



Why Half a Degree of Global Warming Is a Big Deal

THE EARTH HAS ALREADY warmed 1 degree Celsius (1.8 degrees Fahrenheit) since the 19th century. Now, a major new United Nations report has looked at the consequences of jumping to 1.5 or 2 degrees Celsius.

Half a degree may not sound like much. But as the report details, even that much warming could expose tens of millions more people worldwide to life-threatening heat waves, water shortages and coastal flooding. Half a degree may mean the difference between a world with coral reefs and Arctic summer sea ice and a world without them.

An additional half-degree of warming could mean greater habitat losses for polar bears, whales, seals and sea birds. But warming temperatures could benefit Arctic fisheries.

Extreme heat will be much more common worldwide under 2°C of warming compared to 1.5°C, with the tropics experiencing the biggest increase in the number of "highly unusual" hot days.

The Mediterranean region is expected to see "particularly strong increases in dryness" in a 2°C world compared to a 1.5°C world.

A half a degree of warming could be significant for small island nations, which are

particularly vulnerable to sea level rise and other climate change impacts.

Global crop yields are expected to be lower under 2°C of warming compared to 1.5°C, especially in sub-Saharan Africa, Southeast Asia, and Central and South America.

Small changes, big impacts

The report from the Intergovernmental Panel on Climate Change, compiled by hundreds of scientists from around the world, warns that these dangers are no longer remote or hypothetical.

Nations have delayed curbing their greenhouse gas emissions for so long that warming of 1.5 degrees Celsius (2.7 degrees Fahrenheit) is now all but inevitable. At current rates of warming, the world will likely cross the 1.5 degree threshold between 2030 and 2052, well within the lifetime of most adults and children alive today.

And 1.5 degrees is a best-case scenario. Without an extremely rapid, and perhaps unrealistic, global push to zero out fossil fuel emissions and remove carbon dioxide from the atmosphere, 2 degrees or higher this century looks more likely.

Each time the Earth heats up an extra half-degree, the effects aren't uniform across the planet. Some regions, such as the Arctic,

will heat up two to three times faster. The Mediterranean and Middle East regions could see a 9 percent drop in water availability at 1.5 degrees of warming and a 17 percent drop at 2 degrees, according to one major study cited in the report.

"If you're looking at this one region, which is already water-scarce today and sees a lot of political instability, half a degree makes a really big difference," said Carl-Friedrich Schleussner, the head of climate science and impacts at Climate Analytics and the lead author of that study. "It's a good reminder that no one experiences the global average temperature."

The odds of extreme weather events like severe heat waves or powerful rainstorms also don't go up uniformly with an extra half-degree. The number of extremely hot days around the world, for example, tends to rise exponentially as the global average temperature increases, the report said.

The risk of tipping points

The report also highlights the possibility that even modest amounts of warming may push both human societies and natural ecosystems past certain thresholds where

sudden and calamitous changes can occur.

Take coral reefs, which provide food and coastal protection for half a billion people worldwide. Before the 1970s, it was virtually unheard-of for ocean temperatures to get so warm that swaths of corals would bleach and die off. But as global average temperatures have risen half a degree in that span, these bleaching events have become a regular phenomenon.

With an additional half-degree of warming above today's levels, the report said, tropical coral reefs will face "very frequent mass mortalities," though some corals may adapt if given enough time. But at 2 degrees of total warming, coral reefs are in danger of vanishing entirely.

It is less certain when other long-feared tipping points will occur, such as the irreversible disintegration of the vast ice sheets on top of Greenland or West Antarctica. But the report warns that these ice sheets could potentially start to destabilize with 1.5 to 2 degrees of warming, committing the world to many more feet of sea level rise for centuries to come.

The report also warns that vulnerable areas, like many African countries and small island nations, may struggle to cope with multiple impacts. Crop failures, heat waves and the expansion of malaria-carrying mosquitoes compound when they occur together.

"You're not just adapting to one thing at a time, you're adapting to everything shifting at once," said Kristie L. Ebi, a professor of public health at the University of Washington and one of the lead authors of the report's chapter on climate impacts.

Beyond 1.5 degrees

At the United Nations climate negotiations in Paris in 2015, countries promised to hold total global warming to well below 2 degrees and agreed to "pursue efforts" to limit warming to 1.5 degrees. Leaders of small island nations, like the Marshall Islands and Maldives, had deemed that lower goal essential to their survival.

At this point, however, both goals are starting to look wildly out of reach. If you add up all the national pledges made in Paris to curb emissions, they would put the world on track to warm around 3 degrees Celsius or more.

Holding warming to 1.5 degrees, the report said, would entail a staggering transformation of the global energy system beyond what world leaders are contemplating today. Global greenhouse emissions would need to fall in half in just 12 years and zero out by 2050. To stay below 2 degrees, emissions have to decline to zero by around 2075. Virtually all of the coal plants and gasoline-burning vehicles on the planet would need to be quickly replaced with zero-carbon alternatives.

In addition, the report said, the world would have to swiftly develop and deploy technology to remove billions of tons of carbon dioxide from the atmosphere each year — using technology that is still untested at large scales.

"My view is that 2 degrees is aspirational and 1.5 degrees is ridiculously aspirational" said Gary Yohe, an environmental economist at Wesleyan University. "They are good targets to aim for, but we need to face the fact that we might not hit them and start thinking more seriously about what a 2.5 degree or 3 degree world might look like."

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