

THE POWER OF CLIMATE CHANGE

Minnesota Meteorologists Explain Climate Change

Minnesotans love to talk about the weather. But when weather patterns change, experts encourage people to shift their conversations to climate change.



"Climate is what you expect. Weather is what you get. Climate change tilts the odds towards extreme weather, the way steroids pump up a baseball player. You can't prove any single home run was sparked by steroid use, but you did see how it increased the player's batting average."

Paul Douglas,
Meteorologist



"When I see changes in data from our own backyard, I take notice."

Dr. Mark Seeley,
University of Minnesota
Extension Climatologist
and Meteorologist

By the Numbers

For decades, Dr. Mark Seeley and other climatologists have tracked three climate trends—**rising temperatures, extreme storms and higher dew points**—driving the frequency and intensity of **extreme weather** in Minnesota.

Temperatures Are Rising

The temperature in Minnesota has increased 1°F to 2°F since the 1980s, after decades of essentially no change. The closer to the present that the trend is assessed, the greater the rate of observed increase.

Projected increases: 2°F to 6°F more by 2050 and 5°F to 10°F by 2100.

Extreme Storms

Yearly frequency of the largest storms—those with three inches or more of rainfall in a single day—have more than doubled in just over 50 years.

In the past decade, such dramatic rains have increased by more than 70%.

Scientists project that extreme weather events will occur more frequently.

Dew Points Are Higher

Dew point measures the air's moisture. When dew point temperatures reach 70-plus degrees Fahrenheit they are tropical. We are experiencing greater frequency of 70°F dew points. When the dew point and air temperature are high, so is the heat index, a measure of how the temperature feels with the two combined.

Minnesota had never recorded an 80°F dew point until the summer of 1966. Since then, 80°F dew points have occurred more frequently.



Seven of Minnesota's 10 warmest years occurred in the last 15 years.



Since 2004, Minnesota has had three 1,000-year flash floods.



On July 19, 2011, Moorhead was the hottest, most humid spot on Earth. Its 88°F dew point and 134°F heat index eclipsed the Amazon Jungle—the only other place in the Western Hemisphere with a dew point in the 80s.

How We Cause Climate Change

Ninety-seven percent of scientists—including the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA)—agree that humans are causing climate change.

"Changes in temperature, precipitation patterns, snow and ice cover, and sea level have naturally happened throughout history," Dr. Mark Seeley said. "What's different now is how quickly changes are happening, given increasing levels of greenhouse gases in the atmosphere."

Burning fossil fuels (oil, coal, natural gas) to run our power plants, vehicles and factories produces carbon dioxide, the most predominant greenhouse gas. The Earth's atmosphere acts like a pane of glass in a greenhouse, trapping the sun's heat in the lower atmosphere and causing the Earth's surface to warm.

Minnesota Experts and Economists Raise Flags

While total costs of some climate change impacts, such as heat-related illnesses and water quality issues, are still unknown, two costs are hitting people's pocketbooks now.

Already Paying the Price for Climate Change

The cost associated with climate change is real—not just a projection for the future. We are already paying the price.

Climate change makes weather events like severe drought more likely and is causing sea levels to rise.

As the frequency and intensity of extreme weather increases, so do our home insurance rates, the number heat-related health emergencies, and disturbances to our crops and other industries.



Disaster Costs

We also pay the costs of responding to climate-related emergency situations and rebuilding afterwards.

Since 1997, 32 severe weather natural disasters cost Minnesota nearly \$500 million. This is the price we pay for not adapting ourselves. And, we will continue to pay the price if we do not work together.

Billions in Damages from Electricity Generation

University of Minnesota economists estimate the total annual health and environmental damages from electricity generation in Minnesota are more than \$2 billion.

That is \$800 million in health costs—largely related to respiratory and cardiovascular health impacts from “criteria air pollutant” emissions (sulfur dioxide, nitrous oxides, particulates, ammonia and volatile organic compounds).

More than \$1.2 billion is from damages related to global climate change.

Emissions from coal-fired electricity generation contribute to more than 90% of the total damages.

Further, the American Lung Association estimates particulate matter from coal-burning power plants cause 24,000 premature deaths, 550,000 asthma attacks and 38,000 heart attacks per year nationally.



Drought and Floods at Once?

New precipitation trends have the potential to cause both increased flooding and drought, based on the localized nature of storms and their intensity, leaving parts of the state drenched and others dry. In 2007, 24 Minnesota counties received drought designation, while seven counties were declared flood disasters. “At first, we thought that vast discrepancy was a singularity, a sample of one,” Dr. Mark Seeley said. **“But in 2012, 55 Minnesota counties received federal drought designation at the same time 11 counties declared flood emergencies.** Two times in 10 years is no longer a singularity.”



Flooding in 2012 in Northeast Minnesota damaged roads and bridges, water and sewer systems and other infrastructure, costing \$108 million. More than 1,700 homes and 100 businesses were damaged or destroyed, costing more than \$12 million.

About that Polar Vortex — Earth Still Logged Its Fourth-Warmest January

Despite bone-chilling cold in Minnesota, the 2014 Polar Vortex was an icy blip in a hotter global story.



Meteorologist Paul Douglas explains: “We are all hard-wired to react to weather, not the longer, slower (global) climate trends that have so many scientists concerned. You’d never know it staring at the thermometer in your backyard, but the planet continues to run a low-grade fever.” Here’s a clip from Climate Central: “[January 2014] was the fourth-warmest January since recordkeeping began in 1880. It was also the 347th consecutive month with above-average temperatures compared to the 20th century average, which has been fueled in large part by climate change.”

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In ways both plain and simple, the world's climate is changing. As is Minnesota's.

Scientists have issued their strongest position on climate change, warning that changes are happening now and are no longer a far-off concern. Moreover, problems will grow substantially worse unless greenhouse gas emissions are brought under control, particularly in the next 15 years, to forestall the worst effects of global warming.

In Minnesota, climate change has hit home, with three 1,000-year floods since 2004 and dozens more intense weather events—from hailstorms to tornadoes to droughts.

Financial impacts are just as real. In 2013, Minnesota had some of the highest weather-related disaster claims in the country, even topping some tornado- and hurricane-prone states. And, University of Minnesota economists estimate that electricity generation annually causes more than \$2 billion in environmental and health damages, such as asthma aggravated by air pollutants.

Scientific predictions of extreme heat, poor air and water quality, and sweeping changes to Minnesota's wildlife and fish habitats foreshadow significant changes in the way we work, live and play.

