

## Biodiversity and agriculture – rivalry or a new friendship?

Like agriculture and climate change, agriculture and biodiversity, and hence food security, are interconnected in both a negative and a positive sense. In this article, our author describes what we know about the links, what role the agricultural sectors have to play in the sustainable use and conservation of biodiversity and what the transition of agricultural systems which this requires could look like in small-scale and in large-scale production.

By Irene Hoffmann

Biodiversity plays a crucial role in achieving food security and nutrition for all. Biodiversity also provides regulating and supporting ecosystem services for agriculture, including nutrient cycling, soil formation and rehabilitation, as well as habitats for wild species, biological pest control and pollination. Biodiversity makes production systems and livelihoods more resilient to shocks and stresses, including the effects of climate change. But despite global efforts spanning several decades, biodiversity continues to be eroded; in their 2019 publications, the Food and Agriculture Organization (FAO) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) provide evidence that many of the drivers that have negative impacts on biodiversity are at least partly caused by inappropriate agricultural practices.

Without changes in production and consumption patterns and reductions in food waste and losses, the agricultural sectors will struggle to meet future food demands. As demand grows, the role of the agricultural sectors in the sustainable use and conservation of biodiversity will become even more significant. Regarding biodiversity and food security, food system and sustainable agricultural transitions are part of a larger debate on the role of farm size in global food security, biodiversity and landscape fragmentation as well as land-sharing versus land-sparing, and have most recently been addressed in the development of the post-2020 global biodiversity framework.

The following focuses on terrestrial (mostly crop production) systems, despite the important role of biodiversity and its management in marine and coastal ecosystems and inland waters, and the diverse roles of livestock across many ecosystems.

### Biodiversity on which land?

Going back in history, humans have shaped the planet for more than 12,000 years. Therefore, current biodiversity losses are caused not only by anthropogenic degradation of un-



For smallholders, biodiversity conservation must be linked to food security and livelihood improvements.

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touched “natural” ecosystems, but also, and indeed mainly, by changes in the intensity of land already modified. Many of the most biodiverse areas remaining on the planet are forests or drylands, covering about one third of the terrestrial area; they are often managed by indigenous peoples under traditional low-intensity systems, including hunting and gathering. Roughly another third of the land area is too cold or dry for permanent human use, or is covered by extensive shrub- and rangelands.

Agricultural land accounts for more than one third of the terrestrial area. It includes diverse cultural landscapes with dynamic and productive mosaics of ecological communities in varying states of succession, and cultural modifications have been continued or maintained over millennia in many regions, often in smallholder systems, where a wealth of biodiversity for food and agriculture was developed and conserved. At least a quarter of the global land area is traditionally occupied and used or managed by indigenous peoples, and in these areas,

biodiversity is generally declining less rapidly than elsewhere.

### Biodiversity-friendly practices and diverse landscapes as parts of the solution

In the next decade, the agricultural sectors – including crop and livestock production, forestry, fisheries and aquaculture – need to rapidly upscale the best practices identified for managing biodiversity for food and agriculture and for halting the loss of biodiversity within and outside of agricultural systems. FAO country reports on The State of the World’s Biodiversity for Food and Agriculture show that the use of a wide range of management practices and approaches regarded as favourable for the sustainable use and conservation of biodiversity for food and agriculture at landscape, farm and field level, such as landscape management and ecosystem approaches, agroforestry or sustainable soil management, is increasing. However, it is difficult to evaluate

the extent to which these approaches are being implemented. This is firstly because, especially in smallholder systems, many biodiversity-focused practices are relatively complex and can be knowledge-intensive, and are context and location specific and secondly because few appropriate assessment methods and cause-effect relationships have been demonstrated, while benefits of practices materialise only in the relatively long term.

There is an ongoing discussion about the impact of practices versus farm or plot size on biodiversity. The FAO report shows that agricultural landscapes can provide habitats for biodiversity and promote connectivity between protected areas and other biodiverse areas.

Farm holding and field size – though different – are dimensions of landscape heterogeneity, since small-scale agricultural systems with high-field border density, buffer strips, hedges and trees provide habitats and can boost associated biodiversity (e.g. pollinators, natural enemies of pests). This is where smallholders come into the game. Globally, smallholder farms under two hectares represent 84 per cent of all farms and occupy around 12 per cent of the global farmland; they were found to harbour greater crop and non-crop biodiversity at the farm and landscape scales compared to larger farms, as a recent publication in *Nature Sustainability* has shown. Very small fields sizes have a substantial share in the total agriculture of Asia and Africa, but play a smaller role in Western Europe, while large fields dominate in post-Soviet Union countries, the USA, Brazil, Australia, Argentina and Canada. According to the June 2021 issue of *World Development*, large farms of more than 50 hectares represent one per cent of all farms but occupy 70 per cent of farmland.

### What agricultural systems transition should look like

Hunger and poverty are most widespread in rural and smallholder settings in developing countries, where the diversity of food consumed is often low. Smallholder farm systems, when faced with population growth and continued poverty can result in increased biodiversity loss, including through cropland expansion into forests that harbour large parts of wild biodiversity. Local subsistence agriculture accounted for 33 per cent of deforestation in the tropics and subtropics over the 2000–2010 period. Expansion also happens in the commercial sectors: large-scale commercial agriculture accounted for about 40 per cent of

deforestation in the tropics and subtropics over the same period and 70 per cent of the deforestation in Latin America.

In more intensive large-scale systems, agri-environmental policies should aim at reducing field sizes and the share of crops under particularly intensive management while simultaneously promoting diversification. In less biodiverse regions and low-external input farming systems, intensification is an option for closing production yield gaps without necessarily causing additional decline in biodiversity. This can be achieved through improved nutrient, water and pest/ disease management, and innovative approaches such as precision or climate-smart agriculture; however, care has to be taken to not create threats to traditional genetic resources for food and agriculture and wild species depending on extensively managed landscapes.

Agriculture can impact biodiversity but the intensity and extent to which this happens depends on biodiversity richness, abundance and endemism in and surrounding the intensified area or farm. Even when agricultural expansion and intensification has already occurred, there are ways to enhance ecosystem services or increase productivity through a range of biodiversity-friendly practices and approaches, as indicated above. Where productive ecosystems are degraded, they have to be restored to their productive potential.

### Targeting agricultural stakeholders for sustainable use, conservation and restoration of biodiversity

Policy-makers need to balance decisions involving land use for biodiversity conservation and agricultural production, taking into account needs of stakeholders, and identify hotspots of biodiversity as well as potential future conflicts and loss of environmental and societal resilience.

Smallholders are both food producers and stewards of biodiversity. While smallholders' globally managed land area is small, their numbers are collectively large and their contribution to food security is significant. However, rural poverty rates are high. For this group, which has been neglected by R&D and extension services in many low- and middle-income countries, biodiversity conservation must be linked to food security and livelihood improvements. Such links could be rewarding smallholders for their conservation benefits towards genetic resources for food and agri-

culture and associated and “wild” biodiversity (e.g. pollinators), and improving market access through public procurement schemes for biodiversity-friendly production methods or specialty markets for traditional foods with higher prices. Policies also need to ensure that agricultural intensification does not lead to reductions in genetic diversity for food and agriculture, and that investments and policy incentives promote diversified agriculture, health and well-being.

The global land area managed by farmers who are not smallholders is significantly larger, and this group, thanks to their relatively lower numbers and often better organisation, are potentially easier to target than local networks of smallholders. Biodiversity-friendly practices need to be up-scaled and promoted through capacity development and strengthening policy frameworks. Biodiversity can be promoted on larger farms by stimulating more biodiversity-friendly management practices, especially reducing the use of pesticides and more effectively using fertilisers, and increasing habitats such as buffer strips, hedges and trees. These farmers operate in the formal sector of the economy where regulation, taxes and incentives take hold. They are also often linked to global value chains, where consumer pressure, government commitments and corporate standards involving zero-deforestation and eco-labelling bring about change. Ecosystem accounting at national and corporate levels and innovative investment could further enhance the links between conservation and production.

Nature cannot afford to rival agriculture. Dual goals of conserving biodiversity while increasing the efficiency and yield of food production can be simultaneously achieved through acknowledging and valuing the full contribution of nature to agricultural systems and engaging with all stakeholders at all levels. Political will and multistakeholder action are key.

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**Irene Hoffmann** is Secretary of the Commission on Genetic Resources for Food and Agriculture, Office of Climate Change, Biodiversity and Environment, at the Food and Agriculture Organization of the United Nations (FAO) in Rome, Italy.  
Contact: irene.hoffmann@fao.org

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