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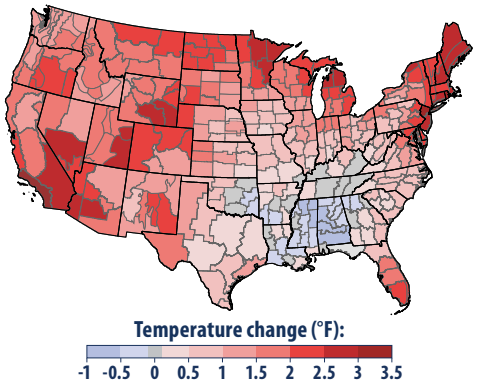
What Climate Change *Means for* West Virginia

West Virginia's climate is changing. Most of the state has warmed one-half to one degree (F) in the last century, and heavy rainstorms are becoming more frequent. In the coming decades, a changing climate is likely to increase flooding, harm ecosystems, increase some health problems, and possibly threaten some recreational activities.

Our climate is changing because the earth is warming. People have increased the amount of carbon dioxide in the air by 40 percent since the late 1700s. Other heat-trapping greenhouse gases are also increasing. These gases have warmed the surface and lower atmosphere of our planet about one degree during the last 50 years. Evaporation increases as the atmosphere warms, which increases humidity, average rainfall, and the frequency of heavy rainstorms in many places—but contributes to drought in others.

Greenhouse gases are also changing the world's oceans and ice cover. Carbon dioxide reacts with water to form carbonic acid, so the oceans are becoming more acidic. The surface of the ocean has warmed about one degree during the last 80 years, and sea level is rising at an increasing rate. Warming is causing snow to melt earlier in spring.



Rising temperatures in the last century. All regions of West Virginia have warmed, though they have warmed less than most of the United States. Source: EPA, Climate Change Indicators in the United States.

Increasing Temperature and Changing Precipitation Patterns

Rising temperatures and shifting rainfall patterns are likely to increase the intensity of both floods and droughts. Annual precipitation in most of West Virginia has increased since the first half of the 20th century, and precipitation from extremely heavy storms in the eastern United States has increased by more than 25 percent since 1958. During the next century, average annual precipitation and the frequency of heavy downpours are likely to keep rising. Average precipitation is likely to increase during winter and spring but not change significantly during summer and fall. Rising temperatures will melt snow earlier in spring and increase evaporation, and thereby dry the soil during summer and fall. As a result, changing the climate is likely to intensify flooding during winter and spring, and droughts during summer and fall.

Flooding, Drought, and Navigation

Flooding occasionally threatens riverfront communities, and heavier storms and greater river flows could increase this threat. The U.S. Army Corps of Engineers operates dozens of dams and reservoirs to help prevent serious floods in West Virginia. Nevertheless, dams and other flood control structures cannot prevent all floods. In recent decades, the state has had flood-related disaster declarations nearly every year. These disasters have often been associated with heavy rainstorms that also caused landslides and mudslides.

Floodwaters from the Little Kanawha River in Parkersburg. Credit: Ed Hupp, Wood County Emergency Management.

Meanwhile, increasingly severe droughts in West Virginia and nearby states could pose challenges for transportation on major rivers like the Ohio and the Kanawha. In 2005, a drought closed portions of the lower Ohio River to commercial navigation, which delayed shipments of products to and from West Virginia and adjacent states.

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Ecosystems

A changing climate threatens ecosystems by disrupting the existing relationships between species. Wildflowers and woody perennials are blooming—and migratory birds are arriving—sooner in spring. Not all species adjust in the same way, however, so the food that one species needs may no longer be available when that species arrives on its migration. This can lead to animals not getting enough food. Warmer temperatures allow deer populations to increase, leading to a loss of forest underbrush, which, in turn, makes some animals more vulnerable to predators. Rising temperatures also enable invasive species to move into areas that were previously too cold.

Rising temperatures and changing precipitation could also harm aquatic ecosystems. Warmer water lowers the level of dissolved oxygen in surface water, which can severely limit fish populations. Because fish cannot regulate their body temperatures, warmer water can make a stream uninhabitable for fish that require cooler water. Warmer water can also increase the frequency of algal blooms, which can be toxic and further reduce dissolved oxygen. Summer droughts may amplify these effects, while periods of extreme rainfall can cause runoff that increases pollution in streams.

Recreation

Recreation and related tourism in West Virginia are closely tied to the weather. Many people enjoy whitewater rafting on West Virginia's rivers every year, including more than 60,000 on the Gauley River alone. The use of these rivers depends on the flow of water being sufficient for the thrilling rides that people seek. Native populations of brook trout, the official state fish, depend on West Virginia's mountain streams remaining cold. But suitable habitats for brook trout and other coldwater fish are likely to shrink as some streams become too warm to support them.

A native brook trout camouflaged against the rocky bottom of a cold West Virginia stream. Credit: Steve Brown, West Virginia Division of Natural Resources.

Higher temperatures are likely to shorten the season when the ground is covered by snow, and thereby shorten the season for skiing, snowboarding, and snowmobiling. Shorter seasons could harm local economies that depend on winter recreation. Increasingly heavy rains could increase pollution runoff and harm water qualify for fishing and swimming.

Forests and Farms

Rising temperatures and changes in rainfall are unlikely to substantially reduce forest cover in West Virginia, although the composition of those forests may change. More droughts would reduce forest productivity, and climate change is also likely to increase the damage from insects and disease. But longer growing seasons and increased carbon dioxide concentrations could more than offset the losses from those factors. Forests cover more than three-quarters of the state. Maple, beech, and birch are the most common tree species in the central part of the state, while oak and hickory dominate the forests elsewhere. As the climate changes, oak and hickory trees are likely to become more common in the central part of the state as well.

Climate change may also pose challenges for farmers. Longer frost-free growing seasons and increased concentrations of atmospheric carbon dioxide tend to increase yields for many crops during an average year. But more severe droughts and more hot days are likely to reduce yields. Higher temperatures are also likely to reduce livestock productivity: hot weather causes cows to eat less, grow more slowly, and produce less milk—and it can threaten their health.

Human Health

Hot days can be unhealthy—even dangerous. High air temperatures can cause heat stroke and dehydration, and affect people's cardiovascular and nervous systems. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor.

Changing the climate can harm air quality. The longer growing season may increase the length and severity of the pollen season for ragweed and other allergens. Higher temperatures increase the formation of ground-level ozone, a key component of smog that causes chronic and acute respiratory conditions. EPA and the West Virginia Department of Environmental Protection have been working to reduce ozone concentrations. As the climate changes, continued progress toward clean air will be more difficult.

The sources of information about climate and the impacts of climate change in this publication are: the national climate assessments by the U.S. Global Change Research Program, synthesis and assessment products by the U.S. Climate Change Science Program, assessment reports by the Intergovernmental Panel on Climate Change, and EPA's *Climate Change Indicators in the United States*. Mention of a particular season, location, species, or any other aspect of an impact does not imply anything about the likelihood or importance of aspects that are not mentioned. For more information about climate change science, impacts, responses, and what you can do, visit EPA's Climate Change website at www.epa.gov/climatechange.

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