

Climate change in *Tennessee*



While climate change is often talked about in the future tense, our climate is already changing in both averages and the number and intensity of extremes. Tennessee has recently experienced both record flooding and unprecedented drought, increased instances of severe weather and tornadoes, and overall warmer temperatures as a result of climate change. The Southern Climate Impacts Planning Program (SCIPP) is a climate hazards research program whose mission is to help Tennessee residents increase their resiliency and level of preparedness for weather extremes now and in the future.

Climate Change: Observations

Temperature

While “global warming” implies rising temperatures, climate change isn’t quite that simple. Tennessee’s cities are experiencing faster temperature increases in comparison to more rural areas, where temperatures are rising more slowly.

On average, temperatures in the Southeast have risen 2° Fahrenheit since 1970, and the number of freezing days has declined by 4-7 days each year in the region (NCA).



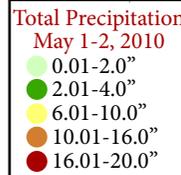
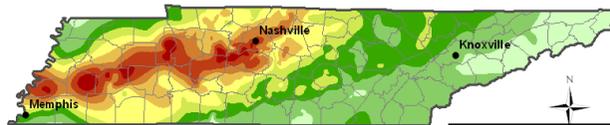
Mosquito-borne illnesses, like Malaria and Dengue fever, spread in the southeast during the last decade as freezing days and annual frosts gradually decreased (CDC).

The rate of annual heat-related illnesses and deaths in the U.S. has tripled in the last 20 years as heat waves have become more common and more intense. Each year, high temperatures kill more people than hurricanes, floods, tornadoes, blizzards, and lightning combined (CDC).



All of the environmental changes observed in the last 150 years resulted from a 2 degree global temperature rise. Temperatures in the U.S. Southeast are projected to increase another 4-8 degrees by 2100 (NCA).

Spotlight on Disaster: The 1,000-year flood



May 1, 2010 was a Saturday morning like most others in Tennessee. From Memphis to Knoxville, residents woke to a slight drizzle and foggy skies. A storm system was moving through, like so many others had before, and people went about their day as usual. But when two days passed with no relief from the downpour, Tennesseans began to realize how epic the storm would become.

In less than 48 hours, more than one-third of Tennessee was under water, with some places getting more than 20 inches of rain. The Cumberland River, Duck River, Buffalo River, Harpeth River, and the Red River all crested anywhere from 12 - 25 feet above flood stage. FEMA designated 30 counties as disaster areas. Damage to Nashville alone cost \$1.5 billion.

In the end, 24 people died, and more than \$128 million in federal aid was paid to more than 60,000 families affected by the flood. The storm has since been dubbed “The 1,000-year flood.” A similar flood struck the very next year, and killed 19 people and cost \$2 billion (FEMA).

Precipitation

Overall, precipitation has increased by as much as 10 percent in parts of Tennessee during the last century, which is slightly less than the 20-30 percent increase observed across the rest of the southeast.



Precipitation patterns - meaning how much, how often and in what period of time Tennessee gets rain or snow - changed drastically in the last several decades.



More intense downpours in shorter time periods are becoming more frequent, which leads to more flash flooding and infrastructure damage, with longer periods of drought between downpours (NCA).

Snow has begun melting earlier each spring, which disrupts the natural recharge time of many aquifers in Tennessee and its neighboring states (University of Colorado-Boulder).



Adaptation in Action

In 2007, Tennessee imposed restrictions on community water systems, and banned lawn watering and other non-necessary water usages. More than 500,000 people followed the water restrictions, and as a result only one out of 158 water systems ran completely dry during the 2007 drought (Drought Management Plan 2010).



Overview

The models scientists use to project future climate change are extremely thorough, consider the unique geography and climate of every region, and look forward 25 and 100 years (NOAA).

Climate change acts as a threat-multiplier, loading the dice for more intense hurricanes, heat waves, floods, droughts, and extreme weather.

Droughts will become more frequent, last longer and be more intense. Rains following droughts will often be quick and heavy, causing flash-flooding and destroying aging and vulnerable infrastructure (NCA).



With more dry periods, higher temperatures and more lightning, large wildfires are expected to become more common (Price 2012, NCA).

Average overall precipitation in Tennessee is expected to increase by about 7 percent in the next 50 years, with rain and snow becoming heavier in winter (EPA).



Plant growing seasons will likely become longer, the types of plants that can survive in Tennessee will begin to change, and precipitation events will become more intense causing more flooding of agricultural areas (USDA).

Hardiness zones have already begun changing and will continue to move north as winter freezes become less frequent.

Climate change is also a localized problem with local solutions. Nashville and Chattanooga signed the U.S. Climate Protection Agreement - a commitment to meet or beat the Kyoto Protocol in their communities, urge different levels of government to do the same, and encourage Congress to pass greenhouse gas reductions laws.

Climate Change: Projections

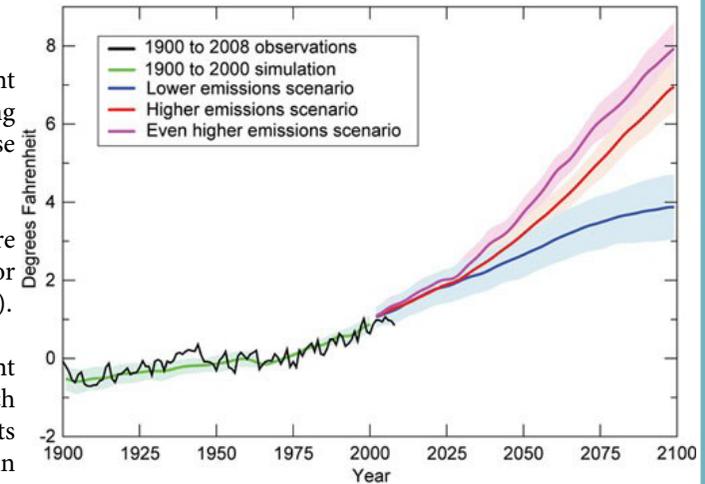
Temperature



Future temperature rise depends partly on the amount of greenhouse gases added to the atmosphere in coming decades. Global temperatures are expected to increase another 3-12 degrees Fahrenheit by 2100 (IPCC).

Projections for the U.S. Southeast show a temperature increase of 4-8 degrees by 2100, with projected increases for interior states 1-2 degrees higher than coastal areas (NCA).

Major consequences of warming include a significant increase in the number of hot days (above 95 degrees) each year and an overall decrease in freezing events and frosts (NCA). More heat and less cooling are expected to result in more heat-related deaths, more vector-borne illnesses and a major shift in plant species (EPA).



Global temperature rise depends largely on future emissions scenarios, which range from low, 3°F increase, to high, 12°F or higher (IPCC).

Climate Change: By Sector

Forestry

Climate change hits the forestry industry hard (Karetinkov et al. 2008). Disease, invasive species, insects and fires could reduce productivity of Tennessee's forests by as much as 10 percent by 2050 (NCSL 2008 and Tennessee Wildlife Resources Agency 2009).

Agriculture

While crops like soybean and cotton may flourish under the new climate conditions, scientists project a net loss of 10 percent in crop yields as ground-level ozone increases in the next 50 years (Karetinkov et al. 2008). Agriculture would decrease by at least 15% if the temperature and precipitation variability increased between 10-25% (EPA).

Water Resources

Snow melting earlier is expected to lead to more restrictions on water usage, poorer water quality, and higher water treatment costs (Karetinkov 2008, NCSL 2008, and Tennessee Wildlife Resources Agency 2009). Agriculture, urbanization and mining raise the stress on groundwater in addition to rising temperatures (NCA).

Public Health

Public health is directly linked to climate change. Warmer temperatures aid the spread of disease-carrying insects. Heat-related deaths could increase as summer temperatures and the number of heat waves increase (NCSL). Smog and decreased air quality will likely worsen with climate change, aggravating respiratory diseases and increasing instances of asthma.