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Information About Estuaries and Near Coastal Waters
February 2001 - Issue 11.1

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Protecting and Restoring Urban Watersheds: Conserving Biodiversity in the New York/New Jersey Harbor Estuary

When most people think of New York and New Jersey, they think of skyscrapers, highways, and a human megalopolis. In the midst of this urban metropolis lies the New York/New Jersey Harbor Estuary, a dynamic ecosystem covering 42,128 square kilometers. Despite the 20 million people living and working in this economic hub, there remain open areas that support wetland, aquatic, coastal, and forest communities. Thousands of hectares of forest - despite great development pressure - support habitat for wood thrushes, scarlet tanagers, and great-horned owls. Five islands in the NY/NJ Harbor comprise the largest colonial wading bird rookery in the metropolitan region, the Harbor Herons Complex, fed by salt marshes that support healthy invertebrate and fish populations. Threatened green and endangered leatherback sea turtles feed in Raritan Bay during the summer. Twelve pairs of peregrine falcons and fifteen pairs of piping plovers - both federally listed species - nest in New York City. Green milkweed and globose flat sedge grow on serpentine barrens in Staten Island among, more than two dozen rare plant species surviving in New York State and New Jersey. The mammoth human development has taken its toll; seventy five percent of the areaís historical wetland resources have been lost, resulting in the isolation and endangerment of numerous species.

As part of the National Estuary Program, the New York/New Jersey Harbor Estuary Program (HEP) developed a Comprehensive Conservation and Management Plan (CCMP) and formed a Habitat Workgroup (HWG) to implement the habitat objectives of the plan:

- restore and maintain an ecosystem that supports an optimum diversity of living resources on a sustained basis;
- preserve and restore ecologically important habitat and open space;
- encourage watershed planning to protect habitat; foster public awareness and appreciation of the natural environment;
- minimize erosion and decrease sediment and pollutants; and
- increase public access consistent with maintaining the Harbor/Bight ecosystem.

Given the human pressures on the existing natural systems in the harbor, a critical priority of the program is to secure and protect public and private properties that remain undeveloped. When acquisition is not possible, rigorous restoration must serve as a substitute. Damaged habitat does not necessarily return without intervention. The HWG has documented, through long-term monitoring supported by the NY/NJ Harbor Oil Spill Trustees, that unrestored salt marsh, destroyed by oil spills that occurred as long ago as 1990, has not recovered through natural processes. After a decade, the sites remain denuded; the ecosystemís structure and function has not recovered.

But restoration and mitigation are not cure-alls. There has been great debate within the HWG as to whether the current wetland regulatory guidelines requiring one-to-one or three-to-one mitigation replacement acreage in public works projects and damages claims are too conservative. It is uncertain whether wetland mitigation, as it is practiced, maintains the goal of no loss or no net loss. While state-of-the-art restorations and creations can "build" wetlands that look natural, there is considerable controversy as to how long it will take, if ever, for these created or restored systems to function as high-quality natural wetlands. Successful replacement of wetlands is usually measured only at the grossest structural level -- replacement of dominant vegetation cover type -- and does not account for the full complement of the wetland ecosystem functions, including development of the peat substrate, abundance of invertebrate populations, storage of essential nutrients, and development of nutrient cycles. Forest restorations take decades longer to recover full structural and functional values.

In response to these concerns, the HWG developed standard and comprehensive five-year monitoring protocols to be required in any mitigation program to ensure restoration success. Monitoring parameters include vegetation success recorded by basal area spread, above and below ground biomass, flowering stems (indicators of potential seed recruitment), invertebrate recolonization, soils, and fish and avian use. These monitoring protocols serve as indicators that help us to gauge our success, correct our failures, and study recovery over time.

In 1999, the U.S. Fish & Wildlife Service (USFWS), working with the HWG, released the report ìSignificant Habitats and Habitat Complexes of the New York Bight Watershed.î The HEP Acquisition and Restoration Priority Map targeted sites within these habitats and provided the foundation for many of the habitat-oriented projects in the NY/NJ Harbor. Sixty acquisition sites and 88 restoration projects have been identified, selected by the presence of federally, state, and locally rare species, size, continuity with other natural areas, imminence of development, and other criteria.

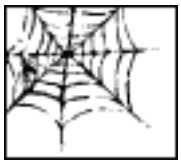
The US EPA and USFWS also recently released ìWetlands of Staten Island, New York: Valuable Vanishing Urban Wildlands,î an addition to the National Wetland Inventory, and a guideline for greater protection of the Arthur Kill/Kill van Kull and Raritan Bay wetlands. Northwest Staten Island is an area of great natural value and development potential, containing some of the most diverse tidal wetlands of New York City.

Presently, more than $200 million is committed to HEP priority habitat restoration and acquisition projects. The New York State Clean Water/Clean Air Bond Act and the City of New York awarded $20 million to New York City (NYC) Parks and New York State Department of Environmental Conservation (DEC) to restore HEP priority sites. NYC Parks/ Natural Resources Group, is overseeing an additional $40 million in restoration projects with monies recovered from damages claims, public works mitigations, and grants. Natural resources damages claims, public works mitigations, and grants are funding several of New York Cityís most comprehensive forest restorations, as well as salt marsh, freshwater wetland and riparian projects in the Arthur Kill, Jamaica Bay, and Long Island Sound. NYS DEC has channeled monies for public works mitigations and damages into several HEP priority sites, including the Alley Pond Park watershed, Terra-Peninsula Preserve, and Dreier-Offerman Park. The Port Authority of New York and New Jersey has conducted several successful restorations implementing the HEP-endorsed five-year monitoring protocols.

The Army Corps of Engineers, with several partners, has initiated restoration studies for Jamaica Bay, the Bronx River, and the Hudson-Raritan Estuary which include many HEP restoration priorities.

Over the past five years, New York City has acquired more than 1,500 acres of natural land in HEP priority watersheds that are now part of the NYC Parks 11,000-hectare emerald empire. In New Jersey, there is great anticipation of the implementation of the Garden State Preservation Trust Act, which will protect significant natural areas forever. New Jersey Department of Environmental Protection recently acquired property at the headwaters of the Rahway River, the Leonardo wetlands in Raritan Bay, and Old Tappan Reservoir and Forest on the Hackensack River, and has committed $15 million for the next three years for additional HEP acquisition priorities. Last yearís efforts culminated with a letter to President Clinton from the New York and New Jersey Senate delegation requesting that $30 million be earmarked for HEP acquisition and restoration priority sites. This was a critical step towards the costly acquisition of threatened New York and New Jersey habitat. Despite these measures, salt marsh, freshwater wetlands, and adjacent forests continue to be destroyed in HEP Priority sites, most recently at Cheesequake State Park, New Jersey, and Outerbridge Ponds, Staten Island. Existing penalties for violations of the Clean Water Act are inadequate and fail to act as a deterrent nor adequately reflect the costs of restoring, monitoring, or aquiring habitat replacement in an area which contains some of the most expensive real estate in the world. The New York/New Jersey HEP Habitat Workgroup will publish a status report in February, 2001 featuring innovations in restoration ecology and protection of these watersheds.

For further information, please contact Marc A. Matsil, Chief of the NYC Parks Natural Resources Group and Chair of the NY/NJ Harbor Estuary Programís Habitat Workgroup, Phone: (212) 360-1417, E-mail: raptor@parks.nyc.gov at City of New York Parks & Recreation, 1234 Fifth Avenue, New York, New York 10029.



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Noxious Seaweed Found in Southern California Coastal Waters

Dubbed "killer algae," the alien seaweed Caulerpa taxifolia was discovered in June 2000 in a coastal lagoon in Carlsbad, California, within San Diego County. An aggressive clone of this species has already proven to be highly invasive in the Mediterranean Sea, where the governments of France, Spain, Monaco, and Italy have been unable to control its spread. The first confirmed American occurrence of this invasive species in California has caused considerable alarm. The resulting press coverage of the issue led to discovery of a second infestation of Caulerpa taxifolia in Huntington Harbour in Orange County (about 75 miles north of the Carlsbad occurrence). Efforts are underway to eradicate Caulerpa taxifolia from California and control its spread before the infestation reaches the magnitude seen in the Mediterranean.

Caulerpa taxifolia is a green alga native to tropical waters, and typically grows to small size and in limited patches. In the late 1970s, this species attracted attention as a fast-growing and decorative aquarium plant that became popular in the saltwater aquarium trade. Around 1984, this species apparently escaped or was released from an aquarium into Mediterranean waters, and rapidly spread from an initial patch of about one square yard to over two acres by 1989. By 1997, French scientist and Caulerpa expert, Alexandre Meinesz reported it blanketed more than 11,000 acres of the northern Mediterranean coastline and has recently been found growing off northern Africa. Genetic analysis suggests that all Caulerpa taxifolia plants in the Mediterranean are clones of the original, inadvertently released aquarium plant.

In areas where the species has become well established, it has caused ecological and economic devastation by overgrowing and eliminating native seaweeds, seagrasses, reefs, and other communities. In the Mediterranean, it is reported to have harmed tourism and pleasure boating, devastated recreational diving, and had a costly impact on commercial fishing both by altering the distribution of fish as well as creating a considerable impediment to net fisheries. The dense carpet that this species can form on the bottom could inhibit the establishment of juveniles of many reef species, and its establishment offshore could seriously impact commercial fisheries and navigation through quarantine restrictions to prevent the spread of this species. This threat is not exclusive to California. Besides being likely to thrive in other warm locales, such as the Gulf of California, and the Gulf of Mexico, more north cooler waters may be at risk because Caulerpa persists at water temperatures as low as 50_ F.

According to Meinesz, this clone can grow larger, at deeper depths (in excess of 300 feet), and in colder waters than the tropical populations of the species and therefore threatens not only tropical areas, but temperate regions as well. It grows on almost any substrate and in many different energy regimes, ranging from protected bays to exposed headlands. Great monotypic stands can develop, giving the appearance of a carpet of "astroturf." Caulerpa spreads readily via fragmentation, making prevention of spread and mechanical removal nearly impossible. Fishing nets and boat anchors are believed to be primarily responsible for the dispersal of the species throughout the Mediterranean.

Despite bans on its possession in France, Spain, and Australia, this organism continues to be transported and sold by the aquarium trade; fearing its eventual introduction into US waters, over 100 prominent scientists petitioned the federal government in 1998 to ban the use of Caulerpa taxifolia in American aquaria, leading to its designation in 1999 as a prohibited species under the Federal Noxious Weed Act. The discovery of this species in southern California, recently reported in the journal Nature to be genetically identical to the strain in the Mediterranean, confirms that it nevertheless continues to invade valuable marine ecosystems. It is likely that the alga was released from an aquarium at the locations in California where it has been discovered, a practice banned under California law.

Eradication

Although delays in recognizing the true threat of the invasion in the Mediterranean make the eradication of Caulerpa taxifolia there unlikely, distribution of the Caulerpa discovered in California is restricted enough that eradication efforts have been optimistically undertaken. After exploring techniques such as dredging, hand removal, draining of the lagoon, and application of various herbicides, a biological consulting firm in San Diego developed and implemented a plan to treat the seaweed in situ to avoid further fragmentation and spread. Each patch of Caulerpa was covered with a heavy plastic tarp that was sealed to the bottom at the edges and fitted with a small "port" on top that allowed for the introduction of herbicide under the tarp. The tarp allowed for the direct treatment of the target patch, while preventing the loss of herbicide to the lagoon waters.

Although the algae appeared to have been effectively treated, the tarps were left in place to prevent the growth of Caulerpa from portions of it that grow in the mud and that may not have been fully treated by the herbicide application. All known Caulerpa has been treated in Carlsbad, and the site is surveyed monthly, with monitoring continuing for at least five years in order to detect regrowth. A very similar eradication is currently ongoing in Huntington Harbour.

The initial success of the eradication efforts should not lull the public or regulators into a false sense of complacency. The possibility of infestations that so far have avoided detection, as well as a stock of Caulerpa residing in American aquariums, nearly ensures that this seaweed will continue to pose a threat to US coastlines.

Public Education

The public can help prevent and detect infestations of Caulerpa taxifolia. The most important task is to prevent the introduction of any aquarium organisms into water bodies. Extreme care must be taken when cleaning or dismantling fish tanks, because a half-inch piece of Caulerpa taxifolia that is inadvertently washed into the gutter while rinsing a fish tank on the lawn could quite plausibly travel through the storm drain directly to a nearby estuary or beach and establish itself there. Aside from caution, an even more responsible action would be to eliminate any risk of accidental introduction by discontinuing the use of Caulerpa in home aquaria. Caulerpa can be removed from the tank, with all the material it is attached to

(rocks, gravel, etc), placed in a freezer for 24 hours, and then placed in the trash for disposal in a landfill. Under no circumstances should any unwanted aquarium plants or animals be released into the wild.

In addition to prevention of new introductions, detection of existing infestations is also critical. It is crucial that all people who spend time exploring the ocean bottom be educated and involved in detection and reporting. SCUBA and free divers as well as recreational and commercial fishermen can participate in the surveillance effort by familiarizing themselves with the appearance and habit of this seaweed. It is bright green with feathery fronds (see photographs) and grows in a low mat on the ocean bottom. Caulerpa could become entangled in fishing equipment that reaches the sea floor, but it does not float, so it is unlikely that it will be spotted on the surface of the sea. Large patches may be visible from the air due to its distinct bright green color.

If Caulerpa taxifolia is observed in the wild, do not disturb it. Note as much information as possible about the location where it was found and report it immediately to the Southern California Caulerpa Action Team at (858) 467-2952 or E-mail: caulerpa@rb9.swrcb.ca.gov.

For further information, contact Rachel Woodfield, Merkel & Associates, Phone: (858) 560-5465; E-mail: RachelAnnW@aol.com, visit the websites at http://www.swrcb.ca.gov/rwqcb9/programs/caulerpa/caulerpa.html EXIT disclaimer and http://www.mcbi.org/caulerpa/babbitt.html (No Longer Available), or read Killer Algae by Alexander Meinesz, translated by Daniel Simberloff, University of Chicago Press, 1999.

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Sowing Seeds for Eelgrass Restoration

With an innovative underwater planting device, researchers at the University of Rhode Island hope to break new ground in seagrass restoration

Eelgrass (Zostera marina) is a marine plant with significant ecological value, providing habitat for invertebrates and juvenile fish, reducing erosion, dampening the effects of flooding and promoting water quality. Many studies have shown that eelgrass is in decline worldwide, due primarily to degraded water quality associated with human activities such as increased nitrogen loading and pollution. In response to this trend, eelgrass restoration activity has increased in the past decade.

Because of the amount of work involved in eelgrass restoration, most experts conclude that the best way to conserve these ecosystems is to strive for higher water quality so that less eelgrass habitat is lost in the first place. That said, scientists do believe that eelgrass restoration can help kick start the recovery process, as long as the water quality has returned to adequate levels and there is a history of eelgrass presence at the site in question. Researchers at the University of Rhode Island (URI) are currently testing a new method of eelgrass planting that will add to the list of techniques available to

resource managers tackling this problem.

Currently, most eelgrass restoration experts use the "adult-shoot" method, pioneered by C.E. Addy in the Chesapeake Bay during the late 1940s, where plants are uprooted from one area and transplanted to another. This work is very time-consuming because each shoot must be extracted and then replanted by waders, snorkelers or, as is often the case, SCUBA divers. Seeds, on the other hand, can be collected and planted in groups, so that less time and personnel are required. While adult-shoot restoration is still much more common than seed-based restoration, most experts acknowledge that a more efficient method is necessary to successfully carry out large-scale projects. If a seed-based restoration technique can be perfected and mastered, it may become the most cost-effective means for restoring multiple-acre sites. However, seed-based restoration is still very much in the experimental phase.

The largest successful eelgrass restoration projects - far outnumbered by the number of failures - are less than 10 acres in area, and the majority of these are closer to one acre. Recently, however, several large restoration projects that are still in the planning stage have placed particular focus on the cost-effectiveness of various restoration methods. In Laguna Madre, Texas, managers and scientists are planning a 70-acre restoration project in response to a recent oil spill that wiped out local eelgrass meadows. In Rhode Island, the US Army Corps of Engineers is considering three separate restoration projects in coastal lagoons that, taken together, account for 180 acres.

Restoring 180 acres is ambitious, especially when one considers the costs of adult-shoot transplanting methods. Mark Fonseca of the NOAA National Ocean Service Laboratory notes that, based on successful Federal Court cases in which he has been involved, adult-shoot planting efforts can cost $41,836 per acre (in 1996 dollars). At that rate, the Rhode Island coastal lagoons project alone would cost more than $7.5 million. The advent of these vast restoration projects accentuates another possible drawback of adult-shoot transplantation methods: this technique requires the harvesting of native eelgrass stocks to provide material for planting in project areas. Up to now, restoration projects have usually been limited in size and the negative effects of collecting eelgrass from an existing "donor" bed have been considered negligible. Now, managers are expressing concern that large scale harvesting of eelgrass shoots for various restoration projects could have a substantial and detrimental effect on existing populations.

In an effort to make large-scale eelgrass restoration a reality, researchers at URI are currently testing a boat-pulled sled, the culmination of six years of research, which automatically deposits eelgrass seeds below the surface of the sediment in estuaries and near-shore coastal areas. According to URI ecologists Dr. Scott Nixon and Steve Granger, test plantings of 2,000 eelgrass seeds per square meter took place in the fall of 2000, and results on seed germination and seedling survival will be available in the summer of 2001. The researchers are hoping that the field experiment will realize the 50% success rate observed in URI tank experiments. Such success would yield 1,000 eelgrass shoots per square meter, which is

approximately the upper range of the natural carrying capacity for eelgrass in the near-shore coastal areas of Rhode Island.

Anything close to 50% survival in the field would be an unqualified success. Dr. Robert Orth of the Virginia Institute of Marine Science has worked with seed-based eelgrass restoration in the Chesapeake Bay for over 10 years. In his experience, survival rates only approached 50% when the seeds were contained in burlap bags. Moreover, attempts by his lab to use an underwater planting sled did not exceed the 5 - 15% survival rate achieved when the seeds were simply thrown over the side of the boat.

The URI project, funded by the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), addresses one of the main problems with seed-based eelgrass restoration methods: the tendency of the seeds to be washed away or consumed by predators before finding a haven in the sediment. To increase seed survival, URI ecologist Mike Traber encased the eelgrass seeds in a gelatin matrix, which is injected directly into furrows carved by the sled. The seeds are pushed through the sled and into the ground by a specialized food-processing pump designed to inject precise amounts of jelly into donuts. The pump was built by the Edhard Corporation in Hackettstown, New Jersey, and provided to the researchers at a reduced cost. A weighted flange on the back of the sled than covers up the furrows, burying the seeds under approximately an inch of sediment.

URI researchers note that a method may work in one area but be less effective in a different area. Hence, the idea behind this project is to add more tools to the coastal resource managerís arsenal, not to design a cure-all method. Towards this end, the URI team also enlisted a horticulturist from the plant science department to look at alternative methods for increasing the germination rates of eelgrass seeds.

Projects on the scale of those currently pending in Texas and Rhode Island highlight the need for more efficient restoration methods. If researchers like Orth and those working on the URI project can make seed-based restoration viable, they will no doubt find managers willing to put these new techniques to the test.

For more information, contact Kalle Matso at CICEET, Phone: (603) 862-3508; or E-mail: kalle.matso@unh.edu or visit the CICEET website at http://ciceet.unh.edu EXIT disclaimer.

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Coastal Restoration Through Wetland Mitigation Banking

Beginning in the fall of 1998, Marsh Resources Inc. (MRI), a wetland mitigation banking company, undertook construction of one of the largest public wetland mitigation banks in the Hackensack Meadowlands District, Bergen County, New Jersey. The Meadowlands District is a 32-square mile area located in northeastern New Jersey within five miles of New York City.

Wetland mitigation banking, although a new concept to many, has been around for almost twenty years. The first wetland mitigation bank was approved in Louisiana in the early 1980ís, but the acceptance and use of mitigation banks became a reality after 1995 when the Federal government issued the notice entitled Federal Guidance for the Establishment, Use and Operation of Mitigation Banks, signed by the US Army Corps of Engineers, US EPA, Natural Resources Conservation Service, US Fish and Wildlife Service and the National Marine Fisheries Service. It defines mitigation banking as "wetland restoration, creation, enhancement, and in exceptional circumstances, preservation undertaken expressly for the purpose of compensating for unavoidable wetland losses in advance of development actions, when such compensation cannot be achieved at the development site or would not be as environmentally beneficial." While on-site mitigation is preferred, wetland mitigation banking, when used appropriately, has proven to be more successful and effective then previous piece-meal mitigation policies.

MRI conceived the idea to restore this much degraded site to a more natural wetland condition and use it as a public wetland mitigation bank. The site contained 206 acres of degraded, Phragmites-dominated salt marsh system located along the Hackensack River. It had been greatly disturbed over the last fifty years by mosquito ditching and construction of the nearby New Jersey Turnpike. The property is owned by the parent company, The Williams Companies, Inc. based in Tulsa, Oklahoma, an energy and communications company with surplus lands and a great interest in mitigating potential impacts from their projects and others.

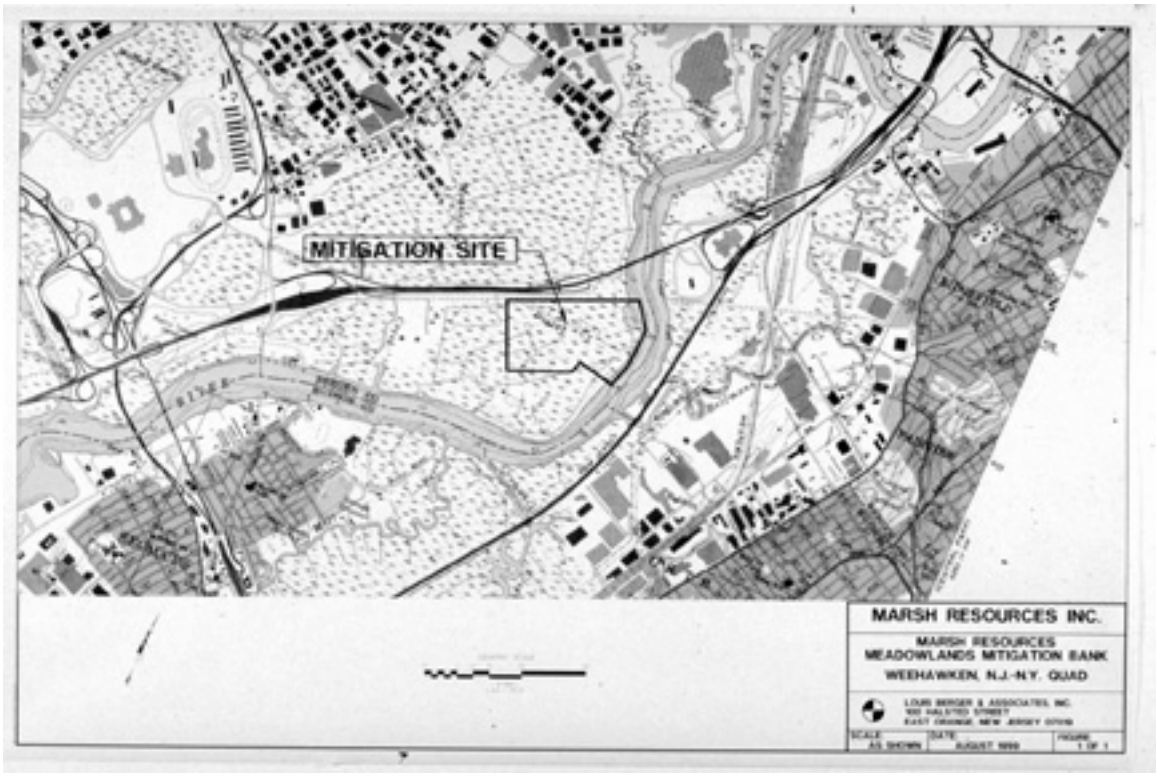
Permitting

MRI worked with the Meadowlands Interagency Mitigation Advisory Committee (MIMAC), which is comprised of the US Army Corps of Engineers, US EPA, US Fish and Wildlife Service, National Marine Fisheries Service, New Jersey Department of Environmental Protection and the Hackensack Meadowlands Development Commission, to develop the conceptual plans and ultimately the construction plans. It took about a year and a half to address the ecological recommendations and obtain all regulatory approvals for construction of the restoration project, now known as the Marsh Resources Meadowlands Mitigation Bank (Bank). The Bank will be used to compensate for permitted, in-kind, wetland impacts in the Bankís service area (made up of the Hackensack River Watershed, Hackensack Meadowlands District political boundaries, Newark Bay area and the New Jersey side of the Hudson River Watershed).

Restoration

The restoration strategy involved eradicating the invasive Phragmites (or common reed) monoculture including aerial applications and hand spraying of the herbicide Rodeo for two years prior to initiating grading activities. Once the Phragmites were weakened by the herbicide treatment (it never really was killed) it was rolled with specialized equipment known as Rollagons to further eradicate the dense stands. After the Phragmites stands were flattened, long-reach excavators operated off timber mats regraded and built two upland containment islands. A low marsh plain was graded to establish elevations designed to restore tidal flow and to create inundation periods which promote the establishment of native marsh species. Dredge material, resulting from the creation of the meandering channel, was pumped into containment islands to create valuable upland habitat and add habitat diversity.

A challenge during construction was the need to keep the project area flooded while the dredges were operating. A perimeter berm was built around the entire site but proved ineffective because of percolation through the mucky substrate in certain areas. Industrial sized water-filled vinyl tubes had to be brought in to contain water as the dredge excavated the channel system. The creation of the natural meandering channel system was also a challenge since hydraulic dredges typically cannot maneuver around tight curves. To overcome this problem, mechanical excavators adjacent to the new channels fed material to the dredge, while marsh buggies pulled the dredge through the tight meandering curves. All dredged material was used on the site and helped in lowering the overall cost of construction.



After the proper elevations and channels were restored, literally hundreds of thousands of desired marsh species were planted including Spartina alterniflora, S. patens, Distichilis spicata, Baccharis halimifolia, Iva frutescens and Myrica pensylvanica. In addition to the plantings, over 2,200 gallons of salt marsh grass seed were spread across the site. Planting operations had to be timed to meet critical windows for the establishment of a healthy marsh. Significant fencing had to be installed throughout the site to prevent grazing by herbivores, particularly Canada geese.

Today, 120 acres have been restored and are functioning as a natural intertidal estuarine marsh system. The remaining 86 acres are currently being restored and should be planted by mid 2001. The entire site will be monitored for a minimum of five years to ensure long-term success of the restored marsh. Only vegetation monitoring is required by the permitting agencies; the project must maintain an 85% survivability of the newly restored plants. In addition, other parameters will be studied to better quantify the success of the restoration project, including benthic fish, water quality surveys, and a study by Rutgers University comparing fish habitat use in the restored marsh to a Phragmites-dominated marsh.

Although wetland mitigation banking may not be suitable all cases, the Marsh Resources Meadowlands Mitigation Bank provides an example of how private industry and natural resource agencies can work together to accomplish significant marsh restoration projects. Through the sale and appropriate use of wetland mitigation acre-credits, Marsh Resources Inc. hopes to be able to fund, plan, design and build more successful coastal and non-tidal mitigation projects.

For further information on the mitigation bank, please contact Mary Ann Thiesing, US EPA Region 2; Phone: (212) 637-3818 or Rich Mogensen, Marsh Resources Inc.; Phone: (704) 655-9707 or visit the website at http://www.marshresources.twc.com/ EXIT disclaimer

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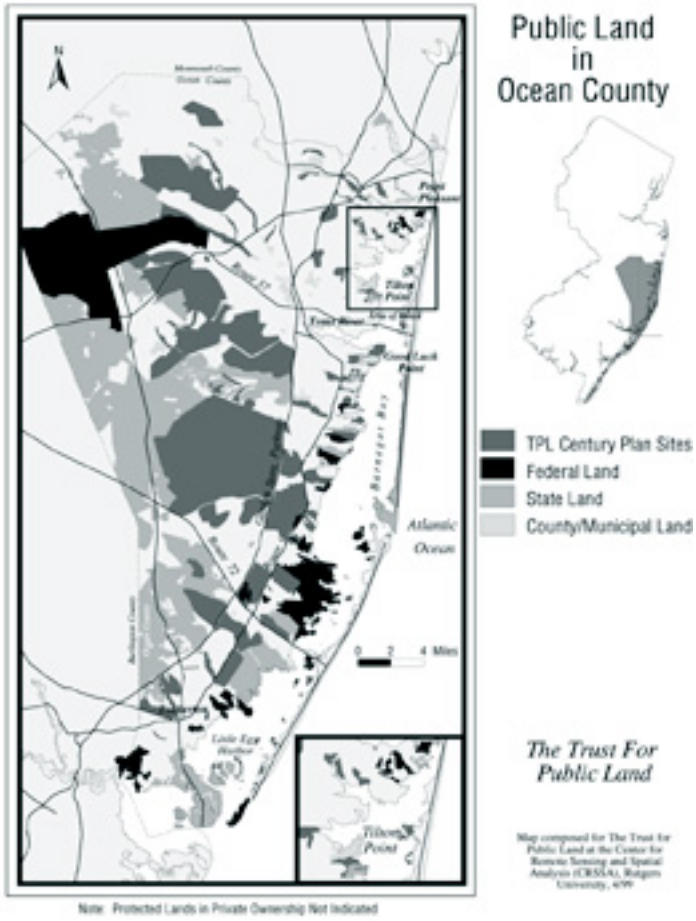
Preserving Land in the Barnegat Bay Watershed to Protect Water Quality

Covering approximately 660 square miles of tidal shoreline, back-bay islands, marsh creeks, and pine and oak forests, the Barnegat Bay Watershed exemplifies the challenge of integrating coastal development and natural resource conservation in New Jersey. Located largely within Ocean County, New Jersey, one of the nationís fastest growing counties, the Barnegat Bay watershed has an approximate year-round resident population of 450,000 and is a premier vacation destination for residents throughout the midatlantic, supporting over 800,000 people during the summer season. Rapid population growth is expected to continue, with year-round population projections estimated at 575,000 by the year 2010.

Barnegat Bay itself is a coastal estuary, part of the National Estuary Program, roughly forty miles long and one to four miles wide. In the bay, fresh and salt water combine to create a delicately balanced and productive aquatic environment that is shallow enough for sunlight to reach the bay floor. The bay is an important source of flounder, weakfish, bluefish, clams, and blue crab. A nearly unbroken chain of barrier islands between the bay and the ocean creates an extraordinarily low rate of tidal exchange, with a complete turnover of water only about once in every 50 days. This relatively slow tidal exchange prolongs the length of time that pollutants remain in the bay.



The primary threat to both the Barnegat Bay ecosystem and drinking water supply is nonpoint source pollution from rapid development. The regionís strong reliance on drinking water wells, coupled with the need for clean water wildlife habitat and protection of the bay ecosystem, means water treatment alone is an impractical solution to the problem of nonpoint source pollution within the Barnegat Bay watershed.

Prioritizing Land for Acquisition

The land acquisition program in the Barnegat Bay watershed has been guided by an abundance of research that has helped to prioritize parcels for acquisition, including studies commissioned by the Trust for Public Land (TPL), the U.S. Geological Survey, the New Jersey Department of Environmental Protection, the Pinelands Commission, and the National Estuary Program.

In 1987 a study of the environmental threat to the bayís watershed was ordered by the New Jersey Legislature and a Watershed Management Plan was developed which called for the creation of buffer zones through the acquisition of sensitive areas. In 1995 TPL published a study entitled "The Century Plan: A Study of One Hundred Conservation Sites in the Barnegat Bay Watershed." The Century Plan described 100 high priority conservation and public-access sites in need of protection. A 1997 follow-up report, entitled "Beyond the Century Plan: Biological Studies and Land Conservation of the Barnegat Bay Watershed," identified other vulnerable lands. These studies identified the top ten areas for priority protection on the basis of five criteria:

- importance to water quality;
- importance as wildlife habitat;
- level of disturbance, with preference to undisturbed properties;

- adjacency, or proximity to already protected properties; and
- size, with a preference for properties large enough to offer significant benefit.

Funding Land Acquisition

To date, considerable progress has been made, and some of the lands recommended for acquisition in the Century Plan have been protected with the use of federal funds through inclusion in the Edwin B. Forsythe National Wildlife Refuge. Two sources of federal funds were used for acquisition of wetlands and adjoining uplands: the Land and Water Conservation Fund and the Migratory Bird Conservation Fund. Another important source of funding was the settlement of a water pollution lawsuit with a local pharmaceutical company, which generated $1.2 million for land protection within the watershed.

Recently, Ocean County has begun its own land acquisition program. Because the county has not had a dedicated source of land protection funding, it had been previously ineligible for grants from New Jersey's $1.5-billion Green Acres program. Green Acres grants go to counties and municipalities that are able to match funds from a local Open Space Trust Fund. Ocean County, with encouragement from TPL, created an Open Space Trust Fund to acquire farmlands and natural open space and to make itself eligible for Green Acres grants. To overcome the reluctance of county officials to impose a new tax for land conservation, TPL engaged a local polling firm, which found that voters favored the concept.

At the same time, a citizens advisory committee was formed which established the Ocean County Partnership for Natural Lands. The partnership conducted a public education program in support of the Open Space Trust Fund and in 1997, 61% of Ocean County voters approved a ballot question to fund the Natural Lands Trust. Financed by a new property tax of 1.2 cents for every $100 valuation, the measure is expected to raise nearly $4 million annually to protect the region's watershed and agricultural lands.

On November 7, 2000, open space measures passed in three townships within Ocean County. In Brick Township three out of four voters approved a referendum that authorizes a levy of one cent per $100 of assessed property values. This levy will raise approximately $450,000 per year for the preservation of open space. In Dover Township 71% of voters supported a referendum to assess an open space tax of 1.5 cents per $100, which will generate $850,000 a year. Similarly, in Ocean Township 62% of voters supported a measure to assess a tax of 1.5 cents per $100, which will raise roughly $45,000 a year for local open space protection.

All acquisition proposals will go through the county's selection matrix, which stresses water supply with an emphasis on the protection of wellhead and recharge zones as well as the preservation of aesthetic values and the county's rural nature. Only natural lands or easements on natural lands will be purchased, and public access will be guaranteed. No development will be allowed on the purchased properties. So far, land acquisition in the Barnegat Bay watershed, funded through a variety of programs, totals approximately 120,000 acres. With the new Natural Lands Trust, the people of New Jersey have voiced their concerns over the preservation of land and acted to fund a land acquisition program to protect Barnegat Bay and its watershed.

For further information, contact Kathy Blaha, The Trust for Public Land, 666 Pennsylvania Ave, Suite 401, Washington, DC 20003, Phone: (202) 543-7552; E-mail: kathy.blaha@tpl.org or visit the website at www.tpl.org EXIT disclaimer

COASTLINES
Information About Estuaries and Near Coastal Waters

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Volunteer Estuary Monitoring Workshops in the National Estuary Program

As a volunteer monitoring coordinator working to protect your estuary, where can you turn to learn more about the skills you need? The US EPA, in partnership with the Center for Marine Conservation, is coordinating a series of workshops in coastal communities near National Estuary Programs (NEPs) to train volunteer water quality monitoring groups. Volunteer monitoring has recently become a popular way to overcome funding limitations while fostering education and public awareness.

Growth in building capabilities of volunteer monitoring groups has increased dramatically in the last fifteen years. Through earlier "Train-the-Trainer" Workshops, the volunteer monitoring coordinator quickly became the focal point for education. Building capacity within the volunteer community by providing training to leaders was welcomed by both the NEPs and the volunteer leadership. NEPs and environmental agencies realized a resource that could complement their monitoring efforts and provide ambassadors for the environment to the public. Volunteers receive specialized training in all aspects of running a successful volunteer monitoring group and the workshops also provide a forum for networking among the volunteers themselves, with the agencies that need the data, and with other environmental groups. The networking provides a means for monitoring groups to share experiences, share equipment and gain purchasing power through economies of scale, and to build trust between the volunteer monitors and monitoring agencies.

Good examples of volunteer monitoring in estuaries and its importance in the decision-making process abound. In 1998, the Tillamook Bay National Estuary Project initiated a four-year study to investigate the interactions of eelgrass with other estuarine species and its response to human disturbance. Under the leadership of estuarine researchers, volunteers collect information on areal coverage and density on three different weeklong occasions between May and September. In the Chesapeake Bay region, volunteers participate in the Submerged Aquatic Vegetation (SAV) Hunt, an annual effort coordinated by the U.S. Fish and Wildlife Service to locate, identify, and map SAV. The SAV Hunt is used to ground-truth the results of an annual aerial survey. A new Maryland law bans clam dredging in SAV beds, and the information provided by citizens helps identify those areas that are now off-limits to clam dredging. Natural resource agencies use the information to help target SAV protection and restoration, and local planning agencies use it when considering permitting for construction projects that may affect aquatic resources. In Tampa Bay, Tampa BayWatch and the Tampa Bay Estuary Program developed a volunteer activity known as the Great Bay Scallop Search. During this annual one-day event held throughout the lower Tampa Bay, volunteer snorkelers patrol seagrass beds and count scallops along transect lines to document scallop population recovery.

Overcoming Boundaries

The theme of the upcoming series of workshops is overcoming boundaries, as in political boundaries. Two of the workshops scheduled this year will be located in watersheds that border international neighbors, in Surrey, British Columbia, Canada on February 26-27, 2001 and Tijuana, Baja California, Mexico on March 15-16, 2001. More workshops are in the planning process for the upcoming year, check out the US EPA website at http://www.epa.gov/owow/estuaries/ for updates.

The workshops are geared towards leaders of volunteer estuary monitoring programs; teachers conducting student environmental monitoring programs and local, state, regional, and federal agencies working to protect environmental resources.

Although the workshops are generally tailored to the NEP volunteer needs, they have a core curricula that includes:

Day 1
Session I: Data Collection, Methodology and Analysis ï Defining questions/objectives

- Identifying parameters
- Quality assurance procedures
- Data analysis
- Data presentation
- Protocols for data sharing with governments users and other data users

Session II: Field Trip, Lab Demonstrations, and/or Equipment Discussion

- Measuring water quality and other environmental quality parameters
- Lab demonstrations
- Equipment comparisons

Day 2

Session III: Publicity, Fund raising and Volunteers

- Publicity/media
- Fund raising, volunteer training, motivation, and incentives
- Networking
- Forming partnerships

Session IV: Using Data

- Monitoring information on the Internet, computer software uses

A new second edition "Volunteer Estuary Monitoring: A Methods Manual" is provided in conjunction with the workshop and offers detailed information on field and lab procedures, quality assurance programs and reasons for monitoring as well as practical insights on recruiting, training, and retaining top notch volunteers. There is no registration fee for the workshop and travel assistance is available. To encourage and facilitate participation of monitoring groups, lodging will be provided based on need, distance traveled to the workshop, and funding availability. Participants receiving lodging will be asked to share a room with one of the other participants. Registration is limited; priority will be given to non-governmental organizations operating near the workshop locations.

To register for a specific workshop or find out about future workshops visit the Center for Marine Conservation website at
http://www.cmc-ocean.org/  or visit the EPA website at
http://www.epa.gov/owow/estuaries/

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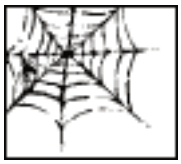
Northern Hawaiian Islands Reef Ecosystem Reserve

On December 4, 2000, President Clinton announced the creation of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve. The Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve includes the marine waters and submerged lands of the Northwestern Hawaiian Islands, extending approximately 1,200 miles long and 100 nautical miles wide. The Reserve is located west north west of the familiar large islands of Hawaii. The Reserve is adjacent to the State of Hawaii waters and submerged lands, the Midway Atoll national Wildlife Refuge and includes the Hawaiian Islands National Wildlife Refuge outside of state waters.

This is the largest area of conservation in U.S. history and the second largest marine protected area on earth, second only to the Great Barrier Reef in Australia. This vast area, representing 70% of all U.S. coral reefs, supports more than 7,000 marine species, approximately half of which are unique to the Hawaiian Island chain. The incredibly diverse species flora and fauna includes the endangered Hawaiian monk seal, leatherback and hawksbill sea turtles and the threatened green sea turtle.

The Secretary of Commerce is currently initiating the process to designate the Reserve as a National Marine Sanctuary. As part of the Reserveís designation, fifteen "Reserve Preservation Areas" have been established that prohibit all consumptive uses, including commercial and recreational fishing. However, existing bottom fishing will be allowed to continue in 8 of the 15 Reserve Preservation Areas. The current proposal is to preserve these areas permanently. Public comment is being sought on this proposal; to comment by e-mail contact: hawaiicomments@noaa.gov.

For further information, please visit http://hawaiireef.noaa.gov EXIT disclaimer



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Morro Bay National Estuary Program Eradication of an Invasive Reed

CHARACTERISTICS The Morro Bay estuary is located on Californiaís central coast, approximately half way between San Francisco and Los Angeles. The 2,300-acre estuary supports one of the most diverse ecosystems in the state, playing a crucial role as a link in the Pacific flyway. Its rich wetlands provide habitat to many threatened and endangered species of plants and animals, some found nowhere else in the world. Draining into the estuary is the Morro Bay watershed that covers 48,000 acres, or 75 square miles. The most renowned feature of this beautiful estuary is Morro Rock, the last in a chain of impressive peaks running from San Luis Obispo to the sea. This unmistakable landmark, used by early explorers, has earned the title "Gibraltar of the Pacific."

The estuary and watershed support many beneficial human uses, such as agriculture, commercial and recreational fishing, recreational boating, tourist attractions which support a large business community, oyster farming, diverse water-oriented recreational opportunities, and electric utility power generation. Protective measures include the recently approved Comprehensive Conservation and Management Plan which contains more than 60 actions designed to address numerous priority problems in the Morro Bay watershed, including water quality, sedimentation, and habitat loss.

The Problem

The giant reed Arundo donax is an aggressive invader of wetland habitats and is nonnative to North America, originally introduced to the Los Angeles basin from the Mediterranean in the 1820ís to deter erosion in drainage canals. The species has subsequently invaded riparian habitat over a wide area in coastal Southern California and to the north. The Morro Bay watershed is host to a pioneer population of this intruder that, if left unchecked, would out-compete native vegetation to become the dominant species in the riparian corridors. In Southern California as much as 90 percent of the riparian habitat has been lost due to human impacts related to agriculture, urban development, and flood control. Protection of the remaining habitat is crucial to the survival of Californiaís native flora and fauna.

The goal of this project was to eradicate giant reed in the upper watershed with minimal impact to the landscape and native vegetation, to address the following Morro Bay National Estuary Programís ("MBNEP") priorities:

1) Avoiding habitat loss through invasive potential of giant reed, 2) Reducing sedimentation and erosion, 3) Improving fresh water flow.

The project had the added benefit of improving riparian habitat for threatened and endangered species, such as the California red-legged frog and steelhead trout.

Morro Bay Estuary

The Morro Bay estuary has been designated as both a state and national estuary, and the MBNEP was formed in 1995 to ensure its protection. The 2,300-acre estuary enjoys a typical Mediterranean climate, characterized by cool wet winters and warm dry summers. The estuarine system includes coastal wetlands, such as salt and brackish tidal marshes and intertidal flats, deepwater channels, and coastal streams. Some areas are continuously submerged while others are alternately exposed and flooded by tides. Draining into the estuary is the Morro Bay watershed, which is comprised of two subwatersheds, Chorro and Los Osos. Chorro Creek drains into the larger Chorro Creek subwatershed, which occupies approximately 60 percent of the watershed, and Los Osos Creek drains into the remaining 40 percent.

The sites for this project were all located in the Chorro Creek subwatershed, with most of the reed removals occurring in Chorro Creek and a few more in Pennington Creek and Dairy Creek tributaries. The creeks within the watershed are typical of Central Californian coastal streams in terms of their aquatic fauna, riparian overstory, and general geomorphology. Both Chorro Creek and Los Osos Creek support a diverse community of flora and fauna, including some threatened or endangered species, such as the California red legged frog and South/Central steelhead trout. The creeks also serve as transportation corridors and habitat for numerous species of birds, aquatic vertebrates, and terrestrial wildlife.

Project Overview

This project required the collaborative efforts of experts from a variety of agencies, including the California Army National Guard (access, planning, biological assessment, and permitting), Cuesta College (permission and access to tributaries), San Luis Obispo Agricultural Department (technical advice, chemical treatment, and labor), California Polytechnic State University (creek access and storage of plant material), Morro Bay National Estuary Program (funding) and the California Conservation Corps (labor and equipment). Most of the removals were located on California Army National Guard property, with some tributary removals on Cuesta College and Cal Poly State University land.

Concern over the pioneer population of giant reed in the Morro Bay watershed ranks high on the priority list, with good reason. Under optimal conditions giant reed can grow more than 5 cm a day. Initial site surveys found that three distinct stands of the reed grew into one massive patch in just two years time. Giant reed self-propagates through stem nodes breaking from the parent plant and taking root further downstream. This allows it to thrive in highly disturbed areas. Left unchecked, the giant reed will out-compete and displace native vegetation.

Removal of giant reed has numerous beneficial effects, including improvement of fresh water flow, water quality, native species habitat, and reducing threats from wildfire. Giant reed depletes fresh water flow

because of its high transpiration rate, taking up 5.62 acre-feet of water per year, triple the 1.87 acre-feet consumed by native riparian plants such as willow. Decrease in summer water flow reduces the flushing that takes place in the Bay and contributes to the accumulation of pollutants, upsetting the natural balance of freshwater and saltwater in the estuary.

Studies funded through the Santa Ana Watershed Project Authority suggest that giant reed also lacks the canopy structure necessary to provide significant shading of riparian habitats, resulting in warmer water then would be found with a native gallery forest of cottonwood or willows. As a result, riverine areas dominated by giant reed tend to have warmer water temperature, resulting in lower oxygen concentrations and a lower diversity of aquatic animals and fish. No known native species of animal in California uses the giant reed as protective cover or forage, and its presence represents a loss of habitat.

Giant reed is also highly flammable throughout most of the year. It appears to be highly adapted to extreme fire events, and can increase the probability and intensity of a wildfire. If giant reed becomes abundant, riparian forests can change from flood-defined to fire-defined natural communities. Additionally, giant reed rhizomes respond quickly after fire, sending up new shoots and rapidly outgrowing any native species that might have otherwise become established in a burned site.

The purpose of this project was to eradicate several giant reed patches in the upper Chorro watershed with minimal impact to the landscape and native vegetation, and to investigate the cost and time required to implement such an endeavor. Though labor intensive, cutting the stems and treating with herbicides is the preferred method to avoid impacting adjacent vegetation and aquatic habitat.

Implementing the Project

Many of the plants in the Chorro Creek drainage were probably only three to five years of age when the planning and surveying for this project began. It was crucial for the eradication plan to be approached with caution and, at the same time, be well thought out and aggressive. Improper removal of reeds can result in broken off stems taking root downstream in as little as two days. Therefore, plants in the headwaters were removed first and the project worked its way downstream, preventing plants from taking root in previously undisrupted areas and eliminating the chance of negating work already done. Also, when removing individual stands, crews worked from the top of the bank toward the creek, so as not to enter the water during the removal process, in order to minimize impacts to the stream.

Actual removal of the giant reed was a time consuming, and delicate process, as a single plant could cover 100 feet in diameter and be intertwined with native vegetation. To minimize the impact to sensitive habitat and to protect native flora, a certified biologist assisted the crew in determining the means for

removal and oversaw the eradication process. Crews had to be careful not to slash away unconsciously to ensure protection of the native flora. Additionally, the area of work presented steep slopes, which made the use of chainsaws, hand work, and herbicide treatment difficult. Once removed, the plants were either piled for later burning, run through a chipper and left on site, or placed in large rollaway dumpsters to be hauled to landfills. When the giant reed debris is dry, there is no fear of propagation.

After the cutting crew had left, the Agriculture Department followed with Rodeo applications. Precision spray equipment was used to allow targeting of the giant reed and avoid native plants and water. To ensure herbicide uptake, blade weed-eaters were used to make fresh wounds within two minutes of an application. As expected, some dormant sprouts emerged after the initial application and were retreated. Standard practice for treating resprouting is to follow up with chemical treatments up to six times in the first year to repeatedly weaken plants and prevent them from growing back to their original size. Retreatment varies from season to season since the giant reed is temperature and moisture sensitive. Monthly observations will continue until the reed is eradicated. The complete cost of the project was approximately $30,000.

Success of the Project

Due to the enthusiasm and efforts of Camp San Luis Obispo and the California Conservation Corps, the project went well beyond the initial goal of removing six plants. The original goal was to remove six plants however, at the projectís conclusion, 17 plants were removed, equivalent to over 840 cubic feet. Once initiated, the value of the project and its successful outcome inspired participation and funds to triple the goal.

Lessons Learned

- The permitting process for receiving a Biological Opinion from the USFWS was very lengthy, involving a full year.
- Giant reed eradication requires an aggressive, long-term commitment of both labor and funding. Without follow-up, initial efforts can be negated in less than a yearís time.
- Removal is very labor intensive and calls for creative ingenuity. Certain sites were so far back in the vegetation that it took one or two days just to clear a path to get to the reed patch.
- Stands of giant reed sometimes intertwine with the native vegetation, which makes removal more difficult. This is especially true when the native vegetation is a 15í wide by 30í deep patch of poison oak. As a direct result of the large amount of poison oak in the project site, many of the crew workers had to obtain medical treatment.
- Tremendous amounts of duff can accumulate under the plants; up to 5 feet of creek material and old stalks are captured at the base of older plants. Flood debris (logs, branches, rocks, styrofoam, plastic, etc.) is mixed with the old giant reed canes hanging into the water from the embankment, to form a thick,

dusty, dirty, tangled mass. Many workers at the site experienced lung irritation, coughing, and sneezing. This material had to be removed by hand, which doubled the anticipated removal time.

- Initially cutting the reeds and then immediately applying herbicide is not always an efficient way to begin eradication. It is costly to keep a herbicide applicator on site each day, all day long, and the biomass could not be removed very quickly. We found it was easier to first remove all the biomass by hand, and then come back and do a fresh cut just prior to chemical treatment.
- Vertical creek banks provided safety and logistical problems that required creative ingenuity and teamwork.

For further information, contact:

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Visit the Morro Bay National Estuary Programís website at www.mbnep.org EXIT disclaimer

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Publications from the Center for Watershed Protection Available

Several new publications are available through the Center for Watershed Protection. The report entitled "Urban Stream Restoration Practices: An Initial Assessment," assesses 24 different urban stream restoration practices around the Mid-Atlantic and Midwest, and is available for $20. The Practice of Watershed Protection, a comprehensive hardcover collection of more than 800 pages of the best feature articles and technical notes from all past issues of the journal Techniques, bound and indexed for easy reference, is available for $80. Another publication entitled "Better Site Design: An Assessment of Better Site Design Principles for Communities Implementing the Chesapeake Bay Preservation Act," is available for $20. In addition, the Center for Watershed Protection has prepared a kit called the "Do It Yourself Better Site Design Kit: Everything You Need to Know About Changing Your Development Rules." The kit can be used by local organizations to improve site design in their community and includes a notebook, two CD slide presentations, templates for creating roundtable agendas and correspondence, books and other materials.

For further information, contact the Center for Watershed Protection, 8391 Main Street, Ellicott City, MD 21043-4605; Phone: (410) 461-8323; Fax: (410) 461-8324; E-mail: dlb@cwp.org. All publications are listed on the publications page of the Center for Watershed Protectionís website at www.cwp.org

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