

Climate change: Are forestry and agriculture (and GMOs) part of the problem or a solution?

Improved crop varieties could play a role in climate change mitigation if they can improve land use, relieving pressure on forests and raising yields without expanding to new land—and GM varieties could be critical.

The U.N. Food and Agriculture Organization recently published a sourcebook from the Global Alliance for Climate Smart Agriculture (CSA) that outlines the role agriculture could play:

Sustainable intensification of crop production aims to increase yields through the better use of natural resources and ecosystem functions. Plant breeding has a crucial role to play to enhance genetic potential both to increase productivity and thus yields and to improve nutrient and water use as well as resistance to climate variability, diseases and pests.

The CSA, which officially launched in September is attempting to change practices and policies on agriculture in response to climate change. It considers the potential of genetic technologies as one strategy to help spur higher productivity, which would provide mitigation for climate change.

Improved crop varieties have played a large role globally in improving food production in the past. The Green Revolution, hailed for its successes in Asia and Latin America, resulted in yield increases of 160 percent between 1961 and 2005, according to estimates by Stanford researchers [published](#) in the *Proceedings of the National Academy of Sciences*. The increased yields came with another benefit: the containment of greenhouse gas emissions. In fact, if it wasn't for the Green Revolution, farmers might have emitted the equivalent of 590 gigatons of CO₂ more than had they not achieved higher yields.

There were some unintended consequences from increased use of chemicals and other problems for the next generation. Environmental costs such as degraded land, depleted groundwater and a rise in pests are a few of the problems that the Global Alliance for Climate Smart Agriculture is addressing under its new paradigm.

A key problem is deforestation in tropical areas. A recent story in [The Guardian](#) highlighted the damage caused by Vietnamese farmers in the Mekong Delta as they rip out carbon-rich mangroves to meet global demand for rice and shrimp. "The relentless pressure to earn more money and boost development is both intensified by climate change and worsening its impact," wrote reporter George Black.

The study by the Stanford researchers confirms this. They found that 27 percent of the yield increases between 1961 and 2005 were due to expansion of crop area. Because the problem of carbon emissions from forests is worst in the tropics, sustainable intensification in these areas stands to have the most impact, according to a [study](#) published in the *Proceedings of the National Academy of Sciences*.

And while agriculture systems themselves produce greenhouse gas emissions, according to a [study](#) by

Vincent Gitz and Philippe Ciais, land use change emission are much more important than direct emissions from agricultural systems.

Which is why, in the view of the Global Alliance, “improvement of crop yields should be prominent in any mitigation strategy. These improvements will also contribute to preserving forest sinks and maintaining their capacity to store carbon over the long-term.”

Mitigation, which aims to prevent greenhouse gas emissions, and adaptation, which develops solutions for a changing climate, both play a part in international climate negotiations by the U.N. Framework Convention on Climate Change. The panel’s last meeting in Lima, Peru, ended just last week.

Of course, agriculture’s strength is that it is really a mitigation *and* adaptation strategy. Sustainable intensification of agriculture could increase resource efficiency for farmers while aiding global goals of increasing carbon stock in soils, trees and perennials.

The International Panel on Climate Change estimates that mitigation from agriculture could reach 5,500 to 6,000 tons of CO₂ per year by 2030 (or about three quarters of the sector’s emissions in 2030). This includes better management of agricultural land—not just a reduction of agricultural emissions.

No one is saying that crop improvements such as genetic modification are the only way to sustainably intensify agriculture, but the IPCC lists improved varieties as potential sources of better cropland management along with other improved practices, including crop/fallow rotations, use of legumes in the crop rotation, cover crops and others. It’s one extra tool in the tool box.

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Additional Resources:

- [Technologies for Adaptation to Climate Change](#), UNFCC
- [Coping with Climate Change: The Importance of Genetic Resources for Food Security](#), Commission on Genetic Resources for Food and Agriculture, FAO
- [Green Genes: Sustainability Advantages of Herbicide Tolerant and Insect Resistant Crops](#), Genetic Literacy Project
- [Sustainable intensification in global agriculture](#), Genetic Literacy Project