Nevada Climate Impacts and Costs

The climate crisis is accelerating in Nevada, posing increased risks and burdening residents with the costs of adapting to a rapidly changing environment. Nevada will experience increasing drought conditions, hotter temperatures, and decreasing snowpack in the coming years.[1] Even if fossil fuel emissions and atmospheric concentrations of greenhouse gasses eventually stabilize through climate action, the severity of these events will continue to rise as we adjust to the new reality of the climate crisis. Below we outline the impacts of climate change Nevada faces and some of the potential costs associated with these impacts. This list is not all-encompassing and other costs may be incurred as a result of additional climate change impacts.

Drought

Nevada is the driest state in the United States.[2] According to NOAA's National Centers for Environmental Information, drought was the second most expensive natural disaster — costing at least $249 billion — in the U.S. over the last three decades.[3] Extreme drought due to climate change poses a significant threat to Nevada. Drought and evapotranspiration (water moving from the land to the atmosphere through plants) are expected to increase 3-15 times from historical levels by the end of the century in Nevada.[4] The largest factor in the predicted increase in evapotranspiration is increased temperatures.[5]

Worsened drought conditions due to climate change in western Nevada[6] increases the risk and occurrence of wildfires,[7] impacting human health and air quality. The Environmental Protection Agency estimates the cost to treat long-term exposures to wildfire is $450 billion, while short-term exposure (2008-2012) leads to premature death and hospitalizations totaling $63 billion.[8] Wildfires are also costly to fight and control. Fire suppression — which includes expenditure on aviation, vehicles, and fire crew

1 "What Climate Change Means for Nevada." https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-nv.pdf.

2 World Population Review, "Driest States [Updated March 2023]." https://worldpopulationreview.com/state-rankings/driest-states.

3 Adam Smith, "2010-2019: A landmark decade of U.S. billion-dollar weather and climate disasters," 2020. http://www.climate.gov/news-features/blogs/beyond-data/2010-2019-landmark-decade-us-billion-dollar-weather-and-climate.

4 McEvoy et al., "Projected Changes in Reference Evapotranspiration in California and Nevada." https://onlinelibrary.wiley.com/doi/abs/10.1029/2020EF001736.

5 Ibid.

6 Miller et al., "Quantitative Evidence for Increasing Forest Fire Severity in the Sierra Nevada and Southern Cascade Mountains, California and Nevada, USA." https://doi.org/10.1007/s10021-008-9201-9.

7 Scasta, Weir, and Stambaugh, "Droughts and Wildfires in Western U.S. Rangelands." https://www.sciencedirect.com/science/article/pii/S0190052816300256.

8 Jesse Roman, Angelo Verzoni, and Scott Sutherland, "The Wildfire Crisis: Greetings from the 2020 Wildfire Season," National Fire Protection Association Journal, 2020. http://www.nfpa.org/News-and-Research/Publications-and-media/NFPA-Journal/2020/November-December-2020/Features/Wildfire.

— cost the U.S. $3.7 billion in 2022.[9] Recently, fires have begun jumping the Sierra Nevadas into western Nevada, posing risk to Nevada residents. That was the case in the Caldor Fire in 2021, in which 1,100 structures were damaged in both California and Nevada.[10] In fact, wildfires have become so severe in California that some major insurance companies have pulled out of the home insurance market,[11] which could become a reality in Nevada as wildfire frequency and severity increase. From 2018-2022, Nevada had 3,052 wildfires that burned over 1.5 million acres of land. On average, the cost of putting out a wildfire is $74,409.[12] Since 1980, the U.S. has experienced an increasing number of wildfires that cost over $1 billion per event. These large wildfires cost the U.S. $13.2 billion per year from 2018-2022, significantly more money than in the 1980's where there were no billion dollar wildfires in the U.S.[13]

Drought also causes water security issues, which will impact a majority of water resources, both local and imported.[14] Lake Mead — a reservoir fed by the Colorado River — provides drinking water to 2.3 million Nevada residents or 75% of Nevada's population. Lake Mead is threatened by decreased snowpack[15] and its elevation has dropped over 150 feet (71% decline in volume) since 2000.[16] In 2021, the Southern Nevada Water Authority agreed to contribute $20 million to protect Lake Mead and aid water conservation efforts.[17] In both 2022 and 2023, the federal government declared a water shortage for Lake Mead that reduced the amount of water available to Nevada.[18] These water shortages are predicted to increase in frequency due to climate change,[19] prompting a deal in May 2023 between Arizona, Nevada, and California to conserve Colorado River water.[20] As a part of this deal, Nevada will reduce water consumption by 25% over the next 3.5 years.[21] According to the NOAA's summary of billion dollar weather events from 2018-2022, drought costs an average of $7.8 billion per year.[22]

9 Jennifer L, "Wildfires Cost Over $148B and 30% of Emissions," Carbon Credits, January 30, 2023. https://carboncredits.com/wildfires-cost-emissions/; Western Fire Chiefs Association, "What Is the Financial Cost of a Wildfire?," December 7, 2022. https://wfca.com/articles/cost-of-wildfires/.

10 Arindam, "Unprecedented Behavior." https://www.verisk.com/insurance/visualize/unprecedented-behavior-wildfires-have-jumped-the-sierra-nevada/.

11 The Associated Press, "Surge in U.S. Thunderstorms" https://www.cbc.ca/news/business/swiss-re-insurance-damage-1.6932920.

12 Bishop, "Wildfire Statistics." https://www.valuepenguin.com/homeowners-insurance/wildfire-statistics.

13 NOAA, "U.S. Billion-Dollar Weather and Climate Disasters" https://www.ncei.noaa.gov/access/billions/.

14 Negin Ashoori, David Dzombak, and Mitchell Small, "Sustainability Review of Water-Supply Options in the Los Angeles Region," Journal of Water Resources Planning and Management 141, no. 12 (December 1, 2015): A4015005. https://doi.org/10.1061/(ASCE)WR.1943-5452.0000541.

15 Gibson and Jones, "Clark County, Nevada: Climate Vulnerability Assessment." https://allinclarkcounty.com/resources/ID_59/Documents/CC_CVA_FINAL_LR.pdf.

16 "Water Shortages"; Hannoun and Tietjen, "Lake Management under Severe Drought." https://www.snwa.com/water-resources/drought-and-shortage/index.html; https://onlinelibrary.wiley.com/doi/full/10.1111/1752-1688.13090.

17 Kaleem and James, "California, Arizona and Nevada Agree to Take Less Water from Ailing Colorado River." https://www.latimes.com/world-nation/story/2021-12-15/drought-colorado-river-water-agreement#:~:text=Water%20agencies%20in%20Arizona%20have,expected%20to%20pay%20%24100%20million.

18 Ibid.

19 Ibid.

20 Bush, "Three States Agree to Reduce Water Usage so the Colorado River Doesn't Go Dry." https://www.nbcnews.com/science/science-news/arizona-california-nevada-cut-water-usage-drought-hit-colorado-river-rcna85567.

21 Lochhead, "Nevada Agreed to Take Less Water. Here's What That Means for You." https://www.reviewjournal.com/news/politics-and-government/nevada/nevada-agreed-to-take-less-water-heres-what-that-means-for-you-2783952/.

22 NOAA, "U.S. Billion-Dollar Weather and Climate Disasters".

Potential Costs Related to Drought

Water Management

- Purchase of water during water-scarce times.[23]
- Public health costs related to increased exposure to water-borne illnesses.[24]
- Replace old pipelines and related infrastructure that have water leak issues.[25]
- Building water conservation infrastructure.
- Upgrade water treatment, wastewater treatment, and other energy infrastructure.[26]
- "Maintain and expand urban and community tree canopy and support ongoing efforts to expand drought-tolerant trees."[27]
- Maintenance of sufficient outflow from Lake Mead (and other drinking water reservoirs) to ensure water quality and quantity.[28]

Wildfires

- Increase fire suppression, including staffing, equipment, and aviation.
- Rebuild or relocate damaged properties and public infrastructure, such as homes and utility lines.
- Relocate public infrastructure where necessary.
- Update power lines to withstand dust from wildfires.
- Implement fire mitigation strategies for the future like burying utility lines underground.
- Plan for and disburse community aid after wildfires.
- Implement fire detection strategies, like solar-powered sensors.[29]
- Rehabilitate the landscape post-fire to reduce the risk of erosion and invasive species and mitigate future fire risk.
- Increased hospitalization costs for asthma attacks and other chronic health conditions (resulting from decreased air quality due to wildfire smoke).

23 Zoë Roller et al., "Closing the Water Access Gap in the United States: A National Action Plan," Dig Deep and US Water Alliance, 2022. https://static1.squarespace.com/static/5e80f1a64ed7dc3408525fb9/t/6092ddcc499e1b6a6a07ba3a/1620237782228/Dig-Deep_Closing-the-Water-Access-Gap-in-the-United-States_DIGITAL_compressed.pdf.

24 Ibid.

25 CISA, "Drought and Infrastructure - A Planning Guide" https://www.cisa.gov/sites/default/files/publications/Drought_and_Infrastructure_A_Planning_Guide_508c.pdf.

26 Ibid.

27 Gibson and Jones, "Clark County, Nevada: Climate Vulnerability Assessment."

28 Hannoun and Tietjen, "Lake Management under Severe Drought." https://onlinelibrary.wiley.com/doi/full/10.1111/1752-1688.13090.

29 Jennifer L, "Wildfires Cost Over $148B" https://carboncredits.com/wildfires-cost-emissions/.

Local Planning and Regulation

- Organize public participation and staffing in the creation of water scarcity management plans.[30]
- Develop tools for monitoring ground and surface water resources for public use.[31]

Education and Awareness Programs

- Public education, outreach, and awareness campaigns about water conservation.[32]
- Increase public outreach to encourage wildfire risk management; educate residents in wildfire safety, technical assistance availability, funding sources, and best practices.

Summary of Costs from Drought

Fire prevention and recovery, water security and water treatment, infrastructure damages, public health, and education and awareness.

Temperature Extremes

Climate change will cause more extreme temperatures in Nevada. Average annual temperatures in Nevada have increased by about 2°F since the 1900's and are projected to continue to increase 3.2 °F to 7.3 °F by mid-century and 8 °F to 12.8 °F by the late century. Las Vegas, Nevada, was the fastest warming city in the United States from 1970 to 2018.[33]

July 2023 was the hottest month in the history of global temperature records.[34] In Nevada, temperatures were regularly in the triple digits leading to unsafe conditions for residents. At least 16 people died from these extreme conditions. In Clark County, heat-related emergency visits were double that of July 2022.[35] Extreme heat and associated public health impacts will only get worse. Clark County is predicted to have an increase of 26 more extreme heat days (days with temperatures at or above 106°F) by mid-century and 60 more extreme heat days by late-century compared to the historical period from 1961-1990. According to the Center for Climate Integrity, Nevada will face over $64 million in climate-driven school cooling costs by 2025, impacting over 400,000 students.[36]

30 CISA, "Drought and Infrastructure - A Planning Guide"

31 Ibid.

32 Ibid.

33 Gibson and Jones, "Clark County, Nevada: Climate Vulnerability Assessment."

34 NASA, "July 2023 Was the Hottest Month on Record." https://earthobservatory.nasa.gov/images/151699/july-2023-was-the-hottest-month-on-record#:~:text=July%202023%20was%20hotter%20than,said%20GISS%20Director%20Gavin%20Schmidt.

35 Solis, July 31, and 2023, "July Brought Nevada Record Heat and Hospitalizations." https://www.nevadacurrent.com/2023/07/31/july-brought-nevada-record-heat-and-hospitalizations/.

36 Center for Climate Integrity, "Hotter Days, Higher Costs: The Cooling Crisis in America's Classrooms." Center for Climate Integrity, 2021. https://coolingcrisis.org.

Potential Costs Related to Temperature Extremes

Structure and Infrastructure Projects

- Energy efficiency retrofits in public and private buildings and housing, including costs for the design and development of energy efficiency standards.
- Increased cooling costs for all public buildings, including green roofs or cool roofing systems on public buildings and new AC installation or upgrade costs for schools.
- Increased road damage due to more frequent extreme heat events.
- Plan for and increase capacity for increased energy demands due to both increased daytime and nighttime temperatures.
- Remove turf and replace it with trees for water conservation and to counter heat islands.[37]
- Increase high-albedo surfaces on buildings, roads, or where feasible.
- "Implement heat reduction strategies including, shade structures, cool pavements, and cool roofs, at parks and recreational sites."[38]

Public Health Projects

- Build and manage more cooling centers, including staffing and tracking of high-risk individuals.
- Formalize a network of well-resourced mobile crisis intervention services to engage communities of concern during emergency and non-emergency situations.[39]"
- Increased demand for publicly financed air conditioning targeted to low income families and public housing.
- Control the increase of vector borne illness — education and physical and chemical controls for ticks and mosquitos.
- Treat victims of vector borne illness.
- Treat victims of heat induced illness.
- Increase in asthma attacks requiring hospitalization (resulting from increased heat and ground level ozone, and the increase in airborne allergens).
- Reduce the urban heat island effect by planting trees.
- Protect drinking water supplies from hazardous algae blooms.

Summary of Costs from Temperature Extremes

Public health costs (e.g., medicare/medicaid), AC installation and improvement where needed, establishing new cooling centers, planting trees to reduce urban heat islands, and protecting drinking water supplies.

37 Gibson and Jones, "Clark County, Nevada: Climate Vulnerability Assessment."

38 Ibid.

39 Ibid.

Flooding and Water Quality – Extreme Precipitation and Decreased Snowpack

Precipitation in Nevada varies from year to year, which impacts streamflow and snowpack. Despite average annual precipitation remaining stable in Nevada in the face of climate change, precipitation intensification of individual storm events is expected to occur due to climate change causing intense flooding.[40] Studies have shown the stormwater systems in Las Vegas, Nevada, are not adequate to prevent flooding from climate change related precipitation events.[41] These climate impacts are already being felt. In developed and dry areas — like Las Vegas and Reno — soil compaction and impermeable roads and sidewalks, which both prevent water infiltration into the soil, exacerbate flooding and runoff during storms.[42] In September 2023, flash flooding wreaked havoc in Las Vegas[43] while stranding thousands and causing one fatality at Burning Man in the northern Nevada desert.[44]

Increasing temperatures also cause earlier snow melt, and more precipitation in the form of rain instead of snow. Drinking water for Reno and Las Vegas primarily comes from the Sierra Nevada mountains and the Upper Colorado River Basin.[45] Similar to drought, reduced snowpack and an earlier melting cause many impacts to drinking water quantity and quality. As a result of a combination of factors, including climate change, the Colorado River can no longer meet the water needs of Nevada.[46]

Potential Costs Related to Flooding and Water Quality

Structure and Infrastructure Projects

- Remove, relocate, acquire, or demolish structures to minimize future flood losses.
- Install, reroute, increase capacity, or implement a routine cleaning plan of the storm drainage system.
- Add extra culverts, increase dimensions of existing culverts, or implement routine cleaning and repairing.
- Install detention or retention basins, relief drains, spillways, drain widening/dredging or rerouting, etc.
- Inspect and maintain drainage systems and flood control structures (dams, levees, etc.).

40 "Climate Change Impacts in Nevada." https://extension.unr.edu/publication.aspx?PubID=3957.

41 Nyaupane et al., "Response of Climate Change on Urban Watersheds"; Thakali, Kalra, and Ahmad, "Understanding the Effects of Climate Change on Urban Stormwater Infrastructures in the Las Vegas Valley." https://ascelibrary.org/doi/10.1061/9780784480632.040; https://www.mdpi.com/2306-5338/3/4/34.

42 "Low Impact Development in Northern Nevada." https://extension.unr.edu/publication.aspx?PubID=3418.

43 Tumin, "Parts of Las Vegas Strip Flood After Heavy Rain." https://www.nytimes.com/2023/09/01/us/las-vegas-flooding.html.

44 Mayorquin, "Trapped in Mud, Burning Man Attendees Are Told to Conserve Food." https://www.nytimes.com/2023/09/02/us/burning-man-storm-flood-mud.html.

45 "Climate Change Impacts in Nevada."

46 McNabb and Swenson, "Water Crisis in the Southwest." https://link.springer.com/chapter/10.1007/978-3-031-27380-3_10.

- Inspect bridges in order to identify and/or implement repairs or retrofits or clean under low bridges.
- Resurface roads with more permeable pavement and concrete.
- Avoid soil compaction during development and construction by limiting heavy construction equipment, adding high permeable sediments (e.g., sand), and/or limiting the removal of vegetation.[47]
- Restore soils post-construction using ripping techniques or adding soil organic matter to increase soil permeability.[48]
- Elevate roads and bridges above the base flood elevation (BFE)[49] to maintain dry access.
- Elevate structures above the BFE, or relocate utilities, water heaters, etc. above BFE.
- Floodproof inside of municipal buildings, for example by installing check valves, sump pumps, or backflow prevention devices.
- Floodproof wastewater treatment facilities located in flood hazard areas.
- Floodproof water treatment facilities located in flood hazard areas.
- Protect emergency operations by requiring or moving all emergency operations centers, police stations, and fire department facilities outside of flood-prone areas.
- Protect critical and emergency facilities by requiring all critical facilities be built one foot above the 500-year flood elevation (to meet requirements of FEMA Executive Order 11988).[50]
- Protect critical and emergency facilities from floods using any other technique, for example, raising components above BFE, installing pumping systems or back-up generators for pumping, building dikes, or stabilizing banks.

Natural Flood Mitigation

- Protect and enhance natural floodplain mitigation features or install green infrastructure to help prevent flooding.

Water Management

- Please refer to "Water Management" costs from the Drought section, as they also apply to decreased water quantity and quality from reduced snowpack.

Local Planning and Regulation

- Update flood risk maps and flood zones.

47 "Low Impact Development in Northern Nevada."

48 Ibid.

49 Base flood elevation (BFE), as defined by FEMA, is "the elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year."

50 Federal Emergency Management Agency, "Executive Order 11988: Floodplain Management," www.fema.gov/executive-order-11988-floodplain-management.

- Develop a floodplain management plan.
- Adopt a stormwater management or drainage plan.
- Adopt, apply, and enforce building codes to ensure buildings can withstand flooding.
- Obtain easements to use privately-owned land for temporary water retention and drainage.
- Join or improve compliance with the National Flood Insurance Program (NFIP). [51]
- Preserve floodplains as open space using any of several land use planning tools: develop a plan that targets hazard areas for acquisition, reuse, and preservation; a land banking program; use of transfer of development rights to keep floodplains vacant; easements to prevent development; or acquiring properties in the floodplain and turning them into open space.

Education and awareness programs

- Increase public outreach to encourage flood insurance purchase; educate residents in flood safety, flood mitigation, technical assistance availability, funding sources, and best practices.
- Locate new utilities and critical facilities outside of susceptible areas.
- Identify, map, or track erosion hazard areas.

Summary of Costs from Flooding and Water Quality

Floodproof buildings, relocate infrastructure in especially flood prone areas, improve drainage systems and flood control structures, elevate infrastructure (buildings, roads, and bridges) where needed, restore natural flood protection, develop and implement comprehensive flood management plans, preserve floodplains, and increase public awareness of flooding.

Other Extreme Weather

Other extreme weather includes: winter storms, wind storms, atmospheric rivers, hail storms, and El Niño and La Niña events.[52]

Potential Costs Related to Other Extreme Weather

Structure and infrastructure projects

- Increased costs of storm recovery and clean-up.
- Protect power lines through pruning trees.
- Bury overhead power lines or install systems that allow small sections of power lines to fail rather than the complete system.

51 U.S. Federal Emergency Management Agency (FEMA), The National Flood Insurance Program (NFIP), at www.fema.gov/national-flood-insurance-program Policy Information by State (https://nfipservices.floodsmart.gov//reports-flood-insurance-data), accessed September 26, 2023; Nevada has over 9,500 policies covering over $2.5 billion.

52 "Nevada's Weather and Climate." https://extension.unr.edu/publication.aspx?PubID=2701.

Other Public Health Costs

Other plausible impacts from climate change that would incur public health costs are increased allergen levels, food- and waterborne infections, and zoonotic diseases.