Food and Agriculture Organization of the United Nations

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

THE STATE OF THE WORLD's BIODIVERSITY FOR FOOD AND AGRICULTURE

in brief

FAO COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

ASSESSMENTS • 2019

The examples shown in this figure are intended to represent the wide variety of plants, animals and micro-organisms at genetic, species and ecosystem levels that compose biodiversity for food and agriculture.

Illustration: Chiara Caproni

What is biodiversity for food and agriculture?

Biodiversity is the variety of life at genetic, species and ecosystem levels. *Biodiversity for food and agriculture* (BFA) is, in turn, the subset of biodiversity that contributes in one way or another to agriculture and food production. It includes the domesticated plants and animals raised in crop, livestock, forest and aquaculture systems, harvested forest and aquatic species, the wild relatives of domesticated species, other wild species harvested for food and other products, and what is known as "associated biodiversity", the vast range of organisms that live in and around food and agricultural production systems, sustaining them and contributing to their output. Agriculture is taken here to include crop and livestock production, forestry, fisheries and aquaculture.

KEY FINDINGS

1. **Biodiversity is essential to food and agriculture**
   - Biodiversity for food and agriculture is indispensable to food security, sustainable development and the supply of many vital ecosystem services.
2. **Multiple interacting drivers of change are affecting biodiversity for food and agriculture**
   - While a range of drivers of change are having major negative impacts on biodiversity for food and agriculture and the ecosystem services it delivers, some provide opportunities to promote more sustainable management.
3. **Biodiversity for food and agriculture is declining**
   - Many key components of biodiversity for food and agriculture at genetic, species and ecosystem levels are in decline.
   - Knowledge of associated biodiversity, in particular micro-organisms and invertebrates, and of its roles in the supply of ecosystem services needs to be improved.
   - Monitoring programmes for biodiversity for food and agriculture remain limited.
4. **The use of many biodiversity-friendly practices is reported to be increasing**
   - The sustainable use and conservation of biodiversity for food and agriculture call for approaches in which genetic resources, species and ecosystems are managed in an integrated way in the context of production systems and their surroundings.
   - The use of a wide range of management practices and approaches regarded as favourable to the sustainable use and conservation of biodiversity for food and agriculture is reported to be increasing.
   - Although efforts to conserve biodiversity for food and agriculture *in situ* and *ex situ* are increasing, levels of coverage and protection are often inadequate.
5. **Enabling frameworks for the sustainable use and conservation of biodiversity for food and agriculture remain insufficient**
   - Enabling frameworks for the sustainable use and conservation of biodiversity for food and agriculture urgently need to be established or strengthened.
   - Research on food and agricultural systems needs to become more multidisciplinary, more participatory and more focused on interactions between different components of biodiversity for food and agriculture.
   - Improving the management of biodiversity for food and agriculture and enhancing its contribution to ecosystem services call for better multistakeholder, cross-sectoral and international cooperation.

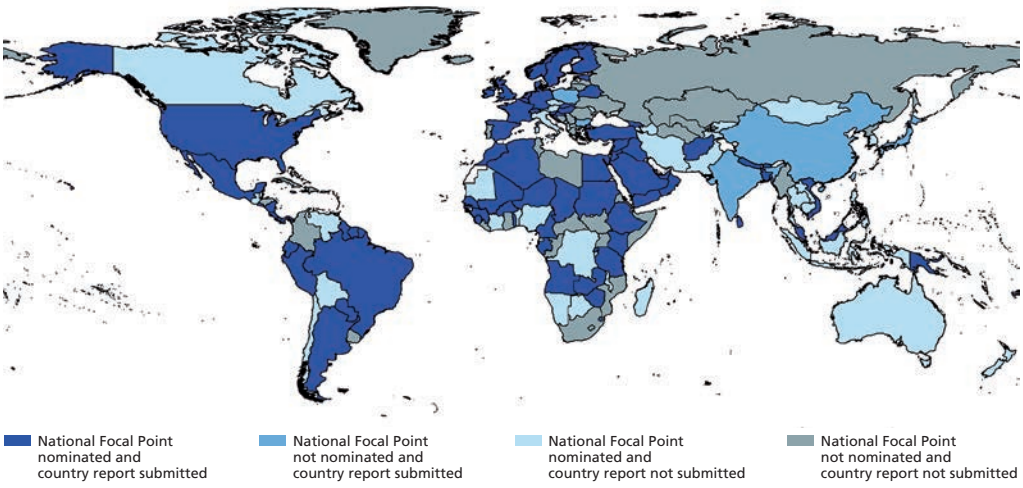
About the report

The State of the World's Biodiversity for Food and Agriculture provides an assessment of biodiversity for food and agriculture (BFA) and its management worldwide, drawing on information provided in 91 country reports (prepared by over 1 300 contributors), 27 reports from international organizations and inputs from over 175 authors and reviewers.

It describes:

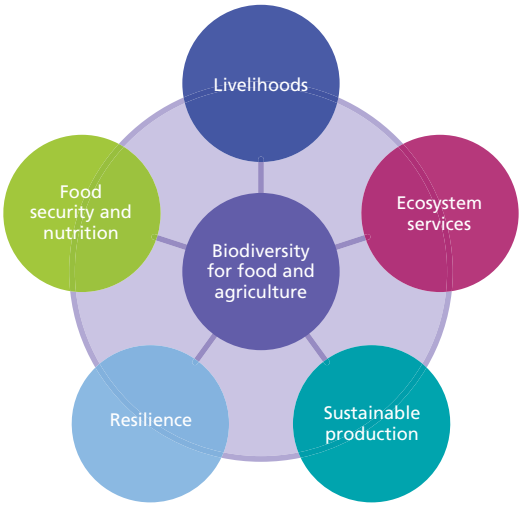
- the many contributions that BFA makes to food security and nutrition, livelihoods, the resilience of production systems, the sustainable intensification of food production and the supply of multiple ecosystem services;
- the major drivers of change affecting BFA;
- the status and trends of various components of BFA;
- the state of management of BFA;
- the state of policies, institutions and capacities that support the sustainable use and conservation of BFA; and
- needs and challenges in the management of BFA.

Participation in the reporting process



Note: Data as of October 2018.
Source: FAO.

Biodiversity is essential to food and agriculture



Biodiversity for food and agriculture is indispensable to food security, sustainable development and the supply of many vital ecosystem services. Biodiversity makes production systems and livelihoods more resilient to shocks and stresses, including to the effects of climate change. It is a key resource in efforts to increase food production while limiting negative impacts on the environment. It makes multiple contributions to the livelihoods of many people, often reducing the need for food and agricultural producers to rely on costly or environmentally harmful external inputs. The country reports highlight the importance of biodiversity, at genetic, species and ecosystem levels, to efforts to address the challenges posed by diverse and changing production systems. Many emphasize the role of 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 – in promoting resilience, improving livelihoods and supporting food security and nutrition.

What needs to be done?

- Ensure that the ecosystems, species and genetic diversity that contribute to the supply of food and agricultural products and the resilience of food and agricultural systems are conserved and used sustainably.
- Strengthen knowledge of the roles of biodiversity in the ecological processes that underpin food and agricultural production, and use this knowledge to develop management strategies that protect, restore and enhance these processes across a range of scales.
- Establish effective policy and outreach measures to support the uptake of management practices that sustainably use biodiversity to promote food and livelihood security and resilience.

Multiple interacting drivers of change are affecting biodiversity for food and agriculture

While a range of drivers of change are having major negative impacts on biodiversity for food and agriculture and the ecosystem services it delivers, some provide opportunities to promote more sustainable management. Analysis of the country reports and the wider literature indicates that BFA is affected by a variety of drivers operating at a range of levels: major global trends such as changes in climate, international markets and demography give rise to more immediate drivers such as land-use change, pollution and overuse of external inputs, overharvesting and the proliferation of invasive species. Interactions between drivers often exacerbate their effects on BFA. Demographic changes, urbanization, markets, trade and consumer preferences are reported to have a strong influence on food systems, frequently with negative consequences for BFA and the ecosystem services it provides. However, such drivers are also reported to open opportunities to make food systems more sustainable, for example through the development of markets for biodiversity-friendly products. Many of the drivers that have negative impacts on BFA, including overexploitation, overharvesting, pollution, overuse of external inputs, and changes in land and water management, are at least partially caused by inappropriate agricultural practices.

The driver mentioned by the highest number of countries as having negative effects on regulating and supporting ecosystem services is changes in land and water use and management. Loss and degradation of forest and aquatic ecosystems and, in many production systems, transition to intensive production of a reduced number of species, breeds and varieties, remain major drivers of loss of BFA and ecosystem services. Countries report that the maintenance of traditional knowledge related to BFA is negatively affected by the loss of traditional lifestyles as a result of population growth, urbanization and the industrialization of agriculture and food processing, and by overexploitation and overharvesting. Policy measures and advances in science and technology are largely seen by countries as positive drivers that offer ways of reducing the negative effects of other drivers on BFA. They provide critical entry points for interventions supporting sustainable use and conservation. However, policies intended to promote the sustainable management of BFA are often weakly implemented.

Countries' evaluation of the effects of drivers of change on biodiversity for food and agriculture in production systems

Drivers of change		Reported effect on biodiversity for food and agriculture
Economic and social	Population growth and urbanization	- -
	Markets and trade	-
	Changing economic, sociopolitical and cultural factors	+ / -
Environmental drivers	Climate change	- -
	Natural disasters	- -
	Pests, diseases, invasive alien species	- -
Drivers at production system level	Changes in land and water use and management	- -
	Pollution and external inputs	- -
	Overexploitation and overharvesting	- -
Other	Advances and innovations in science and technology	+
	Policies	+ +

Note: Darker shades of blue indicate a higher number of responses. The symbols (--, -, +/-, +, ++) indicate whether the impacts of the respective drivers are generally perceived to be very negative, negative, mixed, positive or very positive. See main report for details of the methodology.

What needs to be done?

- Improve understanding of the effects of drivers of change on the sizes and distributions of species populations and on the ecological processes that contribute to the supply of ecosystem services – and take urgent action to address those that are eroding the biodiversity that underpins food and agriculture.
- Improve the monitoring of recognized threats to BFA, such as habitat destruction, pollution, inappropriate use of agricultural inputs, overharvesting, pests, diseases and invasive alien species, and strengthen efforts to reduce their negative impacts.
- Identify existing, and develop new, technologies and management practices that have positive effects on BFA and the supply of ecosystem services, and promote their use.
- Identify and implement policies that help to protect biodiversity from the effects of negative drivers and support its sustainable use; remove or revise policies that have harmful effects.
- Promote the use of BFA in climate change adaptation and mitigation, disaster-risk reduction and in addressing other drivers that negatively affect production systems and the supply of ecosystem services.

Biodiversity for food and agriculture is declining

Many key components of biodiversity for food and agriculture at genetic, species and ecosystem levels are in decline. Evidence suggests that the proportion of livestock breeds at risk of extinction is increasing, and that, for some crops and in some areas, plant diversity in farmers' fields is decreasing and threats to diversity are increasing. Nearly a third of fish stocks are overfished and a third of freshwater fish species assessed are considered threatened. Countries report that many species that contribute to vital ecosystem services, including pollinators, the natural enemies of pests, soil organisms and wild food species, are in decline as a consequence of the destruction and degradation of habitats, overexploitation, pollution and other threats. Key ecosystems that deliver numerous services essential to food and agriculture, including supply of freshwater, protection against hazards and provision of habitat for species such as fish and pollinators, are declining rapidly.

Knowledge of associated biodiversity, in particular micro-organisms and invertebrates, and of its roles in the supply of ecosystem services needs to be improved. While a large amount of information has been accumulated on the characteristics of the domesticated species used in food and agriculture, many information gaps remain, particularly for species, varieties and breeds that are not widely used commercially. Information on wild food species is also often limited. Many associated-biodiversity species have never been identified and described, particularly in the case of invertebrates and micro-organisms. Even when they have, their functions within the ecosystem often remain poorly understood. Over 99 percent of bacteria and protist species remain unknown. For several types of associated biodiversity, including soil micro-organisms and those used for food processing, advances in molecular techniques and sequencing technologies are facilitating characterization. Several countries have active programmes for characterizing soil micro-organisms using molecular methods. In many countries, however, gaps in terms of skills, facilities and equipment constrain opportunities to benefit from these developments.

Crop diversity in farmers' fields **has declined** and threats are increasing.

Of **6 000 plant species** that have been cultivated for food, **9 account** for **66% of total** crop production.

Of **7 745** extant **local breeds** of livestock reported globally, **26%** are classified as **at risk of extinction**.

There are about **60 000 tree species** globally.

694 species are reported to be used in **aquaculture**. **Global capture** fisheries harvest **over 1 800 species** of animals and plants.

33% of **fish stocks** are estimated to be **overfished**, 60% to be maximally sustainably fished and 7% to be underfished.

Bee-colony losses are on the rise; **17%** of vertebrate **pollinator species** are threatened with global **extinction**.

Many countries report **declines** in populations of **birds, bats and insects** that contribute to pest and disease regulation.

Soil biodiversity is **under threat** in all regions of the world.

The IUCN Red List of Threatened Species contains **over 9 600 wild food** species of which **20%** are considered **threatened**.

Over **70%** of **inland** and over **60%** of coastal **wetlands** are estimated to **have been lost** since 1900.

The world's **mangrove area declined** by an estimated **20%** between 1980 and 2005. These vital ecosystems remain **widely threatened**.

Recent years have seen **massive losses of coral** reefs globally.

The global area covered by **seagrass** is estimated to have **declined** by **29%** in the last 100 years.

Global forest area continues to **decline**, although the rate of loss decreased by 50% in recent decades.

Rangelands cover at least **34%** of **global land area**. They are among the ecosystems most affected by land degradation.

Note: Data presented in this figure are compiled from various sources and have various reference years. For more information, see Chapter 4 of the main report.

Monitoring programmes for biodiversity for food and agriculture remain limited. Assessment and monitoring of the status and trends of BFA at national, regional and global levels are uneven and often limited. Even in developed regions, where the population trends of many species are well monitored and there are numerous ongoing research projects on the links between biodiversity and food and agriculture, available data often provide only a snapshot of the status of individual species (or groups of species) in particular production systems, habitats or geographical areas. While it is clear that many components of BFA are declining, lack of data often constrains the planning and prioritization of effective remedial measures.

What needs to be done?

- Address the knowledge and data gaps that exist across all categories of BFA.
- Establish or strengthen monitoring programmes for BFA and provide these programmes with the resources needed to operate over the long term.
- Improve methods for recording, storing and analysing data on changes in the status of species and habitats in and around production systems, and make these data accessible to those that need them.
- Address skill gaps, such as shortages of trained taxonomists, and explore innovative options for improving knowledge of status and trends, such as involving non-specialist "citizen scientists" in monitoring some components of BFA.

Rice–fish culture in China.
© FAO/Luohui Liang.

Mountain grasslands in Switzerland.
© Federal Office for Agriculture of Switzerland.

Stingless bee colony.
© MARDI. Provided by Rosliza Jajuli.

The use of many biodiversity-friendly practices is reported to be increasing

The sustainable use and conservation of biodiversity for food and agriculture call for approaches in which genetic resources, species and ecosystems are managed in an integrated way in the context of production systems and their surroundings. In particular for many types of associated biodiversity and wild foods, sustainable use and conservation require *in situ* or on-farm management integrated into strategies at ecosystem or landscape levels. *Ex situ* conservation should serve as a complementary strategy.

The use of a wide range of management practices and approaches regarded as favourable to the sustainable use and conservation of biodiversity for food and agriculture is reported to be increasing. Eighty percent of reporting countries indicate that one or more of the biodiversity-focused practices on which they were invited to report are being used in one or more types of production system. A much higher proportion of OECD countries than non-OECD countries report the use of these practices. However, it is difficult to fully evaluate the extent to which these approaches are being implemented, because of the variety of scales and contexts involved and the absence of data and appropriate assessment methods. Although countries generally indicate that the impacts of the biodiversity-focused practices on diversity are perceived to be positive, they emphasize the need for more research in this regard, even for practices where research on production issues is well established. Many biodiversity-focused practices are relatively complex and require good understanding of the local ecosystem. They can be knowledge intensive, context specific and provide benefits only in the relatively long term. Many countries note major challenges in up-scaling such practices, and the need to promote them through capacity development and strengthening policy frameworks.

Countries' evaluation of trends in the use of selected management practices and approaches

Management practices and approaches	Production systems (PS)											
	Livestock grassland-based systems	Livestock landless systems	Naturally regenerated forests	Planted forests	Self-recruiting capture fisheries	Culture-based fisheries	Fed aquaculture	Non-fed aquaculture	Irrigated crop systems (rice)	Irrigated crop systems (other)	Rainfed crop systems	Mixed systems
Landscape management	↗	↗	↗	↗					↗	↗	↗	↗
Ecosystem approach to fisheries					↗	↗	↗					
Restoration	↗		↗	↗	↗				↗	↗	↗	↗
Diversification	↗	↗	↗	↗	↗	↗	↗		↗	↗	↗	↗
Home gardens	↗	↔	↗	↗					↗	↗	↗	↗
Agroforestry	↗	↗	↗	↗					↗	↗	↗	↗
Polyculture/aquaponics							↗					↗
Organic agriculture	↗	↗	↗	↗					↔	↗	↗	↗
Low external input agriculture	↗↙	↗	↗	↗					↗	↗	↗↙	↗
Sustainable soil management	↗	↗	↗	↗					↗	↗	↗	↗
Management of micro-organisms	↗		↗	↗	↗				↗	↗	↗	↗
Conservation agriculture	↗	↗	↗	↗					↗	↗	↗	↗
Integrated plant nutrient management	↗	↗	↗	↗					↗	↗	↗	↗
Integrated pest management	↗	↗	↗	↗	↗				↗	↗	↗	↗
Pollination management	↗	↗	↗	↗						↗	↗	↗
Enrichment planting			↗	↗								↗
Reduced-impact logging			↗	↗								
Domestication	↗	↔	↗↙	↗			↗		↗	↗	↗	↗
Base broadening	↗	↗	↗↙	↗					↗	↗	↗	↗

Proportion of countries reporting the PS that report any trends (%)

0–9
10–19
20–29
30–39

↔ Stable
↗ Increasing
↘ Decreasing
↗↙ Mixed trends

Notes: Analysis based on 91 country reports. See main report for details of the methodology.

Although efforts to conserve biodiversity for food and agriculture *in situ* and *ex situ* are increasing, levels of coverage and protection are often inadequate. Crop, livestock, forest and aquatic genetic resources are conserved *in situ* through a variety of approaches, including promotion of their sustainable use in production systems and the establishment of protected and other designated areas. However, many species and populations remain inadequately protected. Relatively few *in situ* conservation programmes are reported to explicitly target associated biodiversity and its roles in the supply of ecosystem services, although such programmes are increasing. Most associated-biodiversity species targeted are conserved through the promotion of biodiversity-friendly production practices, the establishment of protected areas, or policy and legal measures aimed at restricting activities that damage biodiversity. *Ex situ* conservation efforts for BFA are increasing, in particular for plant genetic resources, although many gaps in coverage remain. Much of the diversity present in minor crops, and in livestock, forest and aquatic species, is also not yet secured *ex situ*. Although limited, public- and private-sector *ex situ* conservation initiatives for targeted species of associated biodiversity have been established, with many countries, for instance, holding culture collections of micro-organisms used in agriculture or in agrifood industries. Eight percent of the wild species reported by countries to be used for food are reported to be subject to *in situ* conservation measures and 13 percent to be conserved *ex situ*.

What needs to be done?

- Improve knowledge of the impacts of management practices on BFA.
- Address challenges involved in up-scaling diversity-enhancing practices and approaches, including through capacity development and by introducing or strengthening policy frameworks that facilitate uptake by producers.
- Tackle the underlying knowledge, resource and policy-related constraints to the establishment of effective *in situ* conservation programmes (including on-farm and in other production systems) and *ex situ* conservation programmes, including the remaining technical barriers to the long-term *ex situ* conservation of some species.
- Promote the use of biodiversity-friendly management practices in crop and livestock production, forestry, fisheries and aquaculture, including, where relevant, traditional management practices associated with local or indigenous communities.
- Promote the maintenance of viable areas of natural or semi-natural habitat within and around production systems, including those that are intensively managed – where necessary, restoring or reconnecting damaged or fragmented habitats.
- Promote the establishment and maintenance of protected and other designated areas to conserve BFA.

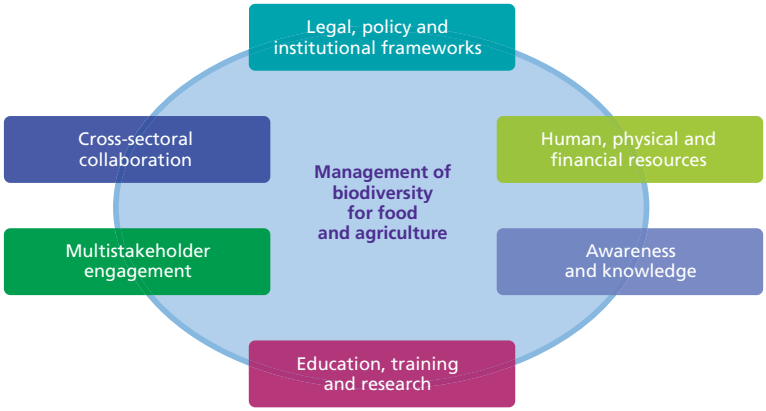
Enabling frameworks for the sustainable use and conservation of biodiversity for food and agriculture remain insufficient

Enabling frameworks for the sustainable use and conservation of biodiversity for food and agriculture urgently need to be established or strengthened. Most countries have put in place legal, policy and institutional frameworks targeting the sustainable use and conservation of biodiversity as a whole. Policies addressing food and agriculture are reported to be increasingly based on ecosystem, landscape and seascape approaches. However, legal and policy measures explicitly targeting wild foods or components of associated biodiversity and their roles in supplying ecosystem services are not widespread. Constraints to the development and implementation of effective policy tools include a lack of awareness among policy-makers and other stakeholders of the importance of BFA, and in particular wild foods and associated biodiversity, to livelihoods and food security. There is a large knowledge gap in terms of how existing policies are affecting these components of biodiversity and the ecosystem services they provide. Diverging interests among stakeholders hamper the development and implementation of laws, policies and regulations, as do shortages of human and financial resources.

What needs to be done?

- Raise awareness among decision-makers about the importance of BFA to sustainable production, livelihoods, food security and nutrition, and about potential means of developing or strengthening relevant policies.
- Increase education and training for stakeholders at every level to improve their knowledge of how management practices and policies affect BFA and the supply of ecosystem services.
- Carry out valuation studies to guide national policies and research programmes.
- Strengthen incentive mechanisms for the sustainable management of BFA.
- Improve cross-sectoral collaboration and multistakeholder engagement and cooperation in the management of BFA.
- Monitor and assess the impact of policies on BFA.
- Mainstream BFA into all relevant policy areas.

Enabling framework for the management of biodiversity for food and agriculture



Research on food and agricultural systems needs to become more multidisciplinary, more participatory and more focused on interactions between different components of biodiversity for food and agriculture. Improvements to the sustainable use and conservation of BFA are often constrained by a lack of understanding of interactions between sectors (crop and livestock production, forestry, fisheries and aquaculture), between wild and domesticated biodiversity, and between the ecological and socio-economic components of production systems. Cooperation across disciplines, and greater involvement of producers and other stakeholders in research projects, can help to overcome these knowledge gaps.

Improving the management of biodiversity for food and agriculture and enhancing its contribution to ecosystem services call for better multistakeholder, cross-sectoral and international cooperation. Ensuring the sustainable use of BFA requires effective actions by relevant authorities and improved collaboration among a range of stakeholder groups (producers and their organizations, consumers, suppliers and marketers, policy-makers, and national and international governmental and non-governmental organizations) across the sectors of food and agriculture and between the food and agriculture sector and the environment/nature-conservation sector. The management of BFA spans international borders and the conventional boundaries between sectors. Frameworks for cooperation at national, regional and international levels in the management of genetic resources are relatively well developed in the individual sectors of food and agriculture. Cross-sectoral cooperation and multistakeholder collaborative activities specifically targeting associated biodiversity and wild foods are less widespread and need to be expanded and strengthened.

The State of the World's Biodiversity for Food and Agriculture presents the first global assessment of biodiversity for food and agriculture worldwide. Biodiversity for food and agriculture is the diversity of plants, animals and micro-organisms at genetic, species and ecosystem levels, present in and around crop, livestock, forest and aquatic production systems. It is essential to the structure, functions and processes of these systems, to livelihoods and food security, and to the supply of a wide range of ecosystem services. It has been managed or influenced by farmers, livestock keepers, forest dwellers, fish farmers and fisherfolk for hundreds of generations.

Prepared through a participatory, country-driven process, the report draws on information from 91 country reports to provide a description of the roles and importance of biodiversity for food and agriculture, the drivers of change affecting it and its current status and trends. It describes the state of efforts to promote the sustainable use and conservation of biodiversity for food and agriculture, including through the development of supporting policies, legal frameworks, institutions and capacities. It concludes with a discussion of needs and challenges in the future management of biodiversity for food and agriculture.

The report complements other global assessments prepared under the auspices of the Commission on Genetic Resources for Food and Agriculture, which have focused on the state of genetic resources within particular sectors of food and agriculture.

Full report at http://www.fao.org/3/CA3129EN/CA3129EN.pdf

The 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.

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