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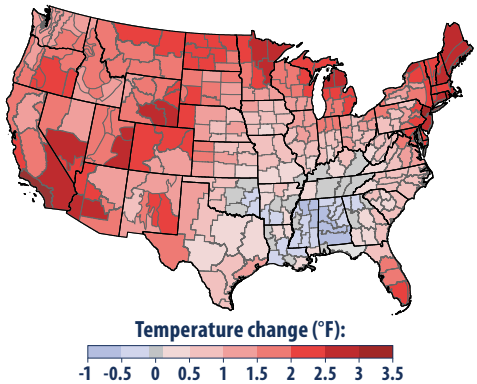
What Climate Change *Means for* South Dakota

South Dakota's climate is changing. In the past century, most of the state has warmed by one to two degrees (F). Rainstorms are becoming more intense, and annual rainfall is increasing. In the coming decades, summers are likely to become increasingly hot, which may amplify some risks to human health and decrease yields of some crops while lengthening the growing season for others.

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 during 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. The warming in South Dakota has been more than the average warming nationwide. Source: EPA, Climate Change Indicators in the United States.

Precipitation and Water Resources

Changing climate is likely to increase the demand for water and make it more available. Rising temperatures increase evaporation and water use by plants, which make soils drier. But rainfall is likely to increase enough to allow soil moisture to increase slightly or remain about the same as today. More water is likely to run off into the Missouri River and its tributaries.

The resulting increase in river flows could benefit recreational boating, public water supplies, and electric power generation. During droughts, decreased river flows can lower the water level in lakes and reservoirs, which may limit municipal water supplies and impair swimming, fishing, and other recreational activities. But if more water flows through the rivers before or during a drought, these problems will be less likely. Higher water flows also increase hydropower production, which accounts for almost 40 percent of the energy produced in South Dakota. Nevertheless, droughts are likely to become more severe in downstream states. When droughts lower water levels enough to impair navigation, the U.S. Army Corps of Engineers releases water from the upstream dams, making less water available to South Dakota.

Rising Temperature and Heavy Storms

Warmer air tends to have more water vapor, so more water can be potentially released in a storm. During the last 50 years, the amount of rain falling during the wettest four days of the year has increased about 15 percent in the Great Plains. Over the next several decades, heavy downpours will account for an increasing fraction of all precipitation. Larger river flows and more intense rainstorms would each increase the risk of flooding.

Scientists do not know how the frequency and severity of tornadoes will change. Rising concentrations of greenhouse gases tend to increase humidity, and thus atmospheric instability, which would encourage tornadoes. But wind shear is likely to decrease, which would discourage tornadoes. Research is ongoing to learn whether tornadoes will be more or less frequent in the future.

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Agriculture

Rising temperatures and changes in rainfall are likely to have both negative and positive effects on South Dakota's farms and ranches. Hot weather causes cows to eat less and grow more slowly, and it can threaten their health. Increased winter and spring precipitation could leave some fields too wet to plant, and warmer winters may promote the growth of weeds and pests. During drought years, hotter summers will dry the soil. Within 70 years, the frequency of days above 100°F is likely to double. Even where ample water is available, higher temperatures would reduce yields of corn in the warmest parts of the state.

The overall yield of corn, however, is likely to increase in cooler parts of the Great Plains. Although higher temperatures would reduce yields of wheat and soybeans, increased concentrations of carbon dioxide are likely to increase yields enough to offset the impact of higher temperatures. Increased precipitation at the beginning of the growing season could also benefit some crops. Warmer and shorter winters may allow for a longer growing season, which could allow two crops per year instead of one in some instances. Warmer winters may also benefit cattle, offsetting some of the harm from hotter summers: during the winter of 1996–1997, for example, high winds and heavy snow killed half of the newborn calves and 100,000 adult cows in the northern Great Plains.

Forests

Longer growing seasons and increased carbon dioxide concentrations could increase the productivity of forests. Although forests generally benefit from higher productivity, warmer conditions make forests more susceptible to pests. Temperature controls the life cycle and winter mortality rates of pests such as bark beetles, which have infested and killed trees in the Black Hills in recent decades. With higher winter temperatures, some pests can persist year-round, and new pests and diseases may become established.

Trees killed by a mountain pine beetle infestation in the Black Hills. Credit: Blaine Cook, USDA Forest Service.

Human Health

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 the necessary support services may be limited. While these risks will increase as the climate becomes warmer, illnesses and deaths due to cold weather and snow are likely to decline.

Climate change may also increase the length and severity of the pollen season for allergy sufferers. For example, the ragweed season in the northern Great Plains and Upper Midwest is now 10 to 21 days longer than it was in 1995, because the first frost in fall is later.

A photo of a ragweed plant, a common source of allergens in South Dakota. Like many crops and pollen sources, ragweed will have a longer growing season as temperatures rise. Stock photo.

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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