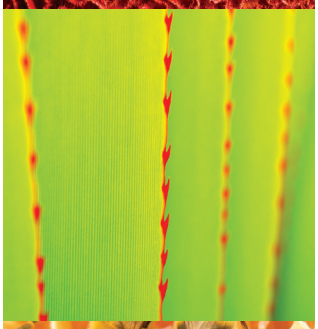
ECOREGION: EASTERN COASTLINE



Sailing to America for the first time in 1620, the Pilgrims landed on the eastern coastline of our nation. Shaped for thousands of years by the crashing waves and weather of the Atlantic Ocean, the eastern coastline has developed wonderfully diverse landscapes set in equally varied climates. From warmer tropical ecosystems such as Florida's beaches, barrier islands, bays, estuaries, and tidal marshes, to the colder reaches and rocky coastline of Maine, each of these landscapes has its own set of plants and animals that call these places home.

These varied landscapes have developed through a combination of processes. As the sea level continues to rise due to melting of continental glaciers left by the Ice Age and the effects of climate change, most of the eastern coastal region has experienced, and continues to experience, submergence. At the same time, rivers and streams deposit sediment surrounding their mouths as they open to the ocean. In addition, the harsh waves of the Atlantic Ocean, which are weakened by the wide continental shelf jutting out into the ocean, slow and deposit the sediment that they carry near the shoreline. Thus, as glaciers melt, the ocean rises, and sediments are deposited along the shoreline. These processes have been happening concurrently for thousands of years and have marked the eastern shoreline by thick deposits of sediment and sea level rise. The shoreline is now referred to as a "**submergent/depositional**" coastline: broad, nearly flat, and low-lying.[1]

Those who live along this coastline must cope with its unique environmental issues. Low-lying land juxtaposed with the vast Atlantic Ocean leads to issues of flooding and erosion. These issues are compounded by the effects of climate change.

IMPACTS OF CLIMATE CHANGE

Higher temperatures are expected to further raise sea level by expanding ocean water and by melting mountain glaciers, and large portions of Greenland and the Antarctic ice sheets. During the last century, sea level along the Mid-Atlantic coast rose 5–6 inches faster than the global average due to **subsidence**, and the Intergovernmental Panel on Climate Change estimates that the global average sea level will rise between 0.6 and 2 feet in the next century.[2,3] The range reflects uncertainty about global temperature projections and how rapidly ice sheets will melt or slide into the ocean in response to the warmer temperatures. However, ice sheets around the world already are melting faster than climate change experts had predicted.[4]

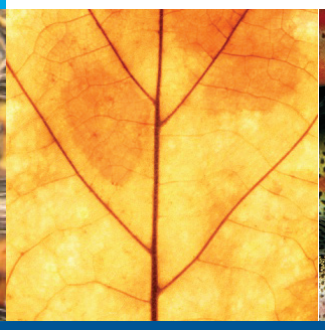
These rising sea levels are expected to have tremendous impacts on the landscapes and habitats along much of the eastern coast. As the seas rise, wetlands, which form buffers against floods, and other low-lying lands may become inundated and beaches may erode, which would intensify the impacts of flooding and increase the salinity of rivers, bays, and groundwater tables. All of these impacts would drastically change the habitats of the eastern coastline's **flora** and fauna.[5]

SPOTLIGHT ON A SPECIES

The diamondback terrapin, *Malaclemys terrapin*, is one of the many species that call the eastern coastline home and are being affected by climate change. Living in salt marshes of estuarine **embayments** and lagoons, the terrapin is the only North American turtle to be fully adapted to life in **brackish** water (a mix of saltwater and freshwater).[6] Its range extends from Massachusetts to Texas in the narrowest of coastal strips along the Atlantic and Gulf coasts of the United States.[7]

Several eastern coastline states have listed the species as endangered (Rhode Island), threatened (Massachusetts), or as a "species of concern" (Georgia, Delaware, New Jersey, Louisiana, North Carolina, and Virginia).

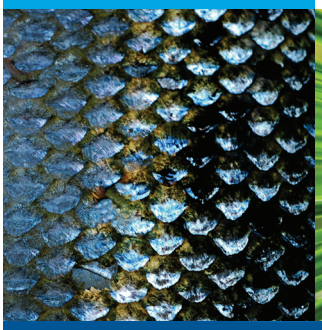
The diamondback terrapin's status as prey for several species coupled with certain aspects of its life cycle and habitat type make it particularly vulnerable to the impacts of climate change. Young terrapins are especially susceptible to **predation** by small mammals that frequent their habitats such as foxes, otters, raccoons, skunks, and birds. Although they are able to live 40 years or more, most turtles do not make it to their first birthday because they are eaten by other animals. If they survive to maturity, females begin to reproduce relatively later in their lifetime—between the ages of 8 and 13, while males begin mating earlier—between 4 and 7. This combination of high rates of death for young turtles and a long wait until females are able to reproduce reduces the terrapin population's ability to increase quickly. In addition, factors such as temperature and habitat availability can reduce survival and reproduction rates. Sea level rise, land **subsidence** at many coastal locations, more people living in the shore zone, and the building of **bulkheads** and other structures to stabilize the shoreline place the habitat of terrapins at



increasing risk.[8,9] Because human infrastructure (i.e., roadways, buildings, and other **impervious** surfaces like sea walls) leaves tidal salt marshes with little or no room to move inland, the ecosystem that terrapins depend on may be lost, making the species even more vulnerable. The permanent loss of nesting habitat through the alteration of estuarine areas poses an imminent threat to many terrapin populations today. Smaller local populations resulting from fragmented habitat can cause terrapin populations to go extinct in some specific areas.[10]

PROFILING A CLIMATE STEWARD

Every summer, local volunteers and undergraduate students from all over the United States and abroad come to the Wetlands Institute in Stone Harbor, New Jersey, to assist in the Diamondback Terrapin Conservation Project. In 1989, Dr. Roger Wood started this project to collect eggs from road killed mother terrapins, which are then incubated and hatched to be released later back into the wild. The project has since grown into a significant conservation program helping the terrapin population by installing roadside barrier fencing to reduce road mortality and conducting round-the-clock road patrols. Because terrapin nesting habitat (typically beach dunes) is increasingly being threatened by human encroachment and climate change, conservation efforts ensure the safety of female terrapins each season, which is important to the survival of the turtle population. Volunteers and students participating in the Diamondback Terrapin Project help both protect the population and raise awareness about the turtle's story. Actions that these students and volunteers take to protect the terrapins include assisting mother terrapins safely across roadways when they travel to and from their nesting sites, and collecting eggs from female turtles who have been hit by cars and raising the hatchlings to "predator proof" size for release back into their marsh habitat. Actions to create awareness include turtle releases with local school children, installing turtle crossing road signs, and distributing informative brochures. These actions build an understanding of the issue in the general public and inspire others to help either indirectly by supporting local educational initiatives, or directly, by joining these efforts and helping terrapins across roads, bulkheads, and other hard structures.



Students and others who do not live near a terrapin nesting habitat can still be involved in these efforts. For example, students can start a pen pal relationship with others who live in terrapin nesting areas to educate their new pals about the stresses terrapins are encountering, or they can adopt a terrapin through the Diamondback Terrapin Project.

Actions on all scales are needed to achieve our goal of slowing climate change and its impacts, and you can help! To learn more about what you can do to help the diamondback terrapins visit: www.terrapinconservation.org/.

FOR MORE INFORMATION

- The U.S. Environmental Protection Agency's Climate Change — Health and Environmental Effects website has a wealth of information about climate change and how it affects sea level rise. www.epa.gov/climatechange/effects/coastal/index.html
- The U.S. Climate Change Science Program includes an assessment of sea level rise impacts on the Atlantic coastline. www.climatescience.gov/Library/sap/sap4-1/default.php
- The National Oceanic and Atmospheric Administration's Chesapeake Bay Office maintains a website with links to government reports on sea level rise in general and the Chesapeake Bay in particular. http://chesapeakebay.noaa.gov/ClimateChangeSites.aspx
- The United States Geological Survey has published studies and fact sheets on the effects of climate change and sea level rise on the eastern shoreline: http://coastal.er.usgs.gov/national-assessment/index.html and http://pubs.usgs.gov/fs/fs2-00/
- The Intergovernmental Panel on Climate Change (IPCC) is the definitive source of unbiased climate change science. www.ipcc-wg2.org/index.html

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