

## Climate Change

A changing climate puts all aspects of life in the Chesapeake Bay watershed at risk. Continued changes in environmental conditions will affect the health of the ecosystem and the success of our restoration efforts.

### How does climate change impact the Chesapeake Bay watershed?

#### Warming temperatures

Warmer air means warmer water, and warmer water means a change in aquatic habitats. According to a study by the University of Maryland Center for Environmental Science, warming water temperatures have been recorded in more than 92% of the Bay's waters. A study by the United States Geological Survey, found overall increases of 1.98 degrees Fahrenheit in air temperatures and 2.52 degrees in stream temperatures in the Chesapeake Bay region from 1960 to 2010. Warmer waters are also less able to hold oxygen. A drop in dissolved oxygen means a rise in the dead zones that suffocate marine life.

#### Sea level rise

Over the past century, Bay waters have risen about one foot, and are predicted to rise another 1.3 to 5.2 feet over the next 100 years. This is faster than the global average because the land around the Bay is sinking through a process called subsidence. As water levels rise, so will coastal flooding and erosion. Marshes and wetlands will be inundated with saltwater and will disappear faster than wetland plants can populate higher ground. A total loss of wetlands will mean a loss of the habitat that traps pollution and provides food and shelter to fish, shellfish and birds.

#### Increased annual precipitation

Of the 33 climate divisions located within our watershed, 32 experienced an increase in total annual precipitation between 1901 and 2017. Seven of these divisions—four of which are located in New York—experienced increases that can be considered statistically significant. As climate change alters air circulation patterns across the region and around the world, annual precipitation rates will rise in some areas and fall in others. In our watershed, annual precipitation rates have increased most notably in New York and slightly in Maryland, Pennsylvania, West Virginia and Washington, D.C. In contrast, annual precipitation rates have experienced very little change in western Virginia. Experts anticipate more frequent and more extreme precipitation events to generate larger and more frequent upstream floods. Heavy rain and snowstorms can damage crops, erode soil and increase flooding. Floods can damage ports, marinas and historical monuments, while threatening buildings, sewer systems, roads and tunnels.

#### Ocean acidification

As the amount of carbon dioxide in the air rises, so does the amount of carbon dioxide in our oceans. When oceans absorb carbon dioxide, the chemical compound reacts with seawater to produce carbonic acid. This raises acidity levels and lowers carbonate ion levels, making it harder for oysters and other shellfish to produce the calcium carbonate needed to form their shells. A loss of oysters and their reefs would affect water quality and habitat.

## Public Health

- Extreme heat has a negative impact on the public health of residents in the Bay watershed and is the number-one cause of weather-related deaths in the United States. It can cause heatstroke, which can lead to confusion, headaches, unconsciousness or even death. Increased temperatures can also extend pollen seasons and increase the formation of harmful ozone, which causes serious respiratory problems.

While extreme heat affects everyone, low-income groups, children, the elderly and those with existing medical conditions are at higher risk of negative impact. Those who live in cities with little tree cover are also more exposed to heat-related impacts due to the phenomenon known as the urban heat island effect. When paved surfaces like roads absorb sunlight during the day, they increase in temperature. That heat is released at night, and when this happens in a city full of paved surfaces, the temperature of the whole city can be much warmer than in surrounding areas.

- With increased temperatures, insects like ticks will also be active for longer. A longer season of tick activity can lead to an increase in exposure to Lyme's disease and other tick-borne illnesses.
- Higher temperatures can increase the uptake of mercury—a toxic contaminant with human health implications—in fish. Long-term exposure to toxic contaminants in our food can lead to serious health issues, including neurological problems and birth defects. In addition, fish and shellfish parasites can become more prevalent in warmer waters. Increased parasite exposure can lead to illnesses if the fish is undercooked.
- An increase in the incidence of infections from Vibrio is also associated with the Bay's increasing temperature trend. While Vibrio occurs naturally in the Chesapeake Bay, the increase in human infections in recent years is correlated with rising temperatures and longer warm-weather conditions during the year, as well as the (higher?) levels of nutrient pollution. A Vibrio infection may occur when a person eats tainted shellfish or swims with open wounds in contaminated waters.

## Agriculture

- As temperatures rise, the annual growing season will be extended and require more resources such as water, fertilizer and pesticides. Fertilizers are already a major source of nitrogen and phosphorus pollution in local waterways so an increase in fertilizers could mean an increase in polluted waterways. Pesticides and herbicides can have a negative impact on fish and birds. Higher temperatures can also increase the formation of ozone, which is toxic to many plants. Increased ozone levels can lead to decreased yields in crops like wheat and soybeans. Livestock impacted by heat stress can be more susceptible to disease and have lowered milk production. Animals in pastures may have less to eat and crop stress might make supplemental grains less available.

## Changing wildlife behavior and distribution

Climactic changes can alter the abundance and migration patterns of wildlife. North American birds have shifted their wintering grounds northward and farther from the coast. Data from the National Oceanic and Atmospheric Administration show 60 percent of the northeast's major fish stocks have shifted toward colder northern waters since the mid-twentieth century. Warming air and water temperatures could also favor the introduction of new, potentially invasive species.

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