



What can agricultural biodiversity do in the fight against climate change?

Photo:
Sorghum varieties
with different drought
resistance, Tanzania.
Credit: Bioversity
International/J.van de
Gevel

Build climate-smart systems

One of the main challenges that farmers have in the context of climate change is its unpredictability. Farmers can no longer rely on the timing of seasons and the availability of rainfall to see them through the year. Using agricultural biodiversity in the fight against climate change is about responding to variety *with* variety. Diversity can help farmers mitigate, adapt and ensure food (and nutrition) security, by providing them with more options to manage climatic risks, and strengthen the resilience of their farms and surrounding landscapes. Below are some examples of how farming communities can use agricultural biodiversity to be climate-smart.

■ Mitigate ■ Adapt ■ Food and nutrition

At the genetic level:

Different crop varieties can be used to deal with climate-induced stress and unpredictability. For example, wheat is particularly sensitive to heat when it flowers (if the flowers burn, no grains are produced). So, planting different varieties of wheat with different flowering times, can reduce the risk of a farmer losing all of his or her crop in case of a sudden heat spike.

Some wheat varieties are also more hardy and able to cope well with poor soil or little water. Farmers can use these varieties to profit from areas they would otherwise struggle to cultivate.

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At the species level:

Different crops and livestock respond differently to environmental stresses such as drought, frost and salinization. Having different species on farm prevents farmers from losing everything and some species will deal with unpredictable shocks better than others. Many farmers also keep livestock as backup to sell when they suffer heavy crop losses.

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In general, mixed crop and crop-livestock systems provide opportunities for synergy and strengthen the overall resilience of a farm. Nitrogen-fixing legumes and trees not only keep soils fertile, but can act as windbreaks to mitigate strong winds and soil erosion from heavy rains. Livestock can be fed with biomass from crop parts that humans do not eat, and in return provide fertilizer for crops in the form of manure, reducing the need for chemical inputs.

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At the landscape level:

Diverse sources of food and smarter seasonal planting help communities cope with 'hungry' seasons. When crops fail, forests, rivers or back up livelihood activities help fill nutrition and food gaps.

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A landscape with many different land uses helps communities and their ecosystems deal with shocks. Forests store carbon, but also reduce soil erosion, runoff and landslides during storms. Managing water, land and soil at a larger scale with practices such as terracing or storage tanks, can help buffer the impacts of climate stress.

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Restoration of degraded lands can also improve agricultural productivity in marginal areas and help store carbon. Restoration can be improved by looking at genetic diversity as well and the contribution that different tree species provide.

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How Bioversity International is contributing to:

Climate-Smart Seed Systems

Often, farmers do not have access to the information they need to deal with changing environmental conditions. Bioversity International helps to foster the sharing of information between farmers, and finds ways to improve farmer knowledge of crop diversity so that they can be more climate-smart. One way we do this is by strengthening seed systems, ie. how farmers acquire and exchange seeds (whether among themselves or via markets and government programmes).

The informal seed system

With shifting climates, many farmers are in need of new seeds and planting material to help them adapt. But they might not have to go very far to find that material. In Mexico, for example, it has been found that midland maize varieties are able to yield well enough in highland conditions. So as temperatures rise in the upper highlands, linking highland farmers to midland farmers (even within 10km of each other) can create a promising source of materials to adapt to change. Often these linkages do not exist yet, and need to be actively cultivated or supported, especially in areas where modern varieties are unsuitable or will take too long to arrive. Bioversity International is strengthening informal seed systems by researching smarter policies and technologies to support community seedbanks, linking farmers to each other, and training them to produce better quality seed and use cheaper seed conservation methods.

The formal seed system

Many plant breeding programmes create crop varieties without investigating their wider geographical adaptation (or have poor information on adaptation). With climate change, this becomes even harder as variety adaptation ranges shift. In India, Bioversity International is looking at modern varieties that might be suitable for a different region than where they are being officially recommended by the government. By screening a broad number of varieties and then testing some of the best with farmers in the state of Bihar, we have achieved 20-30% increases in productivity with existing varieties that were not designed for or disseminated in Bihar. A better management of the information we have about available diversity can go a long way.

Beyond borders

The sharing of seeds and planting materials goes beyond borders as well. Bioversity International works on improving the access and benefit-sharing of plant genetic resources through international agreements such as the International Treaty on Plant Genetic Resources for Food and Agriculture, which is a mechanism to facilitate the access to 64 crops and forages between 132 countries.



Photo: Community members drawing out seasonal calendar of available food (cultivated and wild) in their landscape, Zambia. Credit: T. del Rio

Sustainable crops and diets

Growing crops and varieties that are locally adapted makes sense for productivity, but often brings nutritional benefits as well. Bioversity International has worked in several countries to revive highly nutritious, locally-adapted crops such as quinoa in the Andes and traditional leafy vegetables in Kenya. In India, Bioversity International has worked for more than a decade with the MS Swaminathan Foundation on minor millets, which had been sidelined by agricultural policies in favour of other grains, even though they are nutritious and grow well on marginal lands.

Working with women's groups, we have been able to demonstrate that minor millets can be processed and marketed in a profitable way. School feeding programmes switching from white rice to finger and foxtail millet also showed an increase in children's haemoglobin levels by 32-37.6% within 3 months (compared to control group). This work is part of the reason why millets are now included in the food sourcing schemes of India's current Food Security Bill, which will feed 800 million people.

But adapting to climate change and ensuring good nutrition can extend beyond the farm as well. In the Barotse floodplain in Zambia, we are investigating how rural communities use their surrounding landscape throughout the year to fulfill nutrition needs, particularly during the 'hungry' season when dependence on common pool resources such as forests and wetlands become more important for food. Managing these 'public' ecosystems sustainably is essential so that they can continue to satisfy diverse needs, especially taking into consideration increasing climate unpredictability.



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