

PART I: An Approach to Biodiversity Conservation

Introduction

The Hudson River Valley is one of New York State's most impressive regions, rich in history, and cultural, geological, and biological diversity (Figure 1). At the heart of this region is the Hudson River Estuary, which ranges from saline to fresh water, and pulses daily with four-foot ocean tides. The Hudson River Estuary corridor is one of the most densely populated areas of the country and has long been the fastest growing region of the state. Additionally, it is one of the state's primary industrial centers. As a result, tremendous pressures have been placed on the health and sustainability of the region's natural resources. Despite these stresses, it remains highly productive with thousands of species of plants and animals.

Because of the diversity and complexity of both the biological resources and the threats that face these resources, partnerships involving landowners, municipalities, non-profit organizations, government agencies, and others must be developed to effectively conserve biodiversity in the Hudson River Valley. Successful implementation of the strategies and actions presented in this report will require a commitment to both developing and sustaining these partnerships.

The Hudson River Estuary Biodiversity Program

The purpose of the Hudson River Estuary Biodiversity Program is to support the conservation, recovery, and sustainable use of the biodiversity of the Hudson River Estuary corridor, especially as it relates to terrestrial ecosystems. The project emphasizes voluntary approaches to biodiversity conservation in the context of local home rule.

The broad goals of the program are:

1. To maintain biodiversity in the Hudson River Estuary ecosystem by ensuring the health of all native, terrestrial ecological communities, including plant and animal species, and by protecting ecological processes and overall ecosystem function.
2. To assure opportunities for the public to experience, learn about, and enjoy the abundant biodiversity resources of the Hudson River Estuary ecosystem.

Conservation Area

The Hudson River Estuary Biodiversity Program and this report address biodiversity and conservation opportunities for the terrestrial portions of the Hudson River Estuary ecosystem within the Hudson River Valley. The conservation area is the entire upland area (terrestrial habitat and non-tidal and tidal wetlands) of the 10 counties bordering the Hudson River Estuary from the Troy Dam south to the Verrazano Narrows. Also included are the 5 New York City Boroughs (New York, Bronx, Queens, Kings, Richmond).

The Hudson River Estuary corridor spans approximately 152 miles and covers more than

6,500 square miles, greater than the combined areas of Rhode Island and Connecticut (Figure 2). This definition of the conservation area closely matches the drainage basin boundaries for the Hudson River Estuary, which is tidal as far north as the Federal Dam at Troy.

Areas beyond the Hudson River Estuary Watershed can and do have a profound effect on the estuary and surrounding lands. What happens deep in the neighboring watersheds of the Upper Hudson River in the Adirondacks, the Delaware in the western Catskills, and throughout the Northeast influences biodiversity in and around the Hudson River. Conservation strategies must consider these areas as well, but are not covered in this report.

Biodiversity Defined

Biological diversity, or biodiversity, refers to the abundance and variety of all life on earth. It embodies all of the variety among animals, plants, and microorganisms, their genetic makeup, and the variety of ecosystems in which they live. The definition of biodiversity encompasses three different levels: genetic diversity, species diversity, and ecosystem diversity. Genetic diversity includes genetic variation between species, as well as within and between populations of the same species. Species diversity refers to the variety of different plants, animals, and microorganisms. Ecosystem diversity refers to variability in scale, process, and abiotic factors that define the system. Genetic, species, and ecosystem diversity are all essential to maintaining long-term biodiversity.

Biodiversity Value

Biodiversity has tremendous value to humans and should be protected for many reasons. Humans are interdependent with other organisms on the planet. Our quality of life is inextricably tied to a healthy and diverse environment. We have benefited tremendously from an environment rich in biological variety, from ecological services to aesthetics, recreation, and spiritual benefits.

An investment for the future

One reason we engage in biodiversity conservation is to maintain environmental systems that support quality of life, both for the present and for future generations. Without conservation, future generations may be left with impoverished biological resources. Biodiversity can help ecosystems recover more readily from disturbances resulting from drought, flooding, fire, disease, or human activities. Maintaining biodiversity provides us with options for adapting and responding to changing environmental conditions.

Value for soil, water, oxygen, and ecological balance

Humans derive many benefits from the services provided by intact biological systems. For example, properly maintained natural hydrological cycles, such as those found in unaltered wetlands, stabilize water runoff. Naturally functioning wetlands help to prevent flooding or drought and regulate underground water tables while also filtering and purifying water. Sustaining biodiversity also aids in the formation and maintenance of soil.

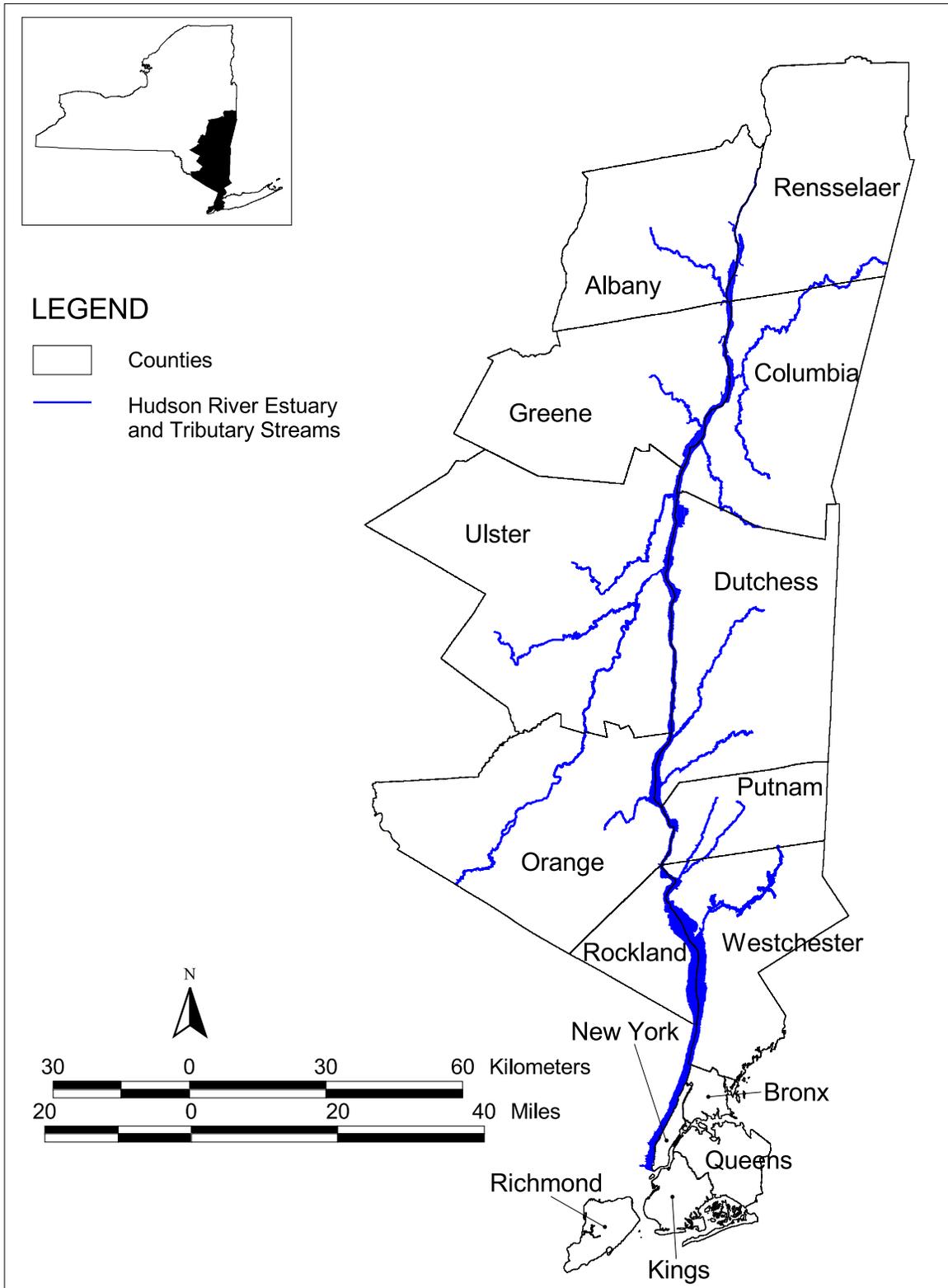


Figure 2. The Hudson River Estuary corridor of New York State is defined as the counties and New York City boroughs bordering the tidal portions of the Hudson River.

Soil productivity is enhanced by the storing and recycling of nutrients through decomposition and reabsorption. Additionally, ecosystems and ecological processes are essential in the production of oxygen and the recycling of carbon as well as the absorption and decomposition of some pollutants in both air and water.

These services are not only a function of ecological processes, but also are provided by species. Breeding populations of predatory birds, mammals, reptiles, amphibians, spiders and insects help to control insect and rodent pests in human-inhabited areas. This natural biological control potentially reduces the need for and cost of controlling agricultural pests with chemicals. Also, the maintenance of natural habitats supports the birds and insects that play a key role in crop pollination.

Value for recreation and cultural heritage

The number of people taking part in recreational activities involving biodiversity is growing each year. Biodiversity in the Hudson River Valley provides residents and tourists alike with a great number of choices in recreational activities including fishing, hunting, trapping, hiking, biking, boating, camping, photography, and wildlife observation. The culture, economy, and beauty of the Hudson River Valley is linked to the biodiversity of the region.

Spiritual value

Perhaps the greatest value in biodiversity is the least measurable. Biodiversity helps fulfill the spiritual, aesthetic, and inspirational needs of people and promotes the emotional health of our modern society. Poets, painters, and musicians have been celebrating the spiritual and aesthetic value of biodiversity in the Hudson River Valley for centuries.

Biodiversity also has intrinsic value, independent of what it provides humans or how it serves our needs and desires, and so, we are moved to treasure and protect it.

Biodiversity Conservation Considerations

The focus of biodiversity conservation efforts should reflect regional conservation goals. Biodiversity conservation initiatives that focus solely on individual elements such as a single species or even a small number of species can lead to inefficient and competing management strategies. It is important not to fall into the trap of focusing all conservation efforts and energies on endangered, threatened, and rare species to the detriment of those that are common. A narrow focus may leave some species unprotected or in jeopardy. Some rare species today were once common and some common species may be at risk of becoming rare. Effective biodiversity conservation can only be accomplished through coordinated efforts across spatial scales and taxonomic levels.

The ultimate purpose of biodiversity conservation is to conserve the entire complement of species, habitats, and processes so that ecological function can be sustained.

Elements of biodiversity exist at many spatial scales; all of which require consideration in a comprehensive conservation program. At its largest spatial scale, the Hudson River Estuary ecosystem encompasses many smaller, distinct ecosystems. Each nested ecosystem is a complex, interacting collection of biodiversity elements and includes all living and non-living components.

Ecological communities are a primary component in the structure of an ecosystem. Ecological communities are uniquely defined by the plants and animals that compose them and soil type, elevation, and other abiotic factors. A mosaic of communities make up the Hudson River Estuary ecosystem, some of which are rare or otherwise exemplary (see Reschke 1990). A community is home to many species of plants and animals. Protecting one community can protect hundreds of species.

A basic, fundamental level and measure of biodiversity is species diversity and includes populations of all species of living organisms. Total species conservation is an inherent goal of biodiversity conservation. Species may be grouped by category indicating their particular contribution to biodiversity and human use. Among these are both vulnerable (rare, threatened, endangered, and species of special concern) and common species, reflecting their relative abundance in the ecosystem. As defined here, vulnerable species include those that are recognized by the federal or state government as being rare (i.e., federal- or state-listed) as well as those species that may not be federally or state-listed, but are rare in the Hudson River Estuary corridor. In addition to vulnerable species, there are some categories of species that may require specific attention. Economically significant species are those species that have an effect on local and/or regional economies. Generally thought of as species that are fished, hunted, trapped, and observed recreationally, these also include pest species. Regionally significant species are those deemed important due to their aesthetic, cultural, or social value to local communities.

Critical to species diversity and species conservation is habitat conservation. Simply stated, habitat is where a wildlife population naturally occurs and obtains support for living (i.e., food, cover, water). Plant and animal species are dependent on their habitat for survival and reproduction, and therefore, the conservation of enough suitable habitat is critical for the effective conservation of overall biodiversity. Setting aside land for habitat is not enough however, if the ecological processes that sustain that habitat are not maintained.

Community Involvement

Biodiversity exists at several scales and comprehensive conservation requires that multiple scales be included. There is no inappropriate scale for conservation. Ultimately, state and federal agencies can provide only a part of the total effort needed to ensure that regional project goals will be achieved. Private lands constitute 90% of the Hudson River Estuary corridor. Therefore, it is essential to work with counties and municipal governments involved in land use planning as well as individual landowners. It follows

that an integral component of biodiversity conservation is an emphasis on developing voluntary approaches and encouraging and assisting voluntary conservation efforts. Only by embracing conservation at all levels through the involvement and cooperation of local communities and landowners will conservation of the Hudson River Estuary ecosystem be successful. If we are to be successful in achieving our goals, it is imperative that people have access to the information necessary to carry out conservation in their local communities.

Partnerships

One of the primary objectives of this report is to create a framework for the coordination of conservation activities and the development of conservation partnerships. It is generally understood that the future of successful conservation lies in our ability to form effective partnerships. Pressures and demands on biodiversity are continually growing and biodiversity is increasingly jeopardized. Even with the dedication of the many individuals and public and private conservation organizations in the Hudson River Estuary corridor, the challenges are too great if each acts independently. Experience has demonstrated that dedicated individuals and organizations working together cooperatively for a common cause can make tremendous accomplishments. Conservation must therefore be a cooperative effort.

There are numerous individuals and organizations involved with biodiversity conservation in the Hudson River Estuary corridor (Appendix I) and conservation partnerships can occur at many levels among several potential partners. Potential partners include, but are not limited to:

- Non-profit Organizations
 - Land Trusts
 - Environmental Organizations
- Federal Agencies
- State Agencies
- County Agencies
 - Soil and Water Conservation Districts
 - Environmental Management Councils
- Local Government Agencies
 - Planning Boards
- Businesses, Corporations
 - Public Utilities
- Educational Institutions (Colleges, Universities, Public Schools)
- Individual Landholders
- Citizen Groups
 - Fish & Game Clubs
 - Watershed Organizations

Threats to Biodiversity in the Hudson River Estuary Corridor

There are numerous important issues facing biodiversity and biodiversity conservation efforts in the Hudson River Estuary corridor. The following are some of the main factors affecting biodiversity and biodiversity conservation across the region. Program areas and specific strategies for addressing these threats are presented in Part III.

- Habitat Change and Fragmentation

The Hudson River Valley landscape is continually changing as a result of natural and human processes. Habitat change is occurring throughout New York State, including within the Hudson River Estuary corridor. In particular, the state is becoming more forested as agricultural land uses diminish. Early-successional habitats and the species that rely upon these habitats are in decline. The Hudson River Estuary corridor is one of the fastest growing regions of New York State in terms of population and urbanization. As a result, there is considerable clearing of natural areas that leads to habitat fragmentation. Additionally, small-scale losses of wetlands, and in particular vernal pools, continues to be a threat to biodiversity.

Habitat fragmentation is the breaking up of contiguous areas of habitat into smaller, less connected pieces. When already small parcels of land are further fragmented by development, they might become too small to support the complex interactions required to maintain an ecosystem. Fragmentation can be detrimental to area-sensitive species and advantageous to invasive or generalist species. Forest interior birds and wide-ranging mammals that require large, unbroken tracts of habitat are particularly vulnerable. Patterns of land use development can significantly affect biodiversity. As the region continues to develop, land-use management that considers biodiversity conservation should be encouraged. For example, decisions made by local planning boards on how a subdivision is laid out can have a substantial negative or positive effect on biological resources.

- Invasive and Overabundant Species

Invasive native and exotic plant and animal species pose a serious threat to biodiversity in the Hudson River Estuary corridor. Generally, invasive and exotic species pose a threat to biodiversity by out-competing and displacing native species and altering ecosystems. The Hudson River Valley is particularly vulnerable to invasion of exotic plants and animals because it is a passageway for commercial goods from other countries as well as other parts of the United States. These invasive species often come as “stowaways” on foreign vessels. Invasive exotic plants are capable of driving out other native plant species in an area and may have reduced value to wildlife in terms of cover, nesting substrate, or as a food source. Invasive native plant and animal species often indicate a disruption in the processes that typically hold native populations in balance.

The more than 100 invasive plant species in the Hudson Estuary corridor include the exotic purple loosestrife (scientific names of species mentioned throughout this report

are provided in Appendix II) and common reed that have overrun wetlands across the region choking out native wetland plants and possibly harming wildlife populations. Examples of invasive animal species include the exotic European starling, mute swan, and zebra mussel, and the native brown-headed cowbird. Invasive, exotic species are a significant threat to our forests, for example, in the Hudson River Valley the hemlock woolly adelgid is moving northward, beech bark disease is moving southward, and the Asian longhorned beetle is threatening sugar maple in New York City and on Long Island.

Similarly, overabundant native species can lead to direct and indirect displacement of other species. For example, white tailed deer can have a tremendous influence on the distribution and abundance of plant species which in turn affect populations of other species, ultimately affecting overall biodiversity in the area. Lastly, changes in the landscape have caused some animals such as raccoons and skunks to increase in abundance, particularly in urban and suburban areas. Large population increases of these generalists are not only a nuisance to homeowners, but can also result in local reductions in biodiversity as they prey on the eggs and juveniles of many other species.

- Pollution (Air, Water, Soil Quality)

Air, water, and soil quality profoundly influence biodiversity. Pollution has many sources and impacts biodiversity in a variety of ways. Air pollutants can lead to soil and water pollution through atmospheric fallout (e.g. rain, snow), which can alter soil and water pH, and ultimately habitats and species. Lichens are extremely sensitive to air quality and are unable to live where the air is polluted. Increasingly, non-point source pollution from pesticides and fertilizers carried with water runoff from lawns, agricultural lands, and roads have a negative effect on biodiversity. There is also evidence that pollution can work its way into the food chain as chemical contaminants (e.g., PCBs, pesticides, and heavy metals) in fish and amphibians and ultimately the reptiles, birds, and mammals that prey on them. In the Hudson River Estuary corridor, pollutants of concern include heavy metals, organochlorines such as pesticides, urban runoff, acid rain, endocrine disruptors, and industrial pollutants such as PCBs.

- Management Conflicts on Public Lands

State and other public lands in the Hudson River Estuary corridor contain significant habitats that are vital to the biodiversity of the region and need to be managed in a manner that directs recreational uses away from ecologically sensitive areas.

Tourists and residents of the Hudson River Valley take part in numerous recreational activities. Commonly, the demand and timing of recreational pursuits exceeds the availability of natural areas for these activities. As a result, tremendous pressures are placed on open space and natural areas, putting a growing stress on biodiversity. Because recreational activities have the potential to negatively affect biodiversity,

there are times when recreational use of an area may need to be limited in order to protect biodiversity. Conserving additional open space and providing directed opportunities for recreation that consider biodiversity conservation are actions needed to ease this pressure. A great part of the value of biodiversity lies in what it offers to us as a source of recreation, learning, enjoyment, and inspiration. The challenge in the Hudson River Estuary corridor is to balance the need for conservation and the demand for access and recreation.

- Lack of Scientific Knowledge of Biodiversity

In spite of ongoing, targeted inventory programs, we still lack important knowledge about the abundance and distribution of important elements of biodiversity. We know perhaps even less about how these elements interact to form ecosystem functions. It is necessary to recognize that in some cases, not enough information is available. It is important to collect baseline information on the biodiversity of the region in order to assess changes over time and evaluate success in meeting conservation objectives.

We need to identify those areas where our knowledge is limited and make a commitment to filling in the gaps. We are limited in our knowledge of the invertebrates, microorganisms, and fungi that account for the majority of species diversity in the region. We are also limited in our knowledge of how to best conserve the entire range of biodiversity. For example, what we have learned about conserving organisms such as vertebrates and vascular plants may not be appropriate for invertebrates or microorganisms.

The Hudson River Valley has been studied extensively. However, tremendous amounts of data from these studies are largely inaccessible and therefore remain unused. Retrieving this information and making it accessible to researchers and the public alike could contribute greatly to our current understanding of biodiversity in the Hudson River Estuary corridor.

- Lack of Public Awareness and Understanding

Humans have been and continue to be the principle determinant of the present and future viability of much of the biodiversity in the Hudson River Valley. Commonly, people are unaware of how their everyday decisions affect biodiversity. It is vital that we are adequately informed about both the costs and benefits of our actions on elements of biodiversity. Educating the public and providing the means to make informed decisions will help in the effort to conserve biodiversity. Many people in the Hudson River Valley have a deep concern for the environment and want to do more for conservation, but do not know how.