

What kind of agriculture do we need in an era of climate change?

Climate change will adversely affect agricultural productivity and human well-being. Overall, it is projected that crop productivity will decline, particularly at lower latitudes, especially in the seasonally dry and tropical regions. This would increase the risk of hunger. Moreover, it is the majority of the world's rural poor who live in areas that are resource-poor, highly heterogeneous and risk-prone, who will be hardest hit by climate change.

On the other hand, agriculture releases a significant amount of carbon dioxide, methane and nitrous oxide into the atmosphere, amounting to around 10-12 percent of global anthropogenic greenhouse gas emissions annually. If indirect contributions (e.g. land conversion, fertilizer production and distribution and farm operations) are factored in, the contribution of agriculture could be as high as 17-32 percent of global anthropogenic emissions.

The challenge is therefore to design an agriculture that adapts and responds to the changes in climate experienced, as well as reduces greenhouse gas emissions. This challenge could be met through biodiverse, agroecologically-based farming.

This was acknowledged by the International Assessment on Agricultural Knowledge, Science and Technology for Development (IAASTD), which is the most comprehensive assessment of agriculture to date¹. Some key findings of the IAASTD were that:

- The future of agriculture lies in biodiverse, agroecologically based farming (including organic agriculture) that can meet social, economic and environmental goals
- Reliance on resource-extractive industrial agriculture is unsustainable, particularly in the face of worsening climate, energy and water crises
- Short-term technical fixes, including genetically engineered crops, cannot adequately address the complex challenges facing agriculture, and often exacerbate social and environmental harms
- Achieving food security and sustainable livelihoods requires ensuring access to and control of resources by small-scale farmers, especially women
- Indigenous knowledge and community-based innovations are an invaluable part of the solution

Why agroecology² is climate friendly

By increasing resilience within the agroecosystem, agroecology increases its ability to continue functioning when faced with unexpected events such as climate change. Resiliency to climate disasters is closely linked to farm biodiversity; practices that enhance biodiversity allow farms to mimic natural ecological processes, enabling them to better respond to change and reduce risk. Thus, farmers who increase interspecific diversity suffer less damage compared to conventional farmers planting monocultures. Moreover, the use of intraspecific diversity (different cultivars of the same crop) is insurance against future environmental change.

Agroecological practices that preserve soil fertility and maintain or increase organic matter can reduce the negative effects of drought while increasing productivity. Water holding capacity of soil is enhanced by practices that build organic matter, helping farmers withstand drought. In addition, water-harvesting practices allow farmers to rely on

¹ The IAASTD was a multi-stakeholder assessment involving more than 400 experts over a period of four years, and was co-sponsored by the World Bank, FAO, UNEP, UNDP, WHO, UNESCO and GEF.

² Agroecology is the science behind ecological/sustainable agriculture.

stored water during droughts. Other practices such as crop residue retention, mulching, and agroforestry, conserve soil moisture and protect crops against microclimate extremes. Conversely, organic matter also enhances water capture in soils, significantly reducing the risk of floods.

Indigenous and traditional knowledge are a key source of information on adaptive capacity, centred on the selective, experimental and resilient capabilities of farmers. Many farmers cope with climate change, in different ways: by minimising crop failure through increased use of drought-tolerant local varieties, water-harvesting, extensive planting, mixed cropping, agroforestry, opportunistic weeding and wild plant gathering. Traditional knowledge, coupled with the right investments in plant breeding, could yield new varieties with climate adaptation potential.

On the other hand, agriculture has the potential to change from being one of the largest greenhouse gas emitters to a much smaller emitter and even a net carbon sink, while offering options for mitigation by reducing emissions and by sequestering carbon dioxide from the atmosphere in the soil. The solutions call for a shift to more sustainable farming practices that build up carbon in the soil and use less chemical fertilizers and pesticides.

There are a variety of practices that can reduce agriculture's contribution to climate change. These include crop rotations and improved farming system design, improved cropland management, improved nutrient and manure management, improved grazing-land and livestock management, maintaining fertile soils and restoration of degraded land, improved water and rice management, fertilizer management, land use change and agroforestry.

It has been estimated that a conversion to organic agriculture would considerably enhance the sequestration of carbon dioxide through the use of techniques that build up soil organic matter, as well as diminish nitrous oxide emissions by two-thirds due to no external mineral nitrogen input and more efficient nitrogen use. Organic systems have been found to sequester more carbon dioxide than conventional farms, while techniques that reduce soil erosion convert carbon losses into gains. Organic agriculture is also self-sufficient in nitrogen due to recycling of manures from livestock and crop residues via composting, as well as planting of leguminous crops.

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