PRINCIPLES OF ESTUARINE HABITAT RESTORATION

WORKING TOGETHER TO RESTORE AMERICA'S ESTUARIES

REPORT ON
THE RAE-ERF PARTNERSHIP
– YEAR ONE –
SEPTEMBER 1999

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ACKNOWLEDGEMENTS

Special thanks are due to the following individuals and organizations who made the project a success.

FINANCIAL AND IN-KIND SUPPORT:

- New York Community Trust
- Pew Charitable Trusts
- *Connecticut Sea Grant College Program*
- *Delaware Sea Grant College Program*
- *Louisiana Sea Grant College Program*
- *Maryland Sea Grant College Program*
- *New Jersey Sea Grant College Program*
- *North Carolina Sea Grant College Program*
- *Washington Sea Grant College Program*

PROJECT IMPLEMENTATION:

- Elizabeth Waters, Facilitator and Author/Editor of Draft Report
- ERF Board of Directors, and the following representatives:

  Frederick T. Short, University of New Hampshire
  Eugene R. Turner, Louisiana State University
  Michael P. Weinstein, New Jersey Marine Sciences Consortium
  Joy Bartholomew, ERF Executive Director
  Denise J. Reed, ERF 99 Conference Organizer, LUMCON
  Robert R. Twilley, ERF 99 Conference Organize, University of S. W. Louisiana

- RAE Board of Directors, and the following representatives:

  John W. Atkin, Save the Sound
  Kathy Fletcher, People for Puget Sound
  Andy Lipsky, Save the Bay
  Todd Miller, North Carolina Coastal Federation
  Victor Pyle, Save the Sound
  Tracy Skrabal, North Carolina Coastal Federation
  William Street, Chesapeake Bay Foundation
  Jacques R. White, People for Puget Sound
  Mark Wolf-Armstrong, Restore America's Estuaries
  Special thanks to Peter Braasch and Steven Kinberg

- All the participants at the RAE-ERF workshops in Beaufort, North Carolina, Seattle, Washington, Stamford, Connecticut and New Orleans, Louisiana.

Cover photos were provided by Mark Wolf-Armstrong.

Dear Colleague,

It is with a great deal of gratitude that we are writing this letter to all of you interested in America's estuaries. And for those of you who are listed in the acknowledgements, we wish to add our sincere appreciation. We are also grateful to countless others who have supported the partnership between Restore America's Estuaries and the Estuarine Research Federation.

America is blessed with more than 100 estuaries. We call them by the name estuary, but perhaps "coastal sanctuary" is a more fitting name. What they do for us is remarkable — some would even say they are miracles of nature. Today, we are in danger of losing their richness, their health and our coastal heritage.

But this story need not have a bad ending — because estuarine habitat can be restored to its former glory. A variety of efforts — ranging from parents and children going out on a Saturday morning and replanting natural vegetation to reconstruction of physical and hydrologic conditions through heavy engineering — have successfully brought estuaries back to life. But we must act now before the bounty of estuaries is lost.

This report is a collaboration and a celebration — collaboration of scientists and field practitioners working together to define the best practices, and celebration of the contributions of so many people striving to restore health to our nation's estuaries. Many scientists and practitioners have invested enormous time, talent and resources to advance the state-of-the-art of estuarine habitat restoration. It is upon this foundation that we are building our new competencies.

But we are just beginning. Through these next few pages we wish to engage in a dialogue — not just now, but for years to come. Ultimately, our aim is to advance the recovery of our nation's coastal sanctuaries — our estuaries.

Sincerely,

Mark Wolf-Armstrong
President
Restore America's Estuaries

Joy Bartholomew
Executive Director
Estuarine Research Federation

INTRODUCTION

Estuaries are bodies of water along coasts formed when fresh water from rivers flows into and mixes with salt water from the ocean. Estuaries and the coastline surrounding them are among the most productive natural systems on earth, producing more food per acre than the richest Midwestern farmland. Known by names like Chesapeake Bay, Puget Sound, and Indian River Lagoon, estuaries provide essential habitat for 80% of the world's fish and shellfish species, and provide a vital buffer between land and water, filtering pollution from runoff and protecting land from flooding.

Decades of population growth, dredging and draining have led to dramatic losses in salt marshes, sea grass meadows, coastal forestland, and the rest of the complex set of habitats that make up the nation's estuaries. Hundreds of thousands more acres of estuarine habitat have been polluted and degraded to a point where they no longer support the wealth of fish and wildlife that once lived there. Over the last 20 years, public and private efforts have been launched at the federal, state and local levels to reverse this pattern of degradation and loss. While progress has been made, estuarine habitat continues to be lost at a much faster rate than it is being restored.

The urgent need to increase knowledge about restoration and the amount of restoration activity taking place have led representatives of Restore America's Estuaries (RAE) and the Estuarine Research Federation (ERF) to form a partnership to address this need. RAE is a coalition of 11 regional community-based organizations that works to preserve estuaries across America by focusing attention on estuarine habitat loss and restoration. Collectively the RAE organizations, working in partnership with others, have restored over 25,000 acres of estuary habitat. They are dedicated to reclaiming one million acres by the year 2010. ERF is a national organization of research scientists dedicated to promoting research on estuaries and the coastal environment and sharing that knowledge with others. Over the past year RAE and ERF sponsored a series of workshops to:

- Assess the current situation with regard to habitat restoration;
- Clarify what is known about how to effectively restore habitat; and
- Develop a collaborative agenda for the year 2000 and beyond.

As the centerpiece for this initial year of collaboration, a set of working principles was developed to guide restoration activities. These principles emphasize the importance of a long-term stewardship approach to restoration and incorporating ecological sensitivity into all restoration planning and practice. They emphasize the need to establish clear, realistic goals for restoration activities at both the estuary and project levels, and the need to find ways to demonstrate to the public that progress is being made, even though full restoration of function may take 10–20 years or more. Finally, the principles emphasize the critical nature of building a strong public constituency to support habitat restoration. This report highlights the results of Year One of the RAE-ERF collaboration.

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CURRENT SITUATION

ESTUARIES UNDER STRESS

Throughout history, people have been drawn to the shores of estuaries for their beauty and bountiful resources. U.S. coastal areas comprise only 17% of the nation's land area, but are home to more than 53% of the population, with hundreds of thousands of new residents being added every year. Estuaries are a vital part of the national economy. Commercial and recreational fishing, boating and tourism provide Americans with more than 28 million jobs. Coastal waters welcome 180 million tourists each year, and the fishing industry alone contributes $111 billion to the nation's economy.

However, the many and often conflicting demands placed on estuaries are putting great stress on these valuable ecosystems. Population growth along the coast has brought increased development, new homes, jobs, and recreational opportunities. But this same development in the watersheds surrounding estuaries creates polluted run-off that degrades and in many cases destroys estuarine habitats — the salt marshes, fish runs, mudflats and mangroves, where thousands of species of plants, fish and other wildlife spend part or all of their lives. Studies show that 95% of the original wetlands in San Francisco Bay have been lost, 85% of the sea grass meadows in Galveston Bay, and an estimated 50% of the salt marshes in Rhode Island. In 1996, the Environmental Protection Agency (EPA) reported that almost 40% of the nation's surveyed estuaries were too polluted for fishing and swimming. Oyster harvests in the Chesapeake Bay fell from 25 million pounds in 1959 to 1 million pounds in 1989, and Chinook salmon, which spend vital parts of their life cycle in Puget Sound, have just been placed on the endangered species list. Aggressive action must be taken quickly to reverse this trend of habitat loss and degradation, or the health and productivity of these unique resources will be lost for generations to come.

THE STATE OF OUR KNOWLEDGE

Thirty years of estuarine habitat restoration research have taught scientists and researchers a great deal about estuaries, how they function and what is needed to restore them. But while much is known, estuarine habitat restoration is a young science and much more needs to be learned.

Practicioners need to build on the existing foundation for restoring physical structure in estuaries, like water flow patterns and vegetation, to learn how to restore function. They must identify ways to transfer knowledge from smaller intensively managed restoration sites to much larger restoration efforts, moving from demonstration projects to larger geographic areas. They need to learn more about the effects of sea level rise, sedimentation and a host of other variables to help set appropriate goals and success indicators for restoration projects in their dynamic natural environments. They need improved models at the habitat level

to help with site selection, understanding tidal flows and selection of reference sites for individual projects. Better models at the ecosystem level will help in understanding things such as life cycles of particular species and links between habitats.

PROGRESS TO DATE

The past three decades have seen a number of local, state, and federal initiatives aimed at habitat restoration and restoring health to coastal environments. Connecticut and New York have launched major state bond initiatives and the state of North Carolina has established a multi-million dollar water quality trust fund. Federal programs like the National Estuary Program, National Estuarine Research Reserves, the U. S. Army Corps of Engineers' Section 1135 and Section 206 programs, and the National Marine Fisheries Services' Habitat Conservation Division have begun to target resources towards estuarine habitat restoration. With a combination of federal, state and private support a number of significant restoration efforts are underway across the country. The following are just a few examples.

- The Chesapeake Bay Foundation and Ducks Unlimited, working with state and federal agencies, have restored 2,500 acres of wetlands and 350 miles of riparian buffers along the shores of Chesapeake Bay. A multi-state oyster restoration project in Chesapeake Bay involving scientists, advocacy organizations, citizens, and state and federal agencies has planted over 100 million oysters on 40 sanctuary reefs as part of a major oyster restoration project.

- The Estuary Enhancement Program in Delaware Bay has 20,500 acres under restoration, preservation and enhancement, and includes the building of six fish ladders to aid fish migration.

- New York City's Department of Parks and Recreation, Natural Resources Group has restored almost 1,500 acres of coastal habitat in this densely urban setting around the Hudson-Raritan and Long Island Sound estuaries. Connecticut's Department of Environmental Protection has worked with a wide range of partners to restore another 2,000 acres of degraded tidal marshes along the shores of the Sound.

- Twelve acres of eelgrass, inter-tidal mud flat, and salt marsh have been restored in the Piscataqua River, which links Great Bay and the Gulf of Maine, as part of a port expansion project in Portsmouth, New Hampshire.

- People for Puget Sound has launched over 20 habitat restoration sites on the Duwamish River, which flows into Puget Sound in downtown Seattle.

- Save the Bay has been working with volunteers, scientists and local communities to evaluate the ecological integrity of over 3,000 acres of estuarine wetlands in Narragansett Bay, Rhode Island and Massachusetts. Over 74 potential wetland restoration sites have been identified through this evaluation process.

Major initiatives are also underway in the Florida Everglades, in coastal Louisiana as part of the Coastal Wetlands Planning, Protection and Restoration Act, and in the San Francisco Bay-Delta watershed as part of the CALFED process. While all of these efforts are promising, they are only a start. Work is needed in many areas to increase the amount and effectiveness of restoration activities.

CHALLENGES TO FACE

Estuarine habitat restoration will not be easy. To move forward, many challenges must be met:

Do a better job of balancing human and ecological needs.

More and more people want to live along the coast. They want clean water, good jobs, plentiful seafood and a host of recreational opportunities. But all of this new development puts pressure on estuaries, threatening the lives of the creatures that inhabit them and the quality of life of the people living along their shores. The challenge is to find ways to balance all interests, human and environmental, to achieve a sustainable way of life along the coast. Ways must be found to restore habitat that protect other vital economic interests. People also must be willing to revisit some of the ways in which they live and work, recognizing they are an integral part of the natural environment and have a responsibility to live in harmony with it.

Significantly increase the amount of restoration activity taking place and the funding available to support this work.

Habitat is being lost at a far greater rate than it is being restored. Awareness of the economic and social value of estuaries and increase the rate of restoration activity must be raised. This must include launching more restoration projects of all kinds, particularly larger efforts with potential benefits on an estuary-wide level, and providing sustained funding to support this.

Be patient, but show progress along the way.

Restoration cannot be accomplished overnight. It takes time for natural processes to be re-established. Restoration scientists and practitioners need to show how restoration can contribute to economic and community vitality and identify progress points along the way, so that the public comes to value restoration efforts and supports them over the long-term.

Do a better job of sharing what is known.

There are few central data banks that provide comprehensive inventories of restoration opportunities and case studies. This is due in part to the failure of scientists, managers, regulators and non-profits to share what they've learned and use it to improve restoration practices. Scientists and practitioners need to work together to evaluate previous restoration projects, learn from them, and use this knowledge as a basis for restoring and managing sites in the future.

Continue to learn and provide the funding to support this work.

Every restoration project must be viewed in part as an experiment, with built in monitoring and research to advance our understandings and improve the quality of future restoration activities. A reasonable amount of funding for research and monitoring should be included as part of every restoration initiative, large or small, to build our knowledge and understanding of how these complex ecosystems function.

Act now.

The health of the economy, strong public interest in environmental issues and new sources of funding for restoration activities create a window of opportunity that will not last forever. To take advantage of this, the leadership of ERF and RAE are committed to work together to build greater public understanding of restoration needs, to improve understanding of restoration science and practice, improve the quality of restoration planning and implementation, and to increase the amount and scale of restoration activity in this country.

As a starting point, the following principles are proposed as a guide to restoration activities and an agenda for future RAE-ERF collaboration. RAE-ERF is dedicated to developing the funding needed to advance these principles and support this ambitious agenda.

RESTORATION PRINCIPLES

As the centerpiece of the initial year of work, the RAE-ERF collaborative developed a set of principles to guide restoration activities. These principles should be used to guide all types of restoration activities: research projects, community based restoration projects, mitigation projects driven by regulatory requirements and projects funded by federal, state and local government. They represent a step toward best management practices for estuarine habitat restoration and provide useful guidance for restoration activities.

The principles are divided into four categories: context, planning, design and implementation, built around the existing state of knowledge.

CONTEXT

PRINCIPLE 1: PRESERVATION OF EXISTING HABITAT IS CRITICAL TO THE SUCCESS OF ESTUARINE RESTORATION.

- Annual loss of healthy estuarine habitat far outstrips the rate at which degraded habitat can be restored.
- Preservation of existing habitat must be the starting point for efforts to achieve a net gain in healthy, functioning estuarine habitat.
- Preservation activities must be combined with an aggressive restoration program to achieve national estuarine restoration goals.

PRINCIPLE 2: ESTUARIES CAN BE RESTORED ONLY BY USING A LONG-TERM STEWARDSHIP APPROACH AND DEVELOPING THE CONSTITUENCIES, POLICIES AND FUNDING NEEDED TO SUPPORT THIS.

- Restoration of estuarine habitats requires time and vigilance to allow the cumulative effects of smaller projects to emerge and larger scale natural processes to re-establish themselves.
- A balanced approach to environmental stewardship and sustainable economic growth in the coastal zone should be sought that recognizes the needs of humans as well as other species that inhabit estuarine watersheds.
- As pressures on estuaries increase, sustained efforts will be needed to maintain this balance between human and ecological needs.

PRINCIPLE 3: THE SIZE, SCALE AND AMOUNT OF RESTORATION ACTIVITY MUST INCREASE SUBSTANTIALLY TO HAVE A SIGNIFICANT EFFECT ON OVER-ALL ESTUARINE FUNCTIONING AND HEALTH.

- Restoration efforts must move from demonstration projects to larger scale activities that restore more acreage and achieve economies of scale. Scientists and practitioners should collaborate closely on this to be sure we apply what we have learned to date in designing these larger projects.

- New methods and technologies are needed to make restoration as cost effective as possible.
- Approval requirements need to be streamlined to allow projects to move forward efficiently.

PRINCIPLE 4: **GREATER PUBLIC AWARENESS, UNDERSTANDING AND INVOLVEMENT IN ESTUARINE HABITAT RESTORATION ARE NECESSARY TO THE SUCCESS OF INDIVIDUAL PROJECTS AND TO ACHIEVE NATIONAL RESTORATION GOALS.**

- Successful restoration efforts require an informed public ready to support the policies, funding and changes in lifestyle needed to restore and maintain estuaries as healthy and productive ecosystems.
- The public must be involved in direct and meaningful ways in all aspects of the restoration process — design, implementation and monitoring — so they understand what is possible and what is at stake and can see progress along the way.
- Connections must be made between habitat restoration and other social and economic goals.
- The scientific, advocacy and regulatory communities need to have a continuing exchange with the public about general progress and problems in habitat restoration, and about the results of specific restoration projects, to provide information and accountability.

PLANNING

PRINCIPLE 5: **RESTORATION PLANS SHOULD BE DEVELOPED AT THE ESTUARY AND WATERSHED LEVELS TO SET A BROAD VISION, ARTICULATE CLEAR GOALS AND INTEGRATE AN ECOSYSTEM PERSPECTIVE.**

- Estuary-wide restoration plans are needed to provide a framework for restoration efforts. They should be based on sound ecological principles and incorporate realities of public preferences and funding.
- The plans should be used to set restoration priorities within an estuary, using scientific criteria, such as the presence of certain hydrology to build on, and socio-economic factors, such as cultural and aesthetic values and community and economic interests.

- Restoration priorities should not be rigid. Estuaries are dynamic, conditions will change, and priorities may need to change in response.
- It is important to stay open to community priorities that arise outside the plan and can engage people in ways that provide benefits beyond those of a specific project.

PRINCIPLE 6: ESTUARINE RESTORATION PLANS SHOULD BE DEVELOPED THROUGH OPEN REGIONAL PROCESSES THAT INCORPORATE ALL KEY STAKEHOLDERS AND THE BEST SCIENTIFIC THINKING AVAILABLE.

- Restoration planning should involve as many stakeholders as possible to build ownership in the plan and its implementation.
- Core planning teams should include scientists, agency representatives, policy makers and representatives of organizations with an interest in the future of the estuary.
- Property owners and other members of the public should be kept up to date on the process and given frequent opportunities to participate.
- The planning process should have the benefit of quality information provided from all available sources.
- Restoration plans should be designed as catalysts for restoration activity, not as ends in themselves. Everyone involved in developing the plans should be charged with implementing them to ensure that plans are practical, scientifically sound and lead directly to action.

DESIGN

PRINCIPLE 7: PROJECT GOALS SHOULD BE CLEARLY STATED, SITE SPECIFIC, MEASURABLE AND LONG-TERM – IN MANY CASES GREATER THAN 20 YEARS.

- Goals should be set for individual restoration projects as well as for larger scale estuary restoration plans.
- Goals should be measurable and realistic for the site selected. They should build on favorable habitat conditions and residual values or functions where they exist.
- Opportunities to form partnerships with neighboring land owners to expand the size and scale of restoration projects should be explored.

- Given the uncertainties involved in restoration, goals should be expressed in terms of a scientifically developed range of acceptable outcomes based on appropriate reference habitats.
- Project timeframes need to allow sufficient time for natural processes to be re-established and function restored. Interim goals and progress points need to be identified to make sure a project is moving in the right direction and sustaining public interest and support along the way.

PRINCIPLE 8: SUCCESS CRITERIA FOR PROJECTS NEED TO INCLUDE BOTH FUNCTIONAL AND STRUCTURAL ELEMENTS AND BE LINKED TO SUITABLE, LOCAL REFERENCE HABITATS.

- Success criteria should be identified that relate in a meaningful way to the functioning of the habitat(s) being restored and include such things as vegetation, hydrology, presence/absence of key biotic components, nutrient cycling, energy flow and production.
- The criteria should be linked to the scientifically determined set of goals or endpoints identified for the project.
- Success criteria must be measurable, widely accepted and able to be translated into terms the public can understand so they can follow the progress being made.

PRINCIPLE 9: SITE PLANS NEED TO ADDRESS OFF-SITE CONSIDERATIONS, SUCH AS POTENTIAL FLOODING AND SALT WATER INTRUSION INTO WELLS, TO BE SURE PROJECTS DO NOT HAVE NEGATIVE IMPACTS ON NEARBY PEOPLE AND PROPERTY.

- Habitat restoration projects should be designed to prevent any negative effects on other property in the vicinity.
- Project neighbors should be provided with information about the project and answers to questions and concerns about potential impacts.

PRINCIPLE 10: SCIENTIFICALLY-BASED MONITORING IS ESSENTIAL TO THE IMPROVEMENT OF RESTORATION TECHNIQUES AND OVER-ALL ESTUARINE RESTORATION.

- All restoration projects/programs need a well thought out, scientifically based monitoring component as part of their design. Monitoring is necessary to evaluate the success or failure of a project/program and provide a basis for making adaptive changes.
- Key indicators need to be identified that are linked to restoration goals and can serve as the foundation of the monitoring program. Monitoring protocols should be kept as simple and replicable as possible to minimize costs.
- Monitoring costs need to be built in up front to be certain this critical part of the restoration project/program is carried out.
- As the number and size of restoration projects/programs grows, the need for monitoring will grow and require increased collaboration between scientists, citizens and advocacy organizations. Monitoring results from today's projects and programs can be used to improve the quality of design of future efforts, creating an ongoing dynamic partnership between the science and practice of restoration.

IMPLEMENTATION

PRINCIPLE 11: ECOLOGICAL ENGINEERING PRACTICES SHOULD BE APPLIED IN IMPLEMENTING RESTORATION PROJECTS, USING ALL AVAILABLE ECOLOGICAL KNOWLEDGE AND MAXIMIZING THE USE OF NATURAL PROCESSES TO ACHIEVE GOALS.

- Ecological engineering practices built on ecological knowledge are more likely to be successful in restoring functional habitat and more cost effective over the long term than more traditional engineering practices.
- Historical data and appropriate reference sites can be used to design ecologically appropriate interventions.
- The best way to accomplish full restoration is to remove barriers to natural functioning, such as dams, ditches and other man-made structures, and allow natural hydrology and drainage patterns to re-establish themselves.
- The benefits of ecological engineering should be shared widely with all agencies and organizations engaged in habitat restoration activities.

PRINCIPLE 12: ADAPTIVE MANAGEMENT SHOULD BE EMPLOYED AT AS MANY RESTORED SITES AS POSSIBLE, SO THEY CONTINUE TO MOVE TOWARD DESIRED ENDPOINTS AND SELF-SUSTAINABILITY.

- Because estuaries are dynamic systems, restoration involves a great deal of uncertainty. Restoration activities must be evaluated and changed through adaptive management if they do not appear to be moving the site toward desired habitat conditions.
- A well designed monitoring program serves as the basis for this evaluation and adjustment process.
- The ultimate goal of all restoration efforts is self-sustainability, but this may not be possible in situations where human impacts continue to affect the site and long-term adaptive management may be required.

PRINCIPLE 13: LONG-TERM SITE PROTECTION IS ESSENTIAL TO EFFECTIVE ESTUARINE HABITAT RESTORATION.

- Restored sites should be placed under long-term protection whenever possible, to prevent future actions or development from reversing the restoration process.
- There are many different ways to protect restoration sites, including land acquisition, conservation easements, and other land use controls, as well as maintaining the necessary water quality requirements of restored sites.
- Efforts to protect restored sites long-term will require cooperation between landowners, governments and non-profit organizations committed to the protection of these resources.

PRINCIPLE 14: PUBLIC ACCESS TO RESTORATION SITES SHOULD BE ENCOURAGED WHEREVER APPROPRIATE, BUT DESIGNED TO MINIMIZE IMPACTS ON THE ECOLOGICAL FUNCTIONING OF THE SITE.

- Providing public access to restoration sites is a way of increasing public awareness of the value of these estuarine areas. Allowing appropriate recreational uses like hiking and wildlife observation and use by schools are ways to enhance the value people place on these sites, increasing the likelihood they will continue to support ongoing preservation and restoration activities.
- At some locations public access may not be appropriate or possible, but it is important to look for ways to allow access in as many cases as possible.

RAE-ERF AGENDA 2000 AND BEYOND

It will take a major effort on the part of everyone concerned about the future of the nation's estuaries to reverse years of degradation and neglect. But restoration of these resources that are such a vital part of our environment, economy and quality of life must be a high national priority. Many more and larger restoration projects are needed. More monitoring and research will be required to ensure the effectiveness of these efforts. More funding must be sought and secured from both public and private sources to support these activities.

To rise to the challenge, leaders of ERF–RAE have agreed to pursue an aggressive collaborative agenda to advance estuarine habitat restoration. It includes pursuing actions in four major areas: advocacy and policy development, planning and implementation, research, and networking and communication.

ADVOCACY AND POLICY DEVELOPMENT

- Engage in a national outreach campaign to decision-makers and the public at large to raise understanding about habitat restoration, the urgent need for action and the necessity of a long-range stewardship approach to meet restoration needs.
- Seek specific legislative, regulatory and administrative policy changes that will promote quality restoration, including revisiting the regulatory mitigation process and looking for ways to eliminate conflicts and over-laps in regulatory requirements and non-regulatory programs at the federal and state levels.
- Seek additional funding for restoration design, implementation, monitoring and research to increase the quality and quantity of estuarine habitat restoration activity.
- Develop mechanisms for scientific involvement in developing restoration policies, regulations and plans, to strengthen the scientific basis of all restoration activity.

PLANNING AND IMPLEMENTATION

- Involve scientists as core participants in restoration planning activities at the project, estuary and ecosystem levels to ensure that plans incorporate the best quality scientific information available at the time.
- Involve scientists in the development and implementation of monitoring protocols for community-based restoration activities, drawing on their expertise to develop monitoring protocols and interpret results.
- Involve more social scientists and grassroots organizers in restoration planning, design and implementation to incorporate a broader range of interests and concerns into restoration practice.
- Co-sponsor additional national or regional events on ways to approach habitat restoration, including developing transferable models and refining broadly applicable monitoring protocols and success criteria.

RESEARCH

- Incorporate research components into more community restoration projects by building partnerships between research teams and restoration practitioners and developing a graduate student internship program between universities and advocacy organizations.
- Initiate research projects directed at moving from small demonstration projects to the next level in size and scale, including experiments to take successful pilot projects and transfer them to other sites in a region as part of developing regional models.
- Advocate for the inclusion of restoration research in the priorities of EOS, NSF and other funding sources to increase the amount of funding available for habitat restoration research.

NETWORKING AND COMMUNICATION

- Develop scientifically sound public information pieces to provide citizens and policy makers with education on habitat restoration needs and practice.
- Coordinate with existing data sources to establish a common database of restoration research and activities that is updated frequently and easily accessible to all interested parties.
- Develop a roster of scientists, by region, willing to collaborate on planning and implementing community-based restoration projects.
- Develop a habitat restoration case study series documenting successes, failures and transferable findings and techniques.
- Promote the formation of state level technical teams including participants from universities, state agencies and advocacy groups, to integrate restoration planning, implementation, research and funding efforts at the state and regional levels, building on existing models and experience.

PRINCIPLES OF ESTUARINE HABITAT RESTORATION

WORKING TOGETHER TO RESTORE AMERICA'S ESTUARIES

CASE STUDIES

1. **RESTORATION OF COASTAL WETLANDS IN THE GULF OF MAINE**
2. **AN ECOSYSTEM-SCALE RESTORATION PROJECT IN DELAWARE BAY**
3. **THE NORTH CAROLINA CLEAN WATER MANAGEMENT TRUST FUND**
4. **THE BAY AREA REGIONAL WETLANDS ECOSYSTEM GOALS PROJECT**
5. **USING VOLUNTEERS TO ADVANCE THE PRINCIPLES OF ESTUARY HABITAT RESTORATION –TAMPA BAY**
6. **OYSTER RESTORATION IN VIRGINIA'S LAFAYETTE RIVER**

1. RESTORATION OF COASTAL WETLANDS IN THE GULF OF MAINE: A REGIONAL APPROACH TO DEVELOPING METHODS FOR INVENTORY, MONITORING AND SUCCESS CRITERIA

Human activities have altered, degraded or destroyed many of the original tidal wetlands within the Gulf of Maine (GOM). The emphasis of federal, state, provincial and community programs is now on restoring the natural hydrology and functional values of these systems. Restoration efforts include mitigation projects to compensate for permitted impacts and proactive projects to increase the amount and quality of coastal habitats. Despite this emphasis, the overall effectiveness of tidal wetland restoration in the region is uncertain. Contributing to this uncertainty are a lack of comprehensive baseline information on sites available for restoration, widely varying degrees of restoration project monitoring, inconsistencies in monitoring data collection and a paucity of scientifically-defensible standards and criteria for determining restoration success.

A bi-national (United States and Canada) project was initiated in 1999 to address these needs, sponsored by the Global Program of Action Coalition (GPAC) for the GOM under the auspices of the United Nations Environment Program (UNEP). Project goals are to develop a GOM-wide inventory of potential salt marsh restoration sites and a monitoring network of restored and reference salt marshes. To date, the common protocols needed to establish these regional inventory and monitoring programs have been developed in a workshop setting. The regional inventory model consists of agreed-upon data fields for describing site location and size, type of alteration and the method and cost of planned restoration. Similarly, the regional monitoring protocol consists of sampling methods and designs for collecting data on a minimum set of core variables related to marsh physical characteristics, vegetation and fauna.

Implementation of the GOM inventory and monitoring programs is expected to occur through partnerships between estuarine professionals and volunteer members of community-based organizations. Federal, state and provincial agencies charged with tidal

marsh protection and restoration have agreed to use the regional inventory model for describing and cataloging restoration opportunities within their jurisdictions, and community organizations are also being urged to use this format for local projects. Site-specific inventory data from all sources can then be submitted to a regional database, maintained by the U.S. Fish and Wildlife Service GOM Program. The resulting comprehensive inventory of restorable sites will provide a basis for prioritizing among potential restoration projects and will offer consistent baseline information for gauging overall restoration progress.

Organizations are also being encouraged to apply the regional monitoring protocol to restored and reference tidal marshes throughout the GOM. Additional funding is being sought to apply the protocol to other restored and reference marshes throughout the region. Environmental professionals and scientists will guide data collection efforts, compile data from the site network and synthesize resulting information. Onsite data collection will involve members of community-based organizations and will be facilitated by volunteer coordinators with access to State and Provincial repositories of scientific equipment. Ultimately, comparisons of wetland characteristics between restored and reference sites will be used to identify reliable indicators of restored marsh functions and to suggest regionally applicable success criteria for restoration projects.

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2. AN ECOSYSTEM-SCALE RESTORATION PROJECT IN DELAWARE BAY – A LIVING ILLUSTRATION OF THE RAE-ERF RESTORATION PRINCIPLES

One of the world's largest tidal wetland restoration projects, the Estuary Enhancement Program (EEP), was conceived to offset the loss of fish to a once-through cooling system at the Salem Nuclear Power Generating Station owned by Public Service Electric and Gas (PSEG) on the Delaware Bay. An estimated one billion eggs, larvae and juveniles of estuarine-resident and marine-transient species are lost each year in the once-through cooling system at the Salem Station. As an alternative to the construction of two natural draft cooling towers, PSEG proposed the EEP, an ecosystem-scale restoration project, to replace the species of concern [weakfish (*Cynoscion regalis*); spot (*Leostomus xanthurus*); white perch (*Morone americana*); and bay anchovy (*Anchoa mitchilli*)] lost in the cooling system. Based on the positive correlation between the primary production of salt marshes and the secondary production of nekton, an aggregated food chain model was employed to estimate the required area of tidal salt marsh needed to offset the loss of the major species of concern in the Bay. From the model, over 5,040 ha of diked salt hay (*Spartina patens*) marsh and common reed (*Phragmites australis*) degraded brackish marsh was proposed for restoration, enhancement and protection.

Beginning in 1994, a multi-disciplinary team of over 50 specialists in the ecology, design and construction of coastal wetlands participated in a series of summits to develop the conceptual and engineering designs for the restorations and establish performance criteria and implement adaptive management procedures to ensure project success on the appropriate temporal and spatial scales. Because of its size and uniqueness, the EEP has become a focal point and an important case study for scientists engaged in restoration ecology and the application of the principles of ecological engineering (i.e., self-design, minimal intrusion, adaptive management, etc.) within a landscape ecology framework. The long-term success of the project will be monitored within the context of "bounds of expectation," meaning a range of reference marsh platforms and acceptable end-points established by the advisory teams.

From experiences gained thus far, the scientists involved in the EEP have extracted a set of restoration principles that include:

1) State project goals clearly, as agreed to by the stakeholders, and make sure the goals are site-specific and realistic.
2) Restore degraded sites rather than create new wetlands.
3) Select sites in a landscape ecology framework.
4) Ecological engineering practices should apply.
5) Restored sites should be self-sustaining but should be guided by adaptive management toward desired endpoints.
6) Site monitoring should be planned and implemented and should last until success is assured.
7) Success criteria should include functional as well as structural components, framed by a "bound of expectation."
8) Develop and implement a management plan that considers impacts to people and property.

9) Sites should be developed, where possible, with conservation restrictions to ensure their perpetuity and to protect adjacent property.
10) Site plans should encourage public access for sustainable uses.

By documenting the pathways to success, it is hoped that other restoration ecologists will benefit from the experiences gained through the EEP.

More information on the Estuary Enhancement Program can be viewed and/or downloaded from the PSEG web site: http://www.pseg.com/eep/index.html

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3. THE NORTH CAROLINA CLEAN WATER MANAGEMENT TRUST FUND: AN INNOVATIVE MECHANISM FOR FUNDING THE ACQUISITION AND PROTECTION OF SENSITIVE HABITATS

Several years ago, it was clear to the North Carolina General Assembly that in order to maintain and restore the level of water quality that North Carolinians deserve and expect, they must accomplish more than they would be able to do with traditional programs alone. Thus, in 1996 the state General Assembly established the North Carolina Clean Water Management Trust Fund (CWMTF) to fund projects that 1) enhance or restore degraded waters, 2) protect unpolluted waters and/or 3) contribute toward a network of riparian buffers and greenways for environmental, educational and recreational benefits.

At the end of each fiscal year, 6.5% of the unreserved credit balance in North Carolina's General Fund (or a minimum of $30 million) is deposited into the CWMTF. Revenues from the CWMTF are then allocated in the form of grants to local governments, state agencies, and conservation nonprofit organizations to help finance projects that specifically address water pollution problems. The 18 member, independent CWMTF Board of Trustees has full responsibility over the allocation of monies from the Fund. Since 1997, the CWMTF has contributed over $140 million in funds to projects with a total cost of almost $383 million (37% of total project costs).

The potential for this initiative is immense; but its success depends upon local communities and organizations to develop creative proposals that will protect and restore the rivers, lakes, creeks and estuaries of North Carolina. To date, funded projects have included: acquisition of land for riparian buffers or for establishing a network of greenways for environmental, educational or recreational uses; acquisition of easements in order to protect surface waters or urban drinking water supplies; restoration of degraded lands for their ability to protect water quality; repairs of failing waste treatment systems or failing septic tank systems; improvements to stormwater controls and management; and facilitation of planning that targets reductions in surface water pollution.

As an example, the North Carolina Coastal Federation (NCCF), a 501(c)(3) nonprofit organization and member of Restore America's Estuaries, was able to acquire and protect the 31-acre Hoop Pole Creek property through a $2.52 million grant from the CWMTF. The property borders an area of suburban sprawl and was close to being developed before being purchased by the NCCF. Hoop Pole Creek serves as a refuge for fish, wildlife and plant communities, enhances water quality and maintains the ecological integrity of the local aquatic community. As a vital buffer between surrounding land uses and productive estuarine waters, this area is one of the few locations in Bogue Sound where shellfish beds consistently remain open for harvest. NCCF is protecting this area for its outstanding water quality benefits as well as preserving its historical and recreational values for the general public. Providing the public access to this area through a nature trail is part of its mission, and NCCF provides brochures with trail maps for self-guided tours or guided walks led by its staff of naturalists.

More information on the Clean Water Management Trust Fund can be viewed and/or downloaded from the CWMTF web site at: http://www.cwmtf.net/

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4. THE BAY AREA REGIONAL WETLANDS ECOSYSTEM GOALS PROJECT: A MODEL GOAL-SETTING PROCESS IN SAN FRANCISCO BAY, CALIFORNIA

The San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project) was undertaken in June 1995 to establish a long-term vision for a healthy and sustainable baylands ecosystem. It presents recommendations for the kinds, amounts and distribution of wetlands and related habitats that are needed to sustain diverse and healthy communities of fish and wildlife resources in the San Francisco Bay Area, and it represents the culmination of more than three years of work by scientists, resource managers and other participants. The geographic scope of the Goals Project includes portions of the San Francisco Estuary that are downstream of the Sacramento-San Joaquin Delta (Suisun Bay, San Pablo Bay and San Francisco Bay) and focuses on the baylands—the lands within the historical and modern boundaries of the tides.

Shortly after the Goals Project began, the interagency group directing the effort, the Resource Managers Group (RMG), prepared a statement of purpose: "The San Francisco Bay Area Wetlands Ecosystem Goals Project will use available scientific knowledge to identify the types, amounts and distribution of wetlands and related habitats needed to sustain diverse and healthy communities of fish and wildlife resources in the San Francisco Bay Area. The Goals Project will provide a biological basis to guide a regional wetlands planning process for public and private interests seeking to preserve, enhance and restore the ecological integrity of wetland communities." The RMG also developed recommendations (presented in the Goals Report) and appointed members of key focus teams including: 1) plants; 2) fish; 3) mammals, amphibians, reptiles and invertebrates; 4) shorebirds, waterfowl and other birds; and 5) hydrogeomorphology.

The process for developing the goals involved several steps: selecting key species and key habitats, assembling and evaluating information, preparing recommendations and integrating recommendations into goals. The RMG decided to develop goals based on species needs because there was relatively abundant information available on bayland species and habitats. There was general agreement that goals developed to improve habitats for many kinds of plants and animals would concurrently provide other important wetlands services, such as nutrient cycling, flood control and water quality improvement. The goals recommendations are founded on one important premise: there should be no additional loss of wetlands within the baylands ecosystem. Furthermore, as filled or developed areas within the baylands become available, their potential for restoration to fish and wildlife habitat should be fully considered.

At the recommendation of the Science Review Group, the RMG prepared a set of principles to guide the development of the habitat goals. In essence, the principles comprise the RMG's assumptions of what the goals should be. The RMG solicited comments from the public, the focus teams and the Science Review Group before preparing the final list of guiding principles. According to these principles, the goals should:

1) Present a vision of habitat changes needed to improve the Bay's ecological functions and biodiversity;
2) Increase the quantity and quality of wetlands without trying to 'reach' the past;
3) Be based on evaluations of the habitat needs of representative species;

4) Give priority to the habitat needs of native species;
5) Emphasize protecting and restoring wetlands that support threatened, endangered, and other special-status species while ensuring adequate habitat for other species;
6) Enhance the Bay's ability to support resident and migratory species;
7) Recognize that it will be impossible to maximize habitat for all species;
8) Recognize the habitat values provided by some existing land uses such as farming and salt production;
9) Include recommendations for habitats adjacent to the baylands;
10) Be based on existing biological information, knowledge of historical conditions and sound professional judgment; and
11) Be modified in the future to reflect improved scientific understanding and practical experience in wetland restoration.

The goals establish a flexible vision for restoring bayland habitats. Because they are not a blueprint of specific projects, implementing the goals recommendations will require close coordination among landowners, agencies and others. Accordingly, the RMG recommended that the agencies and the public work together to develop an appropriate process for implementing the goals. This process should seek to ensure better coordination, identify appropriate research and monitoring and improve agency policies and procedures.

The Estuary Project's *Comprehensive Conservation and Management Plan* designates the California Resources Agency as the lead agency for developing a regional wetlands plan. The Resources Agency agreed to work with the Bay Area Wetlands Planning Group in developing this plan. Group members have recently drafted a general scope for this effort. The tasks in the draft scope include forming a stakeholder committee, holding technical workshops, preparing a draft plan, seeking public comments on the draft plan and preparing a final plan. The stakeholder committee will include landowners, business interests, environmental groups and local governments. Initial stakeholder meetings are scheduled to begin in mid-1999, and developing the wetland plan is expected to take six to twelve months.

More information on the San Francisco Bay Area Wetlands Ecosystem Goals project can be viewed and/or downloaded from the San Francisco Estuary Institute web site at: http://www.sfei.org/

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5. USING VOLUNTEERS TO ADVANCE THE PRINCIPLES OF ESTUARINE HABITAT RESTORATION: THE TAMPA BAY EXPERIENCE

"Working together makes all the difference" is the motto in Tampa Bay, where volunteers are the life-blood of the Tampa Bay Estuary Program (TBEP). Volunteers allow the governmental and non-governmental groups to accomplish estuary protection and restoration activities that they could not afford to do otherwise. The Bay Conservation Corps, administered by the nonprofit group Tampa BayWatch through a grant from the TBEP, facilitates the involvement of thousands of volunteers in a wide variety of Bay improvement activities described below.

SALT MARSH GRASS AND SEAGRASS PLANTING PROJECTS

Tampa BayWatch coordinates the planting of salt marsh grasses (primarily *Spartina alterniflora*) and seagrasses to address the loss of 44% of the Bay's salt marsh habitat and 80% of the Bay's seagrass habitat. To date, over 200,000 plants have been installed at sites throughout Tampa Bay.

HIGH SCHOOL WETLAND NURSERIES PROGRAM

The nursery project directly involves local high school students in the restoration of salt marsh habitats, where they gain hands-on experience in resource management and environmental stewardship and thrive on the feelings of accomplishment they earn after nurturing the plants to maturity in the campus nursery and installing them in major restoration projects around the bay. Today, 12 high schools maintain wetland nurseries that produce over 50,000 salt marsh plants a year for the Bay.

MONOFILAMENT FISHING LINE REMOVAL FROM COLONIAL BIRD NESTING ISLANDS

Tampa BayWatch and National Audubon Society cooperate in the largest event of its kind in the country to clear over 60 bird nesting islands of deadly monofilament fishing line, ensuring a safer nesting environment for the birds.

STORM DRAIN STENCILING PROJECTS

Storm drain stenciling projects are community efforts to label the cement caps covering storm drains to remind residents that whatever goes down the drain can affect water quality in our rivers and bay.

THE GREAT BAY SCALLOP SEARCH

Each year, Tampa BayWatch coordinates a resource monitoring project where volunteers snorkel throughout the lower Tampa Bay area to document scallop populations. Data from past Scallop Searches has been used to develop a transplanting program where scallops from healthy donor sites to the north are transplanted to the lower Bay to re-establish viable scallop breeding colonies throughout the Bay.

Volunteers are a critical part of the restoration and protection activities in the Bay, and the opportunities that Tampa BayWatch and the Tampa Bay Estuary Program provide help to build citizen awareness of, concern for, and participation in the restoration and recovery of the Tampa Bay estuary.

More information on Tampa BayWatch's volunteer programs can be viewed and/or downloaded from the Tampa BayWatch web site at http://www.tampabaywatch.org

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6. OYSTER RESTORATION IN VIRGINIA'S LAFAYETTE RIVER

At one point in time, the Queen of England requested Virginia oysters by name. However, after many years of over-harvesting, disease and sedimentation, the mighty oyster reefs of the Chesapeake which once loomed as navigation hazards, have been nearly wiped out. While only a small fraction of the prior oyster population remains, today there is a reason for hope for the Virginia oyster.

In 1998, the Chesapeake Bay Foundation (CBF) joined forces with the Norfolk Rotary Club, the Virginia Marine Resources Commission (VMRC) and Old Dominion University (ODU) to begin restoring the depleted oyster population of Virginia's Lafayette River. Recognizing that a healthy bay and a healthy economy are inextricable linked, the Norfolk Rotary Club raised $28,000 to put toward the construction of two oyster sanctuary reefs. Using the funds as leverage, CBF and VMRC attracted additional funds to complete the reefs.

ODU scientists helped determine the best locations for the reefs based on circulation patterns, sediment and water quality considerations to maximize larvae survival and spat settlement. Once the sites were chosen, VMRC constructed the reefs by piling shell material to simulate historic inter-tidal oyster reefs. The three-dimensional reef design was based on research conducted by the Virginia Institute of Marine Science which shows that placing oysters higher in the water column improves their health. CBF helped stock the reefs through its oyster gardening program, in which citizens and schools raise oysters in floating cages to protect them from sedimentation and predation.

With the help of hundreds of volunteer oyster gardeners, CBF has transplanted nearly 250,000 oysters the Lafayette River and other oyster reefs in Virginia. So far, the project has resulted in a tremendous increase in the oyster population in the Lafayette River—the number of new oysters around the reef and up to one mile away has grown 23-fold. The Lafayette River oyster restoration project represents just one example of massive restoration efforts now taking shape in Virginia and Maryland. The goal now is to achieve a ten-fold increase in the number of oysters in the Chesapeake Bay over the next five years.

More information about Chesapeake Bay Foundation's oyster gardening program can be viewed and/or downloaded at its web site at: http://www.savethebay.cbf.org/action_center/outdoor_activities/oyster_gardening.htm

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