

# Warming Will Hurt Poor Nations Most

The name implies a place where plants thrive, but don't let words fool you. The expected greenhouse warming will likely harm agriculture in many countries, particularly the poorer ones, warns the first international study on this topic.

"Our main conclusion is that the developing countries are most vulnerable to climate change in terms of agriculture," says Cynthia Rosenzweig, an agronomist at Columbia University and NASA's Goddard Institute for Space Studies in New York City. Rosenzweig led the agriculture study with Martin Parry of the University of Oxford in England. They discussed their findings last week at the International Geographical Congress in Washington, D.C.

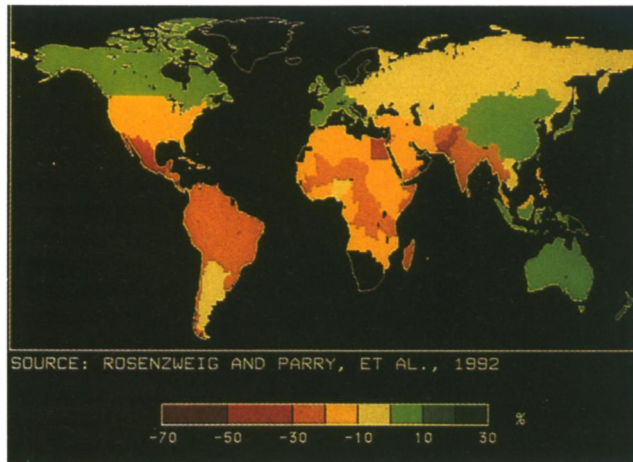
Conducted by scientists in 25 countries, the study indicates that the global warming from greenhouse gas pollution will enhance agricultural disparity between rich and poor nations. In temperate zones, where developed nations reside, global warming may increase crop yields; but a warming will probably diminish yields in tropical areas, where many developing nations are located.

Agriculture in mid-latitude and high-latitude countries may benefit from global warming because it will help plants currently limited by the colder temperatures of these regions. Conversely, countries nearer the equator will suffer because conditions there already lie close to the limit of temperature tolerance for many crops. Warmer temperatures will stress these plants even more, Rosenzweig says.

According to the study, decreased crop yields and increased food prices could significantly swell the ranks of people suffering from hunger. By the year 2060, the number of people at risk of hunger could rise 10 to 50 percent above the level projected with no climate change, a number estimated at 640 million people for that year. The hunger threat will hit African nations hardest, the study finds.

In the real world, farmers continually alter their methods to suit the weather, so Rosenzweig and Parry tested the impact of modest adaptation strategies, such as altering planting dates, changing crop varieties, or stepping up irrigation efforts in areas where it is already practiced. Such methods could offset most negative aspects of climate change in developed countries, but the developing world would benefit little from these minimal strategies, the researchers report.

Even extreme adaptations — such as installing irrigation systems or developing new crop varieties — would not erase the negative impacts of climate change in the developing world, the study suggests.



*Crops in the hot-house: In this simulation of the year 2060, colors indicate percentage changes in average national crop yields, relative to a simulation of that year with no climate change. The simulation allows farmers to make modest adaptations to changing conditions.*

However, slowing population growth could offset the increase in hunger caused by even severe climate change.

To make the agricultural projections, Rosenzweig and her colleagues started with three different climate forecasts provided by separate general-circulation models, which simulated how a doubling of greenhouse gases will alter climate. The scientists plugged the climate forecasts into models that estimate crop growth, taking into account how increasing carbon dioxide will fertilize plants. The crop-growth results then went into a model that simulates world food trade.

Rosenzweig says the study's specific numerical findings cannot serve as a forecast because the project included many models, each harboring major uncertainties. Nonetheless, she says the general trends are important because they appear in all of the various simulations. "The implications about developing versus developed countries are very robust," she told SCIENCE NEWS.

In the past, scientists lacked a clear view of how climate change might affect tropical regions — in part, says Rosenzweig, because projections suggest that temperatures would increase less dramatically in tropical areas than in mid-latitude and polar zones. Prior to the new study, researchers could argue that enhanced crop growth from higher carbon dioxide levels would balance the relatively small temperature rise expected in the tropics, she says.

The agriculture study, commissioned by the U.S. Environmental Protection Agency, is the first to take a detailed global look at the agricultural impacts of climate change. In doing so, it offers a bleaker picture than previous reports.

A 1990 assessment by the Intergovernmental Panel on Climate Change, which relied mostly on published literature, concluded that nations could minimize

losses in global food production, but it could not estimate the cost. In a 1991 study, a National Academy of Sciences panel projected that agriculture could largely adapt to future climate change.

"My impression is that [the new study] is giving a more accurate picture of the potential changes than we've had previously," says William R. Cline, an economist studying climate change at the Institute for International Economics in Washington, D.C.

Gary Evans, head of the Agriculture Department's global change office, says the study's disturbing conclusions don't square with observations about agricultural trends in the United States.

"Technological capabilities in agriculture have proven for the last 50 to 75 years to be able to keep up with any shifts and changes that have taken place," he says, suggesting that similar developments around the world may be able to cut the losses from climate change in developing nations. Pointing to the current famine in Somalia, Evans speculates that war and other problems will cause greater food shortages than will climate change.

The agriculture study is one of six sponsored by EPA to examine the international impacts of climate change. Another of the studies, concerning human health, is offering conclusions very similar to those of the agriculture project.

Although not complete, the study so far shows that "people in developing countries appear to be highly vulnerable to heat-related mortality today and therefore have an increased risk under global warming situations," says study leader Laurence S. Kalkstein, a climatologist at the University of Delaware in Newark. A projection for Shanghai, China, suggests that the number of heat-related deaths there could climb 10-fold by the year 2060, Kalkstein reported at last week's geography meeting.

— R. Monastersky