


# THE WEATHER AND CLIMATE OF *West Virginia*

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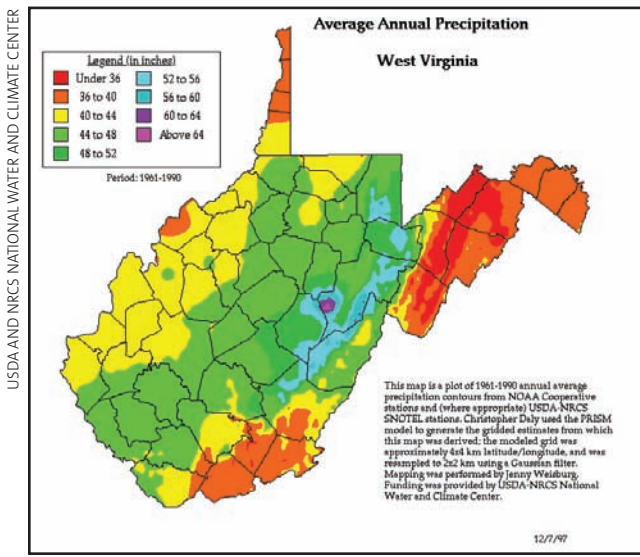
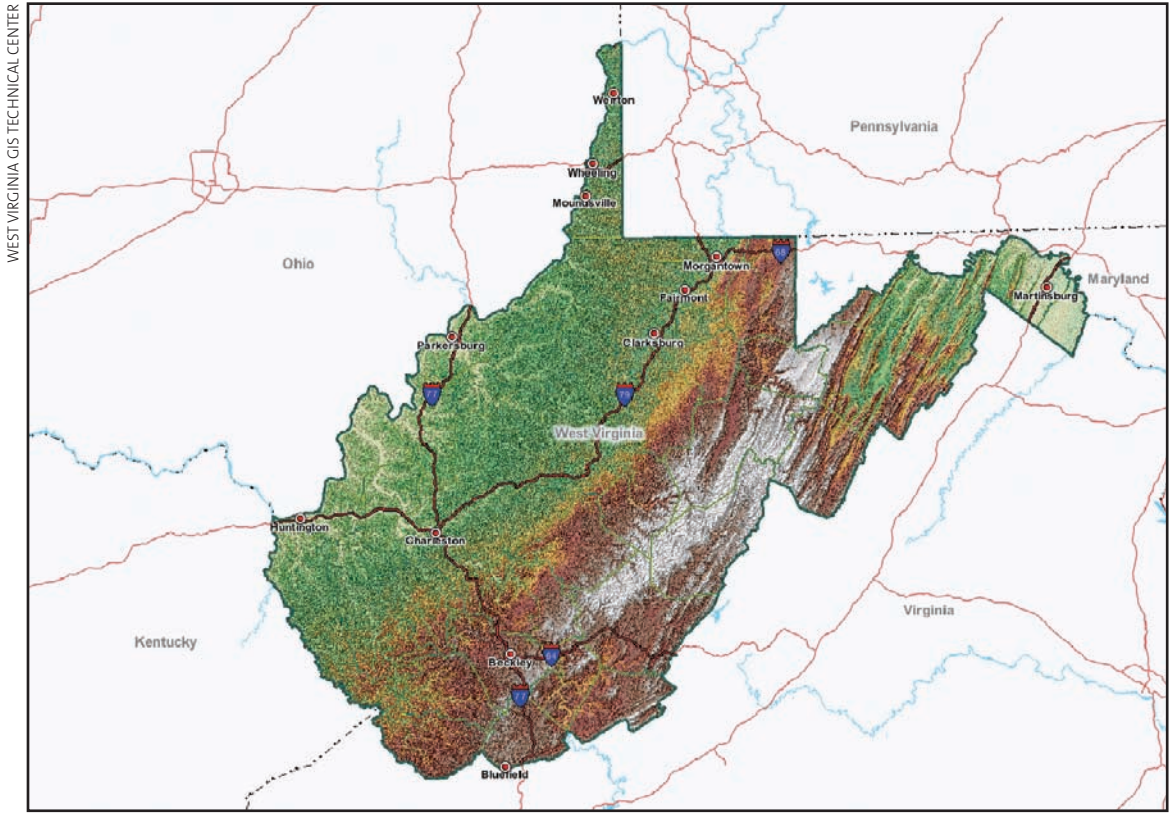
**W**est Virginia is a geographically small state that only covers about 24,000 square miles. However, due to two distinct two panhandles that protrude to the north and east, the state's dimensions are actually 200 miles square. The northern tip extends farther north than Pittsburgh, Pennsylvania, while the eastern tip is only 60 miles from Washington, D.C. In addition, the southernmost point is farther south than Richmond, Virginia, while the westernmost point is farther west than Port Huron, Michigan. The unusual shape and location of the state has coined the phrase, "West Virginia is the most southern of the northern states, the most northern of the southern states, and the most western of the eastern states."

West Virginia's dramatic topographic transitions result in a unique and highly variable climate and weather regime, especially when one crosses the state perpendicular to the Allegheny Mountains. West Virginia's inland location re-

moves a direct Atlantic Ocean influence from its weather and climate and ensures that the state's climate is more continental than maritime. The Allegheny Mountains run north to south along the Virginia border and are largely responsible for the state's east-to-west climatological changes. The highest point in the state, Spruce Knob, has an elevation of 4,863 feet above sea level. In fact, the mean elevation in the state is about 1,500 feet, which is the highest for any state east of the Mississippi River. This is more than 500 feet higher than Pennsylvania, the second highest mean elevation for a state. The topography varies greatly by county, with some individual counties exhibiting elevation changes of more than 3,000 feet.

### Temperature

Temperatures statewide average about 52°F and naturally increase southward. In the mountains, however, elevation changes lead to decreases of approximately 5 to 10°F, keeping the annual av-



The average yearly precipitation in West Virginia from 1961-1990.

## Precipitation

The average annual precipitation of West Virginia is about 44 inches. However, the pattern of the precipitation is strongly influenced by the physical geography, namely, the Allegheny Mountains. Beginning at westernmost points near Huntington and along the Ohio River, where the elevation is approximately 500 feet, precipitation values average near 40 inches per year. Traveling eastward into areas consisting of rolling hills and valleys, the elevation gradually increases to 750 to 2,000 feet above sea level. This area, which is located in the Ohio River watershed, experiences annual precipitation up to 50 inches, with a major contribution linked to orographic uplift. The elevation dramatically increases eastward, reaching altitudes of up to 3,500 feet across the Allegheny Plateau. It is in this rugged ridge-and-valley region that the highest annual precipitation values are recorded. Pickens (in Randolph County) receives more than 64 inches a year on average. The ridge of the Alleghenies (with peak elevations of just over 4,800 feet) lies just east of the plateau. The ridge line divides the Ohio River watershed from the Potomac/Chesapeake Bay watershed, which drains the eastern third of the state. Precipitation decreases substantially east of the ridge due to the orographic rain-shadow effect. As the elevation rapidly decreases, so too does precipitation.

erage locked into the 40s. During the winter, the average daily temperature is about 32°F, while in the summer it is about 70°F. Regardless of season, the daily temperature range runs between 20 and 25°F. The record high temperature of 112°F occurred in Martinsburg in 1936, and the record low temperature of -37°F occurred in Lewisburg in 1917. The record high occurred in one of the warmest years on record; in fact, 15 other states have their record annual high temperature sharing the same year.

Here, the South Branch (of the Potomac) Valley, with less than 36 inches of precipitation, is the driest area in the state. The eastern panhandle also consists of steep slopes and valleys oriented southwest to northeast. Again, elevation in this rain shadow region decreases rapidly, reaching approximately 240 feet, the lowest in the state. Similarly, rainfall drops off, as well. Only about 40 inches of precipitation falls near Harper's Ferry along the Potomac.

Annual snowfall totals show a similar geographic pattern, with lower values in the southwestern lowlands near Huntington and "snow-shadow" regions in the eastern part of the state. Higher values are also focused in the northern mountains. The annual snowfall ranges from 12 to 24 inches in those southwestern lowlands, while it is greater than 72 inches in the mountains. West Virginia is the southernmost state in the east that experiences snowfall amounts this great. Snowfall amounts in the Alleghenies rival those found in favorable lake-effect areas in New York and Pennsylvania.

## Clouds and Fog

West Virginia is also one of the more cloudy areas of the country. Beckley, Elkins, and Huntington all average about 200 days per year with overcast conditions. These locations are among the cloudiest in the eastern United States. Fog is predominantly responsible, and it is prevalent throughout the state due to two primary factors. The first factor is linked to high evapotranspiration rates from extensive forest cover. The second factor is rapid nighttime radiation loss from elevated locations and the ensuing cold air drainage that often fills valleys. This combination causes West Virginia to be one of the foggiest locations in the country, with several towns reporting dense fog (visibilities below 0.25 miles) for at least 40 days per year.

## Major Weather Events

West Virginia has a wide array of severe weather including thunderstorms and snowstorms. Tornadoes are rare (only an average of two per year), primarily because of the climate



NATIONAL PARK SERVICE

West Virginia is one of the foggiest locations in the country. Here, fog swirls around the base of the New River Gorge Bridge.



In 1985 the remnants of Hurricane Juan produced flash floods across the state. Here, Main Street in Moorefield, West Virginia, stands under several feet of water.



The 1985 flooding wreaked havoc across Moorefield, West Virginia, including the Heck's General Store.

created by the state's unique topography. The few that do occur are usually minor in intensity. However, during the famous April 3-4, 1974, nationwide tornado outbreak there were at least six tornadoes reported in the state. On April 9, 1991, a derecho event developed from a bow echo that raced across the state. Winds exceeded 80 mph in many parts of the state, with more than 200,000 residents losing electricity. Two deaths and 86 injuries were also attributed to these high winds. Not since the 1974 tornado super-outbreak had there been so much damage.

However, flooding is by far the deadliest and costliest weather-related disaster in the state. Every year, heavy rainfall over the steep, rugged topography creates flood or flash flood events. The two most memorable flood events occurred in 1937 and 1985.

### *1937 Great Ohio River Flood*

The 1937 flood remains on the record books for the southwestern part of the state near Huntington. This flood affected all parts of the

Ohio River from Pennsylvania to Illinois but hit especially hard in southwestern West Virginia. The river at Huntington crested at 69 feet (19 feet above flood stage), a record that still stands today. Heavy rainfall occurred over a two-week period from January 13 to 25 that year, with amounts ranging from 6 to 12 inches in the region. This was four times the average January precipitation and amounted to almost 20 percent of the average annual total. The persistent warm January rainfall on already saturated ground (from December snow-cover melt) coupled with the drainage from neighboring regions created unprecedented flooding. Local newspapers reported that small buildings were floating down the streets and that homes were pushed off of their foundations. Many homes and buildings were without power and heat because of blown fuses and electrical wiring faults. Restaurants ran out of food and it was estimated that 6,000 people in the city were left homeless. Drinking water

was shut off in the city for more than a week, and natural gas was not available for 40 percent of the residents for two weeks. Five residents died and there was more than \$18 million (in 1937 dollars) in damages linked to the event. After the Great Ohio River Flood, 39 flood-control dams were built upstream to prevent such a catastrophic flood from occurring again.

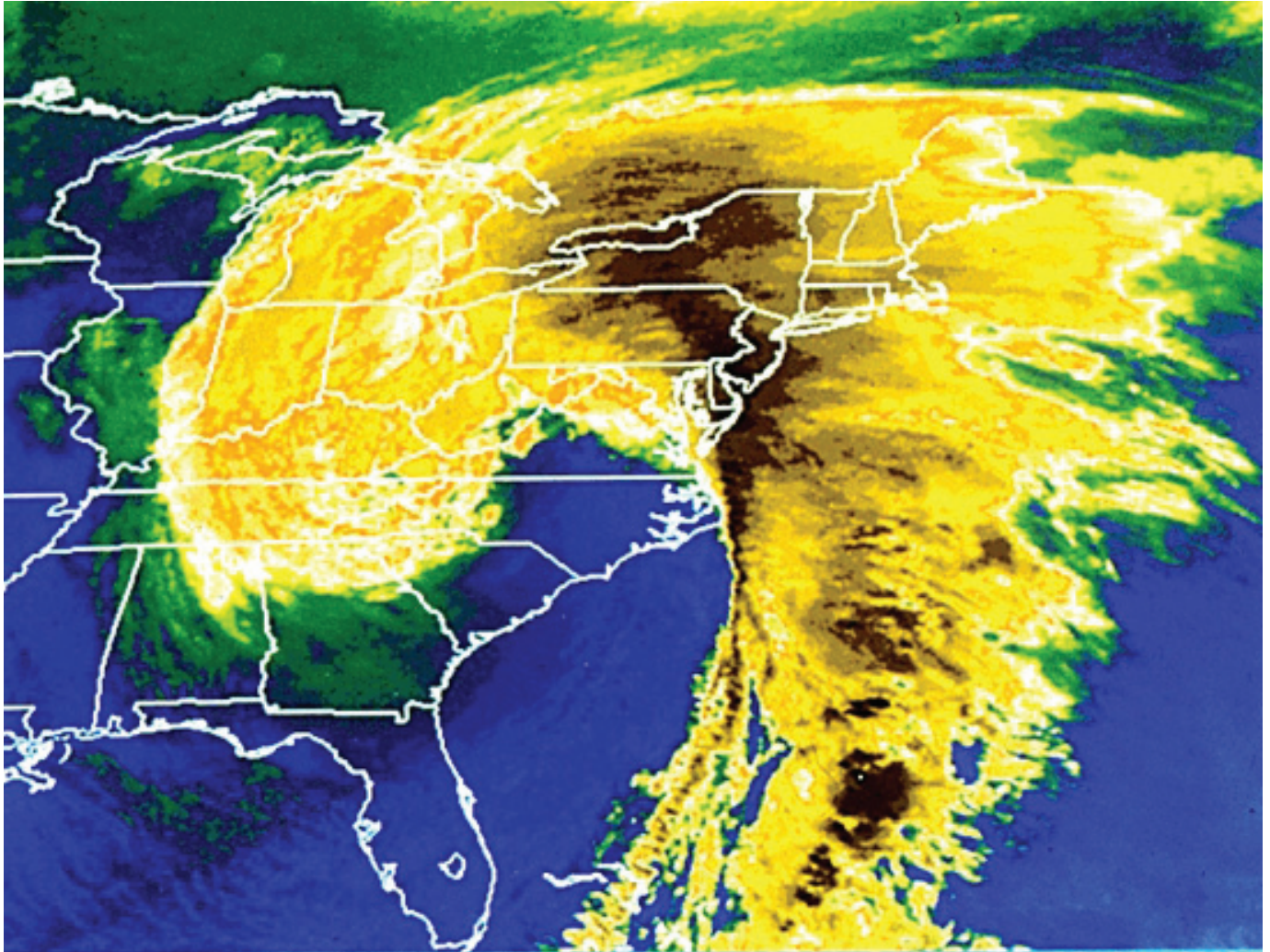
### 1985 Flash Flooding

It is not uncommon for West Virginia to receive heavy rainfall from tropical cyclones making landfall (e.g., Hurricane Camille, 1969; Hurricane Ivan, 2004), but in 1985 the remnants of Hurricane Juan produced flooding that residents will never forget. Hurricane Juan made landfall in Louisiana as a Category 1 storm and gradually moved toward the northeast. As Juan weakened and became extratropical, it interacted with an upper-level low-pressure system that was “cut off” from the main flow. As Juan’s remnants



NOAA

The surface and upper air weather maps for November 26, 1950, shows the The Great Appalachian Storm of November 1950, which dropped as much as 57 inches of snow on parts of the state.



This satellite image shows the extent of the 1993 superstorm, which dropped at least 12 inches of snow across the majority of the state, while the western slopes of the mountains received 24 to 48 inches.

stalled over the state, persistent rainfall ensued. On November 5, more than 5 inches of rain fell in the mountains. The resulting flash flooding was intensified as water was channeled through relatively narrow valleys and canyons. Entire towns (such as Rowlesburg and Paw Paw) were destroyed. The Monongahela, Cheat, Potomac, and all rivers in north-central West Virginia set record crests that still hold today. Nearly 50 people drowned as a result of the swiftly rising and fast-moving waters.

If rainfall is deemed a significant event in West Virginia, then snowfall could rival it for impact. Consider these three major events:

#### *The Great Appalachian Storm of 1950*

The Great Appalachian Storm of November 1950 remains as the record for the western slopes of the Central Appalachians. It began near Chesapeake Bay on November 25, looking like a coastal system. However, the storm started developing toward the northwest in a retrograde manner as the upper level low became “cut off.”

This allowed cold air to funnel over the state from the northwest, while Atlantic moisture moved in from the southeast. This provided the ingredients for a legendary snowstorm over the following three days. Most of the state reported at least 24 inches of snow. Elkins received almost 30 inches, Parkersburg 34 inches, and Pickens 57 inches. But it was Coburn Creek that logged an amazing 62 inches. An arctic air mass came in behind the system and brought bitterly cold temperatures (dropping to near zero in some locales). Other areas in the United States had record cold temperatures with this storm system, including Chicago ( $-2^{\circ}\text{F}$ ) and Louisville ( $-1^{\circ}\text{F}$ ). Along the East Coast, a full-blown “nor’easter” evolved, with Newark, New Jersey, reporting a gust of 108 mph and Mt. Washington, New Hampshire, clocking a gust of 160 mph. In nearby Columbus, Ohio, the Ohio State-Michigan football game went on as scheduled, despite blizzard conditions. Nearly 50,000 fans showed up to watch the “Blizzard Bowl,” with a Rose Bowl berth the payoff. Michigan won the

game 9-3 without making a single first down and only gaining 27 yards on offense.

### 1993 March Superstorm

The so-called “Storm of the Century” affected the entire East Coast of the United States. The storm started as a Gulf low on March 12 and then rapidly intensified thanks to a deep upper-level trough that extended to the Gulf Coast and allowed cold air to penetrate far to the south. The center of the low (with extremely low pressure readings) began to quickly track up the eastern seaboard. As with the 1950 storm event, the mix of cold air from the northwest and moisture from the southeast provided the setting for a major snowstorm event.

Snow started to fall in southern West Virginia on the evening of March 12. Heavy snow almost covered the entire state on March 13 when the center of the low was southeast of West Virginia. When the low was near Washington, D.C., the central pressure was approximately 960 millibars (28.35 inches of mercury), with pressures across the entire state of West Virginia below 980 millibars (28.94 inches of mercury). Category 2 hurricanes often have pressures around 960 millibars. The snow began to taper off the morning of March 14.

At least 12 inches of snow covered the majority of the state, while the western slopes of the mountains received 24 to 48 inches. Snowshoe, a noted ski resort, reported 44 inches of snow. Most impressive was that all of this snow fell in just a little more than 24 hours! As with the 1950 storm, very cold temperatures were in place all over the eastern United States, along with some impressive wind gusts due to the extremely strong pressure gradient around a very intense low-pressure system. However, since this storm was in March, temperatures quickly rose the next week and the rapid snowmelt created more flooding for the state.

### Snowy February 2010

February 2010 was one of the snowiest in the state’s history. Two major snowstorms struck the mid-Atlantic region during the month, along with cold temperatures that allowed for other snow systems to persist. Unofficially, Davis, in Tucker County, reported 116.6 inches of snow and Davis, in Tucker County, reported 11.6 inches of snow and Bayard, in Grant County, received 158.2 inches in February alone! These snow totals eclipsed the old record of 88 inches in Pickens in 1964, making Bayard the new state monthly snowfall record. The amount of snowfall that fell in February 2010 normally matches seasonal averages. In fact, the seasonal totals for

these locations were very close to all-time state records too. The unofficial seasonal totals for Davis and Bayard were 251.4 and 284.8 inches, respectively. These would just fall short of the state seasonal snowfall record set in Kumbrow State Forest of 301.4 inches in 1959-1960.

It is West Virginia’s topography that drives the dramatic characteristics of the state’s weather and climate. The rapid changes in elevation cause dramatic variations in temperature and precipitation, in an otherwise small geographical area. While the lowlands generally have very mild and temperate conditions, the mountainous regions have much cooler conditions and much more precipitation. Flooding continues to be the state’s worst natural hazard, thanks to runoff from higher terrain being funneled into narrow river valleys. Occasional intense extratropical cyclones can bring some of the most impressive snowfall totals found anywhere in the eastern United States. West Virginia’s tourism slogan can also certainly apply to the state’s weather and climate; they can be “Wild and Wonderful” too. **W**

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