

***Why do some people doubt climate change science?***

Despite an overwhelming consensus among scientists regarding the reality of climate change, some people have expressed doubts about climate change science. They claim that the information from climate models should not be trusted because scientists are just making predictions.

It is true that since we cannot know precisely what the earth's future environment will be like, there is uncertainty associated with climate models' projections. For instance, we cannot know future greenhouse gas emissions levels exactly; they will depend on many factors including international negotiations, regional political decisions, unforeseen natural events, and technological developments. Despite these uncertainties, the scientific community broadly accepts that climate change will have dramatic effects.

Furthermore, making informed predictions to help plan for the future and manage risk is common in many sectors. Public health officials create plans for disease outbreaks even if there is uncertainty about the likelihood of an epidemic. The military prepares for many possible conflicts. School administrators plan for a range of potential disruptions—students arriving late, teachers being out sick, and emergency situations like fires and floods.

In each case, decision makers incorporate the best information they have into planning for the future and continue to adapt their course of action as new information becomes available. This is especially important for climate change, where the decisions we make today will impact the environment we live in for decades.

**The Effects of Climate Change**

Rising temperatures are just one aspect of climate change. The term “global warming” has sometimes been replaced with “global weirding” because there are so many effects of climate change beyond increasing temperatures.

***What are the impacts of climate change?***

The effects of climate change include rises in sea level, extreme weather events, and threats to human health. Already, many parts of the world are beginning to feel the effects of climate change, while the risk of even greater impacts multiplies each year.

**Oceans:** Climate change could raise the level of the world's seas by up to three feet by 2100. Rising sea levels are caused by polar ice caps melting and by ocean waters expanding as they warm (as water increases in temperature, it expands to take up a greater volume of space).

Much of the world's population and many of the planet's most fragile ecosystems could become more vulnerable to coastal flooding. Experts predict that densely-populated coastal cities, such as Calcutta, New York, and Shanghai, could experience more floods. In



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A lobster boat off the coast of Maine in the United States. In recent years, lobster populations have suffered dramatic declines in coastal Massachusetts, Rhode Island, and Connecticut. Scientists attribute the decline in southern New England to rising water temperatures associated with climate change.



Sergey Vladimirov (CC BY 2.0).

On July 29, 2010, temperatures in Moscow, Russia reached 100°F for the first time in the 130 years that measurements have been kept. The record temperature came in the midst of a heat wave that lasted for more than three weeks. The heat wave also caused hundreds of forest fires, created smog that blanketed Russia, and contributed to the death of thousands of Russians who were vulnerable to the extreme temperatures and poor air quality. Above, people in Moscow seek relief from the heat by wading in a fountain in a city park.

the southeastern United States, some homes and coastal properties could be under water within the next thirty years as a result of sea level rise.

Numerous low-lying island countries, such as the Carteret Islands, the Marshall Islands, and Kiribati are becoming engulfed by the sea. Some of their residents, often called the first climate change refugees, have begun to leave the islands. People who lived on the Carteret islands have already been forced to evacuate, and Kiribati has purchased land from Fiji, over one thousand miles away, so its citizens seeking refuge from sea level rise have somewhere to go.

The ocean also absorbs some of the excess CO<sub>2</sub> in the atmosphere. With more CO<sub>2</sub>, oceans become more acidic, which is harmful to marine life and could negatively affect ocean ecosystems for centuries.

**Extreme weather events:** Climate change is affecting weather patterns around the world. In recent years, scientists have observed greater extremes of temperatures (conditions that are either extremely hot or extremely cold), increased numbers of heat waves, and more droughts in many regions of the world.

In addition to temperature extremes, the number and strength of powerful storms has increased. This may be caused by rising ocean temperatures increasing the amount of water that evaporates into the atmosphere. The additional warm water vapor makes storms more powerful. Rising sea levels also increase the amount of damage storms cause, meaning storms that have been less of a problem in the past are now becoming more dangerous. For instance, flooding in the Northeastern United States from Hurricane Sandy in 2012 may not have been as widespread and damage may not have been so costly were it not for the impacts of climate change on the seas.

Scientists are generally cautious about saying that climate change caused a particular event. Instead they look for patterns over time and are confident that climate change increases the chance that extreme weather events will occur more frequently.

**Health:** Climate change impacts human health in many ways. Heat waves and air pollution increase the risk of heat stroke, certain allergies, asthma, and heart disease, especially among people living in urban areas. For example, the 2003 summer heat wave in Europe contributed to over seventy thousand deaths.

In addition, droughts threaten reliable and affordable access to clean water for drinking and food production, which are essential components of good health.

Extreme weather events often have tragic death tolls and destroy the resources needed to promote health among members of affected communities. For instance, powerful storms can restrict transportation, damage medical facilities, and cause power-outages, limiting access to health care. More frequent and intense floods can lead to water contamination and the spread of waterborne diseases like cholera and diarrhoea.

Changes in temperature and rainfall may also shift the geographic ranges of insects that help spread certain diseases. For instance, dengue fever, a mosquito-borne disease of tropical and subtropical regions, returned to the United States in 2009 after being absent for almost seventy-five years.

**Species Migration:** As drastic and varied environmental changes unfold, some species will be able to adapt to new conditions. Others may have to change their geographic range and relocate to more suitable locations where they have a better chance of survival. Species that cannot adapt or relocate may die out and go extinct.

Plants and animals are generally shifting their habitat ranges either towards the North and South Poles or towards higher altitudes to avoid warming temperatures. Various seasonal aspects of plant and animal life cycles are also being affected, like the migration patterns of birds and insects. For example, moths on Mount Kinabalu in Borneo are flying higher



A hospital in Bangladesh for people afflicted with cholera, a waterborne disease. Increases in water temperatures caused by climate change may contribute to the spread of this disease.

Mark Knobil (CC BY-SA 2.0).

up the mountain (at an average rate of 220 feet in altitude per decade) to escape increasing temperatures.

Many species will not be able to adapt or move fast enough to keep up with the changing climate. Moreover, if species have to move to find new places to live, their migration routes may be blocked by human-made obstacles like dams, roads, and cities or competition with other species. In these cases, the likelihood of species extinction may increase. Each of these effects—species relocations and extinctions—can disrupt entire ecosystems and the valuable services they provide to human societies.

**Food and agriculture:** The changing climate directly affects food production and could increase costs. With increasing temperatures and changes in rainfall patterns, crop yields in some locations may improve, while in others they may decline. Overall, the negative impacts of climate change will outweigh the positive ones. The yields of major crops like wheat, rice, and corn will decrease in many regions of the world.



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In August 2012, an official from the U.S. Department of Agriculture and a farmer inspect a soybean field in Missouri affected by drought. At the time, the Department of Agriculture estimated that about 60 percent of the United States was experiencing extreme drought.

More frequent droughts and floods will make food production more difficult for farmers. They may have to completely alter how they approach agriculture in the case of drastic climate change by growing different crops, changing irrigation practices, and using greater quantities of chemical pesticides.

In addition, increasing ocean temperatures associated with climate change will impact fisheries, which are important to both the food supply and economies of many countries. Furthermore, these effects will take place at the same time as global demand for food is increasing, which together can contribute to rising food prices.

**Conflict and Security:** Climate change and its far-reaching environmental effects may also be contributing to political conflict and security concerns in countries around the world. In less wealthy countries, where governments are often unable to respond quickly or adequately to disasters, a series of poor harvests or the collapse of fisheries could force millions of

refugees across borders, causing violence or governmental collapse.

Alternatively, governments could become more authoritarian in order to deal with the security risks. For example, the Southeast Asian country of Myanmar was devastated by a cyclone (hurricane) in May 2008. Despite nearly 140 thousand deaths, the displacement of one million people from their homes, and widespread disease and starvation, the military rulers did not allow humanitarian aid workers to enter the country until weeks after the storm.

Increasingly severe weather systems such as hurricanes, monsoons, or droughts could lead to military conflicts over access to clean water and food supplies. Many attribute the conflicts in Sudan to disputes over natural resources such as land and oil reserves. The violence in New Orleans, Louisiana after Hurricane Katrina in 2005 is also an example of what some people in desperate situations resort to. Some believe that climate change

contributes to tensions in the Middle East, with warmer, drier conditions leading to increased instances of drought and food scarcity. The U.S. military is particularly concerned about the effects of climate change because many U.S. military bases lie at sea level and are threatened by the prospect of rising oceans.

**“The area of climate change has a dramatic impact on national security.... Rising sea levels, severe droughts, the melting of the polar caps, the more frequent and devastating natural disasters all raise demand for humanitarian assistance and disaster relief.”**

—Former U.S. Secretary of Defense  
Leon Panetta, 2012

## Conclusion

You have just read a brief overview of the causes and effects of climate change and have seen that a warming world is already influencing the lives of plants, animals, and people across the globe. While our understanding of how global warming works and why it is happening have steadily improved over the past few decades, the question of what to do about climate change remains.

In Part II of the reading, you will explore how governments and other groups, including businesses and nongovernmental organizations, are working both to prevent dangerous climate change and to cope with its effects. You will begin to consider who is responsible for the problem of climate change, who is most at risk, and why a unified international strategy for dealing with a changing climate has not yet emerged.