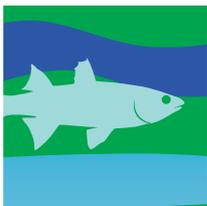
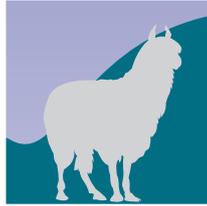


COUNTRY REPORTS



THE STATE OF **KENYA'S**
BIODIVERSITY FOR FOOD AND
AGRICULTURE

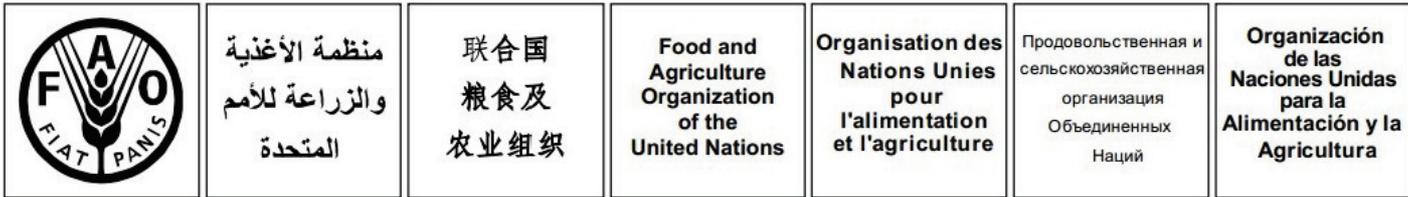
This country report has been prepared by the national authorities as a contribution to the FAO publication, *The State of the World's Biodiversity for Food and Agriculture*. The report is being made available by the Food and Agriculture Organization of the United Nations (FAO) as requested by the Commission on Genetic Resources for Food and Agriculture. The information in this report has not been verified by FAO, and the content of this document is entirely the responsibility of the authors, and does not necessarily represent the views of FAO, or its Members. The designations employed and the presentation of material do not imply the expression of any opinion whatsoever on the part of FAO concerning legal or development status of any country, territory, city or area or of its authorities or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed by FAO in preference to others of a similar nature that are not mentioned.

REPUBLIC OF KENYA



The State of the World's Biodiversity for Food and Agriculture

Kenya Report



**Guidelines for the preparation of the Country
Reports for *The State of the World's Biodiversity
for Food and Agriculture***

November 30, 2013

COMMISSION ON
GENETIC RESOURCES
FOR FOOD AND
AGRICULTURE



Country:

National Focal Point:

INSTRUCTIONS FOR DYNAMIC GUIDELINES

How do I complete the dynamic guidelines?

1. You will require Adobe Reader to open the dynamic guidelines. Adobe Reader can be downloaded free of charge from: <http://get.adobe.com/uk/reader/otherversions/>. Use Adobe Reader Version 10 or higher.
2. Open the dynamic guidelines and save it (save as -> pdf) on your hard drive.
3. Please rename it <name of your country>.pdf.
4. You may forward the dynamic guidelines to stakeholders you would like to involve or inform by e-mail. You may also print and/or save the dynamic guidelines.
5. It is advisable to prepare textual responses (including any formatting such as bullet points) first in a separate document and then to copy and paste them into the form. Please use font Arial 10. Acronyms and abbreviations should be avoided if possible. If included, they must be introduced (i.e. written out in full) the first time they are used. Note that the text boxes are expandable. Once text has been entered, the box will automatically enlarge to make its content fully visible when you click outside its border.
6. When you have finished completing the dynamic guidelines, click the "Submit by Email" button on the last page and send the completed dynamic guidelines to SOW-BFA@fao.org. This should automatically attach the document to an email that you can then send. Otherwise, please attach the completed dynamic guidelines manually to an e-mail and send it to SOW-BFA@fao.org. A letter confirming official endorsement by relevant authorities should also be attached to the email.
7. You will receive a confirmation that the submission was successful.

Where can I get further assistance?

Should you have any questions regarding the dynamic guidelines, please address them by e-mail to SOW-BFA@fao.org.

How, by whom and by when must the completed dynamic guidelines be submitted?

Once officially endorsed by the relevant authorities, the completed dynamic guidelines should be submitted (click the "Submit by Email" button on the last page) by the National Focal Point. Completed dynamic guidelines should be sent **by December 31st, 2014**.

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THE ESSENTIAL ROLE OF COUNTRY REPORTS

The preparation of Country Reports is one of the most important steps in the process for preparing the first report on *The State of the World's Biodiversity for Food and Agriculture* (the SoWBFA Report), and will be critical in filling in gaps to existing information and establishing baseline information on biodiversity for food and agriculture, and on its role in providing multiple ecosystem services. The preparatory process of Country Reports should also be considered a strategic planning exercise and the report generated an overview of the country's sustainable management practices of biodiversity for food and agriculture and a tool for the assessment of national priorities and future needs to be addressed. Country Reports should also be seen as an opportunity to engage and stimulate the interests of a wide range of stakeholders from different sectors, and including smallholders.

The present Guidelines for Country Reports (Guidelines) aim to help countries to assemble baseline information and highlight the importance of a collaborative process, bringing together experts (including those stakeholders with experiential knowledge, such as farmers, pastoralists, forest dwellers and fisher folk) across sectors to assess available information and analyze gaps and needs. The Guidelines are also structured as a tool to guide data collection, planning and policy making at national level.

The Guidelines make a distinction between information countries may wish to provide in support to their own strategic planning, from the information needed for the preparation of the overall SoWBFA report. Countries may wish to draw upon documents prepared for the various sector State of the World's Reports for their cross-sectoral synthesis.

I. INTRODUCTION

1. The FAO Commission on Genetic Resources for Food and Agriculture (the Commission) is the only intergovernmental forum which specifically deals with the whole range of genetic resources for food and agriculture. Genetic resources for food and agriculture are the building blocks of biodiversity for food and agriculture. The mandate of the Commission covers all components of biodiversity for food and agriculture. To implement its broad work programme and to achieve its objectives through a planned and staged approach, the Commission adopted and subsequently revised and updated its Multi-Year Programme of Work (MYPOW). CGRFA-14/13/Report, *Appendix I*, Table 1.

2. One of the major milestones of the MYPOW is the presentation of the first report on *The State of the World's Biodiversity for Food and Agriculture* (the SoWBFA Report) to the Commission's Sixteenth Regular Session (to be held in 2017) and the consideration of follow-up to the SoWBFA Report, including through a possible Global Plan of Action. The SoWBFA Report will also be a major milestone in the context of the United Nations Decade on Biodiversity.

3. The Commission requested FAO, at its Eleventh Regular Session in 2007, to prepare the SoWBFA report, for consideration at its Sixteenth Regular Session, following a process agreed upon by the Commission. CGRFA-11/07/Report It stressed that the process for preparing the SoWBFA Report should be based on information from Country Reports and should also draw on thematic studies, reports from international organizations and inputs from other relevant stakeholders, including centres of excellence from developing countries. CGRFA-14/13/Report, paragraph 14.

4. The Commission stressed that the SoWBFA Report should focus on the interactions between sectors and on cross-sectoral matters, taking full advantage of existing information sources, including sectoral assessments. It also suggested that

priority be given to key supplementary information not available in existing sources. CGRFA-14/13/Report, paragraph 14.

5. The Commission acknowledged that the report's findings would be preliminary and incomplete in a number of areas and requested FAO to ensure that such information gaps would be assessed and highlighted in the report. It also requested FAO to include in the report lessons learned and success stories on the conservation and sustainable use of biodiversity for food and agriculture. CGRFA-14/13/Report, paragraph 15.

6. The SoWBFA Report will provide a baseline analysis of the state of knowledge. Incompleteness and gaps in available information should be clearly identified and acknowledged and used to direct future assessments. In compiling information for their Reports countries should state clearly where information is not available on specific subject areas.

7. The present Guidelines for the preparation of Country Reports contributing to the SoWBFA Report present an overall approach and a set of objectives that can guide the preparation of Country Reports, the scope of the report and the structure that can be used, as well as an appropriate timeline and process for their preparation.

8. The Guidelines assist countries to provide information complementary to sector reports in order to address the following questions:

- What is the state of the conservation and use of biodiversity for food security and nutrition, ecosystem services and sustainability?
- What trends can be identified in the conservation and use of biodiversity for food and agriculture and in the effects of major drivers of change?
- How can conservation and use of biodiversity for food and agriculture be improved and the contributions of biodiversity to food security and nutrition, ecosystem services, sustainability and the improvement of livelihoods of farmers, pastoralists, forest dwellers and fisher folk be enhanced?

9. Major differences exist between countries with respect to the nature, conservation and use of biodiversity for food and agriculture. To provide baseline information, highlight knowledge gaps and to facilitate the regional and global synthesis of the information countries are therefore invited to follow the structure provided in the Guidelines as closely as possible in the preparation of their Country Report.

II. OBJECTIVES OF THE GUIDELINES

10. These Guidelines have been prepared by FAO to assist in the preparation of Country Reports contributing to the SoWBFA Report. The Guidelines have been designed to assist countries to undertake a strategic assessment of their biodiversity for food and agriculture, with particular emphasis on components of biodiversity for food and agriculture that are not traditionally considered by the other sectoral assessments and yet contribute to the livelihoods of smallholder communities. These include uncultivated or wild food and non-food products, as well as species of importance to production systems.

III. SCOPE, STRUCTURE AND CONTENT

Scope of the Country Report

11. The scope of the Country Reports includes the variety and variability of animals, plants and micro-organisms at the genetic, species and ecosystem levels that sustain the structures, functions and processes in and around production systems, and that provide food and non-food agriculture products. A detailed description of the scope of the Country Report is provided in Annex 1. Production systems, as defined for the purposes of this report, include the livestock, crop, fisheries and aquaculture, and forest sectors (description provided in Annex 2).

12. The present Guidelines for the Country Report mainly focus on those areas not covered by sectoral reports, e.g. the biological diversity associated with different supporting and regulating ecosystem services within production systems or of importance to them, referred to hereinafter as associated biodiversity, as well as wild resources used for food. In addition to this, countries that previously presented or are currently preparing a Country Report on Plant, Animal, Aquatic or Forest Genetic Resources may wish to integrate information from these reports in the preparation of their Country Report for the SoWBFA.

13. The Guidelines should help countries to provide information from an ecosystem perspective, including on the provision of ecosystem services, and on the implementation of an ecosystem approach. They will also assist countries to report on the use of biodiversity for food and agriculture for food security and nutrition, rural livelihoods, sustainability and sustainable intensification as well as on relevant gender perspectives. In this way, the Guidelines will assist countries in describing the multiple functions and the multiple values to producers and users of biodiversity for food and agriculture.

Structure of the Country Report

14. An Executive Summary is recommended, along with a section providing an Introduction to the Country, which would provide a description of the country and an overview of the different sectors.

15. Country Reports should follow as closely as possible the structure of the SoWBFA Report as presented in CGRFA-14/13/3 Appendix 1, which includes the following Chapters:

Chapter 1:	Introduction
Chapter 2:	Drivers of change
Chapter 3:	The state and trends of biodiversity for food and agriculture
Chapter 4:	The state of use of biodiversity for food and agriculture
Chapter 5:	The state of interventions in the conservation and use of biodiversity for food and agriculture
Chapter 6:	Future agendas for conservation and sustainable use of biodiversity for food and agriculture

16. An analysis of the different ways in which biodiversity for food and agriculture is used and supports cultural, social and economic values of local communities and traditional peoples will be an important aspect of the SoWBFA Report and of Country Reports. The Country Reports should therefore take full account of these aspects and seek the involvement of the widest range of stakeholders. In this respect, it is recommended that the scope of activities includes actions being taken by the public, private and nongovernmental sectors, and takes account of gender perspectives, and the needs, priorities and perspectives of indigenous peoples and local communities through their organizations.

IV. TIMELINE AND PROCESS

17. In line with the overall process, as established by the Commission, the Director-General of FAO sent a Circular State Letter on 10 June 2013 to countries requesting them to identify National Focal Points for the preparation of Country Reports by November 30, 2013, and invited countries to submit their Country Reports no later than 31 December 2014.

18. The following steps are recommended in preparing the Country Report, using a participatory approach:
- Each participating country should appoint a National Focal Point for the coordination of the preparation of the Country Report who will also act as focal point to FAO. National Focal Points should be communicated to Ms Linda Collette, Secretary, Commission on Genetic Resources for Food and Agriculture (cgrfa@fao.org), by November 30, 2013.
 - Countries are encouraged to establish a national committee to oversee the preparation of the Country Report. Given the cross-sectoral nature of the Country Report, the national committee should consist of as many representative stakeholders as practical (representing government, research and civil society) including from different sectors (fisheries and aquaculture, forest, livestock and plants) and those able to support analysis of associated biodiversity. It is recommended that the national committee also include a gender specialist along with someone who can contribute to economic issues, with a natural resource management, environmental economics, or other relevant background. It is recommended that within the 13 months countries are given for the preparation of the Country Report, the national committee meets frequently to review progress and consults widely with key stakeholders.
 - The national committee may find it useful to establish cross-sectoral and inter-departmental/inter-ministerial working groups to compile data and information for specific sections of the Country Report, or to write specific chapters of the Country Report.
 - The National Focal Point should coordinate the preparation of the first draft of the Country Report, which should be reviewed by the national committee. The National Focal Point should facilitate a consultative process for broader stakeholder review, including stakeholders from various ministries, departments, NGOs, research institutions, and stakeholders with experiential knowledge, such as farmers, pastoralists, forest dwellers and fisher folk, etc.
 - Following the stakeholder review, the National Focal Point should coordinate the finalization of the Country Report, submit it to the government for official endorsement and transmit it to FAO in one of the Organization's official languages (Arabic, Chinese, English, French, Russian and Spanish) by 31 December 2014. The Country Report will be an official government report.
 - If countries are unable to submit final Country Reports by the set deadline, preliminary reports of findings should be provided to FAO to contribute to the identification of global priorities for inclusion in the SoWBFA Report.

The FAO contact for the preparation of Country Reports is:
Secretariat
Commission on Genetic Resources for Food and Agriculture
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla

V. DETAILED METHODOLOGY AND GUIDANCE BY CHAPTER

The guidelines outline the suggested content and provide questions to assist countries to undertake their strategic analysis and develop each section of their Country Report. The questions are provided to facilitate analysis, to stimulate discussion and to ensure that the Country Report contains strategic directions that address priorities and needs. Questions that are critical to enable basic understanding of the conditions in your country and facilitate regional and global synthesis of the data and information collected are indicated in **bold**. Please try to ensure that data and information are provided for these questions wherever such information is available.

Questions are organized and formulated in relation to the production systems that are present in your country. Thus it is very important to fill in Table 1 in the Introduction to establish a list of production systems that will be used throughout the Guidelines.

EXECUTIVE SUMMARY

It is recommended that the Country Report contains an executive summary of 2-3 pages highlighting the main findings of the analysis and providing an overview of key issues, constraints and existing capacity to address the issues and challenges. The executive summary should indicate trends and driving forces and present an overview of the proposed strategic directions for future actions aimed at the national, regional and global levels.

Agriculture is the mainstay of Kenya's economy and the growth of the sector is crucial to the country's overall economic and social development. The sector directly contributes about 27.3% of Gross Domestic Product (GDP) and a further 27% through linkages with manufacturing, distribution and service related sectors. Other major contributors to the national GDP are manufacturing (10.0%), transport and storage (8.3%), whole sale and retail trade (8.2%), real estates (7.8%) and education (5.2%).

Kenya's average poverty level exceeds the 50% mark. The causes of poverty and food insecurity in Kenya include low agricultural productivity, inadequate access to productive assets (land and capital), inadequate infrastructure, limited well functioning markets, high population pressure on land, inadequate access to appropriate technologies by farmers, effects of global trade and slow reform process.

Kenya has a rich diversity of plants, animals, aquatic and microbial organisms contributed by a range of habitats. This diversity provides a wide range of ecosystem services important for increasing resilience in food security and nutrition, livelihoods, environmental health and sustainability of production systems. Genetic Resources for food and Agriculture in Kenya has been on the decline due to genetic erosion brought about by human activities and climate change related factors. Among these factors, the most common include desertification, population pressure on land, changes in land and water use management, over-exploitation, ethnic conflicts, drought, floods, government policies and ironically advances in Agriculture. Recognising the importance and threats to this biodiversity, the government has put in place mechanisms of ex-situ and in-situ conservation by establishing the Genetic Resources Research Institute (GERRI) under the newly created Kenya Agricultural and Livestock Research Organization (KALRO) in addition to other existing institutions.

Ex-situ and in-situ conservation activities and initiatives are widespread in Kenya and include seed banking, field gene banks, cryo preservation, livestock conservation farms, botanic gardens, national parks, forest reserves, national monuments and conservancies. Major players in the conservation of biodiversity in Kenya include farmers, KALRO-GERRI, National Museums of Kenya (NMK), Kenya Forestry Research Institute (KEFRI), Kenya Forest Service (KFS), Kenya Wildlife Service (KWS), Public and private Universities, Private Institutions and individuals, collaborating International Organizations such as ICRISAT, ICIPE, ILRI, ICRAF and CYMMYT. The National Gene bank of Kenya under GERRI is the only long term ex-situ conservation facility in the country. However, the main focus since its inception has been plant genetic resources. Whereas all the diversity of plants in the country has not been conserved ex-situ, the animal, aquatic and microbial genetic resources have lagged behind. The areas which need action and priority include improving infrastructure, human capacity, review and harmonisation of policies for major institutions involved in in-situ and ex-situ conservation, establishing partnership, enhancing data sharing mechanisms and mainstreaming of International Conventions and Treaties.

CHAPTER 1: Introduction to the Country and to the role of biodiversity for food and agriculture

Proposed structure of the chapter and information to be included in the Country Reports

The first objective of this Chapter is to present an overview that will help the reader appreciate the context for the Country Report by providing a general overview and summary of the features, demographics and major trends in overall biodiversity for food and agriculture in the country. Explicit attention should be given to associated biodiversity, ecosystem services and wild foods.

Countries that previously presented or are currently preparing a Country Report on Forest, Aquatic, Animal or Plant Genetic Resources, should be able to use some of the background information contained in these reports to prepare parts of their introductory section.

In this Chapter, countries will create a list of their different production systems that will be frequently referred to in subsequent chapters.

This chapter will seek information on the following topics:

- Basic information on the size and location of the country; its main physiographic and climatic features; human population;
- A synthesis of the current situation with respect to the current and potential contribution of biodiversity for food and agriculture to food security and nutrition, ecosystem health and sustainability of production systems, as supported by associated biodiversity and ecosystem services. Specific attention is also given to wild foods;
- Description of the different production systems within the country, as well as an overview of their importance to the national economy and rural livelihoods.

Preparation of the Country Report

1. Provide a description of the process that was followed in preparing the Country Report, preferably providing the names (with affiliations and addresses) of the participants, including all stakeholders consulted.

The focal point was appointed by the Ministry of Agriculture, Livestock and Fisheries. The focal point constituted a working committee composed of members from various institutions as below

1. Dr. Desterio O. Nyamongo, Genetics Resources Research Institute, P. O. Box 30148, Nairobi
2. Mr. Joseph I. Kamau, Genetics Resources Research Institute, P. O. Box 30148, Nairobi
3. Mr. Patrick O. Ochieng, Ministry of Agriculture, Livestock and Fisheries, State Department of Agriculture, P. O. Box 30028, Nairobi.
4. Mr. James M. Mwanombe, Kenya Forest Service, P. O. Box 30513, Nairobi.
5. Dr. Itambo Malombe, National Museums of Kenya, P. O. Box 40658, Nairobi.
6. Stephen F. Omondi, Kenya Forestry Research Institute, P. O. Box 20412, Nairobi.
7. Mr. Cleopas Okore, Ministry of Agriculture, Livestock and Fisheries, State Department of Livestock, P. O. Box 34188, Nairobi.
8. Dr. Samuel M. Mbuku, Beef Research Institute, P. O. Box 3840, Nakuru.
9. Mr. Mwaura Magothe, Ministry of Agriculture, Livestock and Fisheries, State Department of Livestock, P. O. Box 257, Naivasha.
10. Mutune Masai Kenya Marine Fisheries Research Institute, P. O. Box Nairobi

The committee was subdivided into technical thematic groups. The groups consulted the necessary stakeholders that included University of Nairobi, University of Eldoret, Moi University, Jomo Kenyatta University of Agriculture and Technology, Kenyatta University, Egerton University, International Livestock Research Institute, International Centre for Insect Physiology and Ecology, World Agroforestry Centre, Kenya Marine and Fisheries Research Institute, Kenya Livestock Breeders Organization, National Environmental Management Authority, Kenya Wildlife Service, Nature Kenya and World Conservation Union-East Africa Regional Office. Each thematic group held a workshop to prepare the draft report. The committee held a second workshop to prepare the final report.

General overview of the country

2. In a few paragraphs, provide a synthetic overview of your country, including the size, location, main physiographic and climatic features. Include a section on human population, providing disaggregated data on women and men contribution and involvement in agriculture. Briefly discuss as well the overall nature and characteristics of the economy, including the contribution of the different sectors. You may wish to draw upon the country overviews provided in the first chapters of previous and ongoing Country Reports on Forest, Aquatic, Animal or Plant Genetic Resources.

Kenya is situated in eastern Africa between latitudes 4°27' N and 4°28' S and longitudes 34°E and 42°E, with a surface area of 582,600 Square Kilometers. The country is divided into five ecological zones namely Hyper Arid, Arid, Semi-Arid, Sub-Humid and Humid. The Great Rift Valley is a major landmark, running through the country from north to south. The human population was estimated at 41.7 million in 2014 (Kenya National Bureau of Statistics, 2014). Most of the population is concentrated in the rural high potential areas and urban centers. The Arid and Semi Arid Lands (ASAL), which occupy about 83% of country's land surface area, carry less than 25% of the population. The climatic conditions vary from hot and dry in the north, warm and humid at the coast to cool and wet in the central highlands. The annual rainfall ranges from 200 mm in the arid and semi arid regions to 1800 mm in the highlands. Agriculture is the backbone of Kenya's economy and contributed 27.3% of national GDP in the year 2014. Other major contributors to the national GDP were manufacturing (10.0%), transport and storage (8.3%), whole sale and retail trade (8.2%), real estate (7.8%) and education (5.2%).

Role of biodiversity for food and agriculture

Countries that previously presented or are currently preparing a Country Report on Forest, Aquatic, Animal or Plant Genetic Resources, should be able to use some of the background information contained in these reports to prepare this part of their introductory section. Detailed information on associated biodiversity, ecosystem services and wild foods will be provided in chapters 2, 3, 4, and 5 of the Country Report, and thus, countries may wish to consider developing this section after completing the main body of the Country Report.

3. Provide a summary of the role of biodiversity for food and agriculture in improving food security and nutrition, the livelihoods of farmers, pastoralists, forest dwellers and fisher folk, ecosystem health and sustainability of production systems in your country. Specific attention should be given to associated biodiversity, ecosystem services and to wild foods. The summary should also draw attention to the *ex situ* and *in situ* conservation of biodiversity for food and agriculture, the most significant aspects of use to improve food security and nutrition in the country, major changes observed in the last 10 years and the main factors causing changes. Significant risks or dangers to the conservation and use of biodiversity for food and agriculture may also be highlighted.

Biodiversity plays major roles in provision of quality food for humans, feed for livestock, source of income, source of materials for breeding, habitat restoration, construction, environmental health, ethno-veterinary and human medicine, cultural practices and energy source. Some microorganisms are used for food processing and preservation and maintenance of soil fertility. Some insects are a source of income, food and fibre while others are pollinators. During times of scarcity, the crop wild relatives act as source of food to rural communities.

Ex-situ facilities such as seed and semen banks act as source of germplasm for crop and livestock breeding, respectively. In recognition of the importance of ex-situ conservation of genetic resources, the government has established the Genetic Resources Research Institute under the Kenya Agricultural and Livestock Research Organization, whose mandate is to conserve plant, animal, aquatic and microbial genetic resources. In addition, the government has established livestock genetic resources farms and protected areas (parks, forest reserves and monuments) for in-situ conservation. Private organizations and individuals have established ranching schemes and conservancies.

The diversity of life forms in Kenya has been on the decline due to genetic erosion brought about mainly by desertification, population pressure on land, changes in land use and water management, overexploitation, climate change related phenomena like extreme temperatures and floods, policies, encroachers and alien invasive species, advances in Agriculture, pollution and overgrazing. Major risks and dangers to conservation and use of biodiversity include high costs of maintenance of ex-situ facilities and power outages, disease and pests, catastrophic events such as fires, floods and droughts, genetic drifts, genetic shifts, social conflicts, theft, market demands, influx of exotic germplasm, encroachers and alien invasive species.

Production systems in the country

IMPORTANT: Throughout these guidelines, questions on production systems will refer to the production systems identified in Table 1 as present in your country.

4. Indicate, for each of the production systems listed in Table 1 below, whether it is found in your country or not, regardless of its importance.

Table 1. Production systems present in the country.

Sector	Code	Production system names (Place pointer on the production system name for a detailed description)	Check if present in the country
Livestock	L1	Livestock grassland-based systems: Tropics	<input checked="" type="checkbox"/>
	L2	Livestock grassland-based systems: Subtropics	<input type="checkbox"/>
	L3	Livestock grassland-based systems: Temperate	<input type="checkbox"/>
	L4	Livestock grassland-based systems: Boreal and /or highlands	<input type="checkbox"/>
	L5	Livestock landless systems: Tropics	<input checked="" type="checkbox"/>
	L6	Livestock landless systems: Subtropics	<input type="checkbox"/>
	L7	Livestock landless systems: Temperate	<input type="checkbox"/>
	L8	Livestock landless systems: Boreal and /or highlands	<input type="checkbox"/>
Forest	F1	Naturally regenerated forests: Tropics	<input checked="" type="checkbox"/>
	F2	Naturally regenerated forests: Subtropics	<input type="checkbox"/>
	F3	Naturally regenerated forests: Temperate	<input type="checkbox"/>
	F4	Naturally regenerated forests: Boreal and /or highlands	<input type="checkbox"/>
	F5	Planted forests: Tropics	<input checked="" type="checkbox"/>
	F6	Planted forests: Subtropics	<input type="checkbox"/>
	F7	Planted forests: Temperate	<input type="checkbox"/>
	F8	Planted forests: Boreal and /or highlands	<input type="checkbox"/>
Aquaculture and Fisheries	A1	Self-recruiting capture fisheries: Tropics	<input checked="" type="checkbox"/>
	A2	Self-recruiting capture fisheries: Subtropics	<input type="checkbox"/>
	A3	Self-recruiting capture fisheries: Temperate	<input type="checkbox"/>
	A4	Self-recruiting capture fisheries: Boreal and /or highlands	<input type="checkbox"/>
	A5	Culture-based fisheries: Tropics	<input checked="" type="checkbox"/>
	A6	Culture-based fisheries: Subtropics	<input type="checkbox"/>
	A7	Culture-based fisheries: Temperate	<input type="checkbox"/>
	A8	Culture-based fisheries: Boreal and /or highlands	<input type="checkbox"/>
	A9	Fed aquaculture: Tropics	<input checked="" type="checkbox"/>
	A10	Fed aquaculture: Subtropics	<input type="checkbox"/>
	A11	Fed aquaculture: Temperate	<input type="checkbox"/>
	A12	Fed aquaculture: Boreal and /or highlands	<input type="checkbox"/>
	A13	Non-fed aquaculture: Tropics	<input type="checkbox"/>
	A14	Non-fed aquaculture: Subtropics	<input type="checkbox"/>
	A15	Non-fed aquaculture: Temperate	<input type="checkbox"/>

	A16	Non-fed aquaculture: Boreal and /or highlands	<input type="checkbox"/>
Crops	C1	Irrigated crops (rice) : Tropics	<input checked="" type="checkbox"/>
	C2	Irrigated crops (rice) : Subtropics	<input type="checkbox"/>
	C3	Irrigated crops (rice) : Temperate	<input type="checkbox"/>
	C4	Irrigated crops (rice) : Boreal and /or highlands	<input type="checkbox"/>
	C5	Irrigated crops (other) : Tropics	<input checked="" type="checkbox"/>
	C6	Irrigated crops (other) : Subtropics	<input type="checkbox"/>
	C7	Irrigated crops (other) : Temperate	<input type="checkbox"/>
	C8	Irrigated crops (other) : Boreal and /or highlands	<input type="checkbox"/>
	C9	Rainfed crops : Tropics	<input checked="" type="checkbox"/>
	C10	Rainfed crops : Subtropics	<input type="checkbox"/>
	C11	Rainfed crops : Temperate	<input type="checkbox"/>
	C12	Rainfed crops : Boreal and /or highlands	<input type="checkbox"/>
Mixed	M1	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	<input checked="" type="checkbox"/>
	M2	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Subtropics	<input type="checkbox"/>
	M3	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Temperate	<input type="checkbox"/>
	M4	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Boreal and /or highlands	<input type="checkbox"/>
Others [please specify]	O1		<input type="checkbox"/>
Others [please specify]	O2		<input type="checkbox"/>
Others [please specify]	O3		<input type="checkbox"/>
Others [please specify]	O4		<input type="checkbox"/>
Others [please specify]	O5		<input type="checkbox"/>

5. Provide in Table 2 a description for each production system. Countries may wish to use the following criteria, where information is available:

Environmental features and characteristics:

- a) additional information on climate (arid, semi-arid, humid, subhumid);
- b) features of the landscape mosaic.

Rural livelihoods and sustainable use:

- c) share of smallholders;
- d) proportion of the production system found in urban or peri-urban context;
- e) share of the population actively contributing to the production system disaggregated by gender, including number of employees if available;
- f) importance of the production system to the incomes, livelihoods and well-being of rural communities;
- g) levels of agricultural intensification and the reliance of synthetic inputs, modern varieties, fossil fuels, etc.

Table 2. Description or characterization of production systems within the country

Production system	Description
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Livestock grassland-based systems: Tropics	In this system there are pastoral-range and ranching production systems. In pastoral-range, households generally keep a mixture of species mostly camels, cattle, goats, sheep and donkeys. The herd and flock sizes vary between households, but they are predominantly small and of indigenous types. Traditional husbandry systems are used with very low external inputs. The Ranching systems are mostly commercial enterprises maintained at medium to high external input levels, in areas where rain-fed agriculture is not viable. Depending on the potential of the locality, they tend to keep one or two economically viable livestock species. The diversity may range from improved indigenous breeds to continually introduced exotic breeds and their crosses. The species include cattle, camels, goats and sheep.
Livestock landless systems: Tropics	The Landless system is mainly practised in urban and rural areas where feeds are mainly introduced from outside the farm system. Species mostly kept are pigs, chicken, ducks, turkeys, goats, sheep and cattle. The system is practised commercially with high input requirements.
Naturally regenerated forests: Tropics	Indigenous closed canopy forests which include afro-montane forests (Mt. Kenya, Mt. Elgon, Cherangany and Mau), dry forests (Taita hills, Marsabit) and the Mangroves. There are also woodlands and wooded grasslands in the Arid and Semi-arid areas.
Planted forests: Tropics	These are mainly plantations of exotic trees mainly for the supply of industrial wood. There are government owned (135,000 ha) and privately owned (90,000 ha) plantations. The main trees planted are pine, cypress and eucalyptus.
Self-recruiting capture fisheries: Tropics	This refers to the natural water bodies where fish biomass (numbers) are regulated by recruitment, natural and fishing mortality
Culture-based fisheries: Tropics	This refers to a natural water ecosystem where its natural recruitment does not meet the required level but is supplemented by restocking with fingerlings from culture systems
Fed aquaculture: Tropics	This refers to fish reared and fed in controlled environment
Irrigated crops (rice) : Tropics	Irrigated rice refers to areas where rice is cultivated purposely provided with water, including land irrigated by controlled flooding
Irrigated crops (other) : Tropics	Irrigated crops other than rice refers to agricultural areas purposely provided with water, including land irrigated by controlled flooding.
Rainfed crops : Tropics	Agricultural practice relying exclusively on rainfall as its source of water.
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	Production systems with multiple components. They include: <ul style="list-style-type: none"> • Crop-livestock: mixed systems in which livestock production is integrated with crop production. • Agro-pastoralist: livestock-oriented systems that involve some crop production in addition to keeping grazing livestock on rangelands; they may involve migration with the livestock away from the cropland for part of the year; in some areas, agropastoral systems emerged from pastoral systems • Agroforestry-livestock: mixed system in which livestock production is integrated with the production of trees and shrubs • Integrated aquaculture: mixed systems in which aquaculture is integrated with crop and livestock production. May involve ponds on farms, flooded fields, enrichment of ponds with organic waste, etc. • Other combinations

6. Provide a map of production systems in your country, marking the places and regions mentioned in the Country Report.

Add
Delete

7. For each production system found in your country (refer to Table 1), indicate in Table 3 the area under production (km², hectares, acres, other). If not applicable, indicate the estimated production quantity (major products aggregated) using the appropriate unit or measure (tonne, head, inventory, cubic metre, etc.) for the production system. If available, indicate the contribution of the production system to the agricultural sector economy in the country (%). Please use the most recent data available and indicate the year of reference for the data or estimates. Specify NK if not known or NA if not applicable.

Table 3. Area under production, production quantity and contribution to the agricultural sector economy of production systems in the country.

Production systems	Area		Production - quantity		Contribution to the agricultural sector economy	Reference year
	Value	Unit (enter)	Value	Unit (enter)	%	year
Livestock grassland-based systems: Tropics	471,943	Km square	328,680 MT of meat and 2.08 Billion litres of milk		24.0	2012-2013
Livestock landless systems: Tropics	11,653	Km square	8,217 MT of meat and 5.2 Million litres of milk		0.6	2012-2013
Naturally regenerated forests: Tropics	1,140,000	hectares				
Planted forests: Tropics	225,000	hectares	26 million	cubic metres	1	2009
Self-recruiting capture fisheries: Tropics			168,011 metric tonnes			2014
Culture-based fisheries: Tropics						
Fed aquaculture: Tropics	2,119	Hectares	24,096 metric tonnes			2014
Irrigated crops (rice) : Tropics						
Irrigated crops (other) : Tropics						
Rainfed crops : Tropics						
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	99,050	Km square	210,903 MT of meat and 3.1 Billion litres of milk		15.4	2012-2013

8. Comment on the effects on biodiversity for food and agriculture of production destined for exportation versus production for local and/or national consumption. Where information is available, indicate for each production system the proportion of production that is destined for export, the major commodities involved, the impact on the methods of production (e.g. adoption of specific production practices to meet export needs) and the implications for biodiversity.

Kenya exports indigenous live animals and products (meat, milk and skin) mainly to COMESA and Middle East markets. The per capita consumption of meat in Kenya is estimated at 16.7 Kgs compared to a global average of 41.9 Kgs (FAO, 2013). The per capita consumption is 100 litres against the recommended 200 litres. The domestic and international markets enhance conservation of biodiversity as individuals or communities strive to conserve what fits into their livelihoods. However, in some instances, this shrinks genetic diversity due to overreliance on few local breeds and introduction of exotic breeds. The major export crops are tea, coffee, vegetables, fruits and flowers, mainly to European countries. This has led to genetic

erosion due to monoculture and reliance on few species and varieties. Kenya imports sugar, rice, maize, wheat, barley, beans, cotton seed cake, sunflower seed cake and seeds for horticultural crops. Whereas imports have helped to improve on food security and nutrition, they have resulted in pest and disease spread and introduction of alien invasive species that threatens genetic diversity of crops and their wild relatives.

Kenya imports wood and wood products mainly from neighbouring countries for timber and electricity poles. The high demand for timber and electricity poles has encouraged investment by the private sector and individual farmers in plantation forestry. This has resulted in the clearance of indigenous trees and other vegetation in preference for eucalyptus species leading to genetic erosion of forest trees and ornamentals. There is also illegal overexploitation of certain high value woody species such as sandalwood (*Osyris lanceolata*), Meru oak (*Vitex keniensis*) and red stinkwood (*Prunus africana*) for export markets. The high demand for carvings has led to near extinction of wood species such as Muhuru (*Brachylleana huilensis*) and Mpingu (*Dalbergia melanoxylon*).

The Fishery industry in Kenya provides fish for export and local consumption. The main fish catches from inland waters are Nile perch (*Lates niloticus*) The Nile tilapia (*oreochromis niloticus*) Omena, catfish among others. About 75% of the Nile perch production is destined for export and the rest for local consumption. The Nile tilapia is consumed locally as well as Omena which is locally consumed for food and as a source of animal protein in animal feed.

The Marine fisheries has four identifiable market segments, Household fresh fish market, Fishmeal export and ornamental live fish export market Marine fish export occur in two main forms. Frozen whole fish and semi processed fish tunas and other large fish species such as sharks

CHAPTER 2: Drivers of change

Proposed structure of the chapter and information to be included in the Country Reports

This Chapter provides an assessment of the major drivers causing changes (drivers list and descriptions provided in Annex 3), either positive or negative, on the state of biodiversity for food and agriculture in the country, with specific attention to changes in the associated biodiversity in and around production systems, ecosystem services and wild foods. This Chapter also encourages countries to compare drivers between different production systems.

The Chapter will address the following topics related to drivers of change in biodiversity for food and agriculture:

- The effects of drivers and stressors over the past ten years on a) associated biodiversity, b) ecosystem services and c) wild foods;
- Impacts of drivers on the involvement of women in the maintenance and use of biodiversity for food and agriculture, the application and preservation of traditional knowledge, and rural poverty alleviation;
- Countermeasures addressing current and emerging drivers, best practices and lessons learned.

The Country Report should include information or reference to any specific studies that have been carried out in the last ten or so years that relate observed changes in the extent or distribution of associated biodiversity and wild foods in the country to different drivers.

IMPORTANT: Throughout these guidelines, questions on production systems will refer to the production systems identified in Table 1 as present in your country.

One of the main objectives of this report is to identify knowledge gaps and to provide baseline information for future assessments. Thus please indicate where information is unavailable.

Effects of drivers of change on associated biodiversity

9. What have been the most important drivers affecting the extent and distribution of associated biodiversity in the last 10 years in your country? In describing the drivers you may wish to indicate the production systems where associated biodiversity is most affected and identify drivers that are common to the various components of associated biodiversity listed. Indicate where possible the indicators used to measure changes, along with the sources of information.

1) Changes in land and water use and management as exemplified by agricultural expansion, deforestation, desertification,

transport(roads, railroads, and ports), public service (waterlines), and private companies (mining). Land subdivision results to growing of fodder crops and trees leading to a decrease in pollinators thus reducing their biodiversity. Settlement of pastoralists and subdivision of ranches leading to reduced grazing lands causing a reduction in rumen microbial diversity due to reduced feed resources.

- 2) Pollution and external inputs such as agriculture waste (fertilizers), urban waste (waste water), industrial waste (heavy metals) leading to destruction of plants and aquatic organisms.
- 3) Over-exploitation and overharvesting of natural products from forestry and fisheries threatens some species such as saddle wood and Omena thus reducing their biodiversity. Overgrazing especially among nomadic communities reduces vegetative cover as well as microorganisms and insects such as Tse tse flies.
- 4) Climate change induced phenomenon such as droughts and floods lead to general loss of associated biodiversity.
- 5) Natural disasters such as fires destroy forests and grasslands leading to loss of plant, insects and microorganisms biodiversity
- 6) Alien invasive species such as Eichhornia crassipes (hyacinth) and Prosopis juliflora (Velvet mesquite-commonly known in Kenya as Mathenge) lead to loss of aquatic and terrestrial biodiversity, respectively. Pests such as army worms frequently threaten grasslands biodiversity. Diseases such as maize lethal necrosis threaten maize biodiversity.
- 7) Demographic factors such as population growth and density, urbanization, behavior in relation to attitude about biodiversity and change in values and beliefs threaten biodiversity
- 8) Institutional factors such as policies governing land use, corruption and mismanagement of biodiversity hot spots lead to loss of associated biodiversity.
- 9) Economic factors such as inequality manifested by increase of those leaving below poverty line from 50 to 56 % (REF) has increased the rate of degradation of the environment as people compete for products and services leading to loss of associated biodiversity. Globalization on the other hand has led to liberalization of markets leading to unfavorable competition and overexploitation of natural resources leading to loss of associated biodiversity.
- 10)Population increase that leads to high demand of fish products. This leads to increased fishing effort and results to depletion of fish stocks in the wild,.
- 11) uncontrolled and wrong harvesting methods.
- 12) Climate change and environmental degradation of the fishery environment

10. Where associated biodiversity is believed to be affected by climate change, please provide additional information on the nature, severity and frequency of the climate threat and the production systems impacted.

Climate change in Kenya is characterized by droughts and floods. The minimum temperature has risen generally by 0.7 – 2.0 degrees Celsius and the maximum by 0.2 – 1.3 degrees Celsius, depending on the season and the region. There is a general decline of rainfall in the main rainfall season of March-May (the “Long Rains”). Major rivers show severe reduced volumes during droughts, and many seasonal ones completely dry up. This has impacted negatively on irrigated (C1, C5, C8) and rain fed crops (C9,C12) due to water scarcity. The consequent crop failures in 2009 for instance, placed an estimated 10 million Kenyans or one fourth of the entire population at risk of malnutrition, hunger and starvation. Mixed systems (M1, M4) have also been affected by emerging pests and diseases such as maize lethal necrosis as well as loss of livestock and subsequent social conflicts as communities fight for pasture and water. The western part of the country including the area around the Lake Victoria frequently experience flooding during the rainy seasons. Species loss has been observed, while in some places, the number of indigenous and important species has tremendously dwindled (Source: NCCRS, 2010).

Effects of drivers of change on biodiversity for food and agriculture

This section applies to all biodiversity for food and agriculture. Countries that previously presented or are currently preparing a Country Report on Forest, Aquatic, Animal or Plant Genetic Resources, may wish to use these reports as reference.

11. For each production system present in your country as indicated in Table 1, fill in the code and name of each production system in Table 4 (repeat Table for each production system). For each production system indicate which drivers have been influencing biodiversity for food and agriculture, disaggregated by sector, during the past 10 years (description of drivers can be found in Annex 3). Drivers may have a strongly positive (2), positive (1), negative (-1), and strongly negative effect (-2), or no effect at all (0) on biodiversity for food and agriculture. If the effect of the driver is unknown or not applicable, please indicate not known (NK) or not applicable (NA).

Table 4. Effect of drivers on sector biodiversity within production systems in the country, by animal (AnGR), plant (PGR), aquatic (AqGR) and forest (FGR) genetic resources.

Production systems	Drivers (Place pointer on the driver name for a detailed description)	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
		PGR	FGR	AnGR	AqGR
Livestock grassland-based systems: Tropics	Changes in land and water use and management			-1	
	Pollution and external inputs			0	
	Over-exploitation and overharvesting			-1	
	Climate change			-1	
	Natural disasters			0	
	Pests, diseases, alien invasive species			0	
	Markets, trade and the private sector			1	
	Policies			0	
	Population growth and urbanization			0	
	Changing economic, socio-political, and cultural factors			-1	
	Advancements and innovations in science and technology			0	
Other [<i>please specify</i>]:					
Livestock landless systems: Tropics	Changes in land and water use and management			-1	
	Pollution and external inputs			0	
	Over-exploitation and overharvesting			0	
	Climate change			0	
	Natural disasters			0	
	Pests, diseases, alien invasive species			0	
	Markets, trade and the private sector			-1	
	Policies			0	
	Population growth and urbanization			-1	

	Changing economic, socio-political, and cultural factors			0	
	Advancements and innovations in science and technology			-1	
	Other [<i>please specify</i>]:				
Naturally regenerated forests: Tropics	Changes in land and water use and management		-2		
	Pollution and external inputs		-1		
	Over-exploitation and overharvesting		-2		
	Climate change		-1		
	Natural disasters		-1		
	Pests, diseases, alien invasive species		-1		
	Markets, trade and the private sector		-1		
	Policies		1		
	Population growth and urbanization		-2		
	Changing economic, socio-political, and cultural factors		1		
	Advancements and innovations in science and technology		1		
	Other [<i>please specify</i>]:Ethnic conflicts				
Planted forests: Tropics	Changes in land and water use and management		1		
	Pollution and external inputs		-1		
	Over-exploitation and overharvesting		-2		
	Climate change		-1		
	Natural disasters		-2		
	Pests, diseases, alien invasive species		-2		
	Markets, trade and the private sector		-2		
	Policies		2		
	Population growth and urbanization		-1		
	Changing economic, socio-political, and cultural factors		-1		
	Advancements and innovations in science and technology		1		
	Other [<i>please specify</i>]:				
Self-recruiting capture fisheries: Tropics	Changes in land and water use and management				0
	Pollution and external inputs				-2
	Over-exploitation and overharvesting				-2
	Climate change				-1
	Natural disasters				-1

	Pests, diseases, alien invasive species				0
	Markets, trade and the private sector				0
	Policies				2
	Population growth and urbanization				-1
	Changing economic, socio-political, and cultural factors				-1
	Advancements and innovations in science and technology				1
	Other [<i>please specify</i>]:				
Culture-based fisheries: Tropics	Changes in land and water use and management				-1
	Pollution and external inputs				-2
	Over-exploitation and overharvesting				-2
	Climate change				0
	Natural disasters				0
	Pests, diseases, alien invasive species				-1
	Markets, trade and the private sector				1
	Policies				2
	Population growth and urbanization				-1
	Changing economic, socio-political, and cultural factors				-1
	Advancements and innovations in science and technology				1
	Other [<i>please specify</i>]:				
Fed aquaculture: Tropics	Changes in land and water use and management				-2
	Pollution and external inputs				-1
	Over-exploitation and overharvesting				0
	Climate change				0
	Natural disasters				-1
	Pests, diseases, alien invasive species				-1
	Markets, trade and the private sector				-1
	Policies				1
	Population growth and urbanization				1
	Changing economic, socio-political, and cultural factors				1
	Advancements and innovations in science and technology				1
	Other [<i>please specify</i>]:				
Irrigated crops (rice) : Tropics	Changes in land and water use and management	2			

	Pollution and external inputs	-1			
	Over-exploitation and overharvesting	0			
	Climate change	-2			
	Natural disasters	-1			
	Pests, diseases, alien invasive species	-1			
	Markets, trade and the private sector	-2			
	Policies	2			
	Population growth and urbanization	-2			
	Changing economic, socio-political, and cultural factors	0			
	Advancements and innovations in science and technology	-2			
	Other [<i>please specify</i>]:				
Irrigated crops (other) : Tropics	Changes in land and water use and management	-2			
	Pollution and external inputs	-1			
	Over-exploitation and overharvesting	NK			
	Climate change	-2			
	Natural disasters	-2			
	Pests, diseases, alien invasive species	-2			
	Markets, trade and the private sector	-2			
	Policies	-1			
	Population growth and urbanization	-2			
	Changing economic, socio-political, and cultural factors	-2			
	Advancements and innovations in science and technology	-2			
	Other [<i>please specify</i>]:				
Rainfed crops : Tropics	Changes in land and water use and management	-2			
	Pollution and external inputs	-2			
	Over-exploitation and overharvesting	-2			
	Climate change	-2			
	Natural disasters	-2			
	Pests, diseases, alien invasive species	-2			
	Markets, trade and the private sector	-2			
	Policies	2			
	Population growth and urbanization	-2			
	Changing economic, socio-political, and cultural factors	-2			

	Advancements and innovations in science and technology	-2			
	Other [<i>please specify</i>]:Ethnic conflicts	-2			
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	Changes in land and water use and management	-2			
	Pollution and external inputs	-2			
	Over-exploitation and overharvesting	-2			
	Climate change	-2			
	Natural disasters	-2			
	Pests, diseases, alien invasive species	-2			
	Markets, trade and the private sector	-2			
	Policies	2			
	Population growth and urbanization	-2			
	Changing economic, socio-political, and cultural factors	-2			
	Advancements and innovations in science and technology	-2			
	Other [<i>please specify</i>]:Ethnic conflicts	-2			

Effects of drivers of change on associated biodiversity

12. What have been the main drivers affecting regulating and supporting ecosystem services in the country during the last 10 years? Describe, for each production system, the major driver(s) affecting ecosystem services and indicate the effect on ecosystem services as being strongly positive (2), positive (1), negative (-), strongly negative (-2), no effect (0), not known (NK), or not applicable (NA) in Table 5 (repeat table for each production system). Place pointer on the ecosystem service name for a detailed description.

Table 5. Major drivers and their effect on ecosystem services in production systems.

Production systems	Drivers (Place pointer on the driver name for a detailed description)	Effect of drivers on ecosystem services (2, 1, 0,-1, -2, NK, NA) (Place pointer on the ecosystem service name for a detailed description)								
		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Livestock grassland-based systems: Tropics	Changes in land and water use and management	1	1	-1	1	1	-1	0	0	0
	Pollution and external inputs	0	0	0	0	0	0	0	0	0

	Over-exploitation and overharvesting	-1	0	-1	-1	-1	-1	-1	-1	-1
	Climate change	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Natural disasters	0	-1	-1	0	-1	-1	0	-1	-1
	Pests, diseases, alien invasive species	0	0	0	0	0	NA	NA	NA	0
	Markets, trade and the private sector	NA	-1	-1	0	-1	-1	0	0	0
	Policies	0	1	0	0	0	0	1	1	0
	Population growth and urbanization	0	-1	-1	-1	-1	-1	-1	-1	-1
	Changing economic, socio-political, and cultural factors	0	1	1	1	1	0	1	0	0
	Advancements and innovations in science and technology	0	1	1	1	1	1	1	1	1
	Other [<i>please specify</i>]:									
Livestock landless systems: Tropics	Changes in land and water use and management	-1	1	1	-2	1	-1	-1	-1	-1
	Pollution and external inputs	-1	-1	-1	0	-1	-1	-1	-2	-1
	Over-exploitation and overharvesting	-1	-1	-2	-2	-2	-2	-2	-2	-2
	Climate change	-2	-2	-2	-2	-2	-2	-2	-2	-2
	Natural disasters	-2	-1	-1	-2	-1	-2	-2	-2	-2
	Pests, diseases, alien invasive species	0	-2	1	2	2	2	2	1	2
	Markets, trade and the private sector	0	2	1	1	1	0	0	0	0
	Policies	1	1	1	1	1	1	1	1	1
	Population growth and urbanization	-1	1	-1	-2	-2	-2	-2	-2	-2
	Changing economic, socio-political, and cultural factors	1	2	0	1	0	2	1	1	1
	Advancements and innovations in science and technology	1	1	2	2	1	0	1	0	0
	Other [<i>please specify</i>]:									
Naturally regenerated forests: Tropics	Changes in land and water use and management	-2	-1	-1	-1	-2	-1	-1	-2	-1
	Pollution and external inputs	-1	NK	-1	NK	-2	-1	NK	-1	-1
	Over-exploitation and overharvesting	-2	-1	-2	-1	-1	-1	-1	-1	-1
	Climate change	-1	-2	NK	-1	-1	0	-1	0	NK
	Natural disasters	-1	1	-1	0	1	-1	-1	-1	-1
	Pests, diseases, alien invasive species	-1	0	-1	NK	-1	1	-1	-1	0
	Markets, trade and the private sector	0	0	0	-1	0	0	-1	-1	-1
	Policies	1	1	NK	1	1	1	1	1	1
	Population growth and urbanization	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Changing economic, socio-political, and cultural factors	-1	-1	-1	-1	-1	-1	-1	-1	-1

	Advancements and innovations in science and technology	1	1	1	1	1	1	1	1	1
	Other <i>[please specify]</i> :									
Planted forests: Tropics	Changes in land and water use and management	-2	-1	-1	-1	-1	-1	-1	-2	-1
	Pollution and external inputs	-2	-1	-1	NK	NA	-1	NK	-1	-1
	Over-exploitation and overharvesting	-2	-1	-2	-1	-1	-1	-1	-1	-1
	Climate change	-1	-2	NK	-1	NK	0	-1	0	NK
	Natural disasters	-1	-1	-1	0	1	-1	-1	-1	-1
	Pests, diseases, alien invasive species	-1	0	-1	NK	NK	1	-1	-1	0
	Markets, trade and the private sector	-2	1	-1	-1	-1	-1	-1	-1	-1
	Policies	-2	1	NK	-1	-1	-1	-1	-1	-1
	Population growth and urbanization	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Changing economic, socio-political, and cultural factors	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Advancements and innovations in science and technology	1	1	1	1	1	1	1	1	1
	Other <i>[please specify]</i> :									
Self-recruiting capture fisheries: Tropics	Changes in land and water use and management									
	Pollution and external inputs									
	Over-exploitation and overharvesting									
	Climate change									
	Natural disasters									
	Pests, diseases, alien invasive species									
	Markets, trade and the private sector									
	Policies									
	Population growth and urbanization									
	Changing economic, socio-political, and cultural factors									
	Advancements and innovations in science and technology									
	Other <i>[please specify]</i> :									
Culture-based fisheries: Tropics	Changes in land and water use and management									
	Pollution and external inputs									
	Over-exploitation and overharvesting									
	Climate change									
	Natural disasters									
	Pests, diseases, alien invasive species									

	Markets, trade and the private sector									
	Policies									
	Population growth and urbanization									
	Changing economic, socio-political, and cultural factors									
	Advancements and innovations in science and technology									
	Other <i>[please specify]</i> :									
Fed aquaculture: Tropics	Changes in land and water use and management									
	Pollution and external inputs									
	Over-exploitation and overharvesting									
	Climate change									
	Natural disasters									
	Pests, diseases, alien invasive species									
	Markets, trade and the private sector									
	Policies									
	Population growth and urbanization									
	Changing economic, socio-political, and cultural factors									
	Advancements and innovations in science and technology									
Other <i>[please specify]</i> :										
Irrigated crops (rice) : Tropics	Changes in land and water use and management	-2	1	-2	2	1	2	2	2	-2
	Pollution and external inputs	-1	-2	-2	NK	-1	-1	NK	-2	-2
	Over-exploitation and overharvesting	0	0	NK	NK	NK	NK	NA	NK	NK
	Climate change	0	0	0	2	0	NK	-2	-2	-2
	Natural disasters	0	0	0	2	0	NK	-2	-2	-2
	Pests, diseases, alien invasive species	-1	-1	0	1	0	NK	-2	-2	0
	Markets, trade and the private sector	0	0	0	0	0	NK	0	-2	NK
	Policies	1	1	2	2	0	NA	2	2	2
	Population growth and urbanization	-1	0	-2	-1	-1	NK	-2	-2	-2
	Changing economic, socio-political, and cultural factors	-1	0	-2	-1	-1	NK	-2	-2	-2
	Advancements and innovations in science and technology	-1	2	2	2	2	NK	2	-2	-2
Other <i>[please specify]</i> :										
Irrigated crops (other) : Tropics	Changes in land and water use and management	-1	0	-1	2	1	-2	-2	2	-1
	Pollution and external inputs	-1	-1	-2	NK	-1	-2	-2	-2	-1

	Over-exploitation and overharvesting	NK	-2							
	Climate change	0	0	0	2	-1	NK	-2	-2	-2
	Natural disasters	NK	NK	NK	2	-1	NK	NK	-2	-2
	Pests, diseases, alien invasive species	0	-2	0	2	0	1	-2	-2	NK
	Markets, trade and the private sector	0	0	0	0	-1	NK	NK	-1	NK
	Policies	1	2	2	2	2	NK	2	1	2
	Population growth and urbanization	-1	0	-2	-1	-1	NK	-2	-2	-2
	Changing economic, socio-political, and cultural factors	-1	0	-2	-1	-1	NK	-2	-2	-2
	Advancements and innovations in science and technology	-1	1	1	1	2	1	2	2	-1
	Other [<i>please specify</i>]:									
Rainfed crops : Tropics	Changes in land and water use and management	-2	-2	-2	-2	-2	1	-2	-2	-1
	Pollution and external inputs	-1	0	-2	NK	NK	NK	NK	-1	-1
	Over-exploitation and overharvesting	-1	0	-2	-2	NK	NK	NK	NK	-1
	Climate change	-2	-2	-2	-2	-1	1	-2	-2	-2
	Natural disasters	-2	-2	-2	-2	-1	NK	-2	-1	-2
	Pests, diseases, alien invasive species	-2	-2	-2	-2	-1	1	-1	-1	NK
	Markets, trade and the private sector	-2	-1	-1	-2	-1	NK	NK	NK	NK
	Policies	2	2	2	2	2	NK	NK	NK	NK
	Population growth and urbanization	-1	0	-1	-2	-1	1	-1	-1	-1
	Changing economic, socio-political, and cultural factors	-1	0	-2	-2	-1	NK	-1	-1	-1
	Advancements and innovations in science and technology	1	2	2	2	2	NK	1	1	-1
Other [<i>please specify</i>]:Ethnic conflicts	-2	-2	-1	-2	-2	NK	NK	NK	NK	
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	Changes in land and water use and management	1	-1	-1	1	1	1	-1	1	-1
	Pollution and external inputs	-1	-1	-1	-1	-1	NK	-1	-1	-1
	Over-exploitation and overharvesting	-1	0	NK	NK	NK	NK	-1	-1	-1
	Climate change	-1	-2	-1	-1	-1	1	-2	-2	-2
	Natural disasters	-1	-2	-1	-1	-1	NK	-1	-1	-1
	Pests, diseases, alien invasive species	-1	-2	-1	-2	-1	1	-1	-1	NK
	Markets, trade and the private sector	-1	-2	-1	-1	-1	NK	NK	1	NK
	Policies	2	2	1	1	2	NK	2	2	NK
Population growth and urbanization	-1	0	-1	-2	-1	1	-1	-1	-1	

Changing economic, socio-political, and cultural factors	-1	0	-1	-2	-1	NK	-1	-1	-1
Advancements and innovations in science and technology	-1	1	1	2	2	NK	1	1	-1
Other <i>[please specify]</i> :									

13. Briefly describe the main driver(s) affecting ecosystem services in each production system, as identified in Table 5. Include where possible a description of the components of associated biodiversity that are affected, the indicators used to measure change, and the source of information.

Changes in land and water use and management:

Impacts: Due to population pressure grasslands have been cleared to give way to construction of houses, thereby reducing pasture and thus stocking capacity as well as destroying habitats for associated biodiversity. Clearing of trees to give way to farming as it happened in Mau forest, affects the water and nutrient cycling and causes land degradation.

Over-exploitation

Impacts: Over-exploitation of high value woody species for timber, carvings and beauty products has led to near extinction of relevant species and associated biodiversity. Over grazing reduces vegetative cover leading to degraded habitats.

Climate change:

Impacts: Climate change related phenomena such as extreme temperatures and reduced and changing rainfall patterns have led to frequent fires and flooding as well as emergency of new pests, diseases, encroacher and invasive species, consequently affecting flow of water into water reservoirs and associated biodiversity.

Pollution.

High levels of soil erosion leading to high sediments loads increasing the levels of nutrients into the aquatic ecosystems

Weak interventions

Poor legislation and lack of enforcement of the existing legislations

Effects of drivers of change on wild foods

14. What were the main drivers affecting the availability, knowledge and diversity of wild foods during the last ten years in the country? In Table 6, indicate the major drivers affecting availability, knowledge and diversity of wild foods, and if the effects are strongly positive (2), positive (1), negative (-1), strongly negative (-2), no effect (0), not known (NK), or not applicable (NA).

Table 6. Drivers affecting availability, knowledge and diversity of wild foods.

Drivers (Place pointer on the driver name for a detailed description)	Effect of drivers (2, 1, 0,-1, -2, NK, NA)		
	Availability of wild foods	Knowledge of wild foods	Diversity of wild food
Changes in land and water use and management	-2	-1	-2
Pollution and external inputs	NK	NK	NK
Over-exploitation and overharvesting	-2	0	-1
Climate change	-2	0	-1
Natural disasters	-2	-1	-2
Pests, diseases, alien invasive species	-1	0	-1
Markets, trade and the private sector	-1	1	0

Drivers	Effect of drivers (2, 1, 0,-1, -2, NK, NA)		
Policies	1	1	1
Population growth and urbanization	-2	-1	-2
Changing economic, socio-political, and cultural factors	-2	-1	-2
Advancements and innovations in science and technology	1	1	1
Other <i>[please specify]</i> :			

15. Briefly describe the main drivers affecting the availability, diversity and knowledge of wild foods in your country, as identified in Table 6. Include where possible indicators used to measure change, along with the source of information.

In Kenya, rangelands occupy about 70% of the land area and are home to large populations of wild animals and plants (Lusweti, 2011). Wild species and/or weeds are important source of food (vitamins, minerals and other nutrients), income for cash-poor households, useful genes and harbor bio control agents useful in agriculture (Cromwell et al., 1997). However, human activities and climate change related phenomena are a threat to this diversity in Kenya. The main drivers affecting the availability and diversity of wild foods in Kenya are changes in land and water use and management, over-exploitation and overharvesting, climate change, natural disasters, pests, diseases, alien invasive species, policies, population growth and urbanization and advancements and innovations in science and technology (NEMA, REF). An indicator of this change is the one million acre irrigation project funded by the government which began two years ago near the Tana delta, Athi River County (MOA, REF). Moreover, there are nearly 34 invasive alien animal and plant species in Kenya (Kedera and Kuria 2005). The most pervasive invasive alien plant species in Kenya include Velvet mesquite (*Prosopis juliflora*), Tick berry (*Lantana camara*), Mauritius thorn (*Caesalpinia decapeltata*) and the water hyacinth (*Eichhornia crassipes*). The main drivers affecting the knowledge of wild foods in Kenya are population growth and urbanization and government policies which influence economic, socio-political and cultural factors.

Effects of drivers of change on traditional knowledge, gender and rural livelihoods

In answering questions 16 to 18, describe the major drivers that have had an impact in the last 10 years and include where possible indicators used to measure change, and sources of information.

16. Which drivers have had the most significant effect on the involvement of women in the maintenance and use of biodiversity for food and agriculture?

Change in land and water use management, climate change, population growth and urbanization and changing economic, socio-political, and cultural factors.
Non involvement of women at decision making levels, Lack of sensitization, Poverty and a high burden of supporting families mainly for widowers.. In addition, Advancement in fisheries technology and high population growth coupled with high encroachment of critical habitats are additional factors negatively affecting fishery biodiversity

17. Which drivers have had the most significant effect on the maintenance and use of traditional knowledge relating to biodiversity for food and agriculture?

Drivers with the most significant effect on the maintenance and use of traditional knowledge relating to biodiversity for food and agriculture in Kenya include population growth and urbanization, government policies, advances in Agriculture and changing economic, socio-political, and cultural factors.
Lack of Packaging and information sharing on the use of traditional methods.
Discard of traditional methods as primitive and socioculture virtues

18. Which drivers have had the most significant effect on the role of biodiversity for food and agriculture in improving food security and sustainability?

Government policies, advances in Agriculture and changing economic, socio-political, and cultural factors.

Use of traditional knowledge and skills for value addition and control of post harvest losses. And especially for fishery products

Countermeasures addressing current and emerging drivers of change, best practices and lessons learned

19. Referring to the information provided in this Chapter, identify countermeasures planned or in place to reduce adverse consequences of drivers on a) associated biodiversity, b) ecosystem services and c) wild foods. Provide any expected outcomes, lessons learned and best practices.

The constitution of Kenya ensures state support to sustainable natural resource exploitation, increasing and maintaining tree cover at 10 percent, protection and enhancement of biodiversity as well as indigenous knowledge.

The National Climate Change Response Strategy advocates participation of over 35000 schools, 4300 women groups, 16350 youth groups and six development authorities in water harvesting and tree planting, which is clearly stipulated in the Forest Restoration and Conservation Programme.

Existing laws such as The Wildlife Conservation and Management Act, 2013 have provisions for countering a wide range of biodiversity related impacts.

Policies and action plans based on continued monitoring of biodiversity in the Important Bird▲ and Biodiversity area in Kenya have been formulated based on the results of studies of specific sites and taxonomic groups;

a) Maintenance of forest fragments together with human modified habitats, habitat connectivity, and replacement of exotic plantations with indigenous plants to conserve and protect amphibian in the Taita Hills.

b) Mainstreaming of biodiversity into the economy and development plans.

c) Continued research and monitoring of IBAs and KBAs including climate change monitoring.

d) Measures to check elephant and rhino poaching with outreach to ivory and rhino horn consumers in Asia.

e) Resolution of human-wildlife conflict

f) Building capacity of stakeholders on environmental, social, regulatory, and biodiversity conservation issues.

g) Use of locally-based monitoring of natural resources and community management of Protected Areas (PAs).

h) The Strategic Environmental Assessment (SEA) process extends the aims and principles of Environmental Impact Assessment (EIA) beyond the project level and aims to integrate environmental considerations into higher levels of decision making. The Kenya Wildlife Service (KWS) is charged with a broad range of conservation, management, and enforcement functions, with fines and terms of imprisonment prescribed for a broad range of offences under the Kenya Wildlife Conservation and Management Act, 2013. Community Forest Associations (CFAs) have been formed and sensitized under the Kenya Forest Act, 2005 and subsidiary legislation, and have been involved in developing management plans for four coastal forest IBAs and other forests such as Kakamega, Nandi and Cherangany hills.

In addition, various policies and action plans have compelled the government to embrace mobilization for forest protection through participation of CFAs, training of CFA members, and ensuring land tenure for sustainable participation and support of PFM in new sites.

Also, action plan for conservation in Arabuko-Sokoke Forest emphasizes enhancement of connectivity and quality of habitat and security of elephants while safeguarding against human-elephant conflict.

Integrated soil fertility management (ISFM) practices which comprises combined use of soluble fertilizer and organic inputs alongside improved germ-plasm to maximize agronomic use and efficiency of the applied nutrients are promoted in Kenyan

Small-scale farmers to conserve soil biota which includes soil fungi and earthworms.

Strategic Management Plans covering the major ecosystems in the country such as Mt. Kenya, Aberdares, Mt. Elgon, Cherangany, Marsabit and Arabuko-Sokoke have been prepared or are in the process of preparation. These are overarching and long-term plans that generally provide direction on management activities by the various environment management agencies (mainly KFS and KWS) working within the respective ecosystems.

County Integrated Development Plans (CIDP) have also been prepared by each of the 47 Counties and these take into consideration the environment.

Sensitization and Knowledge transfer on the use of local available methods. For conservation

Government intervention in supporting local initiatives as well as working with the local stake holders to enhance conservation.

CHAPTER 3: The state and trends of biodiversity for food and agriculture

Proposed structure of the chapter and information to be included in the Country Reports

The main objective of this Chapter is to describe the state of biodiversity for food and agriculture in the country, with an emphasis on associated biodiversity and wild foods, and to identify current trends. The Chapter should also indicate current gaps and future needs and priorities. Where possible, countries should identify interventions required to support maintenance of associated biodiversity and indicate whether action is required at local, national, regional or global levels.

This Chapter will seek information on the following topics:

- The state of diversity between and (where any information exists) within species with respect to associated biodiversity and wild foods;
- The importance of the different components of associated biodiversity in relation to ecosystem services;
- The main factors influencing the state of genetic diversity with an emphasis on threatened and endangered species and resources;
- The state of activities and of the development of monitoring and information systems on the state of biodiversity for food and agriculture;
- The state of any specific conservation actions that target associated biodiversity and wild foods;
- Major gaps in the information available and opportunities and priorities for improving knowledge of state and trends of biodiversity for food and agriculture.

Where possible, indicate whether the information systems are gender-sensitive, specifying to what extent the different types and levels of knowledge of women and men are taken into account.

IMPORTANT: Throughout these guidelines, questions on production systems will refer to the production systems identified in Table 1 as present in your country.

One of the main objectives of this report is to identify knowledge gaps and to provide baseline information for future assessments. Thus please indicate where information is unavailable.

Overall synthesized assessment of forest, aquatic, animal or plant genetic resources

Countries that previously presented or are currently preparing a Country Report on Forest, Aquatic, Animal or Plant Genetic Resources may have important information on genetic diversity in these various reports. Therefore, Countries may wish to take full advantage of their different sector reports to develop a comprehensive description and comparison of the state, trends, and state of conservation of forest, aquatic, animal or plant genetic resources. The following indications are designed to provide guidance on the topics that could be addressed.

20. Describe the overall 1) state, 2) trends and 3) state of conservation of diversity of forest, aquatic, animal or plant genetic resources in your country with respect to:
- a) common characteristics shared by all sectors;
 - b) major differences between sectors;
 - c) synergies or trade-offs in the state of diversity between sectors.

The responses should include relevant information on socio-economic, political and cultural dimensions as well as biological ones. Information on the significance of common characteristics, differences, synergies and trade-offs with respect to achieving food security and nutrition, sustainable production or the provision of ecosystem services should also be provided.

Animal biodiversity is on the decline due to socio-economic reasons. The need to increase productivity has resulted in the use of exotic breeds for upgrading of local breeds. As a result some local breeds such as the Kikuyu zebu have disappeared.

Kenya is estimated to have 7500 plant species (ICUN). The spirit of the CBD envisaged the conservation of biological diversity, the sustainable use of its components, and fair and equitable sharing of the benefits arising out of the utilization of genetic

resources (Agard et al., 2010). However, the change in land and water management being observed in different parts of the country such as the one million acres Galana irrigation scheme proves the contrary. There is also growing concern that overexploitation of some of the plant species such as sandalwood and Aloe may lead to their extinction. More still, the percentage of people living below poverty line has risen from 50% to 56% over the last decade. Population growth and urbanization continue to exert pressure on wetlands around major cities such as Nairobi thus threatening wild and cultivated terrestrial and aquatic plants. Invasive weeds such as hyacinth continue to threaten both terrestrial and aquatic species in Lake Victoria and the Northern part of the country. The on-going restructuring of government institutions has recognized the need to give more support to conservation of biodiversity by creating the GERRI under the umbrella body KALRO. One of the mandates of GERRI is to conserve the diversity of forest, aquatic, animal or plant genetic resources in Kenya. Nevertheless, conflicting institutional mandates between the NEMA and KWS and other conservation agencies are a hindrance to conservation efforts. For example, whereas GERRI has a well-established seed bank at Muguga, it is difficult for staff from GERRI to access seeds for ex-situ conservation from any National Park managed by KWS.

Governance or institutional frameworks play an important role in forestry management in Kenya. While the Kenya Forest Services (KFS) has been recently re-structured and the Forest Act reviewed, governance and institutional issues still persist which drive mangrove degradation. They include: (i) weak enforcement of existing legislations, (ii) lack of mangrove management policy, (iii) rampant sectoral approach to management due to overlapping or conflicting mandates, (iv) lack of effective coastal planning, (v) inadequate institutional capacities and (vi) poor stakeholder's or community participation. These underlying root causes act at levels that lead to destructive practices in the coastal zone such as discharge of untreated municipal wastewater, sedimentation, over-exploitation and forest encroachment.

In Kenya, the legal basis for protection of marine mammals exists through the Wildlife Act Conservation and Management Act Chapter 376 of 1975 and is currently listed on Appendix II of CMS of which Kenya is a signatory. However, awareness of the protection status of dolphin populations among fisher folk and the enforcement and surveillance mechanisms hardly exist.

State and trends of associated biodiversity and ecosystem services

This section seeks information on the state of associated biodiversity in different production systems and in relation to the provision of ecosystem regulating and supporting services.

21. Have any changes been detected in your country for the different production systems over the last 10 years in components of associated biodiversity? If so, indicate if trends are strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 7. If no information is available, indicate not known (NK). If not applicable, (NA).

Table 7. Trends in the state of components of associated biodiversity within production systems.

Production systems	Trends in last 10 years (2,1,0,-1,-2, NK, NA) (Place pointer on the component of associated diversity name for a description)			
	Micro-organisms	Invertebrates	Vertebrates	Plants
Livestock grassland-based systems: Tropics	NK	NK	NK	NK
Livestock landless systems: Tropics	NK	NK	NK	NK
Naturally regenerated forests: Tropics	-1	-2	-1	-1
Planted forests: Tropics	-1	-1	-1	-1
Self-recruiting capture fisheries: Tropics				
Culture-based fisheries: Tropics				
Fed aquaculture: Tropics				
Irrigated crops (rice) : Tropics				0
Irrigated crops (other) : Tropics				2

Rainfed crops : Tropics				0
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	NK	NK	NK	1

22. Briefly describe the changes or trends in diversity recorded in Table 7. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.

Based on recent analysis of known biodiversity records, Kenya is home to 7004 species of vascular plants, 766 bryophytes and 2071 species of fungi including lichens. Three key areas with high plant diversity are Mt. Elgon, Nairobi upland dry forests and the coastal forests, with 650 to 950 species per 0.5 degree square. Of the 7004 plant species found in Kenya, 577 (8 percent) are endemic. The families of Aloaceae, Verbenaceae, Vitaceae and Euphorbiaceae are particularly rich in endemic plants indicating their relative geographic isolation and adaptation to Kenya's landscapes especially the woodlands. National centers of endemism for Kenya include the coastal Inhambane Swahilian centre of endemism, ranging from southern Somalia to northern Mozambique, and the isolated mountain peaks of the Afromontane forests, recognized as an Eastern Africa Hotspot. The two centers account for over 80 percent of the endemic species. Site based studies and biodiversity reviews have also confirmed these results indicating serious gaps in biodiversity studies in which many species or forest are understudied. Fischer et al. (2010) has increased plant species diversity in Kakamega lowland rain forest from 400 to 899, which is more than double and recorded several species new to Kenya (*Dopatriumbaoulense*, *Liparis nervosa*, *Nerviliaadolphi*, *Oeceoclades maculata*, *O. Ugandae*, *Oxyanthuslepidus*, *Paspalumconjugatum*, *Tetracerapotatoria*, *Turraeavogelioides* and *Vernoniaconferta*) and species new to science (*Aframomum spec. nov.* *Renealmia spec. nov.*). This is in addition to 53 species recorded for the first time in Kakamega forest. In addition, *Dorsteniachristenhuizii*, a new plant species in the family Moraceae, was described from the Taita Hills (found in moist water-intakes of Ngangao and Mbololo forests) in 2013. Furthermore, forest fragments such as wooded grassland hilltops, with elements of afromontane and moist vegetation, in lower Eastern (Nzau area, Matooi, Mumoni, Endau, Nuu hills) and Marsabit areas have been found to harbor more diversity than hitherto known, and should be considered as KBAs. In particular, Nzau hill and surrounding hilltops have a total 748 different plant species where over 64 species are endemic, and several new species to science (*Aloe cf. A. confusa* and *Dorsteniaspnov.* (Malombe et al., 2015). Luke (2005) recorded 1396 plant species in Shimba Hills National Reserve and surrounding forest fragments namely Mkongani North and West Forest Reserves, Matuga, Mwaluganje Forest Reserve and Elephant Sanctuary, as well as Kaya Chombo, Kaya Teleza, Chitsanze Sacred Grove and the recently destroyed Kaya Miyani. He likened the Shimbas with adjacent mega diverse Usambara mountains in Tanzania and suggested the need to guard them zealously. In total 356 vascular plant taxa (species, subspecies and varieties) have been classified as threatened or near threatened. Of these, 24 taxa (21 species) are Critically Endangered, 111 are Endangered (83 species), 167 are Vulnerable (128species) and 67 are Near Threatened (56 species). Threatened species are particularly common in the Fabaceae, Euphorbiaceae and Rubiaceae families. The highest number of threatened species, 95 in all, is found in the Coastal Forest (Mwachala et al., 2011). According to Luke (2005), in Shimba hills, one species is critically endangered; six endangered and 35 are vulnerable according to IUCN threatened categories. He however added that the potential rare taxa are 276, most of which are strictly limited to Shimba hills area and that conservation re-assessment need to be arranged.

Most of the animals are still poorly understood especially the invertebrates. For the vertebrates, a total of 2528 (250 Small Mammals, 1100 Birds, 200 Reptiles, 110 Amphibians and 898 Fishes) with the highlands and evergreen savannahs such as Masai Mara having higher concentration. For example, there are six bird▲ biomes in Kenya as defined by Fishpool and Evans (2001); with the Somali Masai biome having the most representative species (Bennun and Njoroge 1999). The Guinea- Congo Forest biome though only represented in Kenya by Kakamega forest- a relic of the expansive western Africa lowland forests is represented by 43 species in Kenya. The Sudan and guinea savannah is marginal in Kenya, being at its extreme eastern limit. Most species in this biome are not found elsewhere in the country apart from Kongelai Escarpment and its environs. The invertebrate is represented by over 25000 invertebrates in the country with about 900 and 900 bees and butterflies species recorded, respectively. About 500 land-snail species are recognized from Kenya too (Verdcourt, 2006), Even for the most useful insect like the bees farmers can only identify mainly the honey-bee *Apis mellifera* despite the importance for food production through pollination. Over three-quarters of flowering plants worldwide are pollinated by bees. The richest known locality for invertebrates in Kenya is Kakamega Forest where over 240 species of bees and 72 species of land-snails have been documented, and the coastal forest and savannah ecosystems. Over 90 species of bees have been documented in Nairobi City Park (Gikungu, 2007; Gikungu, 2010; Lange & Maes, 2001).

The general associated forest biodiversity in the country still remain understudied, yet an increased loss of habitat or degradation is being witnessed. According to Akotsi and Gachanja (2004), the Mau Complex forests, for example, lost 7084.24 hectares of cover mainly of indigenous forest through clear-felling for agriculture and settlements, representing 1.8 percent of the total area. In Mt. Elgon, a loss of 1029 hectares of indigenous forest was detected while the forest plantations were regenerating. The least affected forests are those on the Cherangani hills with only 174.3 hectares deforested. In Aberdares, destruction of the forest through illegal logging, charcoal production and grazing by cattle was noted. However, Mt. Kenya forest showed signs of significant improvement as 6013.5 hectares of previously deforested areas were recovered through regeneration largely attributed to the working conservation strategies. Also, in the Taita Hills moist cloud forests, the general area was negatively affected due to agricultural encroachment but a forest cover increased between 1985 and 2010, at least in part due to

plantations of exotic trees (Gereauet al., 2014).

Overall, plant diversity hotspots are increasingly falling outside the key protected forests even before the climate and land use change threats are considered. Large protected areas, such as Tsavo, fall in between the high diversity plant areas. The coastal forest protected areas are especially important in plant conservation but better protection is needed. The main drivers of biodiversity loss has been observed as habitat loss and over-harvesting of natural resources

23. Have any changes been detected in your country for the different production systems over the last 10 years in regulating and supporting ecosystem services? If so, indicate if trends are strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 8. If no information is available, indicate not known (NK). If not applicable, (NA).

Table 8. Trends in the state of regulating and supporting ecosystem services within production systems.

Production systems	Trends in last 10 years (2,1,0,-1,-2, NK, NA) (Place pointer on the ecosystem service name for a description)								
	Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Livestock grassland-based systems: Tropics	NK	NK	NK	NK	NK	NK	NK	NK	NK
Livestock landless systems: Tropics	NK	NK	NK	NK	NK	NK	NK	NK	NK
Naturally regenerated forests: Tropics	-2	NK	NK	1	1	1	-1	-1	1
Planted forests: Tropics									
Self-recruiting capture fisheries: Tropics	NA	-1	NK	NK	-1	NK	-1	-1	-1
Culture-based fisheries: Tropics	Na	-1	NK	Nk	-1	Nk	-1	-1	-1
Fed aquaculture: Tropics	NA	-1	-1	NK	NK	-1	-1	-1	-1
Irrigated crops (rice) : Tropics									
Irrigated crops (other) : Tropics									
Rainfed crops : Tropics									
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics									

24. Briefly describe the changes or trends in diversity recorded in Table 8. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.

Mau Forest Complex:

According to GoK (2009), the Mau complex is the largest closed-canopy forest ecosystem of Kenya, yet it continues to be seriously degraded through irregular and ill-planned settlements (encroachment), as well as through uncontrolled and illegal forest resource extraction and conversion to agricultural production. For example, through a series of forest excisions (purportedly for settlement of the landless poor) and encroachment, some 107,707 hectares representing approx. 25 per cent of the Mau Complex area has been converted to settlement and farmlands over the last 15 years. Through the excisions of 2001 alone, 61,586.5 hectares of forest in the Mau Forests Complex was to be converted to settlements. It is estimated that, within the remaining gazetted forests in the Complex, some additional 46,122 hectares have been encroached, posing serious threats

to the sustainability of the ecosystem.

Also, over 800 ha of forest land was burned by accidental fires in March 2015.

Mt Elgon:

Makerere University Institute Of Environment And Natural Resources (MUIENR) & National Museums Of Kenya (NMK) (2005), commissioned by IUCN noted continued degradation. However the existing PFM programmes between community and government agencies since then has strengthened effort to reduce degradation through fires, poaching and encroachment.

Mt Kenya:

Eight to Eleven plant communities are distributed along altitudinal gradient and underpinned by soil types. Plants in alpine and ericaceous zones were related to soil P, C and silt contents. The soils are acidic and nutrient poor in Chogoria route compared to Sirimon route. Threats to vegetation and species populations are negatively affected by wildlife especially elephants, and fire and anthropogenic effects around the settlements. Insect borer attack and grazing of young shoots of bamboo and Ocotea species by elephants is wide spread (Musila et al. 2009).

Kakamega and Nandi hills Forest:

According to Schaabet al. (2010), aerial maps surveys indicate both gain and loss of forests cover due to encroachment from pressures of high population in need of natural resources. This is exacerbated by passage of roads through the forests.

25. Is there evidence that changes in biodiversity for food and agriculture have impacted ecosystem services in your country? Indicate if strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 9 and provide a description of specific situations and documentation where available.

Table 9. Impact of changes in biodiversity for food and agriculture on ecosystem services.

Production systems	Changes	Impact of changes in biodiversity for food and agriculture on ecosystem services (2, 1, 0, -1, -2, NK, NA) (Place pointer on the ecosystem service name for a description)								
		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Livestock grassland-based systems: Tropics	Changes in animal genetic resources	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									

Livestock landless systems: Tropics	Changes in animal genetic resources	NK								
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Naturally regenerated forests: Tropics	Changes in animal genetic resources	-1	-1	-1	-1	-1	-1	-2	-1	-1
	Changes in crop genetic resources	-1	-1	-1	-1	-1	-1	-2	-1	-1
	Changes in forest genetic resources	-1	-1	-1	-1	-1	-1	-2	-1	-1
	Changes in aquatic genetic resources	-1	-1	-1	-1	-1	-1	-2	-1	-1
	Changes in micro-organism genetic resources (associated biodiversity)	-1	-1	-1	-1	-1	-1	NK	-1	-1
	Changes in invertebrates genetic resources (associated biodiversity)	-2	-1	-1	-1	-1	-2	-2	-2	-1
	Changes in vertebrates genetic resources (associated biodiversity)	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Changes in plants genetic resources (associated biodiversity)	-2	-1	-1	-1	-1	-1	-2	-1	-1
Planted forests: Tropics	Changes in animal genetic resources	NK								
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Self-recruiting capture fisheries: Tropics	Changes in animal genetic resources									
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									

	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Culture-based fisheries: Tropics	Changes in animal genetic resources									
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Fed aquaculture: Tropics	Changes in animal genetic resources									
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Irrigated crops (rice) : Tropics	Changes in animal genetic resources	NK								
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Irrigated crops (other) : Tropics	Changes in animal genetic resources									

	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Rainfed crops : Tropics	Changes in animal genetic resources									
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	Changes in animal genetic resources	NK								
	Changes in crop genetic resources									
	Changes in forest genetic resources									
	Changes in aquatic genetic resources									
	Changes in micro-organism genetic resources (associated biodiversity)									
	Changes in invertebrates genetic resources (associated biodiversity)									
	Changes in vertebrates genetic resources (associated biodiversity)									
	Changes in plants genetic resources (associated biodiversity)									

26. Briefly describe the impacts on ecosystem services recorded in Table 9. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.

NK

27. List any associated biodiversity species or sub-species (if information is available) that are in some way actively managed in your country to help provide regulating or supporting ecosystem services in Table 10. Indicate in which production systems they occur and indicate if diversity information is available. Provide any available sources of information.

Table 10. Associated biodiversity species that are in some way actively managed in your country to help provide regulating or supporting ecosystem services.

Ecosystem service provided (Place pointer on the ecosystem service name for a detailed description)	Actively managed species (name) and sub-species (where available)	Production systems (code or name)	Availability of diversity information (Y/N)	Source of information
Pollination	Bees, butterflies, bats	L1, L5, F1, F5, M1	Y	NMK (BIOTA East, invertebrate section (insects), Mammlogy section-Musila or Risky&Karatina University-Dr. Webala (bats)/ Zoology Department, Bee Centre),
Pest and disease regulation	Mosquitoes, beetles, freshwater snails	L1, L5, F1, F5, M1	Y	NMK (BIOTA East, invertebrate section/ zoology department, Bee centre),
Water purification and waste treatment				
Natural hazard regulation				
Nutrient cycling	Fungi (including michorhizae)	F1, F5	Y	NMK (Botany/ Mycology section), ICRAF
Soil formation and protection				
Water cycling				
Habitat provisioning	Associated biodiversity including pollinators	F1	Y	Nature Kenya
Production of oxygen/ Gas regulation				
Other [please specify]:				

28. Does your country have monitoring activities related to associated biodiversity? If yes, describe these. Where possible provide information on the components of associated biodiversity that are monitored and on the geographical coverage of the monitoring system (local, regional, national, global). Include references to the sources of information, if possible.

Coastal forests of Kenya and Taita Hills' Eastern Arc Mountains (in conjunction with Tanzania), where status and trends of all associated biodiversity especially plants, invertebrates and vertebrates are monitored (see Gereau et al., 2014). Birds in particular are monitored in forests through IBA initiatives in Kenya including Nairobi environs (see Nature Kenya reports). Bees, as pollinators, freshwater snails as disease vectors including land-snails as soil fertility enhancers are also actively studied and monitored by the Invertebrate section, Zoology Department, of National Museums of Kenya especially in Nairobi area,

Kakamega Forest, Taita Hills, Kenyan wetlands and coastal forests. A Bee Centre to study pollinators is also in place at the National Museums of Kenya (NMK).

Currently, threatened species including plants, insects (butterflies), reptiles, mammals and reptiles are being monitored in the eastern montane forests of Kakamega, Nandi and Cherangani hills through Nature Kenya programme on 'Strengthening Networks in Protected Areas'. Other information on pollinator contribution to food security and species status can be found in BIOTA East reports at the NMK.

Species of associated biodiversity at risk of loss

In this section the objective is to identify species of associated biodiversity within the country that are at significant risk of loss, degradation or extinction.

29. List in Table 11 any components of associated biodiversity for which there is evidence of a significant threat of extinction or of the loss of a number of important populations in your country. Specify the degree of the threat according to the classification in use in your country or following the IUCN Red List Categories and Criteria. Include a description of the threat and list references or sources of information if available.

Table 11. Main threats to associated biodiversity identified as at risk.

Associated biodiversity species	Degree of threat	Main threat	References or sources of information if available
Plants	356 (24 Critically Endangered, 83 Endangered and 169 Vulnerable. Also, 81 are Near Threatened)	Habitat loss/fragmentation and over exploitation	IUCN (website-redlisted species,), East African Redlisting Authority (1st to 8th meeting)
Vertebrates	66 (2 Critically Endangered, 16 Endangered and 16 Vulnerable. Also, 28 are Near Threatened). 4 are Data Deficient.	Habitat loss/fragmentation, over exploitation, illegal poaching. Herbicides and pesticides in case of birds/lions	IUCN (website-redlisted species,), NMK, MEWNR, 2014
Invertebrates	Largely unknown except general decline for pollinators (bees) and 5 (1 Critically endangered land snail and 4 endangered land snails from Taita Hills and Thika Gorge forests,	Habitat (floral decline), Pollution, herbicides/pesticides	IUCN (website-redlisted species,), IUCN NMK
Add row			
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Conservation of associated biodiversity

This section collects information on the state of conservation of components of associated biodiversity providing ecosystem services within production systems in your country.

30. Does your country currently have any *ex situ* conservation or management activities or programmes for associated biodiversity for food and agriculture? These may include, for example, culture collections, collections of pollinators, etc. If so, list these in Table 12.

Table 12. *Ex situ* conservation or management activities or programmes for associated biodiversity for food and agriculture.

Components of associated biodiversity	Organisms, species and sub-species (where available) conserved	Size of collection	Conservation conditions	Objective(s)	Characterization and evaluation status

Components of associated biodiversity	Organisms, species and sub-species (where available) conserved	Size of collection	Conservation conditions	Objective(s)	Characterization and evaluation status
Plants	Species/specimens, Accessions/batches	Over 1 million	East Africa herbarium (dry voucher collections) Nairobi Botanic gardens (Over 2000 collections of mainly rare/threatened species)	Systematics/research (species diversity discovery), mapping species distribution and identify collection and conservation gaps, ethnobotany (local uses of species) and empirical utility (medicine, etc), conservation and restoration of threatened flora . Also, important for environmental education/natural resource use and sustainable utilization purposes	Clearly labeled according to families/genera/species (=Hutchison's families of flowering plant families 1st ed./ APG III (in case of herbarium/dicots). Constantly re-labelled/curated based on new systematics revisions including Flora of Tropical east Africa. Ethnobotany data based on card index and digitized
Micro-organisms	As above (including cultures)	Over 5000	Collections in the herbarium and slides	As above, including soil and nutrient cycles	As above
Vertebrates	Species/specimens/ snake park	Amphibians and reptiles 30000, Fishes 43000, mammals 20000, birds 30000	wet or skin collections	Research and education	
Invertebrates	Species/specimens including bee Centre, butterfly farm (Kipepeo) in Mombasa	Over 2 million (many unknown/undescribed)	Dry collection Also, live butterfly collection	Systematic and conservation research, and biogeography. Also, education and income generation	

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31. Does your country currently have any *in situ* conservation and management activities or programmes in your country that support the maintenance of associated biodiversity? If so provide any available information on organisms and species managed or conserved, site name and location, production system(s) involved, conservation objective and specific actions that secure associated biodiversity or ecosystem services (if any).

Table 13. *In situ* conservation or management activities or programmes for associated biodiversity for food and agriculture.

Components of associated biodiversity	Organisms, species and sub-species (where available) conserved	Site name and location	Production system(s) involved (code or name)	Conservation objective(s)	Specific actions that secure associated biodiversity or ecosystem services
Plants	Protected forests/reserves and kayas (sacred gloves)	KFS/KWS Over 63 coastal kaya forests	Stable, although isolated degradation	Protections of forests and associated biodiversity (including ecosystem services)	Forest types and biodiversity status (monitoring for protection)
Micro-organisms	Protected forests/reserves and kayas (sacred gloves) e.g. Taita hills and Kereita Forest	KFS/KWS Over 63 coastal kaya forests	Stable, although witnessed isolated degradation	Protections of forests and associated biodiversity (including ecosystem services)	Forest types and biodiversity status (monitoring for protection)
Vertebrates	Protected forests/reserves and kayas (sacred gloves)	KFS/KWS	Stable, although isolated degradation	Protections of forests and associated biodiversity (including ecosystem services)	Forest types and biodiversity status (monitoring for protection)
Invertebrates	Protected forests/reserves and kayas (sacred gloves)	(CFCU/ Githitho)	Stable, although isolated degradation and potential mining noted in ArabukoSokoke	Biodiversity conservation, research/ Education and livelihood enhancement	Forest types and biodiversity status (monitoring for protection)

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32. What activities are undertaken in your country to maintain traditional knowledge of associated biodiversity? Has traditional knowledge of associated biodiversity been used to inform conservation and use decisions in your country? Please share best practices and lessons learned.

The importance and role of IK in use and protection of forest associated biodiversity is enshrined in the Kenya constitution 2010 (article), where, in addition, an agency on Intangible Heritage is proposed. Also, the Government under Vision 2030 has committed to transform traditional knowledge to indigenous technology and protection under Intellectual Property laws so that the traditional knowledge owners can gain.

In particular, the National Museums of Kenya undertakes documentation of IK through various activities of research, usually coordinated through Kenya Resource Center for Indigenous Knowledge (KENRIK) section under the Center for Biological Diversity (CBD) Department. Other research institutions and universities are also researching and teaching IK, including Genetic Research International where use of traditional practices have been documented and used to preserve associated biodiversity.

The main aim of KENRIK (see www.museums.or.ke) is to document and preserve the endangered /threatened indigenous

knowledge held by different communities in Kenya which has traditionally served an important role in environmental conservation, natural resource management, food security and traditional healthcare systems. Specific activities include the following;

- Documentation of traditional foodways
- Traditional medicine and medicinal plants documentation.
- Community based conservation (restoration and sustainable harvesting)
- Capacity building and networking with other stakeholders
- Traditional foods and their inventories, ethnobotanical surveys, conservation status, threats and associates IK.
- Ethno-ecological technologies, climate change, traditional farming systems

Some of the on- going or completed programmes and projects include;

- Traditional knowledge and materials in construction / building – the case of LoitaMaasai and Sabaot of Mt Elgon: On going
- Indigenous Knowledge and sustainable management of human and livestock food resources in Mt Kulal Biosphere Reserve, Marsabit County: On going
- Indigenous Agricultural Knowledge Systems (INDAKS) research in Kitui: On-going
- Traditional foodways of the Isukha community of Kakamega county and the Pokot of Baringo county (<http://www.biodiversityinternational.org/e-library/publications/detail/safeguarding-intangible-cultural-heritage-a-practical-guide-to-documenting-traditional-foodways/>) : Completed
- Survey of Economic Plants in Arid and Semi-Arid Lands, (SEPASAL): Completed
- Traditional Medicines and Medicinal Plants (TM&MP): Completed
- Ecology of Eastern Mau forest, funded by the Green Belt Movement: Completed
- Documentation of sacred sites and forest groves in Kenya: Completed
- Indigenous food plants programme (IFPP) : Completed

Resulting innovations include use of indigenous vegetables (IVs) in Kenya, where, not only the germplasm has been collected and conserved ex situ for breeding purposes, but also increasing health living is witness as supermarkets continue buy and sale IVs. In addition, a mid- term goal/initiative has been supported through NMK to establish Natural Resource programme based on IK. Furthermore, the many sacred groves (kayas) at the coastal forests are being managed and protected by local knowledge/practices. Also, the Indigenous People (composed of 10-14 groups) mainly composed of marginalized communities such as Ogiek, Samburu, Njemps have been prioritized in community-led management of forests' to help coordinate and conserve forests (Forests Act, 2005).

The communities around the Kakamega Forest formed a Community Based Organization known as The Kakamega Environmental and Education Programme (KEEP) whose main objective is to participate in the conservation efforts within the Kakamega forest as well as creating awareness within the local communities and schools. Some of the KEEP community activities include: butterfly farming/silkworm rearing, bee keeping, snake rearing, medicinal plants and tree nurseries. These activities are based on the traditional knowledge that members of this community hold and which have been passed from generation to generation. KEEP has also collaborated with ICIPE and KEFRI under a bio-prospecting agreement to market products from *Mondia whitei* also known as *Mondia Tonic* which is currently registered as a trademark at KIPi. This product is obtained from the plant *Mondia whitei*, which has been traditionally used in part as an appetizer and vigour booster and is popular among the Luhya people of Western Kenya.

Other institutions include Agroforestry of wild fruit trees in western Kenya (World Agroforestry Centre).

33. Provide any available information on gender dimensions with respect to the maintenance of and knowledge about associated biodiversity. These may include differences in the roles and insights of women and men with respect to maintaining particular resources, monitoring their state, overseeing their management at different stages of production or ecosystem management.

Across the globe, and particularly in tropical regions rich in biodiversity, in villages, on farms, in homesteads, forests, common pastures, fields and borders, it is women who manage most of the plant resources that are used by humans. This means that they have the greatest local plant knowledge and are mainly responsible for the in situ conservation and management of useful plants, whether domesticated or wild.

Women tend to be more actively involved than men in the household economy. This typically involves the use of a much wider diversity of species for food and medicine than are traded in regional or international markets. Women generally have the primary responsibility of providing their families with food, water, fuel, medicines, fibres, fodder and other products. Often they need to rely on a healthy and diverse ecosystem for a cash income. The production, use and sale of traditional vegetables is traditionally a women's affair. As a result, rural women are the most knowledgeable about the patterns and uses of local biodiversity.

Women are:

- o Plant gatherers
- o Home gardeners
- o Herbalists
- o Seed custodians

State and trends of wild resources used for food

34. Provide in Table 14 a list of wild food species known to be harvested, hunted, captured or gathered for food in your country, and that are not already included in a completed or ongoing Country Report on Forest, Aquatic, Animal or Plant Genetic Resources. Indicate in or around which production system the species is present and harvested, and the change in state of the species over the last 10 years (strongly increasing (2), increasing (1), stable (0), decreasing (-1), or strongly decreasing (-2), or not known (NK)). Indicate where differences within species have been identified and characterized.

Table 14. Wild species used for food in the country.

Species (local name)	Species (scientific name)	Production systems or other environments in which present and harvested	Change in state (2,1,0,-1,-2, NK)	Differences within species identified and characterized (Y/N)	Source of information
Mushrooms	Cantharellus species	F1	NK	N	Gateri et al., 2014
Mukolekyia	Zanhaafricana	F1	-2	N	EA herbarium/ NMMK, ICRAF,
Mjafari (Swahili), mukenea (kamaba), rook (Luo), songoou (Samburu)	Zanthoxylumchalybeum Engl. var. chalybeum	F1	-2	Y	Maundu et al., 1999; Gaya, 2009?
	Acacia bussei	F1	-1	N	KWS (illegal charcoal trade)
Mbuyu (Swahili), Muamba (kamba), mubuyu (mbeere)	Adansonidigitata	F1	-1	N	Pers. observ.; Maundu et al. 1999
Kiazi-kikuu (Swahili), Kikwa (kikuyu)	DioscoreaminutifloraEngl.	F1	-2	N	Pers. observ.; Maunduet al. 1999
Omukombero (luyha), muhukura (Kikuyu), ogombo (Luo)	Mondiawhitei(Hook.f.) Skeels	F1	-2	Y	NMK/EA; Pers. observ.; Maunduet al. 1999; KEFRI
Mutuya (Kikuyu)	Myrianthusholstii	F1	-2	Y	NMK/EA; Maunduet al. 1999; KEFRI
Kamusuusuu (Kamba), kipkurriet (Kipsigis), kimiro (Luyha), emiro (Luo), mitoo (maa)	Crotalaria brevidens	F1 (Only seen in cultivation)	-2	N	NMK/EA; Pers. observ.; Maunduet al. 1999
	Ipomoea lapathifolia	F1 Seasonally flooded Black cotton habitats – now overgrazed	-2	N	NMK/EA; Pers. observ.; Maunduet al. 1999; KEFRI
	Elaeisqueensis (wild forms)	F1 Coastal forest patches	-2	Y	NMK/EA; Pers. observ.; Maunduet al. 1999; KEFRI
	Enseteedule (wild form)	F1 Humid forests	-2	Y	NMK/EA; Pers. observ.; Maunduet al. 1999; KEFRI

Species (local name)	Species (scientific name)	Production systems or other environments in which present and harvested	Change in state (2,1,0,-1,-2, NK)	Differences within species identified and characterized (Y/N)	Source of information
	Encephalartosildebrndt ii	F1 Coast	-2	Y	NMK/EA; Pers. observ.; Maunduet al. 1999; KEFRI
	Eriosemashiennse	Stony hill sides in mid altitudes– now denuded			NMK/EA; Pers. observ.; Maunduet al. 1999
Kikomole, Kitotoo (Kamba)	Pachystigmaschumanianum	F1	-2	N	NMK/EA; Pers. observ.; Maunduet al. 1999

Add row
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Wild food resources at risk

In this section the objective is to identify uncultivated and wild species used for food within the country that are at significant risk of loss.

35. List in Table 15 any wild food species for which there is evidence of a significant threat of extinction or of the loss of a number of important populations in your country. Specify the degree of threat according to the classification in use in your country or following the IUCN Red List Categories And Criteria. Include a description of the threat and list references or sources of information if available.

Table 15. Main threats to wild food species identified as at risk.

Wild food species (scientific name)	Degree of threat	Main threat	References or sources of information if available
Salacia sp. (unmatched at the EAH) collected by P. Maundu on once sacred Thui Hill in Makueni county near Mukuyuni, 1992 (only seen here) and now original hill vegetation nearly changed by humans	V. high	Expansion of agricultural land, settlements	Maundu et al., 1999; Maundu, Pers. Observ. Species status reported to PCP programme mid 90s (single individual at the Nairobi Botanic Gardens, NMK headquarters).
Crotalaria brevidens	High	Cultivated vegetable species. V. Rare in the wild. Its cultivation on the decline	Maundu et al., 1999; Maundu, Pers. Observ.

Add row
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Provide information, where available, as to how the loss of wild food species affects the livelihoods of those that depend on them and on the general impact of their loss on food security and nutrition. Include references to the sources of information, if possible.

None

Conservation of wild resources used for food

36. Are any *ex situ* conservation or management activities or programmes established in your country for wild food species? These may include, for example, culture collections, collections of insects, fungi, etc. If so, list these in Table 16.

Table 16. *Ex situ* conservation or management activities or programmes for wild food species.

Wild food species conserved (scientific name)	Size of collection (number of accessions and quantities)	Conservation conditions	Objective(s)	Characterization and evaluation status
Butterflies, bees (Butterfly House, Mombasa, NMK)		Display glass house	Conservation, protection and commercial	Good
Seeds (NMK -EA Herbarium & KENRIK, KALRO, KEFRI)	>2000 species with orthodox seeds	>-18oC (Deeper freezers)	Active seed biology research	Good
Botanic gardens (NMK), JKUAT, etc)	>2000 species	Living collections	Conservation and environmental awareness	Good
Add row				
Delete row				

37. Are any *in situ* conservation and management activities or programmes established in your country that supports maintenance of wild food species? If so list these in Table 17 provide the following information for each activity or program: site name and location, production system(s) involved, conservation objective and specific actions that secure wild food species (if any).

Table 17. *In situ* conservation or management activities or programmes for wild food species.

Wild food species conserved (scientific name)	Site name and location	Size and environment	Conservation objective(s)	Actions taken
None				
Add row				
Delete row				

38. What activities are undertaken in your country to maintain traditional knowledge of wild food species (indicate if the extent to which these have already been described in sector reports)? How can traditional knowledge of wild food species be accessed and used to inform conservation and use decisions?

None

39. Provide any available information on gender dimensions with respect to the maintenance of and knowledge about wild food species. These may include differences in the roles and insights of women and men with respect to harvesting particular resources, monitoring their state, overseeing their ecosystem management.

None

Natural or human-made disasters and biodiversity for food and agriculture

This section collects information on natural or human-made disasters and their impact on and response from biodiversity for food and agriculture as a whole.

40. **Has your country experienced any natural or human-made disaster(s) that has had a significant effect on biodiversity for food and agriculture and/or on ecosystem services in the past 10 years? List in Table 18 those for which any information exists on their effect on biodiversity for food and agriculture and/or ecosystem services. Indicate the effect on different components or services as significant increase (2), increase (1), no change (0), some loss (-1), significant loss (-2), or not known (NK).**

Table 18. Natural or human-made disasters that has had a significant effect on biodiversity for food and agriculture in the past 10 years in the country.

Disaster description	Production system(s) affected (code or name)	Effect on overall biodiversity for food and agriculture (2, 1, 0, -1, -2, NK)	Effect on ecosystem services (2, 1, 0, -1, -2, NK)
Drought	L1	-1	0
Forest fires	F1, F5	-1	NK
Add row			
Delete row			

41. Briefly summarize any available information, including the year of the disaster, a description of the effects of the disaster on the different components of biodiversity for food and agriculture and/or on the effects on ecosystem services, and references to the supporting documentation.

Following the 2008-2011 drought, the government, together with the European Union, United Nations, World Bank, and other partners, undertook a Post-Disaster Needs Assessment (PDNA) aimed at developing a quantitative estimation of the impact of the drought on the socioeconomic development of the country and recommendations for immediate recovery and long-term resilience-building. The sectors had varying distribution of damage and losses however, livestock sustained a very significant share. There were substantial deaths of domestic animals of different types. The second most drought affected sector was agriculture where production of food and industrial crops reduced. The urban water supply and sanitation systems sustained partial damage, faced production losses due to limited water availability as well as higher-than-normal costs of production. In rural areas, individual family systems sustained partial damage due to the lowering of the groundwater table, and rural inhabitants were forced to collect water from far away sources (2008-2011 Drought Kenya Post-Disaster Needs Assessment (PDNA), 2012)

42. **Provide any available evidence from your country that changes in biodiversity for food and agriculture caused by natural or human-made disasters have had an effect on livelihoods, food security and nutrition.**

The rainfall deficit that persisted from 2008 to 2011 constituted a drought in the following ways i) lower-than-normal precipitation duration and intensities at various times which rendered it as a meteorological drought; ii) an agricultural drought with inadequate soil moisture to meet the needs of various crops in the country; iii) a hydrological drought with deficiencies in the availability of surface and groundwater supplies over periods of time; and, iv) a socio-economic drought with physical water shortages affecting the health, well-being, and quality of life of communities across the country. In the livestock sector, there was decline in production of meat, milk and other by-products, as well as spending of significant amounts in providing veterinary attention, water and feed for the animals that amounted to approximately Ksh 643.2 billion. Ownership of the described damage and losses was heavily concentrated on private sector entities (approximately 92 percent of total damage and losses). This included individuals, households, or enterprises that owned domestic animals that died, food and industrial crops that failed, damaged fishing equipment and production, food processing losses, and higher costs for water in rural areas

43. Provide any available evidence that the enhanced use of biodiversity for food and agriculture has contributed to improving livelihoods, food security and nutrition in the context of a natural or human-made disasters. Describe and provide source of information.

Invasive alien species and biodiversity for food and agriculture

44. Are there invasive alien species identified in your country that have had a significant effect on biodiversity for food and agriculture in the past 10 years? List in Table 19 those for which any information exists on their effect on biodiversity for food and agriculture and/or ecosystem services. Indicate the effect on different components or services as strong increase (2), increase (1), no effect (0), some loss (-1), significant loss (-2), or not known (NK).

Table 19. Invasive alien species that have had a significant effect on biodiversity for food and agriculture in the past 10 years.

Invasive alien species (scientific name)	Production system(s) affected (code or name)	Effect on components of biodiversity for food and agriculture (2,1,0,-1,-2, NK)	Effect on ecosystem services (2,1,0,-1,-2, NK)
Lantana camara	-1	-1	-2
Parthenium hysteroforus	-2	-2	-1
Prosopis juliflora	-2	-2	-2
Dodonaeaviscosasspangustifolia	-1	-1	-1
hyacinth (Eichhornia crassipes)	M1	-2	-2
Add row			
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45. Briefly summarize any available information related to the invasive alien species listed in Table 19, including a description of the effects of the invasive alien species on the different components of biodiversity for food and agriculture and/or on the effects on ecosystem services, and references to the supporting documentation.

Partheniumhysteroforus has been seen to explode in distribution in the last 10 years, first in Nairobi, and has now spread in many parts of the country especially grazing areas adversely impacting livestock and wildlife in National Parks (Nakuru) as is said to poisonous (Wabuyelet al., 2014). Dodonaeaviscosa, which is native and fast encroaching woodlands/wooded Combretum grasslands (evergreen bushland, e.g. East Pokot-Laikipia, Nakuru, Machakos and Makueni counties) limiting once important grazing and farming communities (Alvarez et al., 2015/In press).

46. Has biodiversity for food and agriculture contributed to managing the spread and proliferation or controlling established invasive alien species in your country? If yes, provide information on the invasive alien species involved, the components of biodiversity for food and agriculture and any indication on how the components of biodiversity contributed to managing the spread and proliferation or controlling established invasive alien species in your country. Provide references to the supporting documentation.

Control of hyacinth weed by use of beetle as a biological control agent

Similarities, differences and interactions

47. Comment on those aspects with respect to the state, trends and conservation of associated biodiversity or wild food biodiversity in relation to the state, trends and conservation of sector genetic resources. It would be helpful to provide your observations under the following headings:

- a. main similarities between associated biodiversity, wild food diversity and the different sectors;
- b. major differences between associated biodiversity, wild food diversity and the different sectors;

- c. synergies or trade-offs between associated biodiversity, wild food diversity and the different sectors.

The responses should include relevant information on socio-economic, political and cultural dimensions as well as biological ones. Information on the significance of common characteristics, differences, synergies and trade-offs with respect to achieving food security and nutrition, sustainable production or the provision of ecosystem services should also be provided.

Gaps and priorities

48. With respect to the state, trends and conservation of associated biodiversity and ecosystem services:

- a. What are the major gaps in information and knowledge?
- b. What are the main capacity or resources limitations?
- c. What are the main policy and institutional constraints?
- d. What actions are required and what would be the priorities?

a) What are the major gaps in information and knowledge?

- Biodiversity data sharing and updates lacking or at lowest levels
- Data on species status and populations trends limited to obvious species like large mammals and threatened tree species.
- Molecular systematics

b) What are the main capacity or resources limitations?

- Taxonomic impediment! There are increasingly few basic science based research scientists and institutions to study organismal species diversity both in the field and the laboratory.
- Research facilities in the laboratories (collection centers) and funding lacking, and therefore limited scientific description/ discovery, mapping and monitoring. Ad hoc explorations are increasingly discovering a number of new species in plants and fungi, and even animals. Furthermore most of invertebrates are yet to be described or discovered.
- Forensic/molecular systematic laboratories are lacking or ill-equipped.

c) What are the main policy and institutional constraints?

- Limited access to research facilities (National parks) and lack of funding for biodiversity research.
- Turnover of experienced taxonomists from collection faculties (e.g. Museums) to universities without replacement coupled with diminishing taxonomic interests by young generations.
- Collection management and curations, which are the arbiters of correct species names, are not constantly met due to limited staff numbers and lack of new collections because of changing policy in access and collection of genetic resources.

d) What actions are required and what would be the priorities?

More funding for research and review Access and Benefit sharing of CBD's convention. More awareness to local communities on the importance of natural heritage and intangible benefits to environment and humanity.

Enactment of legislation and enforcement of the same by the national and county governments

49. With respect to the state, trends and conservation of wild resources used for food:

- a. What are the major gaps in information and knowledge?
- b. What are the main capacity or resources limitations?
- c. What are the main policy and institutional constraints?
- d. What actions are required and what would be the priorities?

50. With respect to the impact and response to natural or human-made disasters and biodiversity for food and agriculture:

- a. What are the major gaps in information and knowledge?
- b. What are the main capacity or resources limitations?
- c. What are the main policy and institutional constraints?

d. What actions are required and what would be the priorities?

51. **With respect to the impact of invasive alien species on biodiversity for food and agriculture:**

- a. **What are the major gaps in information and knowledge?**
- b. **What are the main capacity or resources limitations?**
- c. **What are the main policy and institutional constraints?**
- d. **What actions are required and what would be the priorities?**

According to Odeny, et al., (2009), (report commissioned by UVIMA-BioNET-EAFRINET)

a) What are the major gaps in information and knowledge?

- Literature related to identification, reporting and management tools of IAS are scanty.
- Unclear criteria for what is declared IAS. Decisions made based on ad hoc observations of accidental alien introduction.
- Lack of harmony between institutions handling management and control of IAS

• The resources and capacity to address IAS issues is wanting

• Data of invasive species monitoring plans and information sharing mechanisms lacking. If available based on institutional platforms.

• Data of IAS limited to a few organisms/species.

b) What are the main capacity or resources limitations?

- Funding level for species monitoring and even eradication/control quite low
- Low quality laboratories and tools such as DNA barcoding databases

c) What are the main policy and institutional constraints?

• Activities and data on IAS exist in various formats in different institutions. This affects efficiency in overall management of emerging challenges and associated problems with identification, control, monitoring and management. Invasive species policy remains unclear, but generally importation or transportation of invasive species material prohibited.

d) What actions are required and what would be the priorities?

- Improve capacity on identification of IAS to involve all categories of flora and fauna.
- Records of IAS in Kenya are variable in number and species specific, and harmony is required.
- Awareness of the species recognized as IAS and actions of control required to general public and research institutions.
- Various institutions working on IAS management, guided by government focal point, need to draw amicable workplans while observing areas of overlap and clear budget is allocated.
- Communication strategy for the collaborative institutional work is required. Databases need to developed in various institutions and sharing network/ methods established.
- Training in DNA barcoding techniques to improve morpho-similar IAS and enhance control measures

CHAPTER 4: The state of use of biodiversity for food and agriculture

Proposed structure of the chapter and information to be included in the Country Reports

The questions in this chapter seek to obtain information on:

- The contribution of biodiversity for food and agriculture to:
 - production (or provisioning ecosystem services) and especially to food security and nutrition and to rural poverty reduction;
 - supporting and regulating ecosystem services;
 - sustainability and resilience;
- The application of an ecosystem approach;
- The state of the sustainable use of biodiversity for food and agriculture.

Since the sectoral State of the World reports already presented or in preparation provide information separately on the use of animal, aquatic, forest and plant genetic resources, the responses here should provide available information on:

- The combined use of genetic resources coming from different sectors;
- Synergies between genetic resources of the different sectors
- The use of all types of associated biodiversity, either as separate components or in combination;
- The use of wild foods and, where information exists, other important wild harvested products.

The uses of biodiversity for food and agriculture can include:

- The direct use of genetic resources from different sectors or of associated biodiversity and wild foods, individually or in combination;
- The indirect use through the provision of supporting and regulating ecosystem services;
- The support for land/water restoration or other land/water management objectives;
- The support of cultural ecosystem services including:
 - Use for cultural, amenity or social reasons;
 - Use in education or scientific research.

To help reporting and provide a common framework for analysis of Country Reports a set of biodiversity maintaining management practices and diversity based practices have been identified in Annex 5 and Annex 6. These provide a framework for a number of the questions in this Chapter.

The information provided for this Chapter should also cover the adoption of an ecosystem approach. One such approach has been developed under the Convention on Biological Diversity and comprises 12 principles.

A final section of this Chapter of the Country Report should address the sustainable use of different components of biodiversity for food and agriculture, wild foods and other wild harvested products.

Where information is available, comment on the different roles played by men and women in the use of genetic resources, use and consumption of wild foods and knowledge over local ecosystems.

The use of management practices or actions that favor or involve the use of biodiversity for food and agriculture

This section looks for information on the extent to which biodiversity maintaining management practices and diversity based practices are in use in your country.

52. For each of the production systems present in your country indicate in Table 20 the extent of use of management practices that are considered to favor the maintenance and use of biodiversity for food and agriculture.

In the table indicate the percent of total production area or quantity under the practice (where known), changes that have occurred over the last 10 years in the production area or quantity under the practice (significant increase (2), some increase (1), no change (0), some decrease (-1), significant decrease (-2), not known (NK), not applicable (NA)),

and any identified change in biodiversity for food and agriculture associated with the practice (strongly increasing (2) increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK), not applicable (NA)).

Table 20. Management practices that are considered to favor the maintenance and use of biodiversity for food and agriculture.

Production systems	Management practices (Place pointer on the management practice name for a description)	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Livestock grassland-based systems: Tropics	Integrated Plant Nutrient Management (IPNM)	5	NK	NK
	Integrated Pest Management (IPM)	2	NK	NK
	Pollination management	2	NK	NK
	Landscape management	5	NK	NK
	Sustainable soil management practices	4	NK	NK
	Conservation agriculture	3	NK	NK
	Water management practices, water harvesting	5	NK	NK
	Agroforestry	5	NK	NK
	Organic agriculture	5	NK	NK
	Low external input agriculture	1	NK	NK
	Home gardens	0	NA	NA
	Areas designated by virtue of production features and approaches	0	NA	NA
	Ecosystem approach to capture fisheries	0	NA	NA
	Conservation hatcheries	0	NA	NA
	Reduced-impact logging	0	NA	NA
Other [<i>please specify</i>]:				
Livestock landless systems: Tropics	Integrated Plant Nutrient Management (IPNM)	10	1	1
	Integrated Pest Management (IPM)	2	NK	NK
	Pollination management	2	NK	NK
	Landscape management	1	NK	NK
	Sustainable soil management practices	5	1	1
	Conservation agriculture	10	1	1
	Water management practices, water harvesting	10	1	1
	Agroforestry	0	NA	NA
	Organic agriculture	10	1	1
	Low external input agriculture	10	1	1

	Home gardens	80	2	2
	Areas designated by virtue of production features and approaches	0	NA	NA
	Ecosystem approach to capture fisheries	0	NA	NA
	Conservation hatcheries	0	NA	NA
	Reduced-impact logging	0	NA	NA
	Other [<i>please specify</i>]:			
Naturally regenerated forests: Tropics	Integrated Plant Nutrient Management (IPNM)	70	1	1
	Integrated Pest Management (IPM)	60	1	1
	Pollination management	30	1	1
	Landscape management	30	1	1
	Sustainable soil management practices	50	1	1
	Conservation agriculture	60	1	1
	Water management practices, water harvesting	70	1	1
	Agroforestry	10	1	1
	Organic agriculture	10	1	1
	Low external input agriculture	20	1	1
	Home gardens	50	1	1
	Areas designated by virtue of production features and approaches	0	N/A	N/A
	Ecosystem approach to capture fisheries	10	1	1
	Conservation hatcheries	0	N/A	N/A
	Reduced-impact logging	15	1	1
Other [<i>please specify</i>]:				
Planted forests: Tropics	Integrated Plant Nutrient Management (IPNM)	0	NA	NA
	Integrated Pest Management (IPM)	0	NA	NA
	Pollination management	0	NA	NA
	Landscape management	100	NK	NK
	Sustainable soil management practices	100	NK	NK
	Conservation agriculture	0	NA	NA
	Water management practices, water harvesting	50	NK	NK
	Agroforestry	NK	NK	NK
	Organic agriculture	0	NA	NA
	Low external input agriculture	100	NK	NK
	Home gardens	NK	NK	NK

	Areas designated by virtue of production features and approaches			
	Ecosystem approach to capture fisheries			
	Conservation hatcheries			
	Reduced-impact logging			
	Other [<i>please specify</i>]:			
Self-recruiting capture fisheries: Tropics	Integrated Plant Nutrient Management (IPNM)			
	Integrated Pest Management (IPM)			
	Pollination management			
	Landscape management			
	Sustainable soil management practices			
	Conservation agriculture			
	Water management practices, water harvesting			
	Agroforestry			
	Organic agriculture			
	Low external input agriculture			
	Home gardens			
	Areas designated by virtue of production features and approaches			
	Ecosystem approach to capture fisheries			
	Conservation hatcheries			
	Reduced-impact logging			
Other [<i>please specify</i>]:				
Culture-based fisheries: Tropics	Integrated Plant Nutrient Management (IPNM)			
	Integrated Pest Management (IPM)			
	Pollination management			
	Landscape management			
	Sustainable soil management practices			
	Conservation agriculture			
	Water management practices, water harvesting			
	Agroforestry			
	Organic agriculture			
	Low external input agriculture			
	Home gardens			
	Areas designated by virtue of production features and approaches			

	Ecosystem approach to capture fisheries			
	Conservation hatcheries			
	Reduced-impact logging			
	Other [<i>please specify</i>]:			
Fed aquaculture: Tropics	Integrated Plant Nutrient Management (IPNM)			
	Integrated Pest Management (IPM)			
	Pollination management			
	Landscape management			
	Sustainable soil management practices			
	Conservation agriculture			
	Water management practices, water harvesting			
	Agroforestry			
	Organic agriculture			
	Low external input agriculture			
	Home gardens			
	Areas designated by virtue of production features and approaches			
	Ecosystem approach to capture fisheries			
	Conservation hatcheries			
	Reduced-impact logging			
Other [<i>please specify</i>]:				
Irrigated crops (rice) : Tropics	Integrated Plant Nutrient Management (IPNM)	NK	2	1
	Integrated Pest Management (IPM)	NK	2	1
	Pollination management	NK	NK	NK
	Landscape management	NK	1	1
	Sustainable soil management practices	NK	1	1
	Conservation agriculture	NK	1	1
	Water management practices, water harvesting	NK	1	1
	Agroforestry	NA	NA	NA
	Organic agriculture	NA	NA	NA
	Low external input agriculture	NK	1	1
	Home gardens	NA	NA	NA
	Areas designated by virtue of production features and approaches			
	Ecosystem approach to capture fisheries			
	Conservation hatcheries			

	Reduced-impact logging			
	Other [<i>please specify</i>]:			
Irrigated crops (other) : Tropics	Integrated Plant Nutrient Management (IPNM)	NK	1	1
	Integrated Pest Management (IPM)	NK	1	1
	Pollination management	NK	NK	NK
	Landscape management	NK	1	1
	Sustainable soil management practices	NK	1	1
	Conservation agriculture	NK	1	1
	Water management practices, water harvesting	NK	1	1
	Agroforestry	NK	1	1
	Organic agriculture	NK	1	1
	Low external input agriculture	NK	1	1
	Home gardens	NK	1	1
	Areas designated by virtue of production features and approaches			
	Ecosystem approach to capture fisheries			
	Conservation hatcheries			
	Reduced-impact logging			
	Other [<i>please specify</i>]:			
	Rainfed crops : Tropics	Integrated Plant Nutrient Management (IPNM)		
Integrated Pest Management (IPM)				
Pollination management				
Landscape management				
Sustainable soil management practices				
Conservation agriculture				
Water management practices, water harvesting				
Agroforestry				
Organic agriculture				
Low external input agriculture				
Home gardens				
Areas designated by virtue of production features and approaches				
Ecosystem approach to capture fisheries				
Conservation hatcheries				
Reduced-impact logging				
Other [<i>please specify</i>]:				

Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	Integrated Plant Nutrient Management (IPNM)	70	1	1
	Integrated Pest Management (IPM)	60	1	1
	Pollination management	30	1	1
	Landscape management	30	1	1
	Sustainable soil management practices	50	1	1
	Conservation agriculture	60	1	1
	Water management practices, water harvesting	70	1	1
	Agroforestry	10	1	1
	Organic agriculture	10	1	1
	Low external input agriculture	20	1	1
	Home gardens	50	1	1
	Areas designated by virtue of production features and approaches	0	N/A	N/A
	Ecosystem approach to capture fisheries	10	1	1
	Conservation hatcheries	0	N/A	N/A
	Reduced-impact logging	15	1	1
Other [<i>please specify</i>]:				

Provide or cite references to any documentary evidence that exists to support the evaluation given above. Indicate where practices used in a production system are affecting biodiversity for food and agriculture in another production system.

Where evidence exists of an effect of any of these practices on biodiversity for food and agriculture, provide a brief summary of the effect, the components of biodiversity for food and agriculture affected, and available indicators. Include any available references or reports.

53. For each of the production systems present in your country indicate in Table 21 the extent of use of diversity based practices that involve the use of biodiversity for food and agriculture.

In each table indicate the percent of total production area or quantity under the practice (where known), changes in the production area or quantity under the practice that have occurred over the last 10 years (strongly increasing (2), increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK)) and any identified change in biodiversity for food and agriculture associated with the diversity based practice (strongly increasing (2) increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK)).

Table 21. Diversity based practices that involve the enhanced use of biodiversity for food and agriculture.

Production systems	Diversity based practices (Place pointer on the diversity based practice name for a description)	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
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Livestock grassland-based systems: Tropics	Diversification	10	1	1
	Base broadening	15	1	1
	Domestication	20	1	1
	Maintenance or conservation of landscape complexity	10	1	1
	Restoration practices	5	1	NK
	Management of microorganisms	3	NK	NK
	Polyculture/Aquaponics	0	NA	NK
	Swidden and shifting cultivation agriculture	5	NK	NK
	Enriched forests	10	NK	NK
	Other [<i>please specify</i>]:			
Livestock landless systems: Tropics	Diversification	35	1	1
	Base broadening	15	1	1
	Domestication	2	NK	NK
	Maintenance or conservation of landscape complexity	5	NK	NK
	Restoration practices	7	1	NK
	Management of microorganisms	6	NK	NK
	Polyculture/Aquaponics	0	NA	NK
	Swidden and shifting cultivation agriculture	18	1	NK
	Enriched forests	0	NA	NK
	Other [<i>please specify</i>]:			
Naturally regenerated forests: Tropics	Diversification	0	NA	NA
	Base broadening	0	NA	NA
	Domestication	0	NA	NA
	Maintenance or conservation of landscape complexity	2	NK	NK
	Restoration practices	10	1	NK
	Management of microorganisms	0	NA	NA
	Polyculture/Aquaponics			
	Swidden and shifting cultivation agriculture			
	Enriched forests	0	NA	NA
	Other [<i>please specify</i>]:			
Planted forests: Tropics	Diversification	<1	NK	NK
	Base broadening	0	NA	NA

	Domestication	<1	NK	NK
	Maintenance or conservation of landscape complexity	<1	NK	NK
	Restoration practices	<1	NK	NK
	Management of microorganisms	0	NA	NA
	Polyculture/Aquaponics			
	Swidden and shifting cultivation agriculture			
	Enriched forests	0	NA	NA
	Other [<i>please specify</i>]:			
Self-recruiting capture fisheries: Tropics	Diversification			
	Base broadening			
	Domestication			
	Maintenance or conservation of landscape complexity			
	Restoration practices			
	Management of microorganisms			
	Polyculture/Aquaponics			
	Swidden and shifting cultivation agriculture			
	Enriched forests			
	Other [<i>please specify</i>]:			
Culture-based fisheries: Tropics	Diversification			
	Base broadening			
	Domestication			
	Maintenance or conservation of landscape complexity			
	Restoration practices			
	Management of microorganisms			
	Polyculture/Aquaponics			
	Swidden and shifting cultivation agriculture			
	Enriched forests			
	Other [<i>please specify</i>]:			
Fed aquaculture: Tropics	Diversification			
	Base broadening			
	Domestication			
	Maintenance or conservation of landscape complexity			
	Restoration practices			

	Management of microorganisms			
	Polyculture/Aquaponics			
	Swidden and shifting cultivation agriculture			
	Enriched forests			
	Other [<i>please specify</i>]:			
Irrigated crops (rice) : Tropics	Diversification	NK	1	1
	Base broadening	1	NK	1
	Domestication	NK	NK	1
	Maintenance or conservation of landscape complexity	-1	_1	_1
	Restoration practices	NK	NK	NK
	Management of microorganisms	NK	NK	NK
	Polyculture/Aquaponics	NK	NK	NK
	Swidden and shifting cultivation agriculture	NK	NK	NK
	Enriched forests	NK	NK	NK
	Other [<i>please specify</i>]:			
Irrigated crops (other) : Tropics	Diversification	1		
	Base broadening	1		
	Domestication	NK		
	Maintenance or conservation of landscape complexity	_1		
	Restoration practices	NK		
	Management of microorganisms	NK		
	Polyculture/Aquaponics	1		
	Swidden and shifting cultivation agriculture	NK		
	Enriched forests	NK		
	Other [<i>please specify</i>]:			
Rainfed crops : Tropics	Diversification			
	Base broadening			
	Domestication			
	Maintenance or conservation of landscape complexity			
	Restoration practices			
	Management of microorganisms			
	Polyculture/Aquaponics			
	Swidden and shifting cultivation agriculture			
	Enriched forests			

	Other [<i>please specify</i>]:			
Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	Diversification	20	1	1
	Base broadening	10	1	1
	Domestication	10	1	1
	Maintenance or conservation of landscape complexity	25	1	1
	Restoration practices	30	1	1
	Management of microorganisms	10	1	1
	Polyculture/Aquaponics	0	NA	NK
	Swidden and shifting cultivation agriculture	30	1	1
	Enriched forests	10	-1	-1
	Other [<i>please specify</i>]:			

Briefly summarize the information that exists on the effect of the diversity based practice on different components of biodiversity for food and agriculture. Indicate where practices used in a production system are affecting biodiversity for food and agriculture in another production system. Include any available references or reports to support the evaluation given above.

54. List and briefly describe any specific programmes or projects that have been undertaken in the country to support any of the practices listed in Table 20 and Table 21. Provide information where available on what types of activities were supported, areas and numbers of farmers, pastoralists, forest dwellers and fisherfolk involved, state and outcome with respect to components of biodiversity for food and agriculture.

a) Boran Cattle Improvement Program - the objective of this national program is genetic improvement, conservation and sustainable utilization of Boran cattle for increased meat production. This is done through rigorous selection criteria at the nucleus herd and utilization of appropriate dissemination pathways for improved genotypes to the commercial populations.

b) Sahiwal Cattle Improvement Program - the objective of this national program is genetic improvement, conservation and sustainable utilization of Sahiwal cattle for increased meat and milk production. This is done through rigorous selection criteria at the nucleus herd and utilization of appropriate dissemination pathways for improved genotypes to the commercial populations.

c) Small East Africa Zebu Cattle Improvement Program - the objective of this national program is genetic improvement, conservation and sustainable utilization of Small East Africa Zebu Cattle for increased meat production. This is done through rigorous selection criteria at the dispersed nucleus herds and utilization of appropriate dissemination pathways for improved genotypes to the commercial populations.

d) Red Maasai Sheep Improvement Program - the objective of this national program is genetic improvement, conservation and sustainable utilization of Red Maasai Sheep for increased meat production. This is done through rigorous selection criteria at the dispersed nucleus herds and utilization of appropriate dissemination pathways for improved genotypes to the commercial populations.

In the fisheries sector The government has involved communities in the co management of fisheries resources. By enacting a legislation to establish beach management units. Setting up none fishing grounds and especially in the nursery and breeding areas. Setting up the standards for fishing gears and banning destructive fishing gears and practices. Close fishing seasons for the recovery of the stocks

Sustainable use of biodiversity for food and agriculture

Sustainable use of biodiversity for food and agriculture ensures its utilization in ways that do not compromise its continuing availability and its use by future generations. Sector reports will provide information on sustainable use of the different sector genetic resources. Here the focus is therefore on associated biodiversity and on wild foods.

55. **What are the major practices in your country that negatively impact associated biodiversity and/or wild foods? Answers can be provided in Table 22 where examples of general types of practices are listed.**

Table 22. Major practices that negatively impact associated biodiversity and/or wild foods in the country.

Types of practices	Major practice (Y/N)	Description	Reference
Over-use of artificial fertilizers or external inputs	Y		
Over-use of chemical control mechanisms (e.g. disease control agents, pesticides, herbicides, veterinary drugs, etc.)	Y		
Inappropriate water management	Y		
Practices leading to soil and water degradation	Y		
Over-grazing	Y		
Uncontrolled forest clearing	Y	Loss of 5% forest cover between 1990-2005. 70% loss of mangrove cover	UNEP (2006). Africa environment outlook 2. United Nations Environment Programme, Nairobi. Twong'o, T. K. and Sikoyo, G. M. 2002. Status of the resources on coastal aquatic ecosystems of Kenya and Tannzania. " http://www.acts.or.ke/books/docs/TBNRM ."
Fishing in protected areas	N		
Overharvesting	N		
Other [<i>please specify</i>):			

Add row
Delete row

Please comment on the reasons why the practices are in use and discuss if trade-offs are involved.

56. **Briefly describe any actions and countermeasures taken to limit unsustainable use and/or support sustainable use of associated biodiversity and/or wild foods.**

Presidential ban on overexploited resources such as indigenous trees through appropriate agencies like KFS and KWS. Other recently protected species included in the presidential ban are *Osyris lanceolata* and Aloe, among others.

Continuous species conservation assessments for IUCN red-listing. For plants, the East African Plant Red-listing Authority committee meetings once or twice per year involving taxonomists and conservation experts in the region including IUCN and potential threatened species are subjected to the criteria categories for new conservation status or review. The list of threatened species is shared indicating the causes of threats and if overexploitation for food or trade the species is evaluated for CITES protection. Domestication and commercialization of overexploited yet viable species like Aloe

Due to declining wild fish stocks, the Government through the Economic stimulus project in the fishery sector (ESP) supported farmers to farm fish countrywide so as to reduce pressure on the wild stock. This was to increase fish production in the country and enhance food security as well as creating employment. Feeds and seed standard for fish have been established as well as hatcheries to provide fish seed and feed to farmers. The government is also introducing carrying out research to domesticate local fish species to include them in the list of farmed fish in the country. This is envisaged to increase fish production and also conserve biodiversity. There is also a program to introduce selected fish species in man made and natural small water bodies countrywide

57. **Provide in Table 23 any information available that lack of biodiversity for food and agriculture is limiting food security and nutrition, and/or rural livelihoods in the different production systems in your country. Indicate the production systems affected together with any information on the extent of problem (significant lack (2), some lack (1)), describe the effects on livelihood, food security and nutrition, and the components of biodiversity for food and agriculture that are limited.**

Table 23. Effect of the lack of biodiversity for food and agriculture on production, food security and nutrition and livelihood.

Production system	Biodiversity component for which diversity is lacking	Extent of problem (2,1)	Effect on food security and nutrition	Effect on livelihood	Reference
Add row					
Delete row					

The contribution of biodiversity for food and agriculture to improving productivity, food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification

This section looks for information on the direct contributions of biodiversity for food and agriculture to improving productivity, food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification. It is concerned specifically with the combined use of genetic resources coming from different sectors, the use of all types of associated biodiversity, the use of wild foods and, where information exists, other important wild products.

Note the ways in which biodiversity for food and agriculture contributes to food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification are often linked. Answers to the requests for information below may therefore be combined.

58. **Where available, provide information that increasing the amount of biodiversity for food and agriculture, including associated biodiversity, in production systems in your country have improved the following:**

- a) productivity;
- b) food security and nutrition;
- c) rural livelihoods;
- d) ecosystem services;
- e) sustainability;
- f) resilience;
- g) sustainable intensification.

What specific actions have you undertaken to strengthen the contribution of biodiversity for food and agriculture to

improving these outcomes? For each of these aspects, briefly describe the nature and scale of the actions implemented, the production systems involved, and the outcomes, results obtained or lessons learned from these actions.

Where available provide information on the components of biodiversity for food and agriculture involved, the stakeholders involved and the gender aspects of these actions. Note that information on policies, legislation or regulations should be reported in Chapter 5 and your response here should be concerned with interventions at production system level.

- a) Productivity; PGR as a component of biodiversity has been used to increase crop yields as well as to develop or select materials for adaptation or mitigation of the effects of climate change. For example, improved crop productivity in Kenya has been achieved through improved use and management of PGR such as seeds and other planting materials. Major players include KALRO (formerly KARI), Kenya Seed Company, universities and other private seed companies. Research institutions have also used PGR to develop drought tolerant varieties.
- b) Food security and nutrition; food security is the ability of all people at all times to access enough food for an active and healthy life (Commonwealth Secretariat). Four conditions that must be fulfilled to ensure food security and nutrition include availability, access, stability and utilization. Increased diversity of PGR along variable food production value chains has helped to improve food security and nutrition in Kenya.
- c) Rural livelihoods; The livelihood of people is determined by five capitals; namely human capital (eg education), natural capital (eg land, biodiversity), financial capital (eg access to credit), social capital (eg community networks), physical capital (eg livestock) and the institutional environment within which people operate (REF). Livelihoods are vulnerable and thus exposed to shocks, seasonal variability and/or long term trends. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain its capabilities and assets both now and in the future while not undermining the natural resource base. Increased diversity of PGR facilitates access to livelihood assets to many communities in Kenya.
- d) Ecosystem services; Ecosystem services are defined as the benefits provided by ecosystems to human life. Increasing diversity of PGR in Kenya ensures provision of key ecosystem services such as nutrient cycling, carbon sequestration, pest regulation and pollination and sustains agricultural productivity.
- e) Sustainability; Increasing diversity of PGR has ensured increased and sustainable crop yields and nutritional diversity in all agro ecological zones in Kenya. Good farming practices which follow ecosystem-based approaches designed to improve sustainability of production systems enable consumers to get products such as flowers that are of high quality, safe and produced in an environmentally and socially responsible way.
- f) Resilience; Resilience is the ability to withstand shocks. In the face of prolonged drought, poor households in rural areas in Kenya rely on wild plants for food. This is made possible by the high diversity of wild plants and landraces.
- g) Sustainable intensification. Sustainable crop production intensification aims to maximize options for crop production intensification through the management of biodiversity and ecosystem services (rf). In Kenya, sustainable intensification has been made possible by increasing diversity of PGR used in developing varieties for mitigating and adapting to climate change, restoration of degraded habitats and providing food for an increasing population among others.
- h) Aquaculture in the country has increased fish production from 7,000mt to 48,000mt. This translates to about 23% of the total landed fresh water in the country. (Source SDF Annual Report 2014) The country has established standards for export of farmed fish to ensure the growth of fish farming industry for both local and export markets. SDF is currently assisting farmers in accessing new local and foreign markets as well as value adding of the farmed fish.

59. Do you have information on the proportion of the population in your country that uses wild food on a regular basis for food and nutrition? If available, include information such as the proportion of the diet that is collected from the wild in normal time and in times of scarcity, drought, natural and human-made disaster, and the degree to which wild foods are used (for subsistence, supplementing, nutrition, other).

Provide explanations and additional information as regards the gender differences in the patterns of use, management and consumption of wild food, including data disaggregated by sex.

Not known

The adoption of ecosystem approaches

60. Describe in Table 24 the extent to which you consider that ecosystem approaches have been adopted for the different production systems in your country (widely adopted (2), partially adopted (1), not adopted (0), not applicable (NA)) and indicate whether ecosystem approaches are considered of major importance (2), some importance (1), no importance (0), not applicable (NA). You may also want to describe landscape approaches that have been adopted in your country.

Table 24. Adoption of and importance assigned to ecosystem approaches in production systems in the Country.

Production system	Ecosystem approach adopted (name)	Extent of adoption (2,1,0,NA)	Importance assigned to the ecosystem approach (2,1,0,NA)
Livestock grassland based system	Convention on Biological Diversity	1	2
	Integrated Water Resource Management	1	2
Livestock landless system	Convention on Biological Diversity	1	2
	Integrated Water Resource Management	1	2
	Integrated Land Use Planning	1	2
Mixed systems	Convention on Biological Diversity	1	2
	Integrated Water Resource Management	1	2
	Integrated Land Use Planning	1	2
Irrigated crops (rice) Tropics	Integrated Land Use Planning,	2	2
	Integrated Water Resource Management,	2	2
	Sustainable Forest Management,	NA	NA
Naturally regenerated forests	Convention on Biological	2	2
	Integrated natural resource management	2	2
	Nagoya Protocol on Access and Benefit Sharing related to genetic resources	2	2
Planted forests	Sustainable management principles of forests	2	2
Add row			
Delete row			

61. For each production system in which an ecosystem and landscape approach has been widely adopted (as indicated in Table 24) describe:

- a. The specific actions that have been taken to ensure adoption;
- b. Any observed results from adoption;
- c. Plans for adoption or for further adoption in new or existing production areas;
- d. Lessons learned.

1. Irrigated crops (rice) : Tropics - (i) Integrated Land Use Planning: a) Development and implementation of land use planning policy b) Increased production of rice c) Expansion of area under rice production d) Proper land use planning led to mechanization, and therefore, increased productivity

(ii) Integrated Water Resource Management: a) Establishment of Water Act 2002 that established Water Resources management Authority (WRMA) and Water Resources Users Association (WRUA) b) Controlled abstraction and water use, improved management of the catchment areas c) Expansion and privatisation of rice schemes d) There is need for sustained water supply

2. Naturally regenerated/ Planted forests: - (i) Convention on Biological Diversity, Integrated natural resource management, Nagoya Protocol on Access and Benefit Sharing related to genetic resources, Sustainable management principles of forests: a) Development and implementation of Forest Act 2005 b) Improved forest management, reduced loss of forest land, increased benefits to communities c) Increased adoption of forest management and conservation programmes d) Improved awareness and attitude towards forest management and conservation. Increased resource allocation to the forest sector.

The State Department of Fisheries has set up guidelines for establishment of hatcheries countrywide to ensure constant fish seed production. The department has set in place mechanism to ensure that quality seeds are produced by the authenticated farms

Gaps and priorities

62. **With respect to the use of management practices or actions that favor or involve the use of biodiversity for food and agriculture:**

- a. **What are the major gaps in information and knowledge?**
- b. **What are the main capacity or resources limitations?**
- c. **What are the main policy and institutional constraints?**
- d. **What actions are required and what would be the priorities?**

a) What are the major gaps in information and knowledge?

Lack of guidelines and awareness for the appropriate management practices, e.g. research to generate information and knowledge for example plant species occurring in different ecological zones, linking biological processes with traditional knowledge to boost conservation, lack of information on the amount of products and services derived from the use of biodiversity by the various local communities.

b) What are the main capacity or resources limitations?

Limited number of trained and qualified technical personnel, and limited financial resources for implementation.

c) What are the main policy and institutional constraints?

Lack of policy environment for guidance and designated institutional frameworks for sustained management practices

d) What actions are required and what would be the priorities?

Validation and packaging of appropriate management practices. Establishment of institutional frameworks to guide implementation would be desirable.

e) Before the establishment of the ESP in the country, fish farming knowledge was scanty. Fish seed and feeds were not available. However, these problems have been overcome. Fish seed is available locally from authenticated hatcheries, fish feeds are available. A fish farmers association is in place to assist fish farmers to access funds to start fish farms, access markets. There has been tremendous knowledge transfer through farmer training. The institutions of higher learning are also involved in capacity building as well as established research centers for hands on training for the entire process of fish farming. An aquaculture policy is in place.

63. **With respect to the sustainable use of biodiversity for food and agriculture:**

- a. **What are the major gaps in information and knowledge?**
- b. **What are the main capacity or resources limitations?**
- c. **What are the main policy and institutional constraints?**
- d. **What actions are required and what would be the priorities?**

a) What are the major gaps in information and knowledge?

Lack of guidelines and limited awareness on information and policies for sustainable use of biodiversity. Lack of information on resource availability and distribution nationally, lack of data sharing among various institutions

b) What are the main capacity or resources limitations?

Limited number of trained and qualified technical personnel, and limited financial resources for implementation

c) What are the main policy and institutional constraints?

Lack of policy environment for guidance and designated institutional frameworks for sustained use of biodiversity

d) What actions are required and what would be the priorities?

Establishment and financing of institutional frameworks to guide implementation would be desirable.

64. **With respect to the contribution of biodiversity for food and agriculture to improving productivity, food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification:**

- a. **What are the major gaps in information and knowledge?**
- b. **What are the main capacity or resources limitations?**
- c. **What are the main policy and institutional constraints?**
- d. **What actions are required and what would be the priorities?**

a) What are the major gaps in information and knowledge?

Limited awareness of traits preferred by the Kenyan consumers or breeders for species being conserved.

b) What are the main capacity or resources limitations?

Limited number of trained and qualified technical personnel, and limited financial resources for implementation

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c) What are the main policy and institutional constraints?

Limited policy environment and institutional frameworks for guidance

d) What actions are required and what would be the priorities?

Establishment and financing of institutional frameworks would be desirable.

65. **With respect to the adoption of ecosystem approaches:**

- a. **What are the major gaps in information and knowledge?**
- b. **What are the main capacity or resources limitations?**
- c. **What are the main policy and institutional constraints?**
- d. **What actions are required and what would be the priorities?**

a) What are the major gaps in information and knowledge?

Lack of guidelines and limited awareness of the functioning of the different components of biodiversity within a specific ecosystem

b) What are the main capacity or resources limitations?

Limited number of trained and qualified technical personnel, and limited financial resources for implementation and adoption

c) What are the main policy and institutional constraints?

Lack of policy environment for guidance and designated institutional frameworks for sustained adoption

d) What actions are required and what would be the priorities?

Establishment and financing of institutional frameworks to guide adoption would be desirable.

CHAPTER 5: The state of interventions on conservation and use of biodiversity for food and agriculture

Proposed structure of the chapter and information to be included in the Country Reports

The main objective of this chapter is to provide an assessment and analysis of national and local interventions and activities, along with the state of international collaboration, that support conservation and sustainable use of biodiversity for food and agriculture. The analysis of interventions specific to plant, animal, forest and aquatic genetic resources will be based on the information provided in the respective State of the World Reports.

Information on the following topics should be covered in the Country Report:

- National policies, programmes and enabling frameworks that support or influence conservation and sustainable use of biodiversity for food and agriculture and the provision of ecosystem services;
- Policies, programmes and enabling frameworks governing exchange, access and benefits;
- Information management;
- Local and informal-sector actors and initiatives;
- Availability of capacity and resources;
- Participation in international and regional policies, legal frameworks and collaboration with other countries;
- Knowledge generation and science for the management and sustainable use of biodiversity for food and agriculture.

National policies, programmes and enabling frameworks that support or influence conservation and sustainable use of biodiversity for food and agriculture and the provision of ecosystem services

66. **Identify and describe the main policies, programmes and enabling frameworks that support or specifically address the objectives below, briefly describing the policies, programmes or enabling frameworks listed and provide any available information on the extent of implementation or of lessons learned. For each objective, list up to 10 major policies, programmes and enabling frameworks.**
- Support the integrated conservation and sustainable use of biodiversity for food and agriculture across sectors;**
 - Support the conservation and sustainable use of associated biodiversity;**
 - Address food security and nutrition with explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods;**
 - Address the maintenance of ecosystem services with explicit reference to biodiversity for food and, associated biodiversity and/or wild foods;**
 - Improve resilience and sustainability of production systems with explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods;**
 - Support farmers, pastoralists, forest dwellers and fisher folk to adopt and maintain practices that strengthen the conservation and use of biodiversity for food and agriculture.**

- a) 1. Agricultural Sector Development Strategy is the overall national policy document for the sector ministries and all stakeholders in Kenya. The document outlines the characteristics, challenges, opportunities, vision, mission, strategic thrusts and the various interventions that the ministries will undertake to propel the agricultural sector to the future.
2. National Livestock Policy 2008
3. Environmental Management and Coordination Act, 1999 that provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto.
4. The National Policy on traditional knowledge, genetic resources and traditional, cultural expressions aims to enhance the preservation, protection, and promotion of sustainable use of traditional knowledge, genetic resources and traditional cultural expressions in Kenya.
5. Science and Technology Act
6. The Constitution 2010 require the country to attain 10% forest cover. It also specifically mentions the conservation of biodiversity.
7. The Vision 2030 which is the country's development blueprint for the period 2008-2030 also has provisions for increase of forest cover as one of the main targets for environment goals. It singles out the "Water Towers" as flagship projects for their water catchment role.
8. Seeds and Plant Varieties Act (Cap 326), 2013
- b) 1. Environmental Management and Coordination Act 1999

2. The national policy on traditional knowledge, genetic resources and traditional, cultural expressions aims to enhance the preservation, protection, and promotion of sustainable use of traditional knowledge, genetic resources and traditional cultural expressions in Kenya.
3. Wildlife Conservation and Management Act, 2013
4. National Heritage and Monument Act, 2006
5. The Forests Act 2005 and the Strategic Plan for KFS 2009-2014 requires that the forests are managed sustainable for provision of ecosystem goods and services. It reserves all indigenous forests for water catchment and biodiversity conservation.
6. Kenya Agricultural and Livestock Act, 2013
- c) 1. National livestock policy
2. The national policy on traditional knowledge, genetic resources and traditional, cultural expressions
3. National dairy development policy that provide for the improvement and control of the dairy industry and its products.
- 4 Revised Kenya National Biodiversity Strategy and Action Plan (2010)
- 5 Integrated Coastal Zone Management Policy (2010)
- 6 Environment Management and Coordination Act (1999)
- 7 National Water Policy (1999)
- 8 Water Act (2002)
- 9 Forest Act (2005)
- 10 Fisheries Policy (2008)
- 11 Heritage Sites (2006)
- 12 National Land Policy (2009)
- 13 Energy Act (2006)
- 14 Biodiversity regulation (2006)
- d) 1.The Agriculture, Fisheries and Food Authority Act that provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture, Fisheries and Food Authority, to make provision for the respective roles of the national and county governments in agriculture excluding livestock and related matters in furtherance of the relevant provisions of the Fourth Schedule to the Constitution and for connected purposes. The authority has been established.
- 2.National Biosafety Act, 2009
3. Environmental management and coordination act
4. Kenya agriculture and livestock research act
- e) 1. The Agriculture, Fisheries and Food Authority Act that provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture, Fisheries and Food Authority, to make provision for the respective roles of the national and county governments in agriculture excluding livestock and related matters in furtherance of the relevant provisions of the Fourth Schedule to the Constitution and for connected purposes. The authority has been established.
2. National livestock policy
3. Biosafety act
4. Agricultural sector development strategy
- f) 1. The Agriculture, Fisheries and Food Authority Act that provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture, Fisheries and Food Authority, to make provision for the respective roles of the national and county governments in agriculture excluding livestock and related matters in furtherance of the relevant provisions of the Fourth Schedule to the Constitution and for connected purposes. The authority has been established.
2. National livestock policy
3. The national policy on traditional knowledge, genetic resources and traditional, cultural expressions
4. National poultry policy
5. National dairy development policy

67. **List up to 10 major policies, programmes and enabling frameworks in your country that enhance the application of an ecosystem approach or a landscape approach and that contain an explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods. Include a brief description of the policies, programmes and enabling frameworks together with any information on the extent of their application (production system and area) and observed effect. Where possible provide examples of best practices or lessons learned.**

1. Livestock policy
2. The Agriculture, Fisheries and Food Authority Act that provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture, Fisheries and Food Authority, to make provision for the respective roles of the national and county governments in agriculture excluding livestock and related matters in furtherance of the relevant provisions of the Fourth Schedule to the Constitution and for connected purposes. The authority has been established.
3. The national policy on traditional knowledge, genetic resources and traditional, cultural expressions, 2008

4. National Biosafety Act, 2009
5. Environmental Management and Coordination Act
6. Kenya Agriculture and Livestock Research Act
8. Forest Act, 2005
9. Water Act, 2002

Briefly describe policies, programmes and enabling frameworks that meet the objectives described in questions 68 and 69. Consider the following discussion points in your responses, where information is available:

- a. extent of implementation;
- b. production systems involved;
- c. the extent of use of biodiversity for agriculture;
- d. lessons learned;
- e. evidence of indicators of vulnerability that have decreased as a result of these efforts;
- f. describe the value added of mainstreaming gender in programmes, policies and enabling frameworks, providing sex-disaggregated data where possible.

68. Describe up to 10 major policies, programmes and enabling frameworks in your country that embed the use of biodiversity for food and agriculture, including its different components, into disaster management and response.

1. Seeds and Plant Varieties Act, 2013
2. Kenya Agricultural and Livestock Act, 2013
3. Forest Act, 2005

69. Describe up to 10 major policies, programmes and enabling frameworks in your country that embed the use of biodiversity for food and agriculture, including its different components, into climate change adaptation and mitigation strategies and plans (NAPAs, NAPs, NAMAs, etc.).

1. Environmental Management and Coordination Act, 1999
2. The National Climate Change Adaptation Strategy is one of the enabling frameworks prepared under the facilitation of the Climate Change Secretariat. An action plan is also in place.
3. Seeds and Plant Varieties Act, 2013
4. Kenya Agricultural and Livestock Act, 2013
5. Forest Act, 2005

70. **What arrangements are in place or foreseen in your country that help to ensure that the conservation of biodiversity for food and agriculture is taken into account in national planning and policy development of sectors other than agriculture (e.g. NBSAPs or infrastructure development such as transport or energy)?**

The country is in the process of preparing the NBSAP after the expiry of the previous one. In addition, the Environment Management and Coordination Act 1999, requires the undertaking of SEA (Strategic Environment Assessment) and the EIA (and also Environmental Audits) for all projects. The SEA is a requirement for large scale projects such as roads, harbours, airports, mineral exploration among others. The national environmental management authority supervises and coordinates all environmental matters within the country and is the principal instrument of government in the implementation of all policies relating to the environment. It ensures environmental assessment and mitigation measures in any infrastructure development.

71. **Has your country identified any obstacles to developing and implementing legislation that would protect associated biodiversity? List and describe initiatives in Table 25.**

Table 25. Obstacles to developing and implementing legislation that would protect associated biodiversity identified in the country.

Component of associated biodiversity	Obstacles to legislation for protection of associated biodiversity
--------------------------------------	--

Component of associated biodiversity	Obstacles to legislation for protection of associated biodiversity
Flora and fauna	Conflicts and overlaps in legislations and mandates among various institutions Lack of awareness and failure to enforce legislations
Add row	
Delete row	

Provide a concise description of the obstacles to legislation reported in Table 25, and specify a course of action proposed to address this, where possible. Where possible provide examples of best practices or lessons learned.

(i) Conflicts and overlaps in legislations and mandates among various institutions - Review and harmonise the existing legislations.
(ii) Lack of awareness and failure to enforce legislations - Creation of awareness among different stakeholders and enforcement of existing legislations.

Policies, programmes and enabling frameworks governing exchange, access and benefits

72. **Has your country taken measures with the aim of ensuring that access to its genetic resources shall be subject to its prior informed consent (PIC) and that benefits arising from their utilization shall be shared in a fair and equitable manner? If yes, identify for which resources and for which uses (e.g. to conduct research and development on the genetic and/ or biochemical composition of the genetic resource) prior informed consent has to be obtained and benefits have to be shared. Indicate in Table 26 for the different categories (and possibly uses) of associated biodiversity, if prior informed consent has to be obtained and benefits have to be shared.**

Table 26. Policies and programmes governing the access to its genetic resources of associated biodiversity established in the country.

Component of associated biodiversity	Intended use (e.g. any use, research and development, commercial use)	PIC and benefit-sharing required (Y/N)
Micro-organisms	Research and development	Y
Invertebrates	Research and development, commercial use	Y
Vertebrates	Research and development, commercial use	Y
Terrestrial and aquatic plants	Research and development, commercial use	Y
indigenous/local knowledge	Research and commercial use	Y
Add row		
Delete row		

73. **Has your country taken measures with the aim of ensuring that the prior informed consent or approval and involvement of indigenous and local communities is obtained for access to genetic resources and that benefits arising from the utilization of genetic resources that are held by indigenous and local communities, are shared in a fair and equitable way with the communities concerned, based on mutually agreed terms? If yes, provide a description of the measures and where possible, examples of best practices or lessons learned.**

Yes, some communities have developed biocultural protocols which aim at ensuring that prior informed consent or approval and involvement of indigenous and local communities is obtained for access to genetic resources and that benefits arising from the utilization of genetic resources that are held by indigenous and local communities, are shared in a fair and equitable way with the communities concerned, based on mutually agreed terms.
Kenya ratified the Nagoya Protocol in May 2014. In addition, Legal Notice No. 160 requires that a PIC must be obtained before access to the genetic resources including local knowledge is accessed. The provisions of this legal notice are enforced by all the resource managers in this country (KFS, KWS, NMK). The benefits have been in various forms such as technology transfer

and also monetary. However, there are many challenges especially where the genetic resources of interest occur in an area where there is no clear government agency in control. Furthermore, a good number of institutions or people who interested in accessing these genetic resources do not wish to follow the law or find the process of obtaining the required permits and licences tedious and cumbersome because there are several agencies involved each with different requirements. It is also difficult in signing a PIC in some circumstances because some communities do not have clear structures and therefore a PIC signed with one group could easily be disputed.

Information management

74. List and describe any linkages between sector information systems on biodiversity for food and agriculture at national level. Where possible provide examples of best practices or lessons learned.

1. Botanical research and herbarium management systems
2. Domestic Animal Genetic Resource Information System (DAGR)
3. Domestic Animal Diversity Information System (DAD-IS)

75. **Has your country established national information systems on associated biodiversity? List in Table 27, along with a description of the components of associated biodiversity addressed, and a brief description of information included, use and applications of the information system.**

Table 27. National information systems on associated biodiversity in the Country.

National information system (List)	Components of associated biodiversity addressed (List)	Concise description of information systems
Botanical Research and Herbarium Management System (BRAHMS)	Plants including bryophytes	Specimen based that provides information about plants of Kenya and East Africa in general i.e. species name, collector, and dates of collection. Use opportunities include data synthesis including production of distribution maps, species uses (e.g. food, medicine, etc.) indicated
Access	Fungi (mushrooms, michorhizae)	As above
File Maker Pro	Cultural heritage and some invertebrate/vertebrae data	Creates custom databases, publishing data online, producing reports and data sharing (i.e. Relational Database Management System used to store, update and retrieve data).
SPECIFY software	Some invertebrate/vertebrae data	Tailor made for protocols, standards and tools created by international initiatives as well as need to capture and share biodiversity data among local area and remote places. Basically developed to capture, validate, process, store, consult and transfer biodiversity information
CDS/ISIS	Libraries	Non-numerical datasets

Add row

Delete row

76. Has your country established information systems intended to support maintenance of traditional knowledge on biodiversity for food and agriculture, including associated biodiversity? If yes, describe these and include information where available on socio-economic, policy and collective action aspects.

- Survey of Economic Plants for Arid and Semi-Arid Lands (SEPASAL) database based at Kenya Resource Centre for Indigenous Knowledge (KENRIK) at the NMK on useful wild and semi-domesticated plants of tropical and subtropical dry lands (including Kenya). Basically these are species used as food, forage, make building materials, among others.
1. References given: Overholt, W. A., Ngi-Song, A. J., Kimani, S. K., Mbapila, J., Lammers, J. P. & Kioko, E. 1994. Ecological considerations of the introduction of *Cotesia flavipes* Cameron (Hymenoptera: Braconidae) for biological control of *Chilo partellus* (Swinhoe) (Lepidoptera: Pyralidae) in Africa. *Biocontrol News and Information* 15: 19-24.
 2. Kioko, E. N., Overholt, W. A. and Mueke, J. M., 1995. Taxonomic significance of isoenzymes in two stem borers of maize and sorghum in Kenya. (Lepidoptera: Pyralidae). *African Entomology*, 3 (2): 167 - 171.
 3. Raina, S. K.; Kioko, E.; Zethner, O. and S. Wren (2011). Forest habitat conservation in Africa using commercially important insects. *Annual Review of Entomology*, 2011, Volume 56, 465 - 485.
 4. Raina, S. K; Kioko, E. N.; Gordon, I. and C. Nyandiga (2009). Improving forest conservation and community livelihoods

through income generation from commercial insects in three Kenyan forests. A book published by icipe Science press. ISBN 92 9064 2084. 87 pp.

Stakeholder participation and ongoing activities that support maintenance of biodiversity for food and agriculture

77. List the most important stakeholder groups, including groups or associations of farmers, forest dwellers, fisher folk and pastoralists, NGOs or other civil society organizations active in the conservation of biodiversity for food and agriculture. Briefly summarize their scope, objectives and activities and any outcomes to date. Where possible provide examples of best practices or lessons learned.

The Samburu local livestock keepers supported by an NGO, LIFE network, seeks to establish the significance of the Samburu community traditional way of life, the value of their indigenous livestock breeds and terms of access and of their genetic resources and traditional knowledge. This has eventually led to development and utilization of biocultural protocol for Red Maasai Sheep.

78. Describe any incentives or benefits to support activities for the conservation and sustainable use of biodiversity for food and agriculture or associated biodiversity (such as payments, provision of inputs, subsidies or other forms of incentives/ benefits). Briefly describe how these have been applied, to what extent and the stakeholders involved (including provisions on gender balance if any). Indicate any lessons learned and planned development incentives.

- (i) Establishment of livestock breeders show and trade
- (ii) Alternative sources of livelihoods based on nature
- (iii) Forest Act provides for private land gazetement, and therefore, able to access technical service and refunds of a portion of the management costs. Honourary appointment as a forester

79. List up to 10 major projects (either in progress or completed in the last five years) that support the conservation and sustainable use of biodiversity for food and agriculture, associated biodiversity and/or wild foods. For each project listed describe the components of biodiversity, the production system and area covered, and the results, outcomes and lessons learned. Projects described in sector reports need not be described here.

- (i) Useful plants project (UPP)

80. List in Table 28 up to 10 major landscape based initiatives to protect or recognize areas of land and water in your country of particular significance for biodiversity for food and agriculture.

Table 28. Landscape based initiatives to protect or recognize areas of land and water in the country with particular significance for biodiversity for food and agriculture.

Landscape based initiatives	Description of sites and their characteristics of relevance to biodiversity for food and agriculture	Extent (area)
Water tower agency	Conservation of the five major water catchment areas in Kenya	
Mt. Kenya pilot project	Mapping water and biodiversity resources in Mt. Kenya	
Tana and Athi River Development Authority	Protection and conservation of natural resources	
Ewaso Nyiro Development Authority	Protection and conservation of natural resources	
Lake Basin Development Authority	Protection and conservation of natural resources	
Kerio Valley Development Authority	Protection and conservation of natural resources	
Add row		
Delete row		

Collaboration between institutions and organizations

81. Describe existing linkages and collaboration between sectors in national programmes and policies governing

conservation and sustainable use of biodiversity for food and agriculture. These may include overall strategies and plans developed by your country, committees or other national bodies which oversee or support collaboration, shared actions, facilities or resources and specific activities which involve inter-sector collaboration.

- (i) Agricultural Sector Development Strategy
(ii) National Forestry Programme

82. How are ministries working together to meet Aichi Targets as they may apply to the conservation and sustainable use of biodiversity for food and agriculture in your country?

- (i) Establishment of a Secretariat to coordinate the Kenya's Vision 2030 programme across all government ministries

83. What future actions have been planned to support your country's efforts in addressing Aichi Targets as they may apply to the conservation and sustainable use of biodiversity for food and agriculture in your country?

Review, Enactment and implementation of relevant legislations

84. Is your country involved in the implementation of regional and/or international initiatives targeting the conservation and sustainable use of associated biodiversity? List initiatives in Table 29.

Table 29. Regional and/or international initiatives targeting the conservation and sustainable use of associated biodiversity.

Initiatives	Scope (R: regional, I: international)	Description	References
East African Plant Genetic Resources Network	R	Capacity building on conservation of plant genetic resources	
IGAD biodiversity management program	R	Conservation of transboundary genetic resources	
Add row			
Delete row			

Capacity development

85. What training and extension programmes, or elements of programmes, at all levels, exist that target the conservation and sustainable use of associated biodiversity?

- (i) Farmer Field Schools
(ii) Farmer Group Extension Program
(iii) Community based organizations

86. What higher education programmes exist that target the conservation and sustainable use of associated biodiversity genetic resources? List in Table 30 the institutions, as well as the programmes and enrolment, disaggregated by sex, if possible.

Table 30. Higher education programmes specifically targeting the conservation and sustainable use of associated biodiversity genetic resources in the country.

Institution	Programme	Level	Enrolment (total)	Enrolment (male)	Enrolment (female)
University of Nairobi	Zoology, entomology, botany and Conservation Biology	BSc, MSc, PhD			

Institution	Programme	Level	Enrolment (total)	Enrolment (male)	Enrolment (female)
Egerton University	Zoology, entomology, botany and Conservation Biology	BSc, MSc, PhD			
Kenyatta University	Zoology, entomology, and botany	BSc, MSc, PhD			
Jomo Kenyatta University of Agriculture and Technology	Zoology, entomology, and botany	BSc, MSc, PhD			
University of Eldoret	Forestry, Wildlife management and Agroforestry, Seed Science and Technology	BSc, MSc, PhD			
Kenya Forestry College	Forestry	Diploma			
Add row					
Delete row					

87. List up to 10 major institutions within your country directly involved in research on the conservation and sustainable use of associated biodiversity. Provide a concise description of the institutions, of their key research programmes and, where possible, provide the number of active researchers.

1. Institute of primate research
2. National museums of Kenya
3. Kenya Forestry Research Institute
4. Kenya Marine Fisheries Research Institute
5. Kenya Agricultural and Livestock Research Organization
6. Kenya Wildlife Service

Knowledge generation and science for the management and sustainable use of biodiversity for food and agriculture

88. With respect to information management, national policies, programmes and enabling frameworks that support or influence the conservation and sustainable use of biodiversity for food and agriculture and the provision of ecosystem services, and govern exchange, access and benefits:

- a. What are the major gaps in information and knowledge?
- b. What are the main capacity or resources limitations?
- c. What are the main policy and institutional constraints?
- d. What actions are required and what would be the priorities?

- a) What are the major gaps in information and knowledge?
1. Lack of mapping and monitoring of the biodiversity / natural heritage resources. Only a few species are mapped and populations monitoring.
 2. Digitization of biodiversity and natural heritage information data incomplete.
 3. Lack of data exchange policy and mechanisms. Also, virtual portal on the available information at very preliminary level.
 4. Lack of awareness on the importance and mechanism in implementation of Access and Benefit Sharing policy on genetic resources.
 5. Evaluation of ecosystem services due to lack of capacity especially in taxonomy and resource evaluation.
- b) What are the main capacity or resources limitations?
1. Lack of funding for digitization, mapping and monitoring of the biodiversity / natural heritage resources.
 2. Limited taxonomic and resource capacity development including ecosystem services
 3. High national poverty status making it difficult to implement conservation mechanisms at community level.
- c) What are the main policy and institutional constraints?
- Overlapping mandates of the research institutions making implementation of the policy and conservation research difficult.
- d) What actions are required and what would be the priorities?

1. Review of institutional mandates.
2. Enhanced awareness creation on the importance of the policy guidelines on conservation and sustainable use of biodiversity resources.
3. Prioritize digitization, mapping and monitoring of biodiversity resources
4. Increased capacity development on biodiversity research particularly systematics, conservation, ecosystem service valuation and agronomy.
5. Enhanced environmental protection and offer alternative livelihoods for the local communities in compensation of indigenous knowledge as well as direct conservation of the natural resources.

89. With respect to stakeholder participation and ongoing activities that support maintenance of biodiversity for food and agriculture and collaboration between institutions and organizations:

- a. What are the major gaps in information and knowledge?
- b. What are the main capacity or resources limitations?
- c. What are the main policy and institutional constraints?
- d. What actions are required and what would be the priorities?

- a) Awareness of existing legislations and policies on biodiversity is limited among the stakeholders; also there are no known programs to sensitize the stakeholders.
- b) Resources and facilities for training stakeholders are limited.
- c) Development and implementations of the legal frameworks. Also overlaps of institutional mandates which the policies have created.
- d) Gazettement and implementation of the draft regulations developed.

90. With respect to capacity development:

- a. What are the major gaps in information and knowledge?
- b. What are the main capacity or resources limitations?
- c. What are the main policy and institutional constraints?
- d. What actions are required and what would be the priorities?

91. With respect to knowledge generation and science for the management and sustainable use of biodiversity for food and agriculture:

- a. What are the major gaps in information and knowledge?
- b. What are the main capacity or resources limitations?
- c. What are the main policy and institutional constraints?
- d. What actions are required and what would be the priorities?

- a) What are the major gaps in information and knowledge?
 - Lack of information and knowledge on how traditional knowledge has been employed by various communities to produce products and services from biological resources for improved livelihoods and what incentives may be needed to advance and to link their value chain with biological processes.
 - Lack of information and knowledge on baseline survey on breeds, species, varieties or micro-organisms preserved in-situ and their distribution in different ecosystems.
 - Lack of information and knowledge on the characteristics and traits of various breeds, varieties or micro-organisms that may be preferred by users (farmers, breeders, sellers or consumers) in order to enhance utilization of germplasm conserved ex-situ.
 - Lack of information and knowledge on the structure of genetic diversity and variations in adaptation as relates to yields and yield components of landraces.
- b) What are the main capacity or resources limitations?
 - Inadequate financial resources
 - Inadequate technical staff trained in relevant disciplines such as Molecular biology, GIS, Bioinformatics, Research Methods, Taxonomy and Public Policy and Administration.
 - Horizontal movement of staff with skills in relevant disciplines
- c) What are the main policy and institutional constraints?
 - Government policy to freeze recruitment of civil servants in order to minimize the wage bill.
 - Conflicting and overlapping institutional mandates.
 - Inadequate infrastructure such as office space, laboratories, equipment, cold rooms and staff housing.
- d) What actions are required and what would be the priorities?

Training the priority may be given to training on molecular characterization and resource mapping.

Reviewing and harmonizing institutional policies and mandates, the priority being policies governing conservation and access to plant genetic resources conserved both in-situ and ex-situ

Provision of infrastructure to the newly created Genetic Resources Research Institute under the Kenya Agricultural and Livestock Research Organization, the priority being building of infrastructural capacity to conserve animal, plant, aquatic and microbial genetic resources.

CHAPTER 6: Future agendas for conservation and sustainable use of biodiversity for food and agriculture

Proposed structure of the chapter and information to be included in the Country Reports

This chapter provides an opportunity to describe plans and priorities to secure and improve the conservation and sustainable use of biodiversity for food and agriculture. Particular attention should be given to future opportunities to enhance the contribution of biodiversity for food and agriculture to food security and nutrition, as well as the elimination of rural poverty. Planned actions and initiatives should be listed that intend to support the following:

- Strengthening the contribution of biodiversity for food and agriculture to secure the multiple benefits of agriculture, including food security and nutrition, rural development, sustainable intensification, and the enhanced sustainability and resilience of production systems;
- Improving recognition and involvement of farmers, pastoralists, fishers and forest dwellers, addressing gender equality, and supporting the roles and contributions of women;
- Contributing to the UN Strategic Plan for Biodiversity and to achieving the Aichi Targets and linking to other related processes undertaken through the Convention on Biological Diversity.

Additionally, Chapter 6 allows an assessment of future needs with respect to policies and legal arrangements, economic frameworks, knowledge creation, capacity development and collaboration.

This part of the Country Report should build on the results presented in earlier Chapters and provide an integrated overview with, where possible, clear priorities for national, regional or global actions. This chapter is structured to benefit countries through an overall synthesis of information provided elsewhere in the report. Countries that previously presented or are currently preparing a Country Report on Forest, Aquatic, Animal or Plant Genetic Resources, may wish to take full advantage of their different sectoral reports to identify an overall perspective.

Enhancing the contribution of biodiversity for food and agriculture

This section provides an opportunity for countries to highlight their plans and priorities, and to describe current constraints to achieving them on enhancing the contribution of biodiversity for food and agriculture to human wellbeing, environmental health and sustainable production. Include any information that might be useful in informing future policies to help strengthen the contribution of biodiversity for food and agriculture to the broader sustainability and development objectives listed below.

92. Describe planned actions and future priorities to improve the conservation and sustainable use of biodiversity for food and agriculture with specific reference to enhancing its contribution to:

- a. improving food security and nutrition;
- b. improving rural livelihoods;
- c. improving productivity;
- d. supporting ecosystem function and the provision of ecosystem services;
- e. improving the sustainability and resilience of production systems;
- f. supporting sustainable intensification.

Refer to the future needs and priorities identified in previous Chapters. The different topics may be dealt with jointly or individually as appropriate to country plans and approaches. Replies should include country perspectives on:

- Ways and means of improving the capacity and operations of the institutions within your country concerned with or affected by the maintenance and use of biodiversity for food and agriculture and particularly of associated biodiversity, including universities, government programmes, NGOs, breeders, private sector entities, organizations and social movements of small-scale producers. Actions to improve collaboration

between stakeholders should be included.

- **Ways and means of supporting the development of new policies or the implementation of the current policies that support the integrated conservation and sustainable use of biodiversity for food and agriculture, and that also specifically target associated biodiversity.**
- **The major information and knowledge gaps that remain to be addressed and options that exist to address them.**

Countries should indicate the ways in which planned actions will contribute to the UN Strategic Plan for Biodiversity and to achieving the Aichi Targets In particular Targets 6, 7, 13. as well as to how they link to other related processes undertaken through the Convention on Biological Diversity.

Ways and means of improving the capacity and operations of the institutions in Kenya include improving infrastructure, human capacity, review and harmonization of policies for major institutions involved in in-situ and ex-situ conservation, establishing partnership (local, regional and international), enhancing data sharing mechanisms and mainstreaming of International Conventions and Treaties.

Ways and means of supporting the development of new policies or the implementation of the current policies include

1. Convening stakeholders meetings by the Ministry of Agriculture, Livestock and Fisheries to review the seed and plant varieties regulations,
2. Creation of the Genetic Resources Research Institute under the Kenya Agricultural and Livestock Research Organization
3. Ratification and domestication of the Nagoya protocol

The major information and knowledge gaps that remain to be addressed include

1. Inventories and resource mapping
2. Characterization to identify the structure of genetic diversity
3. Inadequate human resource with skills to implement international conventions and treaties by lead institutions
4. Inadequate information sharing mechanisms, networks and partnerships

Strengthening the conservation and management of associated biodiversity and wild foods

This section provides an opportunity for countries to highlight their plans and priorities, and to describe current constraints to achieving them on the conservation and management of associated biodiversity and of wild foods.

93. Describe planned actions and future priorities to support conservation and management of the components of associated biodiversity and wild foods including the development of monitoring programmes and of information systems or databases.

Replies should cover country perspectives on:

- **Ways and means of improving the capacity and operations of the institutions within your country concerned with or affected by the maintenance and use of biodiversity for food and agriculture and particularly of associated biodiversity, including universities, government programmes, NGOs, breeders, private sector entities, organizations and social movements of small-scale producers. Actions to improve collaboration between stakeholders should be included;**
- **Ways and means of supporting the development of new policies or the implementation of the current policies that support the integrated conservation and sustainable use of biodiversity for food and agriculture, and that also specifically target associated biodiversity;**
- **The major information and knowledge gaps that remain to be addressed and options that exist to address them.**

Ways and means of improving the capacity and operations of the institutions in Kenya include improving infrastructure, human capacity, review and harmonization of policies, establishing partnership (local, regional and international), enhancing data sharing mechanisms and mainstreaming of International Conventions and Treaties. In addition, there is need to increase financial resources to support efforts by lead agencies to work with other stakeholders.

Ways and means of supporting the development of new policies or the implementation of the current policies include

1. Convening stakeholders meetings by the Ministry of Agriculture, Livestock and Fisheries to review the seed and plant varieties regulations
2. Ratification and domestication of the Nagoya protocol

The major information and knowledge gaps that remain to be addressed include

1. Inventories and resource mapping

2. Characterization to identify the structure of genetic diversity
3. Inadequate human resource with skills to implement international conventions and treaties by lead institutions
4. Inadequate information sharing mechanisms, networks and partnerships

94. **Describe planned actions and future priorities with respect to implementing ecosystem approaches for the various components of biodiversity for food and agriculture.**

On-going review of the National Biodiversity Strategy and Action Plan

Improving stakeholder involvement and awareness

This section provides an opportunity for countries to highlight their plans and priorities, and to describe current constraints to achieving them with respect to stakeholder involvement in the conservation and sustainable use of biodiversity for food and agriculture with specific reference to the recognition and involvement of farmers, pastoralists, fishers and forest dwellers, addressing gender equality, and supporting the roles and contributions of women.

95. **Describe planned actions and future priorities to improve stakeholder awareness, involvement and collaboration in the conservation and sustainable use of biodiversity for food and agriculture. Include a description of the major challenges that will need to be overcome.**

1. The formation of a multidisciplinary National Advisory Committee on Animal Genetic Resources is one way that has brought several key stakeholders together. It is therefore planned to strengthen this advisory Committee to be able to reach more stakeholders and to carry out stakeholder education. This is envisaged to improve the stakeholder awareness, involvement and collaboration in the conservation and sustainable use of biodiversity for food and agriculture.
 2. Further identification of key stakeholders especially the farmers, pastoralists, fishers and forest dwellers, county government officials and policy makers involved in the management of animal genetic resources.
 3. To engage these stakeholders and share with them the importance of conservation and management of Animal Genetic Resources
 4. Involve farmers and pastoralists in activities like exhibitions and shows where they can exhibit their animal genetic resources and compete. This can be a very huge incentive to them and will provide an incentive to keep especially the indigenous animal genetic resources
- Challenges
Major challenges to be addressed include:
1. Market demand which is pushing for high productivity leading to neglect of indigenous animal genetic resources due to their low productivity
 2. Allocation of resources

96. **Describe planned actions and future priorities to support the role of farmers, pastoralists, fisher folk, forest dwellers, and other rural men and women dependent on local ecosystems in the conservation and use of biodiversity for food and agriculture. Replies should include information on recognizing and enhancing the role of indigenous peoples. Include a description of the major challenges that will need to be overcome.**

- (i). Development of National Strategy and Action Plan for animal genetics resources which provide for recognition/ award programmes for best performing livestock keepers/ producers.
 - (ii). Establishment of the 1.1 Million acres Galana/ Kulalu Ranch Irrigation Project. The aim is to optimize the productivity of the Ranch through targeted hi-tech investments on improvement of livestock and crop production, optimization of eco-tourism activities and integration of sustainable utilization of other natural resources.
 - (iii). The Agriculture, Rural and Urban Development Sector in its' Medium Term Expenditure Framework has ensured the building of fisher folk, farmers and pastoralist▲ capacities.
 - (iv). Assessment of land use and forest policy and governance in the forest sector in Kenya
 - (v). Development of the Kenya National Biodiversity Strategy and Action Plans to conserve and sustainably utilize our biological resources.
- Major Challenges
- (i). Influx of exotic genetic material which results in systematic replacement of the indigenous genetic resources.
 - (ii). Major disease epidemics and disasters of various kinds (droughts, floods, etc.) are also a concern particularly in the case of small, geographically concentrated breed populations.
 - (iii). Policies and legal frameworks influencing the livestock sector are not always favourable to the sustainable utilization of animal genetic resources.

97. **Describe planned actions and future priorities to improve recognition of the contribution of women to the**

conservation and use of the different components of biodiversity for food and agriculture, including associated biodiversity. Include a description of the major challenges that will need to be overcome.

- (i). Mainstreaming of Gender issues in agriculture has already been done by creating a Gender Mobilization Support Unit.
- (ii). Involvement of women in the development of biocultural protocols among the livestock keepers.

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ANNEX 1: Recommended scope of the Country Report

Biodiversity for food and agriculture

Biodiversity for food and agriculture includes the variety and variability of animals, plants and micro-organisms at the genetic, species and ecosystem levels that sustain the ecosystem structures, functions and processes in and around production systems, and that provide food and non-food agriculture products. Production systems, as defined for the purposes of this report, include the livestock, crop, fisheries and aquaculture and forest sectors. The diversity found in and around production systems has been managed or influenced by farmers, pastoralists, forest dwellers and fisherfolk over many hundreds of generations and reflects the diversity of both human activities and natural processes.

The present Guidelines for the SoWBFA mainly focus on those areas not covered by completed or on-going Country Reports on Animal, Forest, Plant and Aquatic Genetic Resources, e.g. the biological diversity associated with different supporting and regulating ecosystem services within production systems or of importance to them, referred to hereinafter as associated biodiversity, and wild resources used for food.

Associated biodiversity

For the scope of this report, associated biodiversity comprises those species of importance to ecosystem function, for example, through pollination, control of plant, animal and aquatic pests, soil formation and health, water provision and quality, etc., including *inter alia*:

- Micro-organisms (including bacteria, viruses and protists) and fungi in and around production systems of importance to use and production such as mycorrhizal fungi, soil microbes, planktonic microbes, and rumen microbes;
- Invertebrates, including insects, spiders, worms, and all other invertebrates that are of importance to crop, animal, fish and forest production in different ways, including as decomposers, pests, pollinators, and predators, in and around production systems;
- Vertebrates, including amphibians, reptiles, and wild (non-domesticated) birds and mammals, including wild relatives, of importance to crop, animal, fish and forest production as pests, predators, pollinators or in other ways, in and around production systems;
- Wild and cultivated terrestrial and aquatic plants other than crops and crop wild relatives, in and around production areas such as hedge plants, weeds, and species present in riparian corridors, rivers, lakes and coastal marine waters that contribute indirectly to production.

Note that domesticated species may also provide ecosystem services other than provisioning ones and affect crop, animal, fish and forest production in different ways. However since these species are already addressed in other State of the World Reports, countries may choose whether or not they want to include them in their Country Reports for the SoWBFA.

Integrated analysis of biodiversity for food and agriculture

The scope of the Report builds upon the contribution of individual sector reports by providing an integrative analysis of interactions, including synergies, interlinkages and trade-offs, between genetic resources of the different sectors. This is achieved through the identification of production systems within the country (Annex 2), and particular focus upon ecosystem perspectives in relation to biodiversity for food and agriculture. Questions addressing overall biodiversity for food and agriculture target information that would build upon what may be available in previous or ongoing country reports.

ANNEX 2: Production systems

Table 1. Climatic zones definitions

Climatic zone	Definition
Tropics	All months with monthly mean temperature, corrected to sea level, above 18°C.
Subtropics	One or more months with monthly mean temperatures, corrected to sea level, below 18°C but above 5 °C.
Temperate	At least one month with monthly mean temperatures, corrected to sea level, below 5 °C and four or more months above 10 °C.
Boreal	At least one month with monthly mean temperatures, corrected to sea level, below 5 °C and more than one but less than four months above 10 °C.

Table 2. Production systems descriptions

Name of production system	Climatic zone	Description
Livestock grassland-based systems	Tropics	Systems in which the animals obtain a large proportion of their forage intake by grazing natural or sown pastures, includes: <ul style="list-style-type: none"> Ranching: grassland-based systems in which livestock is kept on privately owned rangeland Pastoralist: grassland-based systems in which the livestock keepers move with their herds or flocks in an opportunistic way on communal land to find feed and water for their animals (either from or not from a fixed home base)
	Subtropics	
	Temperate	
	Boreal and /or highlands ¹	
Livestock landless systems	Tropics	Systems in which livestock production is separated from the land where the feed given to the animals is produced.

¹ High elevation montane environments where climate differs significantly from surrounding lower elevation areas, including alpine and sub-alpine zones, tropical highlands, dryland mountains, etc.

	Subtropics	
	Temperate	
	Boreal and /or highlands	
Naturally regenerated forests	Tropics	Includes: <ul style="list-style-type: none"> • Primary: Forests of native species, where there are no clearly visible indications of human activities and the ecological processes are not directly disturbed by humans • modified natural: Forests of naturally regenerated native species where there are clearly visible indications of significant human activities • semi-natural (assisted natural regeneration): Silvicultural practices in natural forest by intensive management (weeding, fertilizing, thinning, selective logging)
	Subtropics	
	Temperate	
	Boreal	
	Boreal and /or highlands	
Planted forests	Tropics	Includes : <ul style="list-style-type: none"> • semi-natural (planted component) : Forests of native species, established through planting or seeding, intensively managed • Plantations (productive) : Forests of introduced and/or native species established through planting or seeding mainly for production of wood or non-wood goods • Plantations (protective) : Forests of introduced and/or native species, established through planting or seeding mainly for provision of services
	Subtropics	
	Temperate	
	Boreal	
	Boreal and /or highlands	
Self-recruiting capture fisheries	Tropics	Includes capture fisheries in marine, coastal and inland areas that can involve <ul style="list-style-type: none"> • Natural ecosystems • Modified ecosystems e.g. reservoirs and rice paddies;
	Subtropics	
	Temperate	
	Boreal	
Culture-based fisheries	Tropics	Fisheries on resources, the recruitment of which originates or is supplemented from cultured stocks (i.e., populations chosen for culture and not stocks in the same sense as that term is used for capture fisheries) raising total production beyond the level sustainable through natural processes.
	Subtropics	
	Temperate	
	Boreal and /or highlands	
Fed aquaculture	Tropics	The farming of aquatic organisms including fish, mollusks, crustaceans, aquatic plants, crocodiles, alligators, turtles and amphibians. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc. Farming also implies individual or corporate ownership of the stock being cultivated; i.e., the population chosen for culture and not a stock in the same sense as that term is used for capture fisheries. Fed aquaculture production utilizes or has the potential to utilize aquafeeds of any type in contrast with the farming of filter-feeding invertebrates and aquatic plants that relies exclusively on natural productivity. Also defined as "farming of aquatic organisms utilizing aquafeeds in contrast to that deriving nutrition directly from nature".
	Subtropics	
	Temperate	
	Boreal and /or highlands	
Non-Fed aquaculture	Tropics	The farming of aquatic organisms including fish, mollusks, crustaceans, aquatic plants that do not need supplemental feeding. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc. Farming also implies individual or corporate ownership of the stock being cultivated; i.e., the population chosen for culture and not a stock in the same sense as that term is used for capture fisheries. In non-fed aquaculture systems culture is predominately dependent on the natural environment for food, e.g. aquatic plants and mollusks.
	Subtropics	
	Temperate	
	Boreal and /or highlands	
Irrigated crops (rice)	Tropics	Irrigated rice refers to areas where rice is cultivated purposely provided with water, including land irrigated by controlled flooding.
	Subtropics	
	Temperate	
	Boreal and /or highlands	
Irrigated crops (other)	Tropics	Irrigated crops other than rice refers to agricultural areas purposely provided with water, including land irrigated by controlled flooding.
	Subtropics	
	Temperate	
	Boreal and /or highlands	

Rainfed crops	Tropics	Agricultural practice relying exclusively on rainfall as its source of water.
	Subtropics	
	Temperate	
	Boreal and /or highlands	
Mixed production systems (livestock, crop, forest and /or aquatic and fisheries mixed)	Tropics	Production systems with multiple components. They include: <ul style="list-style-type: none"> • Crop-livestock: mixed systems in which livestock production is integrated with crop production. • Agro-pastoralist: livestock-oriented systems that involve some crop production in addition to keeping grazing livestock on rangelands; they may involve migration with the livestock away from the cropland for part of the year; in some areas, agropastoral systems emerged from pastoral systems • Agroforestry-livestock: mixed system in which livestock production is integrated with the production of trees and shrubs⁵⁰ • Integrated aquaculture: mixed systems in which aquaculture is integrated with crop and livestock production. May involve ponds on farms, flooded fields, enrichment of ponds with organic waste, etc. • Other combinations
	Subtropics	
	Temperate	
	Boreal and /or highlands	

ANNEX 3: Drivers of change

Table 1. Drivers of change and descriptions.

Drivers	Description, Subcategories and Examples
Changes in land and water use and management	A change in the use, management and practices around land and water (e.g., deforestation; fragmentation; modification of water regimes; forest degradation; land conversion for agriculture; ecosystem restoration; the role of women and men in land and water use and management, etc.)
Pollution and external inputs	The mismanaged, excessive or inappropriate use of external inputs (e.g., over application of fertilizer and pesticides; excessive use of antibiotics or hormones; nutrient loading, including from use of imported feed; ocean acidification, CO ₂ fertilization; chemical and particulate pollutants, etc.)
Over-exploitation and overharvesting	Unsustainable extraction practices (e.g., overfishing; overhunting; overgrazing; logging and extractive activities exceeding replacement rates or affecting species of uncertain and at-risk conservation status, etc.)
Climate change	The impacts and effects of progressive climate change (e.g., alterations in precipitation regimes; temperature changes; loss of water supply; increased variability; sea level rise; shifts in flowering time or seasonality, etc.)
Natural disasters	Climate shocks, extreme weather events and other natural disasters that threaten agricultural production and resilience of production systems (e.g., hurricanes, earthquakes, floods, fires).
Pests, diseases, alien invasive species	New and emerging threats from pests, diseases and invasive species affecting biodiversity for food and agriculture (e.g., shifting ranges; introductions; increased suitability; loss of predator, etc.)
Markets, trade and the private sector	<p>Trade- Changing terms of trade, globalization of markets, commercialization of products, retailing, the separate capacities of women and men to commercialize products, etc.</p> <p>Markets and consumption - Demand driven changes in production or practices including the tastes, values or ethics of consumers that may impact directly or indirectly biodiversity for food and agriculture, product quantity or quality</p> <p>Private sector - The changing role and influence of private sector and corporate interests</p>
Policies	<p>Policies - Global, regional, national, and subnational legislation and regulations (e.g., conservation regulations, participation and compliance with International treaties and conventions);</p> <p>Economic and policy interventions - Interventions that impact biodiversity for food and agriculture directly or indirectly (e.g., taxes, subsidies, charges for resource use, payments for ecosystem services)</p> <p>Intellectual Property Rights (IPR), Access and Benefit Sharing (ABS) - Direct or indirect impacts of IPR and ABS policy and regulations on biodiversity for food and agriculture.</p>
Population growth and urbanization	<p>Population - Changes in population metrics (e.g., growth, fertility, composition, mortality, migration, health and disease, including different affects on men and women.)</p> <p>Urbanization- (e.g., shifts in proportion of urban and rural; change in urbanization trends, including different effects on men and women)</p>
Changing economic, socio-political, and cultural factors	<p>Economic development - A change in economic circumstances of countries, industries, households (e.g., change in GDP and economic growth; structural change of economy; income diversification, and the different economic circumstances of men and women.)</p> <p>Changing socio-political, cultural or religious factors - Variation in the forces influencing decision-making of men and women, e.g., public participation, shifts in the influence of the state vs. private sector, changes in levels of education and knowledge, shifts in the beliefs, values and norms held by a group of people.</p> <p>Participatory actions – the role of collective action toward conservation and use of biodiversity by stakeholders</p>
Advancements and innovations in science and technology	The development and diffusion of scientific knowledge and technologies, (e.g., advances in breeding; improvements in mobile extension; tools for monitoring; biotechnology applications, access of men and women to information).

ANNEX 4: Ecosystem services

The SoWBFA Guidelines focus primarily on regulating and supporting ecosystem services, described below. Provisioning services relating to biodiversity for food and agriculture are the focus of sectoral State of the World Reports, and are addressed in these guidelines only in relation to associated biodiversity and wild foods, which often fall outside of traditional sectoral reporting. Countries may choose to address additional ecosystem services, including cultural services, for the completion of national reports, particularly where they are directly relevant to the objectives of the SoWBFA Report².

Table 1. Regulating and supporting ecosystem services.

Category	Ecosystem services	Description	Relevant ecosystem functions
Regulating services	Pollination	Role ecosystems play in transferring pollen from male to female flower parts	Agricultural productivity; production of food and goods.
	Pest and disease regulation	Influence ecosystems have on the prevalence of crop and livestock pests and diseases	Biological control; the maintenance and feedback mechanisms preventing outbreaks of pests and diseases, including invasive species.
	Water purification and waste treatment	Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes	Filtering function performed by vegetation cover, soil and aquatic biota.
	Natural hazard regulation	Capacity for ecosystems to ameliorate and reduce the damage caused by natural disasters	Vegetative structure can alter potentially catastrophic effects of storms, floods and droughts through its storage capacity and surface resistance; coral reefs buffer waves and protect adjacent coastlines from storm damage. The services provided by this function relate to providing safety of human life and human constructions.
Supporting services	Nutrient cycling	Flow of nutrients (e.g., nitrogen, sulfur, phosphorus, carbon) through ecosystems	Maintenance of fertility; regulation of excess nutrients; climate regulation; regulation of biotic communities
	Soil formation and protection	Degradation of ecosystems, such as decomposition of organisms or weathering of substrate, to form soil	Maintenance of crop productivity on cultivated lands and the integrity and functioning of natural ecosystems.
	Water cycling	Flow of water through ecosystems in its solid, liquid, or gaseous forms	Regulation of hydrological flows at the earth surface. Maintenance of natural irrigation and drainage, buffering of extremes in discharge of rivers, regulation of channel flow, and provision of a medium for transportation.
	Habitat provisioning	Role of ecosystems in creating and maintaining habitats for a wide variety of organisms	Providing diverse and suitable habitats for species; nursery function for migratory species and as breeding areas.
	Production of oxygen/ Gas regulation	The creation of atmospheric oxygen through photosynthesis	Gas regulation functions include the maintenance of clean, breathable air, and the prevention of diseases (e.g. skin cancer, asthma) May include regulation of the CO ₂ /O ₂ balance, maintaining ozone-layer (O ₃), and regulation of SO _x levels.

ANNEX 5: Management practices supporting the use and conservation of biodiversity for food and agriculture

Table 1. Management practices supporting the use and conservation of biodiversity for food and agriculture.

Management practices supporting the use and conservation of biodiversity for food and agriculture	Description/ examples of management practices
Integrated Plant Nutrient Management (IPNM)	Soil, nutrient, water, crop, and vegetation management practices undertaken with the aim of improving and sustaining soil fertility and land productivity and reducing environmental degradation, often tailored to a particular cropping and farming system. May include the use of farmyard manures, natural and mineral fertilizers, soil amendments, crop residues and farm wastes, agroforestry and tillage practices, green manures, cover crops, legumes, intercropping, crop rotations, fallows, irrigation, drainage, plus a variety of other agronomic, vegetative and structural measures designed to conserve both water and soil.
Integrated Pest Management (IPM)	Pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment by encouraging natural pest control mechanisms that include: crop rotation; inter-cropping; seedbed sanitation, sowing dates and densities, under-sowing, conservation tillage, pruning and direct sowing; where appropriate, use of pest resistant/tolerant cultivars, push-pull strategies and standard/certified seed and planting material; balanced soil fertility and water management, making optimum use of organic matter; prevent spreading of harmful organisms by field sanitation and hygiene measures; protection and enhancement of important beneficial organisms.
Pollination management	Practices that accomplish or enhance pollination of a crop, to improve yield or quality, by understanding of the particular crop's pollination needs, and by knowledgeable management of pollenizers, pollinators, and

² Including those described in the Millennium Ecosystem Assessment, or subsequent adaptations by the TEEB or other sources.

	pollination conditions. Pollinator-friendly practices include minimizing the use of agrochemicals, integrated pest management and mixed cropping to include pollinator friendly crops, preserving wild habitats, maintaining flower-rich field margins, buffer zones and permanent hedgerows to ensure habitat and forage, cultivating shade trees, managing for bee nest sites, and establishing landscape configurations that favor pollination services.
Landscape management	Practices that support the maintenance of biodiversity friendly farming systems, or the diversity of landscape mosaics within and surrounding production systems over particular geographic areas. Examples include riparian corridors, hedges, margins, woodland patches, clearings in forests, ponds or other biodiversity friendly features characteristic of the production environment that may be the result of national or regional policies such as the EU set aside schemes.
Sustainable soil management practices	Management of soil biodiversity to enhance agricultural production by both direct and indirect means, including alteration of the abundance or activity of specific groups of organisms through inoculation and/or direct manipulation of soil biota. Indirect interventions may include manipulation of the factors that control biotic activity (habitat structure, microclimate, nutrients and energy resources) rather than the organisms themselves such as the maintenance of soil cover with organic mulch including crop residues, green manure/cover crops including legumes, and compost to increase soil organic matter, irrigation and liming, as well as cropping system design and management.
Conservation agriculture	Conservation Agriculture (CA) aims to achieve sustainable and profitable agriculture and improve livelihoods of farmers through the application of the three CA principles: no or minimal soil disturbance through direct seeding into untilled soils, maintenance of permanent soil mulch cover, and crop diversification through rotations, associations and sequences.
Water management practices, water harvesting	Water harvesting and management through rain water retention or modification of the landscape (e.g., bunds, zais, terracing) for the restoration and improvement of degraded lands, and to allow cultivation of additional crops with higher water requirements, and improving water productivity of crops.
Agroforestry	Agroforestry is a collective name for land-use systems where woody perennials (trees, shrubs, palms, etc.) are integrated in the farming system.
Organic agriculture	Organic agriculture is a production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system.
Low external input agriculture	Production activity that uses synthetic fertilizers or pesticides below rates commonly recommended for intensive industrial tillage agriculture. It does not mean elimination of these materials. Yields are maintained through greater emphasis on agronomic practices, IPM, and utilization of on-farm resources (especially labor) and management.
Home gardens	An integrated system which comprises different components in a small area around the homestead, including staple crops, vegetables, fruits, medicinal plants, livestock and fish both for home consumption or use and for income. May include the family house, a living/playing area, a kitchen garden, a mixed garden, a fish pond, stores, an animal house, etc.
Areas designated by virtue of production features and approaches	These include areas recognized nationally or internationally by virtue of their landscape and agricultural features. In addition to Satoyama, GIAHS, national parks (IUCN categories), they also include areas recognized for specific agricultural products (e.g. DOP, IGP or Slow Food).
Ecosystem approach in capture fisheries	Approach promoting the diversity of the whole ecosystem in order to support the target species. Considerations include sustainable harvesting of the retained species (target and by-product species); managing the direct effects of fishing (especially on non-retained by-catch and habitat); and managing the indirect effects of the fishery on ecosystem structure and processes.
Conservation hatcheries	Hatcheries and production systems that optimize natural levels and organization of genetic diversity over production. Often for rebuilding depleted populations of commercially important species, (e.g. Atlantic and Pacific salmon).
Reduced-impact logging	A series of practices to improve logging practices such as vine removal, directional felling, limiting skid trails, logging roads and stumping grounds, restrictions on the size and number of trees felled, and post felling removal of waterway blockages, to reduce the residual damage, biodiversity loss and excess CO ₂ emissions associated with conventional logging practices.

ANNEX 6: Diversity based interventions

Table 1. Diversity based practices and interventions

Diversity based practices	Description/ examples of interventions
Diversification	The introduction of new varieties, species, and groups of organisms (e.g., livestock, crops, trees, fish) into a production system or managed environment without replacement or abandonment of other groups, or the maintenance of already-existing diversity in the case of traditionally diverse production systems. May include introductions for restoration or IPM objectives, including fish introduced to control reproduction.
Base broadening	Increasing the amount of genetic diversity used to produce new varieties or breeds used in agricultural production.
Domestication	The development of new crop, aquatic, forest and animal species through deliberate breeding programmes or the continued selection and improvement of existing species from their wild progenitors. These activities may be carried out by national breeding programmes or by farmers and communities themselves.
Maintenance or conservation of landscape complexity	Maintenance or management of components of a landscape mosaic including hedges, waterways, road margins, corridors, windbreaks, living fences, native grasses wild patches of vegetation in the farming landscape, etc.
Restoration practices	Restoring functionality and productive capacity to ecosystems, forests, landscapes, waterways, grasslands and rangelands in order to provide food, fuel, and fiber, improve livelihoods, store carbon, improve adaptive capacity, conserve biodiversity, prevent erosion and improve water provisioning and quality.

Management of micro-organisms	The intentional incorporation, management or maintenance of microbes, fungi and other micro-organisms into a production system or organisms; e.g., inoculation of plants and seeds with arbuscular mycorrhizal fungi, the addition of probiotics in aquaculture and livestock, etc.
Polyculture/Aquaponics	Integrated multi-trophic aquaculture, utilization of different trophic and spatial niches of an aquaculture system in order to obtain maximum fish production per unit area, utilizing natural resource availability.
Swidden and shifting cultivation agriculture	Rotation of plots from intensive cultivation to extended fallow periods for the replenishment of soil fertility.
Enriched forests	Selective logging and enrichment planting to increase the abundance of useful species for food, medicine and timber, often a feature of traditional management practices.