22 Northern Great Plains

Cameron, Montana

Key Message 1

Water

Water is the lifeblood of the Northern Great Plains, and effective water management is critical to the region's people, crops and livestock, ecosystems, and energy industry. Even small changes in annual precipitation can have large effects downstream; when coupled with the variability from extreme events, these changes make managing these resources a challenge. Future changes in precipitation patterns, warmer temperatures, and the potential for more extreme rainfall events are very likely to exacerbate these challenges.

Key Message 2

Agriculture

Agriculture is an integral component of the economy, the history, and the culture of the Northern Great Plains. Recently, agriculture has benefited from longer growing seasons and other recent climatic changes. Some additional production and conservation benefits are expected in the next two to three decades as land managers employ innovative adaptation strategies, but rising temperatures and changes in extreme weather events are very likely to have negative impacts on parts of the region. Adaptation to extremes and to longer-term, persistent climate changes will likely require transformative changes in agricultural management, including regional shifts of agricultural practices and enterprises.

Key Message 3

Recreation and Tourism

Ecosystems across the Northern Great Plains provide recreational opportunities and other valuable goods and services that are at risk in a changing climate. Rising temperatures have already resulted in shorter snow seasons, lower summer streamflows, and higher stream temperatures and have negatively affected high-elevation ecosystems and riparian areas, with important consequences for local economies that depend on winter or river-based recreational activities. Climate-induced land-use changes in agriculture can have cascading effects on closely entwined natural ecosystems, such as wetlands, and the diverse species and recreational amenities they support. Federal, tribal, state, and private organizations are undertaking preparedness and adaptation activities, such as scenario planning, transboundary collaboration, and development of market-based tools.

Key Message 4

Energy

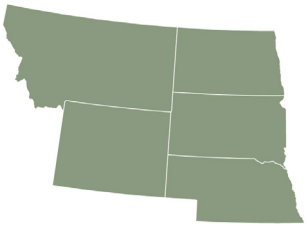
Fossil fuel and renewable energy production and distribution infrastructure is expanding within the Northern Great Plains. Climate change and extreme weather events put this infrastructure at risk, as well as the supply of energy it contributes to support individuals, communities, and the U.S. economy as a whole. The energy sector is also a significant source of greenhouse gases and volatile organic compounds that contribute to climate change and ground-level ozone pollution.

Key Message 5

Indigenous Peoples

Indigenous peoples of the Northern Great Plains are at high risk from a variety of climate change impacts, especially those resulting from hydrological changes, including changes in snowpack, seasonality and timing of precipitation events, and extreme flooding and droughts as well as melting glaciers and reduction in streamflows. These changes are already resulting in harmful impacts to tribal economies, livelihoods, and sacred waters and plants used for ceremonies, medicine, and subsistence. At the same time, many tribes have been very proactive in adaptation and strategic climate change planning.

Executive Summary



In the Northern Great Plains, the timing and quantity of both precipitation and runoff have important consequences for water supplies, agricultural activities, and energy production. Overall, climate projections suggest that the number of heavy precipitation events (events with greater than 1 inch per day of rainfall) is projected to increase. Moving forward, the magnitude of year-to-year variability overshadows the small projected average decrease in streamflow. Changes in extreme events are likely to overwhelm average changes in both the eastern and western regions of the Northern Great Plains. Major flooding across the basin in 2011 was followed by severe drought in 2012, representing new and unprecedented variability that is likely to become more common in a warmer world.

The Northern Great Plains region plays a critical role in national food security. Among other anticipated changes, projected warmer and generally wetter conditions with elevated atmospheric carbon dioxide concentrations are expected to increase the abundance and competitive ability of weeds and invasive species,[1,2] increase livestock production and efficiency of production,[3] and result in longer growing seasons at mid- and high latitudes.[4,5] Net primary productivity, including crop yields[6] and forage production,[7,8] is also likely to increase, although an increasing number of extreme temperature events during critical pollination and grain fill periods is likely to reduce crop yields.[9]

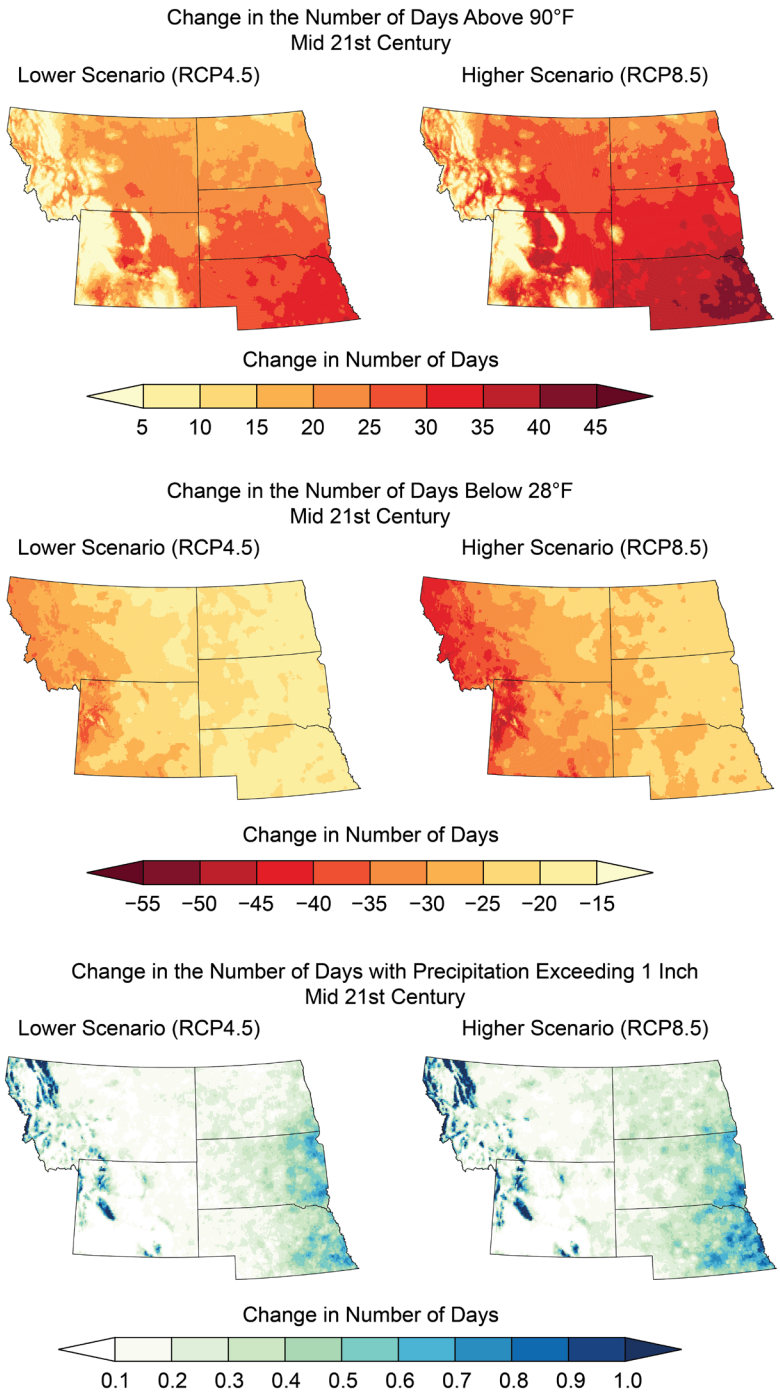
Ecosystems across the Northern Great Plains provide recreational opportunities and other valuable goods and services that are ingrained in the region's cultures. Higher temperatures, reduced snow cover, and more variable precipitation will make it increasingly challenging to manage the region's valuable wetlands, rivers, and snow-dependent ecosystems. In the mountains of western Wyoming and western Montana, the fraction of total water in precipitation that falls as snow is expected to decline by 25% to 40% by 2100 under a higher scenario (RCP8.5),[10] which would negatively affect the region's winter recreation industry.[11] At lower-elevation areas of the Northern Great Plains, climate-induced land-use changes in agriculture can have cascading effects on closely entwined natural ecosystems, such as wetlands,[12] and the diverse species and recreational opportunities they support.

Energy resources in the Northern Great Plains include abundant crude oil, natural gas, coal, wind, and stored water, and to a lesser extent, corn-based ethanol, solar energy, and uranium. The infrastructure associated with the extraction, distribution, and energy produced from these resources is vulnerable to the impacts of climate change. Railroads and pipelines are vulnerable to damage or disruption from increasing heavy precipitation events and associated flooding and erosion.[13] Declining water availability in the summer would likely increase costs for oil production operations, which require freshwater resources.[13] These cost increases will either lead to lower production or be passed on to consumers. Finally, higher maximum temperatures, longer and more severe heat waves, and higher overnight lows are expected to increase electricity demand for cooling in the summer, further stressing the power grid.[13]

Indigenous peoples in the region are observing changes to climate, many of which are impacting livelihoods as well as traditional subsistence and wild foods, wildlife, plants and water for ceremonies, medicines, and health and well-being.[14,15,16,17,18,19,20,21,22,23,24,25,26] Because some tribes and Indigenous peoples are among those in the region with the highest rates of poverty and unemployment, and because many are still

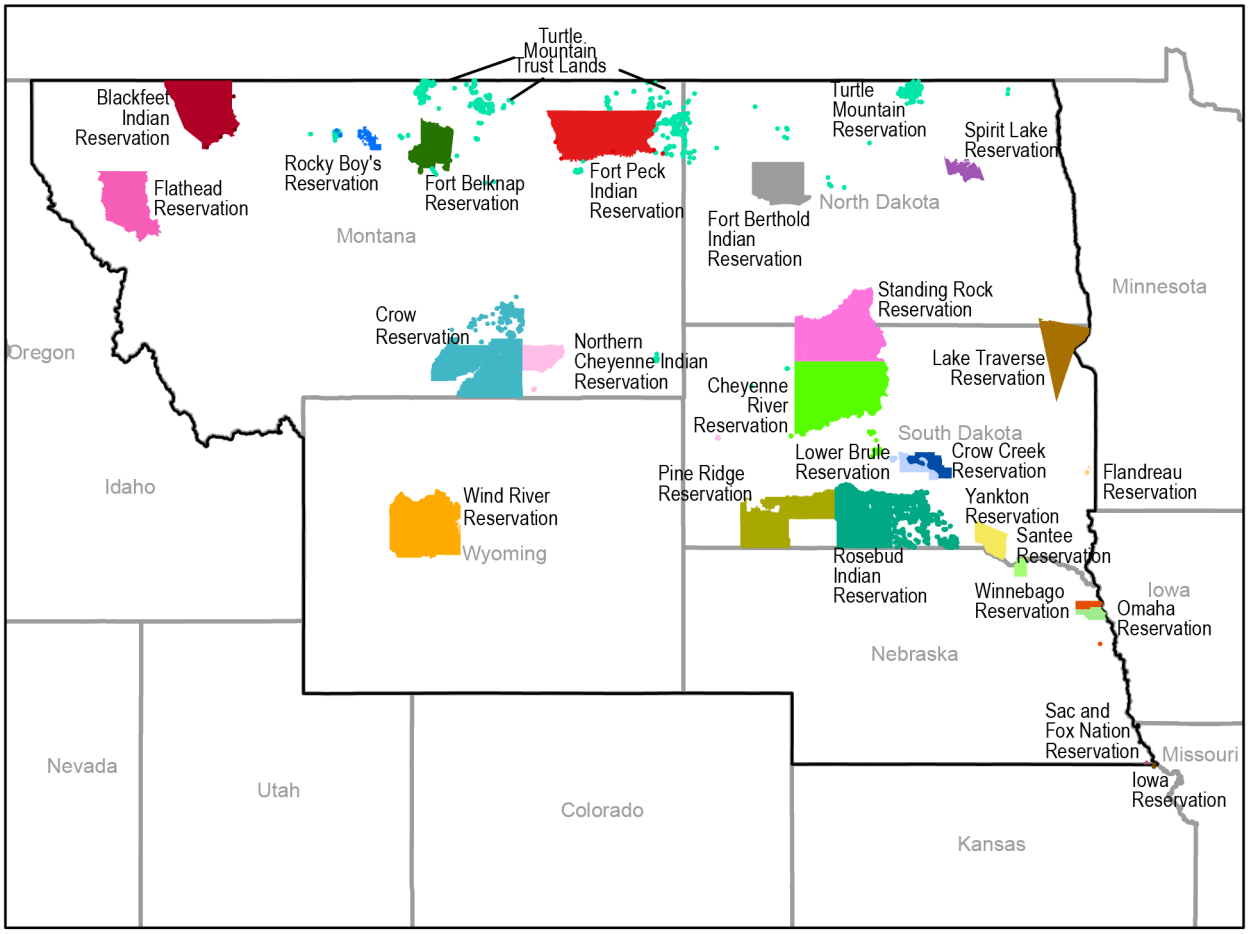
directly reliant on natural resources, they are among the most at risk to climate change (e.g., Gamble et al. 2016, Cozzetto et al. 2013, Espey et al. 2014, Wong et al. 2014, Kornfeld 2016, Paul and Caplins 2016, Maynard 2014, USGCRP 2017[18,24,25,27,28,29,30,31]).

Projected Changes in Very Hot Days, Cool Days, and Heavy Precipitation



Projected changes are shown for (top) the annual number of very hot days (days with maximum temperatures above 90°F, an indicator of crop stress and impacts on human health), (middle) the annual number of cool days (days with minimum temperatures below 28°F, an indicator of damaging frost), and (bottom) heavy precipitation events (the annual number of days with greater than 1 inch of rainfall; areas in white do not normally experience more than 1 inch of rainfall in a single day). Projections are shown as changes from the 1976–2005 average for the middle of the 21st century (2036–2065) for the lower and higher scenarios (RCP4.5 and RCP8.5). *From Figure 22.2 (Sources: NOAA NCEI and CICS-NC)*.

Northern Great Plains Tribal Lands



The map outlines reservation and off-reservation tribal lands in the Northern Great Plains, which shows where the 27 federally recognized tribes have a significant portion of lands throughout the region. Information on Indigenous peoples' climate projects within the Northern Great Plains is described in Chapter 15: Tribes and Indigenous Peoples. *From Figure 22.7 (Sources: created by North Central Climate Science Center [2017] with data from the Bureau of Indian Affairs, Colorado State University, and USGS National Map)*.