Regional Highlights from

Global Climate Change Impacts in the United States

www.globalchange.gov/usimpacts

Coasts

Global sea level has already risen due to the warming-induced expansion of the oceans, accelerated melting of most of the world's glaciers, and loss of ice on the Greenland and Antarctic ice sheets. Sea level is currently rising at an increased rate. A warming climate will cause further sea-level rise over this century and beyond. Rising sea level is already eroding shorelines, drowning wetlands, and threatening homes, businesses, and infrastructure. The destructive potential of Atlantic hurricanes has increased in recent decades in association with increasing sea surface temperatures. In future decades, it is likely that hurricane rainfall and wind speeds will increase in response to global warming. Coastal water temperatures have risen and the distributions of marine species have shifted. Ocean acidification resulting from the uptake of carbon dioxide by ocean waters threatens corals, shellfish, and other living things that form their shells and skeletons from calcium carbonate. These and other forces converge and interact at the coasts, making these areas particularly sensitive to the impacts of climate change.

Key Issues

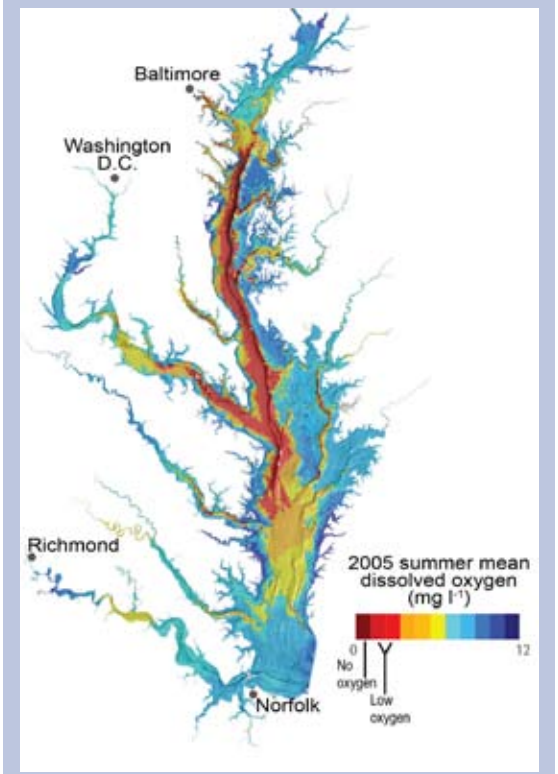
Significant sea-level rise and storm surge will adversely affect coastal cities and ecosystems around the nation; low-lying and subsiding areas are most vulnerable.

High rates of relative sea-level rise have already resulted in the loss of 1,900 square miles of Louisiana's coastal wetlands during the past century, weakening their capacity to absorb the storm surge of hurricanes such as Katrina. Shoreline retreat is occurring along most of the nation's exposed shores. Recent estimates of global sea-level rise are 3 to 4 feet in this century, with higher relative sea-level rise in areas where the land is subsiding (sinking), including most of the Atlantic Coast and Gulf Coast of the United States.

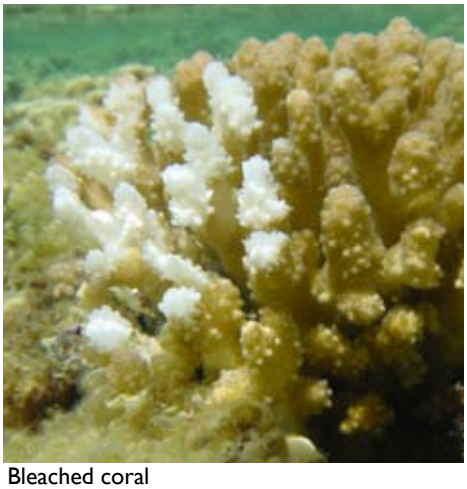
More spring runoff and warmer coastal waters will increase the seasonal reduction in oxygen resulting from excess nitrogen from agriculture.

Coastal "dead zones" with little or no oxygen in the water in the Chesapeake Bay and the Gulf of Mexico are likely to increase in size and intensity as warming increases. As dissolved oxygen levels decline below a certain threshold, living things cannot survive. They leave the area if they can, and die if they cannot. Coastal waters are projected to continue to warm by as much as 4 to 8°F in this century, resulting in a northward shift in the distribution of marine life along the coasts; this is already being observed.

Dead Zones in the Chesapeake Bay



Climate change is likely to expand and intensify "dead zones," areas where bottom water is depleted of dissolved oxygen because of nitrogen pollution, threatening living things.



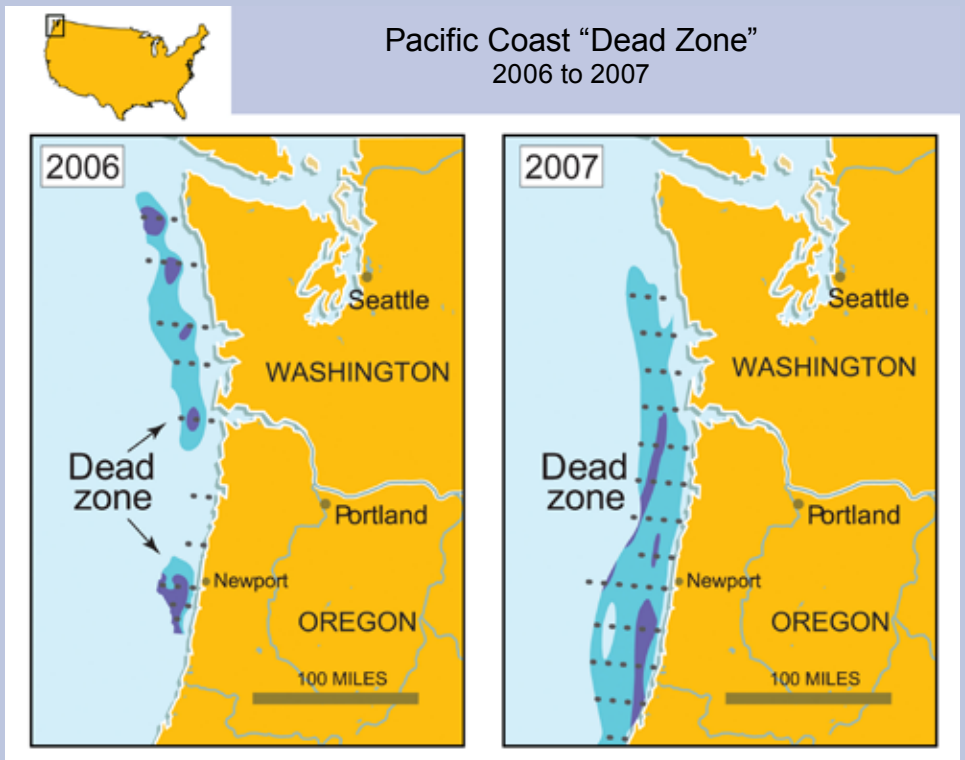
Bleached coral

Higher water temperatures and ocean acidification due to increasing atmospheric carbon dioxide will present major additional stresses to coral reefs, resulting in significant die-offs and limited recovery.

Carbon dioxide affects corals in at least two ways. The first results from warming, which causes corals to expel the symbiotic algae that live within them, nourish them, and give them their color. This is called coral bleaching, and eventually kills the corals if water temperatures remain elevated. The second effect results from carbon dioxide being absorbed by the oceans, acidifying the water. This reduces the ability of living things to create and maintain shells and skeletons. The effects on reef-building corals are likely to be particularly severe during this century.

Changing ocean currents will affect coastal ecosystems.

Recent changes in the California Current that bathes the entire Pacific Coast of the United States have resulted in increased upwelling of deeper ocean water along the coast. This has resulted in the emergence of oxygen-depletion events on the continental shelf off Oregon and Washington – a dead zone not directly caused by agricultural runoff and waste discharges such as those in the Chesapeake Bay and the Gulf of Mexico.



Climate change affects coastal currents that moderate ocean temperatures and the productivity of ecosystems. As such, it is believed to be a factor in the low-oxygen "dead zone" that has appeared along the coast of Washington and Oregon in recent years.[561] In the maps above, blue indicates low-oxygen areas and purple shows areas that are the most severely oxygen depleted.

The full report, including references for the material above, can be found online at: www.globalchange.gov/usimpacts

It is published by Cambridge University Press, with hard copies available at: www.cambridge.org
ISBN 978-0-521-14407-0