



BACK BAY SCIENCE CENTER

Wetland Functions Module

Activity I – How does an Estuary Function as a Filter?

CALIFORNIA STATE CONTENT STANDARDS

Grades 6 – 8

6th Gr. Science:
Earth's Surface – 2b

7th Gr Science:
Investigation and Experimentation - 7a

Grades 9 – 12

Science:
Biology/Life Sciences –
Ecology - 6b, d
Evolution – 8a, b
Investigation and Experimentation – 1b,
c, d, k

EEI P and C: 1c; 11a; 111c; 1Vb, c
Ocean Literacy Principles: 1g; 6e;
Climate Literacy Principles: 6d

BACKGROUND INFORMATION

Wetlands are unique ecosystems with great biodiversity. As the name implies, most are found where water meets land, and include estuaries, marshes, sloughs, mudflats, vernal pools and swamps. Because they exist at the interface of land and water, wetlands offer a diverse range of

microhabitats for both terrestrial and aquatic plants and animals. Although they provide one of nature's richest habitats, they are one of the ecosystems with the highest rate of loss world-wide. While they provide several important services to humans, the land they occupy has often been seen as too desirable to remain "undeveloped".



Estuaries are found where freshwater streams meet the ocean's salt water. They can support marine, fresh, and brackish water organisms that thrive in the mix of the two types of water. The daily movement of water caused by the incoming and out-going tides mixes the water, oxygen and nutrients. An estuary provides the resources for rich aquatic and terrestrial food-webs, each with its array of autotrophs, herbivores, primary and secondary consumers. The water supports plant communities as well as phytoplankton that are the primary

producers, performing the photosynthesis that is the base of the energy or trophic pyramid. The deposition of very fine sediment in the mudflats creates an anaerobic environment for a number of microorganisms. There is also a wide variety of aerobic, or oxygen dependent invertebrates living in the shelter of the mud and catching or filtering food from its safety, as well as detritivores feeding on waste. The diversity of food, and the protection from the ocean's force provide an ideal habitat for small and developing animals. Because of this rich supply of resources, both migratory and resident birds can be regularly observed, feeding on the plankton, fish, arthropods, mollusks, and amphibians, as well as small reptiles and mammals.

One of an estuary's most remarkable functions is largely invisible. As a wetland, it is characterized by the presence of hydric, or saturated soils for at least part of the year, and hydrophytic, water-loving plants. This mix of biotic and abiotic factors combines to perform an amazing natural accomplishment. Within its layers of sediment and spongy roots, pollutants are filtered out of the water before it reaches the ocean. Some of the pollutants are mechanically trapped in the pore space between the sediments, or adhere to root hairs as they percolate through. While an estuary is able to filter water carrying pesticides, herbicides, fertilizers, motor oil and detergents, there is a maximum

load of these toxins, or carrying capacity, that it can process. It's important to remember that even though

an estuary is able to screen out pollutants, the chemicals present can have a perilous impact. For example, phosphates found in many detergents cause Algal blooms, resulting in anoxic conditions, killing many aquatic species. Nitrates found in fertilizers also impact the water and soil chemistries.

The broad expanse of Upper Newport Bay functions as a wide lood plain. The estuary provides a drainage basin for our entire watershed. During heavy winter rains, excess water flowing out of the hills and neighborhood storm drains is dispersed over this wide area. The water velocity is slowed and erosion is decreased. Because the water velocity is slowed, greater sediment deposition and soil stabilization can occur. This increased deposition has to be monitored. If allowed to continue to amass, the streambed can actually become shallower, and ultimately impact the ecosystem.

While at a quick glance a wetland might appear to be open and unproductive land, in fact it is highly productive. It is a vibrant ecosystem, providing shelter and food to an abundance of species, some of which are threatened. It provides a tremendous service, by filtering polluted water before it reaches the ocean and spreads globally. It also serves local communities by decreasing flooding and erosion and stabilizing soils. It also offers a wonderful respite to the visitor. Despite this, California has lost over

ninety percent of its wetlands in recent years. The Estuary Restoration Acts of 2000 and 2007 are targeted at monitoring the health of our estuaries

and sponsoring restoration efforts state-wide. There are now many opportunities for individuals and groups to join local efforts, and add their energies to reclaiming and maintaining these precious ecosystems.

RESOURCES:

www.coastal.ca.gov/publiced/UNBweb/owow.html - Our Wetlands, Our

World, Newport Beach

www.coastal.ca.gov/publiced/waves/waves1.html - Waves, Wetlands, and

Watersheds

http://oceanservice.noaa.gov/education/tutorial_estuaries/welcome.html -

background

<http://www.era.noaa.gov/> - Estuary Restoration information



TEACHER GUIDE – Wetland Functions Module

ACTIVITY I: How does an Estuary Function as a Filter?

OBJECTIVES:

Students will be able to –

1. Identify the main characteristics of a wetland.
2. List at least two examples of a wetland.
3. Identify the three major functions of a wetland.
4. Identify the issues surrounding wetland loss.
5. Identify the state-wide and local community efforts to safeguard and restore wetlands.

KEY TERMS:

Abiotic Aerobic Algal Bloom
Anaerobic Anoxic Aquatic
Autotroph Biodiversity Biotic
Brackish Carrying Capacity
Detritivore Ecosystem Estuary
Flood Plain Food Web Herbivore
Hydric Hydrophytic Microhabitat
Microorganism Migratory Percolate
Primary Consumer Primary Producer
Photosynthesis Phytoplankton
Resident Secondary Consumer
Sediment Terrestrial Wetland

MATERIALS:

- 7 plastic bottles, with bottoms cut off (Liter, 1.5 L)
- 7 1L beakers
- 7 C sand
- 7 C dirt
- 7 C small pebbles
- 7 2" x 2" pieces of screening or fine mesh
- 7 rubber bands
- 3L of dirty aquarium water or 3L water mixed with 5 handfuls mud. Can be sterilized to kill pathogens, by baking at 450 F for 1 hour.
- 7 500ml beakers
- Observation Sheets

Pencils