

Background Information for Climate Change Risk Assessments

Minnesota Climate Trends from the DNR State Climatology Office

An excellent PDF Presentation and Presentation Audio: Understanding Minnesota's Changing Climatology by Kenneth Blumenfeld, Senior Climatologist with the DNR State Climatology Office at: <u>http://www.mgwa.org/mgwa-conferences/</u> <u>mgwa-2018-fall-conference/</u> explains what the data shows about climate change trends in Minnesota.

Another great resource is the new DNR Climate Trends website, which includes the following information:

https://www.dnr.state.mn.us/climate/climate_chan ge_info/climate-trends.html

Minnesota's climate already is changing rapidly and will continue to do so for the foreseeable future. Temperatures are increasing -- especially in winter -- and larger, more frequent extreme precipitation events are occurring.

Substantial warming during winter and at night, increased precipitation, and heavier downpours already 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 decades ahead will bring even warmer winters and nights, and even larger rainfalls, along with the likelihood of increased summer heat and the potential for longer dry spells.

Minnesota keeps getting warmer and wetter Minnesota has warmed by 2.9F between 1895 and 2017, while getting an average of 3.4 inches wetter. While Minnesota has gotten warmer and wetter since 1895, the most dramatic changes have come in the past several decades. Compared to 20th century averages, all but two years since 1970 have been some combination of warm and wet, and each of the top-10 combined warmest and wettest years on record occurred between 1998 and 2017. Although climate conditions will vary from year to year, these increases are expected to continue through the 21st century.

More damaging rains

Heavy rains are now more common in Minnesota and more intense than at any time on record. Longterm observation sites have seen dramatic increases in 1-inch rains, 3-inch rains, and the size of the heaviest rainfall of the year. Since 2000, Minnesota has seen a significant uptick in devastating, large-area extreme rainstorms as well. Rains that historically would have been in the 98th percentile annually (the largest 2%) have become more common. Climate projections indicate these big rains will continue increasing into the future.

Cold weather warming

Most of Minnesota's observed warming has been when it's coolest. Since 1970, winter has warmed 13 times faster than summer, and nights have warmed 55% faster than days. The frequencies of -35F readings in northern Minnesota and -25F readings in the south have fallen by up to 90%. We do not get as cold as we once did, and even though Minnesota always will see periodic severe cold spells, the long-term decline in cold extremes is all but guaranteed to continue.

Beyond 2025, Minnesota can expect a continued rapid decline in extreme cold, and unprecedented extreme rainfall events. Additionally, there are anticipated increases in the severity, coverage and duration of heat waves, and the possibility of increases in the severity, coverage and duration of drought. Examples of Climate Change Impacts Already Being Experienced in Minnesota



Photo above: Following 2016 summer flooding, the MPCA established a temporary solid waste transfer station at the Waseca County fairgrounds to collect and dispose of debris left behind by flood waters.



Photo above: Eastern larch beetles, a tiny bug native to Minnesota, have killed or damaged more than a quarter million acres of tamarack trees in the state. Scientists who studied the bug say the population is growing exponentially because longer, warmer summers now allow them to produce two generations a year, and warmer winters mean more of them survive to reproduce the next year.



Photo above: Wanamingo Public Works employees use a pump to clear floodwater from the sewage plant near the Zumbro River in late September 2016. *Jerry Olson for MPR News*



Photo above: Haze and smoke from western wildfires obscured the downtown Minneapolis skyline in late August 2018. *Evan Frost MPR News*



Photo above: 2007 harvest near Sawyer. There was no wild rice harvest on the Fond du Lac reservation in 2012 because June's massive rainstorm flooded the wild rice too long for it to recover.

Current and Anticipated Impacts of Changes in Minnesota's Climate

Impacts directly relevant to MPCA programs, customers, stakeholders, or mission that already are occurring and expected in the future include (but are not all-inclusive):

- Degradation of forests and community trees which among other effects will likely be detrimental for surface water quality
- Repeated freeze/thaw cycles with resulting damage to the built infrastructure and possibly additional chloride contamination
- Flooding and high water tables leading to wastewater overflows and bypasses, system failures, erosion and sedimentation (possibly contributing to toxic algal blooms)
- Warming surface water bodies affecting water quality, aquatic species, and possibly contributing to toxic algal blooms
- Increasing incidents of wildfire smoke plumes reducing air quality
- More solid and hazardous waste generated from increase in extreme precipitation events

Impacts directly relevant to MPCA programs, customers, stakeholders, or mission that are expected in the future include (but are not all inclusive):

- More incidents of infrastructure failure from extreme temperatures
- Increased ozone formation in population centers from higher temperatures and exacerbated by the urban heat island effect
- More local wildfires during episodes of high heat and drought
- Higher heat index values will worsen urban heat island impacts and threaten human health
- Additional threats to water quality and water supply from extended heat waves and drought

Climate Adaptation: Excerpts from the Fourth National Climate Assessment Chapter 28 See full document at:

https://nca2018.globalchange.gov/chapter/28/

From the Introduction:

Adaptation refers to actions taken at the individual, local, regional, and national levels to reduce risks from even today's changed climate conditions and to prepare for impacts from additional changes projected for the future.

Adaptation is a form of risk management. Risk is sometimes defined as the likelihood of an event's occurrence multiplied by a measure of its consequences for human and natural systems. But because the probabilities and consequences of climate change threats are often not known with precision, it is useful to define risk more broadly as "the potential for adverse consequences when something of value is at stake, and the outcome is uncertain." Risk arises from the combination of exposure to climate hazards, sensitivity to those hazards, and adaptive capacity. Adaptation can, however, provide significant societal benefits, reducing by more than half the cost of climate impacts in some sectors.

Adaptation involves managing both short- and longterm risks. Many important climate-influenced effects have already changed due to past greenhouse gas (GHG) emissions and will continue to change in the decades ahead even if GHG emissions were to stop immediately.

Integrating climate risk management into existing design, planning, and operations workflows (also called mainstreaming) can provide many adaptation benefits. Additional climate risk reduction, particularly under the most severe longer-term climate change projections, emphasizes the need for more and more significant changes to regulatory and policy environments at all scales, to cultural and community resource planning, to economic and financial systems, to technology applications, and to ecosystems.