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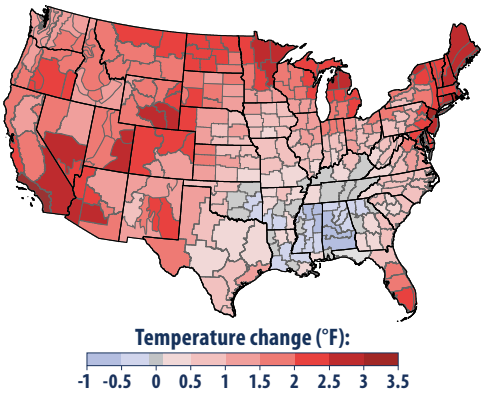
What Climate Change *Means for* Wyoming

Wyoming's climate is changing. In the past century, most of the state has warmed by one to three degrees (F). Heat waves are becoming more common, and snow is melting earlier in spring. Rising temperatures and recent droughts have killed many trees by drying out soils, increasing the risk of forest fires, or enabling outbreaks of forest insects. In the coming decades, the changing climate is likely to decrease the availability of water in Wyoming, affect agricultural yields, and further increase the risk of wildfires.

Our climate is changing because the earth is warming. People have increased the amount of carbon dioxide in the air by 40 percent since the late 1700s. Other heat-trapping greenhouse gases are also increasing. These gases have warmed the surface and lower atmosphere of our planet about one degree in the last 50 years. Evaporation increases as the atmosphere warms, which increases humidity, average rainfall, and the frequency of heavy rainstorms in many places—but contributes to drought in others.

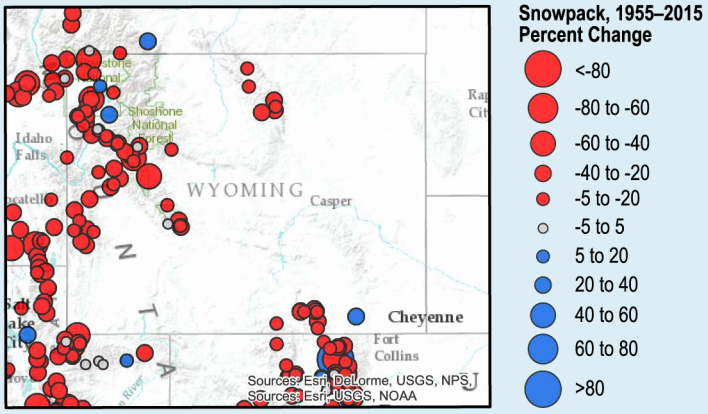
Greenhouse gases are also changing the world's oceans and ice cover. Carbon dioxide reacts with water to form carbonic acid, so the oceans are becoming more acidic. The surface of the ocean has warmed about one degree during the last 80 years, and sea level is rising at an increasing rate. Warming is causing snow to melt earlier in spring.



Rising temperatures in the last century. Wyoming has warmed more than most of the contiguous United States. Source: EPA, Climate Change Indicators in the United States.

Snowpack and Glaciers

As the climate warms, less precipitation falls as snow, and more snow melts during the winter. That decreases snowpack—the amount of snow that accumulates over the winter. Since the 1950s, the snowpack in Wyoming has been decreasing. Diminishing snowpack can shorten the season for skiing and other forms of winter tourism and recreation. The tree line may shift, as higher temperatures and a longer season without snow on the ground allow subalpine fir and other high-altitude trees to grow at higher elevations. A higher tree line would decrease the extent of alpine tundra ecosystems, which could threaten some species.



Trends in April snowpack in Wyoming, 1955–2013. The snowpack has declined at most monitoring sites in Wyoming. Source: EPA.

Wyoming's mountain ranges also contain 1,500 glaciers. As the climate warms, most of these glaciers will retreat and some could disappear altogether. Areas that are no longer covered by glaciers may still accumulate snowpack, but the snow will no longer remain year-round.

An unnamed glacier in the Wind River Range, along with some snowpack that has persisted into the summer. Credit: Sean D. Birkel, University of Maine.

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Precipitation and Water Resources

The changing climate is likely to increase the need for water without necessarily increasing the supply. Rising temperatures increase the rate at which water evaporates (or transpires) into the air from soils, plants, and surface waters. Irrigated farmland would thus need more water. But less water is likely to be available in the Green River Basin, because precipitation is unlikely to increase enough to make up for the additional water lost to evaporation. In other parts of the state, annual rainfall is likely to increase on average, but soils are likely to become drier, and periods without rain may become longer, making droughts more severe. In southeastern Wyoming, drier soils could lead farmers to withdraw more water from the High Plains Aquifer, which is already being depleted in other parts of the Great Plains.

The decline in snowpack could further limit the supply of water. Mountain snowpacks are natural reservoirs that collect the snow that falls during winter and release water when the snow melts during spring and summer. Dams capture most meltwater and retain it for use later in the year. But as the snowpack declines, less water is available upstream of these dams during droughts for ecosystems, water-based recreation, and riparian landowners who draw water directly from a natural lake or flowing river.

Agriculture

Rising temperatures, drier soils, and changing water availability are likely to present challenges for Wyoming's farms and cattle ranches. Hot weather causes cows to eat less and grow more slowly, and it can threaten their health. Reduced water availability would create challenges for ranchers, as well as farmers who irrigate crops. Although warmer and shorter winters may allow for a longer growing season, they may also promote the growth of weeds and pests, and shorten the dormancy for many winter crops, which creates the potential for crop losses due to spring freezes.

Wildfires

Higher temperatures and drought are likely to increase the severity, frequency, and extent of wildfires in Wyoming, which could harm property, livelihoods, and human health. On average, about 1.4 percent of the land in the state has burned per decade since 1984. Wildfire smoke pollutes the air and can increase medical visits for chest pains, respiratory problems, and heart problems.

Cattle grazing after the 2012 Fontenelle Fire west of Big Piney. Credit: University of Wyoming Extension.

Forests

Longer growing seasons and increased carbon dioxide concentrations could increase the productivity of forests, but warmer, drier conditions also make forests more susceptible to pests. Temperature controls the life cycle and winter mortality rates of pests such as bark beetles, which have infested millions of acres and killed millions of trees across the West in recent decades. With higher winter temperatures, some pests can persist year-round, and new pests and diseases may become established. Drought also reduces the ability of trees to mount a defense against attacks from beetles and other pests.

Human Health

By 2050, Wyoming is likely to have twice as many days above 100°F as it has today. Extremely hot and cold days can be unhealthy—even dangerous. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor. The elderly may be particularly prone to heat stress and other heat-related health problems, including dehydration, cardiovascular strain, and respiratory problems. Those with low incomes may be particularly vulnerable due to a lack of air conditioning. Power failures due to severe weather can also present risks, especially in lightly populated areas where access to necessary support services may be limited. While these risks will increase as the climate becomes warmer, illnesses, injuries, and deaths due to cold weather and snow are likely to decline.

The sources of information about climate and the impacts of climate change in this publication are: the national climate assessments by the U.S. Global Change Research Program, synthesis and assessment products by the U.S. Climate Change Science Program, assessment reports by the Intergovernmental Panel on Climate Change, and EPA's *Climate Change Indicators in the United States*. Mention of a particular season, location, species, or any other aspect of an impact does not imply anything about the likelihood or importance of aspects that are not mentioned. For more information about climate change science, impacts, responses, and what you can do, visit EPA's Climate Change website at www.epa.gov/climatechange.

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