

## NEVADA

### ASSESSING THE COSTS OF CLIMATE CHANGE

#### CLIMATE TRENDS IN NEVADA

During the last century, Nevada has experienced a slight increase in temperature, increased precipitation, shortened snow seasons, and more storms overall.<sup>1</sup> These have contributed to more heat waves and a dryer environment statewide.<sup>2</sup>

Precipitation patterns along Nevada's Sierra Mountains are strongly influenced by El Niño events, which are caused by warmer than normal surface temperatures in the equatorial Pacific Ocean.<sup>3</sup> The 1998 El Niño created extreme weather conditions and severe flooding as winter storms climbed the Sierra mountain range and produced up to three times the average amount of seasonal precipitation.<sup>4</sup> Warmer and more arid conditions, however, coupled with a 16-day shorter snow season compared to 1950, have led to limited water supplies and severe drought in parts of the state, particularly in the last seven years.<sup>5,6</sup>

#### OVERVIEW

In the coming decades, the changing climate could affect the economies of Nevada and other states. Recent climate modeling predicts a much drier climate for Nevada, which could put pressure on scarce fresh water resources. Water limitations could affect tourism, real estate development and human health and could result in the loss of billions of dollars. Many western states may confront similar challenges. Due to the regional nature of these outcomes, policymakers may wish to consider both state and regional policies to address climate change.

By 2100, the average temperature in Nevada is predicted to increase by 3° F to 4° F in the spring and fall and by 5° F to 6° F in the summer and winter.<sup>7</sup> El Niño also is predicted to increase in frequency and duration as a result of global climate change.<sup>8</sup> These temperature changes will have major effects on evaporation and precipitation in the state. The decreased availability of water statewide is likely to affect development, tourism and power production.

#### ECONOMIC IMPACTS

##### *Water Resources and the Economy*

Population growth and development drive Nevada's economy, increasing the needs for drinking water, recreation and hydroelectric power. Two million people rely on Lake Mead for daily water needs. The lake level has dropped considerably during the last 20 years, however, making it difficult to meet rising demand (see Figure 1). As of October 2007, both Lake Mead and Lake Powell, another major provider of Nevada water, stood at only 49 percent capacity.<sup>9</sup> Researchers at the Scripps Institution for Oceanography estimate that there is a 10 percent chance that Lake Mead will dry up by 2021 and a 50 percent chance it will be dry by 2050. Increased water consumption, evaporation and decreased water flow from the Colorado River have placed unsustainable strains on this water resource, and climate change is likely to exacerbate the problem. Without Lake Mead, it will become difficult for much of the region to deal with sustained droughts that may occur, leaving between 12 million to 36 million people without a secure water supply.<sup>10</sup>



Figure 1. Water Levels in Lake Mead Since 1980



Source: University of Nebraska-Lincoln, Applied Climate Sciences, www.hprcc.unl.edu/nebraska/Lake-Mead-2007.html.

Demonstrating its success in using water more efficiently, Nevada was able to successfully reduce water consumption by about 18 billion gallons from 2002 to 2006, despite a population surge of 330,000 in the southern part of the state and 40 million visitors.<sup>11</sup> Still, some scientists maintain that, if the current drought continues or if climate change occurs as predicted, drought contingency plans may not be enough to counteract the forces of climate.

A long-term regional water shortage could prove devastating to several economic sectors, challenging the state’s population and economic growth. Although population density in Nevada is relatively low (18 people per square mile), Las Vegas and Reno are densely populated, depend heavily on water and lack a steady water supply.<sup>12</sup> Growth in these areas will be difficult and continue to strain the water supply, due in part to climate change.

As water resources such as Lake Mead dwindle and possibly dry up, water resources will need to be directed to existing commercial and residential sites and could constrain further development. This would be a serious economic setback, since construction and related industries employ 17 percent of Nevada’s workforce—about 157,000 people.<sup>13</sup>

In 2004, the Southern Nevada Water Authority (SNWA) commissioned a study to explore the economic effects of restricting development and reducing population growth to manage water resources. According to the study, a reduction in Nevada construction-related sectors of 65 percent of the current level would translate into a loss of \$18.6 billion in federal, state and local tax revenue. Over 14 years, this translates into \$3.6 billion in lost revenue for state and local governments.<sup>14</sup> The resulting decrease in consumption and labor availability would cause an estimated loss of \$4.7 billion per year in wages, while the value of services and goods not

produced could total \$182.6 billion during this period.<sup>15</sup>

Halting economic development in Nevada obviously may not be economically viable. Four years after the SNWA study, drought continues, and water shortages, despite water conservation efforts, continue to pose severe problems for developers who are attempting to gain water rights for new housing and business development. A proposed solution to such water shortages involves constructing pipelines from eastern Nevada where water resources are available to the Las Vegas area at a cost of \$3.5 billion.

### Tourism

Leisure and hospitality are the largest economic sectors in Nevada, accounting for 27 percent of the state’s workforce.<sup>16</sup> In 2006, Las Vegas hosted almost 39.5 million tourists who spent \$41.62 billion.<sup>17</sup> The full affects of climate change on this sector are not yet fully known, but examples for outdoor recreation are presented below.

It is likely that outdoor recreational activities will be hardest hit by the effects of climate change. Outdoor activities in Nevada include fishing, bird hunting, wild life watching, hiking, water activities and golfing. Warmer temperatures and drought could negatively affect most of these activities. Local Las Vegas golf courses—used by three of every 10 tourists and others who spend \$1.1 billion annually on the sport—require significant water. Limited water resources could reduce golf course irrigation, resulting in a larger amount of brown grass, which could decrease tourists’ desire to choose Nevada as a vacation destination.<sup>18</sup> Nearly \$200 million and more than 1,100 jobs could be lost if climate change resulted in such impacts. Efforts are under way at some courses, however, to limit water demand by planting drought tolerant grass and native vegetation. Such changes have their own economic costs. Table 1 shows the potential economic effects on the golfing industry from fewer golfers due to drought.

Table 1. Effect on Southern Nevada Economy as a Result of Golf Course “Browning”

	Economic Output	# Jobs	Personal Income	Total Economic Impact
Southern Nevada Golf Industry	\$776,472,276	4,481	\$114,594,797	\$891,067,073
Losses if 25% choose not to golf in Nevada	\$194,118,069	1,120	\$28,648,699	\$222,766,768

Source: Zimmer, 2004.



Boating, fishing and water skiing are popular recreational activities on Lake Mead and Lake Mohave, which see approximately 8 million visitors annually. Lake Mead alone generates \$1 billion annually from tourism and recreation.<sup>19</sup> In the past, drastic droughts have diminished the economic revenue from water recreation on these lakes, and declining water levels already are having an effect. For example, Calville Bay is losing \$2 million per year due to the receding shoreline. National Park Service Rangers had to re-locate a marina and ferry service to another harbor to keep them in operation. Each 20 feet that the water level decreases is estimated to cost the National Park Service \$6 million.<sup>20</sup>

Drought also could affect biodiversity and nature-related tourism. Nevada state parks receive between 5,000 and 50,000 visitors per year, depending on the park, but increasing fire threat, especially during the peak season, may limit the number of tourists.<sup>21</sup>

## Health

Health issues related to warmer temperatures and water quality could develop in Nevada in the coming century. The urban heat island effect—the phenomena that causes cities to be 7° F to 10° F warmer than neighboring areas—has a detrimental effect on Las Vegas residents and tourists. An increase of only a few degrees in an already warm climate can cause heat stress in many more people. Higher temperatures also lead to more ground level ozone pollution, which increases asthma attacks, reduces lung function and can cause other respiratory diseases.

Another health risk posed to citizens as a result of diminishing water levels is higher concentrations of pollutants. Perchlorates—which can cause hyperthyroidism and other health effects—are found in particularly high concentrations in Lake Mead and along the Colorado River; these concentrations are likely to increase as water levels decline.<sup>22</sup>

## Agriculture

Agriculture represents a small part of the state's economy, but it is an important source of revenue for rural communities. Main crops include winter and spring wheat, barley, onions, garlic and potatoes. In 2006, the economic value of field and miscellaneous crops totaled \$231.81 million, while the value of livestock is \$2,339.40 million annually.<sup>23</sup> Nevada dairy operations produced 558 million pounds of milk in 2006.<sup>24</sup>

Higher temperatures and increased annual precipitation may lead to temporary increases in productivity and yield, mainly for low irrigation crops. The increasing unpredictability of the seasons and competition for water resources, however, could make agriculture a risky economic venture. Milk production and livestock development could suffer from heat waves and warmer temperatures. Additional economic pressure on the

agricultural sector are caused by the sale of water rights and farming land to accommodate the state's growing population.

## CONCLUSION

A critical assessment will be necessary to determine the possible population growth Nevada can undergo while sustaining available water resources. Decision makers may consider policies that examine the short- versus long-term economic costs of water management. Understanding climate change effects on water availability also will be crucial to balancing development and population growth in urban locations that have limited water supplies.

### MISSING INFORMATION AND DATA GAPS

General climate predictions relating to the entire state of Nevada must be made cautiously due to its variable topography. This study also is subject to uncertainties regarding climate change predictions and the potential effects. Many possible scenarios could result from climate change, so predicted economic effects could vary. Further research is necessary to examine the consequential effects of reduced population growth on the Nevada economy and the economic effects of the state's drought.





## NOTES

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