

Going UP: Sea Level Rise in San Francisco Bay Educator Guide



A resource for using QUEST video in the classroom

Watch it online <http://www.kqed.org/quest/television/going-up-sea-level-rise-in-san-francisco-bay> | 13:16 minutes

QUEST SUBJECTS

Life Science **Biology**
Health
Environment

Earth Science **Geology**
Climate
Weather
Astronomy

Physical Science **Physics**
Chemistry
Engineering

CA SCIENCE STANDARDS

Grades 9-12

Energy in the Earth System
(*Earth Science*)

4. (c, d) Different atmospheric gases that absorb Earth's thermal radiation and the mechanism and significance of the greenhouse effect; Earth, Mars and Venus have differing greenhouse conditions; origins of those conditions and the climatic consequences

6. (c, d) Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition and other factors, such as solar radiation and plate movement; computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.

PROGRAM NOTES

You may not be able to see it, hear it or feel it, but changes are happening slowly in the coastal arena of the San Francisco Bay Area. Along with the rest of the world's oceans, San Francisco Bay is rising. Even the most optimistic estimates about how high and how quickly this rise will occur indicate potentially huge problems for the region.



In this segment you'll find...

- 🔍 statistical information on global warming and sea-level rise.
- 🔍 examples of the impact a rising sea level could have on Bay Area communities.
- 🔍 information on approaches to combating a rising sea level.

TOPIC BACKGROUND

The melting of glacial ice and the subsequent rise in sea level are two of the most pronounced effects of climate change around the globe. The glaciers and ice sheets that hold approximately 75 percent of the world's freshwater are beginning to melt at an alarming rate. In recent years, both the Greenland Ice Sheet and the West Antarctic Ice Sheet have been losing ice at twice their former rate. Such melting has at least two very large impacts on the planet. Regions that rely on the normal annual runoff from mountain glaciers as an important water source will likely face severe water shortages as these glaciers disappear. This means that freshwater dams and reservoirs will start drying up more frequently, and there will be less water for irrigation, hydroelectric needs and even consumption in some major metropolitan areas. Parts of South America and Central Asia, as well as some areas in North America and Europe, are most likely to be affected by this change. The second impact of this melt is of course that the melted freshwater enters the oceans and contributes to rising sea levels.

An increase in freshwater changes the natural salinity of ocean water. This decreases the surface reflectivity, which lets the water absorb more sunlight and causes the ocean temperatures to rise. In turn, rising sea temperatures perpetuate the cycle, contributing to even more glacial melting and floating ice sheets. While there is great debate over how much the seas will rise and what the impacts will be, what is known is that coastal regions stand to be greatly affected by the rising sea levels. Nineteen inches doesn't seem like much, but in terms of rising sea levels, it can mean significant changes for the world. Current estimates predict the water in our oceans to rise by anywhere between 36 and 39 inches. In coastal regions like the Bay Area and the Sacramento Valley, a rise of only 19 inches could have devastating effects. With such a change, both San Francisco Bay and San Pablo Bay could swallow up hundreds of square miles of industrial and residential infrastructure. In addition, the intrusion of large amounts of saltwater into formerly dry land would create enormous environmental problems. Coastal erosion, loss of wildlife habitat and the salinization of freshwater aquifers and soils are among the many problems associated with this potential rise in sea level.

VOCABULARY

Atmosphere

the gaseous envelope of a planet or other celestial body

Barrier

a natural or manmade structure that prevents or hinders movement or action

Climate Change

a change in long-term weather patterns

Global Warming

an increase in the average temperature of Earth's atmosphere

Levee

an embankment for preventing flooding

Marsh

a low-lying area of soft, wet grassland that often forms a transition zone between water and land

Sediment

naturally occurring material broken down and deposited by wind, water or glaciers

Shoreline

the edge of a body of water, the line where water and land meet

Wetlands

an area of land whose soil is saturated with moisture either permanently or seasonally

PRE-VIEWING

- What do you know about global warming and sea-level rise?
- How do you think rising sea levels will affect you and your community?

VIEWING FOCUS

NOTE: You may choose to watch the television segment twice with your students: once to elicit emotional responses and get an overview of the topic and again to focus on facts and draw out opinions.

- What will the San Francisco Bay Area be like if marsh sediments can't keep up with rising sea levels?
- What kinds of changes could rising sea levels cause in the future? Which theory do you think is correct?
- What are some Bay Area neighborhoods already doing to combat rising sea levels?
- Do you think we have adequate defenses against sea-level rise? From the video, what type of defense do you think would work best?

For all media see:

- Segment Summary Student Sheet
http://www.kqed.org/quest/downloads/QUEST_SegSum_StudentSheet.pdf
- Personal Response Student Sheet
http://www.kqed.org/quest/downloads/QUEST_PersResp_StudentSheet.pdf

LESSON PLANS and RESOURCES from QUEST, PBS and NPR

In Bay Area, Battle Against Crumbling Coast NPR

<http://www.npr.org/templates/story/story.php?storyId=123299459>

A February 2, 2010, broadcast from NPR's **All Things Considered** examines the fight to save a cliff-top apartment building from sea-level rise.

Greenland Residents Detect Sea Changes PBS

http://www.pbs.org/newshour/bb/environment/july-dec07/greenland_08-01.html

This **Online Newshour** episode from August 1, 2007, discusses some of the changes experienced by residents of Greenland because of climate change.

The State of the Planet: Global Warming PBS

http://www.pbs.org/journeytoplanetearth/stateoftheplanet/index_globalwarming.html

How is global warming affecting our coastal regions and the planet at large? This article from **Journey to Planet Earth** explores some changes that have already taken place due to global warming and possible issues we'll face in the future.

Mountain of Ice: If the Ice Melts Teachers' Domain

<http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.icemelt/>

This interactive feature adapted from **NOVA Online** allows students to see what could happen to coastlines around the world if large sections of the Antarctic Ice Sheet melt as a result of global warming.

Antarctic Ice: Sea Level Change Teachers' Domain

<http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.sealevel/>

Watch this video segment adapted from **NOVA** to see what might happen to global sea levels if Antarctica's ice sheets collapse due to global warming.

Discuss the Going UP: Sea Level Rise in San Francisco Bay story on the QUEST Blog QUEST

<http://www.kqed.org/quest/blog/2010/08/24/producers-notes-sea-level-rise/>

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The Bay Institute
www.bay.org

California Academy of Sciences
www.calacademy.org

Chabot Space and Science Center
www.chabotspace.org

East Bay Regional Park District
www.ebparks.org

Exploratorium
www.exploratorium.edu

Girl Scouts of Northern California
www.girlscoutsnorcal.org

Golden Gate National Parks Conservancy
www.parksconservancy.org

The J. David Gladstone Institutes
www.gladstone.ucsf.edu

Lawrence Berkeley National Laboratory
www.lbl.gov

Lawrence Hall of Science
www.lawrencehallofscience.org

Monterey Bay Aquarium
www.mbayaq.org

Monterey Bay Aquarium Research Institute
www.mbari.org

Oakland Zoo
www.oaklandzoo.org

The Tech Museum of Innovation
www.thetech.org

UC Berkeley Natural History Museums
<http://bnhm.berkeley.edu/>

U.S. Geological Survey
www.usgs.gov

MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21st CENTURY SKILLS IN TEACHING AND LEARNING

Why Use Multimedia in Science Education?

<http://www.kqed.org/quest/downloads/QUESTWhyMedia.pdf>

- Read about the importance of using multimedia in the 21st century science classroom.

How to Use Science Media for Teaching and Learning

<http://www.kqed.org/quest/downloads/QUESTMediaTips.pdf>

- A collection of tips, activities and handouts to actively engage students with multimedia.

Science Multimedia Analysis

<http://www.kqed.org/quest/downloads/QUESTMediaAnalysis.pdf>

- Give your students the tools to recognize the purposes and messages of science multimedia.

Create Online Science Hikes with Google Maps

http://www.kqed.org/quest/files/download/52/QUEST_ExplorationCreation.pdf

- Do you like the science hike Explorations on the QUEST site? Use this place-based educational guide to create similar science-based maps with youth.

OTHER WAYS TO PARTICIPATE IN QUEST



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KQED Channel 9

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