Loss of Wetlands: Subsidence

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The Fragile Fringe – A guide for teaching about Coastal Wetlands

Objectives:

1. **To define subsidence and demonstrate the resulting effects on wetlands**
2. **To introduce global warming and sea-level rise as factors in wetland loss**

Subsidence in the coastal marshes involves two factors: the sinking of the marsh surface and a lack of sediment being added to the marsh surface. As materials in the marsh settle, decay, and compact, the marsh effectively sinks a little. If new sediments are not being added to the system, the entire system is going to decline in elevation. Water will now pool in these lower elevation spots when there is a very high tide.
As the temperature of the earth increases little by little (global warming) and the sea level begins to rise, these areas become permanently flooded, the marsh is lost, and more open water areas result. To some degree leveeing and channelization have impacted this sinking and building up of the marshes because they reduce the amount of sediment available for vertical marsh buildup. A healthy marsh system with adequate amounts of vegetation will tend to trap whatever sediment is available and promote vertical buildup.

Activities: (for elementary and middle school students)

1. Fill 2/3 of one end of a large glass dish or clear plastic box with loosely packed soil. Let the students mark the level on the side of the container. Using a watering can or spray nozzle, drench the soil (use a ruler or board to keep the soil from being washed into the other end of the container) and let the students observe the difference in "elevation" of the soil. Explain that in a marsh, the air in the soil is always being replaced by water (the percolation process) and the soil settles or subsides.
Materials decay quickly under moist conditions, so this also reduces the amount of organic material in the soil. Ask the students for suggestions as to what would be needed to keep the elevation constant. Ask how building levees along rivers has hindered sediment addition to the wetlands. Water used to drench the soil should have run off into the empty 1/3 of the pan. Have students mark the level of the water on the "shore" (use a toothpick or small stick).
Add additional water to this to simulate sea level rise. Have the students mark the new "sea level" after the addition of the water. If the pan is large enough, create a large wave. If there are any depressions that formed during the settling of the soil, ask the students what happens to them after the wave recedes. Have the students speculate about what will happen to this newly formed pond.

Extension: (for middle school students)

a. Let the students set up the experiment with the soil except that the soil should be 4 - 6" deep. It can be in a large plastic tub or on the ground outside. (The water next to the soil is not necessary for this step.) Have the students decide where they are going to dig a canal. Have them place several strips of paper vertically from the edge of the site of the canal out towards open land. As they dig the canal, they should

place the spoil (dirt dug from the canal) right along the edge of the canal they are digging. As they pile the spoil up along the bank, they should notice that the soil in this area is sinking - the end of the paper along the bank begins to settle lower than the other end. Ask the students to discuss the effect of dredging and canal building on subsidence.

(for upper elementary - middle school students)

2. Subsidence can also be related to the removal of subsurface materials such as gas and oil. Use a gallon milk jug (Fig. 5) with the top cut off and a small hole (large enough for the tip of a balloon to fit through) about 2" above the bottom of the jug. Fill the bottom 2" of the container with soil, partially blow up a balloon (blow it up only enough that it can be flattened out to about 2" as you pile dirt on top of it), and pull the end of it through the hole in the side of the milk jug, and pile 2-4" inches of dirt on top of the balloon.
The air in the balloon will represent a natural gas/oil deposit under the surface. Mark the level of the top of the dirt on the milk jug. Let the air out of the balloon either by cutting the end off or sticking a sharp object through the hole into the balloon. Mark the resulting level of the dirt. Have students suggest possible effects on the coastal regions of the state since oil and gas exploration and removal began in the early 1900's.

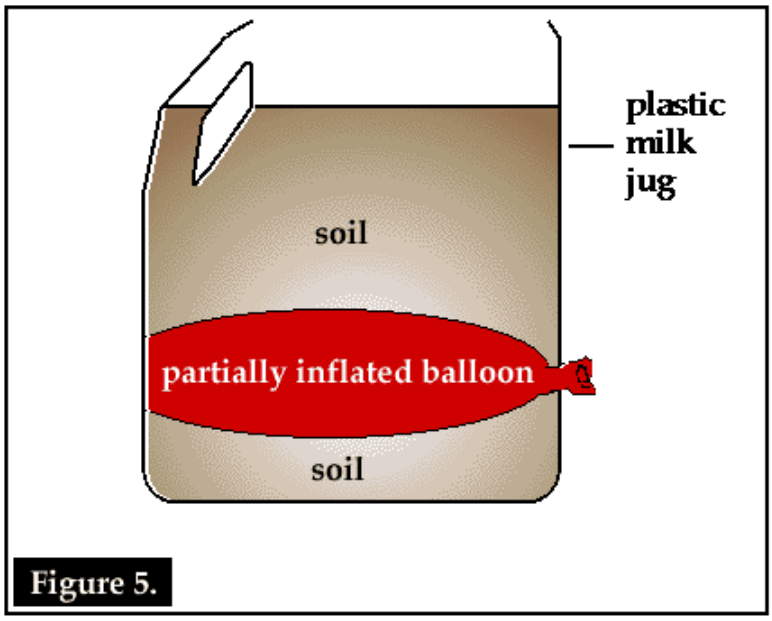

Figure 5.

(for middle school students)

3. Use a mixture of clay, sand, silt, and peat in an aquarium (or other large clear container). Add water to demonstrate the percolation, settling, and compaction of soils in the marsh resulting in subsidence (see note about the mixture to use). Have students watch the mixture after the water has been added and record any changes they see taking place in the mixture. How does the settling occur? Is there a pattern or is it a random process?

To illustrate the possible formation of sinkholes associated with the removal of underground materials such as gas and oil, inflate a balloon and put it under the soil mixture. After the mixture has settled and dried for several days, insert a probe or long skewer and puncture the balloon. Have the students record what happens.

Ask the students to research the occurrence of sinkholes in the United States. With what kinds of geologic structures were these sinkholes associated? Were gas and oil explorations underway in the immediate area?

Note: A ratio (by weight) of 35% sand, 30% silt, 30% clay, and 5% organics (peat) can be used to "produce" a marsh mixture. **A note of caution:** care should be taken to avoid inhaling the mixture over prolonged periods since some of the components are very small and easily become airborne during mixing.