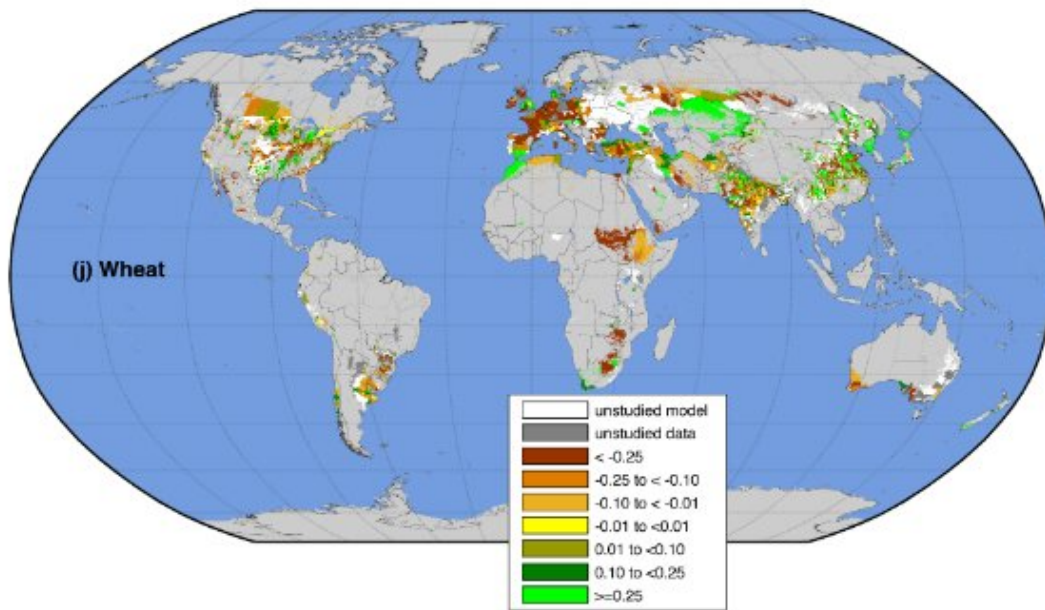


Climate change is already affecting global food production—unequally

May 31 2019



Global map of changes in wheat yield on average annually. Units are measured by tons per hectare per year. Credit: Deepak Ray.

The world's top 10 crops— barley, cassava, maize, oil palm, rapeseed, rice, sorghum, soybean, sugarcane and wheat—supply a combined 83 percent of all calories produced on cropland. Yields have long been projected to decrease in future climate conditions. Now, new research shows climate change has already affected production of these key

energy sources—and some regions and countries are faring far worse than others.

Published in *PLOS ONE*, the University of Minnesota-led study, conducted with researchers from the University of Oxford and the University of Copenhagen, used weather and reported crop data to evaluate the potential impact of observed [climate](#) change. The researchers found that:

- observed climate change causes a significant yield variation in the world's top 10 crops, ranging from a decrease of 13.4 percent for oil palm to an increase of 3.5 percent for soybean, and resulting in an average reduction of approximately one percent (-3.5×10^{13} kcal/year) of consumable food calories from these top 10 crops;
- impacts of climate change on [global food production](#) are mostly negative in Europe, Southern Africa, and Australia, generally positive in Latin America, and mixed in Asia and Northern and Central America;
- half of all food-insecure countries are experiencing decreases in crop production—and so are some affluent industrialized countries in Western Europe;
- contrastingly, recent climate change has increased the yields of certain crops in some areas of the upper Midwest United States.

"There are winners and losers, and some countries that are already food insecure fare worse," says lead author [Deepak Ray](#) of the University of Minnesota's Institute on the Environment, whose high-resolution global crop statistics databases have also been used to help to identify how global [crop production](#) changes over time. These findings indicate which geographical areas and [crops](#) are most at risk, making them relevant to those working to achieve the [U.N. Sustainable Development Goals](#) of ending hunger and limiting the effects of [climate change](#). Insights like

these lead to new questions and crucial next steps.

"This is a very complex system, so a careful statistical and data science modeling component is crucial to understand the dependencies and cascading effects of small or large changes," says co-author Snigdhanu Chatterjee of the University of Minnesota's School of Statistics.

The Institute's Global Landscapes Initiative, whose contributors to this study included Ray, Paul West and James Gerber, has previously produced global scale findings that have been put to use by international organizations such as the U.N., World Bank and Brookings in evaluation of global food security and environmental challenges. The scholars say this report has implications for major food companies, commodity traders and the countries in which they operate, as well as for citizens worldwide.

"The research documents how change is already happening, not just in some future time," says Ray.

More information: Deepak K. Ray et al. Climate change has likely already affected global food production, *PLOS ONE* (2019). [DOI: 10.1371/journal.pone.0217148](https://doi.org/10.1371/journal.pone.0217148)

Provided by University of Minnesota

Citation: Climate change is already affecting global food production—unequally (2019, May 31) retrieved 25 April 2024 from <https://phys.org/news/2019-05-climate-affecting-global-food-productionunequally.html>

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