



Hudson River Estuary Program

HUDSON RIVER ESTUARY ACTION AGENDA 2015-2020

Opportunities for Action

Helping people enjoy, protect and revitalize the Hudson River and its Valley



A Program of the New York State Department of Environmental Conservation

In cooperation with several state and federal agencies, as well as private partners

Andrew M. Cuomo, Governor

Basil Seggos, Acting Commissioner

About the Hudson River Estuary Program

The Estuary Program helps people enjoy, protect and revitalize the Hudson River and its valley. The program was created in 1987 and extends from the Troy dam to upper New York harbor. It is guided by an action agenda, which is updated periodically. This is the new Action Agenda for 2015-2020. The program achieves real progress through a collaborative approach that includes:

- Grants and restoration projects
- Education, research and training
- Natural resource conservation and protection
- Community planning assistance

Implementation of the Action Agenda relies on partnerships with federal and state agencies, as well as local municipalities, non-profits, academic and scientific institutions, businesses, trade organizations, landowners and dedicated volunteers. The Hudson River Estuary Management Advisory Committee (HREMAC) provides guidance to the program, helps the state define goals and evaluate progress, and provides a communication bridge to a wider group of partners and stakeholders. Numerous government partners participate as *ex-officio* members of the committee and help deliver our Action Agenda results. Agency members include:

- NYS Department of Health (DOH)
- NYS Department of State (DOS)
- NYS Office of Parks, Recreation and Historic Preservation (OPRHP)
- Hudson River Park Trust (HRPT)
- Hudson River Valley Greenway (Greenway)
- NOAA, Hudson River National Estuarine Research Reserve (NOAA, HRNERR)
- NY Sea Grant
- US Army Corps of Engineers (USACE)
- US Environmental Protection Agency (EPA)
- NY-NJ Harbor and Estuary Program (HEP)
- Interstate Environmental Commission (IEC)
- New York City Department of Environmental Protection (DEP)

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Hudson River Estuary Program Mission

The Hudson River Estuary Program helps people enjoy, protect and revitalize the Hudson River estuary. Created in 1987 through the Hudson River Estuary Management Act (ECL 11-0306), the program focuses on the tidal Hudson and its adjacent watershed, from the dam at Troy to the Verrazano Narrows in New York City. Appendix 2 shows the geographic setting for our work.

The mission of the Estuary Program is built around six key benefits people receive from a strong and vibrant ecosystem:

- Clean Water
- Resilient Communities
- Vital Estuary Ecosystem
- Estuary Fish, Wildlife and Habitats
- Natural Scenery
- Education, River Access, Recreation and Inspiration

The Estuary Program collaborates with many partners: non-profit organizations, businesses, local governments, state and federal agencies, and interested citizens to deliver these benefits. It develops knowledgeable and effective stewards of the estuary, using an understanding of ecology as a foundation for all of its work. The Estuary Program continues to be rooted in 12 long-range goals that can be found in Appendix 1. The targets and outcomes set for each benefit follow our selected list of accomplishments below. The program is funded through the NYS Environmental Protection Fund and through collaborative projects.

About the Action Agenda 2015-2020

The Hudson River Estuary Program's work is guided by an Action Agenda—a conservation and restoration blueprint which is periodically updated. This document expresses a shared vision for the region, as defined by diverse groups of people who live and work along the river and in its watershed. The Estuary Program's role is to develop the essential actions necessary to achieve that vision and to organize, support and guide many agencies, municipalities, organizations, and other stakeholders to realize that vision.

DEC developed this *Action Agenda* update for 2015-2020 with the input of many community groups and citizens throughout the region, including a Hudson River Summit attended by over 300 people in the spring of 2015. The outcomes included here are measurable and achievable by 2020 and will build on a strong record of success in achieving progress in each of our core areas of expertise. To deliver these outcomes, the Estuary Program offers a variety of programs to support our partners, including education, training, research, technical assistance, mapping, capital projects and grants. By engaging, informing and empowering communities, organizations and individuals, the Estuary Program enables many partners to produce positive impacts on the long-term health of the Hudson River estuary and its watershed.

Government and non-governmental partners have been crucial for the Estuary Program's success. No one organization or agency can fund all the science, education and conservation

initiatives needed to protect and restore the Hudson and its watershed. The volunteer members of the Hudson River Estuary Management Advisory Committee (HREMAC) provide valuable input and advice and help advance the collaborative spirit of the program. Appendix 3 includes a list of HREMAC members and government agency partners.

Since the writing of the last Action Agenda in 2010, the trends, challenges and opportunities that face us have taken on new urgency. We have experienced extreme weather, flooding and coastal storm surges consistent with climate change predictions. We now know that sea level has been rising on the Hudson for a century. We recognize these as clear and definable factors in our environment that pose challenges never before encountered on such a large ecosystem scale.

Our water supply and wastewater infrastructure are aging. Large sums will be required to repair and upgrade them to ensure adequate capacity for current and future climate conditions and for growth in the valley. Other challenges include continued threats to the region's biological diversity and the Hudson's signature fisheries. Changes in land use and sprawl affect the productivity of the ecosystem. Impacts from an emerging suite of new contaminants and a continuing parade of potentially harmful invasive species are cause for concern. Activities such as the expanding transport of oil by rail and barge are also a concern due to risks from harmful spills.

Likewise, the population of the valley is experiencing its own set of changes. Our population is aging and becoming more diverse, requiring a shift in the kind and location of amenities provided by public services. Increasing numbers of residents and tourists are using the entire Hudson for swimming and other activities, raising concerns over water quality and the public's knowledge about river conditions. We are seeing a trend among residents of all ages toward living and working in the region's more urban areas, increasing the need for these areas to become desirable places to live and work and also to become more resilient to changing conditions in the future. Again, this will affect where we put our resources in order to best reach and service the community.

Like the sources of these emerging issues, the solutions must include a diversity of management actions and must involve everyone. The Hudson River Estuary Program, with its model of leadership through partnership, is prepared to take on this challenge. It builds community stewardship by engaging, informing and empowering the people who live, work near and care about the river and its communities to bring about real progress for the river. Our core understanding of ecology, as well as our ability to work across jurisdictions and agency boundaries enables us to develop and implement a shared vision for the river and its valley.

Updating the Action Agenda for the next six years is the first step in continuing this legacy. Development of our program is an ongoing process open to modifications as we progress, and it can be carried out only with the help of existing and new partners. As you read this Action Agenda, we hope you will consider how your vision for the Hudson can be woven into this shared strategy for the future of the river and for the benefits it provides the people who live in, work in and enjoy this remarkable place.

Executive Summary

In the following pages, we present our Action Agenda for 2015-2020. For each of the Agenda's six benefits, we set forth a long-range vision statement and priority targets, as well as measurable outcomes and a selection of actions to be pursued. Our over-arching long-range goals are contained in Appendix 1.

Below is a summary of what's new for 2015-2020 and how our work will be focused.

Clean water:

- Support clean water projects to enhance recreational uses, drinking water sources, and ecosystem vitality, with an increased emphasis on programs to:
 - Identify and support projects which will reduce pathogens entering the Hudson from sewer overflows, run-off, storm water, and failing wastewater treatment systems
 - Support green infrastructure stormwater projects to reduce storm water flows in target pollution areas, such as cities and villages where stormwater is contributing to wastewater overflows and spills
 - Assist communities to sustainably protect water sources in ecologically sound ways
 - Monitor Hudson River environmental conditions in real time
 - Investigate emerging contaminants such as micro plastics
 - Provide funding for pilot communities to develop plans that will prioritize and manage investments in their water quality infrastructure assets
 - Support communities with protecting their drinking water resources
 - Build capacity with communities and watershed groups to implement strategies that protect and maintain water quality in tributaries
 - Protect and restore streamside areas for water quality protection and habitat through plantings and local land-use practices

Resilient communities:

- Expand our investments in resiliency projects, empowering local communities to take positive action on their shoreline to:
 - Reduce their vulnerability to flooding, sea-level rise and storm surges
 - Use and adopt best management practices for adapting to climate change on the river, on tributary streams and in the watershed
- Remove dams and re-size culverts on tributary streams to create solutions that will:
 - Reduce local flooding conditions
 - Improve habitat for species such as American eel
- Assist property owners, land trusts, regional and local leaders in using best land-use methods for conserving natural resources, with an emphasis on areas deemed most important for sustaining a healthy estuary, including:
 - Forests
 - Wetlands
 - Tributary streams

- Help shoreline communities clean up contaminated areas such as brownfields, and improve environmental justice areas
- With community support, conserve 15,000 acres of farms, forests, wetlands, source-water and aquifer protection lands and ecologically significant habitats in the watershed with willing landowners (see also scenery below)

Estuary Fish, Wildlife and Habitats, and a Vital Estuary Ecosystem:

- Continue management programs to restore or sustain American shad, Atlantic sturgeon, river herring, striped bass, and American eel
- Expand our “ecosystem approach” with scientific assessments which will improve our understanding of food webs and habitat use and allow us to use this information for management
- Continue to monitor the extent of vital habitats undergoing rapid change, such as submerged aquatic vegetation
- Design and implement projects to restore river habitats and expand their extent, as defined in the *2014 Hudson River Estuary Habitat Restoration Plan*
- Conserve wetlands and shorelands that may become tidal habitats in the future as sea level rises

Natural Scenery:

- Create on-line and interpretive resources where visitors can learn about the Hudson Valley’s world-famous scenic vistas and viewsheds
- Conserve 2,000 acres of land along or in sight of the Hudson River (coordinate land acquisition needs for conservation of river habitats, scenery, recreation, and water resources and to support resilient communities).
- Provide assistance and resources to landowners and communities who wish to conserve their natural scenery

Education, River Access, Recreation and Inspiration:

- Provide new and upgraded access facilities (boating, fishing, swimming, and wildlife-dependent recreation) along the Hudson, with an increased emphasis on programs to:
 - Enhance the flood and storm resilience of river shoreline access
 - Expand the use of the principles of universal design so that people of all abilities are better able to use river access sites
 - Invest in such improvements at local and state river access sites
- Enhance the impact of our existing programs to educate school children through learning experiences:
 - Support and extend the learning available through Day in the Life of the Hudson River Estuary, through on-line lesson plans and distance learning opportunities at Norrie Point, and citizen science projects
 - Develop short, engaging videos for on-line learning
- Help citizens become better and more informed stewards of the estuary and its ecosystem:
 - Create destinations, exhibits, signage and programs for learning about the Hudson
 - Expand the participation of area residents in stewardship activities

Selected Accomplishments since 1987

Since its creation in 1987, the Hudson River Estuary Program has made significant inroads in meeting the needs of the river, the valley and the people who benefit from and rely on the health of the river and its watershed for their daily lives and their future. This work has included nearly three decades of intensive research, adaptive approaches to management, public outreach, and the development of lasting partnerships. We have much to celebrate!

The following highlights just a few of the program's numerous accomplishments, demonstrating how, together, the Estuary Program and its partners have made a difference for the river and valley we share.

Clean Water

- Water quality in the Hudson has improved dramatically since the 1970s and early 1980s, and the estuary now supports a variety of uses, including swimming, boating, fishing and water supply. These improvements are largely due to the construction of sewage treatment plants, including the North River facility on Manhattan, as well as projects funded through the 1986 Environmental Quality Bond Act and the 1996 Clean Water Air Bond Act. From Albany to New York City, more than 220 species of fish now call the Hudson estuary home for some or all of their life cycle, including spawning populations of shad, striped bass and sturgeon. In New York harbor, oysters are returning.
- For decades, PCB pollution in the river has been the number one chemical contaminant issue to address. In 2009, the General Electric Corporation began PCB cleanup for the sediments in the upper Hudson. Phase 2 of this dredging project began in 2011; the mandated dredging work was completed in 2015, though additional PCBs remain. The project resulted in the removal of more than 2.75 million cubic yards of contaminated sediment, containing an estimated 300,000 pounds (150 tons) of PCBs from the upper Hudson between Fort Edward and Troy. Though our program role in this was limited, the removal of so much PCBs from the ecosystem is anticipated to significantly help us achieve our long-range goals.
- In 2008, DEC and partners established the Hudson River Environmental Conditions Observing System (HRECOS) to gather real-time, internet-accessible monitoring data for



PHOTO CREDIT: PAUL BASTIN

the Hudson River, tracking temperature, turbidity, tides and weather conditions. This innovative collaboration between DEC, the Hudson River Foundation, the National Estuarine Research Reserve, the U.S. Geological Survey, the Cary Institute of Ecosystem Studies, the Lamont Doherty Earth Observatory, Hudson River sloop “Clearwater,” the Beczak Center, and the Stevens Institute of Technology, offers a comprehensive look at the river and its responses to changing conditions in a way never before possible. HRECOS, supported by the Estuary Program, includes more than a dozen stations on the Hudson, the Mohawk River and other tributaries and streams. New partners are expected to join this collaboration in the future.

- In 2008, DEC partnered with the Capital District Regional Planning Commission to address more than 100 combined sewer overflows (CSOs) in the Capital District. The Estuary Program contributed more than \$2 million for planning and engineering studies. In 2014, DEC and capital region cities negotiated agreements expected to reduce swim-season pathogens in the “Albany Pool” by 80%.
- Citizen science initiatives, first piloted in the estuary, have expanded to become state-wide programs. The Estuary Program’s “Trees for Tribs” (tributaries) was launched in 2007 to improve stream buffer habitats and protect water quality by planting native trees and shrubs. It grew into New York State’s Trees for Tribs Program, expanding to other watersheds. Water Assessments for Volunteer Evaluators (WAVE), created by the Estuary Program and DEC’s Division of Water to promote volunteer water-quality monitoring in Hudson River watershed streams and tributaries, became a statewide DEC program in 2014.
- Through partnerships with soil and water conservation districts and community groups, the Estuary Program has supported the construction of green (nature-based) infrastructure projects in Poughkeepsie, Kingston, Middletown, Warwick, Newburgh, New Paltz and other municipalities. The sloop Clearwater has continued this work in Poughkeepsie and Newburgh as part of its Green Cities Program, with volunteer support from the Fall Kill Creek and Quassaick Creek watershed groups. The Estuary Program partners with 15 tributary watershed groups to support development of a river stewardship ethic throughout the valley. Estuary Program support for Riverkeeper’s water quality website and citizen sampling program has helped inform many people of specific problems in their communities.
- A companion Action Agenda has been developed and is being implemented for the Mohawk Valley to guide stewardship of the Hudson’s largest tributary system.

Resilient Communities

- The Hudson River Estuary Program has been helping communities increase resiliency by protecting natural areas with land-use planning since 2001. In 2006, we added a focus on climate change. In 2012 after Superstorm Sandy, we accelerated our work on adapting to inland flooding and sea-level rise in response to Governor Andrew Cuomo's call for action. The NYS Interagency Climate Adaptation Work Group, facilitated by Estuary Program staff, organizes 12 state agencies—DEC, the Environmental Facilities Corporation, Department of Public Service, State University of New York, Department of Ag and Markets, Dormitory Authority of the State of NY, NYS Energy Research and Development Authority (NYSERDA), Department of State, Department of Transportation, Department of Health, Office of the Attorney General and the Department of Homeland Security and Emergency Services—to develop informational tools and guidance for community vulnerability assessments and adaptation planning.



PHOTO CREDIT: STEVE STANNE

- The Estuary Program funded the development of a statewide Climate Smart Certification Program to help communities take action to mitigate and adapt to climate change. The project was managed in partnership with NYSERDA and the DEC Office of Climate Change. Several volunteer municipalities representing large, small, urban and rural communities and counties tested the recommendations.
- In 2013, the Estuary Program partnered with Scenic Hudson and others to pilot the first Tidal Waterfront Flooding Task Force in the City of Kingston. The Kingston City Common Council unanimously adopted the task force's recommendations in November 2013. Following this success, the Estuary Program worked with Scenic Hudson, the Village of Catskill and the Village of Piermont to begin similar task forces in 2014; both villages are now implementing the recommendations of their task forces. A task force is also underway in the Town of Stony Point in collaboration with the NY Rising Program. A program with Historic Hudson River Towns helped build awareness of flooding issues and sea-level rise in Putnam and Westchester counties.

- In 2013, the Estuary Program released high-resolution elevation data or LiDAR (light detection and ranging) for the entire estuary shoreline. LiDAR allows us to determine shoreline elevation at one-foot contour intervals. Using these data, Scenic Hudson released an online “Sea Level Rise Mapper” for the Hudson River shoreline as part of a collaborative effort with DEC to map natural and human resources at risk of sea-level rise and storm surge along the estuary shoreline. The mapper also helps to identify potential long-term planning issues and conflicts.
- Estuary Program staff collaborated with the NYC Department of City Planning and the Mayor’s Office of Recovery and Resiliency to research and understand the ability of natural and engineered buffer areas and wetlands to maximize coastal resiliency to sea-level rise and storms. A plan for using coastal green infrastructure, including constructed reefs, wetlands and barrier islands, was developed for Great Kills Harbor in Staten Island in partnership with New York City.
- The Estuary Program has raised the capacity of municipalities to conserve natural areas and build resilience through local conservation and land use. Since 2001, the program has provided technical assistance to 96 towns, cities, and villages and trained more than 5,000 land-use decision-makers throughout the Hudson Valley. *Conserving Natural Areas and Wildlife in Your Community* (2008) and *Creating a Natural Resources Inventory* (2014) are tools developed to improve local stewardship. Assistance from the Estuary Program has contributed to at least 27 new municipal plans, policies, and procedures that will help build community resilience through protection of natural areas in the watershed.
- The Estuary Program partnered with The Nature Conservancy to identify culverts and dams that are barriers to the movement of fish and other aquatic species throughout the watershed and its tributaries. This database has been merged with information on undersized culverts which present potential flood hazards to communities. The project identified 140 stream barriers which limit the movement of fish and wildlife species of greatest conservation need (SGCN) in the estuary watershed. The project also assessed the capacity of over 330 culverts to pass flood flows in three small watersheds.

Vital Estuary Ecosystem



PHOTO CREDIT: TERRY HARDY

- Since 1987 the Estuary Program, in partnership with other DEC programs (Hudson River National Estuarine Research Reserve [HRNERR], the New York Natural Heritage Program and others), have assembled one of the most extensive biological survey and habitat mapping efforts of any region in the state. Key aquatic habitats that have been mapped include: the river bottom, tidal wetlands, and natural shoreline from the Tappan Zee Bridge to Troy. Wildlife biologists completed upland inventories of rare plants, animals, breeding birds and exemplary habitats, documenting for the first time the global, regional and statewide significance of the area's plants and animals.
- The NOAA Estuary Training Program was established through HRNERR and provides high-quality training on habitats, resource management, technical skills and process skills to local decision-makers, community leaders, environmental groups, local land trusts, natural resource managers and regulators. The Estuary Program's biodiversity outreach program also provides high-quality training and technical assistance to help municipalities incorporate habitat into local land-use planning efforts. The combined effort of these and other programs has trained more than 5,000 decision-makers on local land-use practices that can protect watersheds and ecosystems.

- One the most dramatic comeback stories of the past 25 years is the return of the bald eagle. In 1987, the sighting of a bald eagle was considered rare; only in winter could this bird be seen feeding in the open waters in the Hudson Highlands. After a 100-year absence, the first successful breeding pair of eagles was recorded along the Hudson in Greene County in 1997. Today, as many as two dozen pairs of breeding eagles make the Hudson estuary corridor their home, and the number keeps growing. Dozens of sightings are reported weekly to the *Hudson River Almanac*.
- *The Hudson River Estuary Habitat Restoration Plan*, released in 2014, provides a roadmap to achieve the estuary's aquatic habitat management goal by identifying actions to restore tidal shorelines and shallows and to facilitate fish passage up the Hudson's tributaries. The plan builds on work started in the 1980s by the Estuary Program and HRNERR, a NOAA-DEC partnership created in 1982.
- Projects to understand the connection of food webs, habitat and fish reproduction in the estuary continue with particular assistance from the SUNY College of Environmental Science and Forestry and the Hudson River Foundation. We are also seeking to understand the factors contributing to the reduced numbers of juvenile fish counted in our recent annual monitoring programs.
- Since 2012, DEC staff and citizen-science volunteers have documented a river-wide decline of more than 90% of submerged aquatic vegetation (SAV) in the Hudson River estuary. The loss of SAV may be related to the deposit of 1.75 million tons of sediment from tributaries of the estuary between Poughkeepsie and Troy after Hurricane Irene and Tropical Storm Lee in 2011. SAV is recovering gradually in parts of the estuary, albeit at a slow pace. Current research is contributing important information about SAV populations, prospects for recovery and best approaches for restoration.
- HRNERR, in partnership with the Estuary Program, launched Sustainable Shorelines demonstration projects at two state park sites—Dockside, the Hudson Highlands State Park in Cold Spring and Nyack Beach State Park. A Sustainable Shorelines design project at Nutten Hook is newly funded. A handbook, *Managing Shore Zones for Ecological Benefits*, was released in 2015.

Fish, Wildlife and Habitats

Since 1987 when the Estuary Program was created, New York State has emerged as a strong voice in assessing stock condition and updating amendments to interstate fishery management plans. The Estuary Program has provided scientific support and stock monitoring assistance, enabling DEC to manage fish populations, which drive \$7.5 million annually in recreation and tourism expenditures. Specific results of these efforts are as follows:

- The striped bass fishery increased substantially from the mid-80s through the 1990s. With the increase in population, came increased recreational fishing pressure. Relatively low young-of-year production in the Hudson over the past decade is cause for concern for future spawning stocks. The Atlantic States Marine Fisheries Commission (ASMFC) has acted to stem the decline in coastal migratory spawning stock females, including the Hudson stock, to ensure a future for this important sport fishery.
- The Atlantic sturgeon fishery was closed in 1996 in New York and in 1998 in coastal waters. We are now beginning to see some recovery in the Atlantic sturgeon population, as protected-year classes (from the 1996 closure) are starting to come back to spawn. Atlantic sturgeon was declared an endangered species by NOAA in 2012 under the Endangered Species Act.
- The Atlantic sturgeon juvenile abundance survey has showed a positive trend since 2006, and, last year, catch of juvenile fish was the highest since the sampling program began.
- Research from tagged juvenile Atlantic sturgeon shows that a group of fish spends fall and early winter in a specific shallow water area of Haverstraw Bay. DEC's Hudson River Fisheries Unit and estuary habitat staff began examining this area in 2013 to understand why fish stayed. Food availability is one likely factor.



PHOTO CREDIT: REBECCA HOUSER

- Despite extensive measures taken to conserve them, shad populations have dramatically declined. DEC adopted a shad recovery plan in 2008, which is now being implemented. Recovery has been slow, but our continued annual monitoring of young-of-year abundance should detect any trends in recovery. In fact, 2014 was the best measured abundance since 2011, indicating management changes may be having a positive impact.
- With partners at Bard College and the Village of Ossining, low-tech, affordable “eel ladders” are being successfully piloted by volunteer and school groups to aid migrating eels in reaching additional habitat areas in tributary streams above human-made barriers.
- DEC installed a fish counter in Black Creek to estimate the number of river herring using the creek to help us understand the timing of their movement into the creek and to test the usefulness of this monitoring equipment. The counter tallied 40,000 fish in one day during the peak of fish movement in 2013. Anglers and students have helped us count herring in our creeks, providing important citizen-science data in support of management.
- DEC has mapped key habitats in the Hudson, including the estuary’s tidal wetlands, submerged aquatic vegetation beds, deep and shallow water river bottom, and shoreline from the Tappan Zee Bridge to Troy, enabling biologists to develop a better understanding of food webs and habitat use for Atlantic sturgeon, river herring, shad and striped bass. Fisheries and marine habitat experts have used sonic tags, satellite tags, tracking devices, digital maps and traditional net-fishing methods to identify the links between fish movement and important fish habitat in the river.

Natural Scenery

- In the ten Hudson Valley counties that border the estuary from the Troy dam to New York City, state programs have conserved more than 46,133 acres of scenic vistas, habitats and pastoral landscapes since 1996, including more than 3,500 acres of land along or in sight of the Hudson. This is achieved through partnerships with OPRHP, the U.S. Forest Service, land trusts and others.
- Communities have completed or are developing open space plans through the Estuary Grants Program, and several others have adopted funding mechanisms to conserve local open space. Acquisition-easement grant projects have been completed or are underway to help protect valuable local open space resources.



PHOTO CREDIT: STEVE STANNE

- As part of our ongoing scenic resource database project, in partnership with the Hudson River Valley Greenway, we have identified 1,541 scenic resources and other related features. Information was compiled from 11 datasets, including: Hudson River School Art Trail locations; Fire Towers; Scenic Areas of Statewide Significance; Greenway Trails; Minnewaska State Park Historic Sites and Waterfalls; State Trails; recommended State Fishing Locations; Hudson River Valley Scenic Byways; and Wild, Scenic and Recreational Rivers. They can be seen by the public through an online mapping platform (http://www.landscape.org/new-york/featured_places/hudson_river_valley/).
- In partnership with Metro-North railroad, we removed unsightly and unused utility poles and the wires that dangled from them into the Hudson in the scenic Hudson River Highlands. We partnered with Olana State Historic Site to identify key vista points for conservation.

Education, River Access, Recreation and Inspiration

- Our annual “Day in the Life of the Hudson River” takes place every year in October. Now in its 13th year, the program engages partners from more than 90 schools and reaches more than 3,000 students each year. Participants catch fish in seine nets, track the river’s tides and currents, collect core samples from the river bottom and examine water chemistry. Data collected at 80 different



PHOTO CREDIT: CHRIS BOWSER

- riverfront sites, from New York City to Lock 5 in the Hudson River and into the Mohawk watershed, is shared online to show how each piece of the river fits into the larger Hudson estuary ecosystem. The program is produced in partnership with the Lamont-Doherty Earth Observatory of Columbia University.
- The goal of providing new or improved access in every community has been met where feasible. Seventy-six estuary grants have been awarded for trailered and hand boat launches, fishing piers, on-shore fishing access, trails and shoreline access, swimming and other water-related recreation. Additional access has been developed by DOS, OPRHP, the Hudson Valley Greenway, and DEC cooperative agreements. In 2007, the Estuary Program released the Hudson River Estuary Public Fishing and Boating Access map on CD and posted this information to the Estuary Program’s webpage.
- Our 1990 report, *Between the River and the Railroad*, in collaboration with other agencies, set the stage for acquisition of state lands at Denning Point, Kowawese, and Nutten Hook, as well as development of Schodack Island as an accessible state park. We partnered with Rockland County to develop its new park on the Hudson and with the Greenway and the Water Trail Association to expand access opportunities for kayaking and canoeing on the Hudson. We worked with Pete Seeger to create the RiverPool at Beacon for children to safely swim in the Hudson.

- In October 2009, the Walkway Over the Hudson State Historic Park opened as a legacy project of the Hudson Fulton Champlain Quadricentennial. The park provides access to the Hudson River's breathtaking landscape for pedestrians, hikers, joggers, bicyclists and people with disabilities and is one of the most visited parks in the state. Interpretive panels developed by Estuary Program staff and mounted along the span of the walkway, and a public-friendly display of real-time HRECOS data, reach thousands of visitors with educational information about the river.
- The Estuary Program, in partnership with the New England Interstate Water Pollution Control Commission (NEIWPC), awarded four grants to help provide access to the river and its tributaries for underserved environmental justice communities in Albany, Kingston, New York City and Yonkers. Partners included Groundwork Yonkers, WEA, and the cities of Albany and Kingston.
- The Estuary Grant Program has provided seed money for local work on Action Agenda goals since 1999. To date, 416 grants totaling more than \$14.25 million have been distributed to and matched by municipalities and not-for-profits to build new or improved access facilities, develop alternative shoreline management techniques, map habitats and develop open space and natural resource inventories, restore fisheries, lead climate change adaptation efforts, provide educational programs, protect important lands and scenic resources, and much more.

Benefit 1: Clean Water

Vision

The Hudson River estuary is drinkable, swimmable and fishable.



PHOTO CREDIT: DARCY SALINGER DE VALENZUELA

Clean water is vital to all aspects of life in the Hudson Valley, from drinking water for communities, to infrastructure for economic growth, to clean headwater streams and estuary waters supporting robust fisheries and recreation. After decades of misuse, the Hudson River estuary is increasingly cleaner, providing drinking water for many communities and attracting businesses to the region. These improvements are the result of successful state and federal laws such as NYS's Pure Waters Bond Act, the 1986 Environmental Quality Bond Act and the Clean Water Act, as well as local land-use laws and collaborations among concerned residents, interested businesses, dedicated non-profit organizations and government agencies at all levels. Continuing these positive partnerships will not only maintain the successes achieved to

date, it will help increase clean water benefits in the future and help us make progress toward the following long-range goals to:

- Ensure that Hudson River water quality supports drinking water, swimming, fishing, navigation and ecosystem needs. [Estuary Program Goal 10]
- Protect and restore the streams, their corridors and the watersheds that replenish the estuary and nourish its web of life, and sustain water resources that are critical to the health and well-being of Hudson Valley residents and the ecosystem. [Estuary Program Goal 4]

The estuary has met certain water quality expectations for many years but has not met others. The future of sustainable drinking water will require a comprehensive management approach to our water resources throughout the watershed. On the Hudson, significant water withdrawals are managed on a case-by-case basis. Planning, policy and local conservation measures are needed to meet our long-range goals to conserve clean drinking water as an ecological and economic asset in the region.

The Estuary Program, in partnership with DEC's Division of Water and the NYS Environmental Facilities Corporation, has funded many water quality improvements. However, the need far exceeds available funding. Development of asset management plans for the long-term maintenance of wastewater infrastructure will help municipalities better manage their systems.

The Estuary Program can help by providing technical assistance to communities. In 2008, we began to promote the use of green infrastructure to reduce stormwater pollution, while also delivering benefits for urban living conditions. We are now poised to rapidly expand the use of green infrastructure to reduce combined sewer overflows at strategic sites on the river.

Current trends, challenges and opportunities that will affect our ability to provide these human benefits of the estuary while also sustaining the ecosystem:

- Climate change and changing weather patterns are affecting all aspects of water management, including impacts on aquifer recharge, the potential for increased periods of drought, the position of the salt front and its impact on certain water supplies and the ecosystem as well as other stormwater-related impacts to water quality, and the impact of sea-level rise on wastewater infrastructure in shoreline communities.
- Failing wastewater infrastructure and separated and combined sewer overflows along the estuary and its tributaries will require significant investments to maintain current water quality, and more investment will be needed to secure water quality improvements.
- Additional investment and resources are needed to mitigate stormwater impacts from urban/suburban and agricultural sources, as well as possible impacts from failing on-site septic systems in some locations.

- Increasing numbers of residents and tourists are using the entire Hudson for swimming and other recreation. High pathogen levels in some areas at times may pose health risks for these people. Accurate, timely and publicly available information about water quality is needed in areas most used for swimming.
- Increasing transport of hazardous materials, such as oil on barges and by rail, increases the threat of spills, which could affect water supplies and ecosystems.
- Policies and practices are needed to assure long-term availability of water for people and ecosystems, including management of out-of-basin transfers to meet regional needs, reduce impacts on ecosystems and sustain human use in the future.

Priority Targets, Measurable Outcomes and Selected Actions for 2015-2020

LONG-RANGE TARGET 1: Water quality in the estuary, its tributaries, and watershed is maintained and improved to support municipal drinking water supplies, swimming and other types of water-based recreation, as well as aquatic life.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress.

- a) Municipal sewage systems with infrastructure problems resulting in chronic/repeated sanitary sewer overflows (SSOs) which have been reported under the Sewage Pollution Right To Know Law are identified, and plans to fix the failures are developed.
- b) All CSO communities are taking steps to reduce the number, frequency and volume of effluent flow that contributes to pathogens in the estuary by implementing approved long-term control plans.
- c) Plans and projects are underway so that all municipal discharges that currently lack disinfection will be upgraded with adequate disinfection.
- d) The region-wide need for waste-water infrastructure investments to improve estuary water quality has been characterized.
- e) Five communities in priority areas along the estuary are developing asset management plans for prioritizing future investments in their aging, failing, and at-risk wastewater infrastructure.
- f) Green infrastructure is used where feasible and cost effective to achieve more pollution reduction in the estuary, and the effectiveness of green infrastructure as a tool for improving water quality is better understood.
- g) The contribution of bacteria to pollution of tributaries from sources such as wastewater facilities, septic, agriculture, storm run-off, animals, etc., as well as the influence of such pollution and risk to the Hudson is better understood.

- h) All municipalities will have information available on the web about the highest quality streams in their community, and five willing pilot communities will receive technical assistance to protect them.
- i) Projects are underway to address emerging contaminants such as PPCP, road salt, micro-beads and microplastics and to promote trash-free waters.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Identify opportunities for inter-municipal cooperation to assure that policies and practices are in place that will provide clean water in the region and protect the quality of water resources to meet community and ecosystem needs in the watershed; provide trainings/technical assistance to municipalities on water quality protection and management.
- Work at the state and local levels to continue progress in reducing pathogens and enhancing water quality in the Hudson River and tributaries, especially through infrastructure improvements; create a prioritized list of publicly owned wastewater treatment facilities in need of investment for water quality improvements or at risk of flood damage, and identify ways to assist them. Support research that tracks down sources of pathogens to improve management decisions to reduce impacts to recreation.
- Implement tributary watershed strategies to address stormwater impacts to streams, rivers, and the estuary.
- Work with watershed groups, regional partners and municipalities to implement resource strategies that protect the biological integrity of streams and rivers in the watershed and their influence on the estuary.
- Encourage communities to adopt and implement long-range capital improvement or asset management plans and resiliency strategies for their sewer systems and treatment plants, which will benefit economic competitiveness and also reduce sewage overflows and pathogen and nutrient loads.
- Work with federal and state partners to create a comprehensive restoration plan that addresses water quality needs.
- Provide timely, visible, and meaningful information to communities and recreational users about sewage spills and other incidents and using Sewage Pollution Right-to-Know reporting and other mechanisms so people can make informed decisions about recreating on the Hudson.

- Monitor ambient water quality to better understand conditions that affect recreational uses and make this information available to the public. Better understand which pollution factors impair swimming in the estuary, including sources of pollutants and their transport. Develop citizen-science protocols to improve the quality and availability of this kind of data.
- Promote knowledge of the current condition of the Hudson River ecosystem through the Hudson River Environmental Conditions Observing System (HRECOS).
- Conserve natural areas, forests, and wetlands where they will protect water quality for water supplies and high-quality streams.
- Identify pollutants, including emerging contaminants (e.g., personal care products, microplastics, pharmaceuticals), which may in the future impact our ability to provide clean source-water quality and develop strategies to address them.

LONG-RANGE TARGET 2: Communities sustainably manage water resources for drinking water and other uses in ways that also support resilient ecosystems

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress.

- a) Define locations in need of inter-municipal collaboration for sustainable source-water protection, and develop strategies that can be applied to promote inter-municipal cooperation.
- b) Five willing communities or watershed groups are receiving assistance to sustainably protect their water resources in ways that also support resilient ecosystems.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Develop regional approaches to managing water sources as ecological and economic assets in the region. Continue to engage county planning agencies, local municipalities, regional agencies, water purveyors/suppliers, the economic development community and policy makers to better understand and manage these water resources sustainably. Coordinate with regional sustainability plans.
- Assist watershed groups with updating management plans and on-the-ground projects intended to protect and conserve source-water and sustain stream flows.
- Support implementation of specific projects and practices that would improve the sustainability of water sources, including water conservation, green infrastructure, riparian buffer restoration and forest conservation.

- Engage local and state agencies on regional water supply and wastewater treatment issues to support ecosystem health and economic development in priority growth areas. Where appropriate, assist voluntary consolidation to improve efficiency and minimize operating cost.
- Map the impact on streams resulting from hydrologic modifications and out-of-watershed transfers induced by large-scale water supply and wastewater discharges in the watershed, and, where possible, from cumulative impacts of land development activities.
- Assist communities with inter-municipal conservation plans and strategies to identify source-water management needs, recognizing the role groundwater and land use plays in stream water quality and quantity and the need for environmental flows downstream from water withdrawals.
- Characterize estuary watershed hydrology and sediment loading through such mechanisms as installing and operating stream gauges on major streams and rivers, and modeling; investigate water use and assess future needs and trends throughout the estuary watershed.
- Assist communities in implementing the water-related climate-adaptation strategies of the Climate Smart Certification Program; ensure that communities are aware of water-resource protection and restoration strategies which provide for both human needs and natural resources.
- Strengthen state and local policies to help guide land use and water resource allocation in source watersheds and recharge areas.
- Update the NYS Open Space Plan to address source-water protection needs in the estuary watershed.
- Identify key watershed conservation needs for source-water protection.

Benefit 2: Resilient Communities

Vision

All watershed communities plan and manage their natural resources and built environments to reduce vulnerability to change and to provide for human uses in ways that sustain the estuary and a healthy watershed ecosystem.



PHOTO CREDIT: STEVE STANNE

Changing development patterns, types of industry, modes of transportation and sources of energy have shaped the communities and estuary ecosystems we see today and will shape those we live in tomorrow. Our changing climate has introduced new challenges for communities as well. How resilient our communities are to these changing conditions and how our communities manage their environment will be central to their health and the health of the Hudson River estuary. Our long-range goals are to:

- Address the causes of climate change in the Hudson Valley and prepare for projected impacts to safeguard our homes and businesses and protect the natural resources that sustain these communities. [Estuary Program Goal 6]
- Revitalize all the waterfronts in the valley so that the Hudson is once again the “front door” for river communities, with protected scenic vistas, working ports and harbors, lively town centers offering economic and cultural opportunities, and public river access. [Estuary Program Goal 9]

- Conserve for future generations the rich diversity of plants, animals and habitats that are key to the vitality, natural beauty, and environmental quality of the Hudson Valley [Estuary Program Goal 3]
- Protect and restore the streams, their corridors and the watersheds that replenish the estuary and nourish its web of life, and sustain water resources that are critical to the health and well-being of Hudson Valley residents and the ecosystem [Estuary Program Goal 4]

Creating resilient communities throughout the watershed of the estuary will take a multi-faceted approach involving many of our program areas, including water-quality infrastructure investment, floodplain management, watershed management, waterway access, education, and natural area protection.

In addition to our work throughout the watershed, the Estuary Program, in partnership with the NYS Department of State and other agencies, has supported the revitalization of many river shoreline communities. We have helped implement Governor Cuomo's Office of Storm Recovery objectives for resiliency and provided support for regional sustainability plans and NY Rising. To date, we have invested in access improvements in nearly every waterfront community, and we have assisted many municipalities, county agencies, and landowners with information and planning for flooding and sea-level rise. However, urban environmental conditions remain challenging, requiring our assistance. Communities are beginning to evaluate their vulnerability to changing conditions but need tools, technical assistance, and capacity-building to implement resilient strategies. Investing in such communities will make them more attractive for a new generation of residents, potentially relieving the pressure on important natural open spaces.

Current trends, challenges and opportunities that will affect our ability to provide these human benefits of the estuary while also sustaining the ecosystem:

- People of all ages are trending toward urban areas as places to live and work. Improving urban waterfront communities has the potential to alter trends of suburban and rural development, consistent with Smart Growth and Hudson River Valley Greenway principles.
- A trend of increased rainfall and flooding is creating unstable stream channels, altering aquatic habitats, increasing transport of sediment and other pollutants and threatening life and property.
- Sixty-one communities in the Hudson Valley have adopted the Climate Smart Communities pledge and now need assistance in design and implementation of nature-based solutions.

Priority Targets, Measurable Outcomes and Selected Actions for 2015-2020

LONG-RANGE TARGET 1: Waterfront communities along the Hudson are resilient to flooding, heat and drought and contribute to a clean estuary and a vital ecosystem.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress.

- a) Six Hudson riverfront communities have reduced key vulnerabilities to flooding, heat and drought and improved environmental conditions by implementing nature-based solutions, infrastructure improvements, and land-use practices, consistent with recommendations from waterfront flooding task forces, New York State sustainability plans, New York Rising plans and storm recovery goals.
- b) Improved policy and design guidance is adopted on the use of natural and nature-based features to reduce risk of flooding.
- c) New or updated Local Waterfront Revitalization Programs (LWRP) are underway in 14 riverfront communities and at least five of them are addressing coastal resiliency.
- d) Three or more communities on the shore of the Hudson have projects which contribute to a clean estuary and a more vital ecosystem, especially in environmental justice areas.
- e) Cleanups of contaminated sites are underway in Hastings-on-Hudson and are completed in four or more shoreline communities, including Newburgh, Poughkeepsie, Sleepy Hollow (GM), and Yonkers; Brownfield Opportunity Area plans will have been completed in seven or more Hudson River waterfront communities, including Albany, Catskill, Kingston, Newburgh, and Wappingers Falls.
- f) The Hudson River Environmental Conditions Observing System (HRECOS) has been upgraded to provide near real-time information for a wider variety of uses, including flood response, navigation and education.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

Flood resilience:

- Continue to support state-wide efforts on storm recovery, regional sustainability plans and NY Rising projects.
- Assist communities with identifying wastewater treatment systems and critical assets at risk of flooding and flood damage, and provide assistance to make them more resilient.
- Demonstrate the use of natural and nature-based solutions to mitigate the effects of strong storms and provide ecological value; create and test agency-adopted monitoring protocols.
- Develop opportunities for riverfront communities at risk of flooding to share information and experience and collaborate on flood-resilient projects.
- Encourage communities to take the Climate Smart Communities pledge, participate in the Certification Program, and implement adaptation projects.
- Facilitate partnerships with academic institutions to support the design and implementation of projects that foster climate resilience.
- Foster a Hudson Valley network of climate resilience demonstration projects such as green infrastructure and floodplain reconnection.
- Support assessments and planning processes, such as waterfront flooding task forces and Local Waterfront Revitalization programs that evaluate and prioritize community assets and vulnerabilities to improve environmental conditions.
- Enhance the Hudson River Environmental Conditions Observing System (HRECOS) with features that will measure currents and tide heights in key locations.

Community waterfronts:

- Foster the preparation and implementation of Local Waterfront Revitalization Programs (LWRP) in all riverfront communities to improve environmental conditions.
- Facilitate use of natural/nature-based features (e.g., living shorelines) and green infrastructure, such as stormwater retrofits, to benefit water quality and habitat, provide urban green space, and mitigate extreme heat.
- Support projects to modernize water and sewer facilities in river communities to reduce water pollution and improve environmental conditions.
- Assist Hudson River shoreline communities with identifying and capitalizing on important natural resources and helping people use and enjoy them.
- Plan for and promote cleanup and reuse of brownfield sites, including contaminated and former industrial areas in riverfront communities. Promote solutions that are ecologically enhanced, resilient to sea-level rise and climate change, and beneficial for human use.
- Coordinate with the U.S. Army Corps of Engineers on future maintenance dredging of the river that supports maritime activity in river communities, and restore ecological conditions and habitats.
- Foster sustainable working waterfronts that permit the use of fuel-efficient water-based transport of people and products (such as food produced in the Hudson Valley region) for increased climate resiliency.

- Facilitate communication and coordination between working waterfront stakeholders and riverfront communities so that community planners and waterfront designers have information about the needs of working boats and their benefits to the community and region.
- Support environmental justice projects in shoreline communities, including improved conditions along the river and its tributaries, green infrastructure projects, and programs to help the public use and enjoy the river.

LONG-RANGE TARGET 2: Tributary streams and their floodplains are conserved, re-vegetated, and restored using natural and nature-based solutions to better absorb and slow floodwaters, mitigate erosion, and support the estuary ecosystem.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress.

Flood resiliency and stream flows:

- a) Fifty percent of stream road crossings in the Hudson River estuary watershed below the Troy dam have been assessed for their ability to pass flood flows and their risk of failure, and six or more municipalities have used this information to prioritize and replace undersized flood-prone culverts and bridges using habitat-friendly, flood-resilient approaches that restore natural stream flows and stream bottom conditions.
- b) One hundred Hudson River Estuary municipalities are Climate Smart Communities and 50 have implemented an adaptation strategy in the *Certification Manual*, including actions to conserve their floodplains, shorelines, and/or stream flows.
- c) One or more municipalities have received assistance to identify and implement a suite of flood-reduction strategies in priority flood-prone locations, including reconnecting streams to their floodplains and wetland conservation. (Coordinate with Benefit 3, Target 1)
- d) Steps have been taken to characterize estuary watershed hydrology and sediment loading through such mechanisms as installing and operating stream gauges on major tributaries of the estuary.

Stream habitat conservation and restoration:

- e) Stream restoration projects are underway or completed involving 10 or more stream barriers that limit the movement of fish and wildlife species of greatest conservation need (SGCN), including dams or culverts, especially at locations which could support movement of estuarine species such as river herring and American eel; where feasible, combine with municipal flood resiliency measures (see “a”) above).
- f) Streamside areas in greatest need of protection and restoration have been prioritized.
- g) Assessment of riparian restoration and protection strategies, policies, and practices that could potentially be implemented in the Hudson River Estuary watershed has been completed.

- h) Five willing communities in priority locations have received assistance to adopt practices and policies which protect and restore their streamside riparian areas.
- i) Three miles or more of priority streamside areas have been conserved using “Trees for Tribs” stewardship projects.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

Flood risk management:

- Identify, prioritize, design and implement projects on tributaries of the Hudson to right-size stream/road crossings; conserve floodplains and stream buffers where ecological benefit and managing flood risk can be achieved.
- Assist tributary and Hudson River municipalities in developing conservation measures that manage risks associated with erosion and flooding in priority areas; develop case studies of communities that have successfully managed floodplains and adopted and implemented riparian protection policies.
- Develop policies, practices and tools to help communities maximize the flood protection values of floodplains.
- Assist communities seeking to upgrade their stormwater and wastewater infrastructure to be more climate resilient.
- Support the development of a regional post-storm flood-response training center.
- Identify and prioritize locations for reconnection of streams to their floodplains; provide technical assistance to implement reconnection projects.

Stream habitat restoration

- Develop and publicize natural and nature-based solutions and best management practices (BMPs) for streamside buffers and riparian conservation.
- Map priority areas and restore native vegetation on the banks and floodplains of streams and rivers.
- Improve aquatic connectivity for Species of Greatest Conservation Need (SGCN). Assess, prioritize and map barriers (dams and culverts) to upstream tributary habitat for important migratory and Hudson River resident species, and mitigate barriers with willing landowners. Provide information on the web to assist willing communities and property owners with conservation projects.

LONG-RANGE TARGET 3: Communities along the Hudson and in the watershed use natural resource information to create land-use practices, plans and policies that conserve priority lands and waters to benefit people and the estuary.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) All Hudson Valley municipalities have access to current, science-based information about priority lands and waters, conservation principles, and land-use planning tools and techniques for natural resource-based planning.
- b) Seventy-five willing communities have increased their capacity to develop and improve practices, plans, and policies that conserve priority lands and waters by forming Conservation Advisory Councils, participating in training, using technical assistance, and/or receiving funding.
- c) Thirty communities use in-depth technical assistance and/or funding to incorporate natural resource information and conservation priorities/principles into practices, plans, and policies.
- d) With community support, 15,000 acres of lands or easements have been acquired from willing landowners to conserve farms, forests, wetlands, source-water and aquifer protection lands and ecologically significant habitats in the watershed.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Develop and update technical assistance and extension materials that support local natural resource-based plans, policies, and practices that conserve priority lands and waters, build community resilience, and support the estuary.
- Provide educational and networking opportunities for land-use decision-makers and community leaders to raise awareness of priority lands and waters, understand their role in maintaining healthy communities, and provide information on conservation principles and land-use tools for natural resource-based planning.
- Provide technical and financial assistance to municipalities and regional partners to help community leaders develop and improve practices, plans, and policies that conserve their priority lands and waters, including local and inter-municipal conservation plans, master plans, zoning ordinances, and natural resource inventories and strategies.
- Convene policy makers to assess watershed-wide policies and practices which could improve their land-use management for resilient, sustainable communities.

- Continue to support partnerships among communities and local, regional and statewide land trusts and conservation organizations in the Hudson Valley to promote collaborations that will conserve 65,000 acres of ecologically significant lands in the Hudson River watershed.
- Support the adoption of natural resource conservation principles and practices as part of regional Greenway Compact plans at the county and municipal level throughout the Hudson Valley.

Benefit 3: Vital Estuary Ecosystem

Vision

Life in the estuary thrives with support from healthy forests, wetlands, and streams throughout the watershed.



PHOTO CREDIT: STEVE STANNE

The Hudson River estuary and the watershed surrounding it support extraordinary biological diversity and provide important benefits to people. It is a complex of habitats that includes shoreline wetlands, aquatic vegetation beds and the bottom of the river itself. Supporting the estuary and communities throughout the valley are rich forests, lush wetlands, grasslands and many other habitats. These natural systems are vital for the estuary ecosystem, and they serve our communities as well by reducing flooding, purifying drinking water, providing wildlife-dependent recreational opportunities, and all the social, economic, and ecological benefits associated with these activities.

Given the Hudson Valley's astonishing wealth of life and natural services, our long-range goals for a vital estuary ecosystem are to:

- Conserve, protect and enhance river and shoreline habitats to assure that life cycles of key species are supported for human enjoyment and to sustain a healthy ecosystem. [Estuary Program Goal 2]
- Conserve for future generations the rich diversity of plants, animals and habitats that are key to the vitality, natural beauty and environmental quality of the Hudson valley [Estuary Program Goal 3]

Over the past several years, the Estuary Program has assessed habitat function and conducted extensive research on the ecology of the river. We have identified an estuary-wide framework for habitat restoration and undertaken pilot projects to restore native vegetation in tidal marshes, and soon will begin side-channel restoration at Gay's Point. A successful land-use outreach and technical assistance program has helped more than 100 communities in the watershed and along the estuary to conserve important habitats through a process of engaged public management. The Estuary Training Program has helped resource managers, regulators, advocates, and partners build a local knowledge of and capacity to restore and conserve river habitats.

Although we have established a baseline for analysis of ecosystem change over time in the watershed, we need to better understand estuary-watershed connections. Multiple consequences of climate change will be manifest on practically all Hudson Valley habitats. Wetlands may not keep pace, species will migrate, and new diseases may emerge. The human benefits from these habitats are significant—they include storm protection, water quality improvement, and carbon sequestration.

Certain habitats, such as tributary mouths, need protection to assure their viability as habitat for migratory fishes. Finally, the increasing threat of invasive species, a concern throughout the state, requires significant resources and prevention and control actions.

Current trends, challenges and opportunities that will affect our ability to provide these human benefits of the estuary while also sustaining the ecosystem:

- Climate change is affecting the estuary and its watershed ecosystem. Conserving and restoring healthy, intact habitats will increase the resilience of the estuary, its tributaries and its watershed to the impacts of climate change. We need to also think about what should be established to address future conditions.
- Submerged aquatic vegetation (SAV) dramatically declined following Hurricanes Irene and Lee, affecting food web and juvenile fish habitat. Recovery has been slow; however, new research and monitoring have contributed elements to an emerging strategy of how to jumpstart SAV recovery following large storms.
- The sustainability of estuarine habitats is being affected by shoreline changes. In response to increased flooding and storm activity, shorelines are being reinforced with rip rap and bulkheads. There is an opportunity to use nature-based features to improve the habitat quality of these responses, conserve important shoreline habitats, and protect the opportunity for inland migration of habitats where feasible.
- Recent mapping and modelling suggests that there are currently 2,427 acres of unprotected tidal wetlands in the estuary, and 5,470 acres of new tidal wetland could possibly be created by the year 2100 through inundation of undeveloped areas along the Hudson due to sea-level rise. Of those 5,470 acres, 2,309 acres are conserved by public and private entities, including 359 acres under NYS OGS jurisdiction, with 3,161 acres not currently in conservation management. There is an opportunity to conserve these lands and prevent the type of development which would place future land owners at risk of building in sensitive areas likely to be subject to sea-level rise.

- Invasive species such as water chestnut and zebra mussels will persist, and new arrivals which can alter estuary food webs are likely to arrive without significant preventive actions. Hydrilla, snakehead, mitten crab and Asian carp are of current concern.
- Relatively little information exists on how land use in the watershed connects to the integrity and resiliency of the estuary. Sprawling development patterns can have adverse consequences, including contribution of excess pollutants, nutrients and sediment to tributaries and the estuary, as well as elimination of the benefits that people derive from healthy ecosystems.
- Continued land-use changes on the shoreline and the watershed put additional pressure on the ecosystem.

Priority Targets, Measurable Outcomes and Selected Actions for 2015-2020

LONG-RANGE TARGET 1: The quantity and quality of tidal wetlands, submerged aquatic vegetation (SAV) beds, and natural or nature-based shorelines are increased through conservation and restoration to foster a healthy ecosystem that is resilient to change.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Restoration feasibility studies and/or implementation are underway or completed and being evaluated on a variety of habitat types in the estuary, including: a new side channel at Gay's Point; invasive species removal from tidal wetlands at Tivoli Bays and Stockport Flats; new oyster habitats in the Tappan Zee; and pilot SAV projects in the middle reaches of the estuary. (NOTE: We will coordinate our work on this outcome with Benefit 4, Target 2.)
- b) Protocols have been developed to evaluate the ecological and hazard-mitigation value of natural and nature-based features (NNBF) on New York City shorelines, and protocols have been developed to assess the ecological functioning and physical stability of nature-based shoreline projects in the freshwater, tidal Hudson River estuary.
- c) Four new sustainable shoreline projects and two new shoreline designs have been completed, and site performance is being evaluated on a year-to-year basis and after large storms.
- d) Best management practices (BMPs), key findings, and technical guidance for habitat conservation have been disseminated to 1,000 partners, stakeholders, and other target audiences and are being used to make better decisions. In addition, five habitat conservation programs or projects are underway using these shoreline and habitat BMPs.

- e) Along or in sight of the Hudson, 2,000 acres of land or easements have been acquired by New York State agencies (DEC, OPRHP) and/or conserved through transfer of jurisdiction by NY SOGS to NYSDEC (This acreage goal is a combined total of lands to protect habitats, scenery, water resources, and river access for recreation, and to support resilient communities. [See also Benefit 4, Target 3 and Benefit 5, Target 1.]
- f) The vulnerability of estuary habitats to climate change and other stressors is understood in ways that can inform conservation and management strategies. (See also Benefit 4, Target 3.)

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of following supporting actions to meet 2020 outcomes above:

- Understand and monitor river habitat trends and threats, especially changes in location, coverage, community composition, and sediment accretion rates of submerged aquatic vegetation, tidal wetlands, and shore zone habitats, as well as changes in bottom characteristics and habitat quality of river bottom habitats.
- Train people to manage and protect river habitats, evaluate effectiveness of training in relation to behavior change, and increase access to web-based guidance on best management practices.
- Implement state and federally developed habitat restoration plans, including the *Hudson River Estuary Habitat Restoration Plan* and the *Hudson-Raritan Comprehensive Restoration Plan*.
- Develop and implement pilot projects to restore native submerged aquatic vegetation (SAV) beds, tidal wetlands, side channels, shallow water habitats, and native plant communities; monitor the success of restoration projects.
- Promote use of natural features and nature-based approaches in new shoreline management, where stabilization is reasonable and necessary. Where predominantly hard engineering has been used in the past, and nature-based solutions are not feasible, retrofit, reconstruct, and enhance bulkheads, revetments, and piers using Sustainable Shorelines approaches and best practices.
- Reestablish oyster populations where feasible for the ecological benefits they provide.
- Identify important habitats for acquisition and seek the support of state agencies and land trusts to conserve them.
- Determine which estuary habitats are most vulnerable to climate change, and identify and prioritize conservation and restoration strategies.
- Identify priority areas where tidal wetlands can transition with sea-level change, and implement conservation measures to facilitate this transition.

- On the estuary shoreline, foster research to improve design of coastal green infrastructure strategies in the estuary and New York Harbor. Implement and evaluate the success of pilot Sustainable Shoreline and nature-based shoreline protection projects.
- Characterize estuary watershed hydrology and sediment loading through such mechanisms as installing and operating stream gauges on major streams and rivers, and modeling.
- Coordinate with the U.S. Army Corps of Engineers on future maintenance dredging of the river that supports maritime activity in river communities, and restore ecological conditions and habitats.

LONG-RANGE TARGET 2: Aquatic invasive species (AIS) that could reduce ecosystem vitality are kept out of the estuary, and existing populations of AIS are contained; the potential for new invasions of invasive aquatic plants and animals has been lowered; and the spread of existing aquatic invasive species to beyond the estuary has been slowed.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) The extent of hydrilla in the Hudson River estuary has been determined, and plans to limit its spread have been developed and implemented. Other aquatic invasive species will be addressed as appropriate.
- b) Measures have been taken to prevent Asian carp from entering the Erie Canal system.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Implement regional components of the statewide AIS implementation strategy consistent with the New York State Aquatic Invasive Species Plan.
- Collaborate with Capital Mohawk and Lower Hudson Partnerships for Regional Invasive Species Management (PRISM) on invasive species initiatives.
- Delineate the extent of *Hydrilla* in the Croton River system and surrounding waters, inform the public of the status, evaluate management options, and, where feasible, implement actions to slow or halt the spread of Hydrilla.

- Explore the potential for volunteer monitoring programs to provide AIS early detection and monitoring.
- Support the AIS boat stewards programs for outreach and voluntary boat inspections at high-use locations, and support the construction and operation of boat decontamination stations in conjunction with these at and in the vicinity of public boat launches along the estuary.
- Support and track the work of the Asian Carp Regional Coordinating Committee to implement its annual Asian Carp Control Strategy Framework and its *Monitoring and Response Plan*.

LONG-RANGE TARGET 3: Key ecological connections between the watershed and the estuary are identified to guide management actions in the watershed that support a functional, productive, and resilient estuary ecosystem

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Improve understanding of cross-system connections between the Hudson River estuary and its watershed.
- b) Our improved understanding of estuary-to-watershed connections has been applied to identify and prioritize conservation and management actions in the watershed that are most beneficial to estuary integrity.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Conduct research and monitoring to determine the most important ecological linkages among the watershed, tributaries, and the estuary, and assess threats that pose the greatest risk to these connections that support estuary integrity.
- Identify and map the most important natural areas of the watershed for supporting and sustaining a healthy estuary using predictive spatial models.
- Identify conservation strategies for key linkages that minimize watershed-based threats to estuary integrity and use them in existing outreach and conservation programs.

LONG-RANGE TARGET 4: River impacts from water withdrawals or placement of pipes, power lines and other in-water facilities will be avoided or mitigated.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Final State Pollution Discharge Elimination System (SPDES) permits have been issued for five industrial facilities, including the Roseton and Indian Point Power Plants, containing schedules for the implementation of technologies and operational measures that will minimize fish mortality caused by the operation of the cooling water intake systems.
- b) All new industrial facilities requiring non-contact cooling are operating closed-cycle cooling systems.
- c) All new water withdrawals for industrial or municipal facilities water withdrawals (other than non-contact cooling) operate technologies which minimize fish kills by preventing fish from being impinged on intake screens and from being entrapped in the water withdrawal system.
- d) Fish mortality caused by the operation of water intake systems at industrial facilities, electric power plants and future water intake structures has been minimized, and the use of state-of-the-art methods has increased.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Reduce, or have schedules to reduce fish kills at the four remaining steam electric power plants and all industrial facilities that use once-through cooling systems by imposing the “best technology available” standard pursuant to 6 NYCRR §704.5 and §316(b) of the Clean Water Act. This standard requires minimizing adverse environmental impacts. Require that future Hudson River power-generating and Hudson River industrial facilities have closed-cycle cooling systems.
- Reduce fish kills for all types of future water withdrawals as compared to the impacts of current unmitigated intake structures.

Benefit 4: Estuary Fish, Wildlife and Habitats

Vision

The estuary supports robust populations of fish and wildlife that are popular for fishing and wildlife-related recreation.



PHOTO CREDIT: HUDSON RIVER FISHERIES UNIT

The fish, wildlife and habitats of the estuary that are important for wildlife-related recreation depend upon a healthy environment as well as effective management strategies to ensure their continued role in a balanced and sustainable ecosystem. Today, blue crabs and river herring support the only remaining active in-river commercial fisheries, and the status of the Hudson's more popular recreational fisheries is mixed. In addition to important fisheries, the Hudson is an important migration corridor for many birds people enjoy. Wildlife-related recreation in New York generates billions of dollars spent by anglers and sportsmen and women (\$5 billion) and wildlife watchers (\$4.2 billion).

Considering the importance of these species to the region's economy and ecosystem, our long-range goals for estuary fish, wildlife and habitats are to:

- Restore the signature fisheries of the estuary to their full potential, ensuring future generations the opportunity to make a seasonal living from the estuary's bounty and to fish for recreation and consume their catch without concern for their health. [Estuary Program Goal 1]

- Conserve, protect and enhance river and shoreline habitats to assure that life cycles of key species are supported for human enjoyment and to sustain a healthy ecosystem. [Estuary Program Goal 2]
- Reduce contaminants entering the Hudson River, and remove or remediate river sediments contaminated by long-term pollutants so that food webs of the river are supported, people can safely eat Hudson River fish, and harbors are free of the contaminants that constrain their operation. [Estuary Program Goal 11]

Tracking and monitoring programs for Atlantic sturgeon, striped bass, river herring, shad, glass eels, and blue crab are providing important data on spawning habitat, food sources, river movement and stock condition of these species. Young-of-year populations of American shad, river herring, striped bass, and Atlantic sturgeon are beginning to increase, particularly in 2014. Throughout the watershed, staff have been identifying barriers which limit the movement of fish and wildlife species of greatest conservation need (SGCN), such as culverts and dams that impede access to important habitats by these species. This database will be made available to municipalities to help them prepare for increasing stormwater runoff during major precipitation events and to promote ecosystem resiliency.

In addition to current stressors such as pollution and habitat fragmentation, as the climate changes and sea level rises, wildlife that depend on the Hudson River estuary will need to adapt to wetland migration and temperature-driven range shifts.

Remediation programs are underway for PCBs in the upper Hudson (though some PCBs will remain after mandated remediation is completed) and in NY/NJ harbor for dioxins, primarily in New Jersey waters. The most significant sources of cadmium have been remediated through a superfund cleanup at Foundry Cove in Cold Spring, with the potential need for further remedial work under consideration for a significant historical source of cadmium in the upper Hudson. Targeted restoration of submerged aquatic vegetation (SAV), barrier removal for migratory fish and eel passage, and improvement to stream water quality are all needed to support the restoration of economically important fisheries.

Current trends, challenges and opportunities that will affect our ability to provide these human benefits of the estuary while also sustaining the ecosystem:

- Economically important migratory fish—American shad, river herring, striped bass, sturgeon and American eel—can be affected by factors both in and outside the estuary; in-estuary mortality factors for fish will continue to include harvest, food-web changes, and habitat loss and alteration.
- Federal funding for management of sport fishes appears to be in a period of decline.

- Waterfowl that use the estuary may be negatively impacted by climate change effects on tidal wetlands and overpopulation of some species, such as Canada geese and mute swans.
- There may be a correlation between loss of SAV beds and a decrease in young-of-year fish populations, which requires further investigation.
- PCBs, coal tar and other historical contaminants are being actively remediated but remain in some estuary sediments and may be vulnerable to disturbance during major floods.

Eagles, wading birds, migratory waterfowl, and marsh birds, in addition to many mammals, amphibians, and reptiles, depend on estuary habitats to persist into the future, and the health of the Hudson depends on these species as well. (For example, muskrats create open water habitat in tidal wetlands for fish and other wildlife.)

Priority Targets, Measurable Outcomes and Selected Actions for 2015-2020

LONG-RANGE TARGET 1: Populations of striped bass, American shad, river herring, Atlantic sturgeon, blue crab, American eel, and the near-shore fish community that make up the base of the food chain are robust and sustained at levels that support both a resilient ecosystem and a sustainable commercial and/or recreational harvest.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Atlantic sturgeon continue to make measurable progress toward recovery goals, demonstrated through monitoring, management and research, which contribute to a coast-wide stock assessment and development of a method for generating a numeric recovery goal for the Hudson River stock.
- b) American shad are starting to make measurable progress toward recovery, demonstrated through monitoring, management and research. Research priorities include describing spawning migration patterns in the Hudson River. (See also Benefit 3, Target 1.)
- c) Striped bass show a reverse in the apparent decline in size and number of spawning adult females in the Hudson River, demonstrated through monitoring, management, and research. Research priorities include identifying a way to determine sex-specific mortality rates for Hudson River striped bass.
- d) American eel management is improved through habitat improvement and research on the timing and size of silver eel migration. (See also Benefit 2, Target 2e.)

- e) The sustainability of river herring at current levels has been established, and habitats which require additional conservation and restoration work have been defined.
- f) Blue crab seasonal habitat use and movement has been identified, and research has improved our understanding of the contribution of Hudson River blue crab to the statewide fishery.
- g) The development and use of the best science available to support an ecosystem-based approach to management of the fish of the Hudson River has continued, including improved understanding of food webs, habitats and predator-prey relationships.
- h) Anglers and school groups are actively engaged through citizen-science programs in monitoring and stewardship projects to conserve the estuary's fisheries and their habitats.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Continue monitoring programs for species that are harvested or are of special concern to detect changes requiring management action.
- Analyze available data sets and conduct spatial analysis to inform management strategies for economically important species.
- Adjust management plans and management targets as needed to sustain these signature species.
- Develop and implement recovery plans as needed.
- Understand habitat use and species interactions that may affect sustainability of target species.
- Sustain the public's interest in these fisheries and in fishing.
- Engage anglers in stewardship projects.

LONG-RANGE TARGET 2: Habitats needed to support American shad, river herring, striped bass, black bass, American eel, blue crab, and sturgeon populations during critical life stages and seasons are identified, sustained, and, where possible, restored.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Critical habitats for Atlantic sturgeon, shortnose sturgeon, American shad, and blue crab have been defined by season and life stage.

- b) Strategies for habitat protection and restoration to support American shad, river herring, striped bass, sturgeon populations and American eel during critical life stages and seasons have been identified, and pilot conservation and restoration projects have been implemented and are underway for SAV, shallow water habitats and stream barrier mitigation. (Note: We will coordinate work on this outcome with our work on Benefit 3, Target 1 and Benefit 2, Target 2.)

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Refine habitat management plans for target species, taking ecosystem interactions into account.
- Maintain DEC fixed acoustic-receiver arrays to track tagged fish in the estuary and seek to install near-field arrays to track Atlantic sturgeon at their spawning areas.
- Determine which habitats require additional conservation and restoration work for river herring conservation.
- Complete Significant Fish and Wildlife Habitat updates for sites that are important for conservation, as needed.
- Simplify and expedite the regulatory review of projects that may impact Atlantic and shortnose sturgeon.
- Recommend priorities for site-specific habitat restoration, particularly for submerged aquatic vegetation (SAV) supporting juvenile fish survival and for fish passage to improve stream water quality and habitat connectivity for American eel and other fishes.
- Evaluate fish-tracking data in conjunction with river bottom mapping data.
- Work with federal and state agencies and local stakeholders such as “Partners Restoring the Hudson” to create a comprehensive restoration plan that addresses habitat restoration needs.

LONG-RANGE TARGET 3: Hudson River estuary habitats and floodplains can sustain healthy and diverse populations of wildlife that are important for wildlife-related recreation as sea level rises and coastal habitats change over time.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Identify Hudson River estuary habitats needed to support key wildlife species important for recreation, and recommend strategies for their conservation as sea-level rises and habitats change.
- b) Wildlife habitat and climate interactions are used as a criterion for the conservation of shoreland acreage (coordinate with land conservation outcomes supporting Benefit 3, Target 1 and Benefit 5, Target 1).

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Characterize key birds and wildlife that rely on habitats of the Hudson River estuary, including its floodplain forests.
- Identify estuary wildlife habitat threats, and factor these into conservation plans to protect habitats, migration corridors, and tidal wetland transition zones.
- Identify opportunities for people to take action to protect wildlife through citizen science and wildlife-related activities and recreation.
- Deliver public trainings on sustainable practices to conserve tidal wetlands for wildlife.

LONG-RANGE TARGET 4: Reduce contaminant levels in Hudson River fish and crabs so that they meet federal standards for commercial sale and most species become a healthy source of food for everyone who wants to eat them.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) The New York State Department of Health has annual data needed to set fish and crab consumption advisories that are protective of public health.
- b) The initial influence of the upper Hudson River PCB cleanup on fish concentrations has been assessed.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Continue to monitor PCB in fish, and report trends to the public.
- Provide outreach on fish advisories to the public, including recreational anglers, families with children, and, through community partnerships, immigrants who are often less aware of the advisories.
- Complete the mandated upriver PCB cleanup and the NY Harbor clean-up program to reduce dioxin and evaluate the results.
- Continue statewide and national programs to reduce airborne mercury.
- As cleanups are completed, reevaluate restrictions on commercial and sport fishing harvest and consumption, consistent with sustainability goals for the target species.

Benefit 5: World-Famous Natural Scenery

Vision

Natural scenery is preserved and enjoyed by the public.



PHOTO CREDIT: STEVE STANNE

The natural scenery of the Hudson River Valley has long been recognized as an important aspect of the region's sense of place and has attracted artists and visitors from around the world. The distinct wetlands, forests, open vistas and mountain ranges of the region, along with our local biodiversity, maintain the character of the region so loved by Hudson Valley residents. Our natural scenery has inspired national art and architecture movements, innovations in landscape design and has drawn leading entrepreneurs to the region to establish homes and businesses.

Protecting natural scenery can also help achieve other benefits, such as clean water, a vital ecosystem, and resilient communities. Our scenery inspires people to care about the environment, creating a unique culture of conservation that also sets this region apart. Given the importance of this resource to tourism and the region's economy, our long-range goal is to:

- Conserve key elements of pastoral landscapes and world-famous scenery that define the character of the Hudson River Valley, and provide new and enhanced vistas where residents and visitors can enjoy Hudson River views. [Estuary Program Goal 5]

In recent years, we have identified and mapped scenic vistas and key properties for conservation. A scenic resource database project, developed in partnership with the Hudson River Valley Greenway and Hudson River National Heritage Area, has identified 1,541 scenic resources that are available via a website(http://www.landscape.org/new-york/featured_places/hudson_river_valley/) Working with the Greenway, we are partnering with land trusts throughout the region to identify, inventory, and map more scenic resources. The Estuary Program has also supported partnership projects to remove unused utility poles along the railroad right-of-way and abandoned bulk oil storage tanks to improve river views.

Private landowners, municipal planners, and historic sites along the shore need additional training and resources to conserve important land and vistas. Additional grants to non-profits and communities are needed to plan and map vista improvement projects.

Current trends, challenges and opportunities that will affect our ability to provide these human benefits of the estuary while also sustaining the ecosystem:

- Though the Hudson is world renowned for its natural scenery and many tourists come here to enjoy it, few communities manage this as an economic asset, and few policies or other protections exist to conserve natural scenery, especially along shoreline areas.
- Some of the region's significant scenic vistas are private land whose property owners may be willing to help conserve them. Landowners who clear cut more trees than necessary to improve vistas often create erosion and habitat problems, marring the landscape for others.
- Local and state programs could expand efforts to promote our scenery as an economic asset. For example, the Hudson River School Art Trail and other programs celebrating river vistas have recently gained the attention of tourists.
- Historic sites are beginning to think about how to manage their vistas and landscapes.

Priority Targets, Measurable Outcomes and Selected Actions for 2015-2020

LONG-RANGE TARGET 1: Natural scenery along the estuary shoreline is conserved in ways that sustain a healthy estuary, and vistas and views are enjoyed by residents and visitors alike.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Along or in sight of the Hudson, 2,000 acres of land or easements have been acquired by New York State agencies (DEC, OPRHP) and/or conserved through transfer of jurisdiction by NYSOGS to NYSDEC. This acreage goal is a combined total of lands to protect habitats, scenery, water resources, and river access for recreation, and to support resilient communities. (See also Benefit 4, Target 3 and Benefit 3, Target 1).
- b) Partners seeking to conserve locally important natural scenery along the Hudson estuary shoreline have been empowered through training, technical assistance, and grants.
- c) Opportunities for residents and visitors to enjoy the region's scenery have been expanded by increasing the number of ecologically sound local projects which celebrate, interpret and promote appreciation of the scenery along the Hudson shoreline. Six or more sites have been added to the Hudson Art Trail.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Help communities incorporate key natural scenic resources into their open space plans and proposed project reviews.
- Support good site design and strategies that conserve scenery and expand scenic views.
- Support land acquisition from willing sellers to conserve the most important natural shoreline scenery.
- Promote access to scenic vistas for enjoyment by the public.
- Assist with projects to remove human-made objects that impair the scenic vistas of the region.
- Encourage ecologically sound local projects which celebrate, interpret and increase appreciation of the scenery of the Hudson.

LONG-RANGE TARGET 2: Conservation of natural scenery, which is valued by communities in the watershed, is integrated into local planning for recreation, economic development, tourism and land use, consistent with local home rule.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) All communities have access to up-to-date information on the web about how to identify and conserve natural scenery; training on best management practices has been offered to decision-makers.
- b) Six or more pilot communities are incorporating information on scenic resources into practices, plans and policies, or they have started to assess community values, including scenic resources, for use in local planning and decision-making.
- c) Sites where residents and visitors can enjoy vistas and views have been identified and publicized through the Hudson River Valley National Heritage Area and the DEC natural areas webpage.
- d) The regional and local economic value of scenery is more clearly understood and has been incorporated into economic development plans and decisions.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Map and publish inventories of locally and regionally important vistas, post them to the web and make GIS files available.
- Create on-line resources, such as a website, where local municipalities can promote their scenic resources.
- Advise local governments, willing landowners and other stakeholders on how to conserve local natural scenery and support implementation of conservation projects through local home rule.
- Support the adoption of regional Greenway Compact plans and principles at the county and municipal levels throughout the Hudson Valley.
- Gather regional and local case studies on the economic benefits of scenery
- Research and communicate the regional economic benefit of scenic resources.

LONG-RANGE TARGET 3: River shoreline property owners manage their lands to conserve natural scenery and river vistas in environmentally sound ways.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) All landowners along the Hudson have access to information on the web about ecologically sound vista-management best management practices (BMPs)
- b) All historic sites along the Hudson shoreline have been trained in BMPs for vista management.
- c) Two willing landowners along the Hudson shoreline are using BMPs for vista management and are publicizing their experience through case studies.
- d) DEC includes and encourages BMPs for ecologically sound vista management in their interaction with permit applicants as voluntary actions which can be adopted locally and use DEC-owned shoreline properties.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Develop guidance on ecologically sound Best Management Practices (BMPs) for conserving and managing natural scenery and scenic vistas, and make it available on the web.
- Offer training on BMPs to shoreline property owners, including historic sites, state land-owning agencies and permit staff.
- Support site management plans and projects which remove eyesores affecting views of natural scenery, and facilitate environmentally sound vista maintenance and tree-thinning practices.
- Encourage pilot projects and case studies of ecologically sound vista management.

Benefit 6: Education, River Access, Recreation and Inspiration

Vision

The estuary, as an integral part of our river communities, is valued by Hudson Valley residents, and its many natural resources are available and accessible, providing high-quality, place-based educational, recreational and inspirational experiences.



PHOTO CREDIT: HUDSON RIVER PARK TRUST

The Hudson River estuary and its shores offer exceptional opportunities for education and outdoor recreation, including swimming, fishing, boating, hiking, and river watching. Place-based education about the river promotes knowledge of the ecosystem, mastery of skills required by learning standards, and participation in stewardship activities. As water quality has improved over the last 40 years, the demand for river access by residents and visitors has risen accordingly, as has the pace of riverfront development. Preserving and expanding public access for suitable uses, including access for persons with disabilities and for underserved populations, is important to consider as the riverfront develops.

Effective management decisions that benefit both communities and the estuary ecosystem depend upon engaged community leaders, citizens, businesses, and scientists who understand

the estuary and its surroundings and how interdependent they are. To accomplish this, technical assistance must be made available in user-friendly formats for diverse education efforts ranging from programs in schools and nature centers, to engaging signs and use of the Internet and social media.

The long-range goals for this benefit are to:

- Promote public understanding of the Hudson River, including the life it supports, its role in the global ecosystem and the challenges the river faces and how they can be met. [Estuary Program Goal 8]
- Develop, maintain and improve a regional system of access points for fishing, boating, swimming, hiking, education, river watching and wildlife-related recreation, and build connections that allow residents and visitors to have rich and diverse river experiences. [Estuary Program Goal 7]
- Track our progress and celebrate our successes. [Estuary Program Goal 12]

The Estuary Program has provided capacity-building support to a variety of nature centers and environmental education sites. However, the sustainability of river programs at such sites remains a challenge. *The Hudson River Almanac* currently has 9,200 enthusiastic subscribers, and readership has more than doubled in recent years, offering an opportunity for further use of this engaging educational format. Our signage at state parks and historic sites, such as the Walkway over the Hudson, is memorable and effective, as visitor response attests.

The Estuary Program has enabled a variety of nature centers and environmental education sites to expand their river-based programs and is at the center of a network of educational institutions that focus on river education, reaching tens of thousands of people annually. Signature programs such as Day in the Life of the Hudson River Estuary and the glass eel migration study—a partnership with the Hudson River Research Reserve—provide teachers, students and volunteers with data-gathering experience in the field. The Water Assessment for Volunteer Evaluators program (WAVE), begun by the Estuary Program in the Hudson watershed, has expanded statewide, and the SAV citizen-monitoring program has proved successful. However, effective conservation of the estuary will require that we continue to expand the number of residents who are knowledgeable about the river. The use of social media to reach diverse audiences is key, as is exploring new opportunities to work with partners.

In 1990, the Estuary Program set a goal of conserving lands between the river and the railroad and making them available for access. Working with partners, we have acquired most of those sites and developed them for public use. We have achieved our goal of providing new or improved access to the Hudson in every river community where feasible. The Hudson River Park in NYC, with 16 reconstructed public piers to date and four non-motorized boat houses along with other notable public access projects, has opened up the waterfront to millions of New Yorkers in recent years. However, emerging issues are now affecting our approach to providing river access.

The population in the Hudson Valley is more diverse and is growing older, requiring a fresh look at the location and accessibility of sites for people with a wide range of abilities. It is also critical to provide technical assistance and funding for upgrades to docks, boat launches and other facilities to make them more resilient to storm surge and flooding.

The Estuary Program and its partners have developed expertise in the areas identified above. In recent years we have:

- Created new or improved access in nearly every river community
- Assessed selected sites and actual user “friendliness”
- Provided training on accessibility for persons with disabilities
- Funded dozens of environmental justice (EJ) river access projects from Troy to NYC
- Worked with partners to demonstrate resilient access designs; examples at Long Dock, Beacon and Esopus Meadows have proved adaptable to extreme flooding.

Current trends, challenges and opportunities that will affect our ability to provide these human benefits of the estuary while also sustaining the ecosystem:

- People have less direct connection to the estuary than in generations past and do not understand its benefits nor what aspects of the estuary’s health are important to sustain.
- For people who are looking for meaningful experiences where they can make a contribution, our citizen stewardship programs are increasingly popular and effective as learning and participatory experiences.
- The communication of information should take into account economic and cultural changes and in delivery of information via social media.
- Expansion of our presence in New York City offers a unique opportunity to reach a much larger audience.
- While schools are cutting back on outdoor programs and field trips, many are now using our on-line lesson plans and those of our partners.
- It is more important than ever to help a broader audience reach the Hudson River. ADA standards or universal design principles should be incorporated into the design of new sites and alterations to existing sites. Education projects should strive to be inclusive of individuals with diverse needs and abilities.

- Many economically disadvantaged neighborhoods lack quality access to the river and its tributaries.
- Maintenance of access sites, including dredging, is expensive. Sea level will continue to rise, and more severe storms are predicted, requiring new standards for construction, repair, and maintenance.

Priority Targets, Measurable Outcomes and Selected Actions for 2015-2020

LONG-RANGE TARGET 1 (Education): Residents of the Hudson Valley understand and appreciate the contribution of the estuary, its watershed, and its fish and wildlife to their lives, and take action to conserve the estuary and its resources.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Improve facilities and programs at five or more sites which offer river education, making opportunities to learn about the Hudson more accessible for a wide range of people from geographically and socio-economically diverse communities. Complete construction for the Estuarium on Pier 26 at Hudson River Park in New York City.
- b) Install signage with a consistent set of key estuary natural resource messages at 12 Hudson River access sites; coordinate with signage programs at state parks, historic sites and Hudson River Park in Manhattan.
- c) Survey Hudson Valley residents to establish the current level of public understanding and appreciation of the estuary and watershed, identify the chief means by which residents receive information about these systems in order to improve education efforts, and measure improvements in understanding and appreciation over a period of years.
- d) With education and outreach partners, refine a set of key understandings of the estuary, its fish and wildlife, and its watershed to serve as a basis for messaging to our audiences. Use them to promote a natural history based sense-of-place and a wider understanding and appreciation of the estuary, including its unique biodiversity and flagship species, by publishing the *Hudson River Almanac*, expanding the Great Hudson River Fish Count, and creating 30 educational videos for dissemination through social media via the Internet and other means.
- e) In partnership with NYS Department of Health, provide health advice about eating Hudson River fish in languages that reflect the diversity of Hudson Valley residents. Encourage local fishing and healthy choices in fish consumption by including health advice for other Hudson Valley waters where the whole family can eat the fish. To better target outreach, continue surveys of the public to find out who is eating Hudson fish.
- f) Strengthen local stewardship of estuary resources by expanding the capacity of local partners and schools to participate in citizen science projects.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Explore the use of social media, smartphone apps, YouTube and other strategies to communicate about the estuary, including development of short videos and podcasts posted online.
- Support nature centers and environmental education sites on the Hudson from Troy to New York City as destinations for learning about the river.
- Extend the reach of the *Hudson River Almanac* as a tool for educating the public about the benefits the estuary provides and publish a *Best of the Almanac* book.
- Provide engaging programs that are focused on the natural and human history of the estuary ecosystem, with an emphasis on its unique biodiversity and flagship species.
- Use public access sites and parks as destinations for river learning, including development of educational signage.
- Explore ways to foster stewardship for the estuary; for example, expand the glass eel citizen science monitoring project to include projects promoting eel passage over stream barriers.
- Encourage artists and writers to include river conservation in their work.

LONG-RANGE TARGET 2 (Education): Students who graduate from high school and colleges in the Hudson River Valley have a fundamental understanding of the estuary and its connected local waterways. They appreciate the river's value to natural and human communities and have participated in stewardship activities along the estuary or in its watershed.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Eighty percent of school districts within the Hudson estuary watershed incorporate Hudson River learning in their curricula through field studies and supporting classroom syllabi. Colleges and universities are encouraged to do the same.
- b) Participation in "Day in the Life of the Hudson River Estuary" field studies will be maintained at current levels and classroom use of pre- and post-trip lessons will be expanded.
- c) Through the programs listed above and citizen science projects, connect 10,000 students to the river annually.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Develop effective methods for expanding school field programs, including: “Day in the Life of the Hudson River,” the glass eel monitoring project, river studies at Norrie Point, and Teaching the Hudson Valley, and follow up in ways that will promote longer term river-related learning outcomes.
- Explore ways to expand the use of river-focused curriculum materials in schools.
- Support schools offering river-focused education programs through professional development and teacher training opportunities.
- Expand program opportunities in population centers along the river, especially urban areas and EJ communities.

LONG-RANGE TARGET 3: Access is improved for fishing, swimming, boating, and wildlife-dependent recreation on tidal waters for all using principles of universal design and storm resilience, especially in under-served communities.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Accurate Information on Hudson River access sites is available on the web and in accessible formats, enabling all users to assess site conditions and make choices based on their desires, needs and abilities.
- b) Information and training to implement the principles of universal design and coastal storm resiliency have been developed and are available to park planners and access providers.
- c) All river access sites owned or managed by DEC and OPRHP along the Hudson will be assessed for accessibility—both infrastructure and communication—to ensure that people of all ages and abilities are welcome. In addition, steps are being taken to implement needed improvements where deficiencies are identified at state-owned or managed fishing, boating, swimming and/or wildlife recreation sites.
- d) Ten or more sites operated by local partners have taken steps to improve existing access sites, specifically to better incorporate principles of universal design and/or storm resiliency, and fifteen or more have been designed or built to generally enhance access for fishing, swimming, boating, or wildlife-dependent recreation using such principles.
- e) Awareness of universal access improvements is increased so that people of all abilities are aware of and are using the sites we have collectively improved.

- f) Plans and access improvements along the Hudson or its tributaries are being developed or implemented in at least four economically-disadvantaged neighborhoods and communities in Hudson River shoreline communities.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Support projects which develop, improve or enhance river access for fishing, swimming, boating and wildlife-related recreation for all, using the principals of universal design and storm resiliency, especially in underserved communities.
- Assess and publicize the availability and current conditions of river access sites online and by other means to provide accurate and useful information to visitors of all abilities for trip planning. Support the completion of the Hudson River Valley Greenway Trail (both land and water trails) through conservation of habitat lands and scenic sites along the shoreline, where trail access and usage is compatible with ecosystem protection. Support assessment of water trail sites for accessibility and the new water trail map guide series and website.
- Work with landowning state agencies to coordinate stewardship objectives of all state-owned property on or in sight of the Hudson so that habitat and recreational needs are met.
- Work with agencies and partners to create a federally approved comprehensive restoration plan that addresses access needs.
- Develop and publicize best management practices, technical information and guidance, and case studies on the web and in other accessible formats for implementing principles of universal design and storm resilience on tidal waters of the Hudson. Develop a guidance handbook for canoe and kayak access to waters where no codified standards exist.
- Support environmental justice projects in shoreline communities, including improved access to the river and its tributaries, green infrastructure projects on the shoreline, and programs to help the public use and enjoy the river and its tributaries.
- Support projects through training and grants to facilitate implementation, and implement projects that retrofit estuary access facilities to be more resilient and incorporate resiliency in new access site designs.
- Assess DEC-owned river access sites for storm resiliency and sustainable shoreline attributes, and provide training and support for other agencies to do the same.
- Engage organizations that serve people who would benefit from universal design (rehabilitation hospitals, independent living centers and other facilities, outfitters, park managers and others) to be part of the planning process and host inclusion events (e.g., I Fish NY fishing clinics, Science on the River).

LONG-RANGE TARGET 4 (Access): River maintenance dredging and dredged material management needs are managed to sustain ecosystems and help boat launches, yacht clubs, marinas and ports remain viable sites for enjoyment of the river and maritime trade.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Through the DEC Marina Dredging Task Force, viable options will have been identified for disposal of dredged soil at marinas and boat clubs on the Hudson River estuary.
- b) DEC, USACE and port agencies on the Hudson are coordinating plans for dredging and dredged material management to assure win-win solutions that sustain navigation and ecosystems.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

- Identify ways to facilitate permit and disposal solutions.
- Identify where sedimentation is a problem and which facilities are in need of dredging and by how much.
- Work with the Port of Albany to identify and mitigate potential conflicts resulting from habitat and dredging issues.
- Work with USACE to create a comprehensive restoration plan for the estuary.
(Coordinate with Benefit 1, Target 1 and Benefit 3, Target 1.)

LONG-RANGE TARGET 5 (Celebrating Progress): Progress in conserving the estuary is recognized through reports, regional celebrations and events.

By 2020, we will aim to accomplish the following outcomes through collaboration and partnerships, and we will track and report our progress:

- a) Annual events have been held to celebrate National Estuaries Day and the Hudson River Valley Ramble. Programs such as Science on the River and Teaching the Hudson Valley are offered annually to inform and inspire new estuary stewards. (Coordinate with Benefit 6, Targets 1 & 2.)
- b) Annual reports are posted to the web, providing a summary of the Estuary Program's activities and those of partners to achieve the outcomes of this Action Agenda, and a five-year summary update on the *State of the Hudson* has been published.

We invite agencies and partners to collaborate with the Estuary Program to meet or exceed these 2020 outcomes.

Selected actions for 2015-2020:

The Action Agenda is a vision for collective action and does not assume that any one entity will carry out all of the work. Rather, it is a framework to guide implementation by many partners. The Estuary Program will facilitate some or all of the following supporting actions to meet the 2020 outcomes above:

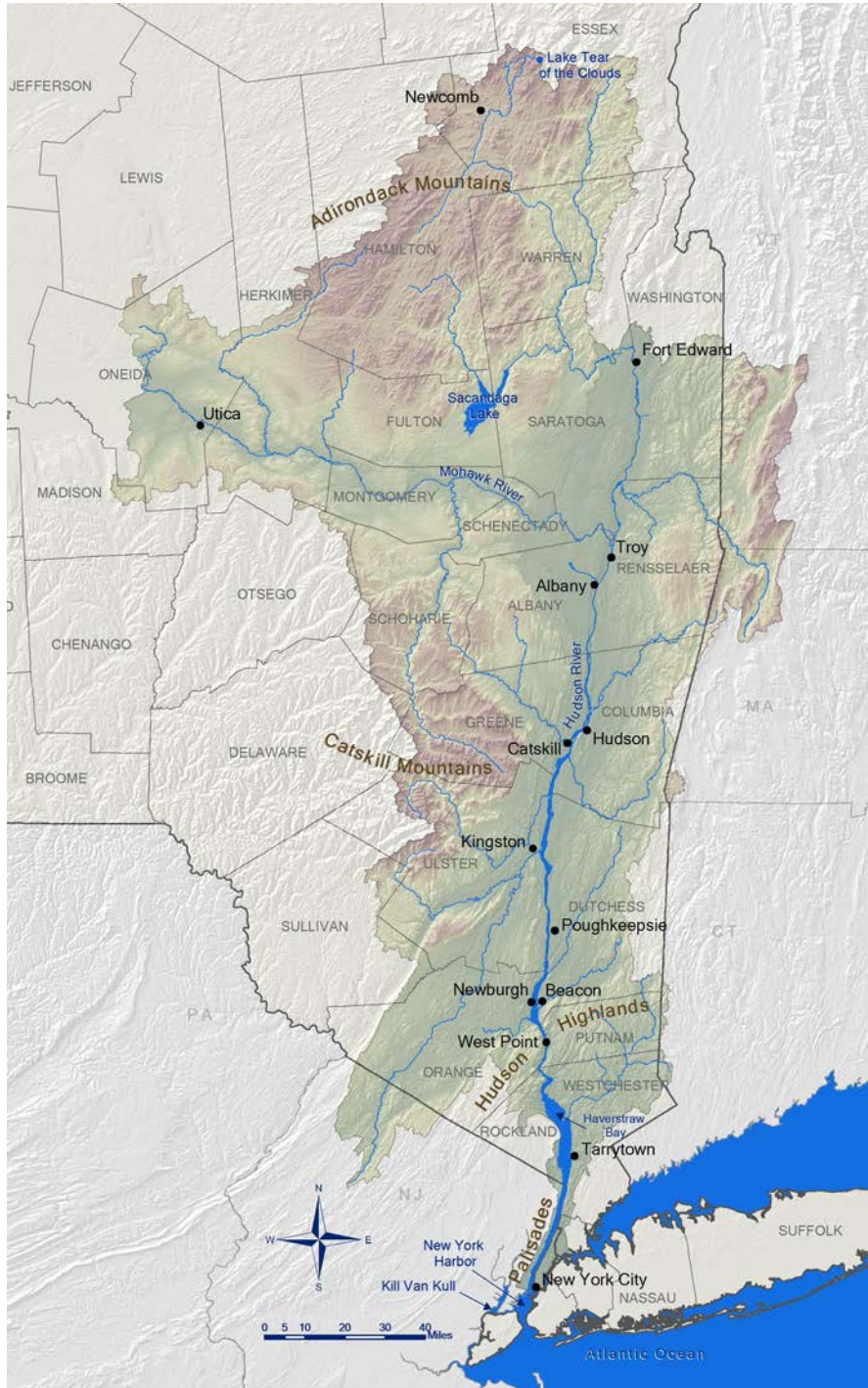
- Provide the public with timely and accurate information and inspiring stories about the estuary through the *Hudson River Almanac*, RiverNet, *Conservationist* magazine, and DEC's Facebook and Twitter feeds
- Issue a *State of the Hudson Report* every five years.
- Reinforce public awareness of progress through informational displays at large-scale river festivals.
- Publish stories about what we have learned and make them accessible to the public online and through other accessible media.

Appendix 1: Hudson River Estuary Program Goals

Helping people enjoy, protect and revitalize the Hudson River and its Valley

1. Restore the **signature fisheries** of the estuary to their full potential, ensuring future generations the opportunity to make a seasonal living from the Hudson's bounty, and to fish for recreation and consume their catch without concern for their health
2. Conserve, protect and enhance **river and shoreline habitats** to assure that life cycles of key species are supported for human enjoyment and to sustain a healthy ecosystem
3. Conserve for future generations the **rich diversity of plants, animals and habitats** that are key to the vitality, natural beauty and environmental quality of the Hudson Valley
4. Protect and restore the **streams**, their corridors and the watersheds that replenish the estuary and nourish its web of life, and sustain water resources that are critical to the health and well-being of Hudson Valley residents and the ecosystem
5. Conserve key elements of the **pastoral landscapes and world famous river scenery** that define the character of the Hudson River Valley, and provide new and enhanced vistas where residents and visitors can enjoy Hudson River views
6. Address the causes of **climate change** in the Hudson Valley and prepare for projected impacts to safeguard our health and safety and to protect the natural resources and local economies that sustain our communities
7. Develop, maintain and improve a **regional system of access** points for fishing, boating, swimming, hiking, education, river watching and wildlife-related recreation, and build connections that enable residents and visitors to have rich and diverse river experiences
8. Promote **public understanding of the Hudson River**, including the life it supports, its role in the global ecosystem and the challenges the river faces and how they can be met
9. **Revitalize all the waterfronts** of the valley so that the Hudson is once again the "front door" for river communities, where scenery and natural habitats combine with economic and cultural opportunity, public access, working ports and harbors, and lively adjacent downtowns to sustain vital human population centers and a healthy environment
10. Ensure that **Hudson River water quality supports appropriate human benefits**, including drinking water, swimming, fishing, navigation and ecosystem protection
11. Reduce **contaminants** entering the Hudson River, and remove or remediate river sediments contaminated by long-term pollutants so that food webs of the river are supported, people can safely eat Hudson River fish, and harbors are free of the contaminants that constrain their operation
12. Track our **progress and celebrate** our successes

Appendix 2: Geographic Area and Environmental Setting



The Hudson River Watershed is 13,400 square miles. The Estuary Program focuses on the 5,200 square miles from the Verrazano Narrows below Manhattan Island to the head of tide at the federal dam in Troy.

The Hudson River estuary, from the Troy dam south to the Verrazano Narrows and the surrounding watershed, also known as the Hudson River Valley, is the focus of this program. This geographic area includes the 153-mile-long tidal main stem of the Hudson River, as well as upper New York harbor, the Hudson's tributaries and the upland areas of the Hudson Valley, encompassing 5,200 square miles of the river's overall 13,400-square-mile watershed. The Estuary Program also gives consideration to pertinent issues in the non-tidal Hudson River, including the river and its tributaries above Troy, the Mohawk River, lower New York harbor, the New York/New Jersey Bight and the waters of Long Island Sound as they influence the estuary and its resources.

The Hudson River estuary has long been recognized as a valuable state and local resource, as well as an integral part of the North Atlantic coastal environment. The estuary serves as a spawning and nursery ground for important fish and shellfish species, such as striped bass, American shad, Atlantic and shortnose sturgeon and blue crab. More than 200 species of fish are found in the Hudson and its tributaries. The estuary contains the only significant acreage of tidal freshwater wetlands within the state. These wetlands, along with the river's brackish tidal wetlands and stands of submerged aquatic vegetation, provide essential habitat that supports the Hudson's rich and biologically diverse web of life. More than 16,500 acres of river habitat along the stretch from the Troy dam to the southern Rockland-Westchester County line have been designated "significant coastal fish and wildlife habitat" by DEC and the New York State Department of State. The New York Natural Heritage Program has identified numerous sites where rare plant and animal species and exemplary natural communities occur. The Hudson Valley is particularly important globally for its diverse assemblage of turtles. In addition, 20 pairs of bald eagles are nesting and raising their young along the shores of the river, and that number is increasing. The estuary also serves as an important resting and feeding area for other migratory birds such as osprey, and a variety of songbirds and waterfowl.

The Hudson estuary serves one of the most densely populated areas in the country. Its north end is flanked by the Cities of Albany, Watervliet, and Troy. Numerous smaller communities are located along both banks of the river to the southern Rockland-Westchester line. From there south, the greater New York metropolitan area, with its estimated population of 8 million, dominates the landscape. Nearly one-half of the population of New York State lives within the 15 counties bordering the estuary, the largest proportion being located in the New York City area. Part of New Jersey's major metropolitan area, likewise, borders the estuary.

Human use of the estuary dates back 8,000-10,000 years before European settlement. Today, the estuary is used for commercial navigation, recreation (including boating, fishing, swimming and wildlife observation), commercial fishing, and municipal drinking water supplies and as a source of inspiration. Several major power-generating facilities, manufacturing plants, petroleum terminals, cement and aggregate plants, resource recovery facilities and various mining operations are located along the banks of the estuary. Railroad tracks hug the shores of the river on the east, from Manhattan to Rensselaer County, and on the west, from Haverstraw State Park in Rockland County to central Ulster County.

Appendix 3: Hudson River Estuary Management Advisory Committee Members and Ex-officios

HREMAC Members:

Dennis Suszkowski, Committee Chairman
Hudson River Foundation

Allan Beers
Rockland County
Dept. of Environmental Resources

Frank Bergman
Hudson River Boat and Yacht Club Assoc.

Andy Bicking
Scenic Hudson

Janet Burnet
Ramapo River Watershed Council

David Church, Commissioner of Planning
Orange County

Nicola Coddington
Irvington Green Policy Task Force

Chris DeRoberts
Central Hudson Gas & Electric Corp.

Bill Emslie
Coastal Conservation Association

Todd Erling
Hudson Valley Agri-Business
Development Corp.

Jerry Faiella
Historic Hudson River Towns

Stuart Findlay
Cary Institute of Ecosystem Studies

Paul Gallay
Riverkeeper, Inc.

Peter Gross
Hudson River Sloop *Clearwater*

Charles Gruetzner
Hudson Valley Marine Trades Assoc.

Lucille Johnson
Vassar College and Environmental
Consortium of Colleges & Universities

Tom Lake
Commercial Fisherman/Educator

Roland Lewis
Metropolitan Waterfront Alliance

Eric Lind
Constitution Marsh Sanctuary

Suzette Lopane
Westchester County Dept. of Planning

Bernard Molloy
Hudson River Watertrail Association

John Mylod
Commercial Fisherman

Steve Noble
City of Kingston Parks and Recreation

George Schuler
The Nature Conservancy

Shino Tanikawa
NYC Soil & Water Conservation District

Rene VanSchaack
Greene County IDA

Russell Yess
Trout Unlimited

HREMAC Ex-officios:

Tom Baudanza
NYC Department of
Environmental Protection

Peter Brandt
US Environmental Protection Agency

Diana Carter
NYS Office of Parks, Recreation and
Historic Preservation

Mark Castiglione
Hudson River Valley Greenway

Noreen Doyle
Hudson River Park Trust

Jamie Ethier
NYS Department of State

Nordica Holochuck
NY Sea Grant

Regina Keenan
NYS Department of Health

Rob Pirani
NY-NJ Harbor & Estuary Program

Peter Weppler
U.S. Army Corps of Engineers