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NOAA National Ocean Service Education: Professional Development: Tides and Currents: Lesson Plan: Climate Change and Tides

This lesson uses web-based resources that are found within the theme with which this lesson is associated. The purpose of the lesson is to help you integrate these web-based resources into your curriculum. If you need more science content information, refer to the text associated with the overall SciGuide topic and with each theme within a SciGuide.

Authors:

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Grade Level:

9–12

Subject Area:

Earth Science

SciGuide Resources:

- NOAA Sea Level on-line
<http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml>
- NOAA Ocean Service Education
<http://www.oceanservice.noaa.gov/education/kits/tides/welcome.html>
- United States Global Climate Change Research Program
<http://globalchange.gov/publications/reports/scientific-assessments/us-impacts>
- Global Climate Change Impacts in the United States- FULL REPORT
<http://globalchange.gov/publications/reports/scientific-assessments/us-impacts/full-report>
- KEY FINDINGS
<http://globalchange.gov/publications/reports/scientific-assessments/us-impacts/key-findings>
- NOAA Climate Service
<http://www.noaa.gov/climate.html>

Standards Addressed:

National Science Education Standards

National Science Education Standards Content Standard C: Life Science

- Behavior of organisms

Content Standard D: Earth and Space Science

- Energy in the earth system

Content Standard F: Science in Personal and Social Perspectives

- Natural resources
- Natural and human-induced hazards
- Environmental Quality

Time Required:

3 class periods

Period 1: Understand the impact of higher tides based on sea level rise on coastal areas.

Period 2: Develop a plan to mitigate the impact of higher tides.

Period 3: Discuss how students can apply their plans to coastal communities.

Lesson Goal:

- Students will be able to evaluate a sea level and tidal data.
- Students will be able to develop a reasonable plan for mitigating coastal impacts.
- Students will be able to discuss and evaluate plans with other students.

Prerequisite Knowledge:

Nationwide, about 5000 square miles of dry land are within two feet of high tide. Although the majority of this land is currently undeveloped, many coastal counties are growing rapidly. Land within a few feet above the tides could be inundated by rising sea level, unless additional dikes and bulkheads are constructed. A two foot rise in sea level would eliminate approximately 10,000 square miles of land (PDF) (26 pp, 267K) including current wetlands and newly inundated dry land, an area equal to the combined size of Massachusetts and Delaware (EPA, 1989).

Some of the most economically important vulnerable areas are recreational resorts on the coastal barriers of the Atlantic and Gulf coasts. In many cases, the ocean-front block of these islands is 5 to 10 feet above high tide; but the bay sides are often less than two feet above high water and regularly flooded (see USGS's 7.5-minute map series). Erosion threatens the high ocean sides of these densely developed islands and is generally viewed as a more immediate problem than inundation of their low bay sides. Many ocean shores are currently eroding 1 to 4 feet per year (FEMA, 2000).

Coastal Water Supplies

Rising sea level increases the salinity of both surface water and ground water through salt water intrusion. New York City, Philadelphia, and much of California's Central Valley obtain some of their water from portions of rivers that are slightly upstream from the point where water is salty during droughts. If sea level rise pushes salty water upstream, then the existing water intakes might draw on salty water during dry periods. Salinity increases in estuaries also can harm aquatic plants and animals that do not tolerate high salinity.

Shallow coastal aquifers are also at risk (IPCC, 2007). The freshwater Everglades currently recharge Florida's Biscayne aquifer, the primary water supply to the Florida Keys. As rising water levels submerge low-lying portions of the Everglades, portions of the aquifer would become saline. Aquifers in New Jersey east of Philadelphia are recharged by fresh portions of the Delaware River which may become saline in the future.

<http://www.epa.gov/climatechange/effects/coastal/index.html>

Procedures/Instructional Strategy:

Students will read the report found at http://www.epa.gov/climatechange/effects/downloads/rtc_sealevelrise.pdf and evaluate the impact of higher tides on coastal areas.

1. Effects on organisms:

Will the higher tide harm any animals directly?

Will the higher tide harm any animals indirectly by preventing migration, feeding, destroying their habitats and/or food supplies, removal of predators which may affect the carrying capacity and a population's impact on resources?

2. What are the impacts on humans that live close to the coast and those that do not live on the coast but may their wells and septic systems impacted.
3. Will the higher tides increase the erosion potential of the coastlines?

Each team's plan will be recorded and presented.

Outcome/Assessment:

Students will create a report to discuss the merits of a proposal to dam the Mediterranean. They will evaluate other plans and receive feedback on their own plan. The applicability of the student's plan for mitigating coastal impacts should be verifiable based on projects already in place or plans put forth by other groups (public works departments, state agencies, etc) professionals.

Extensions:

Students can explore sea level trends at various stations around the global http://tidesandcurrents.noaa.gov/sltrends/sltrends_global.shtml and or the closest coastline to

their homes. They can also compare and contrast areas where sea level is rising and where it might be decreasing.

Students might also find where sea level is rising the fastest and using topographic maps or Google Earth, forecast the impacts that might occur in those areas. Example: Areas with steep elevation change will have less impact, whereas areas with relatively flat terrain might experience more dramatic effects, e.g. Most major cities are on coastlines and most of their infrastructure like water and sewer will be flooded by sea level rise thus compromising the health of millions of people. Flat lying areas such as Florida marshes will also be compromised as salt water infiltrates the habitats of inland flora and fauna.

Helpful information may come from a variety of sources including news reports such as <http://www.sciencedaily.com/releases/2008/11/081122083051.htm>

Classroom Resources:

Computer access for students

Lesson Plan File:

(entire word document containing complete lesson plan and supporting attachments)

[Download Here](#) (pdf, 79kb)

Student Work Description:

Student paper titled, "Sea Level Rise Solutions for the Tuvalu Islands."

Sample of Student Work:

[Download Here](#)

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