Coastal Wetlands, Treasures of Diversity

Coastal wetlands act as nurseries for ocean fish and help cleanse polluted fresh water as it flows into the ocean. Such features in these transition zones between bodies of water and dry land make these ecosystems some of California's most ecologically significant.

Coastal wetlands include a number of natural communities that share the combination of aquatic, semiaquatic, and terrestrial habitats that result from periodic flooding by tidal waters, rainfall, or runoff.

Coastal wetlands support high levels of biological diversity (biodiversity), meaning they contain many different species in their many habitats. Wet soils and water-tolerant plants abound in wetlands, which are intermittently covered by shallow water. In the coastal zones of California, there are many different types of wetlands. The most common types are estuarine salt marshes and mudflats. An estuary is an area where a freshwater river meets the ocean. Salinity fluctuates in estuaries as ocean tides rise and fall, causing predictable cycles of flooding and flushing. In these areas, plants must be able to tolerate salty water to survive. Other types of coastal wetlands in California include freshwater marshes, bogs, vernal pools, and riparian zones along rivers and streams.

Wetland Formation

Geologic and climatic processes created our diverse coastal zones. California is situated on the edge of a dynamic continental plate that has been pushed upward over millions of years by the expanding Pacific Plate. Geologists refer to the movement of these plates as continental drift. Ancient rivers flowing into the Pacific Ocean eroded the rising land mass, forming canyons and valleys. The geologic processes of "continental drift" and erosion defined the rivers and valleys that we know today. Climatic processes further define these regions. During extended periods of cold weather known as "ice

Elkhorn Slough, California

Long-billed curlew

ages," sea water evaporates and is deposited on land in glaciers, causing a decrease in global sea levels. Ice in glaciers reached its greatest volume 18,000 years ago during the most recent glacial period, with sea level more than 328 feet (100 meters) below its present level.

The rivers that had cut their way through the rising land to the ocean emptied their fresh water into the ocean. Earth has been slowly warming over the past 18,000 years, with glaciers melting and sea levels reaching their present depth approximately 7,000 years ago. Flooded coastal river valleys created bays, estuaries, and lagoons. Coastal wetlands formed at the fringes of these large water bodies. These areas are now exposed to fresh water from rivers and rain, as well as tidal influxes of ocean salt water.

California's Wetlands

California has 110 major coastal wetlands, each of which is isolated and biologically diverse. In northern California, most of the coastal wetlands are estuaries and salt marshes bordering river mouths. The San Francisco Bay estuary is the largest on the west coast of both North and South America. This estuary is also one of the most altered wetland areas in the United States. Historically, Southern California supported an extensive network of coastal wetlands at river mouths with salt marshes flanking the region's bays and lagoons. Today, these coastal wetlands fall within highly urbanized locations. The wetlands that remain there are small and isolated from other wetlands, but still play an important role in preserving biodiversity.

The Salt Marsh

The coastal salt marsh, a specific type of coastal wetland, is one of the most productive ecosystems in the world. Coastal salt marsh primary productivity—the rate at which energy accumulates in an ecosystem as a result of photosynthesis by plants—rivals that of tropical rainforests. A variety of animals can consume this energy accumulated in plants, forming a diverse and intricate food web. Marsh plants and phytoplankton that sequester energy from the Sun form the base of a salt marsh's food web. Abundant sunlight in shallow marsh water allows these organisms to photosynthesize at a high rate. Shrimp, clams, oysters, and some fish eat phytoplankton and zooplankton. Larger fish, birds, and wetland mammals in turn eat these animals.

When animals die, decomposers, such as bacteria and fungi, break them down and convert them into nutrient-rich detritus. Waste products from animals add more nutrients to the water and soil. Tides, freshwater flows, and the burrowing action of bottom-dwelling animals circulate the nutrients for use by new organisms. Flowing rivers also carry some nutrients to the ocean, while animals that feed in the marsh and then travel to upland habitats export still other nutrients to upland ecosystems.

There are many diverse habitats in a salt marsh ecosystem. Combined with high primary productivity, this habitat diversity gives rise to astonishing biological diversity. Hundreds of species are adapted to take advantage of different opportunities within this ecosystem. Birds, such as curlews and godwits, have long legs for wading and long beaks for probing for invertebrates in the mud. The rare light-footed clapper rail makes a platform nest of cordgrass in the lower reaches of the marsh, while the equally rare Belding's savannah sparrow nests in the pickleweed in the upper marsh. Migratory birds use salt marshes for resting and feeding stops during their long journey along a migratory route known as the Pacific Flyway. Marsh hawks fly low, hovering in search of rabbits and other small vertebrates that live in the vegetation along the marsh's fringe. Eelgrass beds provide nurseries for many species of juvenile fish, such as the California killifish, pipefish, bay goby, and striped bass. Upland species, such as the raccoon, fox, and coyote, follow the waterline, hunting and foraging.

Salt Grass

Adaptations

Many organisms have adaptations that allow them to cope with the marsh's constantly changing and often extreme environment characterized by high salt concentrations, periodic flooding and drying, and low oxygen levels in waterlogged soils. For example, saltgrass has adapted to excrete salt before it builds up to toxic levels. Many wetland plants contain air spaces in their roots and stems that allow oxygen to diffuse from the tops of plants to the roots. This adaptation allows them to survive in the anaerobic wetland soils. Fiddler crabs are active during low tides when water recedes from mudflats. Since they breathe air, these crabs hide in burrows when the tides rise. There, a pocket of air supplies them with oxygen.

Why They Matter

People rely on many ecosystem goods and ecosystem services provided by coastal wetlands. Marsh plants, such as eelgrass, decrease the speed of currents, absorb wave action, and capture sediments, slowing erosion and protecting shorelines. Coastal wetlands can also store large quantities of water, helping to control flooding. Wetlands also improve water quality. Water flowing into a wetland often contains pollutants from a watershed's upper reaches. As currents slow, sediments settle out. Pollutants in those sediments sink into the wetland floor, where they are buried in layers. To varying degrees, wetland plants take up pollutants, while microorganisms in their tissue and roots break other pollutants down. By acting as natural "water filters," wetlands decrease the amount of pollution that drains into bays and oceans. Wetlands also support fisheries by providing critical habitat and nurseries for commercially important species.

Before the 1970s, many people viewed wetlands as "wasted land." Builders drained, filled, and developed these "swamplands" for housing or commercial development. Industrial pollutants contaminated many remaining wetlands, and road construction blocked critical tidal flow, degrading coastal ecosystems. Additional wetlands have been shrunk or eliminated by the dredging of port channels and filling of estuaries for boat facilities. Tide gates and flood control projects change the natural flow of salt water and fresh water.

Roads over Sweetwater Marsh, San Diego, California

Today, state and federal laws protect the remaining coastal wetlands in California, with further development tightly regulated. But coastal wetlands still suffer from the legacy of past development—all of the activities described above affect the health and functioning of these systems.

Since the 1850s, 97% of California's original coastal wetland acreage has disappeared. The remaining areas represent a critical part of California's biological diversity. As people seek to protect them, they also seek to protect the state's high levels of biological diversity and the goods and services these ecosystems provide. In turn, protectors of wetlands enhance quality of life for humans, today and in the future.