The Consequences of Climate Change

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This article is the third of five in a series to understand the science of climate change. Previous articles in this series looked at the basic concepts of climate change and the causes of climate change. In this article, we explore the consequences of climate change.

Despite a vocal minority of climate deniers, there is no reasonable doubt that the climate is changing and that the change is the result of human activity.

But climate science is complicated, and few adults learned about it in school. If you do not understand climate change as well as you'd like to, let this be your introduction to a basic understanding of climate science. Welcome to Climate Change 101.

Mechanism of Climate Change

Climate change is the result of a buildup of greenhouse gases – primarily carbon dioxide released by human post-industrial activity – in the atmosphere.

In 1950, atmospheric CO2 levels reached their highest point in 800,000 years, and they have been increasing exponentially since. Half of the 45 percent increase in atmospheric carbon dioxide levels has occurred since 1980.

These unprecedented levels of greenhouse gases caused an upward trend in temperatures around the globe that scientists first began to notice in the mid-20th century. The global average surface temperature has increased by 3.6 degrees Fahrenheit (2 degrees Celsius) in the past 140 years, and the change is picking up speed.

The global annual temperature has increased on average 0.13 degrees Fahrenheit (0.07 degrees Celsius) per decade since 1880. It has increased twice as fast since 1981. These numbers may sound small, but they reveal a tremendous increase in heat energy that sets off a cascade of complex shifts to weather and climate systems, with often dire results.

Global Warming

Many of us living in temperate zones might think warmer temperatures sound nice. An extra week of summer or fewer days of shoveling snow would be pretty welcome.

But a recent study has found that a third of the world's population currently lives in areas predicted to reach "extreme heat conditions" within 50 years. "Extreme heat conditions" are defined as having an average temperature of 84°F (29°C). You can find conditions like these in the Sahara Desert.

An increase in the frequency and severity of heatwaves has already resulted in tens of thousands of deaths. Changes in heat and rainfall have caused diseases transmitted by mosquitoes or water to become 10 percent more infectious than they were in 1950. Higher temperatures also contribute to smog, which is a causal factor in respiratory illnesses and can cause death.

Natural Disasters

Drought and wildfires are heat-related natural disasters. Wildfires are occurring with greater frequency and increased severity throughout the United States. Drought, which has been increasing since 1900, is a contributing factor to wildfires. So are the changes to forest systems wrought by pathogens like chestnut blight and insects whose spread is due at least in part to changing climate.

The connection between the frequency of hurricanes and climate change is hard to establish because the effects of climate change were already being felt before technology for reliably tracking hurricanes worldwide was developed. However, the proportion of hurricanes reaching categories four and five – the biggest storms – has significantly increased since 1985.

The amount of rain during hurricanes increased. But climate change contributes to more intense rainfall at other times, too. This leads to more severe and more frequent flooding – a pattern that is already evident in Europe and the American Midwest.

In the past, scientists said that while climate change increases the risk of these types of events, no single event can be definitively attributed to climate change. However, as the frequency of these once-rare events grows and as climate science progresses, scientists are getting closer and closer to being able to say, "Yes, this event was caused by climate change."

Not only a contributing factor to wildfires, drought threatens food supplies.

Melting Ice

Warmer temperatures are already causing massive ice melting around the world. In the Arctic, annual sea ice melt has accelerated, leaving more of the ocean unfrozen for longer periods of time. This, in turn, is threatening the permafrost on land, which is a carbon sink. Melting permafrost adds carbon dioxide to the atmosphere, further accelerating climate change.

In the Antarctic, record high temperatures have created huge melt ponds three times already this summer. Although climate change seems to generate more winter snow in Antarctica, the total ice mass is still decreasing each year. Even glaciers in the coldest part of Antarctica are losing ice, as are glaciers all over the rest of the world. Some glaciers have already disappeared.

Rising Sea Levels

If completely melted, Antarctic ice alone could raise global sea levels 200 feet. Greenland's melted glaciers could raise sea levels 6 feet – roughly twice the amount predicted by 2100. Global sea levels have already risen close to 9 inches since 1880 (nearly 3 inches since 1995).

What difference do a few inches of sea rise make? Eight of the 10 largest cities in the world are coastal and nearly 40 percent of the American population lives near the coast. That means that 190 million people currently live below the minimum predicted high tide line for the year 2100. NOAA has modeled sea-level rise and potential coastal flooding scenarios for the United States if you're curious about how you personally might be affected.

But there are other impacts from sea level rise besides forced migration and loss of historical sites. Storm surges will reach further inland, threatening urban infrastructure; saltwater incursion will ruin aquifers and agricultural areas; entire islands have already been lost and more are at risk.

Ocean Acidification

The ocean is not just getting deeper, its very chemistry is changing. Higher water temperatures increase carbon dioxide and decrease oxygen levels in the water, making the water more acidic. Ocean acidification negatively impacts a broad range of species in numerous ways, from softer crab shells to bleaching coral reefs and creating "dead zones" where few species can survive.

The next article in this series will look at ways that humans can adapt to the climate changes that have already happened.

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