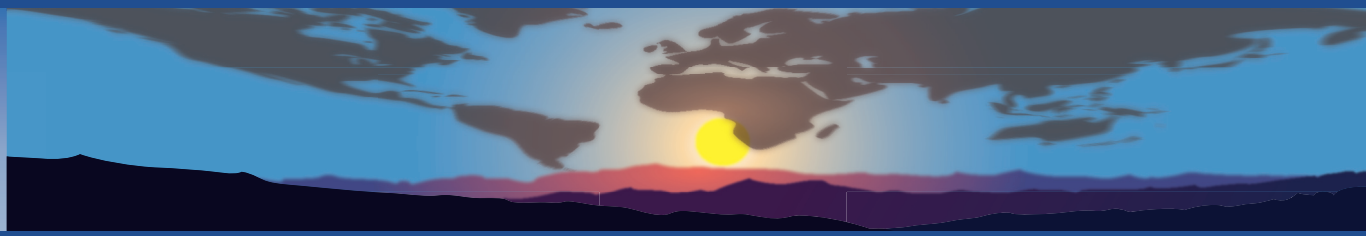
Food and Agriculture Organization of the United Nations



Climate change and biodiversity for food and agriculture

As climate changes, the value of biodiversity for food and agriculture will increase. Genetic resources are the living material that local communities, researchers and breeders use to adapt food and agricultural production to changing needs. Maintaining and using this reservoir of genetic diversity will be the foundation for coping with climate change.

Genetic erosion

At the same time, climate change will be an important driver of genetic erosion in the future. It will both threaten the survival of individual species and affect the way different elements of biodiversity interact in food and agriculture ecosystems. These interactions provide "services", such as pollination, soil fertilization and the natural biological control of plant and animal pests and diseases, that are essential for food production. Smallholder and subsistence farmers and pastoralists will be the hardest hit by disruptions in these services.

This irreversible loss of biodiversity will have serious consequences for global food security. If coordinated efforts are taken at the national and international levels, biodiversity can be conserved and harnessed to help food and agriculture adapt to climate change.

What is at stake?

The Intergovernmental Panel on Climate Change reports that a significant number of species will be at risk of extinction as the global mean temperature increases. Of particular concern are relatives of major crops surviving in the wild. Crop wild relatives are already under severe threat due to habitat loss and environmental degradation. Climate change, which may make their remaining habitats unsuitable for their survival, may drive them to extinction. Research by the Consultative Group on International Agricultural Research based on distribution models (*see maps overleaf*) of wild relatives of three staple crops of the poor – peanuts, cowpea and potato – suggests that by 2055 16 to 22 percent of wild species will be threatened by extinction.

In some areas, food is still gathered from the wild. Genetic erosion represents an immediate threat to the well-being of rural communities. Loss of genetic diversity can also have serious long-term consequences globally. Plant wild relatives may contain the genes for traits that could be used to breed new crop and forest varieties that can meet the challenges of climate change.

Livestock breeds and fish with limited geographic distribution may also face the risk of extinction because of climate change and the increased frequency of natural disaster (droughts, flooding, major storms) associated with it. For example, tilapia, a fish species vital to the food security of millions, originated in areas of Africa where the impact of climate change is expected to be extreme. Loss of genetic diversity in tilapia subspecies, many of which can only be found in African lakes and rivers, would decrease the breeding options for this species worldwide.

Climate change adaptation and mitigation

Researchers and local communities need to reach into the planet's vast genetic reservoir to breed new plants and animals that will thrive in a warmer world and meet the food requirements of an expanding population. For many small-scale and subsistence farmers, adapting to changing conditions may be difficult. The rate of climate change suggests that in many instances locally available genetic diversity will be unable to adapt quickly enough to survive. In these cases, collecting and conserving the threatened diversity will be crucial. Crop varieties or species better suited to new growing conditions may need to be introduced. In the livestock sector, this sort of substitution has already begun. In some drought-prone areas of Africa, pastoralists are switching to raising camels instead of sheep and goats.

Key facts

- The 2005 Millennium Ecosystem Assessment estimates that by the end of this century, climate change will be the main cause of biodiversity loss.
- The Intergovernmental Panel on Climate Change asserts that roughly 20 to 30 percent of species it has assessed are likely to be at increasingly high risk of extinction as global mean temperature exceeds pre-industrial levels by 2 to 3° C.
- Many livestock breeds cannot be genetically improved fast enough to adapt to climate change.
- Coping mechanisms based on local biodiversity are particularly important for the most vulnerable people, who have little access to formal employment, land or market opportunities.

The increased use of biodiversity for food and agriculture, particularly soil microorganisms, also has the potential to mitigate climate change by reducing the accumulation of greenhouse gases in the atmosphere. Harnessing local biodiversity can maintain the health of forests and the fertility of agricultural soils, both of which are important carbon sinks. It can also reduce the need for nitrogen-based fertilizers, a major source of greenhouse gases, and other energy-intensive commercial inputs.

What is to be done?

There is an urgent need to determine the distribution of biodiversity for food and agriculture both in the wild and in the fields and assess its vulnerability to climate change. Matching biodiversity distribution mapping with different climate change scenarios is a basic requirement for countries to develop conservation strategies. Information is also needed about the biodiversity held in national and international gene banks. The potential to harness this biodiversity to cope with climate change remains untapped, largely due to a lack of information on the characteristics of the genetic diversity conserved and their performance in the field. Global information systems that can store and manage this data and make it accessible to researchers, breeders and farmers are essential.

This information and analysis needs to be integrated into future reports of the Intergovernmental Panel on Climate Change. And the panel's climate change data and projections need to be incorporated into FAO's global biodiversity assessments.

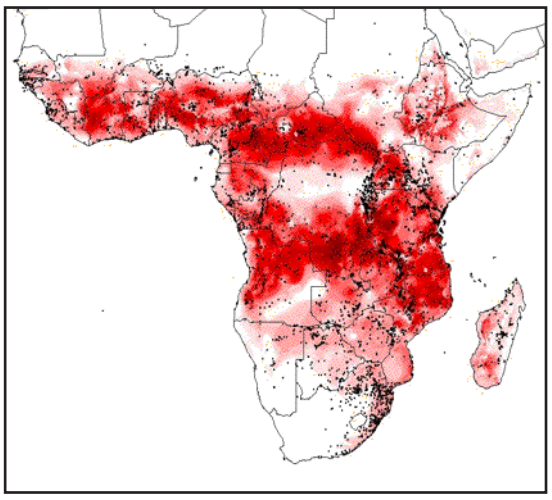
Farmers at the forefront

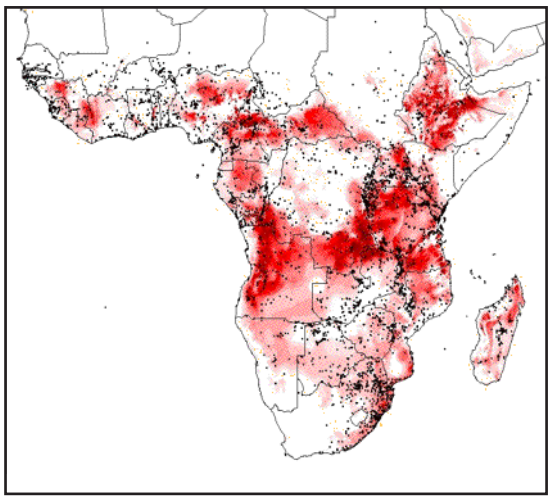
Rural communities have the largest stake in developing strategies to cope with climate change, and understanding how they are currently using biodiversity to cope with climate change should be the basis for future actions. Men and women farmers, pastoralists and fisherfolk and their local institutions need to be given access to information about climate change and the ways locally available biodiversity can help them adapt.

Access to agricultural biodiversity will determine whether a given strategy is feasible. Governments must ensure that rural communities have access to the biodiversity they need. Especially important will be global exchange mechanisms that can ensure every country has access to genetic resources for food and agriculture and that can guarantee the fair and equitable sharing of the benefits arising out of their use.

Decline of a strategic resource

Projections suggest that by 2055 climate change will cause the dramatic decline (map on right) of the important genetic resource wild vigna (related to the African staple cowpea, an important and inexpensive source of protein) from its current distribution and genetic diversity (map on left).





Source: Jarvis, A., et al., The effects of climate change on crop wild relatives, Agric Ecosyst Environ (2008)

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