



Global Climate Change

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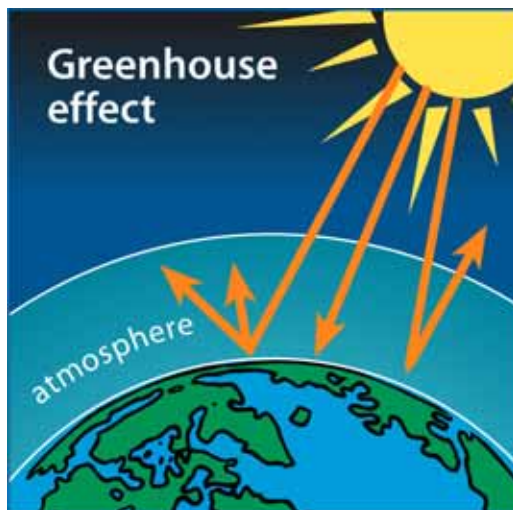
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Climate change, also called global warming, refers to any significant change in climate lasting for decades or longer. A certain amount of climate change can result from natural factors, such as variations in the sun's intensity or, over very long periods of time, changes in the earth's orbit or position of the continents. But scientists believe that the changes now going on are primarily a result of human activities. As a result, the earth is expected to warm substantially during just a few decades, returning it to conditions not seen for hundreds of thousands or even millions of years.

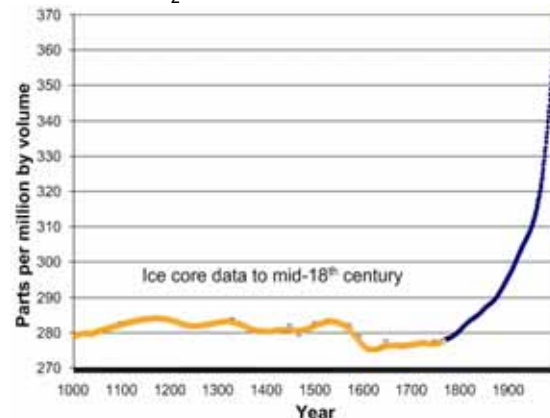
The greenhouse effect

The earth's atmosphere acts like a pane of glass in a greenhouse, trapping the sun's heat in the lower atmosphere and causing temperatures at the surface to warm. Life depends on this natural greenhouse effect; without it, average temperatures would be 60 degrees Fahrenheit (F) colder.



Some of the atmospheric or greenhouse gases that trap heat include water vapor, carbon dioxide (CO₂), methane, nitrous oxide, ozone and certain synthetic fluorocarbons. Some of these occur naturally, but since the industrial age began, more gases have been added to natural levels. Studies of ice cores show that CO₂ levels have risen by a third since the pre-industrial era. Most of that increase comes from burning fossil fuels, including coal and petroleum, to run our cars, factories and power plants.

CO₂ Levels Since 1000 A.D.



About seven billion metric tons of carbon are released through human activity every year. CO₂ added today remains in the atmosphere for 100 years or more, which means that the atmosphere is thrown more and more out of balance each year. Since scientists say that CO₂ is responsible for three-fourths of any predicted warming, temperature increases are inevitable.

What's the evidence?

- The average temperature of the Earth's surface has increased by about 1.2 to 1.4 degrees F since 1900. Other aspects of the climate are also changing, such as precipitation patterns, snow and ice cover, and sea level.
- The 20th century's 10 warmest years all occurred in the last 15 years of the century. 1998, 2002, 2003, 2005 and 2006 were the warmest years on record, according to the Earth Observatory of the National Aeronautics and Space Administration.
- The arctic ice pack has lost about 40 percent of its thickness during the past 40 years.
- Alaska's permafrost is thawing, causing the ground to drop 30 feet in places.
- In 2002, a massive Antarctic ice shelf known as Larsen B thawed and collapsed into the sea, causing 1,255 square miles of ice to disintegrate into thousands of melting icebergs.
- Mountain glaciers the world over are receding, from Europe's Alps to Asia's Himalayas to North America's Rocky Mountains. The glaciers in Montana's Glacier National Park are expected to be gone by 2030; the extensive glaciers on Tanzania's Mount Kilimanjaro will be gone even sooner.
- Malaria-bearing mosquitoes are appearing in elevations formerly too cool to support them (7,000 feet).
- Sea level has risen four to 10 inches worldwide in the last century. The Pacific island of Western Samoa loses more than a foot of land to the rising sea every year.

Forecast for the future

In 1988, an international scientific body, the Intergovernmental Panel on Climate Change (IPCC), was created by the World Meteorological Organization and the United Nations. The IPCC has forecast a mean global temperature change of two to seven degrees F. by the year 2100. This rate of warming is two to seven times greater than the warming observed during the 20th century. In 2006, an IPCC report said that the likelihood that warming in the past and future was due to human activity was 90 percent.

It is important to remember that what sound like small temperature changes can have big consequences. At the peak of the last ice age, 18,000 years ago, it was only

seven to 10 degrees F colder than today, and glaciers covered most of North America. A temperature seven degrees warmer than today will no doubt bring equally dramatic environmental changes — and at a rate perhaps 100 times faster than any previous climate changes.

- Warming will not be evenly distributed around the globe; northern latitudes, including Minnesota, will warm more than equatorial or southern latitudes.
- Winters will warm more than summers.
- Because warmer temperatures lead to increases in atmospheric moisture, precipitation is expected to increase during the next 100 years.
- Beachfront and low-lying property will begin to flood during the 21st century due to a sea level rise of eight to 23 inches. This is due to:
 - ocean water that expands as it warms
 - melting mountain glaciers worldwide
 - melting Greenland and west Antarctic ice sheets

The estimate is uncertain because it is affected by the speed at which the Greenland and west Antarctic ice sheets melt. Each one contains enough ice to raise sea levels 20 feet.

What does climate change mean for Minnesota?

Minnesota has warmed an average of about one degree F during the last 100 years. Parts of northern Minnesota have warmed five degrees F or more in winter. As the warming continues, northern cities like Hibbing may grow to look more like Albert Lea or even Des Moines.

Precipitation has already increased 20 percent in the southern half of the state since 1900. This fits with the climate change scenario that predicts a generally wetter and more humid Minnesota climate. Minnesota may come to look more like Missouri. We may lose our northern coniferous forests through warmth-induced disease, fires and a massive dieback already underway in Canada and Alaska; and our cold-loving creatures like trout and moose will disappear. As a general rule of thumb, climate zones and vegetation zones shift northward about 60 miles for each one degree Celsius (1.8 degrees F) increase in temperature. Minnesota farmers will gain a longer growing season, and hay fever sufferers will sneeze a few more weeks each year.

What is Minnesota doing?

On February 22, 2007, Governor Tim Pawlenty signed into law bipartisan legislation that set a renewable

energy requirement in Minnesota of 25 percent by the year 2025. The Governor also signed the landmark Next Generation Energy Act on May 25, 2007, which also addresses global warming and energy efficiency. Since fossil fuel use is responsible for most CO₂ emissions, this law will help reduce those emissions and fight climate change. Many of these steps are already underway. The new legislation will:

- Require Minnesota electric utilities to generate at least 25 percent of the electricity Minnesotans use from renewable resources by 2025. Xcel Energy, which supplies half the electricity in the state, is required to provide 30 percent of its electricity from renewable resources by 2020.
- Establish a new “E85 Everywhere” program to double the number of E85 pumps in the state from the current nation-leading 300 to 600.
- Use improved energy conservation, rate design and appliance standards to achieve annual energy savings equal to 1.5 percent of annual retail energy sales of electricity and natural gas.
- Invest more than \$35 million in new energy projects and research, including ones for biofuels such as cellulosic ethanol, and advanced bio-gas (gasification of biomass) technologies.
- Reduce Minnesota’s per capita fossil fuel energy use by 15 percent by 2015, through conservation and renewable energy alternatives.
- Set a goal of 1,000 Energy Star commercial buildings to be built by 2010 (there are currently 87).

The legislation established statewide greenhouse gas reduction goals of 15 percent by 2015, 30 percent by 2025 and 80 percent by 2050.

A comprehensive climate change strategy is currently being developed by the Minnesota Climate Change Advisory Group. This group is made up of representatives from industry, environmental groups, local and tribal governments, agriculture and transportation.

What can each of us do?

Greenhouse gas emissions in Minnesota have increased about 20 percent since 1988 alone. About a quarter of each Minnesota household’s annual CO₂ emissions come from the family car. Another 30 percent comes from home heating. Home electric and gas demands, including water heaters, refrigerators and lights, account for another 30 percent. To cut your CO₂ emissions:

- **On the road — use your vehicle less and use it more efficiently**
 - bike, bus, carpool or telecommute at least once a week
 - keep your car tuned and your tires inflated
 - use ethanol-based E85 fuel
 - don’t idle your car
 - buy fuel-efficient vehicles
- **In the home — use less electricity or choose cleaner sources**
 - buy renewable or green power; contact your electric utility for details
 - install high-efficiency furnaces and air conditioners
 - turn down your thermostat in winter, set it higher in summer
 - buy energy-efficient appliances with the Energy Star label
 - replace incandescent light bulbs with compact fluorescents
 - reduce, reuse and recycle to save energy and resources

More information

For more tips on reducing your contributions to CO₂ emissions, visit:

- Minnesota Department of Commerce at www.state.mn.us/portal/mn/jsp/content.do?subchannel=-536881511&id=-536881350&agency=Commerce

For more information on climate change, visit

- U.S. Environmental Protection Agency at <http://epa.gov/climatechange/index.html>
- International Governmental Panel on Climate Change at www.ipcc.ch/
- National Oceanic and Atmospheric Administration’s (NOAA) National Climatic Data Center at www.ncdc.noaa.gov/oa/ncdc.html
- Woods Hole Oceanographic Institution’s Ocean and Climate Change Institute at www.whoi.edu/institutes/occi/viewTopic.do?o=read&id=501