

SAN FRANCISCO ESTUARY PROJECT

Wetlands

Wetlands provide invaluable habitat for fish and wildlife, improve water quality, protect urban and agricultural areas from flooding, and serve many other vital functions within the San Francisco Estuary. Despite their central role in the Estuary's ecology, however, many wetlands face degradation or destruction due to urban encroachment. The San Francisco Estuary Project seeks to promote conservation, restoration, and environmentally sound management of the Estuary's wetlands.

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The Estuary

San Francisco Bay and the Delta combine to form the West Coast's largest Estuary. The Estuary conveys the waters of the Sacramento and San Joaquin Rivers into the Pacific Ocean. The Estuary encompasses roughly 1,600 square miles, drains over 40% of the state, contains about 5 million acre feet of water at mean tide, and redistributes about 80–280 million cubic yards of sediment every year. Its Delta and watershed provide drinking water to 22 million Californians, and irrigation water to 4.5 million acres of farmland. The Estuary also hosts a rich diversity of aquatic life. Each year, two-thirds of the state's salmon pass through the Bay and Delta, as do nearly half of the waterfowl and shorebirds migrating along the Pacific Flyway. Finally, Estuary waters enable the nation's fourth largest metropolitan region to pursue shipping, farming, fishing, recreation, commerce and other activities.

Wetlands

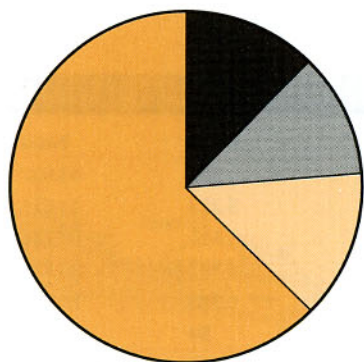
The Estuary encompasses a total of 628,549 acres of wetlands, according to the U.S. Fish and Wildlife Service National Wetland Inventory. Over half of these (385,755 acres) are farmed wetlands; the remainder include marshes, mudflats, streambanks, riparian woodland, salt ponds and other transitional areas between Estuary waters and the land. The largest remaining tidal wetland in California is the Suisun Marsh in the North Bay (over 72,000 acres). In the South Bay, the San Francisco Bay National Wildlife Refuge protects over 19,000 acres of wetlands. Many smaller wetlands, ranging from tiny strips of salt-loving cordgrass to farm fields flooded by winter rains, ring the Bay. Whatever its size or derivation, each wetland plays an important role in the health of the Estuary.

History

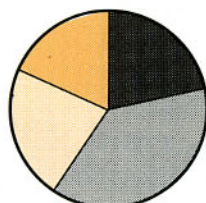
Native Americans lived along the Bay shoreline for over 3,000 years, harvesting wetlands for food and natural salt. The arrival of European settlers in 1769 signalled the beginning of drastic changes in the Estuary. The largest wetland loss occurred between 1860 and 1930, when 97 percent of the Delta's 450,000 acres of tidal marsh were diked and planted with crops to feed California's rapidly growing population. Over time, agriculture and salt production replaced tens of thousands of acres of tidal wetlands in San Francisco Bay.

Urban expansion during the after the Gold Rush filled thousands of acres of wetlands with bayside housing and commerce. A second era of rapid growth followed World War II, sacrificing more wetlands to highways, airports, landfills and other urban development. Flood control and water diversion projects, built to serve agricultural and urban areas, destroyed wetlands and riparian corridors, and altered natural freshwater flows to the remaining downstream wetlands. Tidal marshes suffered most (see pie charts).

Wetland destruction continued until the mid-1960s, when public outcry over a shrinking Bay led to the creation of the San Francisco Bay Conservation and Development Commission (BCDC). Although the rate of Bay fill has decreased dramatically since then, wetland losses continue, particularly in diked seasonal wetlands, which are difficult to delineate and often incorrectly perceived as habitat of little value to fish and wildlife.



1850
545,375 acres



1987
~44,371 acres

The Estuary's Tidal Wetland Acreage

- Central & South
- San Pablo Bay
- Suisun Bay
- Delta

Egret: Ricardo Perez

Dredging Operations

Wetland Types

Marshes: Tidal salt and brackish marshes occupy a narrow zone between mudflats and uplands, and receive ocean tides. They sustain salt-tolerant vegetation, fish nursery grounds, migratory birds and several threatened wild-life species. Salt marshes contain mostly pickleweed and cordgrass; brackish marshes (fresh and saltwater mix) host a wider range of vegetation. Freshwater marshes, while influenced by tidal action, are dominated by



Pickleweed

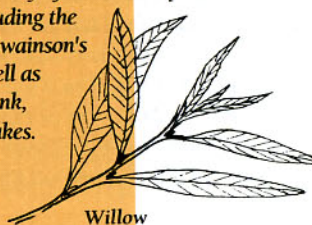
freshwater from rivers and streams. They support freshwater plants such as tule reed and cattail, and at least 57 wildlife species.

Mudflats lie between tidal marshes and the edge of the Bay at low tide. Incoming tides cover mudflats with shallow water, providing habitat for invertebrates, fish, and shorebirds.

Salt Ponds are commercial facilities that extract salt from Bay water by evaporation. Algae is the main vegetation, brine shrimp and birds the primary inhabitants.

Seasonal Wetlands are shallow depressions that typically contain standing water during the rainy season but become drier in summer and fall. They include diked (formerly tidal) salt and brackish marshes, farmed wetlands, abandoned salt ponds, inland freshwater marshes and vernal pools. Diked marshes sustain waterfowl and endangered species. Farmed wetlands support hay production, grazing and row crops. Vernal pools, which fill with rain water in the wet season and dry out in late spring, contain plants that can withstand extremes in water availability.

Riparian Forests are found along stream-sides and Delta forests, Delta levees and channel islands. They contain leafy shrubs such as blackberry and wild rose, and trees such as cottonwood, alder and willow. Riparian forests sustain the Estuary's greatest diversity of land and aquatic bird species (including the threatened Swainson's hawk), as well as raccoon, skunk, deer and snakes.



Willow

Water Quality Improvement

Through a variety of mechanisms, wetlands improve the water quality of urban and agricultural runoff that flows through them. Wetlands trap some natural pollutants, and some wastewater and stormwater contaminants, and either retain them or convert them by biochemical processes to less harmful forms. Wetlands also trap and stabilize sediment that, suspended in the water, can interfere with fish and plant growth, as well as fishing.

Flood Control

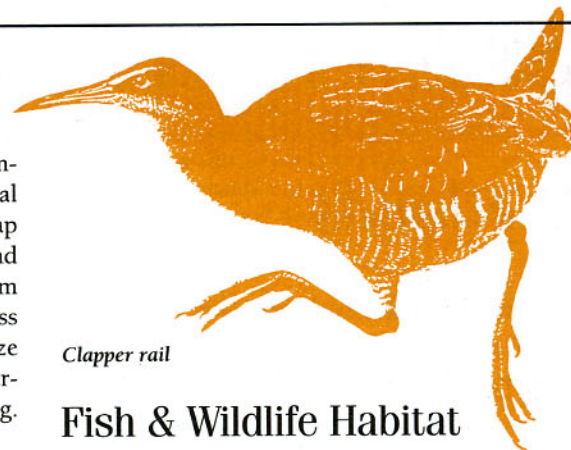
Many freshwater and riparian wetlands pond stormwater, thereby enlarging flood channel capacity when rivers overflow their banks. Delta flood basins and agricultural lands bordering San Francisco and San Pablo Bays also pond water during heavy rains and release it gradually into the Bay at low tide, reducing the flood threat to urban areas when storm runoff coincides with high tide.

Groundwater Recharge

Wetlands can play an important role in replenishing groundwater supplies by allowing transport of ponded surface water into underground basins. In the Delta, for example, surface water flows downward through the permeable peat soil that underlies wetlands. In the South Bay, water from streams and creeks percolates into the underground aquifer, which supplies many drinking water wells.

Open Space

The Estuary encompasses about 300 recreational areas along the Bay shoreline, and in Delta wetlands and waterways. These wetlands provide opportunities for fishing, hunting, walking, environmental education, wildlife observation, photography and picnicking.



Clapper rail

Fish & Wildlife Habitat

Populations of over 300 fish and wildlife species breed, raise young, feed and rest in Estuary wetlands. Countless clams, worms and other invertebrates thrive in mudflats; migratory birds winter in marshes; and fish and crabs use shallow waters as nursery grounds. Wetlands support a food web in which detritus (see glossary) provides food for invertebrates, which are in turn eaten by shorebirds, fish, crabs and human clam diggers. As wetlands become rare, so do some of the species that live in them. Estuary wetlands sustain over 60 plant and animal species that are either listed as rare, threatened or endangered or are candidates for such listing. Of the animal species, the California clapper rail, California least tern, and salt marsh harvest mouse are best known due to their presence on several bayshore properties proposed for development. Of the plant species, palmate-bracted bird's beak and Solano grass, found in vernal pools, are the most endangered.

Shoreline Stabilization

Vegetated wetlands reduce bank and shoreline erosion caused by stream runoff, tidal waters and wave action. Wetlands absorb and dissipate wave energy that would otherwise erode shores and banks. This allows suspended sediment to settle and build up, encouraging more wetland vegetation to take root and further stabilizing the shore.

Estuary Wetlands Acreage

Habitat Type	S.F. Bay ¹	Suisun Bay	Delta	Total
Mudflats	57,776	5,994	322	64,092
Salt/Brackish/Freshwater Marsh	25,466	10,682	8,223	44,371
Seasonal Wetlands	21,150	47,482	16,502	85,134
Farmed Wetland	27,344	8,064	350,347	385,755
Riparian Forest	2,322	404	9,788	12,513
Salt Ponds	36,603	27	54	36,684
Total Wetlands	170,661	72,652	385,236	628,549

¹Includes South/Central Bay and San Pablo Bay

Source: Adapted from Meiores et al., 1991

Pressures on Wetlands

Shoreline Development

The Bay Area's growing population may spur further shoreline development, posing a threat to wetlands. Shoreline residential areas, even those not built on filled wetland, can damage adjacent wetlands by introducing contaminated surface runoff, litter, household pets that hunt wetland wildlife, and human intruders. Continued industrial development along the Estuary shoreline can harm wetlands either directly, by destroying them during construction, or indirectly, by producing toxic runoff and wastewater discharges that may damage wetland plants and wildlife.

Freshwater Diversion

Agriculture and urban growth have led to flood control and water development projects that have produced major wetland losses in the Central Valley and Delta. More of these projects are being proposed to serve increasing demand. Such additional freshwater diversion could cause freshwater or brackish marshes to convert to salt marshes in the Estuary, thus changing the types of species existing in these marshes. Better conservation and management of California's already developed water supplies is necessary to limit the need for additional projects.

Agricultural Practices

Agricultural practices such as tilling the soil and soil compaction promote soil loss and land subsidence, increasing pressure on Delta levees (see glossary). Levee failure may cause flooding, erosion and salt intrusion, thereby degrading water quality and altering wetland habitat. Contaminated agricultural drains can have similar effects. However, some agricultural practices such as winter flooding of cornfields and delayed ploughing of crop residues until Spring can benefit birds and waterfowl.

Runoff & Pollution

Continued urban development increases wastewater flows and surface runoff into the Estuary. To some extent, wetlands can help contain or reduce pollutants. The artificially created DUST (Demonstration Urban Stormwater Treatment) marsh in Fremont California is demonstrating how well wetlands control stormwater pollution. Without proper management, however, accumulated pollutants can degrade wetlands and threaten the food chains they support.

Port, Airport & Highway Expansion

Many of the Estuary's ports, industrial piers and associated facilities are located on or adjacent to wetlands and deepwater habitat. As the shipping industry continues to grow, expansion plans for these facilities may require wetland fill. Currently proposed municipal and airport expansions would fill a total of 300 to 500 acres of wetlands. Planned highway and bridge projects around the Bay could fill 362 acres of wetlands over the next 25 years.

Solid Waste Disposal

Urban expansion creates a need for more solid waste disposal sites, which historically have been located largely in wetland areas. Two recent projects, the Newby Island Sanitary Landfill Expansion in Santa Clara County and the Acme Landfill Expansion in Contra Costa County, affected a total of about 260 acres of seasonal wetlands. Toxic leakage from disposal sites, particularly those that handle hazardous wastes, can damage wetland ecology.

Dredged Material Disposal

In-Bay disposal of material dredged from Estuary shipping channels and ports increases suspended sediment concentrations and can release pollutants disruptive to fish and wildlife resources and wetland processes. The need for new disposal sites may produce added pressures on wetlands, as well as new opportunities for wetland creation or enhancement using clean dredged material.

Glossary

detritus: Small particles of organic matter, largely derived from the breakdown of dead vegetation.

estuary: A partially enclosed body of water where river water meets and mixes with ocean water.

fill: Soil, sand and debris deposited in aquatic areas, such as wetlands, to create dry land, usually for agricultural or commercial development purposes.

groundwater recharge: Replenishment of water that circulates in underground aquifers.

invertebrates: Small organisms like worms and clams that lack a spinal column; many siphon water and suspended sediments for food.

levee: A raised bank of earth built to control or confine water; also known as a dike.

peat: Partially carbonized vegetable tissue that forms as plants decompose in water and are deposited and compacted.

permeable: Able to be infiltrated by water.

riparian: Habitat occurring along the bank of a river, pond, or small lake.

runoff: Water from rain, melted snow or agricultural or landscape irrigation that flows over the land surface.

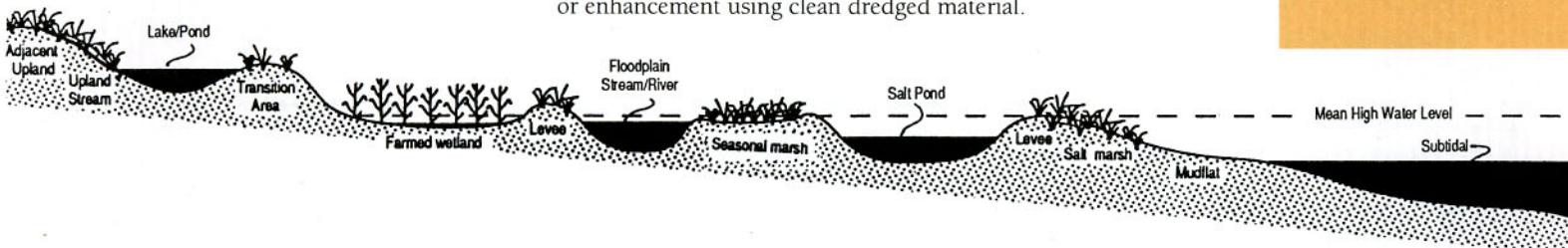
sediment: Mud, sand, silt, clay, shell debris and other particles that settle on the bottom of waterways.

slough: A channel through a marsh or mudflat.

suspended sediments: Undissolved particles floating in water.

tide: The alternating rise and fall of the ocean and Bay surface that occurs twice a day, caused by the gravitational pull of the sun and the moon upon the earth.

wetland: Lands that are often transitional areas between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.



Current Issues

Resources

San Francisco Estuary Project 1990–1998

Comprehensive Conservation and Management Plan

Status and Trends Reports on: Wetlands and Related Habitats in the San Francisco Estuary, Land Use and Population, Pollutants in the San Francisco Estuary, Dredging and Waterway Modification, Wildlife, and Aquatic Resources

An Introduction to the Ecology of the San Francisco Estuary

State of the Estuary, 1992–1997: Vital Statistics, New Science, Environmental Management

Information Sheets on:

Agricultural Drainage, Pollution, Aquatic Organisms and Wildlife, Dredging and Waterway Modification, Water Usage, The Delta, The Estuary, and Land Use

Bay Area EcoAtlas, <http://www.sfei.org>

Contacts

Audubon Society, Golden Gate Chapter, 2530 San Pablo Ave., Suite G, Berkeley, CA 94702 (510)843-2222;

Marin Chapter, (415)383-1770;

Santa Clara Valley Chapter, (408)252-3747

Bay Planning Coalition, 303 World Trade Center, San Francisco, CA 94111 (415)397-2293

Homebuilders Association of Northern California, P.O. Box 5160, San Ramon, CA 94583 (925)820-7626

California Department of Fish & Game, 1416 9th Street, 12th floor, Sacramento, CA 95814 (916)653-7664

Central Valley Regional Water Quality Control Board, 3443 Routier Road, Suite A, Sacramento, CA 95827-3098 (916)255-3000

S.F. Bay Conservation and Development Commission, 30 Van Ness Avenue #2011, San Francisco, CA 94102 (415)557-3686

S.F. Bay Regional Water Quality Control Board, 1515 Clay Street, Suite 1400, Oakland, CA 94612 (510)622-2300

San Francisco Estuary Project, c/o RWQCB, 1515 Clay Street, Suite 1400, Oakland, CA 94612 (510)622-2465

Save S.F. Bay Association, 1736 Franklin St., 4th floor, Oakland, CA 94612 (510)452-9261

U.S. Army Corps of Engineers, 333 Market Street, San Francisco, CA 94105-2197 (415)977-8618

U.S. Environmental Protection Agency, Region 9, 75 Hawthorne St., San Francisco, CA 94105 (415)744-2125

U.S. Fish and Wildlife Service, 3310 El Camino Ave., Suite 130, Sacramento, CA 95825-6340 (916)979-2725

Wetlands Ecosystem Goals Project, c/o RWQCB, 1515 Clay Street, Suite 1400, Oakland, CA 94612 (510)622-2454

Development and Mitigation

In order to protect the public value of wetlands, regulatory agencies restrict wetlands activities to those that require a water-dependent location such as ports, marinas and water-related industry. Whatever the regulations, people continue to view wetlands as desirable locations for housing, restaurants and many other uses. Decision-makers must determine to what extent these uses merit further wetland loss or degradation. Most but not all wetland fill permits require wetland creation, restoration and/or enhancement to offset the loss. Regulatory agencies generally require that an equal or greater wetland acreage be created or a degraded wetland be restored, either on the development site or elsewhere. In practice, however, this no overall net loss policy has not been completely effective. A new or restored wetland rarely completely replaces the lost wetland's functions or values, and sometimes displaces resident wildlife species.

Regulation and Management Conflicts

Many federal, state, and local government agencies, as well as private and semi-private land trusts, regulate and manage the Estuary's wetlands. With each agency working with varying budgets to enforce its own laws, programs and policies, the result has been uneven wetland protection. Farmed wetlands, for example don't fit any current wetland definition and thus remain unregulated.

Sea Level Rise

California's current warming trend may result in smaller snowpacks and less freshwater runoff into the Estuary. According to a recent study, the sea level is likely to rise 2–3 feet in the next 100 years, as polar caps melt and thermal expansion of the oceans occurs. These changes will bring more saltwater into the Estuary, converting fresh and brackish marshes to salt marshes and affecting plant growth patterns, fish spawning and other wetland activities. Moderate to high sea level rise may also flood tidal marshes, converting them to mudflats or open water.

Public Access

Demand for public access to wetlands is increasing. While access trails encourage public appreciation of wetlands, they can sometimes damage limited remaining wetlands and adjacent upland, and introduce disruptive visitors to important wildlife nesting, feeding and resting sites.

San Francisco Bay Area Wetlands Ecosystem Goals Project

The San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project) began several years ago as an effort to answer the question "How much of what kind of wetlands do we need where, and why?" The Goals Project subsequently evolved into a cooperative public-private partnership to develop wetland habitat goals—goals representing a shared vision of the Bay Area's wetlands and associated habitats needed to insure a healthy Bay ecosystem. The Goals Project systematically quantified wetland types, locations, and amounts to establish the baseline data needed to monitor the health of Bay Area wetlands and to restore fish and wildlife populations. Based on the scientific findings, the wetland habitat goals are intended to provide valuable data to decision-makers involved in land use

planning and wetlands restoration and landowners wishing to improve their property's wetlands.

The wetland ecosystem goals report—written descriptions and illustrative maps recommending a mosaic of wetlands and related habitats—completed its public review and comment period the summer of 1998. The completion of the Goals Project marks the opportunity to begin active preparation of a regional wetlands plan for the Bay Area. See contact list for a copy of the goals.

A Case Study

On January 15, 1997, after two decades of environmental battles, the Peninsula Open Space Trust (POST) negotiated an agreement to purchase Bair Island, the largest remaining, restorable wetland area along the southern shorelines of the San Francisco Bay.

POST will pay the Japanese developer Kumagai Gumi Co. Ltd. \$15 million for the 1,626-acre property east of Redwood City. The purchase of the island was negotiated with the help of a three-year, 100% financing package. In order to retire the loan and transfer the property to the wildlife refuge, POST is seeking a \$10 million appropriation from the Federal Land & Water Conservation Fund and is raising the remaining \$5 million from local sources.

The marshlands, visible to motorists along Highway 101 for nearly two miles south of the San Mateo Bridge, will become a wildlife refuge. POST plans to transfer ownership to the Don Edwards San Francisco Bay National Wildlife Refuge, a 25,000-acre system of sloughs, marshes and salt ponds ringing the south part of the Bay, from Redwood City to Hayward.

Bair Island is a rare and special place. It consists of marshes, wetlands, and diked bay wetlands. The island is home to five endangered species: California clapper rail, salt marsh harvest mouse, California least tern, peregrine falcon and California brown pelican. The rail (a large but secretive, ground nesting bird) and the mouse (which may be the only mammal to drink exclusively salt water) have already lost 84 percent of the tidal marsh habitat they need to survive.

Much of the land—divided into three sections—has been diked and drained. But biologists expect that they can easily restore it by breaching levees and allowing bay waters to flood back in, creating lush grasses and wildlife habitat with little effort.

Estuary Project Goals

The San Francisco Estuary Project's primary goal is to restore and maintain water quality and natural resources while promoting effective management of Bay and Delta waters. The Project's Comprehensive Conservation and Management Plan contains the following goals to improve wetlands management:

- *Protect and manage existing wetlands.*
- *Restore and enhance the ecological productivity and habitat values of wetlands.*
- *Expedite a significant increase in the quantity and quality of wetlands.*
- *Educate the public about the values of wetland resources.*

The Estuary Project is now working cooperatively with agencies, environmentalists, business and the public to implement the Comprehensive Conservation and Management Plan.