Vanishing Tidelands

Watch the segment online at http://education.savingthebay.org/vanishing-tidelands
Watch the segment on DVD: Episode 2, 16:43–20:14
Video length: 3 minutes 51 seconds

SUBJECT/S

Science

History

GRADE LEVELS

6–8
9–12

CA CONTENT STANDARDS

Grade 6

Earth Sciences—Resources

6.b. Students know different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.

Grades 9–12

Biology/Life Sciences – Ecology

6.b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

VIDEO OVERVIEW

Most of the tidelands in San Francisco Bay have been diked or filled. In the South Bay, tidal salt marshes were turned into salt ponds.

Signs like this one in the Corte Madera marsh in Marin County were common along San Francisco Bay into the 1970s. (BCDC)

In this segment you'll learn:

- how different the Bay shoreline used to be.
- how tidal marshes were exchanged for grasslands and salt ponds.
- about solar salt production in the South Bay.

TOPIC BACKGROUND

Wetlands are areas that are covered with water all or part of the time. In the San Francisco estuary, the wetlands are affected by the rising and falling of the tides two times each day; therefore, they are called tidal wetlands (or tidelands). Salt marshes exist along the shores of the Bay and are filled with saltwater from the ocean. Brackish (a mix of fresh water and saltwater) and freshwater marshes are located near the mouths of rivers and creeks, as in the Delta. These areas are critical habitats for many birds, fish, and mammals.

Since 1850, approximately 90 percent of the Bay's tidelands have been destroyed through diking and filling. Shallow parts of the Bay were filled in for development such that the Bay is one-third smaller today than it was 200 years ago. Filling started in Yerba Buena Cove during the Gold Rush, followed by other parts of the San Francisco and Oakland shorelines. The Swamp Land Act of 1850 transferred more than 2 million acres of wetlands to private hands in California. This and other state policies allowed, indeed promoted, the filling and "reclamation" of wetlands around the Bay and in the Delta for agriculture. Additionally, much of the marshland in the South Bay was diked off for the creation of salt ponds.

Salt production in San Francisco Bay began in 1854. Salt, composed of sodium chloride (NaCl), exists as a cubic crystal lattice in solid form. There are three methods of salt production: salt mining, solution mining, and solar evaporation. In the third method, solar evaporation, ponds are filled with a shallow layer of seawater or brine. The brine is concentrated by the sun and evaporation. After being moved from pond to pond, the salt crystallizes on the floor of the last pond. Finally, it is collected, washed, and stored. For decades, a million tons of salt were produced annually from salt evaporation ponds in San Francisco Bay.

Today, cities and organizations are working to protect the remaining wetlands, and state and federal agencies are working to convert former salt ponds into wetlands at the north and south edges of the Bay.

VOCABULARY

baylands
the land between high and low tide

brine
water saturated with salt

diking
holding back the waters of a sea or river

hue
color

impermeable
impassable

private enterprise
privately owned business

reclaim
to demand the return of, as a right

swamplands
areas that are seasonally covered in water

terrestrial
land-based

tidelands
the land between high and low tide

PRE-VIEWING ACTIVITIES

- Discuss the parts of the San Francisco estuary. What are wetlands and why are they important? Where are there wetlands in the San Francisco estuary?
- As a class, discuss where salt comes from. Who produces it? Examine this map of salt deposits in North America: http://www.saltinstitute.org/content/download/4348/23631.

FOCUS QUESTIONS FOR VIEWING

- What was tidal marsh exchanged for? *grasslands and salt ponds*
- What year was ownership of swamplands and tidelands transferred to the states? *1851*
- How much did California charge per acre of San Francisco Bay tideland in 1855? *$1*
- How did American law promote filling and reclaiming of the tidelands? *with the Swamp Land Act*
- By the 20th century, how many acres of baylands were cut off from tidal influence? *137,000 acres*
- In the South Bay, thousands of acres of marsh were diked off for what purpose? *to create evaporation ponds for crystallizing salt*
- How much tidal salt marsh has been lost? *about 85 percent*
- Gold miners got the idea for solar salt production from whom? *the Ohlone Indians*
- What gives the South Bay salt ponds their surreal multicolored hue? *organisms that live in the ponds*

POST-VIEWING ACTIVITIES

- Compare the current map of the San Francisco estuary to this historical map: http://www.sfei.org/content/ecoatlas_habitats.
- Watch this slideshow of the changing estuary: http://www.sfestuary.org/sshow/phpslideshow.php?directory.
- Investigate what is being done to restore salt ponds to wetlands. How are salt ponds restored to wetlands? What other restoration projects are happening around the Bay? Find out how to help in the restoration effort.
- Research what the Bay shoreline nearest your school would have looked like before 1850. Explore how it has changed over the last 150 years. Has it been filled in? diked off? Are there projects under way to develop it or restore it? Present your findings to the class.
- Discuss what the estuary might look like in the future. Student pairs draw a map of San Francisco Bay in the year 2050 and present their predictions to the class. What would the wetlands look like? What sort of animals and plants would be found there? Will there be more or less urban development?
- Research methods for making salt crystals. What do we use salt for? Why is salt an important part of our diet?

ABOUT THE AUTHOR

Phaela Peck is a science teacher, environmental educator, and writer based in San Francisco. She has an M.A. in environmental education and has developed curricula for numerous science and environmental education organizations in the Bay Area.

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ADDITIONAL RESOURCES

Bay Area Wetland Tracker
http://www.californiawetlands.net/tracker/ba
Find information on current wetland projects around San Francisco Bay.

"South Bay Challenge: Reclaiming the Salt Ponds for People and Nature," *Bay Nature Magazine*
http://www.southbayrestoration.org/pdf_files/BayNature%20Oct%202004.pdf
This in-depth article provides information on the South Bay Salt Pond Restoration Project, along with images and historical information.

South Bay Salt Pond Restoration Project
http://www.southbayrestoration.org
Find out more about the largest wetland restoration project on the West Coast.

CREDITS

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CHARLES WOLLENBERG: I think it's very difficult now for us to understand what the Bay used to look like, say, in 1850. We now think of the Bay as, there's a very stark difference between the shoreline and the water. But there was a huge intermediary zone of freshwater marshes, saltwater marshes, and mudflats.

JOSH COLLINS: Diking the Bay off increased the amount of grasslands further toward the Bay. That is, we exchanged tidal marsh for grasslands, or for salt ponds in some cases. In any case, we sort of moved the terrestrial world further into the Bay.

NARRATOR: In 1851, Congress transferred ownership of swamplands and all tidelands to each of the states. By 1855, California began selling the tidelands of San Francisco Bay for a dollar an acre.

WOLLENBERG: The way in which American law was developed promoted that. There was something called the Swamp Land Act, which actually, in effect, encouraged people to fill and to what they called "reclaim"—which, of course, wasn't reclaiming, it was claiming—and [which outlined] the way in which private enterprises could gain control of land that was covered over by the Bay.

NARRATOR: By the 20th century, 137,000 acres of baylands—lands between high and low tide—were cut off from tidal influence, dramatically shrinking the Bay's overall size. In the South Bay, thousands of acres of marsh were diked off to create evaporation ponds for crystallizing salt as early as 1854.

LYNNE TRULIO: The habitat was dominated by tidal salt marsh in historic times, and since about the 1850s, about 85 percent of that has been lost.

PAT MAPELLI: There was an opportunity with the gold miners when they saw the Ohlone Indians extracting salt from the natural salt pans around the edge of the Bay to actually commercialize it. That pretty much started the whole solar salt industry here in the South Bay.

NARRATOR: By 1868, 18 separate salt production enterprises were in operation.

MAPELLI: This plant here was actually constructed during the mid-'20s and went into production in the early '30s.

TOM ENCISO: The Bay water will travel through, and each year it builds up in salinity. It takes time for it to evaporate down to get to this point where it will drop the good salt crystals.

MAPELLI: Salt has been produced out here due to the climate, evaporation. The soils are fairly impermeable as well. The operators take control not to dig the mud that's below the salt. Then, that salt is hauled into a wash facility where the salt goes through a wash with a saturated brine before it is then stacked onto our stacking site.

NARRATOR: Today, the organisms living within these salt ponds give the southern end of San Francisco Bay a surreal multicolored hue.