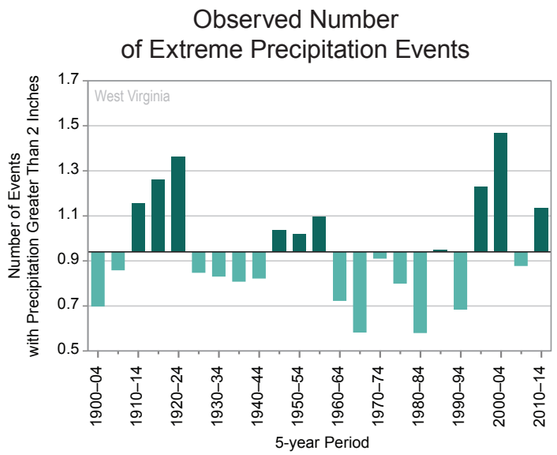


Figure 6: The observed number of extreme precipitation events (annual number of events with greater than 2 inches) for 1900–2014, averaged over 5-year periods; these values are averages from NCEI's version 2 climate division dataset. There is no long-term trend but the numbers have been generally above average over the most recent 20 years. The dark horizontal line is the long-term average (1900–2014) of 0.9 days with precipitation greater than 2 inches per year. Source: CICS-NC and NOAA NCEI.

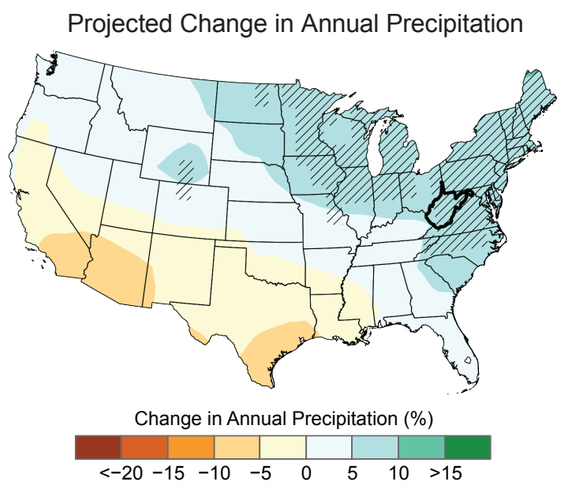
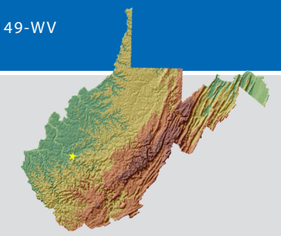


Figure 7: Projected changes in annual precipitation (%) for the middle of the 21st century relative to the late 20th century under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. West Virginia is part of a large area of projected increases in the Northeast. Source: CICS-NC, NOAA NCEI, and NEMAC.



WEST VIRGINIA

Key Messages

Average temperatures have increased slightly less than 1°F since the early 20th century. Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century, with increases in heat wave intensity and decreases in cold wave intensity.

Total precipitation amounts and the number of extreme precipitation events have been above average in the 21st century. Winter and spring precipitation amounts are projected to increase, as well as the number and intensity of extreme precipitation events, posing an increased risk of flooding.

Naturally occurring droughts are projected to be more intense in the future due to temperature-caused increases in the rate of soil moisture loss during dry spells.

The climate of West Virginia is characterized by moderately cold winters and warm and humid summers. The polar jet stream, located near or over the Northeast region during the winter, brings frequent storm systems, which cause cloudy skies, windy conditions, and precipitation. Extreme events that affect the state include floods, droughts, heat and cold waves, ice storms, remnants of hurricanes, and snowstorms, including nor'easters. Due to the state's rugged topography, climate conditions vary considerably. West Virginia has the highest average elevation of any state east of the Mississippi River, which moderates summer temperatures. Average minimum winter temperatures typically range from the low 20s (°F) in the mountainous central and northeastern portions of the state to around 30°F in the far south. Average maximum summer temperatures range from around 85°F in the southwest near the Ohio River to less than 80°F in the east-central mountains. The central portion of West Virginia receives 50 or more inches of precipitation, while around 40 inches falls in the west along the Ohio River. To the west of the state's Eastern Panhandle, a "rain shadow" exists, where average precipitation drops down to about 30 inches each year.

West Virginia has experienced a less than 1°F increase in temperature since the early 20th century. Temperatures in West Virginia increased during the early part of the 20th century and were then followed by a period of cooling. Gradual warming has occurred since the early 1980s to above long-term averages in the 21st century (Figure 1) and slightly warmer than the previous warmest periods

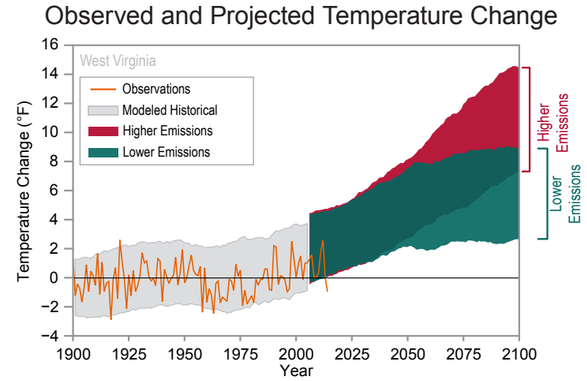


Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for West Virginia. Observed data are for 1895–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions)[1]. Temperatures in West Virginia (orange line) were highest in the 1930s and lowest from the 1960s through the 1980s. Temperatures have risen about 1°F since the 1960s, and in the 21st century have been comparable the levels of the 1930s and early 1950s. Shading indicates the range of annual temperatures from the set of models. Observed temperatures are generally within the envelope of model simulations of the historical period (gray shading). Historically unprecedented warming is projected during the 21st century. Less warming is expected under a lower emissions future (the coldest years being about as warm as the hottest year in the historical record; green shading) and more warming under a higher emissions future (the hottest years being about 12 °F warmer than the hottest year in the historical record; red shading). Source: CICS-NC and NOAA NCEI.

[1]Technical details on models and projections are provided in an appendix, available online at: https://statesummaries.ncics.org/wv.

of the 1930s and early 1950s. The number of very hot days (daytime maximum temperatures above 95°F) in West Virginia has been below average in the 21st century (Figure 2). The number of warm nights

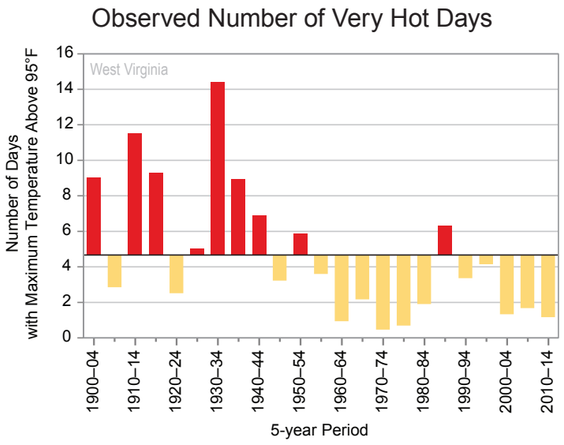


Figure 2: The observed number of very hot days (annual number of days with maximum temperature above 95°F) for 1900–2014, averaged over 5-year periods; these values are averages from five long-term reporting stations. The number of very hot days has consistently remained below average since the late 1940s. Record high numbers occurred during the droughts of the 1930s. The dark horizontal line is the long-term average (1900–2014) of 4.6 days per year. Source: CICS-NC and NOAA NCEI.

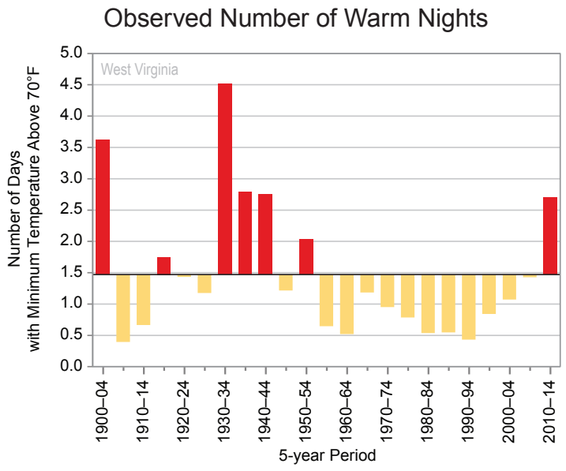


Figure 3: The observed number of warm nights (annual number of days with minimum temperature above 70°F) for 1900–2014, averaged over 5-year periods; these values are averages from five long-term reporting stations. The number of warm nights has generally been below average over the past 60 years (1955–2009), with the exception of a higher than average number of such events during the most recent 5-year period (2010–2014). The dark horizontal line is the long-term average (1900–2014) of 1.5 days per year. Source: CICS-NC and NOAA NCEI.

(nighttime minimum temperatures above 70°F) does not show any long-term trend but there have been above average numbers during the last five years (Figure 3). The number of very cold nights (minimum temperature below 0°F) has been below average since the 1990s (Figure 4).

There is no overall trend in average precipitation in West Virginia for the 118-year period of record. Precipitation has generally been near to above average since the early 1990s. The driest multi-year periods were the early 1930s and the late-1960s, with the driest 5-year period being 1962–1966, averaging 40 inches per year, while the wettest multi-year periods were the early 1900s and the 2000s, with the wettest 5-year period being 2002–2006 (averaging 48.5 inches) (Figure 5). The number of extreme precipitation events (precipitation totals greater than 2 inches) has been above average since the late 1990s, including the highest 5-year average number during 2000–2004 (Figure 6). The mountains of West Virginia are characterized by some of the highest snowfall totals east of the Mississippi River with an annual average of 100 inches of snowfall. During the winter of 2009–2010, record amounts of snowfall (more than 200 inches) occurred, with over 100 inches falling in the month of February. The Great Appalachian Storm of November 1950 brought 34 inches of snowfall to the city of Parkersburg, exceeding the city's snowiest November on record by more than 5 inches.

West Virginia is subject to a wide array of extreme weather including tornadoes, thunderstorms, snowstorms, hurricane remnants, and flooding. Tornadoes are relatively rare events (an average of two-to-five per year) and are usually weak. **Flood-producing extreme precipitation over the rugged topography is the costliest and most severe natural hazard for the state.** From 2005 to 2014 the state received 16 FEMA disaster declarations, 12 of which were related to severe storms and flooding events. The two most significant historical flooding events occurred in 1937 and 1985. The Great Ohio River Flood of 1937 affected numerous states, but the southwestern part of West Virginia near Huntington was the hardest hit. Heavy downpours occurred over a two-week period with rainfall averaging 6 to 12 inches throughout the region. The river level at Huntington crested at 69 feet, 19 feet above flood stage, a record that still stands today. An estimated

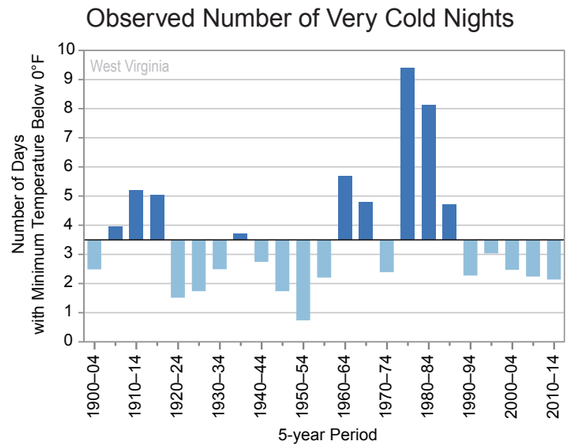


Figure 4: The observed number of very cold nights (annual number of days with minimum temperature below 0°F) for 1900–2014, averaged over 5-year periods; these values are averages from five long-term reporting stations. The number of very cold nights has remained below average for the past two decades (1990–2014). The dark horizontal line is the long-term average (1900–2014) of 3.5 days per year. Source: CICS-NC and NOAA NCEI.

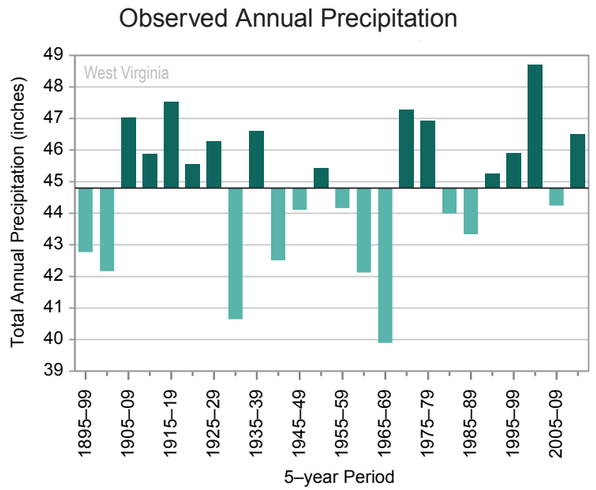


Figure 5: The observed annual precipitation for 1895–2014, averaged over 5-year periods; these values are averages from NCEI's version 2 climate division dataset. There is no overall trend in average annual precipitation for West Virginia over the 118-year period of record. Generally, annual precipitation has been above average for West Virginia since the 1970s. Record-setting levels of rainfall occurred from 2000 to 2004. The dark horizontal line is the long-term average (1900–2014) of 44.8 inches per year. Source: CICS-NC and NOAA NCEI.

$18 million (in 1937 dollars) in damages to homes and buildings occurred. In early November 1985, an extratropical storm, also influenced by the remnants of Hurricane Juan, generated up to 10 inches of rainfall across West Virginia. Extensive river flooding occurred mostly in the eastern portion of the state, resulting in an estimated $570 million in damages (in 1985 dollars) to 3,500 homes and 180 local businesses.

Under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century (Figure 1). Even under a lower pathway of greenhouse gas concentrations, temperatures are projected to most likely exceed historical record levels by the middle of the 21st century. However, there is a large range of temperature increases under both pathways, and under the lower pathway, a few projections are only slightly warmer than historical records (Figure 1). Increased heat wave intensity and decreased cold wave intensity are projected.

Annual precipitation is projected to increase for West Virginia over this century (Figure 7) **with those increases mostly in the winter and spring.** The number and intensity of extreme precipitation events are also projected to increase. These events will likely lead to greater flood risk. Drought is a periodically-occurring natural phenomenon within the state. Higher temperatures are projected to increase the rate of loss of soil moisture during dry spells, resulting in more intense naturally-occurring droughts in the future.

Much of the state's land cover is forested. These forests provide unique habitats for an abundance of plants and animals, some of which are endangered. For example, the state's Red Spruce habitat occupies the largest high elevation area in the northeastern United States. Upland Red Spruce communities are highly vulnerable to climate change due to their topographic location on the highest mountaintops, low elevation barriers to dispersal, and fairly narrow temperature and precipitation tolerances. In the future, climate change may significantly alter Red Spruce forests.