



Food and Agriculture
Organization of the
United Nations

COMMISSION ON
GENETIC RESOURCES
FOR FOOD AND
AGRICULTURE

HOW THE WORLD'S FOOD SECURITY DEPENDS ON BIODIVERSITY



As the world population continues to rise, new ways are needed to sustainably increase agricultural production, improve supply chains, reduce food losses and waste, and ensure access to nutritious food for all at all times.

PEOPLE AFFECTED BY GLOBAL HUNGER

More than 690 million people are affected by hunger today or 8.9 percent of the world population. An estimated 2 billion people in the world did not have regular access to safe, nutritious and sufficient food in 2019 (FAO, IFAD, UNICEF, WFP and WHO, 2020).

Food insecurity can worsen diet quality and consequently increase the risk of various forms of malnutrition, potentially leading to undernutrition as well as overweight and obesity. Moderate or severe food insecurity affects one quarter of the world population. Over half of the people affected by moderate or severe food insecurity in the world live in Asia and more than one-third in Africa (FAO, IFAD, UNICEF, WFP and WHO, 2020).

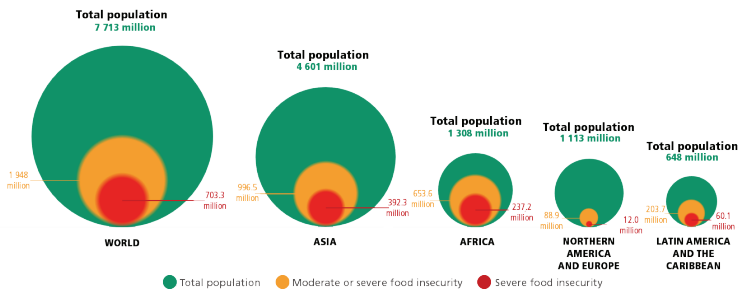


Figure 1: Concentration and distribution of food insecurity by severity across the world regions (2019).

Source: FAO, IFAD, UNICEF, WFP and WHO, 2020; United Nations, Department of Economic and Social Affairs, Population Division, 2019.

"The plain fact is that every mouthful of food you eat comes from the natural world. There's no food that nourishes you that doesn't come from the natural world. Every lungful of air that you take is refined by the natural world, oxygen breathed out by plants. If you can't breathe and you can't eat, you don't exist."

Sir David Attenborough



BIODIVERSITY IS ESSENTIAL TO FOOD AND AGRICULTURE

Biodiversity is the variety of life at genetic, species and ecosystem levels. It is the range and variety of Earth's plants, animals and micro-organisms and is vital to food security. In addition to the crops, livestock – and other plants, animals and fungi that are collected from nature and are referred to as wild foods – that we eat directly, food production depends on a multitude of other species and on the ecosystems in which they live. For example, many of the world's most important crop species depend on animal pollinators – usually insects, but sometimes bats or birds. Countless invertebrate and micro-organism species are essential to the fertility of the soils upon which crop, livestock and forest production depends. A variety of different species help to control pests and parasites that affect food-producing plants and animals. Forests, grasslands, inland wetlands, and marine and coastal ecosystems such as mangroves, seagrass beds and coral reefs provide a range of services to food production and agriculture. Important examples of such services include regulating the flow of water, improving air quality, binding carbon, and hence helping to reduce the threat posed by climate change, providing habitat for species that contribute to food supplies, and providing protection against extreme events such as storms and floods.

If managed appropriately, the species directly used as sources of products in crop, livestock, forest and aquaculture systems can also support other types of production. For example, crop residues can be used as feed for animals. Animal manure can be used to fertilize crop fields, and in some parts of the world many farmers rely on animals for draught power. Trees can provide shelter or shade for crops, livestock or aquaculture ponds, or food for animals. Fish and ducks can be used to control pests in rice paddies.



Sources: Burgin, *et al.*, 2018; BirdLife International, 2018; Beech *et al.*, 2017; FAO, 2014b; 2019a; b; 2020; IPK, 2017; RBG Kew, 2016.

Biodiversity's contributions to food security are often made more effective and reliable by the presence, or availability, of a range of different species and of genetically diverse populations within species.

Biodiversity, at genetic, species and ecosystem levels, is important for efforts to address the challenges posed by diverse and changing production systems, in promoting resilience, improving livelihoods and supporting food security and nutrition. Many practices and approaches improve diversification – using multiple species, integrating the use of crop, livestock, forest and aquatic resources, and conserving and managing habitat diversity at landscape or seascape scale.

Farmers, livestock keepers, forest dwellers and fisherfolk are managers and custodians of biodiversity. Family farms represent over 90 percent of all farms globally and produce 80 percent of the world's food in value terms (FAO, 2014a). Over millennia, producers domesticated and selected the plant and animal populations that gave rise to today's crop and livestock diversity.

Traditional producers and indigenous peoples have a wealth of knowledge on biodiversity and its use in the supply of food. Although indigenous peoples constitute only 5 percent of the world population, it has been estimated that they manage or have tenure rights over about 40 percent of the planet's protected areas and a similar proportion of its ecologically intact landscapes (excluding Antarctica) (Garnett *et al.*, 2018).

The number of tree species in the world is estimated to be about

60 000



About **2 400** species are managed for products and/or services




700 species are included in tree improvement programmes



It is estimated that there are over

160 000 species of fish and aquatic molluscs, crustaceans and plants



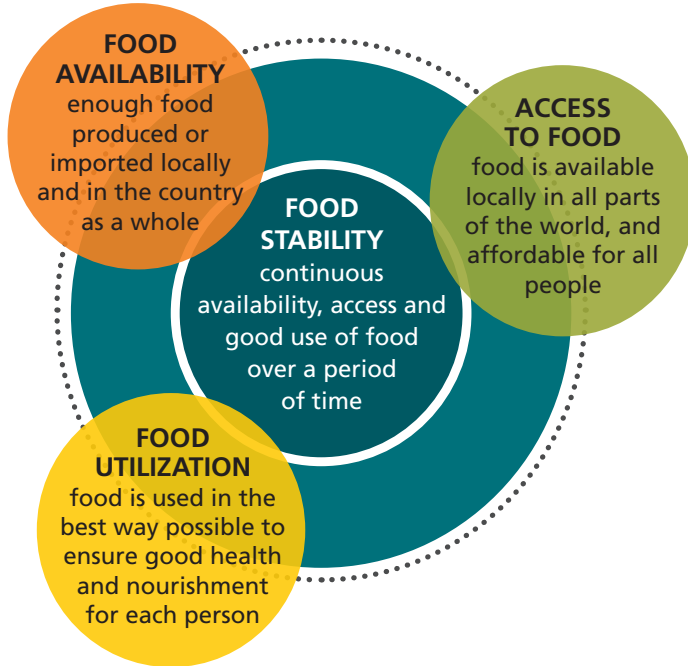
694 species are reported to be farmed



Vectors created by bigfx, macrovector - www.freepik.com

ALL DIMENSIONS OF FOOD SECURITY DEPEND ON BIODIVERSITY

Biodiversity and food security are connected in many ways. Food security is recognized as having four dimensions: availability, access, utilization and stability. Biodiversity contributes to each one of them.



FOOD AVAILABILITY depends on the production and distribution of adequate quantities of a sufficiently wide variety of good quality foods to meet people's nutritional needs. Food production and supply depends on a multitude of different components of biodiversity, both wild and domesticated. Genetic improvement over recent decades has helped food production levels to keep pace with a growing world population. However, the focus of intensive selection on a few species and breeds or varieties has also contributed to the loss of genetic diversity, placing the capacity of food systems to respond to future challenges at risk.

FOOD UTILIZATION relates to the ways in which food products are combined and processed to provide healthy diets. The nutrient composition of foods varies not only across plant and animal species but also across varieties and breeds within species. In addition, safe and nutritious diets depend not only on food products themselves but also on other services provided by biodiversity. For example, many people rely on their local ecosystems to purify their water supplies and as sources of fuelwood. In some places, dung from livestock is also a vital source of fuel for cooking. Micro-organisms are essential in many food-processing activities, for example in bread making and cheese making, as well as in food preservation, for example through fermentation.

ACCESS TO FOOD depends on making sure that food is distributed and available locally and is affordable to all people. Physical, social and economic constraints to food acquisition may need to be overcome so that everyone – including the poorest and most marginalized – is able to obtain the food they need when they need it. As well as providing many people with the means to grow, gather or hunt food to eat, biodiversity can also be a source of income that can be used to buy food (or reinvest in food production, storage or processing), thus improving access to food.

STABILITY is the continuous availability, access and good use of food over a period of time. Biodiversity contributes in many ways to the stability of food supplies. Different kinds of plants and animals are able to provide food at different times of the year and in different environmental conditions. Some are particularly well adapted to coping with threats such as hot or dry weather or pest or disease outbreaks. For many people, wild biodiversity provides a backup source of food when production from domesticated plants and animals is disrupted (Box 1). Whole ecosystems contribute to the stability of the food supply by, for example, reducing the risk of flood or storm damage or by providing habitats for a diverse range of wild pollinators and other wild species and thus reduce the risk of fluctuations in the provision of pollination and other ecosystem services. From a long-term perspective, the conservation of biodiversity makes it available for future generations and for use in addressing hitherto unforeseen challenges.





Box 1: Contributions of wild foods to food security and livelihoods – selected examples reported by countries

In **Ethiopia**, the proportion of the population consuming wild plants varies from 30 or 40 percent in some regions to as much as 56 percent or 67 percent in others. Over 50 percent of the population in the country's Gambella region consume wild meats.

In **Jordan**, wild edible plants provide local inhabitants with a source of highly nutritious food and an opportunity for income generation. The country's National Center for Agricultural Research and Extension has documented more than 100 edible-wild plants which are utilized by local communities as food, salad, spices and traditional medicine.

In **Kiribati**, consumption of wild staple foods, such as giant swamp taro and breadfruit increases in times of emergency or when there are shortages of imported foods (usually rice).

In **Nepal**, wild foods are especially important for some tribal groups (namely the Chepang, Raji, Bankariya and Raute), with wild foods constituting approximately 25 percent of their diets.

In **Niue**, 60 percent of households hunt coconut crabs and 62 percent engage in fishing. Average fresh-fish consumption is estimated at 31.1 kg per person per year.

In **Sweden**, collecting of wild berries and mushrooms is very popular and culturally embedded, although not essential from a food security perspective. Wild lingonberry and bilberry are harvested commercially (10 000 – 20 000 tonnes/year).

In **Zimbabwe**, insects – particularly those that can be collected in large numbers – provide local people with both a supplementary source of nutrition and a source of income. Commercial harvesting and sale of forest insects is a substantial industry in some parts of the country and drives efforts to conserve trees that provide habitat for the targeted insects.

Sources: adapted from the country reports of Ethiopia, Jordan, Kiribati, Nepal (citing Thapa, 2013), Niue, Sweden and Zimbabwe submitted for *The State of the World's Biodiversity for Food and Agriculture* (FAO, 2019a).

BIODIVERSITY CONTRIBUTES TO ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS

Governments, civil society organizations, businesses, United Nations agencies and other entities are working towards achieving the Sustainable Development Goals (SDGs), adopted by the United Nations in 2015. The SDGs are a call to action to achieve by 2030 a more sustainable future for all, end poverty and protect the planet in an integrated way. SDG 2: Zero hunger aims to end hunger, achieve food security and improved nutrition and promote sustainable agriculture. Biodiversity contributes in multiple ways to the achievement of SDG 2 (Table 1).

By committing itself to meeting all the SDGs, the international community has acknowledged that there is a need for transformative change. It has recognized that restoring production ecosystems is a necessary part of transforming food systems and placing them on a more sustainable path. In this context, FAO is working to ensure that biodiversity is taken into consideration at all levels and in all agricultural sectors in efforts to promote food security and healthy diets.

Biodiversity both contributes to, and is affected by, efforts to achieve many other SDGs that have direct or indirect links to food security, including: No poverty (SDG 1); Good health and well-being (SDG 3); Gender equalities (SDG 5); Clean water and sanitation (SDG 6); Decent work



and economic growth (SDG 8); Sustainable consumption and production patterns (SDG 12); Climate action (SDG 13); Life below water (SDG 14); and Life on land (SDG 15) (CBD *et al.*, 2016).

However, across the globe, biodiversity is in decline. Key threats to the biodiversity that contributes to food and agriculture include damaging land-use and water-use practices, often including those associated with food production systems, overharvesting, pollution from a variety of sources, invasive species and the effects of climate change.

The world's agriculture is heavily dependent on a narrow range of species. Only 9 species supply nearly 66 percent of our total crop production, and only 8 of the 40 domesticated mammalian and avian species provide more than 95 percent of the human food supply from livestock. Ten species account for 50 percent of total aquaculture production (FAO, 2019b). Production is often also based on a narrow range of within-species genetic diversity, for example dominated by a few crop varieties or livestock breeds. In many cases, domesticated biodiversity is declining as production systems intensify.

Biodiversity needs to become central to the way we think about human well-being, food security and health. Our actions today need to change for the sake of tomorrow.



Table 1: Ways in which the diversity of genes, species and ecosystems contribute to achieving Sustainable Development Goal 2

SDG 2. Targets	Contributions
<p>2.1 End hunger and ensure access to food all year round</p>	<p>Biodiversity underpins all food supplies, both by directly providing food products and by creating the conditions in which food production can occur.</p> <p>Utilizing a range of species and within-species diversity helps to ensure continuity in the food supply as conditions change with the season or because of shocks such as droughts or disease outbreaks. It allows producers to adapt their livelihood strategies when faced with environmental or economic changes, for example changes in the climate or in consumer demands.</p> <p>Access to wild foods potentially serves as a means of maintaining food intakes in the event of shocks that affect food output from domesticated species or otherwise affect access to food (e.g. because of reduced cash income).</p> <p>Genetic diversity provides the raw material for breeding new varieties and breeds of plants and animals that produce more food or more nutritious food, use inputs more efficiently or are better adapted to their production environments.</p>
<p>2.2 End all forms of malnutrition</p>	<p>As well as enabling increases in the quantity of food available, biodiversity also plays a vital role in terms of providing well-balanced diets. Consuming products from a wide range of species, varieties and breeds helps to ensure that diets contain all the vitamins and minerals needed for a healthy life. Wild foods increase the nutritional quality and diversity of the diets of millions of people.</p>

2.3 Double productivity and incomes of small-scale food producers	<p>Small-scale producers are often highly dependent on their local ecosystems for the supply of the inputs they require (water, livestock feed, etc.). They need crops and animals that are well adapted to the, often harsh, environmental conditions in which they operate.</p> <p>Biodiversity makes production systems more resilient to shocks and provides options for adapting them to change. Well-planned genetic-improvement programmes and access to a wide range of genetic resources can help small-scale producers increase their output or deal with emerging challenges. Growing multiple crops or combining crop, livestock, fish or tree production can give rise to synergies and efficiencies in the use of resources.</p>
2.4 Ensure sustainable food production systems	<p>Biodiversity increases the social, economic and environmental sustainability of food production systems in various ways. It provides many opportunities to improve livelihoods and generate income. Biodiversity-based management practices can help reduce negative environmental impacts, for example by reducing the need to use large amounts of inputs such as pesticides and mineral fertilizers. Diversity of habitats in and around production systems encourages the presence of useful species such as pollinators and the natural enemies of pests. Diversity among these species helps to ensure that the services they provide are maintained over time.</p>
2.5 Maintain genetic diversity of cultivated plants and farmed animals	<p>This target relates directly to the conservation of domesticated biodiversity. Genetic diversity within species is the raw material for evolution by natural selection and for breeding programmes aimed at developing plant and animal populations that can produce more or are better able to cope with harsh conditions.</p>

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

With 178 countries and the European Union as its members, the Commission on Genetic Resources for Food and Agriculture provides a unique intergovernmental forum that specifically addresses biological diversity for food and agriculture.

The main objective of the Commission is to ensure the sustainable use and conservation of biodiversity for food and agriculture and the fair and equitable sharing of benefits derived from its use, for present and future generations. The Commission guides the preparation of periodic global assessments of the status and trends of genetic resources and biological diversity for food and agriculture. In response to these assessments, the Commission develops global plans of action, codes of conduct or other policy instruments and monitors their implementation.



The Commission raises awareness of the need to conserve and sustainably use biological diversity for food and agriculture and fosters collaboration among countries and other relevant stakeholders to address threats to this biodiversity and promote its sustainable use and conservation.

The Commission supports all the SDGs – in particular SDG 1; SDG 2; SDG 12; SDG 13; SDG 14 and SDG 15. The Commission through the Domestic Animal Diversity Information System (DAD-IS) and the World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture (WIEWS), monitors progress towards SDG 2.5 (indicators 2.5.1 and 2.5.2).



WHAT NEEDS TO BE DONE?

- Increase awareness about the importance of biodiversity for food and agriculture to food security and nutrition, and build capacity to manage it sustainably.
- Conserve the ecosystems, species and genetic diversity that contribute to food security by managing them sustainably at production-system level and by tackling broader threats to their survival.



- Improve producers' access to the genetic resources they need in order to improve their livelihoods.
- Mainstream the sustainable use of biodiversity into development policies and into extension activities.
- Promote active networking and exchange of information and knowledge among scientists, breeders, producers and other stakeholders.



REFERENCES

- Beech, E., Rivers, M., Oldfield, S., & Smith, P. P.** 2017. GlobalTreeSearch: the first complete global database of tree species and country distributions. *Journal of Sustainable Forestry*, 36(5): 454–489.
- BirdLife International.** 2018. *State of the world's birds: taking the pulse of the planet*. United Kingdom, 76 p. (available at https://www.birdlife.org/sites/default/files/attachments/BL_ReportENG_V11_spreads.pdf).
- Burgin, C.J., Colella, J.P., Kahn, P.L. & Upham, N.S.** 2018. How many species of mammals are there? *Journal of Mammalogy*, 99(1): 1–14.
- CBD, FAO, World Bank, UNEP, UNDP.** 2016. *Biodiversity and the 2030 Agenda for Sustainable Development. Technical Note* (available at <https://www.cbd.int/development/doc/biodiversity-2030-agenda-technical-note-en.pdf>), and Policy Brief (available at <https://www.cbd.int/development/doc/biodiversity-2030-agenda-policy-brief-en.pdf>).
- FAO (Food and Agriculture Organization of the United Nations).** 2014a. *The State of Food and Agriculture 2014. Innovation in Family Farming*. Rome. (available at <http://www.fao.org/3/a-i4040e.pdf>).
- FAO.** 2014b. *The State of the World's Forest Genetic Resources*. Rome. (available at <http://www.fao.org/3/a-i3825e.pdf>).
- FAO.** 2018. *The State of World Fisheries and Aquaculture 2018 – Meeting the Sustainable Development Goals*. Rome. (available at <http://www.fao.org/3/i9540en/i9540en.pdf>).
- FAO.** 2019a. *The State of the World's Biodiversity for Food and Agriculture*, J. Bélanger & D. Pilling (eds.). FAO Commission on Genetic Resources for Food and Agriculture Assessments. Rome. (available at <http://www.fao.org/3/CA3129EN/CA3129EN.pdf>).
- FAO.** 2019b. *The State of the World's Aquatic Genetic Resources for Food and Agriculture*. FAO Commission on Genetic Resources for Food and Agriculture assessments. Rome. (available at <http://www.fao.org/3/CA5256EN/CA5256EN.pdf>).
- FAO.** 2020. FAOSTAT. (production data for 2018). (available at <http://www.fao.org/faostat/en/>). Cited 15 April 2020.
- FAO, IFAD, UNICEF, WFP & WHO.** 2020. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. Rome, FAO. (available at <https://doi.org/10.4060/ca9692en>).
- Garnett, S.T., Burgess, N.D., Fa, J.E., Fernández-Llamazares, A., Molnár, Z., Robinson, C.J., Watson, J.E.M., Zander, K.K., Austin, B., Brondizio, E.S., Collier, N.F., Duncan, T., Ellis, E., Geyle, H., Jackson, M.V., Jonas, H., Malmer, P., McGowan, B., Sivongxay, A. & Leiper, I.** 2018. A spatial overview of the global importance of Indigenous lands for conservation. *Nature Sustainability*, 1(7): 369–374.
- IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services).** 2019. *Global Assessment Report on Biodiversity and Ecosystem Services*. Germany.
- IPK.** 2017. *Mansfeld's World Database of Agriculture and Horticultural Crops*. [Cited 25 June 2018]. (available at <http://mansfeld.ipk-gatersleben.de/apex/f?p=185:3>).
- RBG Kew (Royal Botanic Gardens, Kew).** 2016. *The State of the World's Plants Report – 2016*. Kew, UK.
- Thapa, R.B.** 2013. *Field research report on food and nutrition security of the forest dependent households from the forests of Nepal*. Bhaktapur, Nepal, Renaissance Society Nepal (RSN).
- United Nations, Department of Economic and Social Affairs, Population Division.** 2019. *World Population Prospects 2019: Data Booklet (ST/ESA/SER.A/424)*. New York, USA. (available at https://population.un.org/wpp/Publications/Files/WPP2019_DataBooklet.pdf).



Food and Agriculture Organization of the United Nations
Commission on Genetic Resources for Food and Agriculture

Viale delle Terme di Caracalla
00153 Rome, Italy

www.fao.org/cgrfa

Cover photo: ©FAO/Seyllou Diallo



Some rights reserved. This work is available
under a CC BY-NC-SA 3.0 IGO licence

© FAO, 2020
CB0416EN/1/07.20