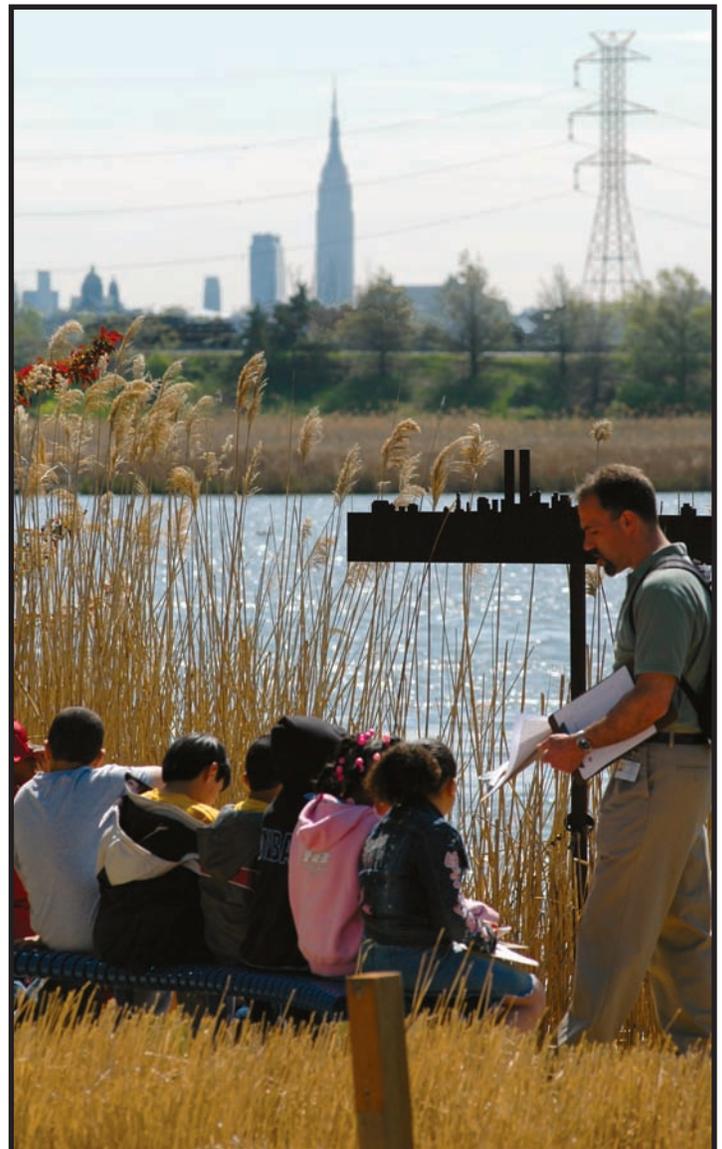


XII. Conclusions



Teaching children at DeKorte Park: helping to ensure their healthy future in the Meadowlands.



Schoolchildren enjoying spring in the Meadowlands.

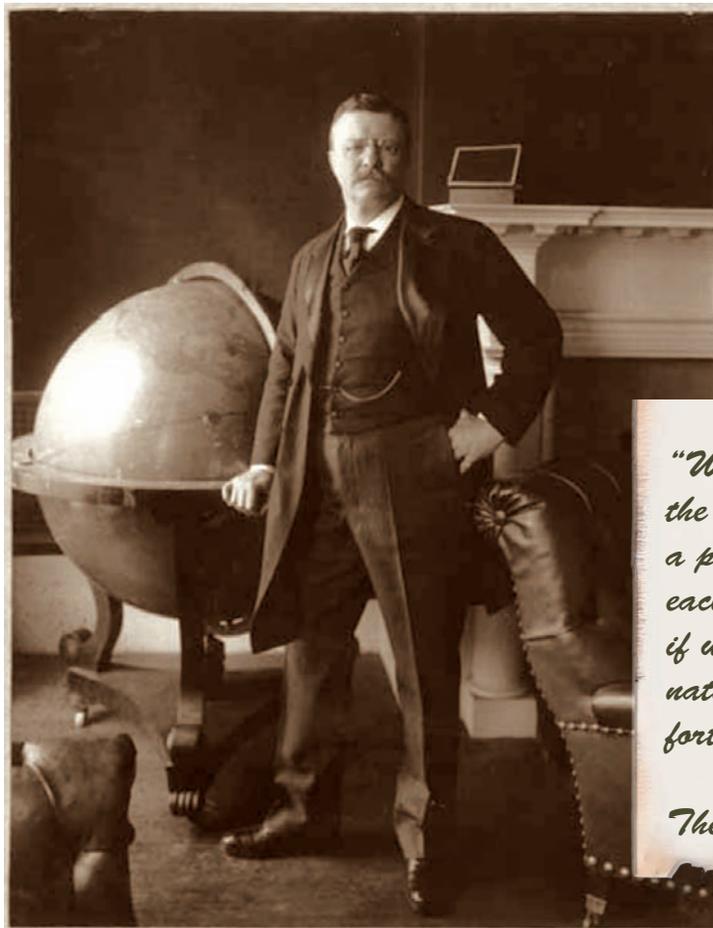
XII. Conclusions

During the past few centuries, the Meadowlands was transformed by human activities—its forests were harvested, its rivers and streams were dammed, its marshes were filled, and its land, water, and air were degraded. The Meadowlands' forests, meadows, waterways, and marshes were replaced by reservoirs, plumbing systems, combined sewer overflows, sewage treatment plants, and a few large pipes discharging into the lower Hackensack River. Untold biodiversity was lost during this transformation; yet surprisingly, considerable biodiversity remained.

Today, the Meadowlands is being transformed again by human activities—landfills and industrial sites are being remediated, invasive species are being controlled to enhance biodiversity, and tidal currents are being restored to diked and ditched marshes. If carefully planned and implemented, remediation, enhancement, and restoration have the potential to revitalize the Meadowlands. For the Meadowlands ecosystem to recover, sustain fish and wildlife resources, and nourish a new image for this long-neglected urban area, Meadowlands stakeholders must embrace a central concept:

“Everybody (man and organisms) lives downstream from everybody else in an estuary.”
Eugene Odum (1971)

Stakeholders must develop a shared vision, supported by clear goals and objectives, and work together. Such actions require improved coordination among all stakeholders, especially federal, State, and local agencies. Finally, stakeholders must establish a unifying authority to provide comprehensive remediation and restoration if the Meadowlands is to sustain fish, wildlife, and people in the future.



“We have fallen heirs to the most glorious heritage a people ever received, and each one must do his part if we wish to show that the nation is worthy of its good fortune.”

Theodore Roosevelt

XII. CONCLUSIONS

A. HUMAN USE HISTORY

B. NATURAL HISTORY

C. HYDROLOGY AND CONTAMINANTS

D. WETLAND AND UPLAND LAND USE

E. INVASIVE AND EXOTIC SPECIES

F. RESOURCE OBJECTIVES

G. RESEARCH AND EDUCATION

H. PUBLIC ACCESS AND RECREATION

I. RESTORATION PLANNING AND COORDINATION

J. SUMMARY



Satellite image of the Hackensack Meadowlands District (boundaries in red) and the surrounding metropolitan region.

XII. CONCLUSIONS

The Service acknowledges and accepts the many challenges of the Meadowlands as an opportunity to fulfill its Mission of *working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people*. The Hackensack Meadowlands also presents the Service, other stakeholders, and the American people with unparalleled opportunities to shape a new image of this long-neglected urban coastal ecosystem, and to improve the quality of life for the 20 million people living in the surrounding urban area.

The Service has a long history of commitment to the protection of the Meadowlands and its fish and wildlife resources. Building upon the previous efforts of many State, federal, and local agencies, the Service has articulated a vision for the Meadowlands in this *Hackensack Meadowlands Initiative: Preliminary Conservation Planning* as a guide for restoring and protecting the Meadowlands and its biodiversity. The Service's vision for the Meadowlands includes:

- (1) a more natural estuarine ecosystem with healthy fish and wildlife resources;
- (2) a cleaner environment (progressive reduction in acute and chronic contaminant effects);
- (3) diverse wetland and associated communities that sustain local and regional populations of native species, including federal trust fish and wildlife resources; and
- (4) public commitment to and diverse social benefits from the Meadowlands.

Restoring and protecting the Meadowlands ecosystem and its biodiversity will require that all stakeholders work together, guided by a common vision.

The Service has presented this planning document to its agency partners in the *Hackensack Meadowlands Initiative*. While it represents the Service's findings, recommendations, and conclusions, the Service presents the Plan to identify the critical issues and to work toward common ground that is critical to advance the restoration of the Meadowlands ecosystem and the long-term protection of its fish and wildlife. Working together and finding common ground to restore the Meadowlands may also be instrumental to broader restoration and protection efforts throughout the New York-New Jersey Harbor.

A. HUMAN USE HISTORY

Understanding the human use and misuse of the Meadowlands is vital to undoing adverse causes and effects and essential in preventing human impacts on this ecosystem from being duplicated continuously in the Meadowlands and elsewhere in the United States. Humans have lived in the Hackensack Meadowlands for 10,000 to 12,000 years. During most of that time the small, native Lenape population had minimal impacts upon the landscape and largely subsisted off the area's abundant natural resources. However, soon after arriving, European colonists in the region

began exploiting the Meadowlands' natural resources and initiated large-scale modification (*e.g.*, ditching and diking) of the Meadowlands for agricultural and other purposes (*e.g.*, transportation and mosquito eradication). With continued population growth and land-use manipulation, the natural water supply became inadequate to supply human demands. The landscape of several watersheds (*e.g.*, adjacent Passaic River basin) was altered and the flows of neighboring rivers were diverted into the Hackensack watershed and stored to provide water. As the human population continued to grow, waters and wetlands and their dependent living resources in the Meadowlands became increasingly neglected and degraded. Degradation of the landscape and waters of the Meadowlands continued for over 200 years. However, since the turn of this century, numerous stakeholders, including NGOs and State and federal agencies, have joined together in an unprecedented manner to protect and restore the Meadowlands. These organizations and agencies have begun several projects to restore specific sites, manage fish and wildlife resources, and educate the public on the value of urban wildlife reserves, nature sanctuaries, and functional wetlands. Such projects are moving environmental restoration forward but make clear the need for, and importance of, *improved collaboration and comprehensive actions (e.g., monitoring, assessment, site remediation, improved water and land use planning) to restore the Meadowlands ecosystem and protect its biodiversity.*

B. NATURAL HISTORY

Notwithstanding the extensive history of misuse of its lands and waters, the Meadowlands remains one of the largest and most productive brackish estuarine wetland complexes in the northeastern United States. The Meadowlands retains and continues to support considerable biodiversity despite the extirpation of many species historically present. It is, in many respects, an urban oasis for many species of plants and animals that find few available or alternative habitats in the highly urbanized, regional landscape. The Meadowlands supports more than 700 species, including more than 330 migratory bird species, and dozens of State-listed and other species that are managed or of special conservation concern. The Meadowlands latitude, geography, and remaining habitats in a sea of urbanization make it a critical stopover area for bird migration. Available information, though limited for many taxonomic groups, indicates that aquatic and terrestrial communities of invertebrates, fishes, amphibians, reptiles, birds, and/or mammals remain imperiled by existing conditions; moreover, the recovery of certain species will be extremely difficult as a result of contaminants and other factors. As coastal areas, especially wetlands, in New England and the middle-Atlantic States are increasingly modified and/or disturbed by human use and activities, the Meadowlands becomes more critical as an environmental oasis for the region's biodiversity. Thus, *development of a comprehensive remediation and restoration plan is critical to address the substantial, complex, and inter-related problems confronting the Meadowlands ecosystem.*

C. HYDROLOGY AND CONTAMINANTS

Historical hydrologic alterations throughout the Hackensack River watershed, despite substantial inputs from nearby watersheds to augment and satisfy the public need for potable water, have greatly reduced the average daily flow of water throughout the Hackensack River and the

watershed, flows which were vital to the biota of the HMD. Secondary treated sewage effluents now comprise the largest source of “freshwater” in the Hackensack River. As a result, water quality in the Hackensack River remains broadly impaired for many criteria (*e.g.*, mercury, fecal coliform bacteria) in comparison with water quality throughout the rest of the Hudson Raritan Estuary, and contributes to hypoxia and other stressors for fishes and invertebrates during summer months. Poor water quality continues to raise serious concerns about the potential functioning of Meadowlands wetlands as “sink” habitats. Such concerns emphasize the need for more *detailed investigations of the movements, diets, and reproduction of fish and wildlife species in the Meadowlands and surrounding region.*

Mercury and the other contaminants of greatest concern in the Meadowlands (*i.e.*, PCBs, dioxins, certain hydrocarbons) are toxic to many species, bioaccumulate in fish and wildlife, and are endocrine disruptors that have adverse effects on growth, survival, and reproduction of animals. Several contaminants that originated from multiple sources or dispersed from localized “hotspots” (*e.g.*, Superfund sites along Berry’s Creek, possibly the most heavily contaminated mercury site in the United States) have become widely distributed in the Meadowlands. The successful remediation of contaminants in such areas is needed; otherwise, restoration activities may create “attractive nuisances” by increasing the availability of those contaminants and their subsequent bioaccumulation in fish and wildlife that use restored wetlands. *Implementation of existing water-quality criteria and development of such criteria for additional contaminants is needed to address the impaired functioning of the Meadowlands ecosystem and the health of its fish and wildlife.* Finally, the legacy of contamination in the Meadowlands will continue and may likely worsen with increasing demand and reuse of the region’s water resources. *Thus, establishment of a state-of-the-art program on a watershed scale to monitor contaminants (including novel compounds) and to address their effects on restoration is critically needed.*

D. WETLAND AND UPLAND LAND USE

Currently, approximately 9,650 acres of wetlands remain in the Hackensack River watershed, of which 5,445 are located in the HMD. There is a pronounced difference in the types, condition, functioning, and risks to wetlands in the HMD as compared to the upper Hackensack River watershed. The large, tidal estuarine wetland areas in the HMD have been highly disturbed through decades—if not centuries—of human activities such as ditching, diking, and dredging. Stream flows have been diverted through culverts, and wetlands have been extensively fragmented by roads and other rights-of-way. As a result, wetlands in the HMD are impaired for certain (*e.g.*, streamflow maintenance) but not all wetland functions. Estuarine wetlands also appear at risk of conversion to deepwater habitats due to sea level rise and other causes (*e.g.*, lack of sediments above the dam). The diverse, palustrine wetlands in the upper Hackensack River watershed help maintain and improve water quality and sustain biodiversity in the lower watershed. However, as a result of their small size, type (*e.g.*, stream), and isolation, palustrine wetlands in the upper watershed remain vulnerable to adverse impacts from surrounding land-use changes and are at increasing risk of development. Thus, Meadowlands stakeholders must also focus attention on *protecting wetlands and adjoining upland buffers in the upper Hackensack River watershed.* Such efforts should include partnerships with agencies and NGOs in New York State.

Landscape cover types throughout the Hackensack River watershed and the HMD have been altered extensively to accommodate human land uses that are typical of the heavily populated northeastern United States. Natural upland areas that serve as buffers around wetlands and water bodies are in poor condition throughout the Hackensack River watershed, and are especially distressed within the HMD. The Meadowlands is recognized as a migration corridor for birds; however, continued adverse impacts on wetlands and uplands (*e.g.*, habitat loss, fragmentation) and exotic species invasion throughout the watershed may diminish the value of the Meadowlands for migratory birds. Better assessment and an improved understanding of buffer-, fragmentation-, and corridor-effects are needed to implement measures to sustain fish and wildlife resources in the Meadowlands. Concerted restoration and planning efforts provide an opportunity for stakeholders to *reverse and rectify historical, adverse land-use impacts on the Meadowlands ecosystem and its biodiversity.*

E. INVASIVE AND EXOTIC SPECIES

Many invasive and exotic plant and animal species occur in wetlands and uplands throughout the Meadowlands and the surrounding watershed. Restoration will require extensive replacement of invasive species with indigenous plant communities more characteristic of the regional landscape. The spread of the invasive form of common reed (Haplotype M), forming dense, monoculture stands throughout nearly all of the Meadowlands, currently presents both a considerable challenge and a dilemma to restoration. Because the spread of common reed has contributed to the loss of native plant diversity, the eradication of common reed has been a major focus of the restoration efforts undertaken to date in the Meadowlands and elsewhere in the Northeast. However, Haplotype M is difficult to eradicate under the current salinity and nutrient regime present throughout much of the Meadowlands and is re-invading most, especially older, restored sites. On the other hand, Haplotype M also grows well in heavily contaminated sediments, stabilizes erosion from some contaminated aquatic sites, and reduces the bioavailability and subsequent effects of certain contaminants. In other words, Haplotype M may be the most acceptable and resistant plant species on some sites because it is able to thrive under the stressful and toxic soil and water conditions. Revegetation with native species may not be advisable on contaminated sites until such sites are remediated. More research is definitely required not just on control of *Phragmites* but also on propagation of native species.

The Service and other stakeholders must collaborate to develop a protocol that will guide decision-making regarding the removal of Haplotype M from heavily contaminated sites. Additional research is needed regarding the effects of Haplotype M on the Meadowlands ecosystem (*e.g.*, growth, survival, and production of fishes) and biocontrol of Haplotype M. Also, the impacts of other invasive plant species (*e.g.*, purple loosestrife, tree-of-heaven, Japanese knotweed) on the Meadowlands ecosystem and its fish and wildlife resources are not well-known and should be assessed and prioritized (given that funding is presently limited). In addition, agencies participating in the restoration of the Meadowlands and elsewhere in the NY-NJ Harbor estuary to date have not addressed invasive species in a coordinated manner but must do so to prevent future invasions of non-native species that may have considerable adverse impacts on indigenous fish and wildlife populations in the region. Public education on the

effects of invasive species, blocking pathways of future introductions, on-the-ground control, working with local nurseries to supply native plant materials, and successful site remediation and restoration are necessary to stop the transport and introductions of exotic and invasive species in the Meadowlands and the NY-NJ Harbor estuary as well as their pernicious effects on the Meadowlands ecosystem. Furthermore, the Service in conjunction with other stakeholders must *identify the desired long-term recovery goals (e.g., vegetational community structure of the Meadowlands) to be achieved through restoration*. This may require modeling that takes into account known and potential stressors such as sea level rise. Given the extreme contamination of much of the Meadowlands, such a plan will need to critically examine and compare alternative remediation, enhancement, and restoration scenarios.

F. RESOURCE OBJECTIVES

Acquisition and protection of remaining wetlands and other open space throughout the HMD and the watershed are critical to safeguarding and sustaining the Meadowlands and its biodiversity. To be effective, prioritization and acquisition of key sites must be planned and coordinated through a central organization. In addition, federal, State, and local laws and regulations should be reviewed to ensure consistency and improve protection of fish and wildlife resources. Stakeholders should review and consider *designation of the Meadowlands as a marine/estuarine protected area to promote and provide comprehensive long-term protection*.

Efforts to restore the Meadowlands ecosystem and protect its fish and wildlife populations must include a comprehensive interagency program to integrate and address hydrologic (*e.g.*, river flow, stormwater control, SLR) and contaminant concerns (*e.g.*, industrial contamination, landfills, sewage treatment). *Many of the historical adverse impacts on fish and wildlife populations can be reversed and rectified*, or at least improved, through: (1) remediation, (2) enhancement, (3) restoration, (4) adaptive management based on monitoring of existing projects, and (5) incorporating urban ecology in future project planning throughout the HRE. It is clear, however, that many questions must be answered through studies and sampling before restoration can begin seriously on a broad scale.

For the Service and most stakeholders, establishment of diverse vegetative communities comprised of native species is a major objective for the Meadowlands. Taking into account the concerns and obstacles discussed throughout previous sections, plant diversity in many wetlands and uplands can still be improved substantially by eradicating and treating common reed that re-invades sites before it becomes re-established, eradicating other invasive exotic species, allowing re-colonization by native species, and monitoring on-site vegetation. *Increasing the extent and connectivity of upland buffer areas* also will promote the recovery of wetland vegetation and the functioning of restored wetlands and will better sustain animal diversity in uplands and wetlands. The Meadowlands currently supports considerable biodiversity, even with all the stressors it contains. Programs targeting the *recovery or re-establishment of populations of keystone species* may further assist the recovery of biodiversity and restoration of the Meadowlands ecosystem.

G. RESEARCH AND EDUCATION

Efforts to remediate, enhance, and restore the Meadowlands and provide long-term protection for its fish and wildlife resources currently are hampered by numerous information gaps; moreover, federal and State agencies are limited in their capacity to generate essential information. Thus, the Service recommends *development of comprehensive and collaborative research programs to provide the highly technical, informational needs required for remediation, enhancement, and restoration*. Research programs should focus especially on: (1) environmental contaminants, water quality, and hydrology, (2) suburban/urban ecosystems, landscapes, and habitats, and (3) invasive and exotic species. Such programs should be developed primarily within and among current stakeholders, but should also be extended to other regional agencies and organizations with certain capabilities and expertise. Communication of research needs and results among stakeholder groups and the principals' group also is critical to ensure that decision-making regarding the Meadowlands and its resources is based on sound science.

Public concern drives public policy, and a citizenry well-informed of the values of the Meadowlands will be necessary to promote acquisition, remediation, and restoration efforts. Development of a unified public outreach program by all stakeholders is necessary to generate and maintain public support for remediating, enhancing, and restoring the Meadowlands and protecting its fish and wildlife resources. In addition, *development of formal and informal educational programs, demonstration projects, and other public exhibits will help stimulate public interest and inspire involvement in Meadowlands issues*.

H. PUBLIC ACCESS AND RECREATION

Social and recreational uses of the Meadowlands have the potential to provide diverse benefits to people in the urban region, including: (1) providing recreational opportunities, (2) increasing local property values and business opportunities, (3) promoting better health and quality of life, and (4) increasing an awareness and appreciation of fish and wildlife and the environment. Thus, social and recreational uses must be carefully considered, planned in the remediation and restoration of specific sites, and subsequently monitored and assessed to prevent future misuse of the Meadowlands. To preserve the Meadowlands ecosystem for future generations of Americans, redevelopment, remediation, and restoration projects must include projects that *increase public access, integrate human uses of open space while sustaining and safeguarding fish and wildlife, and contribute to a new public image for the Meadowlands*. Some projects are underway but lack a vital ingredient: *all stakeholders working together for the future*.

I. RESTORATION PLANNING AND COORDINATION

Numerous federal and State agencies and others are involved in restoration of different sites in the Meadowlands. However, presently there is no shared vision to guide these restoration efforts consistently. Greater collaboration among federal and State agencies, local governments, and NGOs is necessary to address in a more efficient and effective manner the complex problems and issues regarding the restoration of the Meadowlands and the long-term protection of its fish

and wildlife resources. While current funding is adequate to restore small sites, it does not allow sufficient site investigation prior to restoration or monitoring after restoration to determine what has worked or what is not working. Also, such limited funding is inadequate for improving larger sites that may offer greater wildlife benefits. As a result, the current funding will not provide for a comprehensive restoration of the Meadowlands ecosystem. Therefore, stakeholders must *investigate development of a specific funding authority for the restoration of the Meadowlands*. While development of such an authority may take time, current restoration efforts in the Meadowlands could be greatly improved by developing an interagency memorandum of agreement that establishes a principals' group supported by a technical oversight committee to develop a collaborative process and ensure coordination on acquisition, regulatory, remediation, research, and other restoration issues.

J. SUMMARY

Initial efforts to restore and protect the Meadowlands are encouraging; however, improved stakeholder collaboration, comprehensive water- and land-use planning, and long-term management are necessary to address and rectify the complex problems affecting the Meadowlands ecosystem. The long-neglected wetlands, waterways, and fish and wildlife of the Meadowlands must be recognized as public resources; stakeholders must consistently embrace the Meadowlands as one of the region's unique public treasures. The Service and other stakeholders must *work in a coordinated effort, guided by a common vision, to sustain and safeguard the Meadowlands ecosystem, including its fish and wildlife resources*.

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Theodore Roosevelt