

Wetland in a Pan

San Francisco Bay map
Pictures of wetlands
1 Large bin of diatomaceous earth
4 Measuring cups and 1 scooper
12 Round plastic containers
12 Spoons for stirring
12 Plastic paint trays
12 Pairs of sponges marked A through L for the wetlands.
24 Triangle tools for smoothing land
Carpet pieces for pervious surfaces
Mirror paper for impervious surfaces
Plastic shapes for buildings
12 Spray bottles
12 CD case pieces
Wetland in a Pan Observations page

Wetland in a Pan Content

Guiding Questions

Ask students to think about what happens when it rains. Tell the students to think about being outside when it rains and what happens when the water hits the ground. Have the students imagine that they are walking along the sidewalk, walking down the beach, or sitting in a forest. Have students make a list of what happens to rain in different places.

Have students explore the map of the Bay Area and discuss where the rain goes and imagine the flow of all the excess rain water and storm drain water eventually flowing out to the bay. Then ask the students what they think all that water might look like by the time it has traveled over and under and through the land all the way to the bay.

Then share the pictures of wetlands. Discuss with the students how these essential pieces of land are different than other areas of land. Have they been to any places that look like the wetlands in the pictures? Explain to the students the importance of these wetlands.

What is a Wetland?

A wetland is an area of land that is soaked with water for at least part of the year. Wetlands have shallow water, the soil is soggy, and many plants grow out of the water. This is different from a lake which has water too deep for plants to grow all the way from the bottom to the surface. The edges of lakes, however, may be shallow enough to be wetlands. The main types of wetlands are:

Marsh – a wetland with water that moves often because it is on the edge of a lake or near the ocean, so tides or downhill flow keep the water moving. They are usually muddy with short, grass-like plants. Marshes are the type of wetland found in the San Francisco Bay.

Swamp – a wetland with slow-moving river water that has trees growing in it. The soil has many nutrients.

Bog – a wetland filled with a spongy moss called “peat”. The water usually comes only from rain and is stagnant and acidic.

The San Francisco Bay is an estuary that has many marshes. An estuary is a water body where fresh water and salt water meet. Fresh water flows in from rivers in the delta and salt water flows in from the ocean under the Golden Gate Bridge. The river water slows down when it reaches the bay and particles floating in the water settle. This makes the edges of the bay shallow and muddy; perfect for salt marsh plants such as cordgrass and pickleweed to grow.

Wetlands provide unique habitat for many animals. Small crustaceans and insects live in the plants and fish breed in the calm, protected waters. Birds that eat wetland plants,

insects, and fish make their nests next to wetlands. Predators like hawks and foxes also live near these wetlands to hunt those animals.

Pervious and Impervious Surfaces

The roots of plants in wetlands and next to rivers hold the soil in place. If plants are destroyed, nothing keeps the rain from washing the soil into the water. This is called erosion. As soil fills the river, it makes the water cloudy which can make it difficult for underwater animals to see and breathe. When this murky water flows into the San Francisco Bay, the soil settles to the bottom and makes the bay increasingly shallow and murky.

Human-made structures can also influence how water flows. Impervious surfaces such as streets and parking lots don't absorb rainwater, so this water washes off onto the sides of the surface. It flows quickly and gathers dirt, oil, trash, and other small objects as it flows. It then either flows into a storm drain and out into the bay or into nearby streams which also drain out into the bay. The oil, dirt, and trash end up in the bay as well. Pervious surfaces such as lawns, gardens, and natural areas absorb rainwater as it falls. This fills underground water sources (aquifers) and moistens the soil which allows plants to grow.

History of San Francisco Bay Wetlands

Look at the Historical Baylands and Modern Baylands maps. The Historical Baylands map shows an estimate of how the bay looked in the early 1800's before settlers began to drastically change the landscape. Tidal marshes are wetlands in which the water is constantly moving with the tides. Salt ponds are former tidal marshes which were diked (blocked off from the bay) and used to evaporate the salt water to collect salt. Salt farming was a big industry in the bay area.

In the Modern Baylands map, you can see that there are far less tidal marshes. There are many more salt ponds and treatment ponds. Treatment ponds are diked wetlands where water treatment plants release treated water. Agricultural bayland is land which is used for agriculture, but often becomes a seasonal wetland for short periods of time.

Since the 1970's an effort has been made to restore salt ponds, treatment ponds, and agricultural bayland into tidal marsh. Current restoration efforts are happening at Don Edwards National Wildlife Refuge and the Palo Alto Baylands.

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Set-Up

The set up can either be done by the teacher ahead of time or by the students. The instructions below are written as if the students are setting up their own materials.

Separate students into up to 12 groups and instruct each group to take:

- 1 paint tray
- 1 spoon
- 1 round plastic container
- 1 pair of sponges (match the letters)
- 2 triangle tools
- 1 spray bottle
- 1 cd case piece
- 1 handful of plastic building shapes

Preparation of the diatomaceous earth

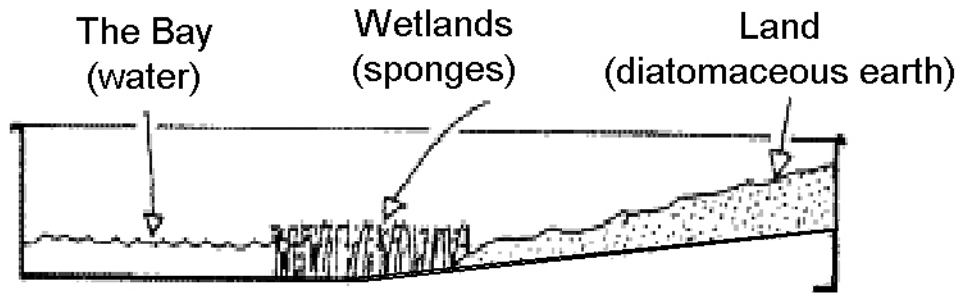
Have each group measure 3 cups of diatomaceous earth into their round plastic container using the 1 cup measurers. Then add 1 ½ cups of water to the container using the half cup measurers. Then use the spoon to mix it thoroughly together.

The ratio of diatomaceous earth to water is 2 parts earth to 1 part water. It is the right consistency when it appears dry, yet can be formed into clumps without falling apart or looking melted. The mixture is too wet if you let it sit and a puddle forms on the surface, even if the rest is hard. The mixture is too dry if powder puffs in the air when stirred.

Note: Diatomaceous earth is made of fossilized diatoms which are a type of hard-shelled algae made mostly of silica. When diatoms die, they layer on top of each other on the bottom of a lake or sea. Diatomaceous earth is found on land in underground areas which once were on the bottom of a lake or sea. It is mined and used as a filter for swimming pools, an abrasive for cleaning, an absorbent to clean up oil, as an insecticide, and many other uses.

Preparation of the pan

1. Dampen the two sponges and squeeze out the water so they fit tightly in the pan.
2. Place the two sponges end to end across the part of the pan where the slope meets the bottom. These will be the wetlands and the bottom will be the bay.
3. Have students scoop the earth into the upper portion of the pan above the wetland. Use the spoon and triangle tools to form a river, hills, and valleys. Then place the pervious and impervious surfaces (the carpet and mirror paper) on the land. Add the small plastic shapes to make buildings.



Activity

1. Use the spray bottle to make rain in the whole pan. Then concentrate the rain on the pervious and impervious surfaces. What do students notice? Can they see if water flows into the bay? What differences are there between how water flows on pervious and impervious surfaces?
2. Use the cd case to gently make waves in the water to represent ocean waves. What do they notice when the waves wash on the wetlands?
3. Remove one of the pieces of wetland. Perform the same activities again – spray the water to make rain and use the cd case to make waves. What differences do students notice in their land?
4. Have each student write observations on the Wetland in a Pan Observations sheet.

Discussion

As a class, share what was observed and relate that to how water and land act in the real world. In the San Francisco Bay, about 90% of the wetlands have been filled in for construction of buildings and roads. Show the maps of wetlands in the San Francisco Bay. Construction, deforestation, and mining have caused tons of soil to fall into the rivers which lead into the bay. Because of that, the bay is slowing filling in and getting shallower. What effects might that have on the environment? What can be done about it?

Areas of filled in wetlands can be turned back into marshes by allowing water to flow again. Sediment is removed from the bay by ships dredging it out and sediment can be prevented from entering rivers by not allowing construction close to rivers and restoring vegetation. Since the 1970's, some areas where wetlands had been destroyed were restored by allowing water to flow back in such as at Coyote Hills in Fremont, Don Edwards National Wildlife Refuge in Alviso, and the Palo Alto Baylands.

Clean-Up

1. The diatomaceous earth can be reused! Scoop the diatomaceous earth from the paint trays back into the round plastic containers and place the containers upright in the bin of diatomaceous earth. They can dry in their individual containers over several days and then be added back into the bin.
2. Rinse and dry all the materials.