

# Fast Facts About Global Warming

2015 was the warmest year on record, with an annual average temperature in the U.S. of 54.4°F, which is 2.4°F above last century's average. According to the National Oceanographic and Atmospheric Administration's 2015 Climate Report this is the 19th consecutive year that the temperature has been higher than the 20th century average. A study by the National Climate Assessment\* reports that the world is warming, global sea level is rising, and extreme weather events are becoming more frequent and more severe. These changes have already resulted in a wide range of impacts across every region of the country and many sectors of the economy. Here are a few of the report's sobering highlights:

**Climate change is happening now and it's primarily human-induced.** The U.S. average temperature has increased by over 2°F, and most of this increase has occurred since 1970. Temperatures are projected to rise another 2°F to 4°F in most areas of the U.S. over the next few decades. The atmospheric concentrations of carbon dioxide (CO<sub>2</sub>), methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years.

**Extreme weather is becoming more severe and frequent,** and includes heat waves, cold snaps, extreme rain and snow precipitation, long periods of drought and flooding, and high winds. The capacity of ecosystems like forests, barrier beaches, and wetlands to buffer the impacts of extreme weather-related events is being overwhelmed. Arctic summer sea ice is receding faster than previously projected and is expected to virtually disappear before mid-century. Extreme heat, sea level rise, and heavy downpours are affecting infrastructure like roads, rail lines, airports, port facilities, energy infrastructure, and military bases.

**Food and water supplies are at risk.** Climate disruptions to agriculture have been increasing and are projected to become more severe over this century, a trend that threatens to diminish the security of America's food supply. Surface and groundwater supplies in some regions are already stressed, and water quality is diminishing in many areas, in part due to increasing sediment and contaminant concentrations after heavy downpours.

**Oceans are at risk.** The ocean absorbs about a quarter of human-caused emissions of carbon dioxide annually, thereby changing seawater chemistry and decreasing pH (making seawater more acidic). More acidic waters create repercussions along the marine food chain, such as making it more difficult for shells to form and coral reefs to form. Recent research indicates that 75% of the world's coral reefs are threatened. Pathogens thrive in warming seas, and this has been linked to significant increases in sea life disease and mortality, which in turn impacts the human populations which depend on them.

## \* What is the National Climate Assessment?

The National Climate Assessment is an extensive report produced every four years by the U.S. Global Change Research Program (USGCRP) which was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990 to "assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change." The National Climate Assessment represents the best available climate science, and involves thirteen major federal agencies and three hundred scientists and experts from academia, and the private and non-profit sectors.

**To view the report in full,** and to access important regional and community information and toolkits that support the planning and implementation of measures to respond and adapt to climate change, visit:

**[www.globalchange.gov](http://www.globalchange.gov)**



# Climate Change in the United States: Benefits of Global Action

A new EPA report estimates the physical and monetary benefits to the U.S. of reducing global greenhouse gas emissions. This report summarizes results from the Climate Change Impacts and Risks Analysis (CIRA) project, a peer-reviewed study comparing impacts in a future with significant global action on climate change to a future in which current greenhouse gas emissions continue to rise. To view the full report visit:

<http://www.epa.gov/cira>

## Increasing Greenhouse Gas Concentrations will have Many Effects

### Future Temperature Changes

We have already observed global warming over the last several decades. Future temperatures are expected to change further. Climate models project the following key temperature-related changes.

#### **Key U.S. Projections**

- By 2100, the average U.S. temperature is projected to increase by about 3°F to 12°F, depending on emissions scenario and climate model.
- An increase in average temperatures worldwide implies more frequent and intense extreme heat events, or heat waves. The number of days with high temperatures above 90°F is expected to increase throughout the United States, especially toward the end of the century. Climate models project that if global emissions of greenhouse gases continue to grow, summertime temperatures in the United States that ranked among the hottest 5% in 1950-1979 will occur at least 70% of the time by 2035-2064.

### Future Precipitation and Storm Events

Patterns of precipitation and storm events, including both rain and snowfall are also likely to change. However, some of these changes are less certain than the changes associated with temperature. Projections show that future precipitation and storm changes will vary by season and region. Some regions may have less precipitation, some may have more precipitation, and some may have little or no change. The amount of rain falling in heavy precipitation events is likely to increase in most regions, while storm tracks are projected to shift poleward. Climate models project the following precipitation and storm changes.

#### **Key U.S. Projections**

- Northern areas are projected to become wetter, especially in the winter and spring. Southern areas, especially the Southwest, are projected to become drier.
- Heavy precipitation events will likely be more frequent, even in areas where total precipitation is projected to decrease. Heavy downpours that currently occur about once every 20 years are projected to occur between twice and five times as frequently by 2100, depending on location.
- The proportion of precipitation falling as rain rather than snow is expected to increase, except in far northern areas.
- The intensity of Atlantic hurricanes is likely to increase as the ocean warms. Climate models project an increase in the number of the strongest (Category 4 and 5) hurricanes, as well as greater rainfall rates in hurricanes.
- Cold-season storm tracks are expected to continue to shift northward. The strongest cold-season storms are projected to become stronger and more frequent.



## Future Ice, Snowpack, and Permafrost

Arctic sea ice is already declining. The area of snow cover in the Northern Hemisphere has decreased since about 1970. Permafrost temperatures in Alaska and much of the Arctic have increased over the last century.

Over the next century, it is expected that sea ice will continue to decline, glaciers will continue to shrink, snow cover will continue to decrease, and permafrost will continue to thaw. Potential changes to ice, snow, and permafrost are described below.

### Key U.S. Projections

- Northern Hemisphere snow cover is expected to decrease by approximately 15% by 2100.
- Models project the snow season will continue to shorten, with snow accumulation beginning later and melting starting earlier. Snowpack is expected to decrease in many regions.
- Permafrost is expected to continue to thaw in northern latitudes; damaging buildings, infrastructure, and ecosystems in Alaska.

## Future Sea Level Change

Warming temperatures contribute to sea level rise by: expanding ocean water; melting mountain glaciers and ice caps; and causing portions of the Greenland and Antarctic ice sheets to melt or flow into the ocean.

Since 1870, global sea level has risen by about 7.5 inches. Estimates of future sea level rise vary for different regions, but global sea level for the next century is expected to rise at a greater rate than during the past 50 years. [ Studies project global sea level to rise by another 1 to 4 feet by 2100, with an uncertainty range of 0.66 to 6.6 feet. ]

The contribution of thermal expansion, shrinking ice caps, and small glaciers to sea level rise is relatively well studied, but the impacts of climate change on ice sheets in Greenland and Antarctica are less understood and represent an active area of research. Changes in ice sheets are currently expected to account for 1.2 to 8 inches of sea level rise by the end of this century.

Regional and local factors will influence future relative sea level rise for specific coastlines around the world. For example, relative sea level rise depends on land elevation changes that occur as a result of subsidence (sinking) or uplift (rising). Assuming that these historical geological forces continue, a 2-foot rise in global sea level by 2100 would result in the following relative sea level rise:

- 2.3 feet at New York City
- 2.9 feet at Hampton Roads, Virginia
- 3.5 feet at Galveston, Texas
- 1 foot at Neah Bay in Washington state

Relative sea level rise also depends on local changes in currents, winds, salinity, and water temperatures, as well as proximity to thinning ice sheets.

## Future Ocean Acidification

Ocean acidification adversely affects many marine species, including plankton, mollusks, shellfish, and corals. As ocean acidification increases, the availability of calcium carbonate will decline. Calcium carbonate is a key building block for the shells and skeletons of many marine organisms. If atmospheric CO<sub>2</sub> concentrations double, coral calcification rates are projected to decline by more than 30%. If CO<sub>2</sub> concentrations continue to rise at their current rate, the combination of climate warming and ocean acidification could slow coral growth by nearly 50% by 2050.



# What You Can Do

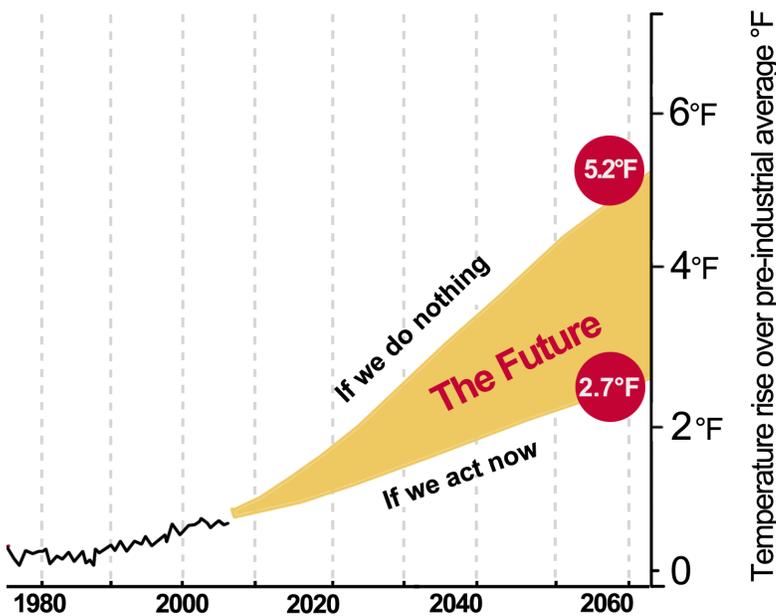
It can feel overwhelming to learn about global warming and the scientific predictions about the changes we're facing this century. But it's important to remember the wide range of possible scenarios. So much depends on how proactive we are in responding to the global warming challenge. Faith communities play a critical role in sounding the alarm and providing positive role models for climate action.

## Together We Can Protect the Climate and Our Future.

**Educate.** The amount of future climate change will largely be determined by choices society makes about emissions today. Learn about and educate others on the threat of global warming. Emissions can be reduced through improved energy efficiency and switching to low-carbon or non-carbon energy sources, such as geothermal, solar, and wind. Get involved at the local level to raise awareness in your home, congregation, and community.

**Role model success.** People of faith across the U.S. are answering the moral call to respond to global warming in their congregations and in their own homes. Start or join a green team or stewardship effort within your own faith community and inspire members to go green. Lead an effort within your own congregation to conserve energy, go solar, recycle, plant trees, grow organic gardens, capture rainwater, and provide energy efficient warming and cooling centers to those in need on the most extreme weather days. Visit IPL's [coolcongregations.org](http://coolcongregations.org) for kits and resources.

**Speak out.** Writing letters to local and national leaders is a very important aspect of responding to global warming. Political leaders take their cue from their constituents -- so be sure to speak up about the ways climate change is affecting your own town and state, and call on leaders to act boldly on climate. [InterfaithPowerandLight.org](http://InterfaithPowerandLight.org) always has ideas on its website for climate advocacy, such as supporting EPA limits on carbon pollution, and supporting clean energy incentives for wind and solar. Writing a letter to the editor of your local newspaper is also an effective strategy for expressing opinions about global warming issues that can influence policymakers and public opinion.



This graph shows two global warming scenarios.

If we continue on the path of using fossil fuels for energy, the warming will be much greater.

If we begin now to transition to clean, renewable energy, we can reduce the warming and severity of the impacts.

We must act now!

*From climate projections formula used for 2013 IPCC Climate Report.*

