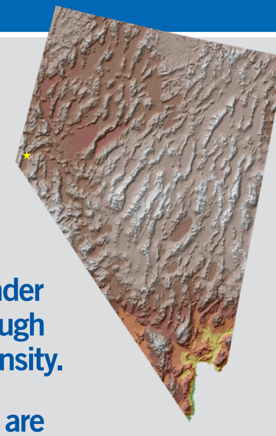
NEVADA



Key Messages

Temperatures in Nevada have risen almost 2.4°F since the beginning of the 20th century. Under a higher emissions pathway, historically unprecedented warming is projected to continue through this century, with associated increases in heat wave intensity and decreases in cold wave intensity.

Nevada is the driest state in the United States, and future projections of annual precipitation are uncertain. Increases in temperature are projected to lead to reductions in late winter and spring snowpack, with potential negative impacts to water supplies.

Drought has been common since the beginning of this century. Higher temperatures will increase the rate of soil moisture loss during dry spells, increasing the intensity of future naturally occurring droughts. The frequency and severity of wildfires are projected to increase in Nevada and surrounding states.

Nevada is largely a dry state with a highly diverse climate due its large range of elevations: from less than 500 feet in the scorching lowland desert in the south to more than 13,000 feet in the cool mountain forests in the north. Las Vegas is one of the hottest cities in the United States, with summer high temperatures averaging 102°F and regularly exceeding 110°F (an average of about 9 days per year reach 110°F or higher). Much of the state lies within the Great Basin, a region between the Rockies and the Sierra Nevada, encompassing numerous small mountain ranges and high-elevation desert valleys. Nevada is located on the eastern side of the Sierra Nevada, which blocks much of the moisture from the Pacific Ocean from reaching the state. Due to the climate and rugged mountainous terrain, much of the land is sparsely populated. The majority of residents live in two concentrated urban areas, the Las Vegas and Reno-Sparks metro areas, which are supported by water from Lake Tahoe and the Colorado River, respectively. Nevada is the Nation's driest state, with statewide annual average (1895–2020) precipitation only 10.2 inches. Regionally, annual average (1991–2020 normals) precipitation varies from 4 inches in some low elevation locations in the southwest to more than 50 inches on high mountain peaks of the Sierra Nevada.

Temperatures in Nevada have risen almost 2.4°F since the beginning of the 20th century (Figure 1)**.** Over the last 26 years, the annual number of very hot days has been above average, with the highest 5-year average occurring during the 2015–2020 period (Figure 2), partly because of very high annual values in 2017, 2018, and 2020. In

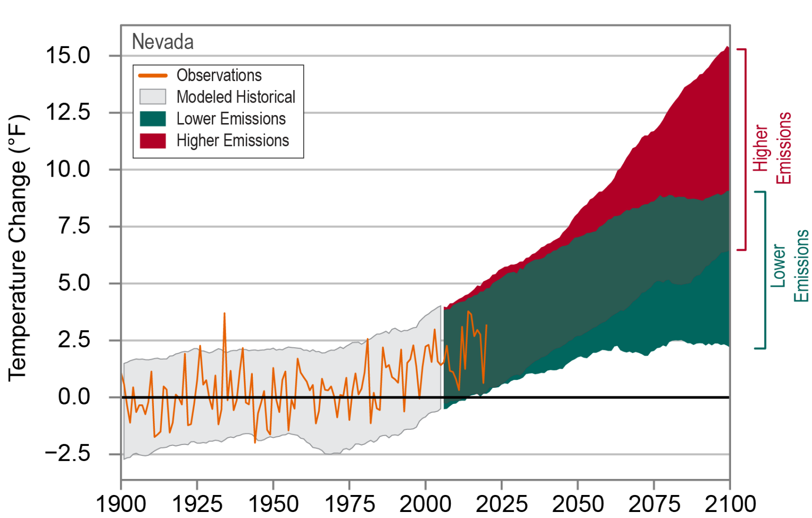


Figure 1: Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for Nevada. Observed data are for 1900–2020. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in Nevada (orange line) have risen almost 2.4°F since the beginning of the 20th century. 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 to continue through this century. Less warming is expected under a lower emissions future (the coldest end-of-century projections being about 2°F warmer than the historical average; green shading) and more warming under a higher emissions future (the hottest end-of-century projections being about 12°F warmer than the hottest year in the historical record; red shading). Sources: CISESS and NOAA NCEI.

addition to a general daytime warming, Nevada has experienced an above average number of warm nights since 2000 (Figure 3). The state is one of the most urbanized in the Nation, with 94% of the population living in areas defined as urban. The urban heat island effect has likely exacerbated these warming trends in Las Vegas in particular, where explosive growth has taken place.

After wet conditions in the late 1990s, total annual precipitation has been near or below average since 2000 but shows no overall trend across the 126-year period of record (Figure 4). Seasonal precipitation patterns vary across the state, with most locations receiving the majority of their precipitation during the winter months. However, eastern and southern areas, including Las Vegas, can experience intense summer rainfall from the North American Monsoon system.

Drought is a critical climate threat for this arid state (Figure 5). Since 2000, the Colorado River basin, the source of water for the southern part of the state, has experienced drought conditions, with impacts on Lake Mead. In addition, winter precipitation was well

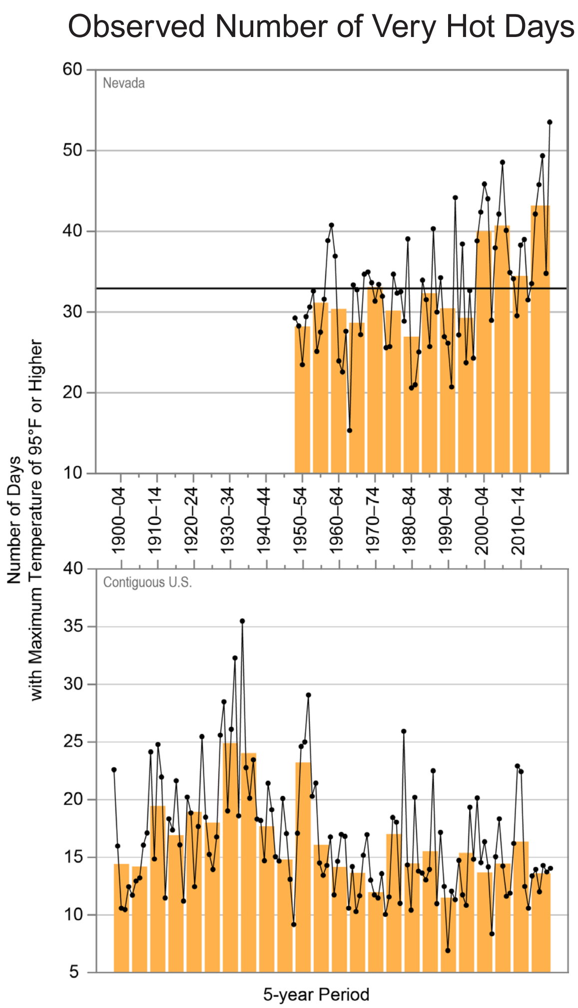


Figure 2: Observed annual number of very hot days (maximum temperature of 95°F or higher) for Nevada from 1950 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 33 days (note that the average for individual reporting stations varies greatly because of the state's large elevation range). Values for the contiguous United States (CONUS) from 1900 to 2020 are included to provide a longer and larger context. Long-term stations back to 1900 were not available for Nevada. Since 2000, the number of very hot days has been well above average, and the highest number occurred during the 2015 to 2020 period. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 19 long-term stations.

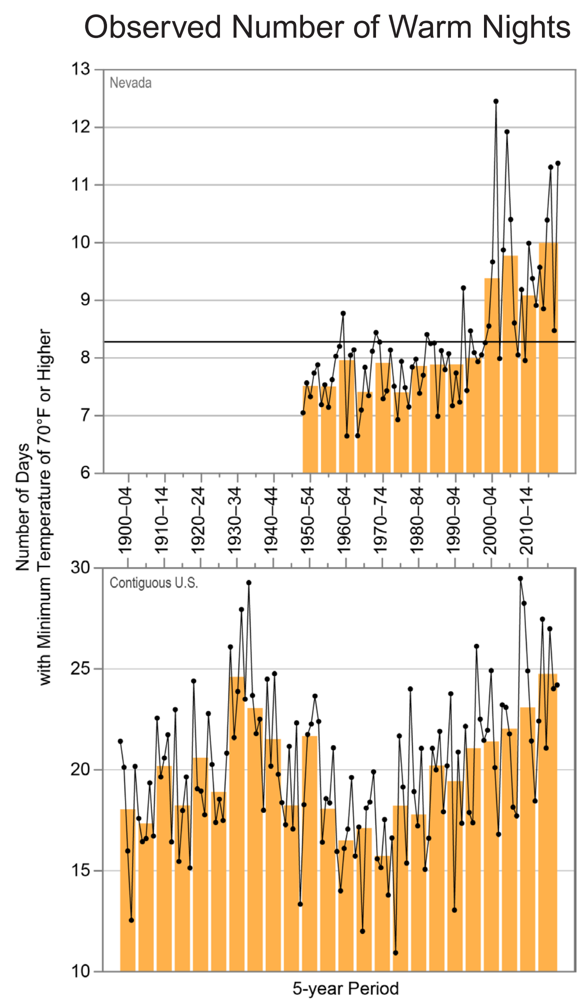


Figure 3: Observed annual number of warm nights (minimum temperature of 70°F or higher) for Nevada from 1950 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 8.3 nights (note that the average for individual reporting stations varies greatly because of the state's large elevation range). Values for the contiguous United States (CONUS) from 1900 to 2020 are included to provide a longer and larger context. Long-term stations back to 1900 were not available for Nevada. The number of warm nights has been above average since 2000, and the highest number occurred during the 2015 to 2020 period. Sources: CISESS and NOAA NCEI. Data: GHCN-Daily from 19 long-term stations.

below average from the 2011–12 through the 2014–15 water years (October–September), and all of those years were abnormally warm. This led to a strain on water supplies in agricultural areas that rely on surface water. The majority of the counties in the state have been designated as natural disaster areas due to extreme drought conditions. Lake Mead, the largest man-made reservoir in the United States, provides water for southern Nevada, as well as Arizona, southern California, and northern Mexico. As of October 25, 2021, water storage in Lake Mead was at 34% capacity, and water levels have been dropping since 2000 (Figure 6). Due to aggressive conservation policies, metropolitan areas have been able to manage the reductions in water supplies. Parallel declines in snowpack have been observed over this same time period (Figure 7). Snowpack refills Lake Tahoe every spring, and lake levels slowly decrease throughout the year. Warm and/or dry years lead to low snowpack and associated decreases in the lake's water levels. Since 1900, the lake has fallen below the natural rim 21 times (Figure 8).

Since 2004, the state has received multiple federal disaster declarations for wildfire events. Following the national drought of 2012, western wildfires burned an estimated 9 million acres across 8 states, including Nevada, causing more than $1 billion in damages. In 1997 and 2005, severe flooding along the Truckee River caused extensive damages in Reno and the surrounding area. Summer monsoon rains frequently lead to disruptive flooding in the Las Vegas Valley.

Under a higher emissions pathway, historically unprecedented warming is projected to continue through this century (Figure 1). Even under a lower emissions pathway, annual average temperatures are projected to most likely exceed historical record levels by the middle of this century. However, a large range of temperature increases is projected under both pathways, and under the lower pathway, a few projections are only slightly warmer than historical records. Extreme high temperatures are projected to increase substantially, with potentially large impacts in the very hot southern deserts, particularly the Las Vegas metro area, where 70% of the state's population resides. Extreme heat, combined with the urban heat island effect, will result in poor air quality and an increased risk of chronic respiratory conditions and heat stress.

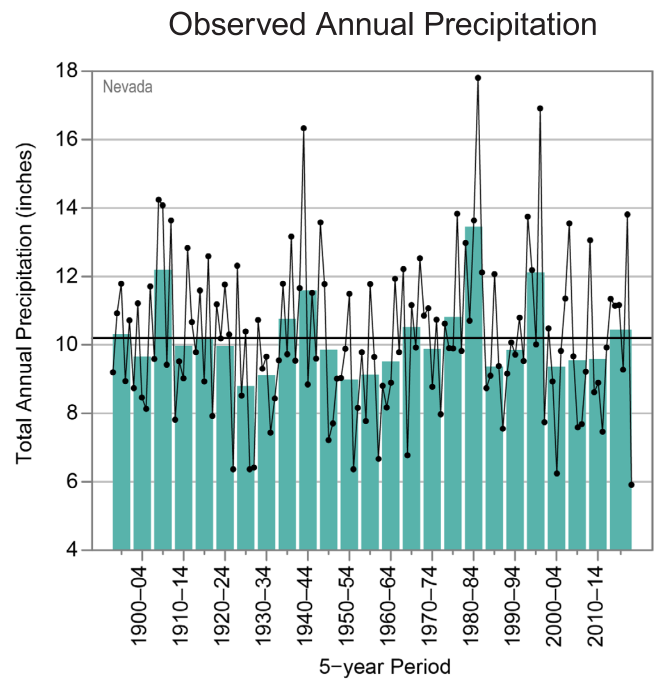


Figure 4: Observed total annual precipitation for Nevada from 1895 to 2020. Dots show annual values. Bars show averages over 5-year periods (last bar is a 6-year average). The horizontal black line shows the long-term (entire period) average of 10.2 inches. Five-year average total precipitation has ranged from 8.4 inches per year during 1958–1962 to 13.5 inches per year during 1980–1984. The early part of this century was below average, but the 2015 to 2020 period was near average. Sources: CISESS and NOAA NCEI. Data: nClimDiv.

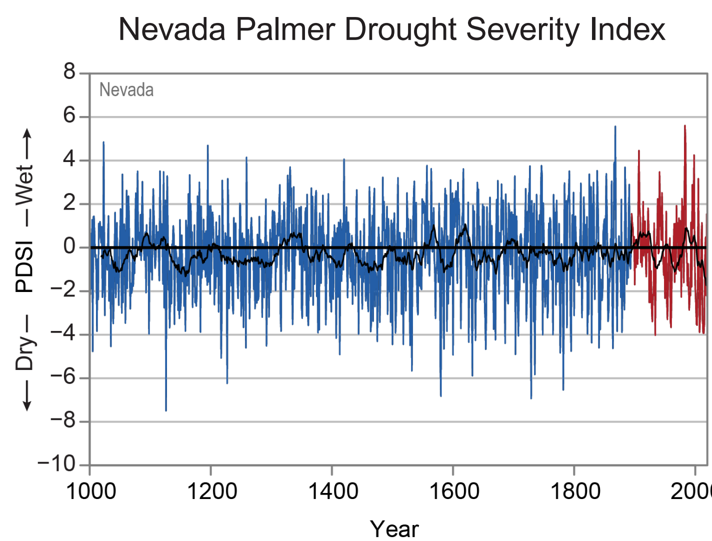


Figure 5: Time series of the Palmer Drought Severity Index for Nevada from the year 1000 to 2020. Values for 1895–2020 (red) are based on measured temperature and precipitation. Values prior to 1895 (blue) are estimated from indirect measures such as tree rings. The fluctuating black line is a running 20-year average. In the modern era, the wet periods of the early 1900s and the 1980s–1990s and the dry period of the 1950s are evident. The extended record indicates periodic occurrences of similar extended wet and dry periods. Sources: CISESS and NOAA NCEI. Data: nClimDiv and NADAv2.

Projected rising temperatures in Nevada will raise the snow line—the average lowest elevation at which snow falls. This will increase the likelihood that precipitation will fall as rain rather than snow, reducing water storage in the snowpack, particularly at those lower mountain elevations that are now on the margins of reliable snowpack accumulation. Higher spring temperatures will also result in earlier melting of the snowpack, further decreasing water availability during the already dry summer months.

Projections of annual precipitation for Nevada are uncertain throughout this century (Figure 9)**, but warmer temperatures are likely to decrease the amount of water in the mountain snowpack and increase the demand for water.** Higher temperatures will also increase the evaporation rate, which will reduce streamflow and soil moisture. Thus, the intensity of future droughts is likely to increase, as will the risk of wildfires in some ecosystems. Increases in population and potentially decreased water flow from the Colorado River may lead to future water security issues across the state.

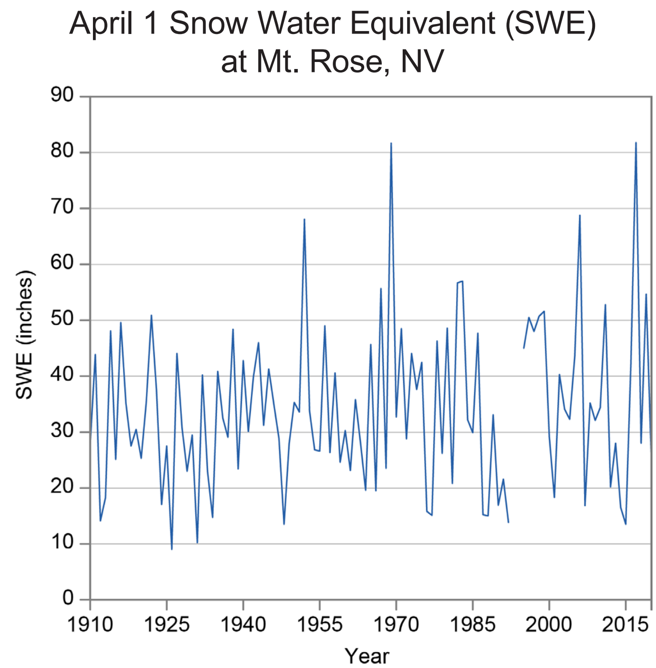


Figure 7: Variations in the April 1 snow water equivalent (SWE) at the Mt. Rose, Nevada, snow survey site from 1910 to 2020. SWE, the amount of water contained within the snowpack, varies widely from year to year. Data is not available for 1993 and 1994. Recent years have seen some of the lowest and highest levels in snowpack depth. Source: NRCS NWCC.

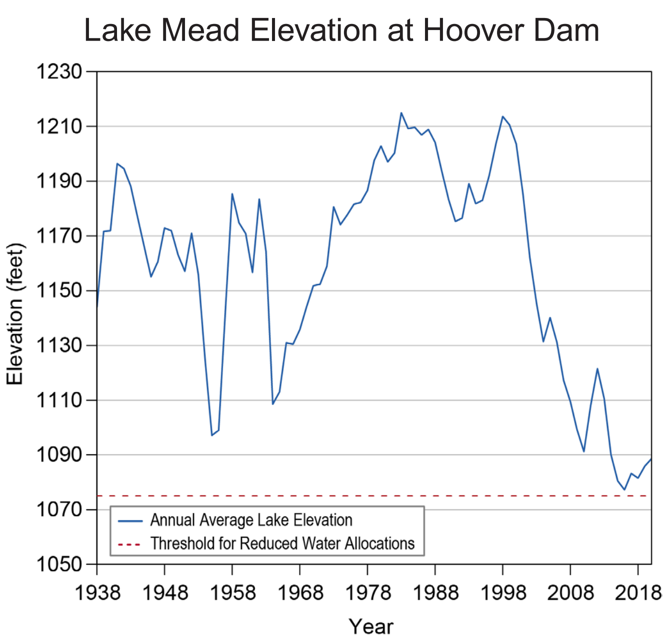


Figure 6: Time series of the annual average water level (blue line) of Lake Mead at Hoover Dam from 1938 to December 2020. Water levels in Lake Mead have varied widely over the years. Low levels in the 1950s and 1960s were due to drought and the filling of Lake Powell, respectively. Recent years have seen the lowest recorded levels since the original filling of Lake Mead. The red-dashed line indicates the threshold (1,075 feet) below which a federal shortage will be declared, resulting in reduced water allocations for Nevada and Arizona. Source: USBR.

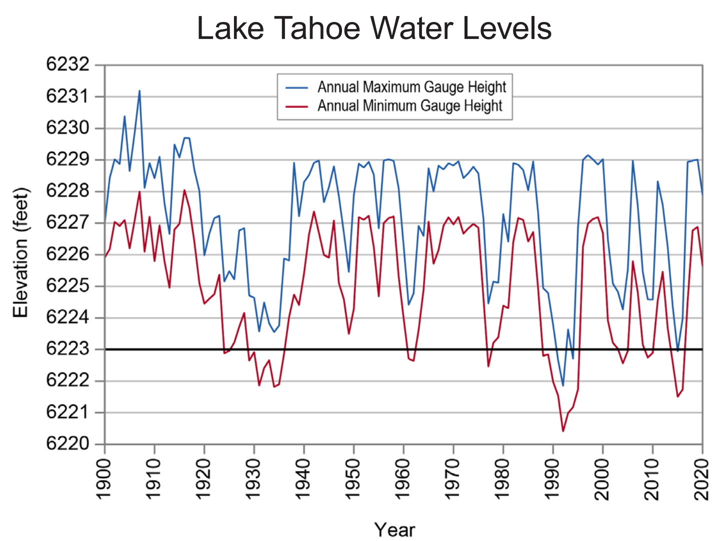


Figure 8: Time series of the annual maximum (blue line) and minimum (red line) water levels for Lake Tahoe (1900–2020). Ground-level lake elevation is 6,220 feet. The horizontal black line shows the natural rim elevation of 6,223 feet. A dam controlling outflow from the lake is 10 feet higher than the natural rim but by law spills at about 6,229 feet. Since 1900, the lake has fallen below the natural rim 21 times. Lake elevation in the early 1990s reached historically low levels. Source: USGS.

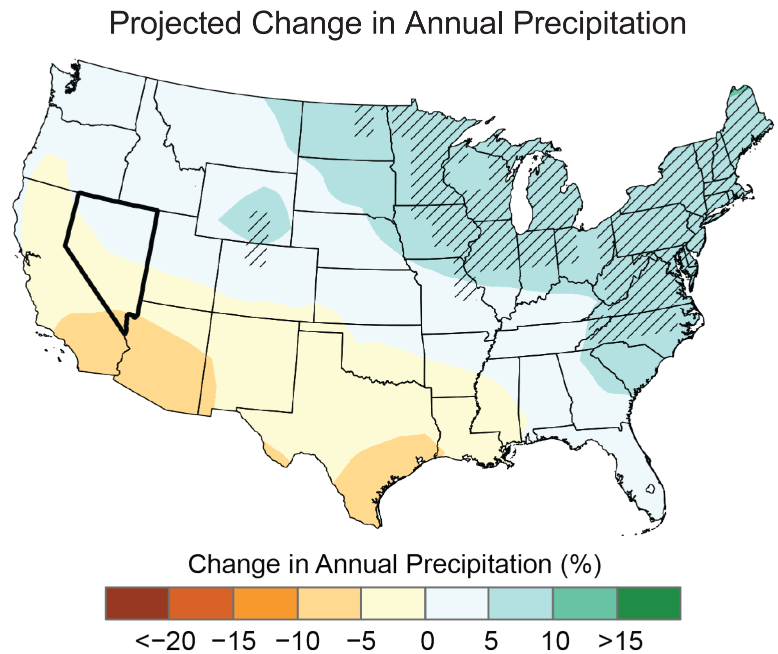


Figure 9: Projected changes in total annual precipitation (%) for the middle of the 21st century compared to the late 20th century under a higher emissions pathway. Hatching represents areas where the majority of climate models indicate a statistically significant change. The projected changes in annual precipitation for Nevada are uncertain, similar to that across much of the Southwest. Sources: CISESS and NEMAC. Data: CMIP5.

Technical details on observations and projections are available online at https://statesummaries.ncics.org/technicaldetails.

WWW.NCEI.NOAA.GOV | HTTPS://STATESUMMARIES.NCICS.ORG/CHAPTER/NV/ | LEAD AUTHORS: JENNIFER RUNKLE, KENNETH E. KUNKEL
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