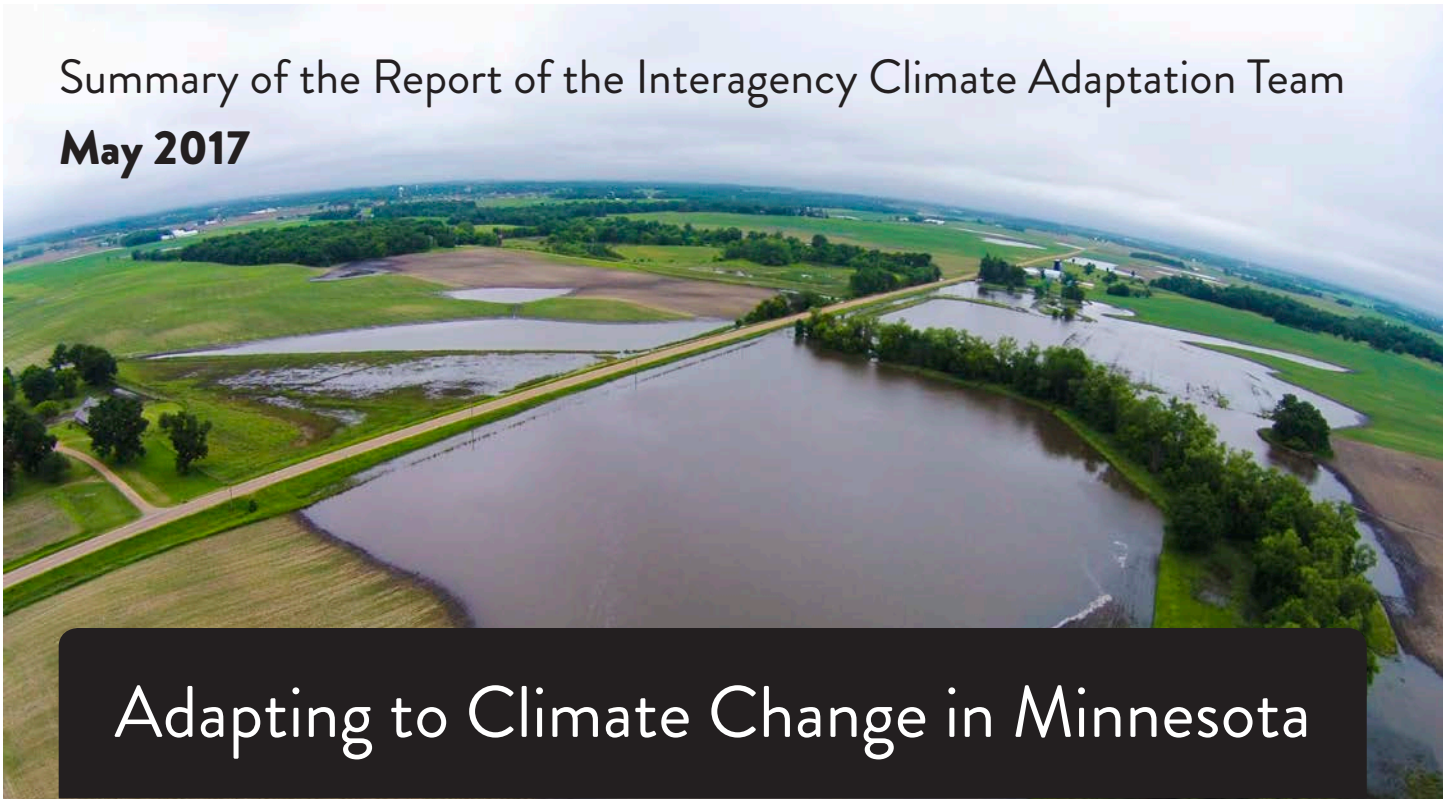
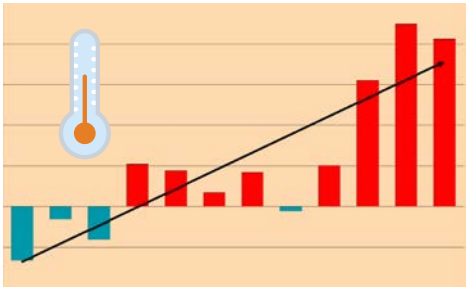
Summary of the Report of the Interagency Climate Adaptation Team

May 2017



Adapting to Climate Change in Minnesota



Our climate is changing

Climate change is already occuring in Minnesota and its impacts are affecting our state's environment, economy, and communities.

Over the last several decades, the state has experienced substantial warming during winter and at night, with increased precipitation throughout the year, often from larger and more frequent heavy rainfall events.

In the years and decades ahead, winter warming and increased extreme rainfall will continue to be Minnesota's two leading symptoms of climate change.

How we're adapting

Minnesota is taking many steps to increase climate adaptation in our state, including a wide range of planning, assessment, and implementation efforts.

This report summarizes ongoing adaptation activities in eleven Minnesota state agencies, including the Departments of Agriculture, Commerce, Health, Military Affairs, Natural Resources, Homeland Security and Emergency Management, and Transportation, as well as the Environmental Quality Board, Pollution Control Agency, Board of Water and Soil Resources, and Metropolitan Council.

Planning for the future

State agencies have developed five statewide climate adaptation indicators to help track Minnesota's progress in climate adaptation.

The Interagency Climate Adaptation Team has also identified six priority recommendations for needed action in climate adaptation by state government. These focus on resilience to extreme precipitation, health of vulnerable populations, preserving ecosystems, strengthening agricultural water management, managing climate impacts in population centers, and better using climate data.

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Minnesota's climate is changing

Minnesota's position near the center of North America subjects us to an exceptional variety of weather. During the course of a single year, most Minnesotans will experience blinding snow, bitter wind chills, howling winds, pounding thunderstorms, torrential rains and heat waves, as well as dozens of bright and sunny days.

The conditions, however, have changed rapidly, and an overwhelming base of scientific evidence projects that Minnesota's climate will see additional significant changes through the end of the 21st century. Over the last several decades, the state has experienced substantial warming during winter and at night, with increased precipitation throughout the year, often from larger and more frequent heavy rainfall events. These changes alone have damaged buildings and infrastructure, limited recreational opportunities, altered our growing seasons, impacted natural resources, and affected the conditions of lakes, rivers, wetlands, and our groundwater aquifers that provide water for drinking and irrigation. The years and decades ahead in Minnesota will bring even warmer winters and nights, and even larger rainfalls, in addition to other climatic changes not yet experienced in the state.

In 2014, the U.S. Global Change Research Program completed its third National Climate Assessment. Both the science summarized in the National Climate Assessment and high-quality climatic data show that in Minnesota and the Midwest, rising temperatures have been driven by a dramatic warming of winter and also nights, with both the frequency and the severity of extreme cold conditions declining rapidly. Annual precipitation increases have been punctuated by more frequent and more intense heavy rainfall events. The heaviest snowstorms have also become larger, even as winter has warmed.

Several other changes noted elsewhere in the U.S. and world have not yet been observed in Minnesota. For instance, summer high temperatures have not increased in several decades, and heat waves have not worsened when compared to historical patterns. Droughts in Minnesota also have shown no long-term increase in magnitude, duration, or geographic coverage. Tornadoes, large hail, and damaging thunderstorm winds are difficult to compare historically but show a complex tendency towards more "outbreaks" consisting of multiple events at a time, though no increases in overall numbers or severity.

We're already seeing the impacts of climate change in Minnesota: **increased rain and higher temperatures**. Projections say these trends will continue in the decades ahead, accompanied by **other changes** we have yet to encounter.

In the years and decades ahead, winter warming and increased extreme rainfall will continue to be Minnesota's two leading symptoms of climate change. Climate models used in the 2014 National Climate Assessment also project that Minnesota will have a greater tendency toward extreme heat, especially by the middle of the 21st century. The future drought situation in Minnesota is less clear and appears to depend on how much greenhouse gas emissions increase by mid-century.

Hazard	Projections through century	Confidence in projected changes
Extreme cold	Continued loss of cold extremes and dramatic warming of coldest conditions	Highest
Extreme rainfall	Continued increase in frequency and magnitude; unprecedented flash-floods	
Heat waves	More hot days with increases in severity, coverage, and duration of heat waves	High
Drought	More days between precipitation events, leading to increased drought severity, coverage, and duration	Moderately High
Heavy snowfall	Large events less frequent as winter warms, but occasional very large snowfalls	Moderately low
Severe thunderstorms & tornadoes	More "super events" possible, even if frequency decreases	

Confidence scale: Lowest > Low > Moderately low > Moderately high > High > Highest

Snapshot of projected and expected trends among common weather hazards in Minnesota, and confidence that those hazards will change (further) through the year 2099 in response to climate change. Graphic based on information from the 2014 National Climate Assessment, and data analyzed by the Minnesota DNR State Climatology Office.

How we're adapting

Based on state agency understanding of climate trends, agencies participating in the Interagency Climate Adaptation Team (ICAT) are now implementing programs to address climate impacts. Here are some of the examples highlighted in the report.

The Minnesota Department of Commerce implements the **Weatherization Assistance Program** providing free home energy upgrades to income-eligible homeowners and renters to help save energy and ensure their homes are healthy and safe. Better insulation builds resilience to heat and cold while also lowering energy bills and greenhouse gas emissions.

The Minnesota Pollution Control Agency, in partnership with Conservation Corps Minnesota, supports **community resilience projects through Youth Outdoors and the Summer Youth Corps**. These projects focus on new green infrastructure in underserved urban neighborhoods and in cities throughout the state. The work helps to reduce stormwater runoff, improve air quality, add pollinator habitat, and increase shaded areas.

The Minnesota Department of Transportation conducted a **climate vulnerability assessment pilot project** as supported by the Federal Highway Administration to examine the effects of climate hazards on transportation systems. The project team scored and ranked 316 bridges, 521 large culverts, 920 pipes, and approximately 45 miles of road segments in MnDOT districts in southeast and northeast Minnesota.

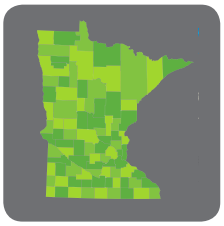
The Minnesota Board of Water and Soil Resources worked with **four landowners and state, federal and local agencies to restore wetlands**, an important approach for adapting to climate change by increasing the resiliency of watersheds. Hydrology restoration and planting diverse seed mixes decreases downstream flooding by retaining water from large storms while also increasing wildlife habitat.

Metropolitan Council **maintains and rehabs its wastewater infrastructure** to ensure the system has capacity to handle future demands and support communities' efforts to reduce excessive flows through inflow and infiltration (I/I) reduction strategies. Efforts by communities, property owners, and the Council have helped to reduce volumes even as precipitation, rainfall intensities, and populations have increased.

Planning for the future

► Statewide climate adaptation indicators

With the goal of better tracking and monitoring Minnesota's climate adaptation progress, ICAT developed five statewide indicators in late 2015 using the Results-Based Accountability process. ICAT established baselines and data sources for each of these indicators in fall 2016.



1. Climate adaptation planning by state agencies, local and tribal governments.

2. Disruptions to the power grid.

3. Emergency department data for heat-related health impacts.

4. Inflation adjusted damages from extreme weather.

5. Canopy cover of urban and community forests.

► Recommendations for action

ICAT's vision is of a resilient, economically thriving, and healthy Minnesota that is prepared for both short- and long-term climate changes and weather extremes. The team recognizes that building a resilient Minnesota in the face of a changing climate is a complex challenge.

While Minnesota state agencies are carrying out a wide range of activities related to adaptation as described in this report, additional opportunities also exist for agencies to increase collaborative efforts on this issue. ICAT has identified the following priority recommendations for needed action in climate adaptation by state government. ICAT will work in 2017 to further flesh out priority actions and work plans related to these recommendations.

Build greater resilience to extreme precipitation.

Identify ways to support health of vulnerable populations through state and local government cooperation.

Increase focus on preserving terrestrial and aquatic habitat to increase resilience of wildlife and native plants.

Strengthen agricultural water management efforts to increase resilience to climate change impacts.

Increase focus on managing climate impacts in cities, towns, and other population centers.

Strengthen our climate information infrastructure to support climate adaptation practices.

In addition to the specific recommendations above, ICAT also recommends that Minnesota state government accelerate the incorporation of climate adaptation into all aspects of state agency operations. This can be accomplished through a variety of methods, such as Governor's Executive Orders, Legislative directives, commissioner-led agency operational orders, agency strategic planning processes, program budgeting and development, and staff training.

ICAT also recognizes that state government will not be able to fully achieve the complex and evolving goal of climate adaptation on its own. It will be necessary and important to build and nurture partnerships on climate adaptation among state government and federal, tribal, and local governments, higher educational institutions, the private sector, nonprofit organizations, community members, and other collaborators. As a vehicle for focusing this collaboration, ICAT recommends that Minnesota state government engage in a comprehensive effort along with public and private partners to develop a multistakeholder statewide climate adaptation plan by 2020.