USA: Washington: Duwamish River Estuary Intertidal Wetlands Restoration

Overview

The Duwamish Estuary in Seattle, Washington has been subject to heavy industrial development and pronounced anthropogenic disturbances associated with the Port of Seattle and other commercial facilities along its waters. This project sought to restore intertidal wetlands at three sites in the estuary, and to thereby enhance public access to the river and create vital habitat for several important species of birds and fish. While project activities varied from site to site, hydrologic modifications were the central focus at all three. Periodic site monitoring has indicated varying degrees of recovery at the project sites, but it has also suggested that human activities continue to threaten the estuary's wildlife populations.

Quick Facts

Project Location:
5428 W Marginal Way SW, Seattle, WA 98106, USA, 47.56137083962889, -122.34712714667967

Geographic Region:
North America

Country or Territory:
United States of America

Biome:
Coastal/Marine

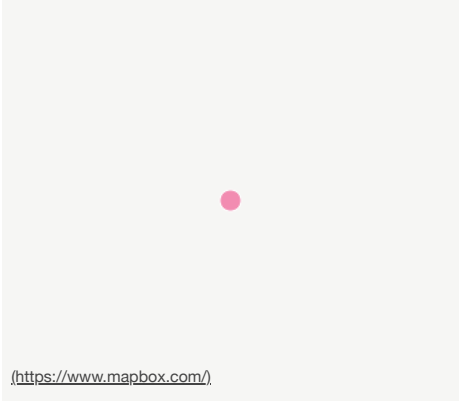
Ecosystem:
Estuaries, Marshes & Mangroves

Area being restored:
3 acres

Project Lead:
U.S. Army Corps of Engineers

Organization Type:
Governmental Body

Location



TIMEFRAME

Project Stage:
Completed

Start Date:
1992-07-06

End Date:
1996-07-06

DEFINING THE PROBLEM

Primary Causes of Degradation

Urbanization, Transportation & Industry

Degradation Description

The Duwamish River provides a passageway to the inland portions of Washington state, and thus has been an area of heavy industrial development. Construction and barge companies, as well as concrete, glass, steel, and lumber factories have all been a part of its economic fabric. This development, while playing a significant role in the economic expansion of the Seattle region, has taken a heavy environmental toll. The developmental history of the Duwamish Estuary has resulted in the loss of approximately 98% of its former intertidal marshes and mudflats. These habitats are critical to juvenile salmon and many other species of aquatic and terrestrial wildlife, and their loss represents a serious threat to the ecological integrity of both the Duwamish River Estuary and the greater Puget Sound.

PLANNING AND DESIGN

Project Goals

To partially restore salmon and other aquatic wildlife populations and their habitat; to enhance public access to the river; and to improve the quality of life along this active waterfront.

Monitoring

The project does not have a monitoring plan.

PROJECT ACTIVITIES

Description of Project Activities:
Three sites along the Duwamish River were identified for initial restoration: the Turning Basin, the General Services Administration (GSA) site, and Terminal 105. These three areas were chosen based on their availability and suitability for restoration and their potential to show marked improvements in critical habitats with restricted funding. Each project had three basic phases: first, the removal of debris; next, the regrading of the shoreline and bottom sediments to restore appropriate intertidal elevations, and; finally, the reestablishment of a riparian buffer. There are a number of habitat reconstruction technologies being demonstrated in this group of projects. At the GSA site, restoration included removal of rock riprap and a large overwater wharf structure to allow natural colonization by existing wetland plants; construction of a sediment "bench" at 0.0-m elevation to promote use by juvenile salmon (Oncorhynchus spp.); and planting of upland riparian vegetation. The T-105 site originally consisted of a vacated

street end and a large pipe that drained a small degraded wetland area. Restoration included removal of debris and replacement of the pipe with an estuarine channel that restored tidal flow to the area. Finally, the Turning Basin site consists of an upland riparian buffer planted with native vegetation and a small regraded upper intertidal basin planted with fringing native sedge, Carex lyngbyei, and rush, Scirpus maritima.

PROJECT OUTCOMES

Ecological Outcomes Achieved

Eliminate existing threats to the ecosystem:

The restored habitats appear to be experiencing increased benthic invertebrate abundances, with the number of taxa ranging from 11 to 29, depending upon the site. In particular, at T-105, the channel and the "delta" region near the mouth have developed invertebrate densities similar to those found at the other restored and reference sites, especially for the amphipod taxa Corophium spp. and Eogammarus confervicolus. This is notable because the T-105 site is at a higher elevation than the benthic reference flats and might have been expected to have lower densities because of this difference. Some of the created habitats are becoming colonized with ecologically important benthic invertebrates. In addition to Corophium and Eogammarus, the sand substrates at the T-105 site are populated by high densities of the polychaete worm Manayunkia aesturina and the harpacticoid copepod Huntemannia jadensis, a prey species for juvenile flatfish. The high intertidal sandflat at the Turning Basin restoration site has had high numbers of ceratopogonid fly larvae (in two consecutive years), and Mesochra rapiens, a common oligohaline harpacticoid copepod and fish prey species (J. Cordell, unpubl. data, Snohomish and Chehalis river estuaries) was abundant in 1997. The important juvenile salmon prey taxon Harpacticus was found only at the GSA intertidal bench and another created bench in the lower waterway (Cordell et al. 1996). Numbers of meiofaunal taxa from 1997 benthic samples ranged from 13 - 33 taxa per site/date. Several taxa were unique to a site, including Coullana canadensis and Pseudobradya sp.at the Turning Basin mudflats, Mesochra rapiens and Onychocamptus mohammed at the Turning Basin sandflat, and Tachidius triangularis at the T-105 channel and delta. Harpacticoid copepod nauplius larvae, turbellarian flatworms, and nematode worms were relatively abundant at all sites. However, harpacticoid nauplii and nematodes reached particularly high peak densities at the Turning Basin mudflat reference and restoration sites. During nine seasons of monitoring, 87 bird species have been observed on the Duwamish waterway. Seasonally, the greatest number of species were seen during the spring months (58 species in spring "˜97 and 48 species in spring "˜98), and the fewest species were sighted during the summer months (38 species in summer '97 and 34 species in summer "˜98). Sightings of native and human-associated species at site T-105 has changed little over nine seasons of data collection. At the Turning Basin restoration site, passerines continued to be a strong presence, especially in the fall and spring. In 1998, red-winged blackbirds bred successfully in the cattail marshes, and American goldfinch exhibited territorial behavior all season and foraged with their fledglings in and around the Carex cages. Shorebirds and waders were regularly observed at the Turning Basin restoration site at all times of the year. This site consistently had the greatest shorebird diversity of all sites. Birds continued to use each site differently. Birds in transit were observed most frequently at T-105, while direct site use (e.g., foraging and resting) occurred primarily at Kellogg Island (the reference site) and the Turning Basin restoration site. In fact, Kellogg Island and the Turning Basin restoration site had the most consistent year-to-year patterns of habitat use. Patterns of emergent vegetation have been observed at each of the project sites. In 1997, understory at the GSA site was dominated by S. marina, Cotula coronopofila, and Lilaeopsis sp. Understory species were found in every quadrat, and 3 to 6 species were found in each quadrat. At the Kellogg Island reference site, 3 to 4 species were found in each upstream quadrat and the understory was dominated by C. lyngbyei, Potentilla palustris, Plantago maritima, and Distichlis spicata. Carex has begun to recruit to this site, and the distributions of shoot density and height of the Carex recruits were both quite skewed. The Kellogg Island reference site had little or no C. coronopofila, Salicornia virginica, or Grindelia integrifolia. The GSA site had no C. lyngbyei, D. spicata, R. repens, or Triglochin maritimum. At the T-105 site, Atriplex patula was recruiting heavily to both sides of the channel. It was found in every systematic quadrat placed along the upstream and downstream sides of the channel. D. spicata, P. maritima, S. virginica, S. validus, and Juncus effusus were found in one quadrat each. Eleven patches of Scirpus maritimus, 7 patches of S. virginica, 5 patches of S. maritimus, 3 patches of P. maritima, and 1 patch each of D. spicata, Cotula coronopofila, P. maritima, Atriplex patula, J. effusus, and Scirpus acutus were counted along the 220-m downstream bank. At the Turning Basin, a diverse assemblage of species has begun to develop in areas that have been protected from goose grazing. Sixteen species were observed in the sampled area, and between three and eight species were found in each quadrat.

Factors limiting recovery of the ecosystem:

The Turning Basin shows the greatest promise for bird habitat among the three project sites. As it is relatively isolated, it was already a magnet for birds prior to the restoration project. Furthermore, two new restoration projects adjacent to this site will create additional habitat and linkages with existing habitat. The T-105 site, on the other hand, has shown a declining abundance and diversity of birds as a result of increasing levels of human activity and anthropogenic disturbances. The timing of the downward trend in avifaunal abundance at T-105 was closely tied to the construction and operation of the rendering plant to the west of the T-105 site. During initial construction, a vacant lot was cleared of trees and brush where 15 - 20 white-crowned sparrows had previously been observed foraging and exhibiting territorial behavior. Since then, no more than one male white-crowned sparrow has ever been seen at T-105. In 1997, killdeer nested in the shrub roses above the slough at T-105 as evidenced by chick vocalizations and broken-wing displays by parents. However, in 1998 there was no sign of nesting activity and killdeer were seen less frequently than in 1997. In 1998, an increase in human activity at T-105 was also observed. People were present during almost every visit and frequently were accompanied by dogs. Upland habitat loss and continued disturbance may result in a permanent decrease in the number of birds at the site. With regard to plant diversity, different challenges are faced at each site. The main impediments to the spread of vegetation in upstream areas seems to be riprapping and goose grazing; whereas downstream areas are limited by strong wave action and destruction by debris. Seed availability does not appear to be a limiting factor since many species will actually germinate when they are protected from grazing (Caren Crandell, Center for Urban Horticulture, Univ. Washington).

Socio-Economic & Community Outcomes Achieved

Economic vitality and local livelihoods:

Volunteer youth groups were used in the planting of the intertidal and riparian buffer areas, and were thus afforded an opportunity to learn about

KEY LESSONS LEARNED

LONG-TERM MANAGEMENT

Long-Term Management

Periodic monitoring will occur at these sites.

FUNDING

Sources and Amounts of Funding

$626,000 USD Federal funding was provided through the Coastal America program.

LEARN MORE

Other Resources

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