Climate intervention technologies may create winners and losers in world food supply

October 5 2023

Credit: CC0 Public Domain

A technology being studied to curb climate change—one that could be put in place in one or two decades if work on the technology began now—would affect food productivity in parts of Earth in dramatically different ways, benefiting some areas, and adversely affecting others, according to projections prepared by a Rutgers-led team of scientists.

Writing in the journal, *Nature Food*, the scientists described the results of computer models simulating varying climate scenarios and their impacts over time on the production of the world's four major food crops: corn, rice, soybeans and wheat in all locations where they are grown.

Some scenarios were produced by simulated stratospheric aerosol intervention (SAI), also known as geoengineering, to halt or reverse climate change, while others, for comparison purposes, weren't. The SAI scenario, inspired by volcanic eruptions, would involve spraying sulfur dioxide gas into the stratosphere. By placing a cloud of what becomes sulfuric acid in the upper atmosphere continuously, the process would shield the Earth from the sun, cooling it.

"Not one of the 11 climate change or climate intervention scenarios we analyzed benefits everyone," said Brendan Clark, a doctoral student in the Department of Environmental Sciences at the Rutgers School of Environmental and Biological Sciences (SEBS), and lead author on the study. "Nations may have different ideas of what constitutes an optimal global temperature, which could lead to conflicts. It would be like people fighting over the thermostat in a house, but on a global scale."

The models showed marked differences in agricultural productivity depending on where a country is positioned on the globe. Continued, uncontrolled climate change, the models revealed, favors crop production in the cold, high-latitude areas, such as Canada, Russia, the U.S. northern border states, Scandinavia and Scotland.

Moderate amounts of atmospheric sulfur spraying, which may either halt or slightly lower global average temperatures, favors food production in the temperate regions known as the mid-latitudes, where most of the large land masses of North America and Eurasia are located, according to the analysis.

Large amounts of climate intervention to significantly reverse warming and lower the global average temperature would favor agricultural production in the tropics, the region of Earth around the equator.

In the Western Hemisphere, the region includes Mexico, all of Central America, the Caribbean and the top half of South America. In the Eastern Hemisphere, the tropics include most of Africa, parts of the Middle East, most of India, all of Southeast Asia, most of Australia and most of the island nations of Oceania.

"Are we willing to live with all these potential impacts to have less global warming? That's the question we're trying to ask here," said Alan Robock, a Distinguished Professor of Climate Science in the Department of Environmental Sciences at SEBS, and a co-author of the study. "We're trying to quantify each of the potential risks and benefits so we can make informed decisions in the future."

The team worked with scientists at the National Center for Atmospheric Research employing the federal laboratory's computer model that calculates global climate and weather patterns. The model simulates atmospheric, land and oceanic climate change as well as crop growth. The work produced 11 different climate scenarios of a future Earth, eight of them formed by differing levels of climate intervention, producing different temperatures, rainfall, and sunlight, and different carbon dioxide emissions.

"Our results highlight the challenges in defining 'globally optimal' strategies," said Lili Xia, an assistant research professor in the Department of Environmental Sciences at SEBS and a co-author of the study. "It's very complicated and it's hard to reach a conclusion, such as saying whether climate intervention is good or bad. I don't know at what point people will reach a decision. But, for me, I feel like it's almost impossible."

Other scientists on the study included Sam Rabin, Simone Tilmes and Jadwiga Richter of the National Center for Atmospheric Research; and Daniele Visioni of Cornell University.

More information: Optimal climate intervention scenarios for crop production vary by nation, *Nature Food* (2023). DOI: 10.1038/s43016-023-00853-3. www.nature.com/articles/s43016-023-00853-3

Provided by Rutgers University