US EPA ARCHIVE DOCUMENT

United States Environmental Protection Agency

August 2016

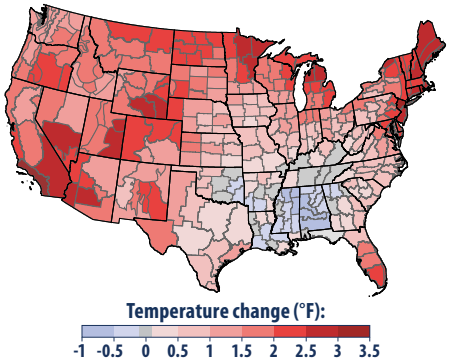
EPA 430-F-16-038

What Climate Change *Means for* Oklahoma

In the coming decades, **Oklahoma** will become warmer, and both floods and droughts may be more severe. Most of Oklahoma did not become warmer during the last 50 to 100 years. But soils have become drier, annual rainfall has increased, and more rain arrives in heavy downpours. In the coming decades, summers are likely to be increasingly hot and dry, which would reduce the productivity of farms and ranches, change parts of the landscape, and possibly harm human health.

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.

While most of the earth warmed during the last century, natural cycles and sulfates in the air cooled eastern Oklahoma. Sulfates are air pollutants that reflect sunlight back into space. Now sulfate emissions are declining, and the factors that once prevented parts of the state from warming are unlikely to persist.



Changing temperatures in the last century. While most of the nation has warmed, eastern Oklahoma has cooled. Source: EPA, Climate Change Indicators in the United States.

Precipitation and Water Resources

Changing the climate is likely to increase the demand for water but make it less available. As rising temperatures increase evaporation and water use by plants, soils are likely to become even drier. Average rainfall is likely to decrease during spring and summer. Seventy years from now, the longest period without rain each year is likely to be at least three days longer than it is today. Increased evaporation and decreased rainfall are likely to reduce the average flow of rivers and streams.

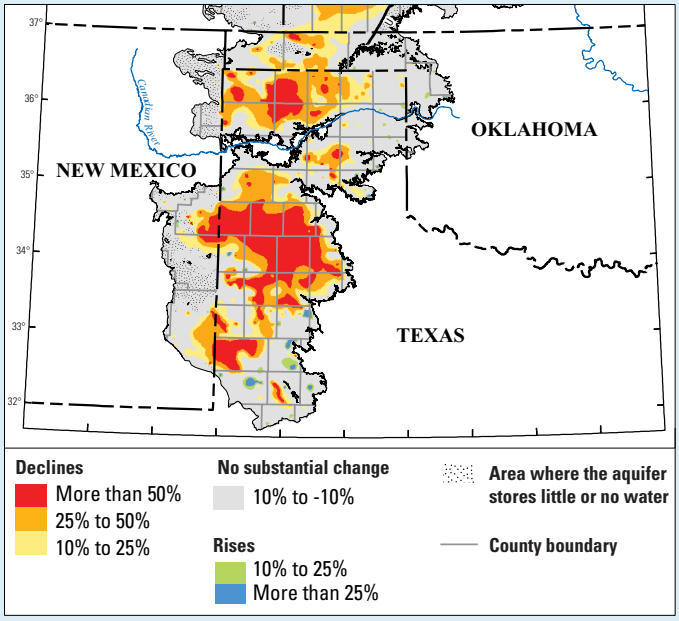
Drier soils will increase the need for farmers to irrigate their crops, but sufficient water might not be available. Approximately 16 percent of Oklahoma's farmland is irrigated. In the Panhandle, most irrigation water is ground water from the High Plains Aquifer System. As a result, this aquifer is becoming depleted. Since the 1950s, the amount of water stored in the aquifer has declined by more than 25 percent in parts of the Panhandle. (See map on back page.)

Decreased river flows can create problems for navigation, recreation, public water supplies, and electric power generation. Commercial navigation can be suspended during droughts when there is too little water to keep channels deep enough for barge traffic. Decreased river flows can also lower the water level in lakes and reservoirs, which may limit municipal water supplies; impair swimming, fishing, and other recreational activities; and reduce hydroelectric power generation. Conventional power plants also need adequate water for cooling. Compounding the challenges for electric utilities, rising temperatures are expected to increase the demand for electricity for air conditioning.

Agriculture

Increasing droughts and higher temperatures are likely to interfere with Oklahoma'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 such as wheat. Yields are likely to decline by about 50 percent in fields that can no longer be irrigated. The early flowering of winter wheat could have negative repercussions on livestock farmers who depend on it for feed.

A dry cornfield in Canadian County during the 2011 drought. Credit: Ron Hays, Oklahoma Farm Report.



Percent depletion of ground water in the High Plains Aquifer, 1950–2013. Source: USGS.

Rainstorms and Tornadoes

Although summer droughts are likely to become more severe, floods may also intensify. 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, the amount of rainfall during the wettest days of the year is likely to continue to increase, which would increase flooding.

Three days of heavy rain in May 2013 led to flooding in Henryetta (shown here) and other communities. Credit: Bruce Jones, The Henryettan.

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. Because Oklahoma experiences about 60 tornadoes a year, such research is closely followed by meteorologists in the state.

Hot Weather, Air Pollution, and Human Health

Hot days can be unhealthy—even dangerous. Seventy years from now, Oklahoma is likely to have three to four times as many days above 100°F as it has today. 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 lung problems. Those with low incomes may also be vulnerable if they lack air conditioning.

Rising temperatures can also increase the formation of ground-level ozone, a key component of smog. Ozone has a variety of health effects, aggravates lung diseases such as asthma, and increases the risk of premature death from heart or lung disease. EPA and the Oklahoma Department of Environmental Quality have been working to reduce ozone concentrations. As the climate changes, continued progress toward clean air will become more difficult.

Wildfires and Landscape Change

Higher temperatures and drought are likely to increase the severity, frequency, and extent of wildfires, which could harm property, livelihoods, and human health. On average, more than 1 percent of the land in Oklahoma has burned each decade since 1984. Wildfire smoke pollutes the air and can increase medical visits for chest pains, respiratory problems, and heart problems.

The combination of more fires and drier conditions may change parts of Oklahoma's landscape. Many plants and animals living in the dry lands of western Oklahoma are already near the limits of what they can tolerate. In some cases, native vegetation may persist as the climate changes. But when fire destroys the natural cover, the native grasses and woody plants may be replaced by non-native grasses, which can become established more readily after a fire. Because non-native grasses are generally more prone to intense fires, native plants may be unable to re-establish themselves.

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.

US EPA ARCHIVE DOCUMENT