

Restoring San Francisco Bay

Watch the segments online at <http://education.savingthebay.org/restoring-san-francisco-bay>

Watch the segments on DVD: Episode 1, 30:35–32:13; Episode 3, 30:11–31:38; Episode 4, 43:33–45:38

Video lengths: 1 minute 56 seconds; 1 minute 46 seconds; 2 minutes 25 seconds

SUBJECT/S

Science

History

GRADE LEVELS

4–5

6–8

9–12

CA CONTENT STANDARDS

Grade 4

Life Sciences

2.a. Students know plants are the primary source of matter and energy entering most food chains.

3.b. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.

Grade 6

Life Sciences—Ecology

5.e. Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

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

Segment 1:

Historical ecologists have been working to try to understand what San Francisco Bay looked like before the Europeans arrived.



Wetland restoration at the former Hamilton Air Force Base in Marin County.

In this segment you'll learn:

- how historical ecologists use a variety of historical documents to piece together how an ecosystem used to function.
- that ecosystems cannot be returned to what they once were, but that historical ecology can provide information on what is possible for restoration.

Segment 2:

Dredge material from the Oakland shipping channel is being used to restore Hamilton Field back to tidal marsh. In this segment you'll learn:

- how dredge material is moved to the Hamilton Field Restoration Project to fill in subsided lands.
- that once the land has been brought back to the proper elevation, plants can grow again, returning the fields to tidal marsh.

Segment 3:

Wetland restoration projects are taking place all around the Bay. In this segment you'll learn about:

- the restoration of the South Bay salt ponds.
- the importance of San Francisco Bay to migrating birds as part of the Pacific Flyway.

TOPIC BACKGROUND

Historical ecology is the study of how ecosystems used to function and how they have changed. Findings from historical ecology projects can assist natural resource agencies and environmental groups in ecological planning and restoration. The San Francisco Estuary Institute is working to understand how the Bay Area landscape has changed since native times.

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 urban development such that the Bay is one-third smaller today than it was 160 years ago. Additionally,

VOCABULARY

archaeologist

one who studies human cultures

depression

a sunken place

diking

holding back the waters of a sea or river

dredge material

mud or sediment removed from the bottom of a body of water in order to make it deeper

geo-reference

to define existence in physical space

GIS

a geographic information system, which is a program that captures, stores, and manages data that is linked to a specific location

historical ecology

the study of what ecosystems used to look like and how they used to function

landmark (adj.)

important, historical

Pacific Flyway

a major north-south route for migratory birds

restoration

the returning of something to its original condition

salt ponds

ponds created for solar salt production

shipping channel

a thoroughfare for ships that is usually deeper than surrounding waters

shorebirds

birds that live in coastal or wetland habitats

subsidence

sinking below a normal level

50 percent of the fresh water that used to flow into the Bay is now diverted for agricultural use and drinking water. In the South Bay, wetlands were transformed into salt ponds for solar salt production. Today, cities and organizations are working to protect the remaining wetlands, and there are numerous restoration projects under way around the San Francisco Bay Area.

The Hamilton Field Restoration Project uses dredge material from the Port of Oakland shipping channel to fill in subsided lands and restore wetlands in San Pablo Bay. Draining of wetlands for agricultural use—or, as in the case of Hamilton Field, for an airport—exposes the soil to oxygen. This allows for microbial oxidation of carbon and the loss of organic material, which results in subsidence. For restoration, the land must be brought back to a level at which plants can grow. The South Bay Salt Pond Restoration Project aims to turn 15,100 acres of industrial salt ponds back into tidal wetlands by slowly opening up the salt ponds to tidal flow.

San Francisco Bay wetlands are an important stopover for migrating birds. As part of the Pacific Flyway—a major north-south route for migrating birds—the Bay is visited by more than 350 bird species looking to rest or find food. Birds migrate south as early as August and north as early as March and can be seen around the Bay during these times.

PRE-VIEWING ACTIVITIES

All Grades

- How have humans changed the San Francisco Bay Area over the last 200 years?
- Is it possible to reverse those changes? Why or why not?

VIEWING ACTIVITIES

Grades 4–5

- Watch segments 2 and 3 and proceed directly to the appropriate Post-Viewing Activities. Record thoughts, feelings, and ideas generated while watching the segments.

Grades 6–8 and 9–12

- Watch segment 1 and pause to answer the Post-Viewing Discussion Questions. Watch segments 2 and 3 and proceed to the appropriate Post-Viewing Discussion Questions and Post-Viewing Activities. Record thoughts, feelings, and ideas generated while watching the segments.

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.

KQED Education engages with community and educational organizations to broaden and deepen the impact of KQED media to effect positive change.

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POST-VIEWING QUESTIONS

Grades 6–8 and 9–12

Segment 1:

- How does historical ecology help us to better understand the Bay?
- How does understanding the past help prepare for the future?
- In this segment, Josh Collins says, “There’s always a danger with these efforts to paint the picture of the past to suggest to people that we can go back there somehow, that ecosystems run backwards, which they don’t. Ecosystems do not run backwards. You can’t reach the past.” Why can’t you reach the past? What does he mean by “Ecosystems do not run backwards?” If we can’t go back, what can restoration efforts do?

Segments 2 and 3:

- How has the use of dredge material changed?
- Why is it necessary to remove dredge material from the shipping channel?
- Should material be moved from one part of the Bay to another? Why or why not?
- What do you think changed in the early 1990s to allow for wetland restoration projects?
- What is unique about the South Bay Salt Pond Restoration Project?
- Why is San Francisco Bay important to migrating shorebirds?
- Is it possible to restore what has been lost in the Bay Area?

POST-VIEWING ACTIVITIES

All Grades

- Visit www.savingthebay.org to find out about local Bay or creek restoration projects and how to get involved.
- Research a shorebird that uses the Pacific Flyway. Where does it nest? Where does it winter? Does it stop in the San Francisco Bay Area? If so, when? How does the Bay support the shorebird’s journey? Prepare a presentation for the class.

Grades 4–5

- Investigate which native California plants might grow in the San Pablo Bay and South Bay wetlands once they are restored. How will these plants support the wetland food webs? Check out the Field Identification Guide of tidal marsh plant species, prepared for the San Francisco Estuary Invasive Spartina Project, and the South Bay Salt Pond Restoration Project’s Web page on the habitat benefits of wetlands to learn about wetland plants.
 - http://www.spartina.org/project_documents/field_guide_tide_plants_low-res_200703.pdf
 - <http://www.southbayrestoration.org/Fact%20Sheets/FS4.html>

Grades 6–8 and 9–12

- Carry out a historical ecology project at your school site. What did the land look like 200 years ago? How did it function? How could this information influence actions taken on the schoolyard or in the school garden?
The San Francisco Estuary Institute’s EcoAtlas contains maps of the Bay Area’s habitats circa 1800 and in the present day:
http://www.sfei.org/content/ecoatlas_habitats.

ADDITIONAL RESOURCES

Bay Area Wetland Tracker

<http://www.californiawetlands.net/tracker/ba>

Find information on current wetland projects around San Francisco Bay.

Delta Subsidence in California: The Sinking Heart of the State, U.S. Geological Survey

<http://ca.water.usgs.gov/archive/reports/fs00500/fs00500.pdf>

This article provides an in-depth explanation of subsidence in the Delta, complete with useful images and diagrams.

Golden Gate National Parks Conservancy

<http://www.parksconservancy.org>

Find out about conservation and restoration work being done in the Golden Gate National Recreation Area. Information about volunteering and school programs is also available.

Historical Ecology, San Francisco Estuary Institute

<http://www.sfei.org/HEP>

Learn more about historical ecology and San Francisco Estuary Institute projects.

PRBO Conservation Science

<http://www.prbo.org>

PRBO Conservation Science offers information on bird and ecosystems research in the San Francisco Bay Area.

“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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Segment 1

NARRATOR: This map, based on Cañizares's work, was among the first maps of San Francisco Bay published in Europe. Today, the works of these early visitors help researchers piece together what San Francisco Bay was like at the time of European contact. The discipline is called historical ecology.

ROBIN GROSSINGER: It's something that geographers and archaeologists and environmental scientists have been doing forever, probably. So for restoration, the question comes up, "What did these systems look like? How did they function?"

To reconstruct what the historical landscape looked like, we assembled dozens, even hundreds of different historical documents—maps, photographs, journals. All of these provide different little hints and clues about how the landscape used to look and function.

Here are the salt ponds in their glorious colors. We've overlaid it so that it geo-references rather perfectly onto modern imagery, so you can see the sloughs and channels there. Then, let's put [it] on the GIS so the mapping that we've done, based on this and all these other sources, so there you can see some of the tidal channels that gave the tidal marshland such complexity and richness as a habitat.

JOSH COLLINS: There's always a danger with these efforts to paint the picture of the past to suggest to people that we can go back there somehow, that ecosystems run backwards, which they don't. Ecosystems do not run backwards. You can't reach the past. In this case, the idea of developing a picture of the past was to give us some sense of what the land would do on its own terms.

Segment 2

NARRATOR: As ships grow ever-larger, the shipping channels must grow ever-deeper. In the 20th century, the dredge material of the Oakland estuary was used to fill in the tidelands surrounding the estuary. Today, dredge material is used for a different purpose. As part of the Hamilton wetlands restoration project, it is moved 20 miles by barge and pipeline to Hamilton Field—a former air force base built on subsided baylands along San Pablo Bay. Mud from the Port of Oakland is now the essential raw material for restoring what were once runways back to tidal wetlands.

BRENDA GOEDEN: We've got a number of places around the Bay that have significant depressions, like this one, where we're five to 15 feet below sea level due to diking of the Bay and the past history. And so we're raising the elevation using dredge material. It gets it up to marsh-plain elevation and then plants start to regrow in the area, and we rebuild marsh much quicker than we would be if we weren't using dredge materials. We're basically taking it from one place, putting it in another, restoring the marshes that were there, and improving water quality in the Bay at the same time.

Segment 3

NARRATOR: As the battle over the Delta waged on, a new vision for the Bay as a whole was growing: the possibility of actually restoring some of what was lost in 150 years of radical change.

WILL TRAVIS: The Bay was on life support. And what we did for three decades was simply tried to keep the Bay alive and not [get] any worse. And then it was really in the early '90s where we started to see wetland restoration projects that went from a few acres, to 10 acres, and then in the North Bay, 10,000 acres.

NARRATOR: By 2002, the opportunity many hoped for arrived, with a landmark deal to buy over 15,000 acres of South Bay salt ponds.

STEVE RITCHIE: This is the second-largest restoration overall in the United States, and it is unique in that it is smack dab in the middle of an incredibly urbanized area.

LYNNE TRULIO: It's surrounded by Silicon Valley and the rest of the San Francisco area, so it's an urban restoration. Seven and a half million people live here. We are planning the restoration with that urban context in mind.

FLORENCE LARIVIERE: I would hope that we would have acres and acres of tidal marsh left, and I would hope we'd have a lot of the wildlife in abundance, the ducks, the geese, the shorebirds.

CAITLIN ROBINSON: A lot of shorebirds and waterfowl nest very far north of here, actually a lot of them in the Arctic, and they fly south along what we call the Pacific Flyway, which we are right in the middle of. They'll either winter here or further south in Central America, some go as far as South America. So the San Francisco Bay has actually been declared a site of hemispheric importance for migrating shorebirds.