M. W. Klemens. [eds.] 2005. *Nature in Fragments: The Legacy of Sprawl*. Columbia University Press, N.Y.
- Perlman, D. L., and J. C. Milder. 2005. *Practical Ecology for Planners, Developers, and Citizens*. Island Press, Washington, D.C.

Chapter 2:

How To Use This Handbook



Which natural areas and wildlife are important in my community? Where are they? What does it mean to conserve a natural area or wildlife species? What smart growth strategies can be used and how have those been applied in the Hudson Valley? This chapter explains how to answer these questions for your community by using this handbook. It includes what municipalities need to know to conserve nature locally

and where it is covered in the book.

This handbook is not intended to replace the many other available publications that deal with local environmental protection. Instead, it covers a range of tools that might be used to protect natural areas and wildlife, from which your community may choose. Reading lists in each chapter guide you to other helpful publications that provide more detail on how to implement the tools. The three appendices include a glossary, detailed information on Hudson Valley habitats, and contact information for the organizations listed throughout this handbook.

Chapter Previews

Chapters 3 through 13 cover three broad areas: Natural Area and Wildlife Conservation in the Hudson Valley (Chapters 3 through 5), Engaging the Public (Chapters 6 and 7), and Local Smart Growth Strategies (Chapters 8 through 13).

Because natural areas and wildlife in the Hudson Valley encompass hundreds of habitat types and thousands of species, it can be a little overwhelming to try to plan for them as well as human needs. Furthermore, habitat protection is essential in any plan to conserve natural areas in your municipality and region because each habitat is home to hundreds of species, both common and rare. Therefore, this handbook recommends focusing on the broad habitat types described in the Hudson River Estuary Wildlife and Habitat Conservation Framework (Penhollow et al. 2006).

Chapter 3 outlines six of these habitat types.

Highlights of Chapter 3

- General overview of habitats in the Hudson Valley, including threats and representative plant and animal species;
- The human benefits of conserving those habitat types

Conserving natural areas and wildlife involves identifying resources at least two levels. First, identify and assess resources town-wide to give an overall view of your community's natural assets. An intermunicipal inventory is even better because natural areas and wildlife do not follow municipal boundaries. A completed inventory can help your community direct development away from the most sensitive and valuable natural assets, determine where conservation action will be most beneficial, as well as help create priorities for open space acquisition. The result can be used in a comprehensive plan, open space plan, watershed plan, or other local conservation program. Second, inventory and assess resources at a site-specific scale where new development is proposed, so that valuable natural areas can be protected and connected across property boundaries while growth continues.

Chapter 4 will help communities include natural areas and wildlife in a natural resources inventory. This inventory is the foundation for conserving nature in your community.

Highlights of Chapter 4

- How to find existing information on natural areas and wildlife in your community
- How to get new information on natural areas and wildlife in your community and what is most useful
- How to prioritize natural areas for conservation
- Examples from the Hudson Valley

Identifying important habitats at both townwide and site-specific scales helps you choose the conservation practices that are appropriate for your community. For example, when important forests are identified, towns will know where to maintain or restore forest connections.

Once a municipality has identified its important natural areas and wildlife, its decision-makers need to understand how to conserve those resources.

Chapter 5 will help communities understand the conservation needs of Hudson Valley habitats and the wildlife that use them.

Highlights of Chapter 5

- General conservation principles
- Conservation principles for each major habitat type in the Hudson Valley
- Requirements for habitat conservation, for example, minimum size, buffers from incompatible uses, management needs
- Which habitats are conserved by state or federal programs
- What local governments can do in their land-use decision-making to conserve habitats
- Resource-specific smart growth strategies
- Examples from the Hudson Valley

Public input and support are very important for a successful conservation program. The next two chapters will help municipalities engage the public.

Chapter 6 describes ways that communities can educate residents and visitors about their unique plants, animals, and habitats. Public outreach and education is essential in all conservation efforts because it helps build support for conservation in your community. Any conservation action taken by the community should include some kind of outreach and education.

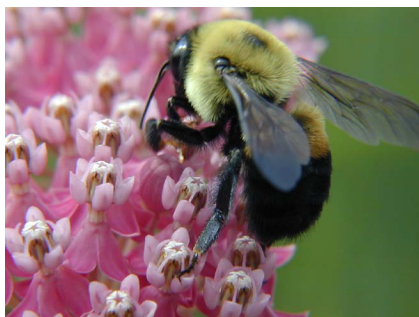
Highlights of Chapter 6

- How municipalities can develop education programs to reach their goals
- Local resources that can help your municipality educate its citizens

Municipalities can use Chapter 7 to help get public input during planning and update the public on progress during implementation. Public participation is important in any planning process. People need to feel heard and sometimes the process of planning (with public input) is as important as the substance.

Highlights of Chapter 7

- Why municipalities should invite public participation
- How municipalities can hold a meeting to encourage public attendance and input
- Examples from the Hudson Valley



There are 250 towns, cities, and villages in the Hudson Valley, and among them one can find communities as different as any in the United States. What will work for a community in Westchester County may not work for one in Greene County. With the valley's diversity in mind, this handbook suggests a variety of strategies to protect resources that span the realm of local planning, regulation, acquisition, and education. Communities may choose the actions that will work best for their resources and communities.

Some of the conservation actions described in this book modify tools that towns already use, like zoning, storm- and wastewater management, and open space planning. Other actions will include new activities. Not all strategies need to be used together to conserve biodiversity, but all tools should address public outreach and education in some way.

Chapters 8–13 describe tools and techniques that municipalities can use to conserve natural areas and wildlife that its citizens value. To determine what habitats and wildlife occur in your community, use Chapter 4.

Chapter 8 discusses ways to include nature in comprehensive plans, and address natural areas and wildlife issues across the entire municipality.

Highlights of Chapter 8

- How to include nature in your comprehensive land-use plan
- How to relate nature to other elements of your plan
- Examples from the Hudson Valley

Chapter 9 describes how zoning, site plans, subdivision regulations, and environmental review can be used to protect natural areas and wildlife. Like the comprehensive plan, these tools are commonly used by Hudson Valley municipalities. They help translate the comprehensive plan from vision to action and define land use in your community. Zoning can be used to think about conserving nature across a municipality, while project review is site-specific. Planning Board members may be particularly interested in the environmental review section, as it describes how planning boards can use their existing State Environmental Quality Review (SEQR) authority to better conserve natural areas and wildlife.

Highlights of Chapter 9

- How setbacks and buffers, cluster development, conservation subdivisions, and biological site assessments can be used to conserve natural areas and wildlife

- Tools that inventory and assess resources at a site scale where new development is proposed
- Examples from the Hudson Valley

Chapter 10 describes low-impact development and stormwater management techniques that can be used to meet the new Phase II standards and have minimal impact on native wildlife.

Highlights of Chapter 10

- The impact of stormwater on natural areas and wildlife
- Stormwater management strategies that have the least impact on habitats and wildlife
- A section on improved wastewater management for people and wildlife
- Examples from the Hudson Valley

Chapter 11 focuses on a commonly used tool—open space planning and conservation—to protect nature.

Highlights of Chapter 11

- How to include natural areas and wildlife in your community's open space plan
- Municipal tools for land conservation
- Examples from the Hudson Valley

Chapter 12 describes how local governments can work together to conserve nature. Intermunicipal approaches are critical for conserving nature in the Hudson Valley because natural areas and wildlife do not follow municipal boundaries.

Highlights of Chapter 12

- Formal and informal ways that municipalities can work together
- How watershed planning can incorporate natural area and wildlife conservation
- Examples from the Hudson Valley

Chapter 13 details how towns can practice natural landscaping on municipally owned lands and encourage it on private lands.

Highlights of Chapter 13

- Natural landscaping as a complement to the other tools described in this handbook.
- Ways that municipalities can promote the use of natural landscaping in their communities
- Problems of invasive plants, including a list of native alternatives
- Local natural landscaping resources

Smart Growth and Ecological Integrity

In the United States, more than two million acres of land are converted to urban use each year, mostly in the form of sprawling and fragmented auto-dependent development on the fringes of cities. During the sixty years since this style of development emerged, researchers have documented associated losses of ecosystem function and environmental quality. There remains a question about whether all types of human development are equally degrading to ecosystems. Might some forms of development have less impact on the environment? Research from South Carolina reveals that traditional neighborhood centers have less of an impact on the diversity of small invertebrates that live in estuaries than sprawl-type development. Studies in the Hudson Valley indicate that watersheds with sprawling suburban development have more impervious surface and less wetland buffer than watersheds with traditional neighborhood centers. Marshes in suburbanized watersheds are more prone to polluted runoff, have more invasive plants, and have less efficient food chains than watersheds with hamlets or villages in them. Smart growth is an attractive option for people because it provides housing options and walkable communities, but this research shows that it can also be better for streams and wetland wildlife.

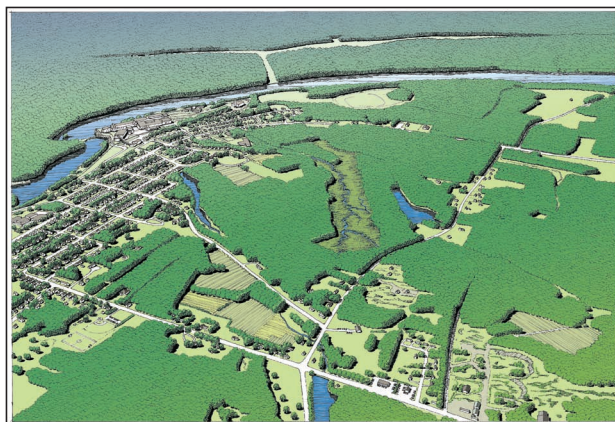
G. S. Kleppel, Biodiversity, Conservation and Policy Program, State University of New York at Albany, Albany, N.Y.

What Does a Growing Community That Conserves Nature Look Like?

The Hudson Valley is growing and will continue to grow. One solution to conserving natural areas and wildlife while accommodating growth is to create traditional neighborhood centers and conserving open space in the surrounding areas. New development of this type is often not permitted under zoning ordinances. This type of development is often referred to as smart growth.

The first step to creating such a community that conserves nature is identifying key natural areas (see Chapter 4). Subsequently locate areas for focused growth away from those areas. In the core growth areas, mix residential and small commercial uses, with increasing lot sizes nearer to the countryside. To conserve natural areas and working lands outside of core growth areas, municipalities could purchase development rights, transfer development rights, use agricultural zoning, allow clustered residential development, and/or create standards for environmental review. Ideally, these strategies will be applied so that a network of conserved and working open space is created.

Many of these smart growth strategies are described in this handbook. Additional planning resources are available to help communities, including the American Planning Association, the New York Planning Federation, the New York State Department of State, the Hudson River Valley Greenway, the Pace Land Use Law Center, and the Government Law Center at Albany Law School. *Greenway Connections* is a Dutchess County resource guide that can help create smart growth in local communities (Dutchess County Department of Planning and Development 2000; see also Corbett and Corbett 2000; Benfield et al. 2000; Sobel 2002; Katz 1994).



A small village in upstate New York nestled on the shores of the upper Hudson River. Over time the village has expanded out from its core along the major roadways and in an extension of the historic grid pattern. Surrounding the village, we find a network of natural areas and historic farmsteads that helps make the village a thriving and livable community.



This is the same village after build out under existing zoning, which allows half-acre lots within the village boundary and one- to five-acre lots outside. This kind of development fragments the existing natural areas and compromises the open space network. This kind of zoning is common throughout the Hudson Valley.



An alternative development scenario shows the same number of units as in the previous image, but follows the principles of conservation development. The historic pattern of streets and lots in the village was extended, and new commercial growth has been concentrated into compact, walkable neighborhoods. To attain the same number of dwelling units allowed by current zoning, an existing small hamlet was expanded.

With this approach, a belt of protected natural areas is established around the perimeter of the village and hamlets, maintaining significant natural and cultural corridors. This open space network incorporates streams and forests and well as farmland protected through voluntary conservation agreements. Neighborhood pocket parks provide greenspace for village residents, which are linked to the open space network via sidewalks and trails.

From the Green Infrastructure Plan for Saratoga County by Behan Planning Associates, LLC, with American Farmland Trust and Dodson Associates. Illustrations by Dodson Associates.

Chapter 3:

Natural Areas and Wildlife Habitat of the Hudson Valley



Background

Understanding the natural areas and wildlife of your town and learning about habitats is important to conserving nature locally. A local plan that aims to protect nature should describe known natural areas and wildlife and the benefits they provide to the residents of the town. This chapter outlines the major habitat types of the Hudson Valley: coastal and estuarine habitats, wetlands, streams, forests, open

uplands and barrens, steep slopes, and urban habitats. These habitats co-occur, connect to one another by water or animals, and are dependent on one another.

This chapter has information about each habitat type that communities can use to develop a local conservation program. To learn more about these habitats, see Appendix 2.

Diversity of the Hudson Valley

The Hudson Valley is a biological crossroads, bringing together northern, southern, western, and coastal species and habitats. The valley's location, plus its varied geology and topography, give rise to the biological riches of the region. The region's habitats provide home to more than 2,000 different kinds of plants, birds, mammals, reptiles, and amphibians. Nearly 90 percent of the birds, mammals, reptiles, and amphibians that live in New York State are found in the Hudson Valley. The Hudson Valley is especially important for turtles, ranking among the top four river drainages in the world for turtle species richness. There are also many thousands of less glamorous, but ecologically important species of invertebrates, fungi, and bacteria, about which little is known. We do know that more species of dragonflies and damselflies are found in the Hudson Valley than almost anywhere else in the nation.

Species Need Habitat Connections: Eastern Box Turtles

The Eastern box turtle, a species of special concern in New York, occurs throughout the Hudson Valley. It is an example of a species that uses several habitats to complete its life cycle. The turtles hibernate in forests, digging in leaf litter and soil to protect themselves from the cold and snow. Once they emerge, box turtles look for food in forests and wetlands and warm up, or bask, in open areas. Breeding typically occurs in the spring and females again seek out open, sunny areas to build nests and lay eggs. In the summer, Eastern box turtles use wetlands and streams to regulate their body temperature and to rehydrate during droughts. By the end of August, eggs begin to hatch. The turtles continue to forage until it is time to hibernate in the forest again. If suitable habitat is not found in a small area, the turtles need to travel farther to meet their habitat needs.

If these suitable habitats are no longer connected, and turtles are forced to cross roads to meet their needs, they are at greater risk. The best way to conserve the Eastern box turtle is to make sure a population has forest, open areas, wetlands, and streams that are connected to one another.

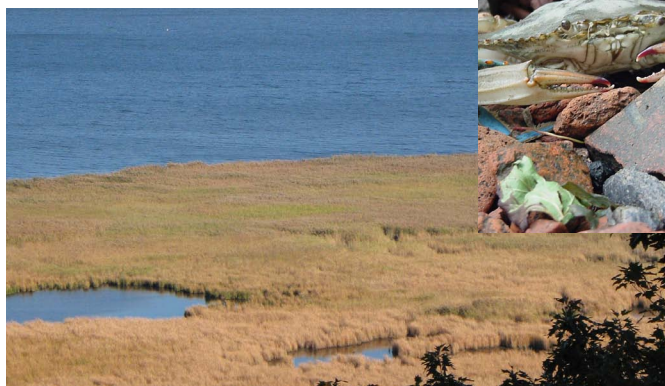
(Dodd 2001; Marchland et al. 2004; Niederriter and Roth 2004)



S. Young

Coastal Habitats—Living In and Along the Hudson River Estuary

The ebb and flow of the tides in the Hudson River Estuary creates habitats distinct from those in nontidal environments. The Hudson River is an estuary with coastal habitat from the Atlantic Ocean to the end of the tidal influence at the Federal Dam near Troy. Coastal habitats of the Hudson strongly influenced by nearby lands are vegetated shallows, tidal wetlands, and intertidal shores. Coastal habitats support a wide array of species because the Hudson River contains salt, fresh,



S. Stanne



G. Kenney

and brackish water. Salt is an influence south of the Tappan Zee year-round, and the water is slightly salty all the way to Newburgh in the summer.

Because tides influence the entire length of the estuary, tidal wetlands can be found all the way to Troy. The tidal wetlands are freshwater north of Newburgh, salty near Manhattan, and a mix in between. These wetlands are important nurseries for fish and provide nesting habitat for marsh birds. Freshwater tidal wetlands, though common on the Hudson River, are a globally rare habitat.

All vegetated shallows are important habitats, even those with nonnative Eurasian water-chestnut. The submerged aquatic vegetation that grows in shallow areas is critical to the health of the estuary ecosystem, providing shelter and feeding areas for fish and invertebrates and food for waterfowl, and contributing life-giving oxygen to the river. Hudson River vegetated shallows support a greater density and diversity of macroinvertebrates and fish than do unvegetated shallow areas.

Intertidal shores are areas that are flooded during high tide. The shores tend to be rocky and gravelly, and are an important habitat for rare plant species like the heartleaf plantain. Intertidal shorelines also provide habitat for foraging birds and fishes.

Benefits of Coastal and Estuarine Habitats

- The river's nursery. Coastal wetlands and vegetated shallows are the nurseries for Hudson River fish and blue crabs, the basis of the Hudson's recreational and commercial fisheries.
- Wastewater treatment. Tidal wetlands help to treat wastewater, removing nitrogen and phosphorus from the water, a service that could cost many thousands of dollars to replace with a treatment plant.
- Water absorption. Coastal wetlands, like inland wetlands, absorb water, helping to protect property from storm and flood damage.

Threats

- Historic changes. Like most large rivers and estuaries, the Hudson River has been greatly altered

during the last 200 years. The historic practice of filling tidal shallows with dredge spoil has contributed to the decline of important commercial and recreational fish species as well as bald eagles and ospreys. It is estimated that more than one-third of the estuary (~3,000 acres) had been filled between Hudson and Troy from 1920 to 1965. This makes it even more important to protect shallows, especially vegetated shallows, because what we see today is a fraction of what once was present.

- Shoreline development. This often involves the filling of wetlands and armoring the shoreline with steel bulkheads. Both of these practices reduce the habitat value of the estuary and prevent the habitat's benefits from being realized.



L. Heady

Representative Species of Hudson Valley Coastal Habitats

Blue crab (*Callinectes sapidus*)

Hudson river water nymph (*Najas guadalupensis guadalupensis*)

Least bittern (*Ixobrychus exilis*)

Black-crowned night heron (*Nycticorax nycticorax*)

Great egret (*Ardea alba*)

Inland Wetlands—Marshes, Swamps, Bogs, Fens, and Woodland Pools

The Hudson Valley is home to many different kinds of wetlands. Marshes are the most commonly known wetland—cattails are a common marsh plant. Wet meadows don't look wet from a distance, but the distinctive plants give them away. Swamps are forested wetlands, with trees adapted to soggy bottoms. Bogs are covered with a mossy mat and harbor rare orchids and insectivorous plants. Seasonal woodland or vernal pools are a common but threatened wetland type important to biodiversity of the Hudson River Valley. These small pools look unassuming and are dry for part of the year, but are the only breeding habitat for certain types of declining species of salamanders. Permanent and temporary streams are often associated with wetlands. As different kinds of wetlands disappear, the unique plants and animals that live in them may be lost.

Benefits of Wetland Habitats

- Water cleansing. Wetland ecosystems remove and recycle nutrients and sediment from the water that flows through them. Filtering out impurities keeps

drinking water clean and provides safe recreational opportunities.

- Nature's sponges. Wetlands also store water, which helps reduce flood damage and feed groundwater aquifers. Streams, lakes, and wetlands naturally store and release water that runs off our increasingly developed landscape.
- Stream feeding. By transferring surface water to groundwater, wetlands also help maintain minimum flows in streams.

Estimated value of all economic benefits generated by a single acre of wetland: \$150,000 to \$200,000

(Lerner and Poole 1999)

Threats

- Broken connections. Species that use vernal pools and large wetland complexes are at risk when connections with surrounding uplands or nearby wetlands are broken.
- Draining and filling of wetlands. These common practices cause direct habitat loss.
- Historic losses. The net loss of wetlands in the region from draining and filling has been great. At least 60 percent have been lost in New York since European settlement. The Hudson Valley lost more wetlands than other regions of the state from 1985 to 1995.

Representative Species of Hudson Valley Wetlands

American woodcock (*Scolopax minor*)

Great blue heron (*Ardea herodias*)

Jefferson (*Amblystoma jeffersonianum*), marbled (*A. opacum*), and spotted (*A. maculatum*) salamanders

Northern leopard frog (*Rana pipiens*)

Pitcher plant (*Sarracenia purpurea*)

Spotted turtle (*Clemmys guttata*)

Tributary Streams and Riparian Areas—Streams, Shorelines, and Floodplains

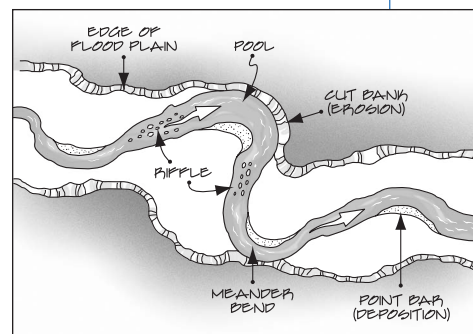
Hudson River tributary streams and their associated shoreline and floodplain areas provide some of the most productive wildlife habitat in the region.

Stream habitats are also among the most threatened habitats in the Hudson Valley. The water and habitat quality of tributary streams are increasingly threatened by removal of shoreline

vegetation, modification of stream channels, and land-use changes in the watershed. Streams

naturally meander and change course over time, moving across the floodplain, with some banks eroding as new banks are deposited. Streams transport large amounts of sediment, gravel, and rock along the bed of the stream during a single storm event. Streams that can periodically flood nearby lands tend to maintain their overall shape and course, even as water, sediment, and rock move.

Shoreline areas and floodplains are ecological transition zones from wet to dry habitats. Vegetation that grows along streams is adapted to frequent flooding. Because floodplains are important seasonal habitats for fish breeding and nursery areas, streams need to remain connected to their floodplains to have healthy fish populations. Trees near the shoreline are especially important for providing shade, bank stabilization, woody debris, and nutrients that benefit stream animals. Many terrestrial species are also dependent on shorelines and floodplains. High quality floodplain forests with large



Features of a natural meandering stream. Riffles are shallow gravel or rock areas on the stream bed. At low flows, water moves faster over riffles and provides oxygen to the stream. Pools are deeper areas on the outside of meander bends between riffles. Riffles, pools, and adjacent floodplains are important habitat features for fish and other aquatic wildlife.

L. Heady



- Vulnerable habitats. Smaller wetlands, especially woodland pools, are particularly threatened because they fall below the state's regulatory threshold.
- Watershed effects. All wetlands are sensitive to pollution and changes in groundwater flow. Changes in a wetland's watershed can change the flow of surface and groundwater that feeds the wetland, resulting in too much or too little water. Nutrient-rich runoff encourages rapid plant growth and the "pea soup" appearance of some lakes and wetlands.

trees are scarce and significant in the Hudson River Valley. Wooded streamside corridors are important as foraging areas for mosquito-eating bats, breeding sites for some bird species, and travel routes for turtles.

Benefits of Stream Habitats

Streams, shorelines, and floodplains provide many benefits to people and wildlife.

- Flow control. Small streams and shoreline areas help regulate the amount of water in larger tributaries, helping to moderate flooding and prevent destruction of stream channels. This affects the quantity and quality of water found in the larger tributaries and the Hudson itself.
- Fish habitat. Vegetation along all streams creates habitat such as undercut banks where fish find refuge, and overhanging tree limbs that cool the water and shelter macroinvertebrates. These small



aquatic insects digest plant nutrients and are in turn food for fish.

- Water absorption. Stream corridor wetlands and floodplains absorb water, reducing flood damage. The roots of riparian vegetation help to strengthen stream banks and provide resistance to erosion.
- Nature's sponges. Riparian wetlands and floodplain forests slow runoff, allowing water to percolate into the ground and be released gradually into the stream—while filtering out nutrients and sediment.
- Dilution. Maintaining stream flow is also essential for diluting pollution that is legally discharged into streams and rivers, particularly sewage wastewater.
- Clean water. Streams provide clean water which supports boating, fishing and swimming.

Threats

- Stormwater. Impervious surfaces in the watershed do not allow the natural recharge of ground water. Instead, water flows overland or through storm drains directly into streams. As a result, urbanized streams have sharp peaks of high flow after rain storms and very low flow in drought because less ground water was stored in the ground to gradually discharge to streams. The diverted stormwater is warmer than groundwater and might contain pollutants and sediment that are harmful to fish and wildlife. Plants that need their roots continually wet will not thrive along stream banks where the water level drops between storms. More runoff can cause streams to erode in some areas, reducing the extent and quality of stream habitats. In addition, downstream flooding can increase.
- Building in floodplains/removal of floodplain vegetation. Building in these areas leads to loss of shoreline habitats and can put private property at risk of erosion and flooding. Removal of woody vegetation increases stream bank erosion risk. Many stream animals, notably native brook trout, are sensitive to increased water temperature that follows clearing of shading plants. Habitat is lost for riparian specialist species.
- Dams and water diversions. Stream plants and animals are adapted to flowing water and periodic flooding. Dams and excessive removal of groundwater stop this natural process. Groundwater pumping can reduce the amount of water in streams, especially during the summer. Dams turn fast-flowing riffle habitats into slower pool habitats, resulting in the loss of specialized species. They also “fragment” the stream by preventing fish and other animals from migrating.



L. Heady

“Amount spent by Americans on the purchase of canoes and kayaks in 1996: \$99.1 million. Protection of our water bodies can enhance local economies by providing recreational opportunities.”

(Lerner and Poole 1999)

Representative Species of Hudson Valley Streams

Cerulean warbler (*Dendroica cerulea*)

River otter (*Lontra canadensis*)

Northern spring (*Gyrinophilus porphyriticus*) and
Northern dusky (*Desmognathus fuscus*) salamanders

Brook trout (*Salvelinus fontinalis*)

Wood turtle (*Glyptemys insculpta*)

Groundwater Resources

Groundwater is a crucial, yet finite, resource that can be depleted if more water is drawn than can be added through recharge. It is also susceptible to contamination from many sources, including septic leaks, animal lots, fertilizers and pesticides, underground tanks, salt storage, chemical storage and spills, and commercial and industrial processes. Pollutants enter streams and lakes from groundwater and adversely affect fish, aquatic insects, and other wildlife.

Groundwater can provide 50 percent of stream flow in normal years and 90 percent of stream flow in dry years.

Benefits of Groundwater

- Millions of people that live in the Hudson Valley depend on groundwater to fill their wells. Its importance cannot be overstated.
- Groundwater is an important source of water for streams and wetlands.

What Can Local Governments Do?

Prevention of groundwater pollution is the best way to protect groundwater quality and its effect on wildlife because cleaning up groundwater is costly and difficult.

The quantity of groundwater can be increased and protected by promoting water conservation and limiting impervious surfaces, especially near critical recharge areas. Water can be recharged by constructed wetlands and ground discharge of gray water (if allowed) or by low-impact development techniques. Water conservation efforts are important all year round, in drought and nondrought conditions. (For more information on limiting impervious surface and low impact development, see Chapter 10)

Groundwater Conservation Resources

The New York Rural Water Association has information about how groundwater concerns can be integrated into the planning efforts of small communities. (www.nyruralwater.org/).

The Groundwater Foundation is a nonprofit organization dedicated to educating and motivating people to care for and about ground water. They sponsor the Groundwater Guardians program, a community-based program that brings businesses, local officials, and citizens together to address groundwater protection issues.

Unfragmented Forests and Habitat Corridors: Forests and Woodlands

Five hundred years ago, most of the Hudson Valley was covered by mature forest with large old trees and a well-developed understory. Today, though forest and woodland is 67 percent of the region's land cover, much of it is in small fragments (DeGloria et al. 2004). Very large forests (greater than 15,000 acres) are uncommon in the Hudson Valley. The large forests that remain tend to be at higher elevations. Lowland forests are scarce in the Hudson Valley because lower elevation areas with deep soils and intermediate moisture were cleared for farming centuries ago and more recently may have been developed for residential, commercial, or industrial use.



K. Strong



K. Strong

Because forests can take hundreds of years to mature, few examples of "old-growth" forest remain in the Hudson Valley. However, forests of moderate-size and -age trees continue to provide valuable habitat and could be mature forest habitat in the future. The many types of forest in the Hudson Valley are defined by the plant species that live there.

Benefits of Forest Habitats

Forest ecosystems protect the quality and quantity of our water supply, clean the air, create soil, prevent erosion, and moderate the climate.

- Clean abundant water. Native forest plants help the ground absorb water, ensuring it reaches aquifers and reservoirs. Forests not only do this better than machines can, but for less money.
- Clean air. Trees in forests and cities naturally clean our air by using carbon dioxide and producing oxygen.
- Climate moderation. Trees capture carbon dioxide, absorbing some of the excess greenhouse gas emissions, thereby slowing the effects of climate change.

- Nature's recycling bin. Fungi, insects, and micro-organisms that live on the forest floor break up dead plants and animals—recycling every ounce of once-living material into soil and nutrients other organisms can use.
- Economic driver. Forests provide economic products (maple syrup and timber) and recreational opportunities (hunting, hiking, and fall foliage-viewing) that contributed \$8.8 billion to New York's economy in 2007 (North East Forester's Association 2007).
- Scenery. Trees and forests also enhance a community's quality of life, enhancing aesthetics and providing shade and cooling.

Threats

- Fragmentation. The carving-up of forests into smaller and smaller lots is called fragmentation. This process decreases habitat quality and ecosystem health by increasing access for predators and parasites, and disrupting wildlife movement. Invasive plants and animals can more easily invade a fragmented forest, changing the unique mix of native plants and animals. Fragmentation can also reduce or eliminate the economic and social benefits of forests listed above.
- Population explosions. Overabundant white-tailed deer thrive in suburbanized landscapes and threaten forest understories and tree seedling growth.

An acre of eastern forest produces more than two tons of oxygen per year, providing enough oxygen for eighteen people.

1.47 tons of carbon dioxide are removed from the atmosphere for every ton of wood a forest grows. That wood stores an average of 31.45 tons of carbon.

(cited in *Biodiversity Project* 2003)

Representative Species of Hudson Valley Forests

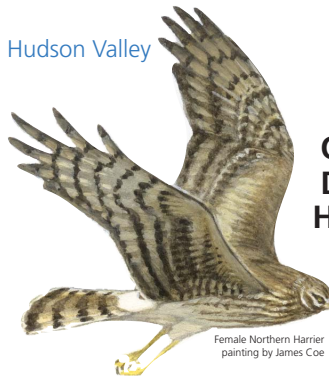
Bobcat (*Lynx rufus*)

Barred (*Strix varia*) and long-eared (*Asio otus*) owls

Scarlet tanager (*Piranga olivacea*)

Worm-eating warbler (*Helmitheros vermivorus*)

Wood thrush (*Hylocichla mustelina*)



Open Uplands and Barrens: Disturbance-Dependent Habitats

Open upland habitats are less common than forests in the Hudson Valley, but provide important habitat for some rare and declining species. Open uplands are also known as disturbance-dependent habitats, meaning they need disturbance to prevent them from becoming forest. In the past, natural disturbance was more common, but today, grassland and shrubland species depend on management. They were maintained historically by natural and human-induced burning, but now many require periodic mowing to prevent succession to forest.



K. Strong

R. Guthrie

- Grasslands. Although limited in range prior to European settlement, grasslands in the state are native. Grassland-dependent species—particularly grassland-breeding birds such as the northern harrier, short-eared owl, sedge wren, grasshopper sparrow, and Henslow's sparrow—are found in few places. Not surprisingly, these habitats occur most often in areas that have been cleared for agriculture.
- Shrublands. Shrublands are found in open areas such as old fields and utility rights-of-way, and on edges of fields and forests and hedgerows. Shrublands are habitats for declining species of songbirds, including the golden-winged warbler, as well as rare butterflies. Shrubland is increasingly of concern in the state because it is declining as a cover type in both wetlands and uplands. From the mid 1980s to the mid 1990s, shrub-scrub wetlands declined statewide by 44,000 acres, or 9 percent (Huffman and Associates 2000).
- Barrens. Barrens are a globally rare habitat adapted to poor (low-nutrient) soil. In the Hudson Valley, barrens are found in the Albany Pine Bush, on the Shawangunk Ridge, and on Staten Island. Barrens

are similar to the plant community of the African Savannah, with a dense and diverse herbaceous understory and sparse tree canopy.

Benefits of Open Uplands and Barrens

- Multiple-use areas. Grasslands and shrublands are compatible with many human activities, and are especially good for hunting, trapping, and birdwatching. Some agricultural activities are compatible with grassland habitat, in particular, pasture for animals and late-season haying. Some species, like the bog turtle, will probably not survive in the Hudson Valley without agriculture.
- Water flow control. Shrublands help manage watershed runoff by retaining snowpack longer than forested areas or grasslands. They also maintain soil cover, act as a living snow fence, and can be a good riparian buffer.
- Scenery. Grasslands and shrublands create pastoral scenery themselves and also provide unobstructed views of distant ridges, mountains, and the river, vistas of particular importance in the Hudson Valley.

Active Farms

Working farms can support a diverse array of species—if managed with nature in mind. Many at-risk species of reptiles, amphibians, and birds depend almost entirely on Hudson Valley farms because they are one of the few current land uses that maintain open grasslands, fields, and shrublands.

Farm-associated habitats are rapidly disappearing throughout the northeastern United States, along with the species that depend on them. Major causes of these declines include regrowth of forests as fields are abandoned, and urbanization, which fragments and eliminates open habitat. As with forest wildlife, many farm-dependent species must be able to disperse among open habitats; therefore, fragmentation by roads and developments should be minimized in agricultural areas having high biological diversity. Policies and practices that promote the continuation of small-to-medium-scale, ecologically sensitive farms that are interconnected would help to maintain biological diversity. Several programs are available to technically and financially assist farmers with habitat conservation through the U.S. Department of Agriculture's Natural Resources Conservation Service.

The Farmscape Ecology Program at Hawthorne Valley Farm in Columbia County aims to explore the relationship between the working farm and the natural landscape. Scientists study wildlife use of farm habitats and relate pasture-plant diversity to milk production. For more information, visit www.hawthornevalleyfarm.org.

Adapted from Orange County (N.Y.) Planning Department 2004.

Threats to Open Uplands and Barrens

- Loss of disturbance. Grassland and shrubland areas have been maintained in the past by natural and human-induced wildfire, beaver activity, and extensive farming. With the loss of disturbance, open uplands are becoming less common.
- Fragmentation. This is a problem for grasslands and barrens, as it is for forests. Breaking habitat connections restricts animal movement, encourages predators and introduces invasive species.

Representative Species of Hudson Valley Open Uplands and Barrens

Bobolink (*Dolichonyx oryzivorus*)

Eastern meadowlark (*Sturnella magna*)

Golden-winged warbler (*Vermivora chrysoptera*)

Northern harrier (marsh hawk) (*Circus cyaneus*)

Rare butterflies

Short-eared owl (*Asio flammeus*)

Parkland and Open Space—Habitats in Densely Developed Areas

Much of this guide is applicable to rural and lower-density suburban areas. However, the Hudson Valley includes fourteen

cities and many more dense older suburbs that provide surprising opportunities for biodiversity. Habitat conservation is no less important in urban areas than rural areas. The

major difference is scale: you will not find the 1,000-acre forest in Yonkers that you might in Ulster County. All of the habitat types described in this handbook can be found in urban areas, though most urban natural areas are smaller and concentrated in parkland and open space. Fragmentation is a dominant landscape feature, which means there will be fewer development-sensitive species.

Some urban areas harbor rare species and unique habitats. Van Cortlandt Park in the Bronx has more butterfly species than all of Great Britain. The Albany Pine Bush is a globally rare pitch pine–scrub oak



K. Strong

community that is home to many rare plants and animals—surrounded by suburban development. Uninhabited islands in New York Harbor are home to nine species of nesting egret, heron, and ibis. Urban streams are often polluted, dammed, straightened, and culverted, yet are often the only seminatural habitat left in cities. Even street trees provide important services, absorbing stormwater, cleaning the air, providing shade, and providing some habitat that is clearly essential in cities. It is important that some natural habitat is preserved in urbanized areas, even if it is not connected to other natural areas.

Benefits of Urban Habitats

Natural areas in highly developed parts of the Hudson Valley provide many benefits. Controlling erosion, improving air quality, retaining nutrients, and protecting water quality and quantity would be costly to reproduce. Developed landscapes can be designed to retain some of these ecological and habitat functions. Because people who have less access to nature are concentrated in cities, urban parks and preserves are important for educating communities about the natural environment. They may be the only exposure to nature urban residents ever have.

Threats and Conservation Issues

- Natural areas in urban and suburban areas are subject to high development and recreation pressures.
- Invasive plant species often dominate in urban parks and natural areas. Invasive plant removal may benefit local wildlife, but removal of invasive plants can sometimes cause more harm than good and should be carefully considered (see Chapter 10).

The Importance of Street Trees and Urban Forests

Urban trees provide more than just shade and visual pleasure. They absorb stormwater, lower winter heating and summer cooling costs, absorb air pollution, and reduce noise. A 2004 report released by American Forests, found that the City of Poughkeepsie has 24 percent tree cover. The city's trees absorb 69,564 pounds of air pollution per year—a service that would cost \$169,831 to replace. It would cost \$11.5 million to build stormwater detention structures that would replace the work the street trees do. Poughkeepsie's trees also absorb 1042 tons of carbon per year (American Forests 2004).

Resources

- Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero. [eds.] 2002. *Ecological Communities of New York State. Second Edition*. A revised and expanded edition of Carol Reschke's *Ecological Communities of New York State*. New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, N.Y.
- Kiviat, E., and G. Stevens. 2001. *Biodiversity Assessment Manual for the Hudson River Estuary Corridor*. New York State Department of Environmental Conservation. Albany, N.Y. 508 pages. www.hudsonia.org
- Penhollow, M. E., P. G. Jensen, and L. Zucker. 2006. *Wildlife and Conservation Framework: An Approach for Conserving Biodiversity in the Hudson River Estuary Corridor*. New York Cooperative Fish and Wildlife Research Unit and New York State Department of Environmental Conservation, Hudson River Estuary Program, Ithaca, N.Y. Available from the Hudson River Estuary Program.
- Reschke, C. 1990. *Ecological Communities of New York State*. New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, N.Y.

Chapter 4:

Natural Area and Wildlife Inventory



An inventory of natural areas and wildlife helps a community to plan for and protect important natural features. It can be comprehensive—looking at land, water, air, plants, animals, etc.—or it can focus on a few important resources in a community. An inventory can be a municipality-wide effort, or intermunicipal, based on a shared natural resource. This chapter describes where to find biological information and how to create priorities for conservation. Once

complete, community leaders can use such an inventory to conserve natural areas using the tools described in the remainder of this handbook.

Create a Map of the Local Ecological Landscape

Creating a map of your ecological landscape using existing information is an important step in creating a local conservation program. The purpose of this map is not to identify areas that are off-limits to development, but to begin to guide the discussion on how local natural areas and wildlife can be conserved. When a map exists, the town has a basis for protecting important habitats through acquisition, easement, or by working with developers and private landowners. The habitat information can be enhanced by species information, biodiversity assessments, and site-specific biological surveys.

As part of this process, your community may choose to inventory additional resources it wishes to conserve, such as drinking water aquifers or farmland.

Your map should identify:

- The known locations of rare animals, rare plants, and significant ecosystems. This is the information that is collected by the New York Natural Heritage Program.
- Hudson River habitats (if applicable).
- Wetlands. Pay special attention to large wetland complexes and clusters of small or medium size wetlands.
- Streams and their corridors. For stream corridors, include at least 200 feet on either side of streams.

- Significant forest resources. Pay special attention to forests larger than 200, 2,000, 6,000, and 15,000 acres, and those along streams and rivers. Some of the larger forests will cross municipal boundaries.
- Grassland areas larger than 100 acres. Areas of this size will be more likely to support rare and declining species of birds.
- Existing species-specific information (see sidebar on page 23).
- Once all of these features are identified on a map or geographic information system (GIS), a pattern will begin to emerge. If the areas do not connect, identify broad swaths of habitat that could serve as potential connections among them*
- The next step is to develop local priorities for conservation.

A NOTE OF CAUTION: The process of identifying your ecological landscape as outlined here is very general. On-the-ground surveys will likely identify additional natural areas and wildlife species in your community. For this reason, a natural-resource inventory should be an ongoing process and should not be substituted for onsite surveys during project review. Moreover, a natural-resource inventory should not be used to direct development or create a management plan for a single site because the information will be too general. To incorporate habitat and species information into those site-specific activities appropriately, it must be confirmed by on-the-ground surveys.

How to Find Habitat Information About Your Community

There are several reliable sources of information for the natural area and habitat information. Much of it is now available for use on a geographic information system. Online resources are listed in the table on page 21. Your regional Department of Environmental Conservation office is also a good source of natural area and wildlife information (see Appendix 3).

* See Kennedy et al. 2003 for more information on appropriate corridor size and location.

What Is a GIS?

A geographic information system (GIS) is a computerized map that can combine different layers of geographic information. It also connects that geographic information to a database. Because a GIS is dynamic, new information can be added over time and different kinds of information can be analyzed together. For example, steep slopes and significant habitats can be overlain to see how these two different types of information might inform land-use planning. A GIS layout can be printed as a paper map for use in meetings and by the planning board.

Using GIS data requires specialized viewing software and often training to use the software and understand its limitations. Some towns have purchased their own GIS and dedicated staff people to maintain it, while others use consultants to develop and maintain the town's system.

Rare Species and Significant Ecosystems

The New York State Department of Environmental Conservation's Natural Heritage Program maintains New York's database on the status and location of rare species and significant ecosystems. It tracks and maps state- and federal-listed species as well as other species that are rare statewide, but not legally listed. The program also tracks and maps significant ecosystems, including different kinds of forests, wetlands, and open uplands, that are rare, or of exceptionally high quality when compared to other examples in the state. The list of species and significant ecosystems (ecological communities) inventoried by the program can be found at www.nynhp.org. Note that the location of some rare species are kept confidential due to their sensitive nature.

Coastal Habitats (Hudson River)

The locations of tidal estuarine wetlands and vegetated shallows have been collected by the New York State Department of Environmental Conservation. The New York State Department of State implements New York's coastal program and maintains information about significant coastal fish and wildlife habitat on the Hudson River.

Wetlands

Wetland maps have been developed by the New York State Department of Environmental Conservation and the U.S. Fish and Wildlife Service. Neither Department of Environmental Conservation freshwater wetland maps nor National Wetland Inventory (NWI) maps show all of the wetland resources in a community. Not all areas of the Hudson Valley have completed NWI maps. Using the freshwater wetland, NWI, and hydric soil maps together is the best way to identify wetlands without on-the-ground surveys. Some county

agencies may have wetland information on GIS.

A town can arrange for its own mapping to fill the gaps or partner with another municipality to share the cost. Site-specific wetland boundary delineation must be conducted to determine whether or not wetlands are present on a particular site. Additionally, towns can require developers to delineate wetlands on each parcel.

Streams and Stream Corridors

Permanent streams have been mapped by the U.S. Geological Survey and the New York State Department of Environmental Conservation. Some county agencies may have higher resolution stream information.

Forests

Forest location information is not typically collected in New York State, but high quality forests are mapped by the New York State Department of Environmental Conservation's Natural Heritage Program. Aerial photos can also be used to identify forested areas. What constitutes a significant forest will vary by community. Chapter 5 has information on wildlife values of different forest sizes. Aerial photos should be used only to identify habitat at a broad scale. All information collected from maps and photos should be confirmed by visiting the site.

Open Uplands and Barrens

Open upland location information is not typically collected in New York State, but rare barrens are mapped by the New York State's Natural Heritage Program. Aerial photos can also be used to identify large open areas, although they should be used only to identify habitat at a broad scale. All information collected from maps and photos should be confirmed by visiting the site.



Table 4-1. Online Natural Area and Wildlife Information

The two best resources for widely available GIS data in the Hudson Valley are the New York State GIS Clearinghouse (www.nysgis.state.ny.us) and the Cornell University Geospatial Information Repository (cugir.mannlib.cornell.edu/). Other useful GIS web sites are U.S. maps and data (www.geodata.gov) and the National Biological Information Infrastructure (www.nbi.gov). New data are added over time, so search these sites for updates.

habitat	available data online	format	web site	notes
rare species and significant ecosystems	rare plant, rare animal, and significant ecosystem fact sheets	fact sheet	www.guides.nynhp.org	Information collected by the New York Natural Heritage Program
coastal habitats	tidal wetlands south of the Tappan Zee	digital scan	twi.ligis.org	Maps are of tidal wetlands protected by New York State
coastal habitats	significant coastal fish and wildlife habitat maps and narratives	CD, paper, GIS	www.nyswaterfronts.com	Information used for state coastal consistency analysis
coastal habitats	Hudson River vegetated shallows from Troy to Yonkers (submerged aquatic vegetation)	GIS	cugir.mannlib.cornell.edu	
wetlands	New York State freshwater wetland maps show regulated wetlands 12.4 acres and larger	GIS	cugir.mannlib.cornell.edu	Maps are of freshwater wetlands protected by New York State
wetlands	National Wetland Inventory (NWI) maps can be downloaded from the U.S. Fish and Wildlife Service	GIS	www.nwi.fws.gov	NWI maps are not complete for all areas of the Hudson Valley.
wetlands	National Wetland Inventory wetland mapper (No GIS software needed)		www.wetlands.fws.gov	
wetlands	hydric soils	GIS		Hydric soils are good indicators of wetlands.
streams and stream corridors	data layer: hydrography 1:24,000	GIS	cugir.mannlib.cornell.edu	
streams and stream corridors	100-year floodplain maps developed by the Federal Emergency Management Agency (FEMA)	GIS	www.nysgis.state.ny.gov	Floodplain maps are not habitat maps, but may help identify floodplains, which do have habitat significance.
forests, open uplands and barrens, urban natural areas	digital orthoimagery	GIS	www.nysgis.state.ny.gov	These aerial photos can be used to identify forested or open lands, or to identify natural areas in a built environment.

The presence of rare grassland and shrubland birds can help confirm that areas on aerial photos are high-quality habitat. The New York State Breeding Bird Atlas (available at www.dec.ny.gov) has general locations of birds across the state. A list of rare grassland birds can be found in Chapter 3 (See also sidebar on page 23).

Urban Habitats

Urban habitats are not fundamentally different from those listed above. The techniques already described can be used to identify habitats in urban areas. Aerial photos can also be used to identify urban natural areas, although they should be used only to identify habitat at a broad scale. All information collected from maps and photos should be confirmed by visiting the site.

Existing Species Specific Information

Some existing sources of species-specific biological information can tell you more about the kinds of habitats in your town. For example, some birds, reptiles, and amphibians can be good indicators of high-quality habitat (see the following table for resources).

Valuable information can be obtained from people in your community, including college or university professors and volunteer naturalist groups (e.g., local birding clubs, Torrey Botanical Society, Bear Mountain League of Naturalists). A list of volunteer naturalist groups in the Hudson Valley can be found in the appendix of the Biodiversity Assessment Manual of the Hudson River Estuary Corridor (Kiviat and Stevens 2001). Pay special attention to species that are rare or declining,

as the presence of these species indicate habitat that is most important to protect (see page 23). Local species lists are also useful for project review.

How To Store Information

Once you've collected the information, you don't want to lose it. You may want to charge a town staffperson or committee (e.g., conservation advisory council or open space committee) with maintaining the information as a database, GIS, or in paper files. Make sure to cite sources and detail methods for accessing the information sources so future users of the information know what you've done.

Developing Priorities

Municipalities that have many natural areas may want to prioritize their conservation efforts. Here are a few questions to ask:

What does your community value? Community values are very important in creating priority. A public participation process can help identify what is important in your community (see Chapter 6 for advice on involving the public). In many communities water is a very important resource—and there are many habitats that support a clean and abundant water supply. Natural areas that contribute to a region's character may be another important factor in your community. Other important community values include recreational opportunities like birdwatching, fishing, hunting, and boating. Next, determine what habitats the community needs to conserve in order to protect what the community values. For example, if your community values clean water, then natural areas like forests, wetlands, and streams may be most important.

Which resources in your area are unique? Natural areas and wildlife that are unique to your county, the Hudson Valley, or the state can be another conservation priority.



L. Heady

For example, sixty-six percent of steep cliff and talus habitat on the Shawangunk Ridge is in the Town of Gardiner, Ulster County, which led the town to develop zoning to help protect its steep slope habitats. The New York State Department of Environmental Conservation, regional conservation organizations, and local naturalists can help identify unique resources.

Which resources in your area are high-quality habitats? A high-quality habitat can be common or rare. It contains native plants and animals, few invasive species, and is of sufficient size to keep living and nonliving parts working together. Your community may choose to conserve those high-quality natural areas and wildlife because they have the best chance of long-term survival. The New York State Department of Environmental Conservation, regional conservation organizations, and local naturalists can help identify high quality habitats.

If natural area and wildlife information is lacking for your community, you may want to prioritize collecting new biological information using one of the tools that follow.

How To Add New Information

There are several ways to get new information:

Identify Ecologically Significant Habitats

Based on the inventory process outlined in this chapter, small but important habitats probably won't be identified (e.g., rock outcrops or crest habitats). The Biodiversity

Assessment Manual for the Hudson River Estuary Corridor (Kiviat and Stevens 2001) outlines a process by which anyone can identify both large and small habitats in their community. Using readily available maps and documents, the manual guides you step by step to accurately identify ecologically significant habitats in your landscape. The manual includes descriptions of significant habitats, the rare or declining plant and animal species that live in those habitats, as well as conservation and management issues.

Table 4-2. Where to Find Information About Your Community's Plant and Animal Species

resource	species information	where to find
New York State Breeding Bird Atlas	breeding bird presence 1980–1985 and 2000–2005	www.dec.ny.gov
New York State Reptile and Amphibian Atlas	reptile and amphibian presence 1990–1998	www.dec.ny.gov
New York Flora Atlas	county plant lists, search for plant species' habitat and rarity	atlas.nyflora.org
Important Bird Areas	sites identified by Audubon New York that are significant to breeding and migrating birds	ny.audubon.org
native trout streams	streams where trout naturally reproduce (not stocked).	regional Department of Environmental Conservation office www.dec.ny.gov

Information from Project Review

Chapter 9 of this guidebook includes suggestions for developing standards for environmental review and requiring biological assessments during project review. Standards for environmental review make it clear what habitats and/or species your municipality wants to assess and how to assess them consistently across projects. Requiring assessments not only informs the development at hand, but can also be added to a municipal natural-resource inventory.

Biological Surveys

Biological information can also be obtained by commissioning surveys by a qualified biologist. A municipality could decide to collect information on habitat and/or individual species the community wishes to conserve. Grants may be available to help fund such a study.

Species of Conservation Concern

We do not recommend that a town try to inventory and protect every plant and animal species that exists. The following references list species of conservation concern.

For animals, use the list of Species of Greatest Conservation Need developed for New York's Wildlife Action Plan (New York State Department of Environmental Conservation 2006). For plants, use the New York State list of endangered, threatened, rare, and exploitably vulnerable plants or the New York State rare plant status lists (Young 2007). Use these lists to prioritize the list of species identified in your municipality. All information is available at www.dec.ny.gov. For more guidance, contact your regional Department of Environmental Conservation office.

Local Examples

Intermunicipal Inventory

Leaders in the towns of Cortlandt, New Castle, Putnam Valley, and Yorktown wanted to learn more about the important wildlife in their town. They hired the Wildlife Conservation Society's Metropolitan Conservation Alliance (MCA), professional biologists whose approach to biodiversity conservation looks beyond political borders. Biologists surveyed public lands and private lands with landowner permission for wildlife species, producing a report that identified the areas in their towns most appropriate for development and those that are most appropriate for conservation (Miller and Klemens 2004). The towns are working at the municipal and intermunicipal levels to implement the report's recommendations, which encourage the use of land-use planning tools to direct development to the most appropriate areas.

Learning to Identify Ecologically Significant Habitats

The intermunicipal Croton to Highlands Biodiversity Plan identified areas in the towns of Cortlandt, New Castle, Putnam Valley, and Yorktown that support high-quality habitat. The plan, developed in partnership with the four towns and the Wildlife Conservation Society, identified tenuous habitat connections that might be stronger if appropriate habitat was found in neighboring Philipstown. A group of volunteers from the Town of Putnam Valley Environmental Committee and the Hudson Highlands Land Trust used the Biodiversity Assessment Manual to identify ecologically significant habitats near those connections in the Town of Philipstown. The volunteers are now working with the Town of Philipstown to help conserve the significant resources.



Tompkins County Unique Natural Areas Program

Tompkins County is in the Finger Lakes Region of New York. Tompkins County's Environmental Management Council developed an innovative way to identify its habitats and share that information with local land-use decision-makers. The Tompkins County Unique Natural Areas Inventory was developed using biological information to identify important resources for local land-use planners and conservation. The areas fall into one of the following categories: important natural communities, high-quality habitat, rare or scarce plants and animals, geological importance, and cultural significance. Natural-area boundaries based on a review of air photographs were delineated by field biologists, digital GIS basemap data, and field visits. Maps and a report are available at town offices and local libraries. The project was led by the Tompkins County Environmental Management Council, in partnership with Cornell Plantations, local naturalists, and citizen input. This program is a good model for providing useful information about unique areas of the region that can be used by local governments (Tompkins County Environmental Management Council 2000). For more information, contact the Tompkins County Planning Department at 607 275-5560.

Regional Information Sources

Some local areas are fortunate enough to have documents that summarize biological information for a region. These can be excellent sources of information for local and intermunicipal plans. A few of these are listed below.

Helderberg Escarpment Planning Guide

Developed over a ten-year period by an award-winning committee, the 257-page *Helderberg Escarpment Planning Guide* (Driscoll and Childs 2002) examines the geology, soils, hydrology, flora and fauna, agriculture, aesthetics, recreation, history, present land use and zoning, noise, and electromagnetic radiation of this unique area. Planners, municipal officials, developers, residents, and anyone else wishing to better understand the special character of the Helderberg Escarpment region will find the guide an invaluable resource. It is a great tool for comprehensive, watershed, or open space planning in the Helderberg Region of western Albany County. An executive summary, front cover, back cover, and table of contents are available for free download at www.mohawkhudson.org, where the complete book can be ordered for \$20 (includes shipping).

Shawangunk Ridge Biodiversity Partnership

The Shawangunk Ridge Biodiversity Partnership was formed by conservation landowners and researchers to create a shared management vision of the ridge in Ulster, Orange, and Sullivan Counties. Since 1994, the members have worked together to collect biological information and develop stewardship guidelines. The partnership created the Green Assets program in 2002, recognizing the stewardship role of local communities in protecting the ridge ecosystem. Through Green Assets, the partnership provides biological information and guidance to the local communities of the Northern Shawangunks. The communities determine how to integrate that information into land-use planning. For more information, contact The Nature Conservancy's Shawangunk Ridge Office at 845 255-9051.

Orange County Open Space Plan

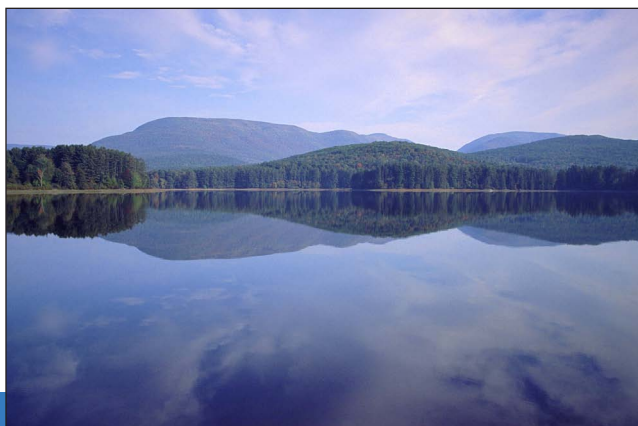
With help from The Nature Conservancy and the Wildlife Conservation Society, the Orange County Planning Department developed the Orange County Open Space Plan in 2004 with biological diversity as one of the priorities. They collected existing biological information and identified areas important for plants and animals, forests and aquatic systems, and corridors to connect them. The biological diversity chapter includes an excellent discussion of the benefits of biodiversity, how past land-use history influences the plants and animals that live in Orange County today, and the greatest threats to local biodiversity. Maps include rare plants, rare animals, forests, and wildlife corridors, and can be used by municipalities for comprehensive open space and watershed planning.

New York/New Jersey Highlands Regional Study 2002 update

The U.S. Department of Agriculture Forest Service (Phelps and Hoppe 2002) updated the 1992 study of the New York/New Jersey Highlands Region. The Highlands region provides water for 11 million people and hosts 14 million visitors annually. The report found that since 1992, the population in the highlands increased 11.5 percent and changing land use is a defining feature of the region. The resource assessment inventoried water, forest, species diversity, aquifers, farmland, and recreation areas. An analysis of all the resources identified the areas that are most important for all of these factors, which the report terms conservation focus areas. This report is a valuable resource to any town in the Highlands region undertaking planning.

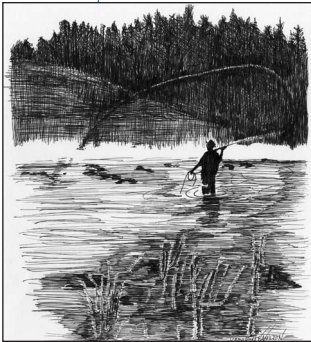
Resources

- LaBruna, D. T., and M. W. Klemens. 2007. Northern Wallkill Biodiversity Plan: Balancing Development and Environmental Stewardship in the Hudson River Estuary Watershed. *MCA Technical Paper No. 13*. Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, N.Y.
- Miller, N. A., M. W. Klemens, and J. E. Schmitz. 2005. Southern Wallkill Biodiversity Plan: Balancing Development and Environment in the Hudson River Estuary Watershed. *MCA Technical Paper No. 8*. Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, N.Y. Order from www.metropolitanconservationalliance.org.
- Tompkins County Environmental Management Council. 2000. *Unique Natural Area Inventory of Tompkins County, Revised Edition*. Tompkins County Environmental Management Council, Tompkins County Department of Planning, Ithaca, N.Y.



Chapter 5:

How To Conserve Habitats

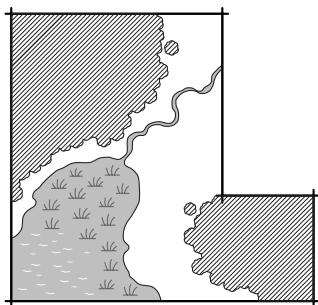


Once a community has made a commitment to conserve nature and identified its important natural areas and wildlife, it is poised to start protecting those habitats. This chapter is dedicated to resource-specific habitat conservation needs and tools for the Hudson River and its shoreline, wetlands, streams, forests, and grasslands. It includes specific information needed to conserve resources (e.g., what does

a meadow need to be good bird habitat?), and suggests tools that best protect the resources. It contains the information municipalities need to incorporate habitat conservation into the smart growth strategies described in the remainder of the handbook.

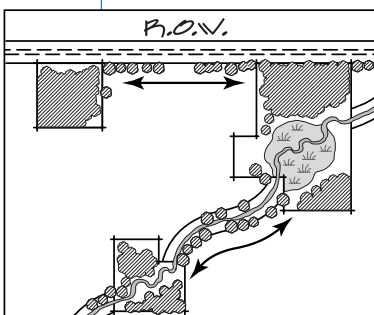
General Conservation Principles

General Conservation principles apply to all habitats described in this handbook. They are the foundation for understanding the conservation guidelines described in the rest of this chapter.



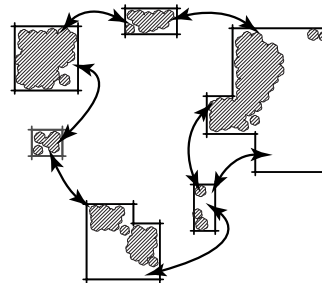
Large, intact blocks of natural areas are most effective for wildlife conservation. Though all conserved habitat contributes to the protection of biodiversity, aim for preserving and expanding large areas whenever possible. Larger patches of habitat are more likely to be healthy and better able to sustain species. Where

conserving a large area is not possible, try to connect the smaller patches of habitat to larger ones to facilitate the movement of species.



Connections are essential. Natural corridors that link larger patches of habitat can connect groups of the same species, which allows them to maintain healthy populations. It also allows for plants, animals, and habitats to adapt to a changing environment. Towns should try

to connect local natural areas and areas in surrounding communities. Ideally, habitat corridors should encompass broad swaths of habitat that are known to be used by wildlife. Linear features with natural habitat, including river and stream corridors, unpaved trails, utility rights-of-way, and unused railroad rights-of-way provide modest linking opportunities, but keep in mind they often do not provide adequate habitat corridors.



Where connections between larger natural areas are not possible, small patches can act as stepping stones for wildlife movement. Small patches of habitat provide refuge where breaks in the network of habitats cannot be avoided.

In areas with especially important habitat, development can be designed in ways that minimize impact on wildlife, for example, using sloped “Cape Cod” curbing to allow turtles, frogs, and salamanders to move across roads.

Protect rare landscape elements, sensitive areas, and associated species. You can identify these resources and their significance as part of a natural area and wildlife inventory. Direct development away from recognized sensitive areas and toward altered and less-sensitive land. It is far more expensive and uncertain to restore a habitat than to protect one that already exists.

Minimize alteration of natural features, including vegetation, soils, bedrock, and waterways. Minimize impervious surfaces to maximize groundwater recharge and reduce changes in surface-water quality and flow. By limiting changes to the landscape, it is more likely that sensitive species and habitats can continue to persist, even in developed areas.

(Adapted from Kiviat and Stevens 2001, McElfish 2004, and Navota and Dreher 2000.)

Conservation is planned action or nonaction to protect, manage, restore, or enhance natural resources for future generations.

Restoration

For more involved projects where work may be needed to solve a problem (e.g., flooding), restore ecological function (e.g., tidal wetlands), or restore a target species (e.g., bog turtles), landowners and local governments should generally seek the advice of recognized restoration experts. An improperly designed restoration project could do more harm than good, despite sound intentions. Keep in mind that permits from state or federal agencies may be required for these kinds of projects.

Conserving the Hudson River Estuary and Its Shoreline

Today, many Hudson River communities are reconnecting with the waterfront. Some are redeveloping waterfronts, others are improving parks and gaining access. It is exciting to see such renewed interest in the Hudson, but development along the shoreline can impact the Hudson's habitats. Waterfront development can occur in a way that maintains the natural resources of the Hudson and its shoreline, so everyone in the region can enjoy its bounty. The local activities that have the most impact on coastal habitat are shoreline development, erosion control, and marina and dock siting.



The most important coastal conservation principles are:

- Coastal habitats are dynamic. Therefore, building on these shifting lands is a challenge. Land near tributary mouths is particularly unstable, naturally eroding and depositing sediment from the watershed.
- Shoreline and shallow water habitats are crucial to the health of many Hudson River fish and birds.

Are Coastal Habitats Protected By the State and Federal Government?

A permit is required for alteration to all tidal wetlands south of Tappan Zee and tidal estuarine wetlands north of the Tappan Zee that are 12.4 acres and larger and appear on the New York State freshwater wetlands maps. Permits are obtained from the New York State Department of Environmental Conservation. Projects in the coastal zone that use state or federal funding or require permits are subject to consistency review by New York State Department of State Division of Coastal Resources. The review ensures the action is consistent with all policies for the State's coastal areas and inland waterways. Policy 7 of the New York State Coastal Management Program addresses habitat: "Significant coastal fish and wildlife habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats." For an explanation of significant coastal fish and wildlife habitats, visit www.nyswaterfronts.com.

What Local Governments Can Do

Require Sensitive Shoreline Development

On site plans for projects on the shoreline, towns could require mapping of all tidal wetlands. When approving Hudson waterfront projects, have applicants avoid filling shallows and small wetlands, which are important nurseries for fish and help protect against storm damage and flooding. Municipalities could also require a building buffer of 75 to 100 feet from the mean high tide mark to protect sensitive coastal habitat from impacts of construction.* More buffer is even better where possible. Leaving 300 feet would allow more flexibility for storm surge, flooding, and future sea-level rise. Buffer areas can be used for unpaved trails and other passive recreation. In urban waterfronts, this may not be feasible. For those projects, leave as much natural habitat as possible, especially wetlands, while still providing public access.

Control Erosion Using Ecological Methods

Though erosion of the Hudson's shoreline is a natural phenomenon, the degree of erosion along the estuary and many of the region's streams and lakes can exceed natural rates due to high water velocities, rapidly changing water levels, loss of stabilizing vegetation, and prior channel modification. The conventional solution to erosion has been to armor channels and shorelines with a hard surface such as concrete, steel, or rock. Of these, steel sheetpiling is the most detrimental to coastal habitats, particularly intertidal shorelines. Such approaches may be effective at the site, but they are typically quite expensive, destroy aquatic habitat, and may actually lead to increased flooding and erosion in other locations downstream.

*See also the Rhode Island Coastal Zone Buffer Ordinance, available at www.stormwatercenter.net.

Where shoreline stabilization is needed, use methods that maintain the ecological structure of the habitat and provide the protection needed. In many cases, protecting the land around areas where the shoreline is moving is all that is required. (see section on Stream channel and riparian zone maintenance on page 32)

Troy Wiedy



Carefully Site Marinas and Docks

Because access to the Hudson is limited, municipalities often don't have a choice in siting marinas and docks. If possible, these structures should be located away from vegetated and unvegetated shallows. The best sites are in deep water or where depth is naturally maintained, which will reduce the need for future dredging, protect habitat, and reduce maintenance expense and habitat impacts. If the marina must be sited in shallows, try to minimize disturbance, especially in large areas of vegetated shallows. Vegetated shallows are essential for the functioning of the Hudson River ecosystem.

Smart Growth Strategy

Local Waterfront Revitalization Plans

Hudson Riverfront communities can develop Local Waterfront Revitalization Plans (LWRPs) with the New York State Department of State Coastal Zone Management Program. The plans typically are developed to help river towns reconnect to the Hudson, but could also be used to protect the Hudson's unique natural resources. Include in the plan up-to-date information about tidal wetlands, natural shoreline characteristics, submerged aquatic vegetation, and fish use of the Hudson near your community. This information can be obtained from Department of Environmental Conservation's Hudson River Programs. Once significant coastal habitats have been identified, there is an opportunity to protect them as the waterfront is developed.

Conservation of Inland Wetlands

The most important wetland conservation principles are:

- Wetlands are affected by what happens in their watersheds up to 2 1/2 miles away (Houlahan and Findlay 2004)
- Healthy watersheds are mostly forested.
- Wetland buffers can be used to moderate the effects of watershed urbanization.
- Wetlands usually have physical and biological connections to streams and other wetlands.

Are Wetlands Protected By State and Federal Governments?

State and federal regulations protect some, but not all, wetlands. Protection under both federal and state jurisdiction is limited. State programs protect wetlands 12.4 acres and larger that appear on wetland maps; wetlands of unusual local importance; and a 100' buffer around those wetlands. Federal programs protect wetland of any size, but do not include a buffer. To find out if a permit is needed for a specific project or activity, contact the regional Department of Environmental Conservation office or the Army Corps of Engineers (see Appendix 3). Do not assume that if state and federal laws are followed that there are no impacts to wetlands. Because of the wetland conservation principles listed above, it is possible to follow those laws and still have an impact on local wetlands.

What Local Governments Can Do

Local governments can use a number of techniques to better protect the natural functions and habitats of wetlands. Local conservation programs can complement state and federal programs, filling the gap in enforcement by protecting smaller wetlands and their buffers. Remember that even for state protected wetlands, there is no substitute for careful local review to determine whether or not a particular project will impact a specific wetland.

Decide Which Wetlands to Be Protected Locally

Knowing which wetlands are most important to your community and how buffers can protect them is essential to any local program. Local wetland conservation programs in the Hudson Valley typically apply to wetlands smaller than those protected by the state. Some municipalities protect areas down to one-tenth of an acre, others only as small as five acres. It depends on how many wetlands are present in your jurisdiction, the services those wetlands provide in terms of flood control, water cleansing, and wildlife habitat, and what is acceptable to the community.

Identify Wetlands on Development Sites

No existing wetlands map includes all wetlands present on a site. Consider requiring wetland boundary delineations on all properties proposed for development and require third-party verification of those boundaries and any onsite determinations that isolated wetlands are present. Define and apply a buffer to help protect the site's wetlands and watercourses from the impacts of new development (see page 29).

Monitor Wetland Health

Local government and citizens can monitor the health of wetlands. A monitoring plan and program can shed light on the health of your community's wetlands. Monitoring

can characterize local wetlands, recognize trends over time, identify problems at a specific site, guide management actions, and provide information about your local ecology. Before starting a monitoring program, set goals for it. Potential goals are education, developing baseline information, identifying water quality problems, and identifying ecological problems. Wetland monitoring is a great opportunity to partner with schools, scouts,

and other youth programs. Remember that you need permission to access private property.

The U.S. Environmental Protection Agency produced a volunteer wetland

monitoring guide that will be useful to developing a local program (U.S. Environmental Protection Agency 2001). The document provides guidance for establishing a volunteer wetland monitoring program, including how to design a wetland study, set study goals, what techniques to use based on your goals, and resources for more information.

Smart Growth Strategy

Local Wetland and Watercourse Protection

In addition to working with the local planning board to conserve wetlands on new developments, municipalities can develop local wetland laws to protect wetlands. This approach will help to protect wetlands throughout the municipality. Understand, however, that local wetland laws have been controversial in several Hudson Valley communities and it is very important that local leaders take the time to engage the public by providing information and gathering input (see Chapter 7 for techniques).

In New York State, towns can regulate wetlands that are not protected by the state. This usually means wetlands smaller than 12.4 acres. Most wetland and stream protection ordinances also include a buffer to protect the resource from construction and or vegetation removal. Towns may also adopt regulations for wetlands already regulated by Department of Environmental Conservation, provided the local regulations are at least as protective as the state regulations, for example, requiring more than a 100-foot buffer. Towns often include streams in as part of a comprehensive wetland and watercourse ordinance. It is important to note that wetland ordinances alone

will not protect wildlife because the required buffers are usually not wide enough to do so.

Recommended elements of a local wetland and watercourse protection ordinance are:

- prohibition of damaging modifications such as channelization, straightening, filling, impoundment, draining, and bank armoring;
- required mitigation for unavoidable disturbances;
- protecting natural buffer zones along the edge of wetlands and watercourses;
- requiring setbacks for buildings and pavement; and
- prohibition of direct discharges of untreated stormwater into natural wetlands and watercourses.

Other ordinances that protect wetlands include those for erosion and sedimentation, and stormwater control (see Chapter 10 for both). Groundwater, a crucial wetland resource, is discussed later in this chapter.

The Cost of Building on Wetlands, Town of LaGrange

The Importance of Local Performance Standards

During the 1960s, the Town of LaGrange in Dutchess County approved a twelve-home subdivision on a site that included a small wetland. After construction of the homes began in the late 1970s, several nearby residents noticed four feet of standing water in the foundations of at least six homes. The residents reported the condition to the building inspector, who said that nothing could be done. The homes were completed and sold, and the developer moved elsewhere.

In the wet winters of the early 1980s, people driving through the development frequently found the roads icy and very dangerous. The sump pumps draining the basements of the homes in the wetland area were the culprits. The homeowners eventually petitioned the LaGrange for help and ultimately the town agreed to pay \$497,000 to relieve basement flooding. Using the planning process to avoid such incidents not only saves taxpayer money but also protects the health, safety, and welfare of future homeowners and promotes more stable property values.

(Adapted from Kendall 1998)

Local Example

Town of Pleasant Valley Wetland and Watercourse Ordinance

The Town of Pleasant Valley (Dutchess County) adopted a wetland, waterbody, and watercourse protection ordinance in 2003. The local law regulates wetlands 1/2 acre and larger. The law stipulates a 100-foot buffer on wetlands and all perennial (permanent) watercourses in town. Within the 100-foot buffer, the town requires that a 25-foot naturally vegetated buffer be maintained except



when the space is needed for emergency purposes or agriculture. A permit is required for draining; dredging, excavation, removal of soil, mud, or gravel; filling; dumping; depositing; building; and changing ebb and flow of water. Though existing plantings and yard can be maintained, there can be no new plantings, walkways, or mowing. A wetlands administrator first determines the significance of the requested action, and then refers the permit to the planning board for approval or denial.

Conservation of Streams

Some elements of stream conservation are similar to wetland conservation. Where this guide identifies the overlaps, the appropriate section will be identified.

The most important stream conservation principles are:

- Streams are affected by what happens in their watersheds;

- Healthy watersheds are mostly forested and have less than 10 percent impervious surface;
- Local plants and animals are adapted to natural variation in stream flow;
- Stream buffers are a tool that can be used to moderate the effects of watershed urbanization;
- Streams naturally move across the landscape over time;
- Streams usually have physical and biological connections to wetlands.

Are Streams Protected by State and Federal Governments?

State and federal regulations protect some, but not all streams, and those protections are limited. In New York State, a permit is required for altering the beds and banks of protected streams. A protected stream is one with

Stream and Wetland Buffers

Aquatic habitats are affected by everything that happens in their watersheds. In urbanizing and suburbanizing watersheds, naturally vegetated buffers can help moderate impacts to stream and wetland ecosystems (Miltner et al. 2004). Buffers aid water quality by trapping or removing sediment, excess nutrients, pesticides, and other pollutants from surface runoff and shallow ground water. They can also reduce excessive bank erosion. Buffers are usually located in what is known as the riparian area, or the vegetative transition zone between a stream or wetland and the surrounding uplands. The information about buffers that follows can be applied to any local conservation effort where stream and wetland buffers are used, including overlay zoning, setbacks, performance standards, site design, wetland and watercourse ordinances, and acquisition.

Buffers are not a tool to prevent development, but to direct development into less sensitive areas. But municipalities should recognize that establishing buffers may affect the way landowners use their properties. To accomplish stream or wetland protection while still allowing development, municipalities can use techniques like flexible zoning. For example, planning boards could permit the same number of units allowed on the property with no buffer area, but then require the lots to be clustered on less sensitive portions of the property. Flexible zoning techniques are discussed in more detail in Chapter 9.

Some Hudson Valley communities protect buffers on streams and wetlands. The largest of these buffers may provide an adequate short-term aquatic buffer, but will not protect all of the animals that use the stream or wetland. Conserving the full range of species that use the habitats requires conserving adjacent upland habitat.

Aquatic Buffer

Buffers of 100 to 200 feet usually protect the water resource and aquatic habitat in the short term (see Table 5-1 on page 30 for specific benefits). Local conditions may warrant an increase in buffer width to adequately protect the resource. One approach is to widen the buffer where there are sensitive areas, including slopes greater than 15 percent, adjacent wetlands along streams, 100-year floodplains that fall outside of the buffer area, and critical habitats.* Critical aquatic habitat might include a stream reach that has spawning native brook trout, presence of a documented significant ecosystem as defined by the New York Natural Heritage Program, or presence of a species of interest that depends on the aquatic habitat, such as wood turtle in streams or spotted salamander for vernal pools. Generally, the aquatic buffer should have natural vegetation. Trees and shrubs are preferable because they provide bank stabilization and shade. The aquatic buffer alone is not sufficient to protect all animals that use the stream or wetland. For that, you need to consider adjacent upland habitat.

Adjacent Upland Habitat

As noted elsewhere in this chapter, wildlife species that use streams and wetlands often use upland habitat adjacent to the water resource. These species will not necessarily be protected with only an aquatic buffer. If adjacent areas are protected, more species will be protected and the stream or wetland system itself will be more protected over the long term. The adjacent upland area may be able to accept limited disturbance. For example, productive vernal pools need an undisturbed buffer of 100 feet, and function best when surrounded by a 750-foot wooded area. The critical forest habitat for vernal pools can sustain up to 25 percent disturbance; larger impacts are likely to eliminate vernal pool wildlife (Calhoun and Klemens 2002). Narrow, isolated buffers along streams may provide only low quality habitat that may attract animals, but do not support breeding (Waterhouse and Harestad 1999).

* Buffer Model Ordinance by the Stormwater Manager's Resource Center, available at www.stormwatercenter.net.

Buffer Conservation Strategies

Protect and Restore Natural Vegetation Along the Edges of Streams, Lakes, and Wetlands

One of the simplest and most beneficial actions that local governments can encourage is protecting or restoring naturally vegetated areas along streams and rivers. A turf grass lawn down to the water's edge is not effective habitat and does little to prevent erosion.

Buffer characteristics can vary depending on local conditions, such as the size and quality of the waterbody or wetland.

However, buffers should:

- Be of an appropriate width. Though any width of native vegetation along the edge of a watercourse or wetland will provide some benefit, the actual width should reflect the conservation goals of the community.
- Provide public access, where appropriate. While a continuous, uninterrupted buffer is preferable for protection of water quality and habitat, some flexibility may be desirable to provide access to a waterbody for recreational uses, particularly in parks and other public lands. Paving through a buffer is generally discouraged; instead use a mown footpath, a stepping-stone trail, or a pervious gravel path.

- Be naturally vegetated. Restored buffers should include native species that are suitable for the local conditions. Trees are essential for Hudson Valley stream health. Knee-high vegetation along lakes and ponds can discourage resident Canada geese. Resources for natural landscaping can be found in Chapter 13.
- Be flexible. Flexibility allows individuals to find innovative ways to conserve a meaningful buffer. For example, variable-width buffers can add protection to floodplains and wetlands or reduce buffer width on smaller residential lots.



Table 5-1. Benefits of Various Stream and Wetland Buffer Widths

This table provides guidelines on buffer widths based on current scientific literature. Only a site-specific biological survey can provide the exact buffer width needed to preserve species and ecosystems at a site. Note that the buffer sizes listed are not meant to be prescriptive, but are intended to help local governments better understand stream and wetland conservation. Buffer width in your municipality should be determined both by science and by what is acceptable in your community.

buffer width (in feet)	conservation benefit	source
80	nutrient and pollutant removal	Kennedy et al. 2003
100–200	buffer to protect water resources and core aquatic habitat	Semlitsch and Bodie 2003
100	temperature and microclimate regulation	Kennedy et al. 2003
100	core temporary woodland pool habitat (vernal pool)	Calhoun and Klemens 2002
160	stream detrital input and bank stabilization	Kennedy et al. 2003
330	water quality and minimal wildlife protection (includes adjacent upland)	Kennedy et al. 2003
250	stream salamander core habitat and buffer	Crawford and Semlitsch 2007
250–575	minimum corridor width needed to include 90 percent of bird species that use streamside habitat (adjacent upland)	Spackman and Hughes 1995
465–950	core riparian habitat for reptiles and amphibians (adjacent upland)	Semlitsch and Bodie 2003
535	long-term health of ecosystem (adjacent upland)	Howard 2004
750	critical terrestrial habitat for vernal pool breeding species (adjacent upland)	Calhoun and Klemens 2002

classification of A, B, or C(T). Listed in declining order of quality, the best use of an “A” stream is considered drinking water; for a “B” stream, swimming; a “C(T)” stream cannot be used for drinking or swimming, but it does support brook trout. See www.dec.ny.gov for more information. Federal programs protect streams and rivers, which means that a permit is required for activities in the regulated area. To find out if a permit is needed for a specific project, contact the regional Department of Environmental Conservation office or the Army Corps of Engineers (see Appendix 3). Do not assume that if state and federal laws are followed there are no impacts to streams. These laws are meant to minimize impacts on streams from development and other land disturbance, not protect them.

What Local Governments Can Do

Local governments can use a number of techniques to better protect the natural functions and habitats of streams. Local stream conservation programs should complement state and federal programs. For example, some municipalities protect buffers along the stream from building or alteration.

Decide Which Streams Are to Be Protected Locally

Knowing which streams are most important to your community and how buffers can protect them is essential to any local program. Streams are classified by order (is it a headwater or a large river?), water quality (is it drinkable, swimmable, or fishable?), and whether the flow is permanent or temporary. Streams of all orders and sizes are important for habitat and water quality. Your community may choose to have different regulations for different stream types. For example, a town could require a narrower buffer on a temporary stream than a permanent stream. The sidebar ‘Stream and Wetland Buffers’ on page 29 includes information on the importance of buffers and can help your community better define them.

Watershed Planning

Because all streams (and most wetlands) in a watershed are connected either by surface or ground water, one of the best ways to think about streams and wetlands is at a watershed scale. Watershed planning is emerging as the preferred management tool to protect stream health and water quality. Most streams and their watersheds span more than a single municipality; therefore conservation efforts should be intermunicipal to be effective. Examples of watershed planning initiatives in the Hudson Valley are described in Chapter 12.

Monitor Stream Health

The benefits of stream monitoring are similar to wetland monitoring. Stream monitoring can characterize your town’s (or watershed’s) streams, identify which of them meet state and federal water quality standards, identify

stream quality trends, identify problems at a specific site, guide management actions, and provide information about your local ecology. Before starting a monitoring program, set goals for the stream-monitoring program. Good goals include education, developing baseline information, identifying water quality problems, and identifying ecological problems. Stream monitoring is a great opportunity to partner with schools, and scouts and other youth programs.

The Hudson Basin River Watch Guidance Document is useful for developing a local program for monitoring stream water quality (Behar and Cheo 2004). Hudson Basin River Watch is a volunteer river-monitoring network for the entire Hudson River watershed. The guidance document includes information on how to design a stream study, what techniques to use based on your goals, and lists regional coordinators who are available for technical assistance. Stream health can also be visually assessed from the condition of its bed, bank, and riparian corridor. This assessment will provide you with different information from water-quality monitoring, though it is compatible. To develop this kind of program, use the Stream Visual Assessment Protocol, developed by the USDA Natural Resources Conservation Service (NRCS) and used by county streamwalk programs (Newton et al. 1998). Contact your county soil and water conservation district for more information (see Appendix 3).

Ecological Stream Channel and Riparian Zone Maintenance

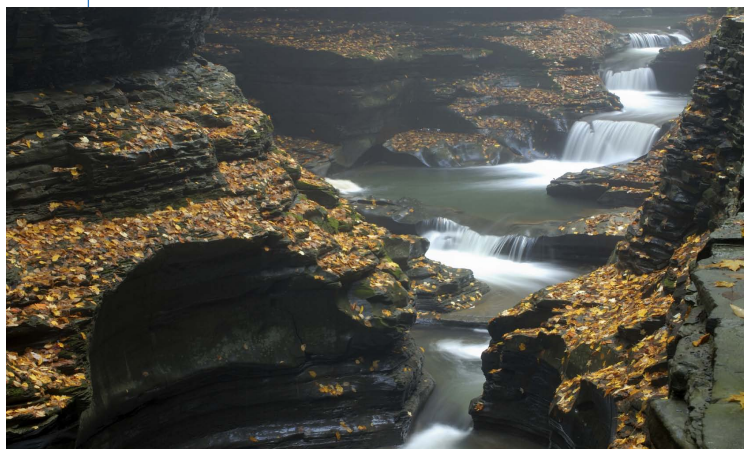
The historical focus of stream-channel maintenance has been the removal of woody debris (snags) and gravel, removal of riparian vegetation, armoring of banks (with rip rap), and straightening of the channel. These techniques are most often used to alleviate flooding and control streambank erosion. These practices ignore the multiple functions and desired uses of a stream channel. As a result, flooding problems are merely transferred further downstream. Newer techniques, such as natural channel design, consider how stream shape influences water and sediment movement in a stream. A properly designed local stream-corridor maintenance program should do the following to the greatest possible extent:

- Retain or restore the natural channel (which requires an understanding of the shape of the stream bed in the affected stream reach*);
- Retain woody debris in the stream to provide cover and nutrients for fish and wildlife;
- Retain or restore native vegetation (especially trees) within the stream corridor and the floodplain;

* This concept is also known as hydrogeomorphology, which is the study of stream shape and how that influences the way water and sediment move through the system.

- Minimize human activities/uses (e.g., trash disposal, buildings, etc.) in the floodplain and, particularly, within the aquatic buffer;
- Apply natural channel-design approaches to control ongoing streambank erosion and gravel deposition;
- Redesign stream crossings (e.g., bridges and culverts) to better accommodate flood waters and minimize biological impacts (e.g., allow for fish passage), especially when repairing the crossing or repaving the road.

The implementation of a maintenance program that follows these guidelines may require a higher initial cost than traditional methods; however, the overall annual costs to local government for maintenance in the floodplain could be significantly reduced over the long term.



Smart Growth Strategies

Local Wetland and Watercourse Regulations

Many towns have used local wetland and watercourse regulations to protect stream buffers of 25 to 200 feet. To define buffers that reflect your community's goals, see the sidebar on wetland and stream buffers on page 29. For more guidance on how to develop a local wetland and watercourse protection ordinance, see the section on conservation of wetlands on page 27.

Other Ordinances

Other ordinances that protect streams include those for erosion and sedimentation, stormwater control, and groundwater protection. Chapter 10 covers erosion and sedimentation and stormwater control.

Voluntary Land Preservation Agreements

Towns can work with landowners to protect wetlands, streams, and riparian areas with conservation easements. These lands are often less expensive than other lands due to their development constraints. The Towns of Montgomery and East Fishkill have established voluntary easement-protection programs along major waterways.

For more information on how to apply this technique, see Chapter 11.

Local Examples

Town of Montgomery, Orange County

The Town of Montgomery, Orange County, has been protecting a locally important river corridor. The Wallkill River runs from northern New Jersey, through Orange and Ulster Counties, and empties into Rondout Creek before entering the Hudson River Estuary. The town identified the river as an important resource, and approached landowners on both banks along the river to protect a 250-foot buffer from development. Many landowners responded by donating an easement to the town preventing development in these areas. To date, 280 acres have been protected along the Wallkill in the Town of Montgomery.

Conservation of Forests

The most important forest conservation principles are:

- Forests need to be large and connected in order to be quality wildlife habitat and provide the most community benefits;
- Forests are more than trees: understory shrubs and herbs are important as well.

How Large Should Forests Be?

How large is an unfragmented forest? It depends on the local area: in a highly developed town, a five- or ten-acre lot with relatively mature trees may be significant. In more rural areas, forests of 200 acres or more provide significant wildlife benefit. Note that forests of this size occur across property boundaries. Communities should strive to conserve a variety of forests. The following table describes the wildlife benefit of different forest sizes. Forest fragments of just five acres or more have some wildlife and significant human health benefit. Therefore, if a town wants to conserve those forest values, five acres should be considered the minimum area for forest habitat. Conserving large functioning forests does not mean they are off-limits to humans. There are many healthy forests that include some development and working forest land.

What Is Protected by Federal and State Government?

There are no state or federal laws that protect forests.

What Local Governments Can Do

There are few tools designed to help conserve forests locally. The primary vehicles for forest conservation in New York are purchase, conservation easement, and private landowner stewardship. Forest conservation can also be addressed using local planning and zoning, including tree conservation ordinances. All of these tools need to be used together strategically to conserve a large forest.

Develop In Ways that Maintain Connections Among Forests

Few parcels are large enough to protect a whole forest. If a natural-resources inventory identifies large, contiguous forests as an important community feature, development on forested parcels can be clustered to maintain ecologically significant connections across property boundaries. Performance standards, and subdivision



and site-plan regulations can also be used to maintain connections (see also Chapter 9). On site plans, forests can be delineated and nonforested areas suitable for reforestation can be identified. Municipalities can ask applicants to identify how connections will be made to adjacent properties. Sample ordinances and performance standards designed to minimize fragmentation can be found in the resource list at the end of the chapter.

Manage for Forests in Municipal Parks

For municipally owned forest lands, towns should consider developing management plans that protect habitat. To maintain forest habitats in parks, it is best not to mow under the trees. Maintaining a well-developed shrub and herbaceous understory will encourage diversity of woodland plants and animals. Maintenance crews should also avoid removing older trees unless they are dangerous. Old, rotten, and even dead trees provide nesting and feeding areas for many types of wildlife.

Manage Deer Impacts

Overabundant white-tailed deer threaten forests in the Hudson Valley. Deer eat shrubs and seedlings in the forest understory, preventing regeneration and reducing habitat quality for wildlife. The causes of deer overabundance are complex, as are the solutions. The Department of Environmental Conservation has produced *A Citizen's Guide to Management of White-tailed Deer in Urban and Suburban New York* (Bishop et al. 1999, 2007). This helpful guide identifies the pros and cons of the various methods that can be used to manage deer populations. Recognizing the problem deer were causing to their forests, the Town of Pound Ridge in Westchester County opened three of its town parks to deer hunting and encouraged private landowners to do the same.

Promote Wildlife-Friendly Forest Management

Forestry can be compatible with wildlife conservation provided it is done in accordance with established guidelines. The *Municipal Official's Guide to Forestry* (Daniels 2005) has tools and information on how local governments can promote sustainable forestry in their communities. Two excellent guides are available to help

Table 5-2. Forest Sizes for Effective Conservation

size in acres	species	notes	importance
5	small mammal diversity to reduce Lyme disease risk (Allan et al. 2003)	minimum size to represent a particular plant community (Kennedy et al. 2003)	
200–2,000	some less-sensitive forest-interior birds	broad corridors provide important connections to larger forests; edge habitats and species will dominate	stepping stone
2,000–5,999	minimum area needed for sensitive forest dependent birds	provide important corridors and connections among larger forests	local
6,000–14,999	some area-sensitive species	can accommodate some large-scale disturbance, but may not be able to maintain entire range of habitats after large-scale disturbance	regional
15,000+	wide-ranging and area sensitive species, including broad-winged hawk, barred owl, neotropical migrants, bear, and bobcat	contain a wide range of forest successional stages; can accommodate large-scale disturbances like blowdowns and fire	global

adapted from Orange County (N.Y.) Planning Department 2004.

landowners harvest timber and protect wildlife (Sullivan and Cox 2004, Calhoun and deMaynadier 2004).

Smart Growth Strategies

Tax Incentives

The New York State Forest tax law (also called the 480a program) can reduce the property tax impacts of working forest lands with an approved management plan from a qualified forester. Private forests of fifty acres or more are eligible for the program if they are managed primarily for timber production. The land conserved by the 480a program is significant in the Hudson Valley. As of April 2004, nearly 87,000 acres of working forest lands were enrolled in the program in the ten-county Hudson Valley Region. Though the program reduces property-tax receipts collected by the town, working forest lands



generally require far less in services than they generate in taxes. When the trees are harvested, the county receives a tax of 6 percent of the timber value. Contact your regional Department of Environmental Conservation office for more information on the 480a program (see Appendix 3).

Purchasing Land or Voluntary Land Preservation Agreements

Fee purchase of forestland or conservation easements that remove development potential or stipulate wildlife-friendly forestry practices can be effective in conserving forest lands. Hiking, hunting, and birdwatching are compatible recreational activities. Trails should be well-defined and directed away from the most sensitive habitats. See Chapter 11 for more information.

Conservation of Open Upland Habitats

The most important open upland conservation principles are:

- conserve open uplands in appropriate areas;
- connect habitats among separately owned parcels;
- facilitate appropriate management to maintain the open habitat.

How Large Should Open Uplands Be?

Contiguous grasslands of at least seventy-five acres, and preferably 250 acres support successful the breeding of rare grassland birds. These include the upland sandpiper, grasshopper sparrow, and northern harrier. Small grasslands of just ten to seventy-five acres will support some rare and declining grasslands birds, notably bobolink, eastern meadowlark, and savannah sparrow. Many birds of prey will use small grasslands for hunting in the winter (Jones and Vickery 1997 a,b,c). Shrubland species are adapted to the temporary habitat and can use smaller areas. Barrens are so rare in the Hudson Valley (and the world) that the habitat should be protected and connected where possible.

What Is Protected By the Federal and State Government?

There are no specific regulations addressing open upland conservation in New York, but some bird and insect species that use grasslands are listed as threatened or endangered by New York State or the federal government.

What Local Governments Can Do

Like forests, there are few tools designed to help conserve open uplands locally. The same primary tools are available: purchase in fee, conservation easement, and private landowner stewardship. Local planning and zoning tools can also be used to maintain connections across property boundaries. In reality, all of these tools will need to be used together to conserve open upland habitat.

Conserve Open Uplands In Appropriate Areas

There are few areas of large grassland habitats in the Hudson Valley that can support grassland-dependent birds. Areas particularly important for grassland birds in the Hudson Valley are the Wallkill River Valley in Orange and Ulster Counties, eastern Greene County, and western Columbia County. Shrubland habitat can occur in smaller patches than grasslands and still support rare species. Barrens are very rare in the Hudson Valley, but need a large, contiguous area for long-term maintenance.

Maintain Connections Among Habitats

Like forests, early successional habitats need to be connected to support rare and declining species. Towns

can help maintain connections in three ways: purchase land or conservation easements, develop in ways that maintain connections, and encourage voluntary private land stewardship to reconnect lands that are no longer connected. The first two are discussed on page 32, conservation of forests. The same principles apply to early successional habitats. Federal incentive programs,



like the Wildlife Habitat Incentives Program and Partners for Fish and Wildlife can help landowners share costs of habitat management.

Manage for Open Upland Habitats

If grassland and shrubland habitats are left alone, they will naturally become forest. Therefore, these habitats often require infrequent mowing or selective removal of trees to maintain rare species that live there. Ground-nesting birds nest in the spring and raise their young throughout the summer. Grasslands can be safely mowed annually in August, or every two to three years. With compatible management, airports, capped landfills, and active farms can provide good grassland habitat. Shrubland can be mowed every ten years outside of peak animal activity periods (e.g., the breeding season). Controlled burns are occasionally used to maintain these habitats, particularly barrens. Powerline rights-of-way can be good shrubland habitat. Maintenance of early successional habitat should be balanced with the need to conserve stands of unfragmented forest. Management regimes should be based on conservation priorities developed during the community's natural-resource inventory.

Manage for Meadows in Municipal Parks

Some municipalities maintain meadow areas in parks by mowing a few times a year. If your community wants to maintain meadow areas for birds, wait to mow until August to avoid disturbing grassland birds and destroying ground nests (Jones and Vickery 1997 a,b,c). Areas known to support rare plants, rare breeding birds, or rare butterflies should also be protected from frequent human disturbance.

Smart Growth Strategies

Sharing the Cost of Habitat Management

Several state and federal programs can be used to keep private land in grassland or shrubland cover. Many of the programs are for use on active farms, which comprise important habitat for grassland birds and other rare species in the Hudson Valley. Federal programs are managed by the Natural Resource Conservation Services (e.g., Wildlife Habitat Incentives Program), and the U.S. Fish and Wildlife Service (Partners for Fish and Wildlife). The New York State Department of Environmental Conservation manages the Landowner Incentive Program using funds from the U.S. Fish and Wildlife Service. These programs can be promoted in your community to conserve open uplands and barrens. Landowners should check with the individual agencies to determine eligibility.

Purchasing Land or Voluntary Land Preservation Agreements

Grassland or other early successional habitat can be conserved through fee purchase or voluntary land preservation agreement. In either case, management is necessary to maintain suitable habitat for wildlife of concern. Hiking, hunting, and birdwatching are compatible recreational activities. Trails should be well defined and directed away from the most sensitive habitats. See Chapter 11 for more information.

Local Examples

Grasslands and Jobs in Greene County

The Greene County Industrial Development Authority (IDA) wanted to attract businesses to the county to provide jobs. Conflict arose when it was discovered that the site chosen for the new business park was used by the state-threatened Northern Harrier. After an initial adversarial relationship with local citizens who were concerned about bird habitat, the IDA worked with the conservationists to develop a preserve for the Northern Harrier hawk. As a result, the Greene Habitat Conservation Advisory Committee was created. Since then, the IDA has conserved 1.4 acres for every acre it has developed while bringing in 600 new jobs. The agency is now working with the committee to design new commercial development sites that protect habitat and to create a habitat-management plan for the conserved areas. The Greene Habitat Conservation Advisory committee is led by the Greene County Soil and Water Conservation District. For more information, contact the District Office at 518 622-3620.

Restoring Connections with Natural Landscaping

The Albany Pine Bush is a unique habitat dominated by pitch-pine and scrub oak and is home to many rare species, including the federally endangered Karner blue butterfly. The habitat is actively managed by the

Albany Pine Bush Commission. Further complicating the conservation of the area, the Albany Pine Bush Preserve is highly fragmented by residential and commercial development. A native landscaping program was developed to connect pine barren habitats that had been separated by development.* The Albany Pine Bush Preserve Commission saw the expansion of a nursing home as an opportunity. As part of the permit approval for the expansion, nine acres were landscaped with native Pine Bush plants, connecting two previously unconnected patches of Pine Bush habitat. In addition, the facility also gave the Albany Pine Bush Commission a conservation easement to prevent future development and a management agreement to maintain the unique plant community on the nine acres. Local middle-school students worked with nursing-home residents to grow and plant the native Pine Bush vegetation used onsite. The conservation project is a great example of public-private partnership and a multigenerational conservation project. For more information, contact the Albany Pine Bush Preserve Commission at 518 785-1800.

Conservation of Urban Habitats

Habitat-conservation opportunities in urban areas are different than in rural and suburban areas. The habitats are smaller and often in need of restoration, but their many community benefits make them worth conserving. There are sometimes opportunities to enhance habitats through new development. The key is to identify and understand the local resources, so that they can be protected, enhanced, or restored.

What Is Protected by State and Federal Government?

No urban habitats are explicitly protected, but some wetlands and streams are protected as described earlier in this chapter.

What Can Local Governments Do?

To conserve local urban habitats, municipalities should identify important habitat throughout the community so they can take advantage of conservation opportunities presented by various projects. Streams often provide enhancement opportunities. Urban streams can benefit from riparian tree planting. Buried streams can be restored by “daylighting,” or exposing them to daylight. Maintaining natural areas within parks can help protect important wildlife habitat. A plan to conserve nature can consider the need to buffer parks from surrounding land-use where appropriate. Homeowners with backyards that border urban natural areas might consider landscaping with native plants to buffer or expand wildlife habitat.

* See description of Glacial Lake Albany Native Plant Restoration Project in the local examples cited in Chapter 13.

Smart Growth Strategies

New York State Department of Environmental Conservation Urban Forestry Program is designed to provide technical assistance for local government, citizen groups, service clubs, and other organizations interested in promoting trees and forests in urban and village settings. Contact your Regional Department of Environmental Conservation office for more information.

Local Example

Newburgh's Hidden Natural Heritage

Quassaick Creek is a tributary of the Hudson located on the border of the City of Newburgh and the Town of New Windsor. To connect urban residents to local natural resources and create a valuable education opportunity, the city sponsored a biological inventory of the creek's corridor. Though the area has long had industrial, commercial, and residential development, the inventory found important biological resources in the corridor. Some significant finds were two state-rare plants and the wood turtle, a state species of special concern. Some industrial development actually helped protect portions of the stream corridor by preventing trespassing and further development. Without taking the important step of inventory, the city would have never known of its hidden biological riches and may have lost them with the development of public access and trails. Now trails can avoid the sensitive areas and highlight Newburgh's biodiversity.



Resources

General Resources

- Duerksen, C., C. D. Elliott, N. Thompson, E. Jonson, and J. Miller. 1997. Habitat Protection Planning: Where the Wild Things Are. *Planning Advisory Service Report* No. 470/1. American Planning Association. Chicago.
- Kelley, K. [ed.] 2003. Local Environmental Ordinances. *Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.
- Kennedy, C., J. Wilkinson, and J. Balch. 2003. Conservation Thresholds for Land Use Planners. *ELI Report*, Washington, D.C. www.elistore.org.
- McElfish, J. 2004. *Nature Friendly Ordinances*. Environmental Law Institute, Washington, D.C. Available from www.elistore.org.
- Van Tine, J. [ed.] 2003. Local Environmental Strategies. *Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.

River Conservation

- Otto, B., K. McCormick, and M. Leccese. 2004. Ecological Riverfront Design: Restoring Rivers, Connecting Communities. American Planning Association. *Planning Advisory Services Report* # 518–519. Chicago, Ill.

Wetland Conservation

- Brady-Connor, J. 2002. *Wetland and Watershed Protection Toolkit: Guidance Materials for Local Governments in New York State*. Association of State Wetland Managers. Berne, N.Y. www.aswm.org.
- 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, New York.
- Kendall, B. 1998. *Local Strategies for Wetland and Watercourse Protection: An Educational Guide*. The Dutchess County Environmental Management Council and Cornell Cooperative Extension of Dutchess County. Millbrook, N.Y.
- Kunsler, J. 2003. Wetlands and Watershed Management: A Guide for Local Governments. *Publication number* 28. Institute for Wetland Science and Public Policy of the Association of State Wetland Managers. Berne, N.Y. www.aswm.org.
- U.S. Environmental Protection Agency. 2001. Volunteer Wetland Monitoring: An Introduction and Resource Guide. *EPA 843-B-00-001*. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Wetlands Division, Washington, D.C. www.epa.gov

Stream Conservation

- Federal Interagency Stream Restoration Working Group. 2001. *Stream Corridor Restoration: Principles, Processes, and Practices*. By the Federal Interagency Stream Restoration Working Group (15 agencies of the U.S. government). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN 3/PT.653. www.nrcs.usda.gov/technical/stream_restoration/
- MacBroom, J. 1998. *The River Book: The Nature and Management of Streams in Glaciated Terrains*. Connecticut Dept. of Environmental Protection Natural Resource Center, Hartford, Conn.
- Postel, S., and B. Richter. 2003. *Rivers For Life: Managing Water for People and Nature*. Island Press, Washington, D.C.

Forest Conservation

The Agroforestry Resources Center in Acra, Greene County, N.Y. promotes incentives for forested land to remain forested in order to provide tremendous environmental, economic, and public health benefits to the surrounding human population. Seminars, lectures, and workshops are held throughout the year. For more information, contact Cornell Cooperative Extension of Greene County at 518 622-9820.

Open Upland and Barren Conservation

Ballard, B. D., H. L. Whittier, and C. A. Nowak. 2004. *Northeastern Shrub and Short Tree Identification: a Guide for Right-of-Way Vegetation Management*. Research Foundation of the State University of New York and SUNY College of Environmental Science and Forestry, Syracuse, N.Y.

Barnes, J. K. 2003. Natural History of the Albany Pine Bush Albany and Schenectady Counties, New York. Field Guide and Trail Map. University of the State of New York. *New York State Museum Bulletin* 502.

Ballard, B. D., and C. A. Nowak. Shrub Identification, Shrub Management, and Shrub Ecology. Web site of the Integrated Vegetation Management (IVM) Research and Development Program, State University of New York. College of Environmental Science and Forestry (SUNY–ESF) Syracuse, New York. www.esf.edu/ivm/ (accessed March 2007).

Jones, A. and P. Vickery. 1997a. *Conserving Grassland Birds: Managing Agricultural Lands Including Hayfields, Crop Fields, and Pastures for Grassland Birds*. Massachusetts Audubon Society, Lincoln, Massachusetts.

Jones, A. and P. Vickery. 1997b. *Conserving Grassland Birds: Managing Large Grasslands Including Conservation Lands, Airports, and Landfills over 75 acres for Grassland Birds*. Massachusetts Audubon Society, Lincoln, Massachusetts.

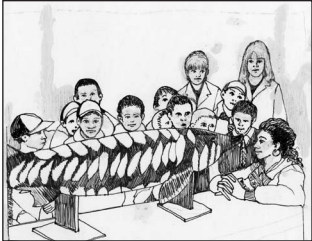
Jones, A. and P. Vickery. 1997c. *Conserving Grassland Birds: Managing Small Grasslands Including Conservation Lands, Corporate Headquarters, Recreation Fields, and Small Landfills for Grassland Birds*. Massachusetts Audubon Society, Lincoln, Massachusetts.

Urban Conservation

Rosenzweig, M. L. 2003. *Win-win Ecology: How the Earth's Species Can Survive in the Midst of Human Enterprise*. Oxford University Press, New York.

Chapter 6:

Public Outreach and Education



"In the end, we conserve only what we love. We will love only what we understand. We will understand only what we are taught."

Baba Dioum, Senegalese poet

"Tell me and I'll forget. Show me, and I may not remember. Involve me, and I'll understand."

Native American proverb

Building public support for nature conservation will be essential to expanding the use and effectiveness of the techniques recommended by this handbook. Though there is growing public support for protecting and restoring natural areas and biodiversity, there are still some questions and uncertainty about it among many segments of the community. Raising awareness of local natural areas and wildlife and the importance of them to the human community is a crucial step to building a local conservation program.

People get information that forms their attitudes and behaviors from many sources in addition to schools. Conservation organizations, community leaders, and the media contribute to the knowledge and values held by the public and they help interpret conservation issues. Local governments can play a significant role in educating their communities. The purpose of this chapter is to identify opportunities for local governments to most effectively use education to raise awareness and appreciation of local natural areas and wildlife. Education techniques described in this chapter can also be used in developing a public participation strategy.

How Can Education Be Used to Protect Natural Areas and Wildlife?

The future of our natural landscapes depends upon the support and involvement of our citizenry. Widely held community values will determine local land use policy through elections and public hearings. A community that is well informed on natural resource issues is more likely to be supportive of decisions to conserve natural areas.

Residents not only influence larger community decisions with their votes but also make daily decisions affecting the health of natural ecosystems. These decisions range from the plants they choose to landscape around their homes to whether they support local initiatives to conserve habitat, which in turn depends upon the degree to which they understand the natural landscape.

Education is the first step in developing a local conservation program. If your municipality is not ready to plan with nature, educating your community is a significant step toward conserving local natural areas and wildlife. In some communities, education will be as important as implementing any of the other techniques described in this handbook.



Smart Growth Strategies

Many local committees can participate in education efforts: conservation advisory councils, watershed groups, and open space committees. Municipalities can partner with other organizations that are already educating the public about nature. Successful conservation efforts are often the result of one or a few dedicated individuals who encourage and inspire communities to get involved; identify and support community leaders who can lead the educational effort to protect biodiversity.

In all approaches, be sure you reach out to a diverse group of people and treat all points of view with respect.

What Is Your Education Goal?

Clearly identifying the goal of an education initiative will help hone the message, identify the audience, and identify the resources that can help you reach your goal. Table 6.1 has examples of education goals and how this handbook can help you reach them.

Identify Your Audience and Potential Partners

The concept of a “general public” is misleading. What we call the public is actually a mix of people with different backgrounds, values, and motivations. Landowners, farmers, parents, landscapers, sportsmen and women, and business owners are all parts of the public. Recognizing this, any directed education effort should seek to identify its target audience or audiences and create strategies that will be most effective in reaching them. For example, to reach residents in a certain part of a municipality, one might write an article for the local neighborhood newsletter. You can work with local outdoor groups, like sportsmen and women, garden, and bird clubs, but also include groups that may not normally be involved in these activities, such as church groups, neighborhood associations, or chambers of commerce.

Think About Your Language

The words you use when talking about nature matter. It helps to talk about natural areas and wildlife or similar terms that are more meaningful to most people. It is also important to focus on reality—natural areas and wildlife in *your* community. Finally, remember to make the connection between nature and everyday life. Information in Chapters 1 and 3 can help you do that.

Look For Educational Opportunities

Municipalities could sponsor and/or promote events that provide learning opportunities about local natural areas and wildlife, such as hikes, outings, paddles, and field trips. They could partner with nature centers, bird clubs, and land trusts that already have education programs to highlight locally significant habitats.

How to Reach People

The method you use will depend in part on the education goals and the audience you want to reach. Here are some ways to get the word out.

- annual events like Earth Day and Arbor Day
- articles in newsletters (community, neighborhood, interest group)
- articles in the local paper
- brochures or fact sheets in water bills or property tax bills
- community lectures
- letters to the editor
- presentations to service clubs, such as Rotary and Kiwanis
- public-access television
- public meetings and charrettes (See Chapter 6.)
- radio and television news stories
- trainings and workshops



Table 6-1. Sample Education and Communication Goals

education goal	when a municipality might set this goal	smart growth strategies in this chapter to help achieve the goal	potential resources
raise community awareness of local habitats	municipality is first considering conserving natural landscapes	identify your audience, look for educational opportunities	local nature centers, bird clubs, sportsman's groups, etc.
build support for conservation of local habitats	municipality is considering developing conservation initiatives	identify your audience, educate community about the importance of local habitats, involve people, lead by example.	detail on benefits of habitats in the introduction and Chapter 3; information from Biodiversity Project 2003
encourage natural landscaping near unique natural areas	after a plan has identified natural landscaping as a way of conserving a specific natural area.	identify your audience, lead by example, hold training and workshops	Chapter 13 has additional resources.

Designate an Official Plant or Animal

One way to raise awareness of local habitats is to pass a resolution designating an official plant or animal that highlights the unique biodiversity of your municipality. The Town of Queensbury, in Warren County, designated the federally endangered Karner blue butterfly as its official animal. Your municipality's official plant or animal need not be an endangered species, though it should be somewhat unique, attractive, and found in the area. From a conservation perspective, it also makes sense

to select a species that indicates high-quality habitat. Turtles and dragonflies are attractive species that are of particular importance in the Hudson Valley. A salamander, orchid, or butterfly is also a good choice. Another way to get more people involved is to have an election or contest (see local examples on page 42). Once an official species is designated, education can focus on the species, its habitat, and stewardship/conservation. By celebrating the species through education and awareness, understanding and conservation support can grow throughout the community. For more information on the Town of Queensbury's efforts to protect the Karner blue butterfly, visit the town's official web site: www.queensbury.net.



Educate the Community About the Importance of Local Habitats

This is extremely important. Not everyone is moved by the plight of declining species, but many are concerned about clean water and public health. Explaining to people how healthy biodiversity is crucial to healthy human communities and economies is an effective way of reaching people. Information in this handbook can be used in education efforts. Resources listed at the end of this chapter may also be helpful.

Emphasize Responsibility and Opportunity

Explain the local role in conserving natural areas and wildlife. Try to describe the problem without emphasizing doom and gloom. There's nothing like despair to turn off an audience.

Get Citizens Involved

Make local habitats relevant by getting people to experience them. Residents can be involved in management and monitoring (see Chapter 5), and natural landscaping. Activities that bring people together help build strong bonds and foster greater public involvement in efforts to enhance the community's image and quality of life. Neighborhood-based programs aimed at improving the environment and biodiversity locally can be appropriate for all ages and provide good

opportunities for neighborhoods to become involved with local conservation. Get a commitment from people to make a positive contribution to the environment, for example, replacing nonnative plants with native alternatives. Research has shown people who say they will do something are more likely to follow through (McKenzie-Mohr and Smith 1999).

Lead By Example

Municipalities take many direct actions that can have a positive impact on natural areas. Taking such an action gives the municipality the opportunity to lead by example. For instance, natural landscaping can be used on municipal lands (Chapter 13) and natural areas can be maintained in some parks (Chapter 5). When building new facilities, use low-impact development and best-management practices to limit impervious area, manage stormwater, and retain natural areas (Chapter 10). This demonstrates the municipality's commitment to conserving nature and sets a good example for the rest of the community. Be sure to let the community know what you are doing and why you are doing it.

Hold (or Co-sponsor) Trainings and Workshops

Training and workshops can be an effective way to share technical information with an audience. For example, if a municipality wanted to increase use of an unfamiliar technique, such as low-impact stormwater management tools or natural landscaping, it might consider holding a training or workshop. Training can also be used to educate violators of local laws, as has been done in New York City.

Controversy

Like many issues regarding land use, conserving natural areas is sometimes considered controversial, often because of misconceptions. The best way to deal with controversy is to be prepared—anticipate controversial aspects and spend more time reaching out to and involving potential opponents to create opportunities for dialogue. Broad public participation in the decision-making processes is an important part of addressing potential controversy. Chapter 7 discusses participation techniques in greater detail. Resource protection does not mean infringing on property rights—it can actually enhance them.

Summary of Benefits

The ultimate goal of environmental education is to help develop environmentally literate citizens, capable of making well-informed decisions about protecting local natural resources. Effective outreach and education efforts lead to:

- Increased public support for measures initiated by public agencies to protect natural areas and habitats.
- Improved public understanding of how nature and wildlife contribute to our sense of community, our sense of place, and to healthy, livable communities.
- Improved understanding of the public's capability to act to conserve nature and to motivate them to take action.



K. Strong

- Improved awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas.
- Improved skills for identifying, participating in, and solving local environmental problems.

Local Examples

Spreading the Word About Your Local Watershed

The Fishkill Creek basin covers approximately 194 square miles in Dutchess and Putnam counties, and encompasses the fastest growing towns in Dutchess County. The primary issue of concern in the basin is water supply. Most of the region's water comes from groundwater well systems that draw from the sand and gravel aquifer in the Fishkill Creek and Clove Creek valleys.

The Fishkill Creek Watershed Committee was born of this concern. The committee's mission is to encourage individuals and entities, both public and private, to work for the protection of the water supply and natural environment within the Fishkill Creek watershed. Education efforts are broad and varied. Committee members use the media to spread their message by

writing letters to the editor, articles in the newspaper, and local cable TV news stories. Local festivals used to spread the word include the Beacon Sloop Club Pumpkin Festival, East Fishkill Community Day, and the Hudson River Valley Ramble. The committee created an e-mail list and web site to update interested parties on issues of concern. Even more people became involved through an award-winning Streamwalk Program in which volunteers walked sixteen miles of Fishkill Creek to document the condition and visible impairments of the stream and shoreline. An education grant encouraged science teachers to use the Fishkill and its tributaries as an outdoor lab. For more information, visit the Fishkill Creek Watershed web site at www.fishkillcreekwatershed.org.

Public-access Television

Several communities have used public-access television to interview regional experts on wildlife and land use. The Town of New Castle conducts biodiversity education and outreach through various shows on public-access television, such as "Environment in New Castle" and "Know Your Parks."

Educating Students About Local Resources

All too often, our biological education does not focus on local resources. That's not true in Albany County, where Farnsworth Middle School students help the Albany Pine Bush Preserve Commission control invasive species, grow native plants from seed, and plant seedlings. The seventh-grade curriculum has integrated the Pine Bush in science, language arts, and math. An elementary school in the same district recently held a vote to elect a new school mascot for four years. The symbol of the Pine Bush, the federally endangered Karner blue butterfly, won in a close election. For more information, contact the Albany Pine Bush Preserve Commission at www.albanypinebush.org.

Conservation Café

The Westchester County Department of Parks developed the Conservation Café as part of the "Conversations on Conservation" series with the goal of creating collaboration among municipal leaders, conservation advisory councils, and environmental advocates. A report by the Federated Conservationists of Westchester found that there was more competition than collaboration when it came to addressing Westchester's environmental challenges. The café is an informal forum for land managers and municipal officials to talk with experts about natural-resource issues. There are several meetings a year. Issues of interest include deer management, native plants, invasive species, Lyme disease, and stormwater. For more information, visit the Westchester County Department of Parks, Recreation, and Conservation web site at www.westchestergov.com.

BioBlitzes

In a BioBlitz, which usually takes place at a local park, scientists take a qualitative census of the biological resources of the area. A BioBlitz can educate the public about nature in their community. The community can be involved as either volunteers or can visit exhibits and displays set up in conjunction with the BioBlitz. More information on local bioblitzes can be found at www.nybioblitz.org.

Education and Communication Resources

Think Locally!

Every municipality has local people who can assist education efforts. Local nature centers, bird clubs, naturalist societies, sportsmen and women's groups, watershed groups, biology professors, teachers, land trusts and preserves can all be great resources for, and partners in, local conservation education efforts. Municipal agencies, including conservation advisory councils, soil and water conservation districts, and local Cornell Cooperative Extension offices are also helpful. Here some other organizations that can help you:

New York State Department of Environmental Conservation Hudson River Estuary Program

www.dec.ny.gov

Education in the estuary program focuses on the Hudson River. The program includes an education web site, booths at fairs, school programs, teacher training, grants, and technical assistance. The estuary program provides support to a system of twenty-five public and private education centers in the Hudson Valley.

The Biodiversity Project (Madison, Wisc.)

www.biodiversityproject.org

The mission of the Biodiversity Project is to assess public opinion on biodiversity; to develop collaborative strategies to increase public awareness and engagement; and to lay the groundwork to implement those strategies. Some especially useful tools available on the web site are the message kits "Great Communities for People and Nature," "Life. Nature. The Public. —Making the Connection," "Getting on Message: Making the Biodiversity–Sprawl Connection," and "Getting on Message: Eastern Forests and Biodiversity."

National Audubon Society of New York

ny.audubon.org

The Audubon centers in the Hudson Valley: Buttercup Farm Sanctuary (Dutchess Co.), Rheinstrom Hill (Columbia Co.), Ramshorn/Livingston Sanctuary (Greene Co.), and Constitution Marsh (Putnam Co.) have nature education programs for adults and children. The web site has details about Audubon's wildlife conservation programs and also has contact information for Audubon chapters throughout the state.

Hudson River National Estuarine Research Reserve (HRNERR)

www.dec.ny.gov

The Hudson River National Estuarine Research Reserve is part of a national system of estuarine research reserves. The reserve is a network of sites on the tidal Hudson: Piermont Marsh (Rockland), Tivoli Bays (Dutchess), Iona Island (Rockland) and Stockport Flats (Columbia). A wide variety of physical, biological, and chemical research projects has been conducted at those sites. Public education programs include field programs for adult audiences, field classes for students, workshops for teachers and youth leaders, traveling exhibits, and presentations to community groups and service organizations. HRNERR also conducts estuary training programs to help land managers and local governments make better decisions for the Hudson River Estuary.

New York State Biodiversity Project

www.nybiodiversity.org

The Center for Biodiversity and Conservation at the American Museum of Natural History partnered with the New York State Biodiversity Research Institute, The Nature Conservancy, the New York Natural Heritage Program, and the New York State Department of Environmental Conservation to create the New York State Biodiversity Project. Some of the products of this project are: a needs assessment of potential biodiversity information users, a web site that provides basic information about New York's biodiversity, state-of-the-knowledge reports on New York's species, and a book on New York biodiversity (Johnson and Smith, 2006).

Chicago Wilderness Atlas of Biodiversity

www.chicagowilderness.org

Chicago Wilderness is a regional consortium of organizations dedicated to conserving biodiversity in the Chicago metropolitan region. The *Atlas of Biodiversity* (Sullivan [undated]) has colorful maps and photographs and tells the story of how geologic forces and human habitation have shaped the region's landscape. It is a great example of how nature and conservation issues can be translated for the public.

Cornell Cooperative Extension

www.cce.cornell.edu

This network of educators is located at the Cornell University campus in Ithaca, as well as in every county in the state. Extension educators present programs and provide materials on natural-resource conservation.

Resources

- McKenzie-Mohr, D., and W. Smith. 1999. *Fostering Sustainable Behavior: An Introduction to Community-based Social Marketing*. New Society Publishers, Gabriola Island, British Columbia.
- Stapp, W. B., A. E. J. Wals, and S. L. Stankorb. 1996. *Environmental Education for Empowerment: Action Research and Community Problem Solving*. Kendall–Hunt Publishing Company, Dubuque, Iowa.

Chapter 7:

Building Support for Conservation: Public Participation



“Planning without citizen participation is neither democratic nor wise . . . [t]heir practical wisdom and support make plans capable of implementation, their knowledge of local conditions fills gaps in the planners’ data and

information, and their varied interests diminish the tendency of planning to embody a single purpose.”

Henry Jackson, U.S. Senator, 1952–1983

Most local officials recognize the logic and wisdom captured by Senator Jackson. The challenge for most leaders is not deciding whether to involve citizens but how to involve them both productively and successfully. For local officials who want to meet the needs of their constituents, engaging citizens in a potentially controversial decision-making process presents real and significant challenges. This chapter highlights successful techniques that have been used by local leaders to engage and involve citizens in the complicated efforts to integrate natural area and wildlife conservation into local planning and zoning decisions.

When a community sits down to implement the goals and vision of a community plan created with robust citizen input, it is more easily implemented by the local legislature (e.g., town board) and local administrative bodies (e.g., planning boards). If a planning process does not adequately involve concerned and affected citizens, they will, at best, publicly question and, at worst, vociferously oppose any implementation measures that change the status quo.

How Can Public Participation Be Used to Protect Natural Areas and Wildlife?

Understanding the diversity of the Hudson Valley landscape and the tools needed to integrate nature in the land-use planning process is only part of this handbook. A community that participates in the decision-making process is more likely to be supportive of decisions to conserve natural areas. Public input on plans and regulations is particularly important when the proposed action will change the way land can be developed. Such

shifts will only be sustained with continued support from the community and affected property owners. Without it, more time and energy will be spent building support during the implementation stage. A municipality can use planning as an opportunity to involve a broad range of citizens to build community consensus about conserving nature.

What Is the Difference Between Consensus and Compromise?

“Compromise involves splitting the difference between positions defined by individual self-interest and often results in an outcome that satisfies no one. By contrast, consensus results in a shared vision of a desirable future state, and derives from a coevolution of individual preferences within a spirit of community responsibility. As people participating in the process gain more knowledge about . . . natural functions, as well as the needs and values of other participants, individual preferences coevolve, which in turn, moves everyone closer to shared goals. This process takes more time, but is more likely to yield an outcome with legitimacy and staying power.”

(Postel and Richter 2003)

Smart Growth Strategies

Once a decision to involve the public has been made, the conveners must be clear about how and why the public is being involved so that the process is productive and efficient. Many of us are painfully aware of how hostile and unproductive some public processes can become. By focusing on the approaches listed below, municipalities are more likely to lead productive meetings.

Create a Purpose for Each Meeting

Are you trying to inform the public or are you trying to receive information from them? The answer to this question will help inform the type of meeting you will hold. Not all meetings require public participation. It is important to assess the degree to which the public

considers the issue significant. The public will become involved according to its perception of the seriousness of the issue. If you are going to make a decision that will require action by another government agency, subject to public hearings, chances are you will want to involve the public.

Invite the General Public, Not Just the “Usual Suspects”

Reaching nontraditional or hard-to-reach groups is a challenge. However, it is important to seek out and facilitate the involvement of potentially affected individuals and groups. A single advertisement in one local newspaper will not attract all the potentially affected people. Reaching out to specific groups by personally inviting them and perhaps holding meetings for segments of the public, like large landowners, can go a long way.

Strategies

Once you identify potentially affected or interested individuals or groups, you need to develop strategies to:

- reach them;
- inform them;
- demonstrate to them the benefits of being involved;
- build relationships with them.

How Is the Public Participating?

If the action taken by the municipality is responding to a well-defined problem and an obvious solution exists, the need for public participation is limited. If however, the problem is not well-defined and the solution is not obvious, the need for constituent involvement is heightened (Hustedde et al.). Be clear about how you want the public to participate. The spectrum below will help you decide how to label the process.

Public Participation Spectrum

Inform ↔ **Consult** ↔ **Collaborate**

Inform—Decision-makers Provide Information on Decision-making Rationale.

- Public participation goal: To provide the public with balanced and objective information to assist them in understanding the problems, alternatives, and/or solutions.
- Promise to the public: We will keep you informed.
- Examples: Open house, web sites, fact sheets, posters or displays in public spaces.

Consult—Opinions and Feedback Solicited from the Public

- Public participation goal: To obtain public feedback on analysis, alternatives, and/or decisions.
- Promise to the public: We will keep you informed, listen to and acknowledge concerns, and provide

feedback on how public input influenced the decision.

- Example: Public meetings.

Collaborate—Public Is Involved in Decision-making Process but Is Not the Decision-maker

- Public participation goal: To partner with the public in each aspect of the decision, including the development of alternatives and the identification of the preferred solution.
- Promise to the public: We will look to you for direct advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.
- Examples: Planning exercises, consensus-building, participatory decision-making.

Create an Agenda

Having an agenda provides the public with guidance as to what will be discussed at your meeting. Start by identifying the meeting's purpose and goals and then identify your target audience. Be clear about the specific objectives of the meeting (e.g., providing information, gathering input, encouraging dialogue). Set times for start and finish and stick to them. Make sure that the agenda identifies where in the meeting the public will be able to speak.

Sample Agenda

- Introductions
- Problem statement and purpose
- Process details and meetings
- Issue identification
- Option generation and evaluation
- Areas of agreement
- Next steps

Greet People at the Door and Distribute Nametags

Greeting meeting participants at the door sets the tone that their participation is desired and valued. The initial greeting creates the basis for relationships through informal conversations. The use of name tags removes barriers to interaction among the participants and encourages name recognition.

Set Ground Rules

Take some time at the beginning to create ground rules for the deliberations. The group should see these rules as their own and should be encouraged to accept them and enforce them during the meetings. Depending on the size and scope of the meetings, ground rules can be simple.

Sample Ground Rules

- Everyone participates: Be sure everyone gets an opportunity to be heard.
- Be courteous: Respect other points of view and wait for others to finish speaking.
- Speak for yourself.

Food and Drink

This is more important than you think! People think better when they aren't hungry. A simple plate of cheese or fruit helps make the environment more welcoming and encourages the formation of relationships in an informal environment. Community meetings are a great opportunity to feature local food.

When and Where to Meet

Identify an appropriate venue for the meeting, one that facilitates the achievement of your objectives. The location chosen for the meeting must address several important needs, including sufficient capacity, accessibility, and the "nature" of the location: Will this site be perceived as neutral territory? If not, the participants may feel guarded and defensive. Make sure that all your stakeholders will be able to participate in your meeting. Be careful that you are not excluding potential stakeholders by having your meeting at an inconvenient time. The meeting should be held at a time that is convenient to as many people as possible. If the time of the meeting presents conflicts for a group of key stakeholders, hold two or even three meetings at different times, so that all can attend. In addition, sufficient time should be dedicated to complete the task at hand. If you try to pack too much into the meeting, participants will feel rushed and pressured and the effort is likely to be a waste of time.

Room Set-up

Think of the information that you are trying to receive from or convey to the public. Arrange seating so participants can see the faces of other participants and help facilitate dialogue. Use graphics, aerial photographs, and maps to organize discussion around specific suggestions. Some public workshops break participants into small groups to encourage dialog and allow for drawing and notes on local maps.

What to Say About Natural Areas?

When talking about natural areas, it is important to do so in a meaningful way to the participants. Speak in clear language, avoid jargon, and try to explain concepts when you can't avoid jargon. Make sure you discuss why high-quality habitats and other natural resources are important to the community at large. Respect people's feelings about property rights and the value of their land. Use the information in this handbook to help you.

Meeting Summary

A summary will help create an understanding about what was discussed, what was agreed to, and what is happening next. It should integrate the agenda, the ground rules, discussion items, and next steps in a way that communicates what occurred. In addition, the summary can be circulated to participants for comment and should be published for the community.

Summary of Benefits

Engaging the community early in planning and zoning processes leads to greater success in implementing the changes needed to protect the natural environment. Towns can share the information on local habitats with community residents. Further, community ideas can be gathered and considered in creating the plan or zoning update. This way, the public will better understand why the town has acted to change development patterns. The best way for the public to understand the rationale for a new land-use approach is to include them in the planning process suggesting the change. Doing otherwise is "neither democratic nor wise."

Local Example**Town of Clifton Park Open Space Plan**

The Town of Clifton Park (Saratoga County) used a consensus-building process in developing their first open space plan. It took three years, but the town created a plan that had broad community support. The open space committee was made up of diverse stakeholders including farmers, builders, recreation groups, and conservation groups. In addition to conducting a natural-resources inventory and an economic analysis, the committee invested a great deal of time in public input and outreach. They used focus groups to get input and build trust, mailed surveys to get input from the across the town, held planning charrettes to identify open space areas, held workshops to introduce the draft plan, and public hearings to get comments on the final plan. To get the word out broadly, committee members provided outreach at town events, gave presentations to civic groups, and held local media conferences. Because the committee emphasized public participation during planning, there was little controversy following the 2003 adoption of the plan by the town board. By 2005, the town had acquired 300 acres, and planned to purchase another 250 acres of critical habitat. Clifton Park has been a model for success and attracted federal, state, county, and local funds to implement its priorities.

Resources

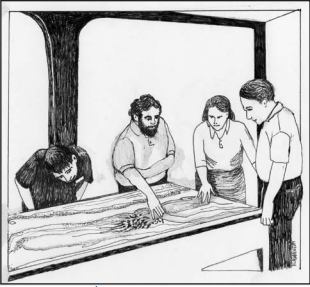
- Arthur, J., C. Carlson, and L. Moore. 1999. *A Practical Guide to Consensus*. To order, contact The Policy Consensus Institute. 1003 East Interstate Ave., Suite 7; Bismarck, ND 58501-0500; 701 224-0588.
- Creighton, J. L. 1992. *Involving Citizens in Community Decision-making: A Guidebook*. Program for Community Problem Solving. Washington, D.C.
- Depoe, S. P., J. W. Delicath, and M.-F. Aepli Elsenbeer. 2004. *Communication and Public Participation in Environmental Decision-Making*. State University of New York Press, Albany.
- Porter, D. R., and D. A. Salvesen. [eds.] 1995. *Collaborative Planning for Wetlands and Wildlife*. Island Press. Washington, D.C.
- Wondolleck, J. M., and S. L. Yaffee. 2000. *Making Collaboration Work: Lessons from Innovation in Natural Resource Management*. Island Press, Washington, D.C.

Author Summary

This chapter was written by Sean Nolon, former director of the Pace Land Use Law Center. The center, founded in 1993, works with law students and local leaders to foster the development of sustainable communities and regions through the promotion of innovative land-use strategies. Mr. Nolon is currently an assistant professor of law and director of the Alternative Dispute Resolution Program at the Vermont Law School in South Royalton, Vermont.

Chapter 8:

Comprehensive Land-Use Planning



“Development and growth, by their very nature, have an impact on our environment. In many cases, that impact can be positive, as proactive planning works to preserve open spaces and protects environmentally sensitive areas.”

*National Association of Homebuilders web site
(www.nahb.com),
Environment page*

“‘Local Comprehensive plans can identify and provide for the preservation of natural resources and sensitive environmental areas’ Village Law ‘7-722(3)(d), Town Law ‘272-a (3)(d), and General City Law ‘28-a(4)(d).”

(Nolon 2002)

Comprehensive plans establish a community’s vision for the future and outline a roadmap for achieving that future by guiding land-use patterns and development. Municipalities throughout the Hudson Valley are updating their decades-old plans, and others are creating them for the first time. As your community is undertaking comprehensive planning, it is an ideal time to begin thinking about natural areas and wildlife. By considering these natural resources during the comprehensive planning process, towns have the opportunity to create strategies to conserve sensitive habitats while planning for future growth and development.

How Can Comprehensive Planning Be Used to Conserve Natural Areas and Wildlife?

The comprehensive plan guides future land-use decisions of community leaders by providing a framework that can be used to evaluate development proposals and phase

public improvements. Some municipal comprehensive plans either do not address natural areas and wildlife or address them in such a general way that it is not always clear what actions the town might take to protect them. Because the comprehensive plan is the basis for land-use decisions, it is important to have good natural area and wildlife information, with a clear outline of how the municipality can conserve those resources. By doing so, the municipality is empowered to use the tools described in this handbook to conserve areas it has determined are important.

Smart Growth Strategies

The comprehensive plan can project a desired vision of what the community will look like in the future. A good plan will achieve the community’s objectives regardless of the rate or ultimate extent of growth. It will also reflect local conditions, concerns, resources, priorities, and opportunities in its recommendations and provide simple, clear, and concise statements and policies that can be understood by all community members, including citizens, developers, builders, and public officials.

Identify Basic Principles

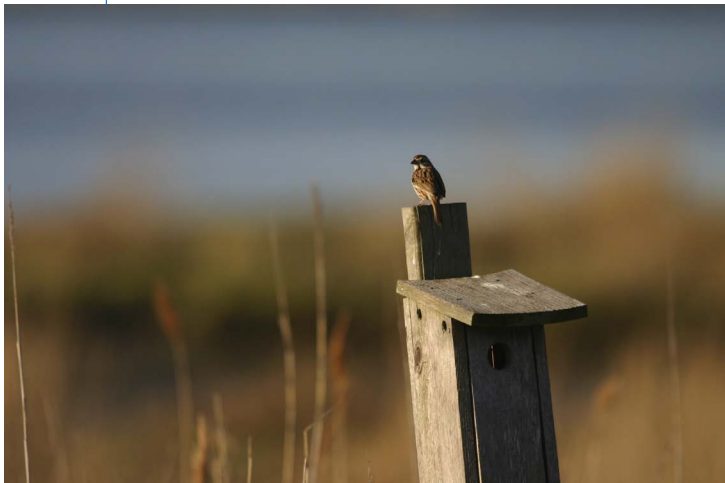
To adequately address natural resources, the plan can embrace several basic principles:

- Natural features are valuable as part of a community’s character, scenery, and wildlife habitat and they provide ecosystem services, including water purification, and as such, contribute significantly to the area’s quality of life.
- Most land-use decisions are made by private landowners and local governments.
- Planning ahead protects natural resources better than reactive environmental review, because natural resources rarely exist on only a single site and cumulative impacts are difficult to gauge one project at a time.
- Planning may reduce conflict by raising awareness of environmental issues before a project is underway.
- Natural resources do not follow municipal boundaries.

Identify Your Ecological Region and Watershed

Every town is part of a larger natural landscape, and local land-use decisions often have an effect on the

larger landscape. In the Hudson Valley, some of the well-known landscapes are the Helderberg Escarpment, the Catskills, the Rensselaer Plateau, the Highlands, and the Wallkill Valley. Every town in the Hudson River Estuary watershed eventually drains into the Hudson itself, but you can also identify the Hudson tributary watershed(s) the town is part of. Recognizing the larger ecological context of the town will help to put in perspective how local decisions may relate to the larger landscape, which is the scale at which ecosystems exist.



Identify Natural Areas

Good information is essential for a good plan. For planning purposes, the identification of natural areas often can be done with existing information. Chapter 4 describes how to find information about specific wildlife and habitats in the Hudson Valley, including stream corridors, wetland complexes, and forests. Sometimes, there is little existing information for your municipality. If this is the case, the plan can recommend additional study with specific recommendations on where and how to collect it. Once natural areas have been identified, the benefits of the town's natural areas and wildlife should be described. For example, forests are essential for keeping drinking water clean, and wildlife viewing is an important recreational activity for residents and visitors. Benefits of habitats to your community are described in Chapters 1 and 3.

Create Maps

Using and displaying land-use maps may be the most effective way to convey the plan's vision to residents, elected officials, and potential developers. Some towns go one step further and create a geographic information system (GIS) either in-house or with help from a consultant. Maps and GISs are very useful when developing the comprehensive plan, but they can also be useful in helping protect natural areas during project

review by various boards in the town. Because GIS maps are dynamic, new information can be added over time and different kinds of information can be analyzed. For example, steep slopes and significant habitats can be overlaid to see how these two different types of information might inform the development process on a particular site.

Write Specific Policy Statements

To strengthen the comprehensive plan's role in conserving the environment, the community can include explicit statements embracing a conservation ethic for protecting nature, as well as specifying what the community wants to accomplish. Consider this example from the Town of Yorktown in Westchester County:

"Yorktown's natural resources are integral to the long-term health, safety, and well-being of not only Yorktown but also neighboring towns and the region. The town should expand efforts to preserve open space and natural resources throughout Yorktown. The ecological integrity of Yorktown's natural resources including groundwater, streams and wetlands, trees and woodlands, steep slopes, and areas rich in biodiversity must be maintained and protected, even as new development occurs."

Identify Specific Actions

Once natural areas have been identified, the comprehensive plan can then refer specifically to a variety of ways in which a community can accomplish natural-resource protection goals and objectives. For example:

Goal:

The town will control stormwater runoff to minimize impact on water bodies and local wildlife. We will use the following objectives to accomplish our goal:

- Examine existing neighborhoods for stormwater-management problems and take steps to rectify any problems.
- Encourage site planning and drainage measures that minimize runoff rate and volume, and ensure water quality.
- Minimize impervious surfaces in new construction and on municipal properties.
- Use the landscape to naturally absorb and filter runoff before slowly releasing it downstream.
- Reduce impervious surfaces and thin natural vegetation to reduce the need for stormwater control.

- Minimize erosion from construction sites.
- When stormwater management is necessary, use techniques that are least harmful to wildlife, such as infiltration and rain gardens.

There is more than one way to protect a particular resource. For example, to protect streams, a municipality could use one of the following techniques: remove stream buffers from density calculations, initiate a watershed committee with other municipalities in the watershed, adopt a wetland and watercourse ordinance, begin a program to educate streamside landowners on best-management practices for stream health, or require setbacks in zoning or subdivision regulations.

Keep in mind that the comprehensive plan may be implemented over several years, so consider actions that can be taken now and five or ten years down the road.

Coordinate with Surrounding Communities

Many natural resources extend beyond community borders. Your municipality can explore what adjacent communities are doing to identify and protect their resources. For example, a community's plans for high-intensity use could compromise the conservation efforts of a large wetland complex in a neighboring community. In addition to working with adjacent localities, it may make sense to work with school districts, sewer districts, and, for those communities in the New York City watershed, the New York City Department of Environmental Protection. Exchanging information and

coordinating efforts for protecting natural resources is encouraged. For more information, see Chapter 12.

Coordinate with Water and Sewer Authorities

The provision of community facilities and services, such as public water systems and wastewater treatment facilities, has a significant impact on development patterns. Existing plans and policies, such as land-use plans, population projections, and public water system extensions, should be integrated in the comprehensive plan. The comprehensive plan committee can invite representatives from county water authorities, public-works departments, and private utilities to discuss plans and policies with your municipality. The committee can work with such agencies to ensure that future utility and facility service areas avoid natural areas that the community wants to protect.

Conservation Advisory Councils

New York's municipalities can create conservation advisory councils (CACs) to advise the planning board on environmental concerns. Sometimes called environmental conservation commissions, these volunteer boards serve a variety of roles in the community. Many are asked by the planning board to review development proposals to help to protect sensitive environmental resources. Others undertake a natural resources inventory to take stock and keep track of the town's natural features, and natural areas can be included, as described in Chapter 4. If a CAC completes

Relate Natural Area and Wildlife Conservation to Other Parts of Your Plan

When developing a plan, it helps to address ways that natural areas and wildlife are related to other important issues in your community. Showing that the relationships have been considered will help local boards integrate decision-making as the plan is implemented.

Housing. Actions that protect natural resources can be considered in concert with goals to enhance housing availability and affordability. Areas of higher density development can be directed away from sensitive habitats in a way that creates affordable housing and economic development opportunities by using higher densities in appropriate areas.

Transportation. Transportation corridors can have a tremendous effect on natural areas and wildlife. New roads can guide development. Some road corridors may be enhanced by preservation of buffers and narrower right-of-ways. Placement of new roads can be coordinated with resource-protection goals.

Utilities and Community Facilities. The provision of community facilities and services, such as public water and sewer, has a significant impact on development patterns. The comprehensive plan could spell out how

future utility and facility-service areas can avoid natural areas that the community wants to protect.

Economic Development. Natural resources often support local industries, including agriculture and forestry. Natural areas also support tourism and recreation. The comprehensive plan can explain how economic development priorities can be compatible with actions to enhance or protect natural resources.

Open Space. If your plan recommends undertaking an open space plan, include natural areas and wildlife in the inventory and as a criterion for prioritization. Show how conserving them supports other community goals.

Water Supply. Protection of a municipal water supply, whether recharge areas for aquifers or watersheds for reservoirs, is compatible with conserving wildlife. This can be spelled out in the comprehensive plan. A biological survey of protected watershed land can help communities manage the land for multiple benefits.

Stormwater. Any section on stormwater management in the plan can recommend best development practices that minimize impact to water bodies and local wildlife.

an open space plan and inventory that is adopted by the town board, it can become a conservation board. The inventory and map then becomes the official open space index of the town and the board may take on additional duties to assist the community with sound open-area planning and natural and scenic resource conservation. The councils can also perform other duties as requested by the town board, including management of municipal lands, and advice on environmental regulations, ordinances, or policies.

Summary of Benefits

Comprehensive planning provides an opportunity for communities to envision their future and to set in motion the policies and actions to realize that vision. Including natural resource protection as an integral part of a community's vision in a comprehensive plan is the first step to enacting protective programs, policy, and legislation. A plan sets the framework for enacting ordinances and laws, and it directs municipal leaders in making appropriate decisions to accomplish community objectives.

Local Examples

Town of Yorktown, Westchester County

Yorktown is a low-density residential community in northern Westchester County, with higher density hamlets. The town has grown from a population of 4,700 in 1950 to 36,300 today, yet important biological resources remain, as identified in the Croton to Highlands Biodiversity Plan (Miller and Klemens 2004). In revising its twenty-year-old comprehensive plan, Yorktown made a strong commitment to balancing development with natural-resource conservation. In a chapter dedicated to natural resources, they laid out eleven specific goals. Goal 7-A, for example, links the protection of natural resources, including "woodlands, water resources, wetlands, threatened and endangered species, and habitat areas for plants and wildlife" to the protection of "the health, safety, and welfare of Yorktown residents." Goal 7-I aims to "promote biological diversity by protecting open space that serves as habitat and/or breeding grounds for a wide range of species." Specific actions are described in a policies section that clearly creates a roadmap for implementation, including natural area and wildlife conservation goals. For example, Policy 7-13 identifies vernal pools as a resource for which more information is needed and describes how the town will collect the data and use it for conservation. For more information, contact the Yorktown Planning department (914 962-6565). A copy of the plan is available online at www.yorktownny.org.

Town of Philipstown, Putnam County

Philipstown is a largely rural town located on the Hudson River and in the Hudson Highlands. It has extensive areas of high-quality habitat, including thousands of acres of intact forests and several small tributaries to the Hudson. In its extensive description of the habitats in the town, Philipstown's comprehensive plan states "Philipstown's open space provides important natural resources for the community-at-large; it supports native species, maintains natural ecological processes, and contributes to our health and quality of life." The plan identifies seven known environmentally sensitive areas and includes a recommendation to conduct a town-wide biodiversity assessment, with an eye toward identifying the highest quality habitat. Some of the recommendations for action include creating a stream corridor overlay zone, review standards for biodiversity, encouraging cluster development to protect contiguous open space in some areas, and developing an open space plan. For more information, visit the town's web site at www.philipstown.com.

Town of Blooming Grove, Orange County

When updating a natural resource inventory for its comprehensive plan, the Town of Blooming Grove used the Orange County Open Space Plan to identify areas important for natural areas and wildlife. The town worked with the county planning department to get a town map of biological resources. Using this tool, the town identified its natural areas and the connections between them within the town. To protect flora, fauna, and habitat, the plan recommends that the town designate the areas of biological significance as critical environmental areas, create an overlay district over these areas to develop new standards for protecting sensitive habitat, design and coordinate development in these areas in ways that maintain connections, consider establishing an open space fund to protect these lands, and complete a town-wide biological resource inventory. For more information, contact the Town of Blooming Grove at 845 496-3895.

Urban Revitalization

One technique for preserving valuable landscapes while accommodating a growing population is to redevelop previously used urban lands, sometimes known as “brownfields.” Brownfields are “property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.” (from U.S. Environmental Protection Agency web site) A similar technique is to develop unused portions of vacant or underutilized shopping plazas. A few of the benefits of reusing sites:

- A recycled parcel is often less expensive to develop than new land, because it is already serviced by roads, utilities, and other infrastructure.
- Brownfields also can be redeveloped into community parks or restored natural areas.
- Brownfield and infill development limits the pressure to develop agricultural land and other open space, potentially impacting valuable habitat.

Specific techniques for redevelopment include special zoning, such as a redevelopment overlay zone, and tax incentives to encourage redevelopment. New York State has a program to help communities clean up and redevelop brownfields. Redevelopment can use several techniques covered in this handbook, including natural landscaping (Chapter 13), natural drainage and improved stormwater management techniques (Chapter 10), and conservation of natural areas (Chapter 5).

“Urban parks, gardens, and recreational open space stimulate commercial growth and promote inner-city revitalization.”

(Lerner and Poole 1999)

Technical Assistance

The New York State Department of Environmental Conservation can help your community include nature in your plan and zoning ordinance. Presentations, habitat information, and suggestions for conservation are all available. Contact your regional Department of Environmental Conservation office (see Appendix 3).

The Hudson River Valley Greenway provides financial and technical assistance for comprehensive plans. Contact the Greenway at 518 473-3835 or visit their web site at www.hudsongreenway.state.ny.us.

The New York State Department of State can help your community with planning. The Division of Local Government offers training and technical assistance at www.dos.state.ny.us/lgss/. The Division of Coastal Resources provides grants for communities in the coastal zone along the Hudson River. Visit their web site at www.nyswaterfronts.com.

Resources

Church, D., and C. Traub. 2002. *A Practical Guide to Comprehensive Planning, 2nd edition*. New York Planning Federation. Troy, N.Y. www.nypf.org

McElfish, J. 2004. *Nature-Friendly Ordinances*. Environmental Law Institute, Washington, D.C. Available for purchase at www.elistore.org.

New York State Department of State. 1998. Creating the Community You Want: Municipal Options for Land Use Control. *James A. Coon Local Government Technical Series*. New York State Department of State. Albany, N.Y.

New York State Department of State. 2004. Guide to Planning and Zoning Laws of New York State. *James A. Coon Local Government Technical Series*. New York State Department of State. Albany, N.Y. www.dos.state.ny.us/lgss/

Nolon, J. 2002. *Well Grounded: Using Local Land Use Authority to Achieve Smart Growth*. Environmental Law Institute, Washington, D.C.

Van Tine, J. [ed.] 2003. *Local Environmental Strategies. Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.

Zoning and Project Review



A municipality's comprehensive plan is merely a guide to land use, and—for its vision to be realized—needs to be implemented with zoning and other tools. Zoning provides for specific and detailed control of the type and intensity of land use within carefully defined districts or zones. It is a flexible technique and can be applied to regulate density, use, and other factors that protect the health, safety, and welfare of the town's residents. Many communities choose to establish subdivision regulations

and site-plan review to ensure that community standards for health, safety, and appearance are met. Impacts to the environment are assessed and mitigated through State Environmental Quality Review.

How Can Zoning and Project Review Be Used to Conserve Natural Areas?

Modifying zoning ordinances to conserve natural areas and wildlife will be most effective in areas known to have significant biological resources. These areas can be identified in a comprehensive plan (Chapter 8) as a result of a natural area and wildlife inventory (Chapter 4).

Note: Zoning can help direct higher density and certain kinds of development away from sensitive habitats. But it cannot remove all development potential from a property nor create a park. That can only be accomplished through open space conservation, where a landowner will voluntarily sell or donate his or her property or its development rights.

Project-review tools, such as site plans, subdivision regulations, and environmental review can be modified to better protect natural areas. For example, towns could require that subdivision plats and site plans identify important natural areas and connections to other habitats offsite, and projects could be designed to avoid sensitive environmental features and maintain connections across property boundaries.

Smart Growth Strategies

Zoning

Effective zoning can provide valuable and effective tools for environmental protection within a community. Under zoning, the entire municipality is divided into districts, and the zoning ordinance identifies what kinds of land uses are allowed in each district. Zoning ordinances can be designed or modified to direct construction away from natural areas. Zoning also can be used simply to prohibit incompatible land uses. For example, certain industrial uses may not be compatible with the known habitat of rare species, whereas low-density residential use may be, particularly if the development is clustered away from sensitive areas and adequate buffers and setbacks are used. Several types of zoning are described below.

Examples of most of the strategies described below can be found in *Local Environmental Strategies* (Van Tine 2003) and *Local Environmental Ordinances* (Kelley 2003). An excellent guide to the application of these planning tools to conserve biodiversity is *Nature-Friendly Ordinances* (McElfish 2004). In that book, several of the following techniques are described in more detail, with local examples from around the United States.

Incentives

Regulation is not the only way that communities can control land use. Some may consider adopting incentive measures to encourage developers and landowners to voluntarily take specific actions.

Density Bonuses: In these programs, local governments allow landowners to construct more units on their land than are allowed by the zoning regulations. In exchange, the developer agrees to set aside open space; protect habitat, buffer streams, and wetlands; or contribute a per-lot fee to an open space fund. Alternatively, a density penalty can be applied if clustering is not part of the site plan.

Transfer of Development Rights: This technique moves development from an inappropriate or sensitive area to a more appropriate one by compensating willing landowners, and is described in Chapter 11.

Preferential Tax Treatment: Economic incentives are another important approach to motivating landowner behavior. One technique, use assessments, allows land to be taxed for its current use rather than the "highest and best use" that is typically used. The New York Agricultural Assessment Program and the Forest Tax Law are two examples of preferential tax treatment in New York.

Conservation Overlay Zoning

Overlay zones build on the underlying zoning by adding new standards to the density and uses allowed under the base zoning district. One of the advantages of an overlay zone is that the entire community need not be rezoned to accomplish conservation objectives.

Overlay zones are commonly used for environmental protection and could be very effective at protecting habitats such as stream corridors, ridges, wetland complexes, wildlife corridors, or rare landscape elements. The Wildlife Conservation Society's Metropolitan Conservation Alliance published a model conservation overlay zone ordinance that outlines finding of fact, legislative intent, designation criteria, and performance standards for stream corridors, wetlands, woodlands, and steep slopes, and may be used in whole or in part (Metropolitan Conservation Alliance 2002).

Supplemental standards in the model ordinance include erosion and sedimentation control, filling and grading, mining and excavation, stormwater management, timber management, and required information for project review.

Performance Zoning

This alternative to traditional zoning regulates development impacts by establishing environmental protection standards that must be met if development is to proceed. Performance standards can be applied townwide, restricted to specific zones (including an overlay zone), or included in subdivision regulations and site plans. Standards that might be required include use of an open space ratio in intensity guidelines, habitat restoration requirements, maintaining wildlife corridors, limits on tree and vegetation removal, use of natural landscaping, and wetland buffer requirements. This technique allows for flexibility in design and layout, as long as environmental conservation standards are met. For example, the standards may require that 80 percent of a floodplain be protected, but leaves it up to an applicant as to where and how. It is important to have clear conservation objectives for resource protection. Performance standards can include monitoring to ensure that indicator species are still present, which may be desirable for very rare species or habitats. Biologists can help develop conservation objectives to ensure they will provide meaningful protection. This type of zoning may be easier to implement in towns that have a professional planning staff that can evaluate environmental standards. A more thorough discussion of performance standards can be found in McElfish 2004.

Zoning Is Flexible

One of the benefits of zoning is that it is flexible. Several zoning tools can be used to reach the same goals. For example, to protect forests, a community could:

- adopt a new subsection in the existing zoning ordinance addressing woodland and forest protection and make those requirements applicable to all zones;
- draft similar protection language but add the new requirements only to specific zone districts through amendments to those chapters of the code;
- create a new chapter or subsection creating a "forest protection zone" and then amend the zoning map to apply that zone where it is appropriate; or
- draft the protections into the text of an overlay zone and then amend the zoning maps to add the overlay district on the existing zoning districts.

Density and Lot Sizes

Some Hudson Valley towns are using larger lot sizes of five to seven acres in the hope of controlling sprawl and protecting open space in rural areas. However, requiring lots of that size can further fragment habitat and can result in more sprawl-type development. A reduction in density (also known as upzoning) won't be adequate to conserve natural areas and wildlife unless it is combined with clustering or conservation subdivisions.

Subdivision Regulations and Site Plan Review

Tools that municipalities can establish to protect nature during project review include: open space standards, stream setbacks, habitat assessments, and cluster development. Specific guidelines can be built into subdivision regulations and site-plan review to protect natural areas. The following techniques can be used with either tool.

Setbacks, Buffers, and Open Space Requirements

Building or development setbacks, sometimes used to provide for the future widening of streets in residential areas, may be used to protect specific development site features such as floodplains, natural habitats, or steep slopes. Setbacks require new development to be built beyond a specified distance from lot lines as stated in the zoning ordinance. Setbacks can also be used to keep disturbance away from streams, wetlands, and sensitive habitats identified by the town.

Open space requirements are a form of setback that requires developers to leave a specific percentage of a site undeveloped. The law in New York permits planning boards to require that developers of residential subdivisions include land for recreational purposes in their plats, or pay per-lot fees used for recreation elsewhere (Morgiewicz 2004). On sites with high habitat value, this provision can be used to promote conservation of sensitive land and its associated recreational values.

Buffers help to separate incompatible land uses. Like setbacks, buffers can require a minimum amount of preserved land to protect natural areas from disturbances such as buildings or parking lots. To protect habitats, buffers should remain as naturally vegetated as possible. For example, a community could require a stream buffer to be planted with native trees and shrubs rather than turf grass.

Cluster Development

Cluster development is a very important tool for conserving natural areas and wildlife at the site scale because it allows buildings to be concentrated away from sensitive natural features. Conventional residential zoning calls for minimum lot sizes and encourages maximal use of the lot for development. An alternative approach is to encourage cluster development, which maintains the number of lots but clusters the development onto a smaller, buildable portion of the site. The municipality could further offer an incentive for a developer to receive a density bonus (extra building lots) in exchange for environmental protection, open space conservation, or open space funds (McElfish 2004). This technique is particularly useful when the intent is to protect specific features on a development site while still allowing development to occur. Cluster development can be promoted in a municipality's subdivision ordinance or required in a certain zone. This technique is most effective in protecting resources when neighboring lots are clustered so that an open space network is created. Clustering the lots on a smaller area of land will not inherently protect nature. First, communities need to identify key resources and how they are connected to offsite resources. Then clustering can be designed to conserve the resources and maintain connections.

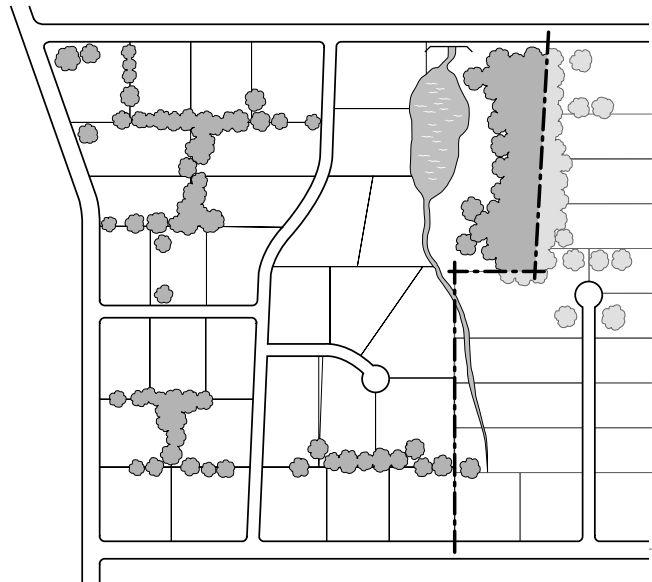
An important consideration in allowing clustering is provision for removing and treating wastewater. Density in areas not served by sewer is often limited by site requirements for septic systems. See Chapter 10 for a discussion on wastewater options.

Conservation Subdivisions*

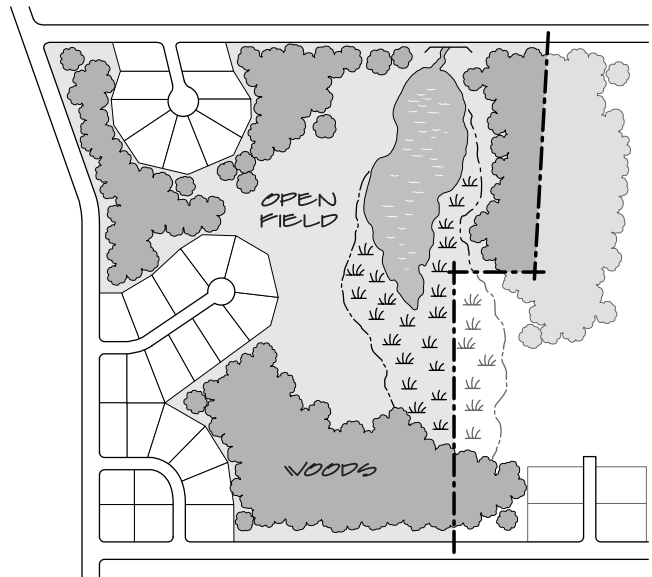
Like cluster development, conservation subdivisions are a powerful tool for conserving sensitive natural features. Conservation subdivisions are unique because they are tailored to the characteristics of a site and are intended to achieve several basic environmental objectives:

- minimize the overall disturbance of the site to prevent soil erosion and compaction during construction;
- facilitate the protection of sensitive habitats, including stream corridors, wetlands, and woodlands;
- allow for the protection of open space and for linkages to adjacent sites; and

* See www.greenerprospects.com for more detailed information on conservation subdivisions.



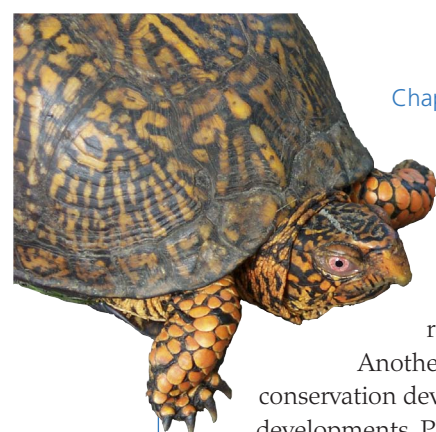
This typical development seeks to maximize the size of the lots and generally disregards the natural areas on site.



This development is better for natural areas and wildlife. The habitats have been delineated and avoided during the subdivision and development process. Infrastructure is minimized with shorter road and less impervious surface will require less stormwater management. Note that habitats are connected across property lines, which is essential for maintaining natural areas and wildlife for the future.

- facilitate the use of natural drainage and landscaping approaches, and reduce the effective impervious area of a development, thereby minimizing offsite stormwater impacts.

In establishing requirements for clustering or conservation subdivisions, it is important to provide clear guidance to applicants. This may be accomplished by (1) clearly stating conservation objectives and priorities in the ordinance so the applicant knows which areas are to be preserved, and then (2) establishing specific cluster design guidelines. Communities also may provide direction on the amount of open space to be preserved



on a site. For example, a community may wish to specify a maximum, rather than minimum, lot size within each residential zoning class.

Another approach for enabling conservation development is through planned unit developments. Planned unit development (PUD) ordinances allow developers the flexibility to design cluster or mixed-use developments that may otherwise conflict with standard zoning requirements. Conservation and development objectives should be clearly outlined so that proposed projects can achieve both. Some of the conservation objectives could be low-impact development and stormwater management, setbacks, open space requirements, and avoiding high-quality or sensitive natural areas and wildlife.

A final consideration of cluster and conservation developments is the need to ensure long-term management and maintenance of sensitive areas. Applicants should identify the entity responsible for management. Municipalities may require that the land be protected via dedication to the municipality or a local conservation organization through a conservation easement or other means. In some cases when an easement or property is donated to a local conservation organization, the applicant donates funds for long-term management and monitoring of the land.

Site-based State Environmental Quality Review

State Environmental Quality Review (SEQR) needs to be applied for every action taken by a municipality, including comprehensive and open space plans. Every time SEQR is applied, it is an opportunity to consider natural areas and wildlife. When SEQR is used as part of the site-review process, it requires state and local agencies to balance approval and decisions they make with a consideration of potential impacts that may result from development proposed on a site. If the project is deemed to have a significant negative effect on one of more aspects of the environment, an environmental impact statement must be prepared in order to identify ways to reduce, avoid, and/or mitigate the impact. SEQR is often used to protect environmental features such as wetlands, streams, water quality, and threatened or endangered species. It can also be very useful to protect other natural areas and wildlife using tools that enhance local planning authority, such as biological site assessments and the designation of Critical Environmental Areas.

Biological Site Assessments

Towns can identify the environmental impacts to natural areas and wildlife by requiring biological surveys or assessments for projects that come before the planning

board. A check of threatened and endangered species through the New York Natural Heritage Program is an excellent first step, but it does not address a host of other sensitive wildlife and habitat issues and it cannot replace site specific surveys. Currently, if wildlife surveys are required, it is usually because the presence of an endangered species is suspected. If there are no such suspicions, often applicants list only deer, raccoon, and other ubiquitous species in the environmental impact statement. As part of their SEQR authority, municipalities can require more in-depth, yet locally appropriate, surveys or assessments to identify the sensitive habitats and wildlife that might be lost or displaced by the new construction. The results can be used to create development that avoids impact on sensitive wildlife or identifies the impacts that can be mitigated.

If a municipality decides to require biological assessments, it should set standards so the same information is collected for every project. By creating standards, the planning board knows they have the information they need to determine impacts, that the information is collected properly, and that the results are comparable between studies. This also gradually builds up a database that can be used as part of an ongoing natural-resource inventory.

This technique can be applied as a local law, as part of the site plan, or using SEQR authority. Having consistent guidelines create a fair process, where all applicants are treated the same and they know what to expect. Try to find ways to require assessments that make it easy for applicants to comply. The Town of Milan has done so by creating guidelines that are used early in the approval process, which minimizes project review delays and expenses. More detail on Milan's habitat-assessment guidelines can be found on page 60.

Critical Environmental Areas

A Critical Environmental Area (CEA) is a specific geographic area designated by a state or local agency as having exceptional or unique environmental or cultural characteristics, thus raising awareness of resource values. CEAs may be developed following an inventory and assessment of resources. In establishing a CEA, the fragile or threatened environmental conditions in an area are identified by the municipality so that they will be taken into consideration in the site-specific environmental review under the State Environmental Quality Review Act. CEAs can be used in conjunction with conservation overlay zones and performance standards to ensure that the impacts to critical resources will be minimized.

Determining Significance

Once a town has identified the natural areas and wildlife that are impacted by a given project, it is in a better

position to determine if there is a significant impact as a result of the project. One way that planning boards and applicants currently determine significance is to answer the questions under “impact on plants and animals” on Part 2 of the Full Environmental Assessment Form (EAF). Several questions on the Full EAF ask about impacts on both threatened and endangered and nonthreatened and nonendangered plants and animals. A community can require documentation for the answers given and devise additional questions based on local ecology and information needs.

A list of species known to be important in the community and made publicly available will be helpful in answering the questions on the Full EAF, as will the Environmental Law Institute report, *Conservation Thresholds for Land Use Planners* (Kennedy et al. 2003). Developing consistent thresholds for applicants is another way to ensure fairness and predictability in the project-review process.

Generic Environmental Impact Statements

A Generic Environmental Impact Statement (GEIS) is



broader and more general than a project-specific EIS and can be used to look at all or a portion of a municipality to determine what development is appropriate, and what is not, in various areas of a community. The GEIS is a useful vehicle for conducting comprehensive environmental and development planning for a geographic area that a municipality wishes to protect or develop or redevelop carefully. Instead of looking at one project in one place, a GEIS can be used to understand the collective impacts of development on the community including effects on natural resources, traffic, and town services.

Cumulative Impact Analysis

New York State law allows the environmental impact of more than one project to be considered at the same time. A small project may not have a negative impact on habitat alone, but when considered in the context of nearby or related projects, the negative impact may be significant. If the lead agency (which is often the municipality) finds that there are cumulative adverse impacts from related projects and those projects have similar impacts on the local environment, that agency may decide to require a cumulative impact analysis. The municipality may also require each applicant to complete a separate environmental impact statement.

Summary of Benefits

Minor changes in zoning and project review can protect natural areas and wildlife with low initial administrative and management costs. These approaches are familiar to many Hudson Valley communities, yet flexible enough to conserve sensitive resources.

Zoning can be used to accomplish a number of community objectives at the same time. For example, in addition to protecting habitat, a floodplain overlay zone could be used to protect water quality, minimize flood damage to residents' property, or to create a system of hiking, biking, or walking trails for recreation.

Cluster and conservation developments can provide substantial savings to developers and the town on infrastructure costs on a per-unit basis because shorter roads and utility lines are needed, and because the developments result in more concentrated service areas for police protection, fire protection, and school buses.

Local Examples

Zoning to Protect Sensitive Resources

The Town of Gardiner has long recognized the significance of the Shawangunk Ridge in its comprehensive plans. So when the town updated its zoning ordinance following the adoption of a 2005 comprehensive plan, it created several provisions to protect the unique ecological and scenic resources of the Shawangunk Ridge. The ridge is divided into three zones, in which land is less stringently regulated at lower elevations and more regulated at higher elevations, in order to protect the steepest slopes and the large blocks of unfragmented forest.

Development standards in the ridge zone require applicants to identify the location of habitats and important forest resources on the property and minimize fragmentation of forest and other ecologically significant areas. Conservation subdivisions are highly encouraged, where 80 percent of the property must be set aside. Conserved lands must have conservation value as determined by a conservation analysis, which

is required for all applications on the ridge. The town's Environmental Conservation Commission reviews all of the proposals in this zone. For more information, visit www.townofgardiner.org.

Biological Site Assessments: Habitat Assessment Guidelines

The Town of Milan Planning board adopted habitat assessment guidelines to help the planning board, town board and applicants work together to conserve the town's natural assets. The guideline text states that "Milan is committed to maintaining its rural character, protecting its environment, and preserving its natural resources." The guidelines are used early in the development review process to establish environmental constraints and guide the plan before the applicant invests significant time and money in design and engineering. "Habitat assessments must be completed before sketch-plan endorsement or initiation of the SEQR process, and before the site's Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan [are developed]. This approach minimizes project review delays and expenses."

Milan's guidelines clearly define how the applicant should complete the assessment. First, applicants must identify significant habitats onsite, using either the *Biodiversity Assessment Manual for the Hudson River Estuary Corridor* (Kiviat and Stevens 2001) or *Ecological Communities of New York State* (Edinger et al. 2002). Second, habitat quality must be evaluated. Again, the guidelines describe how, by listing criteria, requiring identification of species of concern, and suggesting references. Finally, the Milan planning board has standardized reporting, outlining the necessary components for an acceptable habitat report. Similar guidelines are in use by planning boards in the towns of in New Paltz, Shawangunk, and Rosendale.

For more information, contact the Town of Milan Planning Board: www.milan-ny.gov

Biodiversity Review Standards

In 2002, the Town of Cortlandt Planning Board adopted biodiversity review standards. Initially, the standards applied along certain areas: river and stream corridors; near lakes, ponds, and wetlands; and near open space corridors and existing preserves. The guidelines define the species to be assessed and focus on those species that are likely to identify high-quality habitat vs. those that may identify areas more appropriate for development. The standards outline detailed methods: the survey must be conducted by a qualified biologist and must occur during a season appropriate for finding the target species. For example, breeding birds must be assessed during the breeding season (from mid-May to early July), when they are most likely to be observed (in the early morning). The standards also require that surveys are conducted

in all habitats on the property. Applicants must prepare a report for the town that includes methods, location-specific wildlife observations, and recommended development alternatives to minimize disturbance. Finally, the data need to be delivered in a way that can be incorporated into the town's GIS.

For more information, contact the Town of Cortlandt Planning Department (www.townofcortlandt.com).

Resources

- Arendt, R. 1996. *Growing Greener: Putting Conservation into Local Plans and Ordinances*. Island Press, Washington, D.C.
- Church, D., and J. Myers. 1993. *Shawangunk Ridge Conservation and Design Guidebook*. The Catskill Center for Conservation and Development. Arkville, N.Y. www.shawangunkridge.org/design.htm
- Damsky, S., and J. Coon. 2005. *All You Ever Wanted to Know About Zoning . . . 4th edition*. New York Planning Federation. Troy, N.Y. www.nypf.org
- Kelley, K. [ed.] 2003. *Local Environmental Ordinances. Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.
- McElfish, J. 2004. *Nature Friendly Ordinances*. Environmental Law Institute, Washington, D.C. Available from www.elistore.org.
- Metropolitan Conservation Alliance. 2002. *Conservation Area Overlay District: A Model Local Law. Technical Paper Series No. 3*. Wildlife Conservation Society. Bronx, N.Y. 46pp.
- New York State Department of State. 2004. *Guide to Planning and Zoning Laws of New York State. James A. Coon Local Government Technical Series*. New York State Department of State. Albany, N.Y. www.dos.state.ny.us/lgss/
- New York State Department of State. 1998. *Site Development Plan Review Procedure and Guidelines. James A. Coon Local Government Technical Series*. New York State Department of State. Albany, N.Y. www.dos.state.ny.us/lgss/
- Plunkett, K. [ed.] 2003. *Environmental Review of Land Use Projects. Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.
- Van Tine, J. [ed.] 2003. *Local Environmental Strategies. Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.

Chapter 10:

Stormwater Management for People and Wildlife



“Healthy watersheds capture and store water for human and natural needs, but sprawl development creates landscapes that shed water like a raincoat. Water rushing down storm drains when it rains is water that will not come up from your well when it is sunny.”

*Rebecca Wodder, President,
American Rivers*

Stormwater management techniques attempt to reduce the damaging impacts of runoff on water quality, groundwater, flooding, and habitat. Polluted runoff is the leading source of impairment to aquatic systems in the Hudson Valley, and increasingly, groundwater is not being recharged (New York State Department of Environmental Conservation 2000). For this reason, state and federal stormwater management regulations (also known as Phase II regulations) have been implemented. The strategies described in this chapter go beyond the existing Phase II stormwater regulations. Though it may not be immediately obvious, stormwater can also threaten terrestrial plants and animals. Without improved stormwater management, the integrity and quality of the region’s aquatic systems—streams, lakes, wetlands, and groundwater—will continue to be degraded and remaining high-quality examples may be destroyed. Finally, unless stormwater management takes wildlife into consideration, several species may be lost from the Hudson Valley.

How Does Stormwater Affect Natural Areas and Wildlife?

The growing problems of stormwater are related to increases in impervious surface area—streets, parking lots, and buildings—and construction activities that compact the soil. Instead of soaking into the ground, rain that falls on an impervious surface quickly runs off the site via storm drains and drainage ditches, which often send the water directly into streams and rivers. Such runoff cannot effectively recharge groundwater, resulting in more flooding and less available drinking

water. Another result is that streams and wetlands that are naturally dependent on stable groundwater flow may have higher high flows (flooding) and lower low flows, leading to the loss of stream habitat and stresses to fish and other aquatic life. Flooding not only threatens property and the safety of residents, but can cause stream banks to rapidly erode. In addition, stormwater runoff is often contaminated with various water pollutants that are byproducts of urban and suburban activities such as construction, automobile use, and lawn care. Reduced baseflows can cause small streams and lakes to dry up and reduce the stream’s ability to dilute pollutants. If left unchecked, the pollutants can further stress fish and other wildlife species that depend on clean water for food and habitat.

Some common site-development standards may actually worsen stormwater runoff problems. For example, development standards that require wide streets, expansive parking lots, and artificial drainage systems produce even more runoff than residential developments of sixty to seventy years ago. Curbs and catch-basins are commonly used to channel stormwater into storm sewers. In urban areas this may make sense, but in rural and suburban areas, these systems can impede the movement of small animals (See Miller and Klemens 2003 and Calhoun and Klemens 2002). Once in the road, turtles, frogs, and salamanders cannot climb over most curbs, so they travel along the curb—until they reach a storm grate and fall in. The effects of loss of these species can be dramatic, affecting the food availability for many other wildlife. Stormwater ponds and wetlands may act as “decoy” wetlands in areas where high concentrations of frogs, turtles, and salamanders occur. The detention ponds can attract small animals that normally use small wetlands as breeding areas. However, because of pollutant loads and fluctuating water levels breeding is rarely successful (See Miller and Klemens 2003 and Calhoun and Klemens 2002).

Stormwater management needs to accomplish two things: slow the release of stormwater runoff to downstream rivers and make sure runoff water does not degrade surface water quality. Communities in rural and suburban areas may want to consider additional stormwater management guidelines to protect wildlife.

How Can Improved Stormwater Management Be Used to Protect Natural Areas and Wildlife?

Improved stormwater management for people and wildlife can reduce impacts to streams, wetlands, groundwater, and protect small animals. Stormwater management tools that control the quality and quantity of urban runoff will help reduce impacts to streams and wetlands. Using the right techniques in the right places will help reduce impacts of stormwater management on small wildlife. Some of those techniques include: promoting groundwater recharge, locating stormwater ponds away from natural wetlands, and designing curbing and stormwater systems that take local wildlife into consideration.

Smart Growth Strategies

Alternative stormwater drainage and site design approaches can substantially reduce the impacts of stormwater on water quality, groundwater, aquatic habitat, and wildlife. These alternative development techniques, commonly called low-impact development, involve measures that accomplish three basic objectives:

- Reduce the amount of impervious surface area, allowing for groundwater recharge, thereby reducing runoff.
- Use the landscape to naturally filter and absorb runoff before it leaves the development site.
- Provide flexibility to choose and locate stormwater-management practices based on site constraints and natural resources as well as watershed and community factors, which may reduce threats to native wildlife.

Low-impact development designs reflect both old and new design philosophies. Natural drainage and narrow streets mirror a design philosophy that pre-dates the arrival of “modern” subdivision design in the 1950s and 1960s. The use of native landscaping material, is reminiscent of presettlement conditions. Cluster or open space development is a relatively new design approach that reduces impervious area and preserves natural features (See also Chapter 9).

Local governments can ensure that environmentally friendly stormwater designs are implemented in their communities by adopting laws and ordinances to ensure adequate drainage, prevent flooding, protect water quality of streams and lakes, and limit erosion from sites during construction. An additional way to reduce stormwater impacts is to allow for flexibility in local land-use laws that encourage natural drainage, such as vegetated swales and bioretention areas, to minimize impervious surfaces and soil compaction.

Specific recommendations for improved stormwater drainage and site design follow. Because environmental conditions vary, not all of these techniques are appropriate on all development sites. Site-specific design should reflect local conditions. Though some of these techniques may be less expensive to install than conventional development designs, there may be other tradeoffs such as aesthetic perceptions and maintenance needs that should be considered. Detailed discussion of these approaches and tools to help choose the appropriate practices for your situation are provided in the *New York State Stormwater Management Design Manual* (New York State Department of Environmental Conservation 2001) and *Better Site Design: A Handbook for Changing Development Rules in Your Community* (Center for Watershed Protection 1998).

Better Site Design for Conservation of Natural Areas

The following principles related to natural areas conservation for new development sites are adapted from the Center for Watershed Protection and American Rivers. They are intended to help local governments modify their ordinances where appropriate.

- Encourage incentives and flexibility to conserve stream buffers, forests, meadows, and other areas of environmental value. Where it is not possible to conserve natural areas onsite, encourage offsite mitigation. This is particularly important when doing so is consistent with locally adopted watershed or habitat conservation plans of these resources.
- Create along all perennial streams a variable-width, naturally vegetated buffer system that encompasses critical environmental features such as the 100-year floodplain, steep slopes, and freshwater wetlands. Maintain the buffer system through the plan review, delineation, construction, and post-development stages (See Chapter 5 for a discussion on buffer width).
- Limit clearing and grading of a site to the minimum needed to build lots, allow access, and provide fire protection. Manage a consolidated portion of the community open space as protected green space.
- Conserve vegetation at each site by preserving and planting native plants, clustering tree areas, and incorporating trees into community open space, street rights-of-way, parking-lot islands, and other landscaped areas.
- Prevent new discharges of stormwater runoff into wetlands, sole-source aquifers, or sensitive areas.

Natural Absorption

The first step in reducing stormwater impacts is allowing more water to be naturally absorbed into the ground. Natural vegetation—especially trees—help capture and absorb stormwater. Mass grading of development sites strips water-permeable topsoil and compacts underlying soils, further reducing the landscape's ability to absorb precipitation and runoff. Two techniques can be used to promote absorption of rain into the ground. The first is concentrating development in part of a site, conserving community open space that is naturally vegetated. The second is to limit clearing and grading, and mitigate soil compaction.

Reduced Impervious Area

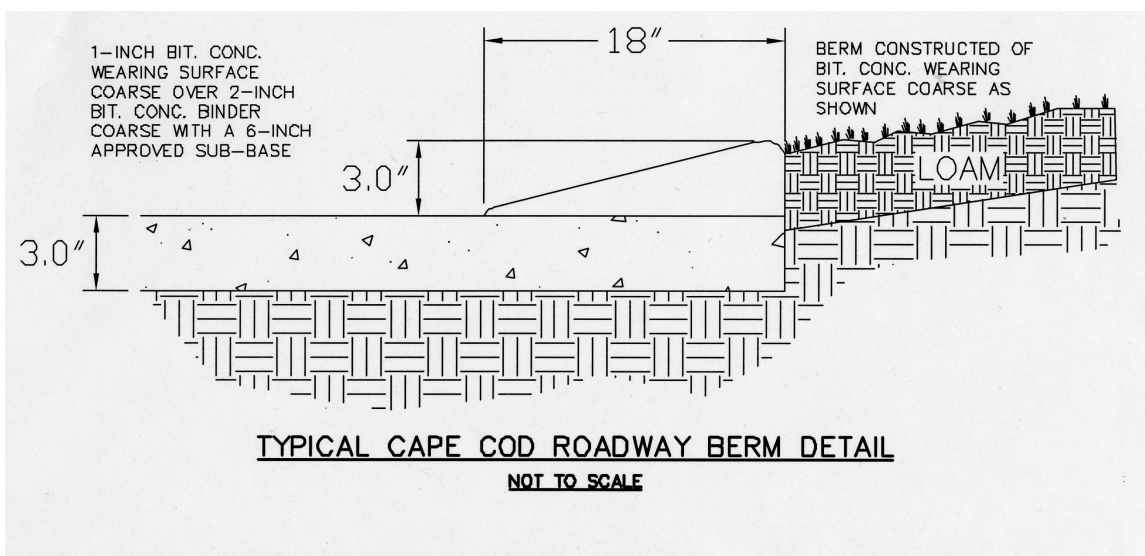
The area of impervious surfaces in a new residential development can be reduced in several ways: reducing building envelopes; allowing narrower streets; eliminating or reducing the size of cul-de-sacs, reducing setbacks between streets and homes, thereby reducing the length of driveways; and encouraging shared driveways, reducing sidewalk widths, or installing sidewalks on only one side of the street. Impervious surfaces also can be reduced in parking lots by downsizing individual parking spaces, installing planting medians, and installing porous pavement in low-maintenance overflow parking areas. Businesses whose patrons park at different times could share parking lots (for example, a bank and a restaurant or a movie theater and a funeral home). Most of these practices require changes to municipal codes.

Vegetated Drainage Swales

Using properly engineered drainage swales and other vegetated channel systems—instead of storm sewers, lined channels, and curbs and gutters—will reduce runoff volumes and increase the removal of damaging pollutants from runoff water. Gently sloped (4:1) vegetated drainage swales will also reduce small wildlife mortality when used instead of storm drains and stormwater devices such as hydrodynamic separators. If curbs are necessary, a Cape Cod-style curb (see below) can be used, which allows small animals to cross roads easily (Calhoun and Klemens 2002). Communities should strive to maintain the natural drainage system, including natural stream channels, wetlands, and floodplains. However, stormwater should not be discharged into a stream, wetland, or tidal wetland without first applying an approved treatment practice to remove pollutants and reduce the surge of water.

Infiltration Practices

Infiltration practices allow stormwater to seep into the ground within 48 hours of a storm event rather than traveling over the surface of the soil, and to recharge groundwater supplies that are essential to the health of many streams and wetlands. Where soils are sufficiently permeable and pollutants from commercial and industrial areas are not a threat, infiltration trenches and basins can reduce surface runoff volumes and naturally recharge groundwater supplies. Unlike stormwater ponds, infiltration practices do not involve a permanent pool of water, so they reduce the chance that amphibians will become trapped in fluctuating water levels.



Bioretention Areas

Bioretention areas use soils and native vegetation to capture and treat stormwater runoff. This technique reduces stormwater impacts by maintaining natural drainage patterns and using vegetation to absorb runoff. Bioretention areas may need to be combined with other stormwater management practices to control runoff volume from larger storms.

Native Landscaping

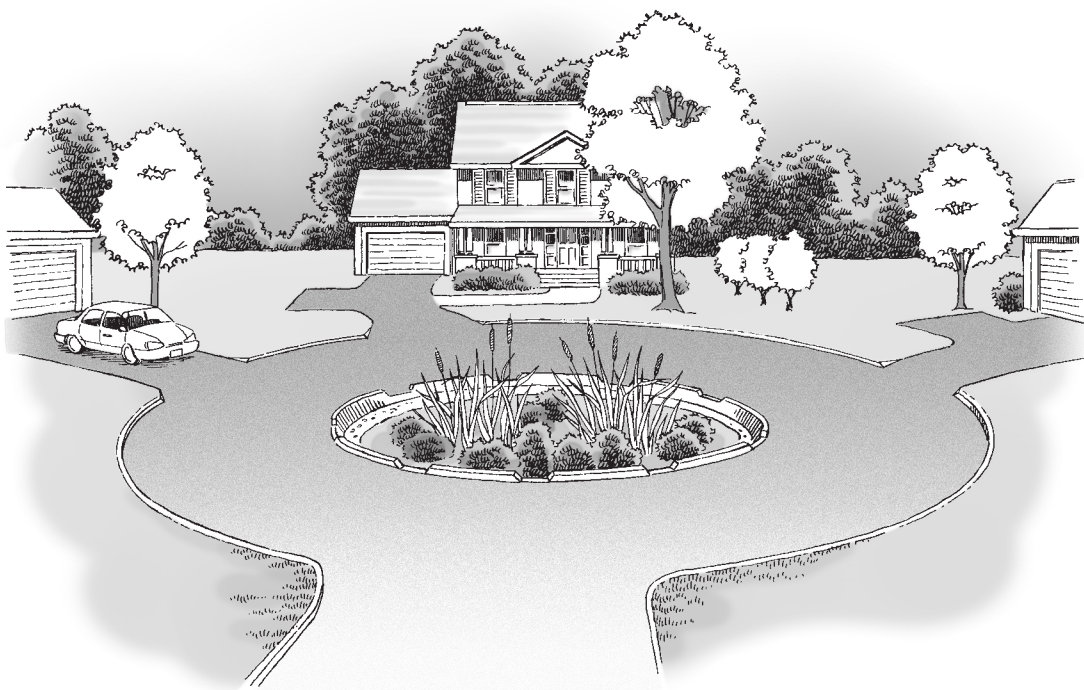
Native landscaping utilizes native plants, particularly native trees, shrubs, and wildflower species, as an alternative to conventional turf grass and ornamental plants. Native landscaping is particularly appropriate in drainage swales, bioretention areas, and rain gardens at the edges of roads, parking lots, and driveways, and can reduce the maintenance needs of conventional turf-grass landscaping such as mowing and irrigation. Native landscaping also provides important localized habitats for birds and butterflies and beneficial insects such as bees. This technique is discussed in greater detail in Chapter 13.

Stormwater Pond and Wetland Design, Management, and Maintenance

The design of stormwater ponds and wetlands incorporates features of natural wetland and lake systems, such as gradual shoreline slopes, a border of wetland vegetation, and areas of open water. In

contrast, conventional designs for stormwater detention basins feature dry bottoms or riprap-edged wet basins. Natural designs remove more stormwater pollutants than conventional wet- and dry-bottom basins, reduce nuisance goose populations, and can provide habitat for waterfowl, water insects, and amphibians. A note of caution is in order here, however. Even well-designed and -constructed stormwater ponds and wetlands can act as “decoy” habitat areas for wildlife that normally breed in vernal pools. To minimize the effect on native salamanders, frogs, and turtles, do not locate stormwater ponds and wetlands within 750 feet of a vernal pool, between vernal pools, or in areas that are primary overland amphibian migration routes, if known (Calhoun and Klemens 2002).

To maximize the benefits of natural basin design, local officials can develop and adopt practices to manage and maintain stormwater basins. Maintenance and management guidelines have been developed by the Environmental Protection Agency and the New York State Department of Environmental Conservation in partnership with the Center for Watershed Protection in Maryland (Center for Watershed Protection 1998, 2005, and New York State Department of Environmental Conservation 2001). Additional guidelines are warranted near vernal pools, as noted above.



A rain garden is a type of bioretention area that is both functional and beautiful.

Road Maintenance

In addition to site design, local governments can implement road maintenance programs to reduce the damaging effects of stormwater on aquatic ecosystems. Regular street sweeping in high traffic areas can substantially reduce runoff pollutants. Reducing the use of road salt can reduce winter runoff impacts on sensitive wetlands, streams, and woodlands. Public and private salt storage can also be designed to reduce damage to aquatic systems (Northeast Illinois Planning Commission 1998).

Summary of Benefits*

When used in combination on a development site, low-impact stormwater management techniques can substantially reduce both impacts and construction costs. Based on case studies, it is estimated that alternative stormwater drainage and site-design approaches can reduce:

- stormwater runoff volumes by 20 to 70 percent (in comparison to conventional development);
- runoff pollutant loads by 60 to 90 percent;
- site development costs by \$1,000 to more than \$4,000 per lot for residential developments, and by \$4,000 to \$10,000 per acre for commercial and industrial developments.

Other documented benefits of these approaches include reduced maintenance and replacement costs, enhanced site aesthetics, improved property values, and greater flexibility of site design. These techniques also will lead to improved protection and enhancement of sensitive natural areas and the region's waterbodies for supporting a diversity of wildlife.

Keeping water clean is almost always cheaper than cleaning it up later.

Local Examples

Progressive Local Laws and Ordinances

Natural drainage has been the standard practice for most low-density residential communities in New York State, with conventional storm sewers, lined channels, and curbs and gutters incorporated as communities become more urbanized. However, with the adoption of new Stormwater Phase II regulations at the federal and state level, many communities in New York State are now required local laws and ordinances to reduce runoff at the source. Construction-site operators and developers in all communities are required to control stormwater runoff from projects that disturb more than one acre.

New York State has developed a Model Local Law for Stormwater Management that communities may use to amend their zoning, site plan, and subdivision laws to minimize impervious surfaces and soil compaction, and to maximize treatment and infiltration of runoff on the development site. Communities may also provide additional natural resource protection by adopting local laws and ordinances that regulate floodplain development or require buffers for streams, lakes, ponds, and wetlands. More information on protection of these habitats can be found in Chapter 5.

Better Site Design

Towns of Clinton and Wappinger, N.Y.

In 2005, recognizing the need to develop code-review tools for local government, two municipalities in the Wappinger Creek watershed participated in a Better Site Design project with help from the Hudson River Estuary grant program. The first phase, code and ordinance worksheet review, was coordinated by the Dutchess County Environmental Management Council using tools and support from the Center for Watershed Protection. The second phase, Better Site Design Roundtables, was coordinated by the staff of the Hudson River Estuary Program.

Through the Wappinger Creek Watershed pilot project the Hudson River Estuary Program gathered considerable background information about how New York State law applies to the Better Site Design principles developed by the Center for Watershed Protection. Two final documents, produced in partnership with the municipalities, provide recommendations for specific local code changes, and at the same time summarize the application of Better Site Design principles in New York State (available from the NYS DEC Hudson River Estuary Program).

* from Schueler and Holland 2000a, 2000b.

Improved Wastewater Management for People and Wildlife

Stormwater management is not the only water pollution control activity that can have an effect on wildlife. Wastewater management is the process by which sanitary sewage is cleaned. How wastewater is managed and sited can have a profound effect on the Hudson Valley's habitats, by determining how and where land is developed and how clean our rivers, streams, and wetlands can be. A municipality's wastewater-management options can impact its ability to allow neo-traditional development, cluster development, and conservation subdivisions.

How Can Wastewater Management Be Used to Protect Natural Areas and Wildlife?

Wastewater planning, including careful selection of technology and management options, can be used to guide land use and support the design of new development to achieve habitat, water quality and quantity, and other conservation goals. Municipal sewer and small community systems can potentially help to guide development to appropriate areas and allow more compact site design. Discharging effluent to fields or forests recycles water back into the local ecosystem.

Management Options

In areas with municipal sewers, developers can often build on smaller lots at a higher density (depending also upon local zoning and other considerations). When the only treatment option is individual onsite septic systems, lot sizes must be larger, which can lead to sprawl and more fragmentation of natural areas. Small community systems are a third option that may allow for higher density at a smaller scale. Each management option has drawbacks, however, and a municipality should research these options carefully. Be sure to work with relevant municipalities, counties, sewer districts, and private utilities. The NYS DEC should also be consulted

when considering wastewater management options, because permits may be required.

Maintenance

Whichever management option is used, maintenance is crucial to maintaining water quality. Municipalities can promote management programs for onsite (septic) systems, work with sewer districts to repair and rehabilitate old sewer lines, and make sure provisions are made for lifetime management of small community systems.

Wastewater Planning

Think about developing a town-wide wastewater management plan to guide decisions on wastewater infrastructure, and link this plan to your local comprehensive plan, open space plan, and other local goals and regulations.

Additional Resources

The National Small Flows Clearinghouse is an education and technical assistance program supported by the U.S. Environmental Protection Agency that offers hundreds of publications, videos, and other resources for local officials, homeowners, engineers, and other audiences, ranging from brochures and fact sheets to detailed design manuals. Many are available free or at low cost (www.nesc.wvu.edu).

The National Decentralized Water Resources Capacity Development Project, funded by U.S. Environmental Protection Agency, has a number of detailed studies on small community/decentralized systems available for download (www.ndwrcdp.org/).

The Rocky Mountain Institute is a research and education organization that has a number of documents available for download regarding wastewater management and water conservation (www.rmi.org).

Resources

Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Center for Watershed Protection. Ellicott City, Md.

New York State Department of Environmental Conservation. 2004. *Stormwater Management Guidance Manual for Local Officials (Includes Model Local Law for Stormwater Management)*. New York State Department of Environmental Conservation. Albany, N.Y.

New York State Department of Environmental Conservation. 2001. *New York State Stormwater Management Design Manual*. New York State Department of Environmental Conservation. Albany, N.Y.

New York State Department of Environmental Conservation. 1993. *Reducing the Impact of Stormwater Runoff from New Development (Second Edition)*. New York State Department of Environmental Conservation. Albany, N.Y.

New York State Soil and Water Conservation Committee. 2004. *New York Standards and Specifications for Erosion and Sediment Control*. New York State Department of Environmental Conservation. Albany, N.Y.

Chapter 11:

Local Open Space Planning and Conservation



Open space is land that is not intensively developed. It can include land important for agriculture, recreation, and scenery as well as natural areas. Open space planning and inventory is important to conserving land because it allows a community to take stock of its resources and determine its priorities. By planning, you will know that limited resources will be used wisely, conserving the land that is most important to your community.

As of 2007, sixteen percent of the Hudson Valley—about 640,000 acres—had been permanently conserved by the state, local government, and nonprofit conservation organizations.

Hudson Valley communities have acquired significant amounts of land, typically with recreational amenities such as ball fields and picnic areas. While they are an important public resource, parks that are largely covered with turf grass do not conserve natural areas and wildlife. Local governments can help conserve wildlife by complementing their traditional acquisitions with more natural areas and by maintaining some native vegetation in existing municipal parks.

Although public-land acquisition techniques are stressed here, the importance of the actions of private property owners in protecting nature should not be overlooked, and should be encouraged by local governments. One way private landowners can enhance habitat on their property is to enroll in state and federal conservation programs, such as cost-share programs for habitat enhancement practices, easement purchases for wetlands, property-tax relief for working farm and forest owners, and land stewardship for threatened and endangered species. Land trusts are private organizations that conserve land and can be another very useful source of assistance and information for private landowners. For a list of local land trusts, see Appendix 3.

How Can Local Open Space Conservation Be Used to Protect Natural Areas and Wildlife?

Open space conservation is an important part of natural area and wildlife conservation because it protects habitats. Each habitat is home to hundreds of species, and habitat protection is essential to protecting wildlife. Acquisition programs can be used with other preservation programs to link existing or future natural areas into a network of habitats useful for wildlife. As the area of protected land and water increases, the variety of habitats that are protected increases as well, which leads to the protection of more wildlife species.

Smart Growth Strategies

Communities in the Hudson Valley are doing a great deal to identify and protect their valuable open space. Several excellent publications are available to help communities with open space planning. All provide more detail than can be included here. The actions summarized below are described in much greater detail in New York State Department of State 2004.



Open Space Inventories

An open space inventory identifies lands that meet criteria set by the community for their open space value. To protect nature, identify lands and waters with significant habitat, using information in Chapter 4. It is also important to identify lands that adjoin high-quality habitat and existing protecting lands. For example,

an inventory might identify areas in your community that have high value for habitat, scenery, or farmland potential. When the inventory is complete, it can also be used help steer growth in your community toward less environmentally sensitive areas.

Open Space Plans

An open space plan outlines a community's priorities, justification, and strategy for conserving land. Sites that meet multiple objectives—such as water-resource protection, habitat protection, and passive recreation—might be your community's highest priority for conservation. Justification can include benefits of natural areas to the human community. An open space plan is best used to conserve natural areas and wildlife when the resources have been identified throughout the municipality, so natural areas can be connected across property boundaries.

The New York State Open Space Plan

New York State revises its open space plan every three years. Staff from the state's Department of Environmental Conservation and the Office of Parks, Recreation, and Historic Preservation lead regional open space committees, who develop the priority projects for the state. Priority projects are the basis for state land purchases.

Conserving Open Space

The tools and strategies that communities can adopt to conserve land listed below may be used alone or in combination. Local governments can also conserve significant amounts of open space by using their authority to direct development to those locations that already have public infrastructure and on a site level by locating structures on the least sensitive parts of a property. Land that is purchased by or donated to a municipality can be managed in accordance with local natural area and wildlife conservation goals.

Voluntary Land-preservation Agreements

A conservation easement is a voluntary legal agreement whereby private landowners agree to limit uses of their land, most often development potential. The agreements are permanent, yet highly flexible, and designed to meet the needs of the landowner and easement holder. In New York, perpetual easements may be held by the state, municipalities, and qualified nonprofits, such as land trusts. Lands with conservation easements remain in private ownership and on the tax rolls.

Dedications/Donations: A Tool to Conserve Sites

Municipalities and land trusts can accept property or easement donations from landowners. This can be accomplished in a number of ways and arrangements

can be made to accommodate the needs of the property owner. Donors may qualify for tax benefits under certain circumstances and conditions.

Purchase: A Tool to Conserve Sites

A public entity also may choose to purchase property from a willing seller. The landowner may sell the land outright at fair market value to an agency, or it may be sold at a bargain price, which may provide tax benefits for the seller. Development rights can also be purchased, resulting in land protected from development by a legal agreement, but the land remains on the tax rolls.

Easement-purchase programs are usually called purchase of development rights (PDR) programs. In this case, a landowner is compensated for the difference between the fair market value of the land and its potential development value. The state's farmland protection program has successfully used this technique to help preserve viable agricultural lands.

"Open space conservation is a one-time investment that can boost property values and swell tax coffers long after the land is paid for. And in survey after survey, home buyers identify nearby open space and trails as among the top features in choosing a home."

(Lerner and Poole 1999)

Transfer of Development Rights: A Tool to Conserve Landscapes

A municipality or group of municipalities can conserve significant landscapes using Transfer of Development Rights. New York State allows municipalities to use this technique to "protect the natural, scenic, or agricultural qualities of open lands, to enhance sites and areas of special character or special historical, cultural, aesthetic, or economic interest or value and to enable and encourage flexibility of design and careful management of land in recognition of land as a basic and valuable natural resource." The area a community or region wants to conserve is called a "sending district." Here, the development rights of a property are purchased from willing sellers, allowing



landowners to continue to use their land. These development rights can then be used in a “receiving district,” areas a community or region has determined are best for development. A generic environmental impact statement can be used to evaluate the impacts of increased development in the receiving district.

Funding Open Space Conservation

Though purchasing land and development rights can be expensive, a number of funding mechanisms and sources are available to governments. Grants are available through the New York State Department of Environmental Conservation, New York Office of Parks, Recreation, and Historic Preservation, and the Federal Land and Water Conservation Fund. Private and nonprofit conservation agencies can provide technical assistance or may acquire land and easements that meet their needs. Local governments can use their taxing and bonding authority for the matching funds often required by public and private funders. From 2000 to 2006, Hudson Valley residents in twenty-two municipalities voted to allocate \$113 million for open space conservation.

From 2000 to 2006, Hudson Valley residents in twenty-two municipalities voted to allocate \$113 million for open space conservation.

Summary of Benefits

Acquiring and managing more natural areas can provide important benefits to communities.

- Open space, public lands, and parks are amenities highly valued by residents, and are attractive to families and businesses looking to relocate.
- Protected areas and parks can add to the community’s economy by providing destinations for active and passive recreation and other tourist activities.
- Open space preservation can help avoid expensive legal battles associated with regulatory protection measures while reimbursing landowners for the economic and other benefits the open space will bring the community.
- Most acquisition measures protect land in perpetuity.

Local Examples

Partnering with Land Trusts

After the Wildlife Conservation Alliance’s Metropolitan Conservation Alliance completed their Eastern Westchester Biotic Corridor report in April 2002, Westchester Land Trust went to work helping the Towns of Pound Ridge, Lewisboro, and North Salem implement the report’s recommendation to protect key lands for conserving lands for at-risk wildlife. The land trust is working with landowners to conserve vital lands for the corridor. It has protected 800 acres through donation and purchase, and is also managing land trust–owned property for natural areas and wildlife, including invasive species control and wetland restoration.

Prioritizing Open Space

The Town of Philipstown, located in the Hudson Highlands, has thousands of acres of intact forests. After completing a community-visioning process, Philipstown 2020, the town updated their comprehensive plan. An open space subcommittee identified open space lands and categorized them by function: community character, public health, habitat, and recreation. The open space work group used biological information from the New York Natural Heritage Program, The Nature Conservancy, Putnam County, and the Rutgers University Remote Sensing Department. The inventory and analysis further refined the community’s natural-resource goals and identified ways to reach those goals. The open space/ natural resource process received funding through a grant from the U.S. Forest Service and Regional Plan Association as part of the New York/New Jersey Highlands Regional Study.

Orange County Open Space Plan

The Orange County Planning Department developed an open space plan with biological diversity as a priority. With input from The Nature Conservancy, the Wildlife Conservation Society, and others, the planning department developed maps of areas important for plants and animals, forests, and aquatic systems, then identified corridors to connect them. The county has established a \$20 million fund to support the plan’s implementation.

Tax-delinquent Property

Tax-delinquent property offered at auction is another way local governments can acquire valuable habitat. In Albany County, staff at the Office of Natural Resources review all properties before they go on the auction block. Environmentally sensitive land along the Normanskill Creek, a tributary of the Hudson River Estuary, was removed from the auction list and transferred to the Mohawk-Hudson Land Conservancy in 2003.

Resources

- LeJava, J., M. Rielly, and J. R. Nolon. 2000. Open Lands Acquisition: Local Financing Techniques Under New York State Law. *MCA Technical Paper* No. 2, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, N.Y.
- Lerner, S., and W. Poole. 1999. *The Economic Benefits of Parks and Open Space: How Land Conservation Helps Communities Grow Smart and Protect the Bottom Line*. Trust for Public Land. San Francisco, Calif.
- New York State Department of State. 2004. *Local Open Space Planning Guide*. New York State Department of State and New York State Department of Environmental Conservation Albany, N.Y.
- Plunkett, K. [ed.] 2003. Open Space Preservation. *Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.

Chapter 12:

Intermunicipal Approaches



Intermunicipal land-use cooperation recognizes that natural resources are often shared by two or more municipalities. In New York, municipalities may work together to share financial resources, promote economic growth, and protect natural resources. Municipalities in the Hudson Valley have worked together to promote tourism, attract business, protect watersheds, and study traffic (Pace University Land Use Law Center 2002).

Planning intermunicipally does not take away the ability of an individual municipality to govern its own land use, but instead allows a shared vision to guide each town's actions in ways that benefit a larger area. This allows for consistent protections across a shared resource while protecting home rule.

How Can Intermunicipal Land Use Cooperation Be Used to Protect Natural Areas and Wildlife?

Natural features and wildlife do not follow municipal boundaries and habitats generally span more than a single town. For example, the Shawangunk Ridge in Ulster County in New York is in parts of eleven towns and one village. The Albany Pine Bush straddles two towns, two cities, and one village. Intermunicipal land-use cooperation allows for coordination of conservation efforts, which is more effective at protecting shared resources.

Smart Growth Strategies

Intermunicipal land-use cooperation for natural areas and wildlife should be based on shared natural features, such as large wetland complexes, watersheds, or important ecological landscapes. Municipal leaders can work together informally or draft and sign an intermunicipal agreement. Cooperation can involve two or more counties, towns, cities, or villages. It may also make sense to work with school districts, sewer districts, and for those communities in the New York City Watershed, the New York City Department of Environmental Protection. A municipality can be part of more than one intermunicipal effort.

Counties

County government is the most basic level of intermunicipal cooperation. Biological resources can be identified at the county level and that information and conservation advice can be shared with municipalities as they update comprehensive plans or create watershed or open space plans. If authorized by the county legislature, county planning boards can review development proposals. If the county planning board recommends against a proposal, the local legislature needs a supermajority to approve the project.

Sharing Information

Neighboring communities will often inventory their resources without knowing what their neighbor has done. A neighboring municipality's effort to identify habitat may shed light on your efforts, by identifying shared habitats or by learning about another municipality's innovative approaches to conservation. Municipalities that are just beginning to conserve habitat can learn from towns that have well-established conservation programs. Towns, cities, and villages might even work together to identify habitats, as has been done in partnership with the Wildlife Conservation Society in the Hudson Valley. Coordination can be as simple as using the same map legends, so habitat maps can be used by residents in both towns.

Complementary Ordinances

Shared natural resources will not be conserved if only one town adopts conservation measures. Adjacent towns can adopt similar or identical ordinances to protect a shared resource. Overlay zones are a good type of ordinance to develop with neighboring communities because they can be applied over any base zone. Another benefit of this approach is that enforcement costs can be shared among towns.

Joint Boards

Forming joint boards is another way to integrate conservation efforts. Neighboring municipalities could develop intermunicipal planning, zoning, or subdivision review boards; conservation advisory councils (CACs); or open space committees. Natural-resource information can be combined, and development impacts could be considered across municipal boundaries. If forming

joint boards is not feasible, consider holding periodic joint meetings to discuss environmental issues that are common to the communities.

Joint Planning or Studies

Local governments can work together to develop local plans or study local resources. This may be especially useful in rural towns that have fewer resources for consultants. Incorporated villages have cooperated with the towns they are in to develop comprehensive and open space plans. Intermunicipal watershed plans are becoming increasingly common in the Hudson Valley as concern over clean water is growing. Adjacent municipalities on the Hudson River may want to develop intermunicipal local waterfront revitalization plans.

Intermunicipal Agreements

Formal intermunicipal agreements are drafted by

committee and then adopted by majority vote of the legislature of the individual municipalities. Included in the document are clearly stated responsibilities of municipalities, approach to implementation, organization of the council, who will represent the municipalities on the council, resources members will commit to the council, insurance, dispute resolution, and the logistics, duration, review, amendment process, extensions, and termination. Agreements can include specific implementation actions so member communities have a roadmap for achieving their goals. Upon signing, a municipality commits to achieving those goals. Examples of natural-area goals might be to conserve 500 acres of land that protects habitat and water quality, develop a voluntary riparian planting program, adopt a wetland and watercourse ordinance, encourage voluntary land-conservation agreements, collect more biological

Watershed Planning

Engaging municipalities through community-based watershed groups is an excellent way of making sure there is enough clean water for drinking, boating, and fishing in the Hudson River Valley. Working intermunicipally makes sense for watersheds because any land use in upstream communities affects downstream communities and land-use and groundwater withdrawals affect the entire watershed, not just a stream. Watershed planning can also support natural area and wildlife conservation, considering the impacts of land use on important water and wildlife resources. In addition, activities that protect terrestrial and aquatic habitat also protect water resources. Increasingly, local watershed groups have been including natural area and wildlife into watershed plans.

Watershed Plan Steering Committee

A watershed steering committee or advisory group of key stakeholders should be established to help guide the development of the watershed conservation and management plan. Watershed steering committees can include representatives from diverse watershed and natural-resource interests, including but not limited to, local, state, and federal government agencies; elected officials; environmental and conservation groups; sportsmen federations; private citizens; scientists; students performing stream monitoring; academia; and forestry, agriculture, and construction businesses.

Although a steering committee is a good way to incorporate public/stakeholder support for the watershed plan, the group can continue after completion of the plan. Continuing a watershed partnership beyond the scope of planning creates a long-term partnership committed to watershed restoration and protection with diverse support and resources.

Watershed Plan Components

Watershed plans typically include three major parts: (1) a characterization of water and land resources; (2) an inventory of stresses or threats to the natural resources; and (3) conservation and management strategies to improve or

protect the watershed. Living resources can be added to the watershed plan in a similar way by characterizing the known wildlife and habitats of the watershed, identifying the threats, and developing strategies to address those threats. This is the same process by which an individual town can identify its habitat resources, just on a broader scale. Pay particular attention to aquatic habitats and land habitats that depend on or affect water resources: wetlands, forests, and stream corridors. Refer to Chapter 4 for help in identifying important natural areas and wildlife connections in a watershed.

Some watershed organizations complete an ordinance review of their municipal partners to determine if local laws adequately protect water quality and quantity. Though many of the laws reviewed also help protect habitat (e.g., erosion and sedimentation), reviewing laws and policies that have natural-area and wildlife impacts can make the review more comprehensive.

Public Input and Outreach

Public outreach and input are important parts of watershed planning. Soliciting public comment is a good way to identify issues, ideas, and strategies during the planning process. Public meetings in watershed towns should be held once a draft plan is complete. Engaging the community and including stakeholders in decision-making may help ensure long-term success of the plan (see Chapter 6). If a community-based watershed group exists, it could lead the public outreach effort. Public education is important because everyone has a potential impact on our water resources. Landowners and land-use decision-makers alike can do something to keep our water clean and abundant.

For more information about watershed planning, contact the New York State Department of Environmental Conservation Hudson River Estuary Program.

information, or any of the other techniques described in this handbook.

Summary of Benefits

By working together to conserve natural areas and wildlife, municipalities can prevent duplication of conservation efforts; combine financial and material resources for cost-effective planning, implementation, and enforcement; and promote a greater diversity of programs and opportunities to address conservation issues. Intermunicipal efforts can also be more effective at attracting technical assistance and funding from state, federal, and private sources.

Local Examples

Shawangunk Regional Open Space Plan

Eleven municipalities have joined forces in the Shawangunk region of Ulster and Orange Counties to protect the character of the rural landscape and promote tourism to the region. The communities worked together in the past to develop a management plan for the Shawangunk Scenic Byway that included natural resources. The municipalities are working together to identify the regionally important open spaces that support the regional quality of life, including those that support natural areas and wildlife.



Eastern Westchester Biotic Corridor

The Towns of Lewisboro, North Salem, and Pound Ridge created an intermunicipal agreement in 2005. The important habitats in those towns were described in the Eastern Westchester Biotic Corridor report by the Wildlife Conservation Society. In the agreement, the first in New York State created solely to protect biological resources, the towns stated the “desire to cooperate to protect wildlife habitat and biodiversity and reduce the impact of development on animals and plants in a connected swath running through Lewisboro, Pound Ridge, and North Salem.” Further, they vowed to review town plans and codes in order to develop a plan to “protect the biotic corridor, adopt conservation overlay zoning, and create incentives to development that protect biodiversity.” The first task is to develop an intermunicipal conservation overlay district. For more information, contact one of the three towns involved at www.lewisborogov.com, www.townofpoundridge.com, www.northsalemny.org.

Creating Complimentary Ordinances

The Rockland Riverfront Communities Council, an intermunicipal council in Rockland County developed to promote natural, historic, and cultural resources, comprises eleven towns and villages that border the Hudson River plus the county and the Palisades Interstate Park Commission. The council has been authorized by resolution of the member municipalities to draft model ridgeline and steep-slope laws. The laws will help each municipality to protect the Palisades’ scenery and prevent erosion. Once complete, the ordinances will need to be adopted by each municipality. The model ordinances will also be part of Rockland’s Greenway compact plan, now in development. In the future, the council is considering developing complimentary wetlands and tree-preservation ordinances. For more information, contact the Rockland County Planning Department, 845 364-3434.

Adopting Goals Intermunicipally

The Wappinger Creek watershed comprises approximately 210 square miles, covering parts of nine towns in Dutchess County. A watershed plan was developed due to concerns about flooding, the degraded water quality of Wappinger Lake, and dependence on limited groundwater in the rapidly growing southern part of the watershed.

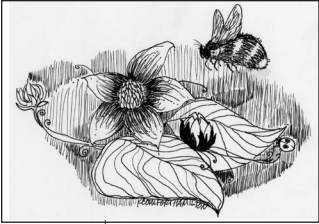
The Wappinger Creek Watershed Intermunicipal Council was created once the plan was complete. The council collectively developed goals to improve water quality in the watershed. All but one of the watershed’s municipalities have committed to achieving the goals. For more information, visit counties.cce.cornell.edu/Dutchess.

Resources

- ZeZula, T. [ed.] 2003. Intermunicipal Land Use Cooperation. *Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. To order, call Center at 914 422-4262. www.law.pace.edu/landuse
- Kunsler, J. 2003. Wetlands and Watershed Management: A Guide for Local Governments. *Publication No. 28*. Institute for Wetland Science and Public Policy of the Association of State Wetland Managers. Berne, N.Y. Available for free download at www.aswm.org.
- Pace University Land Use Law Center. 2002. *A Report from the Intermunicipal Land Use Councils in the Hudson River Region*. Hudson River Valley Greenway. Albany, N.Y.
- New York State Department of State. 1998. Intergovernmental Cooperation. *James A. Coon Local Government Technical Series*. New York State Department of State. Albany, N.Y. www.dos.state.ny.us/lgss/.

Chapter 13:

Natural Landscaping



"I am not a lover of lawns. Rather would I see daisies in their thousands, ground ivy, hawkweed, and even the hated plantain with tall stems, and dandelions with splendid flowers and fairy down, than the too-well-tended lawn."

(Hudson 1919)

The Hudson Valley landscape has been modified by humans for thousands of years. Native Americans set fires to maintain open areas for hunting and agriculture, yet the landscape remained largely forested. After European settlement, most of the forested valley and uplands were cleared for timber and agriculture, and as a result, have been changed by humans in some way. The transition from forest to open areas led to a change in the wildlife that live in the Hudson Valley. However, the habitat remained essentially connected, and wildlife could easily move to more suitable habitats. As habitat and as land across the valley has reverted to forest, many forest-dependent species returned.

Today, the Hudson Valley is becoming increasingly developed, with sprawling land-use patterns and more intensive use by people. Unlike the changes of 500 years ago, the habitat is changing in ways that do not allow sensitive species to adjust. Smaller natural areas are farther apart. Lawns and invasive plant species between natural areas make it more difficult for wildlife to find healthy habitat. Natural landscaping can help address this problem by providing some habitat, maintaining connections for wildlife, and reducing the spread of invasive plants.

How Can Natural Landscaping Help Protect Natural Areas and Wildlife?

Natural landscaping can benefit native animals, attracting colorful butterflies and moths and an array of songbirds that are essential components of healthy ecosystems and enhance our quality of life. It also can serve as a buffer for sensitive habitats in conserved areas. But natural landscaping cannot replace natural areas. Rather, this approach should complement other municipal efforts to conserve wildlife and habitat, like open space

conservation and enhanced project review. For example, the techniques described in this chapter can help maintain the connections between conserved natural areas.

Natural landscaping uses plants adapted to the local conditions (soil, climate, etc.), which are easier to grow and better protect downstream wetlands and watercourses. Native plants, unlike turf grass, can both improve the infiltration and filtering of rain and snow and stormwater runoff, and hold soil in place, thus greatly reducing erosion and siltation of waterbodies. Stands of native vegetation also require fewer chemical control agents—no fertilizers or pesticides, and minimal herbicide once established. Thus, natural landscaping can lead to improved water quality over conventional landscapes.

Smart Growth Strategies

Local governments can assist natural-area management and enhancement in two primary ways:

- Maintain as much natural vegetation as possible. The habitat quality of the Hudson Valley is good overall and leaving natural vegetation is the best way to keep it healthy.
- When it is necessary to have landscaping, favor native plants adapted to local conditions. The predominant landscaping material in the Hudson Valley is the turf-grass lawn. The lawn is borrowed from the heavily grazed, short-grass pastures and formal gardens of Europe. Though turf grass provides recreational space and some aesthetic appeal, it offers little with respect to biodiversity and it is expensive and polluting to maintain.

Local governments can lead by example by applying these principles to their own lands. They can also encourage usage of the principles on private lands, particularly for developments reviewed by local boards.

Identifying natural areas is an important initial step to prioritizing management needs and natural landscaping opportunities (Chapter 4). When a community knows what habitats and connections it wants to maintain, it



will be better able to apply the following techniques where they will have the most benefit for wildlife.

Encourage the Use of Native Plants for Private Landscaping

Natural landscaping also can be encouraged or required for certain components of new development or redevelopment. In particular, natural landscaping could be required in drainage swales, around stormwater



ponds, and along the edges of streams, lakes, and wetlands. Other potentially important sites for the establishment of natural landscapes and habitats are large landholdings, including institutional sites, commercial and industrial sites (e.g., industrial and office parks), houses of worship, and senior housing complexes. Privately owned golf courses and parks can also be encouraged to use natural landscaping. When approving a site plan, a town could require natural vegetation as a buffer to protected areas and stream corridors. Agricultural land also can benefit from using native plants for windbreaks, swales, and streamside buffers.

Use Natural Landscaping on Public Properties

Local governments can work with school districts, park departments, and highway departments to promote the use of natural landscaping on public properties. Municipalities can use native vegetation around buildings and parking lots to enhance aesthetics, reduce maintenance costs, and reduce stormwater runoff. Municipalities also can use native vegetation to remediate landscaping and erosion problems along stream channels and detention basins, as well as along highway and road parkways, ditches, medians, and vacant meadows and open areas. Rights-of-way, such as utility corridors, provide more opportunity for the use of native landscaping (McElfish 2004). Using

natural landscaping in these corridors can help provide continuity and linkages among disjointed habitats.

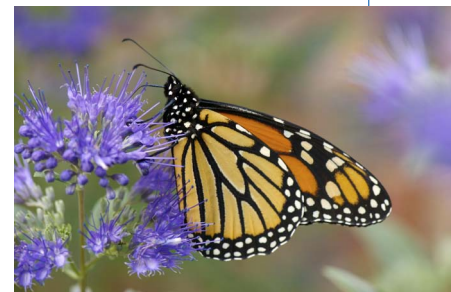
Natural landscaping by school districts, park departments, and colleges provides a unique educational opportunity. Establishing or maintaining natural areas also provides a hands-on learning tool for students and volunteers.

Invasive Plants

Some plant species introduced into this country from Europe or Asia can become very aggressive and replace our native species in the landscape. Some common invasive plant species include Japanese barberry (*Berberis thunbergii*) and Tree-of-heaven (*Ailanthus altissima*) in woodlands, and purple loosestrife (*Lythrum salicaria*) and water chestnut (*Trapa natans*) in wetlands. Though invasive plants can crowd out native plants and make habitat unsuitable for some wildlife species, they are not devoid of habitat value. Further, removal of invasive species can sometimes make problems worse. If you think invasive species are causing a habitat problem in your community, contact a qualified biologist for assistance and possible removal. A more manageable goal is to prevent invasive species introduction and remove invasive plants when populations are small and still manageable.

Towns and landowners can help prevent invasive plants from taking hold. Invasive plants specialize in disturbed landscapes, so completely clearing a site of all vegetation

encourages their growth. Maintaining natural vegetation on construction sites may help. Many invasive species were introduced as ornamental plants, which is why so many of them are attractive. Planting native plants in our public areas and encourage native planting on private lands is an important action local governments and landowners can take to prevent the spread of nonnative plants.



Provide Public Education

Local governments can partner with others to provide information about natural landscaping to citizens, business owners, developers, and civic organizations. Important topics include environmental benefits, plant types, sources, and landscape setbacks at property lines. There are several organizations in the Hudson Valley that specialize in natural-landscaping education (see page 78). Grants may be available for demonstration projects. See Chapter 6 for more information on developing an education program.



Summary of Benefits

Lower maintenance cost.

Natural landscapes require much less time, money, and effort to maintain once they are established. Long-term needs for irrigation, fertilizers, pesticides, and herbicides are virtually eliminated.

Conservation education and scientific study.

Natural-habitat management puts people in touch with nature close to home, work, and other nearby locations. Municipalities, school districts, park districts, and conservation districts can use natural landscaping as an educational tool.

Beautification and property enhancement. Natural landscapes provide aesthetic richness with seasonally changing color and texture that significantly contribute to the beauty of sites and communities.

Maintaining your community's "sense of place."

High-quality natural features such as river corridors and woodlands are part of the identity of a community or neighborhood. Distinctive natural landscaping that preserves the unique characteristics of your community is a unique community asset.

Reduced cost of stormwater management. Native vegetation and topsoil enhances infiltration and slows and reduces the amount of stormwater runoff. This helps reduce infrastructure costs and downstream

flooding, and replenishes groundwater. Stormwater conveyance and detention facilities that simulate natural systems are generally less expensive to build and almost always more economical to maintain.

Reduced soil erosion. If sites are not completely cleared of vegetation and topsoil during construction, less sediment will leave the site. Native plants appropriately used on sloped sites, stream banks, drainageways, and shorelines can effectively hold the soil and reduce erosion due to their deep and fibrous root systems.

Improved water quality. Native vegetation in drainageways helps to filter stormwater to reduce contaminants. Naturally vegetated buffers along streambanks and shorelines intercept surface runoff and slow groundwater flow. The reduced use of fertilizers and other chemicals used for maintenance



Table 13-1. Alternatives to Invasive Ornamental Plants

invasive ornamental plants	native alternatives	attributes of native plant
Yellow Iris (<i>Iris pseudacorus</i>)	Blue Flag Iris (<i>Iris versicolor</i>)	Hardy, water tolerant, provides good shoreline protection. Deer tolerant.
Flowering Rush (<i>Butomus umbellatus</i>)	Swamp milkweed (<i>Asclepias incarnata</i>)	Herbaceous perennial that thrives in moderate to fine soils and wet to moist hydrology. Deer tolerant.
Japanese Barberry (<i>Berberis thunbergii</i>), Burning Bush (Winged Euonymus, Japanese Spindle Tree) (<i>Euonymus alata</i>)	Spicebush (<i>Lindera benzoin</i>)	Attractive fruiting shrubs with food source for birds. Deer tolerant.
Garlic Mustard (<i>Alliaria petiolata</i>)	Black Cohosh (<i>Cimicifuga racemosa</i>), Foamflower (<i>Tiarella cordifolia</i>)	Herbaceous perennials that attract butterflies and birds. Deer tolerant.
Multiflora Rose (<i>Rosa multiflora</i>)	Butterfly Weed (<i>Asclepias tuberosa</i>)	Colorful flowers that attract butterflies and birds. Deer tolerant.
Japanese Honeysuckle (<i>Lonicera japonica</i>)	Trumpet Honeysuckle (<i>Lonicera sempervirens</i>)	Attractive flowers and colorful foliage that attract butterflies and birds. Deer tolerant.
Japanese Knotweed (<i>Polygonum cuspidatum</i> or <i>Fallopia japonica</i>)	American Cranberry (<i>Viburnum trilobum</i>)	Cover for smaller mammals and seed source for birds. Deer tolerant.

Information from the Adirondack Park Invasive Plant Program, Alternatives to Invasive Garden and Landscape Plants in the Adirondacks (www.adkinvasives.com).
Deer tolerance information from the Town of Pound Ridge Conservation Board (www.townofpoundridge.com)

are also important factors in protecting water quality and public health.

Other environmental benefits. Due to greatly reduced reliance on lawn mowers for maintenance, natural landscapes can reduce noise pollution and air pollution, including greenhouse gases.

Local Examples

Glacial Lake Albany Native Plant Restoration Project

The Glacial Lake Albany area, in Albany, Schenectady, and Saratoga Counties, has a unique native plant community dominated by pitch pine and scrub oak. The habitat is also home to the federally endangered Karner blue butterfly. The land managers of preserves in the region needed to soften impacts of development throughout the Glacial Lake Albany area to help protect the butterfly and its sensitive habitat. The project created a program to educate local landowners about natural landscaping and to work with towns to require natural landscaping in new development. Some new subdivisions have deed restrictions that prohibit invasive plants that would damage the unique habitat.

To make the program successful, a source of native plants was needed. The Nature Conservancy recruited wholesale and retail nurseries to grow and sell native plants, which are used for private landscaping and preserve restoration work. Seed is collected by volunteers in the preserves. For more information, contact the Albany Pine Bush Commission at 518 785-1800 or www.albanypinebush.org.



Westchester County “Go Native!”

Go Native! is a collaborative project between Westchester County Parks, the Native Plant Center, and the Federated Conservationists of Westchester. A county executive order in 2001 set the stage for the program: no invasive plants would be planted on county property and nonnative plants will be removed and replaced with native species. The program also encourages residents to plant native species that are locally grown and naturally produced. A list of Westchester’s native plants can be found at the Native Plant Center web site.

Resources

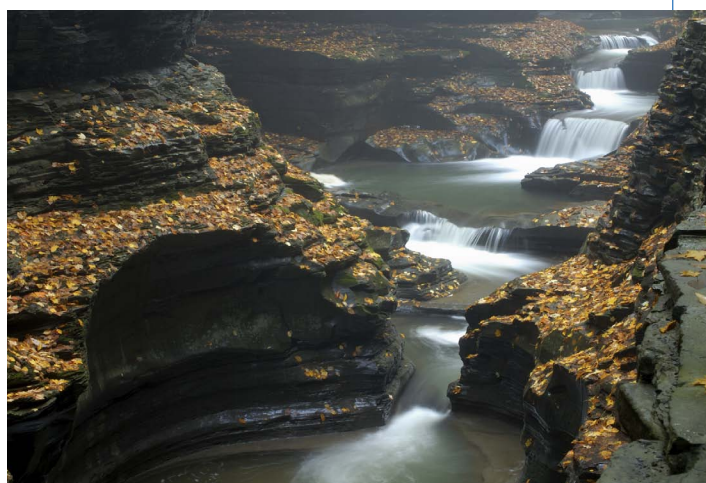
Adirondack Park Invasive Plant Program (www.adkinvasives.com)

Invasive Plant Council of New York State (www.ipcnys.org [accessed December 2007])

Luttenberg, D., D. Lev, and M. Feller. 1993. *Native Species Planting Guide for New York City and Vicinity*. City of New York Parks and Recreation, Natural Resources Group. New York, N.Y.

Restoring NJ Riparian Forest Buffers (njaes.rutgers.edu/njriparianforestbuffers/ [accessed December 2007])

More natural landscaping resources can be found in Appendix 3.



Sources Cited*

- Allan, B. F., F. Keesing, and R. S. Ostfeld. 2003. Effects of Habitat Fragmentation on Lyme Disease Risk. *Conservation Biology* 17:267–272.
- American Farmland Trust and Cornell Cooperative Extension. 1989. *The Cost of Community Services in Towns in Dutchess County, New York*. American Farmland Trust, Northampton, Mass.
- American Forests. 2004. *Greening New York's Cities: How Trees Can Clean Our Water, Improve Our Air, and Save Our Money*. www.americanforests.org/downloads/rea/NY_Report.pdf
- Arendt, R. 2006. *Greener Prospects*. www.greenerprospects.com (accessed February 2008)
- Behar, S., and M. Cheo. 2004. Hudson Basin River Watch Guidance Document, Revised Draft. The River Network, Montpelier, Vt. www.hudsonbasin.org (accessed December 2007)
- Benfield, K. F., J. Terris, and N. Vorsanger. 2000. *Solving Sprawl: Models of Smart Growth in Communities Across America*. Island Press, Washington, D.C.
- Benson, A. B. 1937. Peter Kalm's *Travels in North America. The English Version of 1770*. Revised from the original Swedish Vol. 1. Wilson–Erickson, Inc, New York.
- Biodiversity Project. 2003. *Getting on Message: Eastern Forest and Biodiversity*. Biodiversity Project, Madison, Wisc. www.biodiversityproject.org (accessed December 2007)
- Bishop, P., J. Glidden, M. Lowrey, and D. Riehlman. 1999. *A Citizen's Guide to Management of White-tailed Deer in Urban and Suburban New York*. New York State Department of Environmental Conservation, Albany, N.Y.
- Bishop, P., J. Glidden, M. Lowery, and D. Riehlman. 2007. *A Citizen's Guide to Management of White-tailed Deer in Urban and Suburban New York* [revised]. New York State Department of Environmental Conservation, Bureau of Wildlife, Deer Team, Albany, N.Y. www.dec.ny.gov (accessed January 2008)
- Burroughs, J. 1908. *Leaf and Tendril*. Houghton, Mifflin. Boston, Mass
- Bucknall, C. P. 1989. *The Real Cost of Development*. Scenic Hudson, Inc., Poughkeepsie, N.Y.
- Calhoun, A. J. K., and P. deMaynadier. 2004. Forestry Habitat Management Guidelines for Vernal Pool Wildlife. MCA Technical Paper No. 6. Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York
- 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, New York.
- Center for Watershed Protection. 2005. *Pond and Wetland Maintenance Guidebook*. Prepared for Tetra Tech, Inc., Fairfax, Va. under EPA Contract 68-C-99-253. Center for Watershed Protection. Ellicott City, Md.
- Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Center for Watershed Protection. Ellicott City, Md.
- Corbett, J., and M. Corbett. 2000. *Designing Sustainable Communities: Learning from Village Homes*. Island Press, Washington, D.C.
- Crawford, J. A., and R. D. Semlitsch. 2007. Estimation of Core Habitat for Stream-Breeding Salamanders and Delineation of Riparian Buffers for the Conservation of Biodiversity. *Conservation Biology* 21(1):152–158.
- Daniels, K. H. 2005. *A Municipal Official's Guide to Forestry in New York State*. New York State Department of Environmental Conservation, Albany, N.Y.
- DeGloria, S., M. Laba, and J. Braden. 2004. *Hudson Valley Land Cover Map Accuracy Assessment (30 meter)*. New York Cooperative Fish and Wildlife Research Unit, Department of Natural Resources, Cornell University, Ithaca, N.Y.
- Dodd, C. K. 2001. *North American Box Turtles: A Natural History*. University of Oklahoma Press, Norman, Okla.
- Driscoll, D. A., and L. N. Childs. [eds.] 2002. *Helderberg Escarpment Planning Guide*. Mohawk Hudson Land Conservancy, Slingerlands, N.Y.
- Dutchess County Department of Planning and Development. 2000. *Greenway Connections: Greenway Compact Program and Guides for Dutchess County Communities*. Dutchess County Department of Planning and Development. Poughkeepsie, N.Y.
- Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero. [eds.] 2002. *Ecological Communities of New York State. Second Edition*. A revised and expanded edition of Carol Reschke's *Ecological Communities of New York State*. New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, N.Y.
- Freegood, J. 2002. *Cost of Community Services Studies: Making the Case for Conservation*. American Farmland Trust, Northampton, Mass.
- Houlahan, J., and C. S. Findlay. 2004. Estimating the 'Critical' Distance at Which Adjacent Land-Use Degrades Wetland Water and Sediment Quality. *Landscape Ecology* 19:677–690.
- Howard, T. G. 2004. Buffering Natural Communities for Persistence. Draft methods document. New York Natural Heritage Program, Albany, N.Y.
- Hudson, W. H. 1919. *The Book of a Naturalist*. George H. Doran Company, N.Y.
- Huffman and Associates. 2000. *Wetlands Status and Trends Analysis of New York State: Mid-1980s to Mid-1990s*. Contract Report to the New York State Department of Environmental Conservation, Albany, N.Y. 19 pp. + figs., tables.
- Hustedde, R. J., Smutko, S., and Kapsa, J. J. Turning Lemons into Lemonade: Public Conflict Resolution. *Southern Rural Development Center Series* 221. Mississippi State, Miss. srdc.msstate.edu/publications/lemons/221.htm (accessed January 2008)
- Johnson, E. A., and D. Smith. [eds.] 2006. *Legacy: Conserving New York State's Biodiversity*. American Museum of Natural History, New York State Biodiversity Research Institute, New York State Department of Environmental Conservation, New York Natural Heritage Program, and The Nature Conservancy, Albany, N.Y.

* Sources that appear in the "Resources" sections of each chapter are not repeated here.

- Jones, A. and P. Vickery. 1997a. *Conserving Grassland Birds: Managing Agricultural Lands Including Hayfields, Crop Fields, and Pastures for Grassland Birds*. Massachusetts Audubon Society, Lincoln, Massachusetts.
- Jones, A. and P. Vickery. 1997b. *Conserving Grassland Birds: Managing Large Grasslands Including Conservation Lands, Airports, and Landfills over 75 acres for Grassland Birds*. Massachusetts Audubon Society, Lincoln, Massachusetts.
- Jones, A. and P. Vickery. 1997c. *Conserving Grassland Birds: Managing Small Grasslands Including Conservation Lands, Corporate Headquarters, Recreation Fields, and Small Landfills for Grassland Birds*. Massachusetts Audubon Society, Lincoln, Massachusetts.
- Katz, P. 1994. *The New Urbanism*. McGraw-Hill, N.Y.
- Kelley, K. [ed.] 2003. Local Environmental Ordinances. *Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse.
- Kendall, B. 1998. *Local Strategies for Wetland and Watercourse Protection: An Educational Guide*. The Dutchess County Environmental Management Council and Cornell Cooperative Extension of Dutchess County. Millbrook, N.Y.
- Kennedy, C., J. Wilkinson, and J. Balch. 2003. Conservation Thresholds for Land Use Planners. *Environmental Law Institute Report*, Washington, D.C. www.elistore.org.
- Kerlinger, P. 1996. *Preliminary Report on the Economic Impact of Mohawk Preserve Visitors on Surrounding Communities*. Report prepared for Mohonk Preserve, New Paltz, N.Y.
- Kiviat, E., and G. Stevens. 2001. *Biodiversity Assessment Manual for the Hudson River Estuary Corridor*. New York State Department of Environmental Conservation. Albany, N.Y. 508 pages. www.hudsonia.org (accessed December 2007)
- Lerner, S., and W. Poole. 1999. *The Economic Benefits of Parks and Open Space: How Land Conservation Helps Communities Grow Smart and Protect the Bottom Line*. The Trust for Public Land. San Francisco, Calif. www.tpl.org (accessed January 2008)
- LoGiudice, K., R. S. Ostfeld, K. A. Schmidt, and F. Keesing. 2003. The Ecology of Infectious Disease: Effects of Host Diversity and Community Composition on Lyme Disease Risk. *Proceedings of the National Academy of Sciences* 100:567–571
- Marchland, M. N., M. M. Quinlan, and C. W. Swarth. 2004. Movement Patterns and Habitat Use of Eastern Box Turtles at the Jug Bay Wetlands Sanctuary, Maryland. Pages 55–61 in Swarth, C. W., W. M. Roosenberg, and E. Kiviat. [eds.] *Conservation and Ecology of Turtles of the Mid Atlantic Region*. Bibliomania, Salt Lake City, Utah.
- Massachusetts Audubon Society. *Grassland Birds*. Massachusetts Audubon Society. Lincoln, Mass. 617 259-9500 www.massaudubon.org/ (accessed January 2008)
- McElfish, J. 2004. *Nature-friendly Ordinances*. Environmental Law Institute, Washington, D.C.
- McKenzie-Mohr, D., and W. Smith. 1999. *Fostering Sustainable Behavior: An Introduction to Community-based Social Marketing*. New Society Publishers, Gabriola Island, British Columbia.
- Metropolitan Conservation Alliance. 2002. Conservation Area Overlay District: A Model Local Law. *Technical Paper Series* No. 3. Wildlife Conservation Society. Bronx, N.Y. 46pp.
- Meyer, J. L., L. A. Kaplan, D. Newbold, D. L. Strayer, C. J. Woltemade, J. B. Zedler, R. Beilfuss, Q. Carpenter, R. Semlitsch, M. C. Watzin, and P. H. Zedler. 2003. *Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands*. 23pp. www.americanrivers.org (accessed December 2007)
- Miller, N. A., and M. W. Klemens. 2004. Croton to Highlands Biodiversity Plan: Balancing Development and Environment in the Hudson River Estuary Catchment. *MCA Technical Paper No. 7*, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, N.Y.
- Miller, N. A., and M. W. Klemens. 2003. *Stormwater Management and Biodiversity: Impacts and Potential Solutions*. Fact Sheet, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, N.Y.
- Miltner, R. J., D. White, and C. Yoder. 2004. The Biotic Integrity of Streams in Urban and Suburbanizing Landscapes. *Landscape and Urban Planning* 69: 87–100.
- Morgiewicz, R. 2004. Fees In Lieu of Parkland: A New Look. *NYCOM Municipal Bulletin* May/June 2004, New York State Conference of Mayors and Municipal Officials.
- National Association of Homebuilders web site (www.nahb.com), Environment page (accessed January 2008)
- Navota, J., and D. Dreher. 2000. *Protecting Nature in Your Community: A Guidebook for Preserving and Enhancing Biodiversity*. Northeastern Illinois Planning Commission (NIPC). www.nipc.org/environment/sustainable/ (accessed December 2007)
- Newton, B., C. Pringle, and R. Bjorkland. 1998. Stream Visual Assessment Protocol. *National Water and Climate Center Technical Note 99-1*. U.S. Department of Agriculture, Natural Resources Conservation Service. Washington, D.C. www.nrcs.usda.gov (accessed December 2007)
- New York State Department of Environmental Conservation. 2006. *New York State Comprehensive Wildlife Conservation Strategy*. New York State Department of Environmental Conservation. Albany, N.Y.
- New York State Department of Environmental Conservation. 2001. *New York State Stormwater Management Design Manual*. New York State Department of Environmental Conservation. Albany, N.Y.
- New York State Department of Environmental Conservation. 2000. *Lower Hudson Waterbody Inventory, Priority Waterbodies List Report*. New York State Department of Environmental Conservation. Albany, N.Y.
- New York State Department of State. 2004. Guide to Planning and Zoning Laws of New York State. *James A. Coon Local Government Technical Series*. New York State Department of State. Albany, N.Y. www.dos.state.ny.us/lgss/ (accessed December 2007)
- Niederriter, H. S., and R. R. Roth. 2004. Ecology of Eastern Box Turtles (*Terrapene carolina carolina*) in an Isolated Forest Fragment in Northern Delaware. Pages 63–71 in *Conservation and Ecology of Turtles of the Mid Atlantic Region*. Swarth, C. W., W. M. Roosenberg, and E. Kiviat. [eds.] Bibliomania, Salt Lake City, Utah.
- Nolon, J. 2002. *Well Grounded: Using Local Land Use Authority to Achieve Smart Growth*. Environmental Law Institute, Washington, D.C.
- Northeast Illinois Planning Commission. 1998. *Pavement Deicing: Minimizing the Environmental Impacts*. 1998. Northeastern Illinois Planning Commission. Chicago, Ill.
- North East State Foresters Association. 2007. *The Economic Importance of Wood Flows from New York's Forests*. North East State Forester's Association. Concord, N.H. Available from: www.nefainfo.org (accessed 21 April 2008)
- Ohm, B. W. 2002. *Planning for Natural Resources: A Guide to Including Natural Resources in Local Comprehensive Planning*. Department of Urban and Regional Planning, University of Wisconsin–Madison Extension and Wisconsin Department of Natural Resources. Madison, Wisc.

- Orange County (N.Y.) Planning Department. 2004. *Orange County Open Space Plan*. Goshen, N.Y. www.co.orange.ny.us (accessed January 2008)
- Ostfeld, R. S., and F. Keesing. 2000. Biodiversity and Disease Risk: the Case of Lyme Disease. *Conservation Biology* 14:722–728.
- Ostfeld, R. S., and K. LoGiudice. 2003. Community Disassembly, Biodiversity Loss, and the Erosion of an Ecosystem Service. *Ecology* 84:1421–1427.
- Pace University Land Use Law Center. 2002. *A Report from the Intermunicipal Land Use Councils in the Hudson River Region*. Hudson River Valley Greenway. Albany, N.Y.
- Pendall, R. 2003. *Sprawl Without Growth: The Upstate Paradox*. 2003. The Brookings Institution Center on Urban and Metropolitan Policy. Available on the Brookings Institution web site: www.brookings.edu/metro/publications/200310_pendall.htm (accessed December 2007)
- Penhollow, M. E., P. G. Jensen, and L. Zucker. 2006. *Wildlife and Conservation Framework: An Approach for Conserving Biodiversity in the Hudson River Estuary Corridor*. New York Cooperative Fish and Wildlife Research Unit and New York State Department of Environmental Conservation, Hudson River Estuary Program, Ithaca, N.Y. www.dec.ny.gov (accessed December 2007)
- Phelps, M. G., and Hoppe, M. C. [eds.] 2002. New York—New Jersey Highlands Regional Study: 2002 Update. U. S. Department of Agriculture, Forest Service. *Publication NA-TP-02-03*. www.na.fs.fed.us/highlands/ (accessed December 2007)
- Postel, S., and B. Richter. 2003. *Rivers For Life: Managing Water for People and Nature*. Island Press, Washington, D.C.
- River Street Planning and Development. 2007. *Town and Village of Coxsackie Comprehensive Plan Cost of Community Services Analysis*. River Street Planning and Development.
- Schueler, T. R., and H. K. Holland. 2000a. The Benefits of Better Site Design in Residential Subdivisions. Article 46 in *The Practice of Watershed Protection*. Center for Watershed Protection. Ellicott City, Md.
- Schueler, T. R., and H. K. Holland. 2000b. The Benefits of Better Site Design in Commercial Development. Article 47 in *The Practice of Watershed Protection*. Center for Watershed Protection, Ellicott City, Md.
- Semlitsch, R. D., and J. R. Bodie. 2003. Biological Criteria for Buffer Zones around Wetlands and Riparian Habitat for Amphibians and Reptiles. *Conservation Biology* 17(5):1219–1228.
- Smith, C. R., S. D. DeGloria, M. E. Richmond, S. K. Gregory, M. Laba, S. D. Smith, J. L. Braden, W. P. Brown, and E. A. Hill. 2001. *An Application of Gap Analysis Procedures to Facilitate Planning For Biodiversity Conservation in the Hudson River Valley, Final Report. Part 1: Gap Analysis of the Hudson River Valley and Part 2: Atlas of Predicted Ranges for terrestrial Vertebrates in the Hudson River Valley*, New York Cooperative Fish and Wildlife Research Unit, Department of Natural Resources, Cornell University, Ithaca, N.Y.
- Smith, S. D., W. A. Brown, C. R. Smith, and M. E. Richmond. 2004. *Habitat Vulnerability Assessment for the Hudson River Valley*. Final report submitted to the Hudson River Foundation, New York, N.Y.
- Sobel, L. 2002. *Greyfields and Greenfields*. Congress for New Urbanism. San Francisco, Calif.
- Spackman, S. C., and J. W. Hughes. 1995. Assessment of Minimum Corridor Width for Biological Conservation: Species Richness and Distribution along Mid-Order Streams in Vermont, U.S.A. *Biological Conservation* 71:325–332.
- Sullivan, J. [undated]. *Atlas of Biodiversity*. Chicago Wilderness. www.chicagowilderness.org (accessed December 2007)
- Sullivan, K., and G. Cox. 2004. *Wildlife and Forestry in New York's Northern Hardwoods: A Guide for Forest Owners and Managers*. Audubon New York, Albany, N.Y. ny.audubon.org (accessed December 2007)
- Tompkins County Environmental Management Council. 2000. *Unique Natural Area Inventory of Tompkins County, Revised Edition*. Tompkins County Environmental Management Council, Tompkins County Department of Planning, Ithaca, N.Y.
- U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce. 2003. *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*. U.S. Census Bureau, New York.
- Van Tine, J. [ed.] 2003. *Local Environmental Strategies. Starting Ground Series*. Pace University Land Use Law Center. White Plains, N.Y. www.law.pace.edu/landuse (accessed December 2007)
- Waterhouse, F. L., and A. S. Harestad. 1999. The Value of Riparian Forest Buffers as Habitat for Birds in the Coastal Western Hemlock Zone, British Columbia: A Pilot Study. *Forest Research Technical Report TR-001*. Vancouver Forest Region, Nanaimo, B.C.
- Young, S. P. [ed.] 2007. *New York Rare Plant Status Lists*. New York Natural Heritage Program, Albany N.Y.

Glossary

aquifer an underground layer of permeable rock or soil that holds water. Usually used in reference to drinking water supplies.

area-sensitive species animals that require large areas of suitable habitat to meet their life history needs and support viable populations.

base flow portion of the stream flow that is not generated from overland run-off. Base flows result from seepage of water from the ground into a channel slowly over time and are the primary source of running water in a stream during dry weather.

biodiversity the variety of living organisms, including the ecosystems and natural processes on which they depend; a natural system of all species, their habitats, and the landscape.

biota the total of the flora and fauna of a habitat or region.

bog acidic wetland characterized by spongy peat and sphagnum moss. Most of water in a bog comes from precipitation. Low in nutrients needed for plant growth, therefore a unique set of plants and animals use the habitat (*see also* **fen, marsh, swamp, tidal wetland, vernal pool, wetland**).

brackish a mix of saltwater and freshwater.

buffer or **buffer zone** any area that serves to protect natural areas from human alteration. Often used in reference to streams and wetlands.

conservation planned action or non-action to protect, manage, restore, or enhance natural resources for future generations.

conservation subdivisions subdivision characterized by common open space and clustered compact lots. The purpose of a conservation subdivision is to protect natural resources while allowing for the maximum number of residences under current community zoning and subdivision regulations. In some cases a greater density (incentive bonus) may be offered in the local ordinance to encourage this approach.

conservation target ecosystems, natural communities and species identified as priorities for protection.

corridor a patch of habitat that connects otherwise isolated larger habitat patches and differs from the adjacent land on both sides.

critical habitat components of the landscape that provides essentials for the survival of a population.

daylighting removing streams from underground pipes and culverts; restoring some of the form and function of historic streams.

disturbance natural or anthropogenic event that changes a local environment by disrupting, removing, or adding organisms, soil, or rock, or by subjecting the environment to other disruptions such as pollution by substances, noise, or light.

dredged spoil the sediment removed (dredged) from the bottom of a river. In the Hudson this was done to maintain shipping channels. Dredged spoil was deposited in the river; as a result there are numerous dredge spoil islands in the upper Hudson.

early successional habitat refers in this handbook to non-forested terrestrial habitats, such as grasslands, barrens and shrublands that will turn to forest over time. (*see also* **succession**).

ecosystem a dynamic and interrelating complex of plant and animal communities and their associated non-living environment (soil, water, and air) and the natural cycles that sustain them (nutrient and hydrological).

ecosystem functions the biophysical processes that take place within an ecosystem e.g., nutrient cycling in a forest, sediment transport in a stream

ecosystem services refers to the ecosystem functions from which humans derive benefit. Includes goods (e.g., food and medicine) and services (climate regulation, water purification, flood control).

endemic exclusively native to a particular place.

estuary an arm of the sea subject to tides and the press of salty ocean water. The tidal reach of a river where the freshwater of the river meets the saline water of the ocean.

extinct species is no longer living or existing.

extirpated locally extinct. For example, a species that is extirpated from Westchester County, used to occur there, but is no longer found there.

federally endangered a species listed by the U.S. Fish & Wildlife Service as being in danger of extinction in the near future throughout all or part of its range.

federally threatened a species listed by the U.S. Fish & Wildlife Service that may become endangered in the near future throughout all or part of its range.

fen peat-forming wetlands, receive nutrients through drainage from upslope mineral soils and groundwater movement, less acidic than bogs and more nutrients, groundwater fed supports a more diverse plant community, and unique animal species. (*see also* **bog, marsh, swamp, tidal wetland, vernal pool, wetland**).

floodplain an area of low-lying ground adjacent to a waterbody that is submerged during flooding.

fragmentation the process where large, contiguous landscapes are broken into smaller, more isolated fragments surrounded by human-modified environments.

geomorphology the description and interpretation of land forms.

GIS (Geographic Information System) a computer system that allows for input and manipulation of geographic data to allow researchers to manipulate, analyze, and display information in a map.

gradient slope or inclination of land surface. Also, a pattern of change in any environmental factor, such as moisture or disturbance.

habitat the area where a plant or animal lives that provides all the necessary elements it needs to survive (e.g., food source, cover, mating grounds).

habitat patch a relatively homogeneous type of habitat that is spatially separated from other similar habitat and differs from its surrounding.

habitat sink area that contains suitable habitat for survival of a species, but does not support successful reproduction. In contrast to habitat source, which contains suitable habitat and supports successful reproduction.

Hudson River Estuary the tidal portion of the Hudson River from the Federal Dam at Troy to the Verrazano Narrows Bridge.

Hudson River Estuary watershed the land and water that feed the Hudson River estuary.

hydrology the study of water's properties, distribution, and circulation on Earth. For the purposes of this book, we are primarily concerned with the flow of water on and through the land.

hydroperiod duration of flooding or standing water.

impervious surface surfaces that are impermeable to water, such as roofs and pavement that prevent the infiltration of water on the landscape.

intermittent stream a stream that may only flow during times of excess precipitation or snow melt (*see also* **perennial stream**).

intermittent woodland pool (*see* **vernal pool**)

intertidal area of tidal influence where substrate is exposed and flooded by changing tides (*see also* **subtidal**).

invasive species a species (usually, but not always, non-native) that is able to exploit the landscape, into which it was introduced, out-competing other species due to lack of natural predators and competitors (*see also* **native, non-native**).

landscape a large, diverse land area consisting of a cluster of interacting ecosystems repeated in a similar form.

land use the purpose to which land is used by humans (e.g. protected areas, agriculture, residential, commercial, industrial settlement). (vs. Land cover which is the dominant feature of the land (e.g., forest, meadow, pavement, etc.)

marsh a type of wetland that is frequently or continually inundated with water and is characterized by soft-stemmed emergent herbaceous vegetation. Water from surface water and groundwater; plentiful nutrients and neutral pH; (*see also* **bog, fen, swamp, tidal wetland, vernal pool, wetland**).

mouth or tributary mouth the confluence of a stream or river with a larger body of water.

native plant a plant that has grown in the region since the last glaciation and occurred before European settlement (*see also* **non-native**).

natural community a group of plants and animals living and interacting with one another that share a common environment.

non-native an animal or plant species that has been introduced to an area that is not a part of its range (*see also* **native**).

non-point source pollution diffuse source of pollutants not discharged from a pipe; associated with land use such as agriculture, contaminated groundwater, or onsite septic systems.

nutrients various elements required by plants for growth, such as phosphorus and nitrogen. The limited quantity of these elements in the environment controls plants grown; in excess, nutrients can be harmful.

New York State Endangered any native animal listed by the New York State Department of Environmental Conservation as being in imminent danger of extinction or extirpation from New York State.

New York State Endangered Plant any native plant on the rare plant protected list that has one or more of the following characteristics: (a) currently found in 5 or fewer sites statewide, (b) has fewer than 1,000 individuals statewide, (c) present on fewer than 4 USGS topographic maps, or (d) listed as federally endangered.

New York State Exploitably Vulnerable Plant any native plant on the rare plant protected list that is likely to become rare in the near future throughout all or a significant portion of their range within the state if causal factors continue unchecked. The exploitably vulnerable category also contains plants that are likely to be picked for commercial and personal purposes.

New York State Rare Plant any native plant on the rare plant protected list that has one or more of the following characteristics: (a) 20 to 35 extant sites, or (b) has 3,000 to 5,000 individuals statewide.

New York State Species of Special Concern any native animal listed by the New York State Department of Environmental Conservation as likely to become a threatened species within the foreseeable future in New York State.

New York State Threatened any native animal listed by the New York State Department of Environmental Conservation as being likely to become an endangered species within the foreseeable future in New York State.

New York State Threatened Plant any native plant on the rare plant protected list that has one or more of the following characteristics: (a) currently found in 6–19 sites statewide, (b) has 1,000–3,000 individuals statewide, (c) present on 4–7 USGS topographic maps, or (d) listed as federally threatened.

open space lands that are not fully developed. Open space can mean natural areas, farmland, scenic areas, and even golf courses and cemeteries. It is important to define open space when using that phrase.

perennial stream a stream that flows year round (*see also* **intermittent stream**).

permeable allowing fluids such as water to pass through.

point source pollution pollutants discharged through a pipe, often to a body of water. An example is municipal sewer systems.

pool area with deep with slow moving water; results in sediment deposition; good habitat for trout and mollusks (*see also* **run** and **riffle**).

rain garden a landscaped depression in the ground that is designed to store and treat stormwater.

recharge area an area where water percolates into the soil, replenishing groundwater.

regulated wetland wetlands that are subject to state or federal wetlands laws. In New York State, a wetland may be subject to the New York State Freshwater Wetlands Act, the New York State Tidal Wetlands act and the Clean Water Act.

restoration the practice of restoring degraded or altered lands to a state of higher natural functioning or other desired condition.

riffle shallow area of streams with fast, turbulent water running over rocks; habitat for aquatic invertebrates (*see also* **run** and **pool**).

riparian areas the aquatic ecosystem and the portions of the adjacent terrestrial ecosystem that directly affect or are affected by the aquatic environment. This includes streams, rivers, lakes, and bays and their adjacent side channels, flood plain, and wetlands.

rip-rap hard material placed along a shoreline to prevent erosion and stabilize shorelines, usually rock.

run deep with fast water and little or no turbulence; the main body of water that runs smoothly downstream; good area for small fishes that can't compete for pool areas (*see also* **riffle** and **pool**).

seasonal woodland pool (*see* **vernal pool**)

sheet pile Interlocking steel plates that create a rigid barrier for earth and water, while resisting the lateral pressures of those bending forces. In this book, we are specifically talking about sheet pile along streams and rivers to control erosion.

sprawl, urban sprawl a pattern of land use generally characterized by spread out development, large lot size; generally characterized by automobile dependency.

species of greatest conservation need species that states deem rare, imperiled, or whose status has not been established. The list was developed as part of a Comprehensive Wildlife Conservation Strategy required to access federal funding for those species. In New York State, the list and strategy were completed by the New York State Department of Environmental Conservation www.dec.ny.gov.

subtidal area of tidal influence where substrate is continuously submerged (*see also* **intertidal**).

succession the natural, sequential change in the composition of a plant community over time. In New York, the natural tendency of plant communities is to turn into forest.

supratidal on the Hudson river, the zone along a tidal shoreline within 1 m elevation above the mean high water level; this zone receives tidal flooding from the highest tides (spring tides and storm tides).

swamp a wetland dominated by woody plants (trees and shrubs), saturated soils during growing season and standing water during various times of the year; provide flood protection and nutrient removal; high in productivity and species diversity because of high nutrient content; fed by surfaced water (*see also* **bog, fen, marsh, tidal wetland, vernal pool, wetland**).

tidal wetland a near shore wetland near the ocean or an estuary where the water level is affected by tides (*see also* **bog, fen, marsh, swamp, vernal pool, wetland**).

tributary a stream or river that feeds into a larger stream, river, or lake. The former would be considered a tributary of the latter.

vegetated shallows shallow portion of a body of water (stream, wetland, pond, lake, or river), that has vegetation. In the Hudson River Estuary, vegetated shallow areas include submerged aquatic vegetation, as well as areas with water chestnut.

vernal pool (seasonal woodland pool, intermittent pool) seasonal wetlands in small depressions covered by shallow water for variable periods from winter through spring; may be completely dry for most of summer and fall; important for amphibians, especially mole salamanders and wood frogs (*see also* **bog, fen, marsh, swamp, tidal wetland, wetland**).

wetland transitional lands between terrestrial and aquatic systems where the water table is at or near the surface or the land is periodically saturated or covered by water; characterized by plants present, soils and frequency of flooding (*see also* **bog, fen, marsh, swamp, tidal wetland, vernal pool**).

watershed the land area that drains water, sediment and dissolved materials downslope to the lowest point such as a marsh, stream, river, lake or groundwater site.

Additional Habitat Information

In Chapter 3, the broad habitat types were described. More information on these habitats is available from Penhollow et al. 2006, Kiviat and Stevens 2001, Edinger et al. 2002, and www.guides.nynhp.org.

For Descriptions of Coastal Habitat Types

Ecological Community fact sheets from the New York Natural Heritage Program: Brackish intertidal mudflats, Brackish intertidal shore, Brackish subtidal aquatic bed, Brackish tidal marsh, Freshwater intertidal mudflats, Freshwater intertidal shore, Freshwater subtidal aquatic bed, Freshwater tidal marsh, Freshwater tidal swamp, Tidal river

Ecologically Significant Habitats from the Biodiversity Assessment Manual for the Hudson River Estuary Corridor: Clay bluff and ravine, Estuarine rocky shore, Fresh and brackish intertidal and supratidal marsh, Fresh and brackish subtidal shallows, Hudson River dredge spoil habitats, Hudson River rocky island, Intertidal and supratidal swamp, Supratidal pool, Supratidal railroad and road causeway, Tidal tributary mouth

For Descriptions of Wetland Habitat Types:

Ecological Community fact sheets from the New York Natural Heritage Program: Black spruce–tamarack bog, Deep emergent marsh, Dwarf shrub bog, Hemlock–hardwood swamp, Inland Atlantic white cedar swamp, Inland poor fen, Medium fen, Oligotrophic dimictic lake, Perched bog, Perched white oak swamp, Pine barrens vernal pond, Pitch pine–blueberry peat swamp, Red maple–black gum swamp, Red maple–hardwood swamp, Red maple–sweetgum swamp, Red maple–tamarack swamp, Rich graminoid fen, Rich shrub fen, Rich sloping fen, Shallow emergent swamp, Silver maple–ash swamp, Spruce–fir swamp, Vernal pool

Ecologically Significant Habitats from the Biodiversity Assessment Manual for the Hudson River Estuary Corridor: Acidic bog, Beaver pond, Circumneutral bog lake, Constructed ponds and lakes, Fen and calcareous wet meadow, Intermittent woodland pool, Kettle shrub pool, Noncalcareous wet meadow, Nontidal hardwood swamp, Nontidal marsh, Springs and seeps, Wet clay meadow

For Descriptions of Stream Habitat Types:

Ecological Community fact sheets from the New York Natural Heritage Program: Floodplain forest, Midreach stream, Riverside ice meadow, Rocky headwater stream

Ecologically Significant Habitats from the Biodiversity Assessment Manual for the Hudson River Estuary Corridor: Cool ravine, Intermittent stream, Perennial stream, Riparian corridor

For Descriptions of Forest and Woodland Habitat Types:

Ecological Community fact sheets from the New York Natural Heritage Program: Acidic talus slope woodland, Appalachian oak–hickory forest, Appalachian oak–pine forest, Beech–maple mesic forest, Calcareous talus slope woodland, Chestnut oak forest, Coastal oak–beech forest, Hemlock–northern hardwood forest, Limestone woodland, Maple–basswood rich mesic forest, Mountain fir forest, Mountain spruce–fir forest, Oak–tulip tree forest, Pitch pine–oak forest, Pitch pine–oak–heath woodland, Shale talus slope woodland, Spruce–northern hardwood forest

Ecologically Significant Habitats from the Biodiversity Assessment Manual for the Hudson River Estuary Corridor: Carbonate crest, ledge, and talus; Conifer plantation; Mature mesophytic lowland forest; Non-carbonate crest, ledge, and talus; Rich rocky woodland; Young woods

For Descriptions of Open Upland Habitat Types:

Ecological Community fact sheets from the New York Natural Heritage Program: Dwarf pine ridge, Highbush blueberry bog thicket, Pitch pine–oak–heath rocky summit, Pitch pine–scrub oak barrens, Post oak–blackjack oak barrens (New York City only), Red cedar rocky summit, Rocky summit grassland, Sedge meadow, Serpentine barrens (New York City only)

Ecologically Significant Habitats from the Biodiversity Assessment Manual for the Hudson River Estuary Corridor: Sand plains and barrens, Shrubby oldfield, Upland meadow, Waste ground

Contacts for Organizations and Agencies Listed in This Handbook

Federal Agencies

U.S. Army Corps of Engineers

www.usace.army.mil
New York District
26 Federal Plaza
New York, NY 10278
Phone: 212 264-0100

U.S. Department of Agriculture Natural Resources Conservation Service

www.nrcs.usda.gov
Columbia, Greene, Ulster, Dutchess, Putnam,
Westchester, Rockland and New York City
Counties
Time Square Professional Park
652 Route 299, Suite 202
Highland, NY 12528-2926
Phone: 845 883-7162

Albany and Rensselaer Counties
Leo W. O'Brien Federal Building, Room 333
Albany, NY 12207-2350
Phone: 518 431-4110

U.S. Department of the Interior, U.S. Fish and Wildlife Service

www.fws.gov
Northeast Regional Office 5
300 Westgate Center Drive
Hadley, MA 01035-9589
Phone: 413 253-8200

New York Field Office, New York Ecological
Services, Partners for Fish and Wildlife
nyfo.fws.gov
3817 Luker Road
Cortland, NY 13045
Phone: 607 753-9334

U.S. Department of the Interior, U.S. Geological Survey

www.usgs.gov
Albany District Office
Leo W. O'Brien Federal Building
Albany, NY 12207
Phone: 518 431-4341

New York District Office
425 Jordan Road
Troy, NY 12180-8349
Phone: 518 285-5600

U.S. Environmental Protection Agency

www.epa.gov
Region 2
290 Broadway
New York, NY 10007-1866
Phone: 212 637-3000

New York State Agencies and Programs

New York State Department of Environmental Conservation

www.dec.ny.gov
625 Broadway
Albany, NY 12233

Division of Fish, Wildlife, and Marine
Resources
Phone: 518 402-8924

Division of Lands and Forests
Phone: 518 402-9405

Region 2
1 Hunter Point Plaza
47-40 21st Street
Long Island City, NY 11101-5407
Phone: 718 482-4900

Region 3
21 South Putt Corners Road
New Paltz, NY 12404
Phone: 845 256-3000

Hudson River Estuary Program (Region 3)
Phone: 845 256-3016

Region 4
1130 North Westcott Road
Schenectady, NY 12306
Phone: 518 357-2234

New York State Department of State

www.dos.state.ny.us
41 State Street
Albany, NY 12231-0001

Division of Coastal Resources
www.dos.state.ny.us/about/coastal.htm
Phone: 518 474-6000

Division of Local Government
www.dos.state.ny.us/lgss/index.htm
Phone: 518 473-3355

New York State Office of Parks, Recreation, and Historic Preservation

www.nysparks.state.ny.us
Empire State Plaza, Agency Building 1
Albany, NY 12238
Phone: 518 474-0456

New York City Park Region
679 Riverside Drive
New York, NY 10031
Phone: 212 694-3608

Palisades Interstate Park Commission
Administrative Building
Bear Mountain, NY 10911-0427
Phone: 845 786-2701

Saratoga/Capital District Park Region
19 Roosevelt Drive
Saratoga Springs, NY 12866-2000
Phone: 518 584-2000

Taconic Park Region
P. O. Box 308
Staatsburg, NY 12580
Phone: 914 889-4100

Hudson River Valley Greenway

www.hudsongreenway.state.ny.us
Capitol Building, Capital Station, Room 254
Albany, NY 12224
Phone: 518 473-3835

New York Natural Heritage Program

www.nynhp.org
625 Broadway
Albany, NY 12233-4757
Phone: 518 402-8935

New York State Biodiversity Research Institute

www.nysm.nysed.gov/bri
New York State Museum
Cultural Education Center
Room 3140
Albany, NY 12230
Phone: 518 486-4845

New York State Soil and Water Conservation Committee

www.nys-soilandwater.org
10B Airline Drive
Albany, NY 12235
Phone: 518 457-7076

Regional Nonprofit Organizations

American Farmland Trust, Northeast Regional Office

www.farmland.org
6 Franklin Square, Suite E
Saratoga Springs, NY 12866
Phone: 518 581-0078

Catskill Center for Conservation and Development

www.catskillcenter.org
P. O. Box 504
Arkville, NY 12406
Phone: 845 586-2611

Hudson Basin River Watch

www.hudsonbasin.org
350 Route 29
East Greenwich, NY 12865
Phone: 518 677-5029

Hudson River Foundation

www.hudsonriver.org
17 Battery Place, Suite 915
New York, NY 10004
Phone: 212 483-7667

Hudsonia, Ltd.

www.hudsonia.org
Bard College
Box 5000
Annandale, NY 12504
Phone: 845 758-7053

Cary Institute of Ecosystem Studies

www.ecostudies.org
Gifford House Visitor and Education Center
181 Sharon Turnpike
Millbrook, NY
Phone: 845 677-5359

Metropolitan Conservation Alliance*
www.metropolitanconservationalliance.org

National Audubon Society, New York State Office

ny.audubon.org
200 Trillium Lane
Albany, NY 12203
Phone: 518 869-9731

The Nature Conservancy

New York State Office
www.nature.org
195 New Karner Rd, Suite 200
Albany, NY 12205
Phone: 518 690-7850

Eastern New York Chapter
265 Chestnut Ridge Road
Mount Kisco, NY 10549
Phone: 914 244-3271

Eastern New York Conservation Office
195 New Karner Road, Suite 201
Albany, NY 12205
Phone: 518 690-7878

Open Space Institute

www.osiny.org
1350 Broadway
Suite 201
New York, NY 10018-7799
Phone: 212 629-3981

Pace Land Use Law Center

www.pace.edu/lawschool/landuse
Pace University School of Law
78 North Broadway
White Plains, NY 10603
Phone: 914 422-4262

Scenic Hudson

www.scenichudson.org
One Civic Center Plaza
Poughkeepsie, NY 12601
Phone: 845 473-4440

Resources by County

Note: Only the county land trusts are listed for the counties that have them. All local land trusts are listed for Ulster County, and Rockland County has none. If you want to find additional land trusts in your area, visit the Land Trust Alliance web site at www.lta.org.

Albany County

www.albanycounty.com

Cornell Cooperative Extension
William Rice, Jr. Extension Center
24 Martin Road
P. O. Box 497
Voorheesville, NY 12186-0497
Phone: 518 765-3500

Economic Development, Conservation, and Planning
112 State Street, Room 720
Albany, NY 12207
Phone: 518 447-5660

Soil and Water Conservation District
Box 497, Martin Road
Voorheesville, NY 12186
Phone: 518 765-7923

Mohawk Hudson Land Conservancy
www.mohawkhudson.org
P. O. Box 567
Slingerlands, NY 12159
Phone: 518 436-6346

Columbia County

www.columbiacountyny.com

Cornell Cooperative Extension
Education Center
479 Route 66
Hudson, NY 12534-9706
Phone: 518 828-3346

Columbia County Planning Department
401 State Street
Hudson, NY 12534
Phone: 518 828-3375

Soil and Water Conservation District
www.ccsxcd.org
1024 Route 66
Ghent, NY 12075

Phone: 518 828-4386 (4385) ext.3

Columbia Land Conservancy
www.clctrust.org
P. O. Box 299
Chatham, NY 12037-0299
Phone: 518 392-5252

Dutchess County

www.dutchessny.gov

Cornell Cooperative Extension
2715 Route 44, Suite 1
Millbrook, NY 12545
Phone: 845 677-8223

Department of Planning and Development
27 High Street
Poughkeepsie, NY 12601
Phone: 845 486-3600

Soil and Water Conservation District
2715 Route 44 #3
Millbrook, NY 12545
Phone: 845 677-8011 (8199) ext.3

Dutchess Land Conservancy
www.dutchessland.org
2908 Route 44
Millbrook, NY 12545-5505
Phone: 845 677-3002

Greene County

www.greene-ny.com

Cornell Cooperative Extension
Greene County Office Building
906 Mountain Avenue
Cairo, NY 12413-9503
Phone: 518 622-9820

Department of Planning and Economic Development
Greene County Office Building
411 Main Street
Catskill, NY 12414
Phone: 518 719-3290

Soil and Water Conservation District
www.gcsxcd.com
907 County Office Bldg.
Cairo, NY 12413
Phone: 518 622-3620

New Baltimore Conservancy
www.newbaltimoreconservancy.org
P. O. Box 322
New Baltimore, NY 12124-0322
Phone: 518 436-2955

Greene Land Trust
www.greenelandtrust.org
c/o Greene County Soil and Water Conservation District
907 County Office Building
Cairo, NY 12413
Phone: 518 622-3620

Orange County

www.co.orange.ny.us

Cornell Cooperative Extension
Community Campus
1 Ashley Avenue
Middletown, NY 10940
Phone: 845 344-1234

Department of Planning
124 Main Street
Goshen, NY 10924-2124
Phone: 845 291-2318

Soil and Water Conservation District
225 Dolson Avenue, Suite 103
Middletown, NY 10940
Phone: 845 343-1873

Orange County Land Trust
www.orangecountylandtrust.org
P. O. Box 2442
Middletown, NY 10940-7917
Phone: 845 343-0840

Putnam County

www.putnamcountyny.com

Cornell Cooperative Extension
Terravest Corporate Park
1 Geneva Road
Brewster, NY 10509
Phone: 845 278-6738

Division of Planning and Development
841 Fair Street
Carmel, NY 10512
Phone: 845 878-3480

Soil and Water Conservation District
841 Fair Street
Carmel, NY 10512
Phone: 845 878-7918

Hudson Highlands Land Trust
www.hhlt.org
P. O. Box 226
Garrison, NY 10524-0226
Phone: 845 424-3358

Putnam County Land Trust
www.pclt.net
9 Fair Street
Carmel, NY 10512-1301
Phone: 845 225-0334

Rensselaer County

www.rensco.com

Cornell Cooperative Extension
Agriculture and Life Sciences Building
61 State Street
Troy, NY 12180-3497
Phone: 518 272-4210

Department of Economic Development and Planning
1600 Seventh Avenue
Troy, NY 12180
Phone: 518 270-2914

* Note that the Metropolitan Conservation Alliance is no longer a program of the Wildlife Conservation Society.

Soil and Water Conservation District
County Agriculture and Life Sciences Building
61 State Street
Troy, NY 12180-3496
Phone: 518 271-1740 (1764)

Rensselaer–Taconic Land Conservancy
www.rtlc.org
P. O. Box 40
Troy, NY 12182-0040
Phone: 518 454-2032

Rockland County
www.co.rockland.ny.us

Cornell Cooperative Extension
10 Patriot Hills Drive
Stony Point, NY 10980
Phone: 845 429-7085

Department of Planning
Robert Yeager Health Center
50 Sanatorium Road, Building T
Pomona, NY 10970
Phone: 845 364-3434

Soil and Water Conservation District
50 Sanatorium Road, Building P
Pomona, NY 10970
Phone: 845 364-2667

Ulster County
www.co.ulster.ny.us

Cornell Cooperative Extension
10 Westbrook Lane
Kingston, NY 12401-2928
Phone: 845 340-3990

Planning Department
County Office Building 244 Fair Street
P. O. Box 1800
Kingston, NY 12402-1800
Phone: 845 340-3340

Soil and Water Conservation District
Times Square Office Park
652 Route 299, Suite 103
Highland, NY 12528
Phone: 845 883-7162 ext.202

Cragsmoor Conservancy
P. O. Box 197
Cragsmoor, NY 12420-0197

Esopus Creek Conservancy
www.esopuscreekconservancy.org
P. O. Box 589
37 Oakledge Park
Saugerties, NY 12477-0589

Mohonk Preserve
www.mohonkpreserve.org
P. O. Box 715
New Paltz, NY 12561-0715
Phone: 845 255-0919

Rondout–Esopus Land Conservancy
www.relandconservancy.org
P. O. Box 345
High Falls, NY 12440-0345
Phone: 845 687-7553

Shawangunk Conservancy
P. O. Box 270
Accord, NY 12404-0270
Phone: 845 687-4759

Wallkill Valley Land Trust
www.wallkillvalleylt.org
P. O. Box 208
New Paltz, NY 12561-0208
Phone: 845 255-7547

Woodstock Land Conservancy
www.woodstocklandconservancy.org
P. O. Box 864
Woodstock, NY 12498-0864
Phone: 845 586-2232

Westchester County
www.westchestergov.com

Cornell Cooperative Extension
26 Legion Drive
Valhalla, NY 10595
Phone: 914 285-4640

Department of Planning
432 Michaelian Office Building
148 Martine Avenue
White Plains, NY 10601
Phone: 914 285-4402 or 285-4404

Soil and Water Conservation District
432 Michaelian Office Building
148 Martine Ave.
White Plains, NY 10601
Phone: 914 995-4422

Westchester Land Trust
www.westchesterlandtrust.org
11 Babbit Road
Bedford Hills, NY 10507-1813
Phone: 914 241-6346

New York City
www.nyc.gov

Cornell Cooperative extension
nyc.cce.cornell.edu
16 East 34th Street, 8th Floor
New York, NY 10016
Phone: 212 340-2900

Department of City Planning
22 Reade Street
New York, NY 10007-1216
Phone: 212 720-3300

New York City Watershed, New York City
Department of Environmental Protection
www.nyc.gov/watershed

Soil and Water Conservation District
www.nycscwcd.net
290 Broadway, 24th floor
New York, NY 10007
Phone: 212 637-3877

National Nonprofit Organizations

Biodiversity Project
www.biodiversityproject.org
214 North Henry Street, Suite 201
Madison, WI 53703
Phone: 608 250-9876

Center for Biodiversity and Conservation
research.amnh.org/biodiversity
American Museum of Natural History
Central Park West at 79th Street
New York, NY 10024
Phone: 212 769-5742

The Center for Watershed Protection
www.cwp.org
8390 Main Street, 2nd Floor
Ellicott City, MD 21043
Phone: 410 461-8323

Trust for Public Land
www.tpl.org
Mid-Atlantic Regional Office
666 Broadway, 9th Floor
New York, NY 10004
Phone: 212 677-7171

Natural Landscaping Resources

Brooklyn Botanic Garden
www.bbg.org
1000 Washington Avenue
Brooklyn, NY 11225
Phone: 718 623-7200

Catskill Native Nursery
607 Samsonville Road
Kerhonkson, NY 12446
Phone: 845 626-2758

The Native Plant Center
www.nativeplantcenter.org
Westchester Community College
75 Grasslands Road
Valhalla, NY 10595
Phone: 914 606-7870

New England Wildflower Society
www.newfs.org/garden.htm
Garden in the Woods
180 Hemmingway Road
Framingham, MA 01701
Phone: 508 877-7630

Saratoga Tree Nursery (NYSDEC)
www.dec.ny.gov
2369 Route 50
Saratoga Springs, NY 12866
Phone: 518 581-1439

Staten Island Greenbelt
www.sigreenbelt.org
Native Plant Center
3808 Victory Boulevard
Staten Island, NY 10314
Phone: 718 370-9044

WILD Ones—Central New York Chapter
www.hcgny.com
Habitat Gardening Club of CNY
Phone: 315 487-5742

Index

Towns are indexed under county names.

A

acquisition, 19, 29, 67. *See* open space planning and conservation

Adirondack Park, 2

adjacent upland stream and wetland buffers, 29, 30

aesthetic benefits of conservation, 1, 2, 65
natural landscaping, 76, 77
scenery, 16
zoning and, 55

agricultural areas

farmland protection program, 68
fragmentation in, 17
inventorying, 19
See also farms

Ailanthus altissima (tree of heaven), 76

airports, 35

air quality, protecting, 2

role of forests, 15, 18
role of natural areas in urban habitats, 18

Albany County

Farnsworth Middle School, 42
Glacial Lake Albany Native Plant Restoration Project, 78
Helderberg Escarpment Planning Guide, 24
map of watershed, inside front cover
Office of Natural Resources, 69
Restoring Connections with Natural Landscaping, 35–36

Albany Law School, 10

Albany Pine Bush Preserve, 16, 17–18, 35–36, 71

Albany Pine Bush Preserve Commission, 36, 42, 78

Allan, B. F., 4

Alliaria petiolata (garlic mustard), 78

Amblystoma jeffersonianum (Jefferson salamander), 13

Amblystoma maculatum (spotted salamander), 13

Amblystoma opacum (marbled salamander), 13

American cranberry (*Viburnum trilobum*), 77

American Farmland Trust, 3

American Forests, 18

American Museum of Natural History, 43

American Planning Association, 10

American Rivers, 61

American woodcock (*Scolopax minor*), 13

amphibians

areas of, 22
Atlas, New York State
loss of, from stormwater, 61, 63
migration of, 25, 64
riparian habitat for, 30
See also salamanders

aquatic systems. *See* coastal habitats; groundwater; lakes; streams; wetlands

aquifers, 13

drinking water, 19
See also groundwater

Ardea alba (great egret), 12

Ardea herodias (great blue heron), 13

Army Corps of Engineers, 27, 31

Asclepias incarnata (swamp milkweed), 77

Asclepias tuberosa (butterfly weed), 77

Asio flammeus (short-eared owl), 16, 17

Asio otus (long-eared owl), 16

assessments

biological site, 58
habitat, 56
use, 55

Atlas of Biodiversity (Sullivan), 43

Audubon New York, 22

awareness, raising. *See* education, public; public participation

B

Baba Dioum, 39

bald eagles, 12

barred owl (*Strix varia*), 16

barrens

about, 16–17
maps of rare, 20
See also open uplands

bats, 14

Bear Mountain League of Naturalists, 21

Behar, S., 31

Benfield, K. F., 10

Benson, A. B., 1

Berberis thunbergii (Japanese barberry), 76, 77

Better Site Design, 62

projects, 65

BioBlitz, 43

biodiversity, 12

assessments, 19
defined, 1
fragmentation and, 4
and Lyme disease, 4
planning tools, 55

biodiversity assessment

habitat-identification process, 22

Biodiversity, Conservation, and Policy Program, 9

The Biodiversity Project, 16, 43

biodiversity review standards, 60

biological diversity. *See* biodiversity

biological site assessments, 58, 60

bioretention areas, 62, 64

birds

atlas, New York State, 21, 22

birding areas, local, 22

breeding sites for, 14

buffer width for streamside habitats, 30

forest habitat requirements, 33

grassland bird habitats, 34

nesting habitat, 12

Bishop, P. J., 33

black cohosh (*Cimicifuga racemosa*), 77

black-crowned night heron (*Nycticorax nycticorax*), 12

black-legged ticks, 4

blue crab (*Callinectes sapidus*), 12

blue flag iris (*Iris versicolor*), 77

bobcat (*Lynx rufus*), 16

bobolink (*Dolichonyx oryzivorus*), 17, 34

Bodie, J. R., 30

bogs, 12. *See also* wetlands

bridges, 32

brook trout (*Salvelinus fontinalis*), 14, 15

brownfields, 53

Bucknall, C. P., 3

buffers, 55

aquatic, 29

for parks, 36

natural landscaping as, 75, 76

to protect coastal habitats, 26

to protect riparian habitats, 29

to protect streams and wetlands, 27, 28, 29–30, 32, 56

regulations, 57

for stormwater management, 62

widths of, 30

See also setbacks

building lots

clearing, 62

sizes of, 56, 57

burning bush (*Euonymus alata*), 77

burns, controlled, 35

Burroughs, J., 3

Butomus umbellatus (flowering rush), 78

Buttercup Farm Sanctuary, 43

butterflies

rare, 16, 17

in Van Cortlandt Park, 17

See also Karner blue butterfly

butterfly weed (*Asclepias tuberosa*), 77

C

CAC. *See* conservation advisory councils

Calhoun, A. J. K., 30, 61, 63, 64

Callinectes sapidus (blue crab), 12

“Cape Cod” curbing, 25, 63

catch basins, 61

Cary Institute of Ecosystem Studies, 4

Catskills, 50

Center for Biodiversity and Conservation
(American Museum of Natural History), 43

Center for Watershed Protection, 65

stormwater pond and wetland design information, 64

cerulean warbler (*Dendroica cerulea*), 15

Cheo, M., 31

Childs, L. N., 24

Cimicifuga racemosa (black cohosh), 77

Circus cyaneus (northern harrier), 16, 17, 34, 35

citizen involvement. *See* education, public; public participation

Clemmys guttata (spotted turtle), 13

climate moderation

effect of forests on, 15

microclimate regulation, 30

cluster subdivisions, 10, 29

about, 57–58

density bonuses for, 55

stormwater management and, 62

upzoning and, 56

for wastewater management, 66

coastal habitats, 11–12

benefits of, 12

conservation principles for, 26–27

dredge spoil and, 12

maps of, 20, 21

shorelines and, 2

species (Hudson Valley), 12

threats to, 12

Columbia County, 17, 34

map of watershed, inside front cover

Rheinstrom Hill, 43

community facilities and services

coordinating with, 51

cost of, 2, 3–4, 32, 65, 76

impact of development on, 59

See also intermunicipal cooperation

comprehensive planning, 7, 8

actions, identifying, 50–51

assistance, technical, 53

basic principles, identifying, 49

benefits of, 52

conservation advisory councils, 51–52

ecological region and watershed, identifying, 49–50

examples of, 52

information resources, 53

intermunicipal coordination, 51

maps, creating, 50

- municipal agencies, coordinating with, 51
- natural areas, identifying, 50, 55, 59
- policy statements, 50
- purpose of, 49, 55
- connections. *See* natural areas, connecting
- consensus building, 45, 47
- conservation. *See* natural areas and wildlife conservation; natural resource conservation principles
- conservation advisory councils (CACs), 51–52
 - intermunicipal, 71–72
- conservation boards, 52
- Conservation Café, 42
- conservation easements
 - for conservation/cluster subdivisions, 58
 - defined, 68
 - for forests, 34
 - for streams, 32
 - for urban habitats, 35
 - for wetlands, 67
- conservation principles, general, 25
- conservation program, creating, 19
- conservation subdivisions
 - about, 57–58
 - upzoning and, 56
 - for wastewater management, 66
- Constitution Marsh, 43
- construction. *See* development
- Corbett, J., 10
- Corbett, M., 10
- Cornell Cooperative Extension, 3, 43
- Cornell Plantations, 23
- Cornell University Geospatial Information Repository (CUGIR), 21
- corridors, natural, 25
 - wildlife, 56
 - See also* habitat corridors; natural areas, connecting; stream corridors
- cost-share programs, 67
- county governments, 71
- Crawford, J. A., 30
- Critical Environmental Areas, 58
- Croton to Highlands Biodiversity Plan, 23, 52
- Cumulative Impact Analysis, 59
- curbs, 25, 61, 63

D

- dams and water diversions, 14
- Daniels, K. H., 33
- daylighting, 36
- deer populations, managing, 33
- DeGloria, S. M., 15
- Dendroica cerulea* (cerulean warbler), 15
- density, regulating, 55
 - lot sizes, 56, 57
- density bonuses, 55, 57
- Department of Environmental Conservation (DEC), New York State, 19, 43
 - grants for open space conservation, 69
 - Landowner Incentives Program, 35
 - New York State Forest tax law (480a), 34, 55
 - open space committees, 68
 - permits, 26, 27, 31, 66
 - rare species information, 20
 - significant ecosystems information, 20
 - stormwater pond and wetland design information, 64
 - stream and stream corridor maps, 20
 - technical assistance for planning and zoning, 53
 - Urban Forestry Program, 36
 - wetland maps, 20
- Desmognathus fuscus* (northern dusky salamander), 15
- detention basins, 76
- development
 - in areas with public infrastructure, 68
 - conservation/cluster subdivisions. *See* specific listings
 - economic, 51
 - in floodplains, 14
 - generic environmental impact statements, 59
 - low-density, 55
 - low-impact, 9, 41, 58, 61
 - natural landscaping, using, 76
 - away from sensitive areas. *See* buffers; setbacks
 - and tax burden, 3–4
 - urban revitalization (brownfields), 53
 - wetland boundary delineations, 27
 - See also* comprehensive planning; shoreline development; smart growth strategies; urban sprawl; zoning
- development rights, 10. *See also* conservation easements; transfer of development rights
- dock siting, 26, 27
- Dodd, C. K., 11
- Dolichonyx oryzivorus* (bobolink), 17, 34
- dragonflies and damselflies, 11
- vegetated swales, 62, 63, 76
- Dreher, D. 25
- Driscoll, D. A., 24

Dutchess County

Buttercup Farm Sanctuary, 43
Cary Institute of Ecosystem Studies, 4
Fishkill Creek basin, 42
Greenway Connections, 10
map of watershed, inside front cover
Town of Clinton, 65
Town of Milan, 60
Town of Pleasant Valley Wetland and Watercourse Ordinance, 28–29
Town of Wappinger, 65
Wappinger Creek watershed, 65, 73

Dutchess County Environmental Management Council, 65

E

EAF. *See* Full Environmental Assessment Form

early successional habitats, 34–35.
See open uplands.

eastern box turtles, 11

eastern meadowlark (*Sturnella magna*), 17, 34

Eastern Westchester Biotic Corridor, 69, 73

ecological communities, 20, 21

ecological landscape. *See* landscape, ecological

economic benefits of conservation, 3
for community services, 2, 3–4, 32, 65, 76
economic products, 3, 16
generated by wetlands, 13
local industries, support for, 51
tourism, 2, 69, 71
See also recreational benefits of conservation

ecosystems, significant, 20, 21

Edinger, G. J., 60

education, public, 8
audience, identifying, 40
benefits of, 42
citizen involvement, 41
controversy, addressing, 13
examples of, 42–43
goals, setting, 39, 40
information resources, 43–44
local habitats, concern for, 40, 41
municipal commitment, demonstrating, 41
official species, designating, 41
opportunities for, 40, 76, 77
and watershed planning, 72
See also public participation

EIS. *See* environmental impact statements

endangered species, 1, 58
See also species of conservation concern

environmental conservation commissions.
See conservation advisory councils

environmental impact
cumulative analysis, 59
mitigating, 55

environmental impact statement (EIS), 58

Environmental Law Institute, 59

Environmental Protection Agency.

See U.S. Environmental Protection Agency

erosion

controlling with buffers, 14, 29–32
controlling along shorelines, 26
controlling with native plants, 75, 77
information resources, 66
in local regulation, 56, 73
preventing, 14, 15, 57
See stormwater management; sediment control

Euonymus alata (Japanese spindle tree), 77

Eurasian water-chestnut, 12

F

Fallopia japonica (Japanese knotweed), 77

farmland protection, 5, 68

farms, 35
habitat conservation assistance for, 17, 35
habitat, value of active farms, 17
tax relief for, 67
See also agricultural areas

Farmscape Ecology Program (Hawthorne Valley Farm), 17

Federal Emergency Management Agency (FEMA), 21

Federal Land and Water Conservation Fund, 69

Federated Conservationists of Westchester, 78

FEMA. *See* Federal Emergency Management Agency

Findlay, C. S., 27

fish breeding and nurseries
in coastal wetlands, 12, 26
in floodplains, 13
along streambanks, 14

Fishkill Creek Watershed Committee, 42

flood damage, reducing
with improved stormwater management, 61
with wetlands, 12–14, 26
with natural channel design, 31–32
with zoning, 59

floodplains, 13–15, 56. *See also* streams; wetlands

flowering rush (*Butomus umbellatus*), 78

foamflower (*Tiarella cordifolia*), 77

forest owners, tax relief for, 34, 55, 67

forests, 11, 56
benefits of forest habitats, 2, 15–16, 27
conservation principles, 32–34
floodplains, 13–14
information resources, 38
inventorying, 19, 72
and Lyme disease, 4
maps of, 20, 21
nature of, in the Hudson Valley, 15
preventing, to preserve open uplands, 16, 17, 35
species (Hudson Valley), 16
threats to forest habitats, 16
urban, 18
values of, by size, 33

480a program (forest tax law). *See* New York State Forest tax law

fragmentation, 16

- of forests, 33
- of open habitats (urbanization), 17
- as threat to biodiversity, 4
- due to upzoning, 56

Freegood, J., 3

Full Environmental Assessment Form (EAF), 59

G

garlic mustard (*Alliaria petiolata*), 78

generic environmental impact statement (GEIS), 59, 69

geographic information systems (GIS)

- about, 20
- creating, 50
- GIS data, resources for, 21
- for natural-resource inventories, 19

GIS. *See* geographic information systems

Glacial Lake Albany Native Plant Restoration Project, 15, 29, 36, 78

Glyptemys insculpta (wood turtle)

golden-winged warbler (*Vermivora chrysoptera*), 16, 17

governments, local. *See* local governments

grants

- Better Site Design projects, 65
- for natural landscaping, 76
- for open space conservation, 69

grasshopper sparrow, 16, 34

grasslands, 16

- inventorying, 19
- See also* open uplands

gray water, 15

great blue heron (*Ardea herodias*), 13

great egret (*Ardea alba*), 12

Green Assets program

(Shawangunk Ridge Biodiversity Partnership), 24

Greene County, 34

- grasslands and jobs in, 35
- map of watershed, inside front cover
- Ramshorn/Livingston Sanctuary, 43

Greene County Industrial Development Authority, 35

Greene County Soil and Water Conservation, 35

Greene Habitat Conservation Advisory Committee, 35

greenhouse gas emissions, reducing, 15, 78

groundwater, 12

- aquifers, 13
- benefits of, 15
- contamination, sources of, 15
- natural absorption, 63
- pumping, 14
- sprawl-type development and, 4
- stormwater management and, 61, 62
- See also* wetlands

Grylinophilus porphyriticus (northern spring salamander), 15

H

habitat corridors, 25

- forest, 15|
- See* natural areas, connecting; stream corridors

habitats

- areas needing protection, 21–22, 55
- assessments, 56
- ecologically significant, 22, 23, 67
- high-quality, 21, 22, 41, 67
- information about local, 19, 22
- information resources, 37–38
- loss of, 4–5
- public interest in local, 40, 41
- types of, in the Hudson Valley. *See* coastal habitats; forests; open uplands; streams; urban habitats; wetlands
- See also* natural-resource inventories

Hawthorne Valley Farm, 17

health and safety benefits of conservation, 2, 4, 32

- clean water, 66, 72
- wastewater, 66
- zoning and, 55
- See also* pollution

heartleaf plantain, 12

heating costs, reducing, 18

Helderberg Escarpment, 24, 50

Helmitheros vermivorous (worm-eating warbler), 16

Henslow's sparrow, 16

Hoppe, M. C., 24

Houlahan, J., 27

housing, 3, 51

Howard, T. G., 30

HRNERR.

See Hudson River National Estuarine Research Reserve

Hudson, Henry, 1, 75

Hudson Highlands, 50, 52, 69

Hudson River Estuary

- about, 11–12
- map of watershed, inside front cover

Hudson River Estuary Biodiversity Outreach Program, 5, 65

- contacting, 43
- goals of, 1

Hudson River National Estuarine Research Reserve (HRNERR), 43

Hudson River Valley, 1

- landscapes in, 50
- permanent conservation in, 67
- quality of life in, 2

Hudson River Valley Greenway, 10, 53

Hudson River water nymph (*Najas guadalupensis guadalupensis*), 12

Hughes, J. W., 30

hunting and trapping, 17

Hustedde, R. J., 46

Hylocichla mustelina (wood thrush), 16

I

impervious surfaces

- effect on groundwater, 15
- effect on stormwater, 14
- minimizing, 25, 41, 61, 62, 63

Important Bird Areas (Audubon), 22

incentives. *See* Landowner Incentive Program; Wildlife Habitat Incentives Program; Partners for Fish and Wildlife; tax incentives; zoning

infiltration practices, 63

inland wetlands. *See* wetlands

intermunicipal cooperation, 9

- benefits of, 73
- in comprehensive planning, 51
- examples of, 73
- information resources, 74
- information sharing, 71
- intermunicipal agreements, 71, 72–73
- intermunicipal inventory, 7, 23
- ordinances, complementary, 71

intertidal shores, 12

invasive species

- due to fragmentation, 16, 17
- invasive ornamentals, alternatives to, 77
- reducing, with natural landscaping, 75, 76
- sprawl-type development and, 4
- in urban areas, 18
- value of, 76

inventory map. *See* natural-resource inventories

Iris pseudacorus (yellow iris), 77

Iris versicolor (blue flag iris), 77

Ixobrychus exilis (least bittern), 12

J

Jackson, Henry, 45

Japanese barberry (*Berberis thunbergii*), 76, 77

Japanese honeysuckle (*Lonicera japonica*), 77

Japanese knotweed (*Polygonum cuspidatum* or *Fallopia japonica*), 77

Japanese spindle tree (*Euonymus alata*), 77

Jefferson salamander (*Ambystoma jeffersonianum*), 13

Johnson, E. A., 43

K

Kalm, Peter, 1

Karner blue butterfly, 35, 41, 78

Katz, P., 10

Kelley, K., 55

Kendall, B., 28

Kennedy, C. J., 19, 30, 59

Kiviat, E., 25, 60

Klemens, M. W., 23, 30, 52, 61, 63, 64

Kleppel, G. S., 9

L

lakes, 61

Landowner Incentives Program, 35

landscape, ecological

- conserving, 25, 68–69
- identifying, 49–50
- map of, 19

landscapes, disturbed, 76

landscaping, natural (native), 9, 35–36

- benefits of, 77–78
- in conservation subdivisions, 57
- encouraging, 40, 56
- examples of, 78
- grants for, 76
- information resources, 78
- on private and public properties, 76
- for redevelopment projects, 53, 76
- for stormwater management, 62, 64

land stewardship, 32, 35

- conservation programs for, 67

land trusts, 68

- conservation programs for, 67

land-use. *See* comprehensive planning; development; open space planning and conservation; smart growth strategies; zoning

least bittern (*Ixobrychus exilis*), 12

Lerner, S., 2, 3, 13, 14, 53, 68

Lindera benzoin (spicebush), 77

local governments, 2, 5, 9

- conservation resources for, 37
- forest conservation, role in, 32–34
- joint planning and studies, 72
- open space planning, role in, 68–69
- open upland conservation, role in, 34–35
- shoreline protection, role in, 26–27
- stormwater management, role in, 62
- stream habitat protection, role in, 31–32
- taxing and bonding authority of, 69
- urban habitat conservation, role in, 36
- water conservation, promoting, 15
- wetland protection, role in, 27–28
- See also* intermunicipal cooperation; planning boards; town boards

local laws and ordinances, 58

- complementary (intermunicipal), 71
- educating violators of, 41
- planned unit development (PUD) ordinances, 58
- sample ordinances, 33
- stormwater management ordinances, 65
- tree conservation ordinances, 32
- wetlands and watercourses, regulating, 28–29
- See also* zoning

Local Waterfront Revitalization Plans (LWRPs), 27

long-eared owl (*Asio otus*), 16

Lonicera japonica (Japanese honeysuckle), 77

Lonicera sempervirens (trumpet honeysuckle), 77

Lontra canadensis (river otter), 15

lots. *See* building lots

low-impact development. *See under* development

LWRP. *See* Local Waterfront Revitalization Plans

Lyme disease, 4, 33

Lynx rufus (bobcat), 16

Lythrum salicaria (purple loosestrife), 76

M

maps

Hudson River Estuary watershed, inside front cover
land-use maps, creating, 50
wetlands. *See under* wetlands
See also geographic information systems; natural-resource inventories

marbled salamander (*Ambystoma opacum*), 13

Marchland, M. N., 11

marina siting, 26, 27

marshes, 12. *See also* wetlands

MCA. *See* Metropolitan Conservation Alliance

McElfish, J., 25, 55, 56, 57, 76

McKenzie-Mohr, D., 41

meetings (public), purpose of, 45–46

Metropolitan Conservation Alliance (MCA), 23, 56, 69

Miller, N. A., 23, 52, 61

Mitner, R. J., 29

Model Local Law for Stormwater Management
(New York State), 65

Mohawk-Hudson Land Conservancy, 68

monitoring programs
and conservation easements, 58
getting citizens involved in, 41
performance standards and, 56
for streams, 31
for wetlands, 27–28

Morgiewicz, R., 56

multiflora rose (*Rosa multiflora*), 77

multiple-use areas, 17

municipal parks. *See* parkland

N

Najas guadalupensis guadalupensis (Hudson River water nymph), 12

National Association of Homebuilders, 49

National Audubon Society of New York, 43

National Biological Information Infrastructure (NBII), 21

National Decentralized Water Resources Capacity
Development Project, 66

National Small Flows Clearinghouse, 66

National Wetland Inventory (NWI) maps, 20, 21

Native Plant Center (Westchester), 78

native plants, benefits of, 57, 67, 75. *See also* landscaping, natural

natural areas, connecting

across property boundaries, 34, 68
conservation/cluster subdivisions and, 57
early successional habitats, 34–35
forests, 32, 33
linking existing and future areas, 67
across municipalities, 71
with natural landscaping, 35–36
site plans and, 33, 55
wildlife, 75
See also habitat corridor; natural corridor

natural areas and wildlife conservation, 7

community support for. *See* public participation
easements. *See* conservation easements
information resources, 37–38
intermunicipal cooperation, 23, 51, 71–74
local information resources, 21
natural areas, identifying, 10, 50
outreach and education. *See* education, public
principles. *See* natural resource conservation principles
prioritizing conservation efforts, 22
unique resources, identifying, 22, 40, 58
See also comprehensive planning; habitats; local laws and ordinances; natural-resource inventories; open space planning and conservation; stormwater management; zoning

natural landscaping. *See* landscaping, natural

natural resource conservation principles

for coastal habitats, 26–27
for comprehensive plans, 49
for forests, 32–34
general, 25
information resources, 37–38
for open uplands, 34–36
for stream habitats, 29–32
for urban habitats, 36
value of, 2
for wetlands, inland, 27–28

natural-resource inventories, 33, 55

biological surveys, 23, 58
ecologically significant habitats, identifying, 22
environmental review standards, developing, 23
examples of, 23–24, 47
maintaining, 22
mapping habitats and species, 19–22, 51–52
open space inventories, 67–68
regional information sources, 23–24
species of conservation concern, identifying, 23

Natural Resources Conservation Service (NRCS), 17, 31

natural vegetation. *See* vegetation, natural

The Nature Conservancy, 24, 43, 69, 77

Navota, J., 25

Newton, B. C., 31

New York Agricultural Assessment Program, 55

New York City Department of Environmental Protection, 71

New York City Watershed, 71

New York Flora Atlas, 22

New York Natural Heritage Program, 19, 29, 43, 58, 69
 barrens (rare), maps of, 20
 forests (high-quality), maps of, 20
 rare species, status and location of, 20, 21
 significant ecosystems, status and location of, 20

New York/New Jersey Highlands Regional Study, 24, 69

New York Planning Federation, 10

New York Rural Water Association, 15

New York State Biodiversity Project, 43

New York State Biodiversity Research Institute, 43

New York State Breeding Bird Atlas, 21, 22

New York State Department of Environmental Conservation.
 See Department of Environmental Conservation

New York State Department of State, 10, 67
 Coastal Management Program, 20, 26, 27
 Coastal Resources, Division of, 26, 27, 53

New York State Forest tax law (480a), 34, 55

New York State GIS Clearinghouse, 21

New York State Open Space Plan, 68

New York State Reptile and Amphibian Atlas, 22

New York State Stormwater Management Design Manual (DEC), 62

Niederriter, H. S., 11

Nolon, Sean F., 48

Normanskill Creek, 69

northern dusky salamander (*Desmognathus fuscus*), 15

northern harrier (*Circus cyaneus*), 16, 17, 34, 35

northern leopard frog (*Rana pipiens*), 13

northern spring salamander (*Gyrinophilus porphyriticus*), 15

NRCS. *See* Natural Resources Conservation Service

Nycticorax nycticorax (black-crowned night heron), 12

O

open spaces
 defined, 67
 desirability of, 2
 value of, 3

open space planning and conservation, 2, 3, 5, 7, 8, 52
 benefits of, 63, 69
 density bonuses, 55
 examples of, 69
 funding, 69
 information resources, 70
 intermunicipal committees, 71–72
 inventories, 67–68
 plans, 58, 68

requirements for parkland, 55
 requirements for subdivisions, 56–57
 in rural areas, 56
 SEQR, 58–59
 and taxes, local, 4
 tools and strategies for, 68–69
 in urban habitats, 17–18

open uplands, 11
 about, 16–17
 benefits of open upland habitats, 17
 conservation principles, 34–36
 inventorying, 20–21
 maps of, 21
 rare or exceptional, 20
 resources for conservation, 38
 species (Hudson Valley), 17
 threats to open upland habitats, 17

Orange County, 34
 City of Newburgh, 36
 map of watershed, inside front cover
 NY/NJ Highlands Regional Study, 24, 69
 Orange County Open Space Plan, 24, 52, 69
 Shawangunk Regional Open Space Plan, 73
 Shawangunk Ridge Biodiversity Partnership, 24
 Shawangunk Scenic Byway, 73
 Town of Blooming Grove, 52
 Town of Montgomery, 32
 Town of New Windsor, 36

ospreys, 12

outreach. *See* education, public

overlay zoning, 53, 56, 59
 intermunicipal cooperation on, 71, 73

P

Pace University Land Use Law Center, 10, 71

Pace University School of Law, 48

Palisades Interstate Park Commission, 73

parkland
 creating, with open space conservation, 55
 forests in municipal parks, 33
 meadows in municipal parks, 35
 native plant use in, 57, 67, 76
 See also urban habitats

parking lots, 57, 61. *See also* impervious surfaces

Parks, Recreation, and Historic Preservation, Office of, 68
 grants for open space planning, 69

Partners for Fish and Wildlife, 35

passive recreation, 68

pavement, porous, 63

PDR. *See* purchase of development rights program

Pendall, R., 4

performance standards (zoning), 33, 56

permits
 for restoration projects, 26
 for stream alteration projects, 29–31
 for tidal wetlands, alteration to, 26
 for wetland projects, 27
 for wastewater management, 66

pesticides, 15
reducing, 75, 77

Phase II regulations (stormwater), 61

Phelps, M. G., 24

pine barren habitats, 36

Piranga olivacea (scarlet tanager), 16

pitcher plant (*Sarracenia purpurea*), 13

planned unit development (PUD) ordinances, 58

planning, 5
citizen input, seeking. *See* education, public; public participation
resources, 10
watershed planning initiatives, 31
See also comprehensive planning; open space planning
and conservation; site plans; smart growth strategies

planning boards, 8, 28, 56, 58
conservation advisory councils, 51–52
intermunicipal, 71–72
public input, seeking, 45
See also local governments

ponds. *See* stormwater management; wetlands

pollution, 5
diluting, through maintained stream flow, 14
controlling, with wastewater management, 66
reducing, with natural landscaping, 78
removing, with buffers, 30
stormwater runoff and, 61, 63, 64, 65

Polygonum cuspidatum (Japanese knotweed), 77

Poole, W., 2, 3, 13, 14, 53, 68

population growth, 4, 16

Postel, S., 45

predators, 16

private property
conservation programs for owners, 67
donations and purchases of, 68
natural landscaping, encouraging on, 76
See also conservation easements; land stewardship

project review
benefits of, 59
information resources, 60
SEQR, 58–59
tools, 55

property tax relief, 67. *See also* tax incentives

public-access television, 42

public participation (in conservation), 8
benefits of, 22, 47
consensus vs. compromise, 45
controversy, addressing, 41
examples of, 47
information resources, 48
meetings, purpose of, 46–47
participation spectrum, 46
reaching specific groups, 46
strategy building, 39, 46
for watershed planning, 72
when to solicit, 45–46
See also education, public

public support and understanding. *See* education, public;
public participation

PUD. *See* planned unit development ordinances

purchase of development rights (PDR) programs, 68

purple loosestrife (*Lythrum salicaria*), 76

Putnam County
Constitution Marsh, 43
Fishkill Creek basin, 42
map of watershed, inside front cover
NY/NJ Highlands Regional Study, 24, 69
Town of Philipstown, 23, 52, 69
Town of Putnam Valley, 23

Q

Quassaick Creek, 36

R

rain garden, 64

Ramshorn/Livingston Sanctuary, 43

Rana pipiens (northern leopard frog), 13

recreation, passive, 68

recreational benefits of conservation, 2, 14, 69
birdwatching, 17, 34
boating, 14
clean water, 13, 14
fall foliage, 16
fishing, 12
hiking, 16, 34
hunting, 16, 17, 34
per-lot fees, 56
tourism, 2, 69, 71

redevelopment, 53, 59
natural landscaping on, 76

Rensselaer County
map of watershed, inside front cover

Rensselaer Plateau 50

reptile areas, local, 22. *See also* turtles

Reptiles, Atlas of New York State, 22

reptiles,
migration of, 25, 64
loss of, from stormwater, 61, 63
riparian habitat for, 30

residential
areas, 2, 56
zoning, 57

restoration projects, 26

Rheinstrom Hill, 43

Richer, B., 45

rights-of-way
railroad, 25
utility, 25, 35, 76

riparian areas
as buffers, 29
maintenance of, 31–32
See also buffers; stream corridors; streams

river otter (*Lontra canadensis*), 15

River Street Planning and Development, 3

road maintenance, 65. *See also* community facilities and services

Rockland County, 73

map of watershed, inside front cover
NY/NJ Regional Highlands Study, 24, 69

Rockland Greenway compact plan, 73

Rockland Riverfront Communities Council, 73

Rocky Mountain Institute, 66

Rosa multiflora (multiflora rose), 77

Roth, R. R., 11

runoff, stormwater

controlling with native plants, 16, 75, 76
effects of, 13, 61
urban, 5, 62
See also pollution; stormwater management

rural towns, 72

S

salamanders, 12, 30

Jefferson, 13
marbled, 13
movement of, facilitating, 25
northern dusky, 15
northern spring, 15
spotted, 13
See also amphibians

salt

reducing, 65
storage, 15

Salvelinus fontinalis (brook trout), 14, 15

Saratoga County

Glacial Lake Albany area, 78
Town of Clifton Park, 47

savannah sparrow, 34

scarlet tanager (*Piranga olivacea*), 16

Schenectady County

Glacial Lake Albany area, 78

Scolopax minor (American woodcock), 13

sedge wrens, 16

sediment control, 56. *See* buffers; erosion; stormwater management

Semlitsch, R. D., 30

septic systems, 15, 66

SEQR. *See* State Environmental Quality Review

setbacks, 28, 55

development, 56, 58
landscape, 76
reducing, 63
stream, 56
See also buffers

Shawangunk Ridge, 16, 22, 71

zoning in, 59–60

Shawangunk Ridge Biodiversity Partnership, 24

Shawangunk Scenic Byway, 73

shoreline development, 12, 26–27

shorelines. *See* coastal habitats; riparian areas; streams; wetlands

short-eared owl (*Asio flammeus*), 16, 17

shrublands, 16. *See also* open uplands

site assessments, biological, 58, 60

site plans, 8

to maintain connections, 33, 55
Model Local Law for Stormwater Management, 65
natural landscaping requirements for, 76
performance standards in, 56
to protect natural areas, 56–58
SEQR, 58–59

smart growth, 5, 9

defined, 10

smart growth strategies

conservation easements, 32, 34, 35, 58, 67
cost-sharing, 35
education and outreach, 39–40
Local Waterfront Revitalization Plans, 27
natural landscaping, 75–76
public participation, 45–47, 76
purchasing land (fee purchase), 34, 35, 68
tax incentives, 34, 53, 55
in urban habitats, 36
wetland and watercourse regulations, 28, 32
See also comprehensive planning; intermunicipal cooperation;
open space planning and conservation; stormwater management; subdivision regulations; zoning

Smith, C. R., 1

Smith, D., 43

Smith, S. D., 4

Smith, W., 41

Sobel, L., 10

soil

compaction, 61, 63
creation, 15, 16
hydric, 21
See also erosion

Spackman, S. C., 30

sparrows, 16, 34

species

endangered, 1, 58
inventorying local, 19, 21–22
loss of, from stormwater damage, 61
movement of, facilitating, 25
restoring, 26
supported by working farms, 17
threatened, 58

species in the Hudson Valley

in coastal habitats, 12
in forests, 16
in open uplands, 16, 17
in stream habitats, 15
in urban habitats, 17–18
in wetlands, 13

species of conservation concern, 23

fact sheet/guide, 21
GIS data on, 20, 22

spicebush (*Lindera benzoin*), 77

spotted salamander (*Amblystoma maculatum*), 13

spotted turtle (*Clemmys guttata*), 13

sprawl, urban. *See* urban sprawl

stakeholders, involving. *See* education, public;
public participation

State Environmental Quality Review (SEQR), 8, 55, 58–59

Staten Island, 16

State University of New York at Albany, 9

Sterling Forest State Park, 2

Stevens, G., 25, 60

stormwater management, 9, 41, 51

- benefits of, 65
- bioretention areas, 64
- in conservation subdivisions, 57, 58
- examples of, 65
- impervious areas, reducing, 63
- infiltration practices, 63
- information resources, 66
- natural absorption, 63
- natural landscaping for, 76
- in overlay zones, 53, 56
- reducing cost of, 77
- road maintenance programs, 65
- along shorelines, 26
- storm sewers, 61, 63
- stormwater ponds (basins), 64
- tools for, 61, 62–64
- along urbanized streams, 14
- with urban forests, 18
- vegetated drainage swales, 62, 63, 76

streambank stabilization

- buffer width for, 30
- with natural channel design, 31, 32
- with riparian vegetation, 14
- stormwater and, 61
- with trees, 13

stream corridors, 2, 14

- conservation subdivisions and, 57
- inventorying, 19, 72
- maps of, 20, 21
- overlay zones and, 56

stream flow

- natural variation in, 29, 31
- and pollution, 14
- role of stormwater in regulating, 61, 63, 64, 65
- role of wetlands in, 13

streams (streams, shorelines, and floodplains), 11

- about stream habitats, 13–14
- benefits of stream habitats, 14
- classification of, 31
- conservation principles, 29–32
- information resources, 37
- inventorying, 19
- maps of, 20, 21
- natural landscaping near, 76
- setbacks, 56
- species (Hudson Valley), 15
- threats to stream habitats, 14
- urban streams, 14, 36
- in wetland areas, 12

See also buffers; stream corridors; stormwater management;
wetlands

Stream Visual Assessment Protocol, 31

Strix varia (barred owl), 16

Sturnella magna (eastern meadowlark), 17, 34

subdivision regulations, 8, 33

- intermunicipal boards and, 71–72
- Model Local Law for Stormwater Management, 65
- performance standards in, 56
- to protect natural areas, 55, 56–58

Sullivan, J., 43

Sullivan County

- Shawangunk Ridge Biodiversity Partnership, 24

support, public. *See* education, public; public participation

surfaces, impervious. *See* impervious surfaces

Surracenia purpurea (pitcher plant), 13

surveys (biological), on-the-ground

- commissioning, 23, 58
- importance of, for natural-resource inventories, 19
- of wetlands, 20

swamp milkweed (*Asclepias incarnata*), 77

swamps, 12. *See also* wetlands

T

tax incentives, 55, 68

- New York State Forest tax law (480a), 34, 55
- property tax relief, 67
- for redevelopment, 53

tax rates, local, 3–4

TDR. *See* transfer of development rights

threatened species, 58. *See also* species of conservation concern

Tiarella cordifolia (foamflower), 77

ticks, 4

tidal shorelines. *See* coastal habitats; shoreline development

tidal wetlands, 12

timber, 3, 16, 34, 56

Tompkins County

- Environmental Management Council, 23
- Unique Natural Areas Inventory, 23

Torrey Botanical Society, 21

tourism, 2, 69, 71

town boards, 52

- public input on community plans, seeking, 45
- See also* local governments; planning boards

traffic, 59, 69

training, public, 40, 41

transfer of development rights (TDR), 10, 55, 68–69

Trapa natans (water chestnut), 76

tree of heaven (*Ailanthus altissima*), 76

tributary streams. *See* streams

trout streams, 22

trumpet honeysuckle (*Lonicera sempervirens*), 77

turf grass, 57, 64, 67

turtles, 11

- bog, 17
- movement of, facilitating, 25
- spotted, 13
- travel routes for, 14
- See also* reptiles

U

Ulster County, 22, 34, 71

- map of watershed, inside front cover
- Shawangunk Regional Open Space Plan, 73
- Shawangunk Ridge Biodiversity Partnership, 24
- Shawangunk Scenic Byway, 73
- Town of Gardiner, 59–60

upland sandpiper, 34

upzoning, 56

Urban Forestry Program (DEC), 36

urban habitats, 11

- benefits of, 18
- conservation of, 36
- information resources, 38
- inventorying, 21
- maps of, 21
- parklands and open spaces, 17–18
- resources for conservation, 38
- threats to, 18

urban revitalization, 53

urban sprawl, 75

- controlling, 56
- and fragmentation of habitats, 4, 17
- and obesity, 4
- wastewater management and, 66

U.S. Department of Agriculture Forest Service, 24

U.S. Environmental Protection Agency, 65, 66

- volunteer wetland monitoring guide, 28

U.S. Fish and Wildlife Service, 35

- wetland maps, 20, 21

U.S. Forest Service and Regional Plan Association, 69

U.S. Geological Survey

- stream and stream corridor maps, 20

utilities, 51

- rights-of-way, 35, 76

V

Van Cortlandt Park (Bronx), 17

Van Tine, J., 5, 55

vegetated shallows, 27

vegetated swales, 62, 63, 76

vegetation, natural, 4, 29, 30, 56, 57, 63, 75

Vermivora chrysoptera (golden-winged warbler), 16, 17

vernal pools, 12, 64

- buffers for, 29, 30
- See also* wetlands

Viburnum trilobum (American cranberry), 77

W

Wallkill River Valley, 50

- easements, 32
- grassland bird habitats in, 34

Wappinger Creek watershed, 65, 73

warblers, 15, 16, 17

Warren County

- Town of Queensbury, 41

wastewater treatment, 8

- effect on people and wildlife, 66
- facilities, 51
- through tidal wetlands, 12
- and urban sprawl, 66

water chestnut (*Trapa natans*), 76

water nymph, Hudson Valley, 12

water resources, protecting, 2, 5

- aquifers, 13, 19
- with buffers, 29, 30
- with forest habitats, 15
- with natural areas in urban habitats, 18
- with natural landscaping, 75, 77–78
- with open space plans, 68
- with stormwater management, 61–62
- with streams, 14
- supply of, 51
- with wastewater management, 5, 66
- with wetland habitats, 12–13

waterfront development. *See* shoreline development

waterfront revitalization, 72

water systems, public, 51

watersheds

- intermunicipal agreements, 72
- protection of, 2
- planning, 7, 31, 72
- land-use changes and, 12, 13
- See also* runoff, stormwater; streams; wetlands

Westchester County

- Department of Parks, 42
- Federated Conservationists of Westchester, 78
- Go Native!, 77
- map of watershed, inside front cover
- Town of Cortlandt, 23, 60
- Town of Lewisboro, 69, 73
- Town of Newcastle, 23
- Town of North Salem, 69, 73
- Town of Pound Ridge, 33, 69, 73
- Town of Yorktown, 23, 50, 52

Westchester Land Trust, 69

wetlands, 11, 55

- benefits of wetland habitats, 2, 12–13
- conservation principles, 27–28
- “decoy” wetlands, 61
- information resources, 37
- invasive species in, 76

- inventorying, 19, 72
- maps of, 20, 21, 26, 27
- natural landscaping near, 76
- overlay zones and, 56
- species (Hudson Valley), 13
- threats to wetland habitats, 13
- See also* coastal habitats; groundwater; stormwater management; streams; vernal pools

Wildlife Action Plan (New York State), 23

Wildlife Conservation Society, 71

- Eastern Westchester Biotic Corridor, 73
- Metropolitan Conservation Alliance (MCA), 23, 56, 69
- Orange County Open Space Plan, 24, 69

Wildlife Habitat Incentives Program, 35

Wodder, Rebecca, 61

woodcock, American, 13

woodland pools. *See* vernal pools

woodlands, 15

- invasive species in, 76
- See also* forests

wood turtle (*Glyptemys insculpta*)

wood thrush (*Hylocichla mustelina*), 16

woody debris (snags), 31

workshops, public, 40, 41

worm-eating warbler (*Helmintheros vermivorous*), 16

wrens, 16

Y

yellow iris (*Iris pseudacorus*), 77

Young, S. P., 23

Z

zoning, 8

- benefits of, 59
- boards, intermunicipal, 71–72
- cluster/conservation subdivisions, 57–58, 62, 66
- conservation overlay zoning, 56, 58, 71
- examples of, 59–60
- flexible, 29, 56
- incentives for, 55
- information resources, 60
- limitations of, 10
- Model Local Law for Stormwater Management, 65
- performance zoning, 56
- purpose of, 55
- redevelopment overlay zones, 53
- wastewater management and, 66
- See also* local laws and ordinances

