Food and Agriculture Organization of the United Nations

United Republic of Tanzania

TRAINING MANUAL ON FORESTS AND TREES FOR FOOD SECURITY AND NUTRITION

NINE MODULES

TRAINING MANUAL ON FORESTS AND TREES FOR FOOD SECURITY AND NUTRITION

NINE MODULES

Published by
the Food and Agriculture Organization of the United Nations
and
Ministry of Natural Resources and Tourism, The United Republic of Tanzania

Rome, 2020

Required citation:
FAO and Ministry of Natural Resources and Tourism, the United Republic of Tanzania. 2020. *Training manual on forests and trees for food security and nutrition*. Rome. https://doi.org/10.4060/ca7249en

ISBN 978-92-5-132028-0 [FAO]

Contents

Foreword

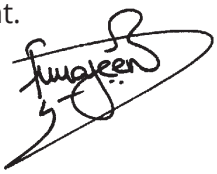
Zero Hunger was adopted as one of seventeen Sustainable Development Goals at the United Nations Sustainable Development Summit in September 2015, which set the multiple goals and targets of the 2030 Agenda for Sustainable Development. Recognizing the significance of forests and trees for the 2030 Agenda, particularly of their roles to eliminate hunger and malnutrition, at its 44th session (October 2017) the members of Committee on World Food Security endorsed the policy recommendations on "Sustainable Forestry for Food Security and Nutrition"[1]. The recommendations encourage countries to acknowledge the importance, raise awareness, and strengthen the role of forests and trees (i.e. forests, and trees outside the forests) within the four dimensions of food security and nutrition (i.e. food availability, access, utilization and stability). Further, it was recommended that countries develop and use policy-relevant knowledge and data on the direct and indirect contributions of forests and trees to food security and nutrition; and develop, implement and monitor policies that integrate agriculture and forest management for improved and sustainable food security and nutrition. In this context, FAO began providing support to country and regional capacity development by collaborating with different government agencies and academic institutions to develop and implement training programmes. The initiative started at country level in Tanzania as a pilot, with the aim to scale up to the regional and subregional levels in Africa.

This manual is one of the products from the initiatives and an output of the review of the draft report on *Forestry for Sustainable Food Security and Nutrition in Tanzania Mainland*, developed by FAO Tanzania in 2018. In line with the conceptual and structural framework of the manual and the overall technical guidance and coordination provided by FAO, a desk review of existing information and other relevant training materials on forests for food security and nutrition produced by FAO, other United Nations agencies, and key institutions in Tanzania, Eastern Africa and South African Development Community countries was conducted. In order to ensure that the training manual captured the context-specific resource materials for Tanzania, technical consultations were held with experts and specialists

1 FAO. 2017. *Policy Recommendations on "Sustainable Forestry for Food Security and Nutrition"*. Available at http://www.fao.org/3/I8877EN/i8877en.pdf

at the Ministry of Natural Resources and Tourism, Mtandao wa Jumuiya za Misitu Tanzania (Network for Communities in Forestry Management of Tanzania), Olmotonyi Forestry Training Institute, Sokoine University of Agriculture, Tanzania Forest Conservation Group, Tanzania Forest Service, and others. Illustrations and best practices relevant to the national context to improve the final training manual document were collected within the country and from the FAO media database.

It is hoped that the use of this training manual will bridge the existing gap between the agriculture and forestry sectors by providing a closer link within the food security and nutrition context. The manual sets a roadmap for existing technical and tertiary training institutions to use for mainstreaming food security and nutrition, as well as to develop curricula on food security and nutrition. It will further benefit the country through capacity-building of its practitioners on issues of sustainable forestry, agriculture, food security and nutrition, and thus contribute to the overall goal of sustainable development.



Fred Kafeero
FAO Representative in the United Republic of Tanzania
September, 2019

Acknowledgements

This training manual on forests and trees for food security and nutrition in Tanzania has been developed with thanks to a joint initiative between FAO and the Ministry of Natural Resources and Tourism. It builds on the preliminary report "Sustainable Forestry for Food Security and Nutrition in the United Republic of Tanzania," drafted by Vincent Vyamana, national consultant, in 2018 under FAO's guidance.

Thanks to all the people who provided their technical inputs during the development of the manual. Special appreciation goes to the pre-validation team which included: FAO Tanzania; the Forest Division and Beekeeping (FDB) of the Ministry of Natural Resources and Tourism (MNRT); Mtandao wa Jamii wa Usimamizi wa Misitu Tanzania - MJUMITA (Tanzania Community Forest Network); Olmotonyi Forestry Training Institute (FTI); Sokoine University of Agriculture (SUA); Tanzania Forest Conservation Group (TFCG); Tanzania Forest Research Institute (TAFORI) and Tanzania Forest Services (TFS). Their substantial contributions were invaluable to the realization of this work.

The manual was prepared by Suzana Augustino, Senior Lecturer at SUA, College of Forestry, Wildlife and Tourism, with the contributions, supervision and technical guidance of Sooyeon Laura Jin from FAO. Special appreciation goes to Geofrey Bakanga from FAO for his coordination support. Special thanks also go to Mauro Bottaro from FAO who reviewed the Gender Module.

Last but not least, thanks go to Brett Shapiro for editing, Desktop Production Limited for graphic design and layout, Emma Gibbs for the final review and its coordination and FAO Tanzania for administrative support.

Acronyms

CIFOR	Center for International Forestry Research
FAO	Food and Agriculture Organization of the United Nations
FBD	Forest and Beekeeping Division
FTI	Forest Training Institute
ICRAF	World Agroforestry Centre
MJUMITA	Mtandao wa Jamii wa usimamizi wa Misitu Tanzania - MJUMITA (Tanzania Community Forest Network)
MNRT	Ministry of Natural Resources and Tourism
NWFPs	Non-Wood Forest Products
SDG	Sustainable Development Goal
SFM	Sustainable Forest Management
SUA	Sokoine University of Agriculture
TAFORI	Tanzania Forest Research Institute
TFCG	Tanzania Forest Conservation Group
TFS	Tanzania Forest Agency
USD	United States Dollar
WFP	Wood Food Programme

Introduction

A. Goals and Objectives

The goals of this training manual are to: enhance the recognition and significance of forestry to food security and nutrition through the sustainable management and use of forests and trees[2]; enhance the food security and nutrition benefits from the forests and trees; enhance and stimulate research and training capacity; strengthen institutional frameworks by incorporating food security and nutrition objectives in forest management policies, programmes and projects; and develop value chains based on forest and tree resources for sustainable development in the country.

The overall objective is to create awareness and enable increased investment in the forestry sector for food security and nutrition in Tanzania. This training manual is also meant to serve as a useful tool for sharing and exchanging knowledge and experiences across different regions (within the country) and beyond.

B. Justification

The concept of forests and trees for food security and nutrition in the country is not new; however, relevant data and information availability is still limited. Particularly at policy level the lack of data and information has led to the under-appreciation of the full benefits of forests and trees for food security and nutrition (including nutritious foods that can add variety to healthy diets[3], additional income to purchase food as well as woodfuel that is critical for cooking and sterilizing water). Therefore, training on this topic can contribute to the achievement of various Sustainable Development Goals (SDGs), including SDG 2 (Zero Hunger) by 2030. The need to have a comprehensive and organized document on the links between forests, trees, and food security and nutrition prompted the

2 Forests and trees refer to both their goods and services.

3 For instance, in Tanzania, the majority of the population consumes wild food resources unknowingly, and information on the potential of forests and trees to contribute to food security and nutrition is inadequate and scattered.

development of this training manual, as well as the need to invest in education and research in food security and nutrition by continuing initiatives to domesticate priority forests and trees to complement the national agenda.

Currently in Tanzania, training institutions for professionals in cross-cutting sectors such as forestry and agriculture do not adequately capture the role of forest and tree resources for food security and nutrition[4], leading to dependency on one sector – agriculture – to cater for food and nutrition diversity. This undervalues the fundamental role of forest ecosystem services for sustainable agriculture by regulating water flows, stabilizing soils, maintaining soil fertility, regulating the climate, and providing habitat for wild pollinators and predators of agricultural pests. Provision of education on sustainable forests and trees for food security and nutrition at all levels seems to be the most conceivable entry point to ensure that adequate knowledge and skills are imparted to professionals. In addition, the need to integrate the role of forests into food security and nutrition is important, especially in training, research, outreach and development, while mainstreaming the concept in the curricula of different national training institutions responsible for educating professionals in different sectors.

C. Beneficiaries of the Manual

The primary beneficiaries are the trainers within and beyond government professionals in forestry, agriculture, nutrition, health and other cross-cutting sectors who need to improve their knowledge, skills and competencies on the roles of forests and trees for food security and nutrition in order to contribute effectively to sustainable development in Tanzania. The roles forests and trees play in improving food security and nutrition are significant in Tanzania[5],[6] despite remaining data gaps.

4 Temu, A.B. & Kiyapi, J. 2008. *New Perspectives in Forestry Education*. A.B. Temu, S.A.O. Chamshama, J. Kung'u, J.R.S. Kaboggoza, B. Chikamai and A.M. Kiwia (Eds). Nairobi, World Agroforestry Centre (ICRAF). ISBN: 978-92-9059-221-1.

5 Johnston, K.B., Jacob, A. & Brown, M.E. 2013. *Forest cover associated with improved child health and nutrition: Evidence from the Malawi Demographic and Health Survey and satellite data. Global Health: Science and Practice, 1(2): 237–248.* Available at http://dx.doi.org/10.9745/ ghsp-d-13-00055.

6 Ickowitz, A., Powell, B., Salim, A. & Sunderland, T. 2014. *Dietary quality and tree cover in Africa. Global Environmental Change, 24: 287–294.*

This training manual can also be used by training institutions to guide curriculum development and review at technical and tertiary education levels, as well as support research and outreach activities. This will not only enhance appropriate integration of the concept but also provide synergies between forests, agriculture, and food security and nutrition across different sectors in Tanzania and beyond.

This manual does not provide comprehensive answers to all target groups; rather, it sets a roadmap for both experienced and inexperienced trainers to actively impart knowledge and skills to contribute to the overall understanding of the concept of forestry for food security and nutrition. Trainers are advised to consult suggested readings (provided at the end of each module) for comprehensive learning to meet their set objectives.

It is envisaged that for future implementation of the training programme, the needs, and baseline understanding and knowledge of the beneficiaries from all relevant sectors, will need to be taken into consideration in order to set suitable training objectives based on the adoption of this manual.

D. Key Messages

1. Over 2.4 billion people worldwide depend on forest goods and services for the provision of nutritious food, woodfuel, building materials, medicines, employment and cash income.

2. Forest goods and services generate income for local people and provide ecosystem services that are essential for sustainable agriculture by regulating water flows, stabilizing soils, maintaining soil fertility, regulating the climate, and providing a habitat for wild pollinators and predators of agricultural pests. However, agriculture remains the most significant driver of global deforestation, and there is an urgent need to promote cross-sectoral coordination between agriculture and forestry.

3. Forest goods and services also generate socio-economics benefits, including employment and increased household income, thus helping local people to lift themselves out of poverty and achieve food security.

4. Forest foods contribute to dietary quality and diversity and serve as safety nets in periods of food scarcity to those directly depending on forests for their livelihoods. They also play a role as coping mechanisms in terms of shocks and crises. Wild foods from forests provide nutritious food and diversity to the diets of millions of rural women, men and children.

5. Forest resources for food security and nutrition have been under serious threats due to deforestation and degradation, uncontrolled fires and overgrazing, unsustainable harvesting due to rapid population growth, and climate change and variability. All these, especially deforestation and degradation, lead to loss of potential species and genetic materials for food security and nutrition. Therefore, it is important to develop mechanisms to offset these threats and ensure sustainability for the future.

6. The contribution of forests and trees to food security and nutrition is still invisible to decision-makers in forestry and other sectors such as agriculture, nutrition and health due to inadequate levels of understanding, data and information.

7. The reviewed National Forest Policy Draft of 2018 recognizes food security and nutrition as an important aspect to consider in the development of forest products and industries in the country.

8. The majority of the population in Tanzania, from both urban and rural areas enjoy forest foods (e.g. wild fruits, nuts, honey) as part of their diet without knowing that they are part of forest resources. Improved awareness of the public on the value of forest foods for a healthy and nutritious diet can contribute to recognizing the critical role of sustainable forest management for food security and nutrition, particularly by the policy-makers.

9. Woodfuel is a primary source of energy for cooking and for sterilizing water for one in three households globally. The dependency rate on woodfuel for cooking and water sterilization is high in both urban and rural areas of Tanzania (62 percent[7]); however, there is a lack of an adequate enabling environment for the sustainable production and use of woodfuel, especially in the

7 World Bank, African Development Bank, United Nations Children's Fund & World Health Organization (WHO). 2011. *Water supply and sanitation in Tanzania; turning finance into services for 2015 and beyond. Country Status Overviews.* African Ministers' Council on Water.

charcoal industry, which could negatively affect the food security and nutrition status of those who rely on woodfuel as their major source of cooking and water sterilization.

10. The importance of woodfuel and its contribution to food security and nutrition in Tanzania cannot be underestimated due to: its potential to provide energy for cooking food and boiling water to enhance nutrient uptake and digestion in the human body; its contribution to household income diversification; and its ability to serve as capital for investing in agricultural activities.

11. The domestication of priority indigenous species of flora and fauna through agroforestry will lead to increased productivity and income, opportunities for employment, and the development of the entire food security and nutrition value chain, while preventing biodiversity losses.

E. Structure of the Manual

This training manual has been organized in nine modules to enable delivery of the subject matter. The timing for each module is left to the users' discretion; however, one day per one or two modules is recommended. In each module, a brief introduction is provided followed by learning objectives, contents encompassing review subtopics of what has been done on the subject matter and any gaps, activities to be involved in, approaches and tools, guiding questions and suggested readings.

The nine modules are:

1. **Food security and nutrition concepts**
2. **Forests and trees for food security and nutrition**
3. **Forests for human health and cultural diversity**
4. **Agroforestry**
5. **Contribution of woodfuel to food security and nutrition**
6. **Ecotourism for sustainable forest management and food security and nutrition**
7. **Domestication of Non-Wood Forest Products for Food Security and Nutrition**
8. **Gender**
9. **Challenges and Opportunities: Forests and Trees for Food Security and Nutrition**

The modules have been arranged to provide the users with logical flows on the topics. They are to be conducted by a specialist or expert and based on a participatory learning approach to ensure interactive learning. The trainer should balance the delivery of the theoretical and technical aspects of the material in order to increase understanding, encourage the participation of the trainees, and achieve the set learning objectives. Users of this training manual are expected to select, adapt and revise the content to meet the target group needs within the resources available.

Detailed knowledge on the subject matter may be obtained from extra reading materials provided by invitation of an expert resource person and/or authentic web resources such as FAO, government departments and others that are available online. Some relevant cases have been incorporated into the manual to enrich and reinforce the discussions. To ensure successful training, it is important that all trainers be familiar with the target group requirements, as well as remaining flexible in order to respond to real situations.

module

1

FOOD SECURITY AND NUTRITION CONCEPTS

1.1 Learning Objectives

Upon completing this topic, the learner should be able to:

i. Understand the food security concept

ii. Understand the basic nutrition concept

iii. Understand and analyse the food utilization dimension linked to nutrition in terms of clean water, good sanitation, clean living conditions as well as maintenance of good health.

1.2 Contents

- ✓ Food security concept
- ✓ Basic nutrition concepts

1.2.1. Food security concept

Food security exists "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". Based on this definition, four dimensions to food security can be identified[8]:

- **Availability:** This dimension addresses whether or not food is actually or potentially physically present, including aspects of production, food reserves, markets and transportation, and wild foods.
- **Access:** If food is actually or potentially physically present, the next question is whether or not households and individuals have sufficient access to that food.
- **Utilization:** If food is available and households have adequate access to it, the next question is whether or not households are maximizing the consumption of adequate nutrition and energy. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, dietary diversity and intra-household distribution of food. Combined with good biological utilization of food consumed, this determines the *nutritional status* of individuals.
- **Stability:** If the dimensions of availability, access and utilization are sufficiently met, stability is the condition in which the whole system is stable, thus ensuring that households are food secure at all times. Stability issues can refer to short-term instability (which can lead to *acute food insecurity*) or medium- to long-term instability (which can lead to *chronic food insecurity*). Climatic, economic, social and political factors can all be a source of instability.

1.2.2. Basic nutrition concepts

Nutrition security is integral to the concept of food security[9] and is closely linked to the food utilization dimension of food security. Nutrition has also been linked to livelihoods, since resources and

8 FAO, International Fund for Agricultural Development, United Nations Children's Fund, World Food Programme (WFP) & WHO. 2018. *The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition*. Rome. Available at http://www.fao.org/3/a-I7695e.pdf.

9 FAO. 2011. *Forests for improved nutrition and food security.* Rome. Available at http://www.fao.org/3/i2011e/i2011e00.pdf.

assets tend to play a key role in the body's nourishment.[10] Forests and trees, being essential sources of livelihood for the majority of the population in rural communities, can be linked directly to nutrition outcomes.

> Good health and well-being do not imply simply the absence of disease but presume a state of physical, mental and social well-being for which an adequate and balanced diet is essential.

The whole aspect of food as a foundation for good nutritional status and a healthy life must be explored in terms of undernourishment and malnutrition. It is important to emphasize food quality to ensure a safe and nutritious food supply and consumption. It is also important to emphasize safe and sound cooking practices that ensure food hygiene to avoid the spread of germs when cooking, preparing and storing food. In this regard, some of the steps to be mentioned are: cleaning (i.e. ensuring that hands, surfaces and equipment are clean before, during and after cooking); storing food at the correct temperature to prevent growth of harmful germs; and avoiding cross-contamination.

It should be understood that safe food and nutritious diets must not be the luxury of the well-off, but a fundamental right of everyone. A strong connection needs to be made on the issues of safe water, clean living conditions, proper sanitation and health services as fundamental for preventing and treating infections and diseases which damage health and nutritional status, and thus as fundamental to good health (physical and mental) and to social and economic development. Therefore, keeping the environment as clean as possible and practising good personal hygiene and food-handling habits need to be emphasized during the session. The importance of forests and trees to supply varieties of forest goods and services that help create healthy living environments – such as the provision of recreational, cultural, spiritual, and aesthetic values – also needs to be emphasized in this session.

1.3 Approaches and Tools

Different approaches and tools may be used in imparting knowledge and skills to the learners. These include (but are not limited to):

10 Maxwell, D., Levin, C., Armar-Klemesu, M., Ruel, M., Saul, M. & Ahiadeke, C. 2000. *Urban Livelihoods Food and Nutrition Security in Greater Accra. International Food Policy Research Institute Report No. 112.* Washington, D.C.

group discussions, plenary presentations and reflections, and participatory mapping and ranking. Depending on the context, video presentations may be used to illustrate complex concepts, and to make the presentation livelier. Trainers are encouraged to use different methods to suit the target group; "energizers" may be useful to maintain alertness.

1.4 Guiding Questions

1. Using the four-dimension approach in the context of Tanzania's rural and urban settings, what are the concepts of food security and nutrition?
2. Can you describe the concept of nutrition linked to the food utilization dimension of food security? Then can you go beyond the food aspect only and elaborate on the importance of woodfuel for cooking and for water sterilization?
3. Using supporting evidences, can you explain the concepts of safe and sound cooking practices, access to clean water, good sanitation and clean living conditions, as well as access to health services to maintain a healthy and active life?

1.5 Suggested Readings[11]

1. FAO & the European Union. 2008. *Food Security Information for Action: Practical Guidelines.* Available at http://www.fao.org/3/al936e/al936e00.pdf.
2. FAO. 2015. *Water for food security and nutrition.* A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome.
3. FAO. 2013. *Eating Well for Good Health.* Available at http://www.fao.org/3/i3261e/i3261e00.htm.
4. FAO. 2002. *Safe and nutritious diet for the consumer.* World Food Summit Side Event – five Years later 10–13 June 2002. Available at http://www.fao.org/worldfoodsummit/sideevents/papersy6656e.htm.

11 All suggested readings are for the benefit of both the trainers and the learners.

module

2

FORESTS AND TREES FOR FOOD SECURITY AND NUTRITION

2.1 Learning Objectives

Upon completing this session, the learner should be able to:

i. Understand the linkages between forests and trees and the four dimensions of food security

ii. Describe the contribution of forests and trees to food security and nutrition in the Tanzanian context

2.2 Contents

- ✓ Linkages between forests and trees to the four dimensions of food security
- ✓ Contribution of forests and trees to food security and nutrition in the context of Tanzania

2.2.1 Linkages between forests and trees to the four dimensions of food security

Forests and trees are closely linked to each of the four dimensions of food security – availability, access, utilization and stability – through the provision of employment, income, energy, nutritious foods, fodder and ecosystem services (Table 1).

Availability

Forests and trees are part of the availability dimension of food security by providing wild foods, livestock fodder and ecosystem services.

- Although foods from forests represent less than 0.6 percent of global food consumption,[12] this low figure masks the importance of forest foods in certain communities around the world, some of which are highly, or entirely, dependent on forest foods.
- Forests and trees provide significant quantities of fodder for livestock as animal feed. For example, it is estimated that 75 percent of tree species in tropical Africa are used as browse by domestic livestock, such as sheep, goats, cattle, camels and donkeys.[13] The contributions of fodder to food security and nutrition are twofold: Livestock are a source of meat and dairy; and animals can also be used for draught power and manure to increase the productivity of farming.
- Trees in livestock systems also provide shade to animals, which is important, especially in arid zones. For example, *Gliricidia maculata* and *G. sepium* were introduced at the end of the 18th century in Africa as shade trees for coffee, tea and cocoa plantations. *Erythrina burana* was used by central Ethiopian farmers to shade the coffee plantations. The practice of using *Erythrina burana* by the farmers is very common in this part of the world, but its properties became known only recently to scientists.[14]
- A wide range of forest ecosystem services – including hydrological services, pollination, biological pest control, climate regulation, nutrient cycling, and soil formation – support and increase

12 FAO. 2014. *State of the World's Forests 2014: Enhancing the socio-economic benefits from forests.* Rome.
13 FAO. 1991. *Household food security and forestry: an analysis of socio-economic issues.* Rome.
14 FAO. 1992. *Trees as browse and to support animal production.* Rome.

agricultural yields. For instance, trees in agroforestry systems enhance agricultural yields by fixing nitrogen, shading heat-sensitive crops, contributing to soil integrity and serving as windbreaks. Around 40 percent of global agricultural land has greater than 10 percent tree cover and can be considered agroforestry.[15]

Harvested baobab fruits, ready for selling at a market. The Gambia. ©FAO/Antonello Proto / FAO

Access

Forests and trees contribute to the access dimension of food security by providing a source of income, for example through the sale of timber, fuelwood or charcoal and non-wood forest products (NWFPs), and through employment in forest enterprises (small, medium and large). Although the relationship between income and food security is highly complex and nonlinear, food insecurity is generally associated with high levels of poverty and lack of opportunities for income and employment.

- The formal forestry sector – defined as commercial activities in the harvesting and production of industrial roundwood, fuelwood and charcoal; sawnwood and wood-based panels; pulp and paper;

15 Zomer, R.J., Trabucco, A., Coe, R. & Place, F. 2009. *Trees on farm: analysis of global extent and geographical patterns of agroforestry.* Nairobi, World Agroforestry Centre.

and wooden furniture – employed 13.2 million people in 2011.[16] The informal sector – defined as non-commercial, subsistence or unregulated and unreported small-scale enterprises – provided employment for an additional estimated 41 million people.

- Income from the production of roundwood, sawnwood, panels, pulp and paper amounted to about USD 600 billion in 2011, and the informal sector generated an additional USD 124 billion. However, it should be noted that the latter figure is probably greatly underestimated because it only includes income from the production of fuelwood and charcoal and the few NWFPs that are recorded in FAO's agricultural statistics.[17]

- Globally, the reported value of NWFP removals amounted to USD 18.5 billion, 15 percent of the total global value of forest product removals in 2005,[18] although NWFP data are incomplete. Rural women, in particular, play a central role in the sustainable harvesting of NWFPs and rely year-round on returns from their sale.[19]

- Added value in the forestry sector contributes around 1 percent of global gross domestic product.[20] Although the cash contribution of forest products to household income may not be large at the global level, it is still critical for the livelihoods of the 50 million people employed (formally and informally) in the sector and for almost 30 million forest owners.[21]

Utilization

Forests and trees provide woodfuel for cooking and sterilizing water, micronutrient or protein-rich NWFPs and herbal medicines, and thus are part of the utilization dimension of food security.

- Over half of all wood produced in the world is used for energy, affecting the nutritional status of about 2.4 billion people who rely on woodfuel for cooking and water sterilization, which reduce the

16 FAO. 2014. *State of the World's Forests 2014: Enhancing the socio-economic benefits from forests.* Rome.
17 *Ibid.*
18 FAO. 2011. *State of the World's Forests 2011.* Rome.
19 FAO. 2013. *Forests and trees outside forests are essential for global food security and nutrition. Summary of the International Conference on Forests for Food Security and Nutrition, Rome, 13-15 May 2013.* Rome.
20 FAO. 2014. *State of the World's Forests 2014: Enhancing the socio-economic benefits from forests.* Rome.
21 *Ibid.*

risk of food- and water-borne diseases. Cooking increases the bio-availability of certain micronutrients[22] in food, makes protein in eggs and meat more easily digestible, and allows iron and other minerals to be better absorbed by the body. About 765 million people (10.9 percent of the global population) use wood energy to boil water to make it safe for drinking and for food preparation. Woodfuel is also used by many households in food preservation processes, including traditional smoking and drying, thus extending the supply of food resources during non-productive periods.

- If not used properly, woodfuel can have negative effects on health. However, improved stove systems can alleviate this risk. Therefore, if sustainably managed and safely utilized, woodfuel has the potential to remain the most affordable and renewable source of energy for cooking, water sterilization and smoking for a large share of the world's population, with low impact on climate change as the carbon emitted is re-captured by the growth of new trees.

- Edible NWFPs gathered from the wild often have a high level of micronutrients or may be rich in protein. Research has shown strong links between forest cover and dietary quality.[23] Fruits, honey, roots and tubers, mushrooms, edible insects, edible leaves and nuts are excellent sources of protein and micronutrients: vitamins A and C, calcium, iron and zinc, to name a few. These forest foods form a small but critical part of diets commonly consumed by rural, food-insecure populations, also adding variety to predominantly staple diets. In some communities with high levels of forest food use, wild forest foods alone are sufficient to meet minimum dietary guidelines for fruits, vegetables and animal source foods.[24]

- Many NWFPs provide medicinal resources for a wide array of ailments. For example, it is estimated that at least 1 billion people use herbal remedies to treat children's diarrhea.[25]

22 For instance, bio-availability of beta-carotene found in tomatoes, carrots, sweet potato increases when cooked; lycopene, anti-oxidant, found in tomatoes increases when tomatoes are cooked.

23 Ickowitz, A., Powell, B., Salim, M.A. & Sunderland, T.C.H. 2014. *Dietary quality and tree cover in Africa. Global Environmental Change, 24: 287-294. DOI:10.1016/j.gloenvcha.2013.12.001.*

24 Rowland, D., Blackie, R.R., Powell, B., Djoudi, H., Vergles, E., Vinceti, B. & Ickowitz, A. 2015. *Direct contributions of dry forests to nutrition: a review. International Forestry Review, 17(S2): 45-53.*

25 FAO. 2014. *State of the World's Forests 2014: Enhancing the socio-economic benefits from forests.* Rome.

Wild fruit from the *Annona senegalensis*. The fruit has high nutritional value.

Stability

Forests and trees contribute to the stability dimension of food security in the following ways:

- Income and wild foods from forests and trees provide a safety net during seasonal shortages and during times of famine, crop failure and economic, social and political shocks.
- Sustainably managed forests and trees provide sustainable forest ecosystems which in turn are key for sustainable agriculture.
- Forest ecosystem services to agriculture decrease the likelihood of agricultural losses from extreme weather events such as droughts and floods that cause soil erosion and landslides.

Processed wild mushrooms for sale in the local market. Tabora region, Tanzania. (© S. Augustino)

- Forests and trees have an essential role in the mitigation of and adaptation to climate change, thus contributing to preventing climate-related food insecurity.

Together with Table1, this section should be elaborated with the FAO infographic on "Sustainable forestry for food security and nutrition" (http://www.fao.org/3/i6783e/I6783E.pdf).

The systematic four-dimension approach to look at the contribution of forests and trees to food security and nutrition is essential. The key links between forest goods and services to the four dimensions of food security also need to be clearly explained. An additional elaboration on the links between food security and climate change vulnerability (see Figure 1) can be made as part of this module.

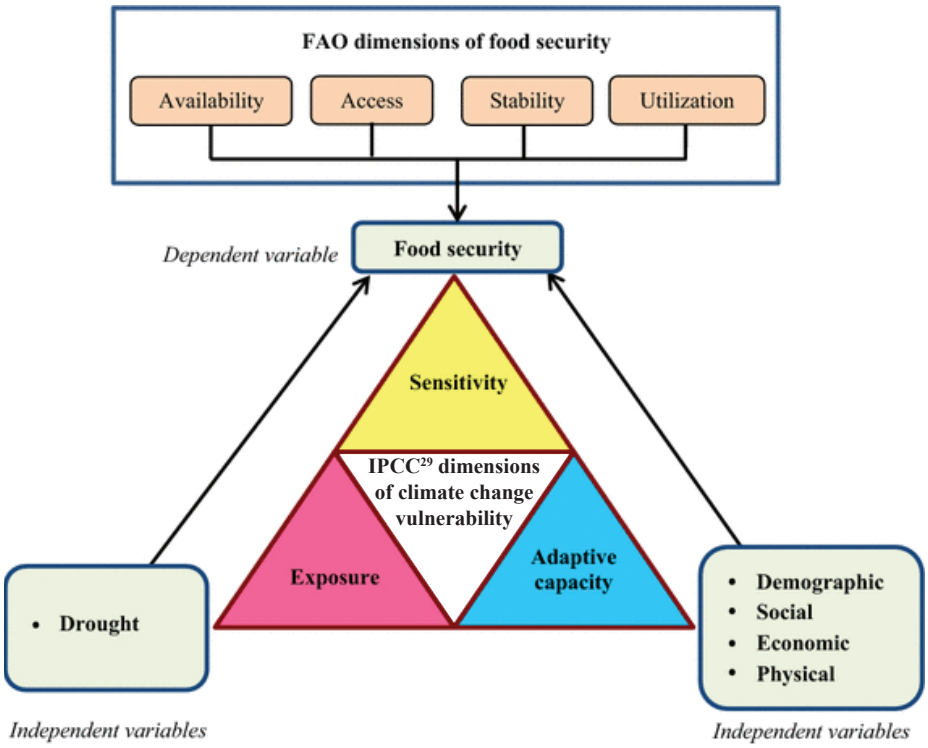
Table 1: The Four dimensions of food security and their linkages to forestry[26],[27]

Dimensions	Definition	Applicable level	Examples of Linkages to forestry	Facts and figures
Food availability	Available food in total = production+ imports+aid+ exports–waste	National	• Availability of edible NWFPs • Support to agricultural and fishery production through forest ecosystem services • Forest ecosystem services supporting and increasing agricultural yields	• Edible NWFPs account for 16.5 kcal/person/day globally • Some 50% of total crop production comes from forest and mountain ecosystems, including all tree crops, while crops cultivated on open, arable flat land account for only 13% of annual global crop production
Food access	Economic, physical, social and legal access to food	Households and individuals	• Increased household income from wood industries, wood and NWFPs	• Global annual income from round wood, sawnwood, panels, pulp and paper: USD 600 billion • Informal-sector annual income from fuelwood, charcoal and recorded NWFPs: USD 124 billion • Forest employment: nearly 45 million people • Forest owners: 30 million people

26 FAO. 2017. *Strengthening Sector Policies for Better Food Security and Nutrition Results.* Rome.
27 Jin, S.-Y. & Reeb, D. 2014. *Storage of food, reviewing the value of forest – forest and food security. World's Food and Agriculture and Fisheries (FAO Korea Association), 611(56): 38-41.* [Korean].

Dimensions	Definition	Applicable level	Examples of Linkages to forestry	Facts and figures
Food utilization	Physical ability to obtain sufficient nutritional intake and nutrition absorption	Individuals	• Woodfuel for cooking • Access to clean water for drinking and cooking • Provision of protein and micronutrients through NWFPs	• 2.4 billion people (one-third of the world's population) cook with wood • In Africa, over 60% of the population relies on woodfuel for cooking • About 765 million people use wood energy to sterilize water
Food stability	Availability, access and utilization at all times without risks	All levels	• Safety nets in times of need • Climate change mitigation and adaptation through sustainable forest management • Protection of ecosystem services for sustainable food production	• Forests have the potential to absorb about 10% of global carbon emissions, if managed sustainably • Forested watersheds and wetlands supply 75% of the world's accessible fresh water for domestic, agricultural, industrial and ecological needs

Figure 1: Linkage between food security and climate change adaptation [28]



2.2.2 Contribution of forests and trees to food security and nutrition in the context of Tanzania

It is important to explore the contribution of forests and trees to food security and nutrition in the Tanzanian context following the four-dimension approach: availability, access, utilization and stability.

For instance, the food availability dimension can be elaborated through the supply of products such as fruits, tubers, mushrooms, medicinal plants and bushmeat. Forests and trees can also increase the supply of edible insects, as is the case with the *Haya* and the culture of collecting and eating edible longhorn grasshopper *Ruspolia*

28 Adopted from Sam, A.S., Abbas, A., Pdmaja, S.S., Kaechele, H., Kumar, R. & Muller, K. 2019. *Linking food security with household's adaptive capacity and drought risk: implications for sustainable rural development. Social Indicators Research, 142(1): 363–385.*

29 IPCC: Intergovernmental Panel on Climate Change

A variety of locally dried and processed medicinal plants ready for selling at the local market. Tabora region, Tanzania. (© S. Augustino)

differens[30] in Tanzania, locally known as *senene,* for enriching plant-based complementary foods and improving the nutrition status of the people. On the other hand, the contribution must be viewed in terms of support to agricultural and livestock production. Trees outside the forests such as those from agroforestry are important sources of livestock fodder, especially during dry season when most rangelands are depleted. In Tanzania, *Ngitili*[31] is a good example of a traditional agroforestry practice in the central northwest part of the country that provides dry-season livestock fodder and year-round fodder supply.

Access to food and the food utilization dimensions can be elaborated by using examples and most recent data and information available in the country on increased household income from wood industries, NWFPs, woodfuel for cooking, access to clean water for drinking and cooking, and provision of protein and micronutrients through NWFPs.

The stability dimension can be elaborated through the provision of essential forest ecosystem services such as: fresh water; climate

30 Mmari, M. W., Kinyuru, J. N., Laswai, H. S. & Okoth, J. K. 2017. Traditions, beliefs and indigenous technologies in connection with the edible longhorn grasshopper Ruspolia differens (Serville 1838) in Tanzania. *Journal of Ethnobiology and Ethnomedicine, 13 (1): 60.*

31 A traditional silvopastoral system practised in western Tanzania whereby farmers reserve part of the grazing land at the beginning of the rainy season to provide high nutritive pasture during the dry season, when supply from unreserved areas is depleted.

regulation; soil formation, protection and nutrient circulation; and pollination. All of these services enhance agricultural production. An example of Miombo woodlands can be introduced in this context as part of the module (see Box 1).

Box 1: Case study 1

The importance of Miombo woodlands to rural communities in Africa

Miombo woodlands provide resources that are vital to the livelihoods of millions of rural and urban people living in and around them in central, eastern and southern Africa. A multitude of products are obtained from them, including food, energy, shelter, medicines, and invaluable environmental and spiritual services. Many indigenous fruit trees such as *Sclerocarya birrea, Azanza garckeana, Parinari curatellifolia* and *Uapaca kirkiana* also play an important although underutilized role in food and nutrition security as well as poverty alleviation, as do nectar-producing genera such as *Brachystegia*, *Julbernardia*, *Syzygium* and *Combretum*, which sustain beekeeping. Commercialization of some forest products (e.g. edible caterpillars, indigenous fruits and by-products) has increased the importance and contribution of these products for both nutrition and incomes.

Woodlands provide 76 percent of total energy used in the Miombo ecoregion. Between 1.4 and 2.5 million people are employed in the traded woodfuels sector, with a traded value of USD 780 million per year. The majority of the Miombo ecoregion countries including Tanzania have the highest per capita woodfuel energy consumption, with biomass accounting for between 60 and 90 percent of total energy consumption. Most woodfuel used in rural areas is in the form of fuelwood and is collected locally, often harvested as dead material, although this can change in situations of scarcity. By contrast, urban people consume traded woodfuels, primarily charcoal.

The beneficiaries of provisioning services vary widely, depending on the degree of commercialization. Women are disproportionately involved in the harvesting, processing and sometimes consumption of many of these goods, although this changes in favour of men for labour-intensive commercial products such as charcoal and honey.

Marginalized groups unable to compete in local labour markets depend heavily on these goods, and wild food nutrition is important for children. Only a few products have international commodity chains (e.g. honey, *Marula* and baobab fruit pulp and seed oil); despite their considerable potential, they have not been utilized to this effect. The importance of Miombo foods during droughts or other household income shocks has been acknowledged. For instance, during a year characterized by poor harvests, wild foods can account for 30 percent of calorie intake. Generally, the contribution of the Miombo woodlands to food security and nutrition (fruits, mushrooms, berries, and edible insects) is invaluable. However, more data is needed on the consumption of these foods and the degree to which they contribute to diets, resource availability, market structure pertaining to these key products, and their nutritional composition.

This highlights the need for incorporating the Miombo woodlands into poverty reduction strategies in most of the countries of eastern and southern Africa. Establishment of woodlots or plantations to cater for multiple purposes has the potential to create benefits throughout the entire food system, provided that proper forest-planning takes place. It is also imperative to quantify woodland contributions to individual and household welfare and raise the profile of these woodlands in policy debates, developing policies that achieve the twin objectives of woodland conservation and local livelihood improvement. Such policy interventions will be important as currently many researchers have assumed that forest products serve as "gap fillers" or "famine foods" rather than engines of development. Improving data on the consumption and production of this vast array of forest products, and the degree to which households depend on them relative to other foods or sources of income is vital to improve policies and guidelines for the ecoregion.

Source: Gumbo, D.J., Dumas-Johansen, M., Muir, G., Boerstler, F. & Xia, Z. 2018. *Sustainable management of Miombo woodlands – Food security, nutrition and wood energy.* Rome, FAO.

2.3 Approaches and Tools

During the session, trainees need to engage in plenary group discussions, presentations, and participatory mapping to fully understand and internalize the topic. Depending on the context, video presentations may be used to illustrate complex concepts and make the presentation livelier. Energizers may be useful to keep the learners alert.

2.4 Guiding Questions

1. What are the links between forests and trees to the four dimensions of food security?
2. What are the links between forests and trees to the four dimensions of food security in the Tanzanian context?
3. What is the contribution of NWFPs to food security and nutrition? Using examples from Tanzania, how can the NWFPs be sustainably harvested, processed and commercialized for maximum income generation at the household level?
4. What is the contribution of woodfuel to food security and nutrition?
5. What is the contribution of forest ecosystem services to food security and nutrition?

2.5 Suggested Readings

1. FAO. 2017. *Cross-sectoral Forestry and Food Security Policy Analysis. Forestry for Sustainable Food Security and Nutrition in the Mainland. Country Narrative Report,* United Republic of Tanzania.
2. FAO. 2011. *Forests for Improved Food Security and Nutrition. Report.* Rome. Available at http://www.fao.org/docrep/014/i2011e/i2011e00.pdf.
3. Neumann, R.P. & Hirsch, E. 2000. *Commercialization of Non-Timber Forest Products: Review and Analysis of Research*. Center for International Forestry Research. Bogor.
4. Ruffo, C. K., Birnie, A. & Tengnäs, B. 2002. Edible Wild Plants of Tanzania. Technical Handbook No. 27. Nairobi, English Press.

module

3

FORESTS AND TREES FOR HUMAN HEALTH AND CULTURAL DIVERSITY

3.1 Learning Objectives

Upon completing this session, the leaner should be able to:

i. Recap the role of forests in human nutrition (already covered in Modules One and Two)

ii. Explain the roles of forests and trees in human health linked to food security and nutrition

iii. Analyse the value of forests and trees for preserving cultural diversity

3.2 Contents

- ✓ Review: Forests and trees for human nutrition
- ✓ Forests, trees and human health (physical and mental)
- ✓ Forests and trees for preserving cultural identity

3.2.1 Review: Forests and trees for human nutrition

Nutrition and health are fundamental pillars of human development across the entire life span. The module can start by reviewing the importance of a balanced and safe diet with diversity of micronutrients such as proteins, vitamins and other minerals for body nutrition[32], making reference to "hidden hunger".[33] The link between forests and trees and malnutrition, which refers to both undernourishment and overnutrition, can be elaborated by linking them to food accessibility and poverty within the country. The issue of neglected and underutilized forest foods needs to be better understood for their key roles in sustaining livelihoods,[34] including their contribution to nutrition. Forest foods – mainly non-starchy fruits and vegetables, mushrooms, bushmeat and edible insects – when combined with other agricultural foods can supply a mixture for a nutritionally balanced diet in terms of providing fibers, vitamins, proteins, fats and minerals for body nourishment to fight malnutrition and maintain health (see Box 2).

Knowledge about the nutrition and health benefits of wild food resources should be emphasized and linked to indigenous knowledge and practices developed over many generations. The need to identify and sustainably manage these wild food resources should be addressed as part of this module.

32 Ickowitz, A., Powell, B., Salim, A. & Sunderland, T. 2014. *Dietary quality and tree cover in Africa. Global Environmental Change, 24: 287–294. http://dx.doi.org/10.1016/j.gloenvcha.2013.12.001.*

33 Hidden hunger, or micronutrient deficiencies, occurs when the quality of food that people eat does not meet their nutrient requirements, so they fail to receive the essential vitamins and minerals they need for their growth and development. These conditions affect two billion people across the globe.

34 Augustino, S. 2018. *Neglected and underutilized fruits and nuts. In: Kasolo, W., Chemining'wa, G. & Temu, A.B. (Eds.) Neglected and Underutilized Species (NUS) for Improved Food Security and Resilience to Climate Change: A Contextualized Learning Manual for African Colleges and Universities.* African Network for Agriculture, Agroforestry and Natural Resources Education, Nairobi.

Box 2: Case study 2

Potential of *Treculia africana* Decne (African breadnut) for food, nutrition and health security

The species is among the currently neglected and underutilized nutritive and medicinal tree species across Africa. The nuts are utilized as food as well as other traditional uses. For example, some African tribes eat the nuts as a course that concludes a meal after roasting or boiling, others grind the nuts for soup, while others produce baked food varieties (e.g. bread and paste). In Africa, the species is claimed to be utilized to accelerate and stimulate skin, hair and bone growth, as well as to cure malaria, coughs, rheumatism and diabetes. The fruits are often hard and fibrous and can weigh up to 8.5 kg.

The nuts are said to be a good source of edible proteins worldwide, producing nutritious and oil-rich foods. Research shows that the pulp of the fruit is not edible by humans but is suitable for livestock. The fruit has many peanut-sized nuts with 12-23 percent protein and up to 15 percent fat. Therefore, the nuts form an important part of the diet. The sap of the male tree is said to be caustic and toxic while that of female tree is said to be utilized medicinally. Environmentally, the African breadnut trees are used for fencing. The tree is also used in soil conservation, especially the litter as mulch and for intercropping systems in agroforestry. The species is common in the wild but can be cultivated or semi-cultivated around the homestead or left on farms for protection, especially where clearance for agriculture is undertaken. The species can be cultivated with seedlings through pot or direct spot-sowing to site. Seed pre-treatment is not required. Propagation by budding, cuttings and shield-grafting is also possible. The nuts from *T. africana* are obtained after the ripe fruits are picked from the tree; processing is mandatory to separate the pulp and seeds through maceration in water. The seeds are later roasted to enable peeling of the small nuts. It is claimed that falling fruits should not be collected since they can be fatal.

The primary processing for *T. Africana* is for food, which involves soaking the seed nuts. Preconditioning of seed nuts may be done in warm water before malting or soaking in hot water to improve the dehulling process, as well as enhancing some functional properties

of flour from the seeds. Post-harvest losses often occur due to poor handling and preservation. Boiling and drying at high temperature reduces selenium and iodine content and may cause seed loss. The duration of cooking affects the odour and colour of the final product. All in all, cooking and roasting of seeds have been claimed to improve their nutritional qualities. It is important to note that processed *T. africana* seeds must meet required standards for food safety and quality in both national and international markets. Since the species is neglected, once it is promoted and becomes well known to consumers, the demand-supply gap may widen.

Source: Augustino, S. 2018. *Neglected and Underutilized Fruits and Nuts. In: Kasolo, W., Cheminig'wa, G. & Temu, A.B. (Eds). Neglected and Underutilized Species (NUS) for Improved Food Security and Resilience to Climate Change: A Conceptualized Learning Manual for African Colleges and Universities.* African Network for Agriculture, Agroforestry and Natural Resources Education, Nairobi.

Open market, where a variety of local foods are being sold. Kerewan, Gambia. ©FAO/Seyllou Diallo

3.2.2 Forests, trees and human health (physical and mental)

Learners should understand that health is much more than the absence of disease; it also encapsulates physical, social, intellectual, emotional, and spiritual well-being. While one's adequate nutrition status can lead to overall health and well-being, an individual's health status also determines one's food security and nutrition outcomes.

Maintaining a healthy status requires optimum nutrition, which can provide the quantity and quality of nutrients needed to build good health and prevent the body from diseases and associated conditions. The roles of forest goods and services (including consuming forest foods, utilizing medicinal properties of herbal plants as well as being in touch with nature/forests) to influence growth, functional abilities and health need to be further explored, especially in view of rapid urbanization and emerging diseases linked to stressful and fast-paced lifestyles such as heart disease, cancer and strokes. For instance, more than 100 studies worldwide have shown that relaxation and stress reduction are significant benefits associated with spending time in green areas.[35]

In Tanzania, medicinal plants obtained from forests and trees form an important element of the primary health care system. Emphasis can be placed on: people's dependence on forests and trees for their overall human health; the pharmaceutical and nutraceutical properties of certain tree species; and the importance of forests and trees to improve people's mental health and reduce depression and stress. It is also crucial to understand that trees and forests can provide a habitat for parasites and diseases that can have an effect on human health. Emphasis needs to be placed on the critical linkages between human, animal, and ecosystem health.[36]

3.2.3 Forests and trees for preserving cultural identity

Forests and trees provide a space for preserving human tradition and cultural identity. For example, in northern parts of Tanzania sacred places within the forests with special trees such as *Olea europea* var. *africana* and *Ficus* spp are used for cultural ceremonies by Maasai

35 Davis, J. 2004. *Psychological Benefits of Nature Experiences: An Outline of Research and Theory.* Naropa University.

36 High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. 2017. *Sustainable forestry for food security and nutrition*. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome.

and Sonjo tribes. These areas are used for prayers to bring rainfall, incantations to inflict a sanction on people who violate traditional norms and rules, and blessings for women who are unable to bear children, thus preserving cultural identities.

Particularly, forest foods and those from trees outside the forests are important components that help define cultural identities and social structures. Emphasis here should be placed on traditional foods that form a major set of defining characteristics of most societies, symbolizing the ways in which a food is used, classified and linked to natural resources.[37] For example, the hunting of animals and consumption of bushmeat plays a special role in the cultural and spiritual identity of indigenous people such as the *Hadzabe* in Tanzania (see Box 3).

Box 3: Case study 3

The *Hadzabe* Ethnic Group: Hunters and Gathers in the *Acacia-Commiphora* Woodland Ecosystem, Tanzania

The *Hadzabe* tribe in Tanzania has long depended on forest resources for their survival. Their number is small but what is striking is the way they have been living without farming or keeping livestock but are in good health while maintaining the environment in sound condition. The *Hadzabe* is a classic example of the ethnic groups in Tanzania that have lived in harmony with nature. Based on their traditions and experiences, *Hadzabe* people have maintained their cultural values as hunters and gatherers (e.g. collecting various types of natural fruits, digging roots/tubers, gathering honey from both stingless and stinging bees without killing the bees). Thus, they obtain their daily food requirements from various trees species, plants and animals. With invaluable indigenous knowledge, *Hadzabe* are able to make hunting tools, such as bows and a variety of arrows that can kill animals quickly. The *Hadzabe* are also knowledgeable about what tree/plant species they can use as sources of medicine for different types of diseases/illness. However, *Hadzabe* are being influenced by the influx of people from different locations and with different traditions.

37 Pretty, J. 2011. *Interdisciplinary progress in approaches to address social-ecological and ecocultural systems. Environmental Conservation, 38 (2): 127–139.*

From the wilderness they collect food from more than 30 types of tree species. Combining them with bush meat and honey, the *Hadzabe* are able to sustain their livelihoods throughout the year. Fruits from *Adansonia digitata* (Baobab trees-Mbuyu) form an important part of their diet, as well as bush meat from baboons/monkeys, followed by tortoise. In addition, the *Hadzabe* obtain natural fruits from trees such as Mkamasi (*Cordia* spp), *Mikole* and *Mikoma* (*Grewia* spp) and *Salvadora* spp, which is also used as a source for making toothbrushes (*miswaki*). Based on the conditions of the natural environment where they live, *Hadzabe* people spend about three to four hours per day to gather the food they need to feed the family.

When integrated cross-sectoral food security and nutrition policies, programmes and legal frameworks are being developed and implemented in Tanzania, the rights of local communities need to be upheld and enhanced to guarantee them food security and nutrition in terms of availability, access, utilization and sustainability. Particular attention should be given to marginalized groups (e.g. women, youth, the elderly, as well as the forest-dependent ethnic groups such as the *Hadzabe*).

Source: FAO. 2017. *Cross-sectoral Forestry and Food Security Policy Analysis. Forestry for Sustainable Food Security and Nutrition in the Mainland.* Country Narrative Report, United Republic of Tanzania.

3.3 Approaches and Tools

Group discussions, plenary presentations, assignments and drama suit the delivery of the session materials. Depending on the context, video presentations may be used to illustrate complex concepts and make the presentation livelier; energizers may also be used to keep the learners alert.

3.4 Guiding Questions

1. How are the concepts of human nutrition and health related?
2. What are the benefits of forests and trees to human health and how are they linked to nutrition?

3. What are the contributions of forests to human health, particular in terms of their medicinal values?
4. What other aspects of health benefits do forests and trees provide apart from nutritious food and medicinal plants?
5. What are the examples from Tanzanian tribes that demonstrate the important cultural values of forests and trees? How is forest food linked to preserving cultural identity?

3.5 Suggested Readings

1. FAO. 2017. *Cross-sectoral Forestry and Food Security Policy Analysis. Forestry for Sustainable Food Security and Nutrition in the Mainland.* Country Narrative Report, United Republic of Tanzania. 80 pp.
2. Karjalainen, E., Sarjala, T. & Raitio, H. 2010. *Promoting human health through forests: overview and major challenges. Environmental Health and Preventive Medicine, 15 (1): 1-8.* Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2793342/.
3. Ruffo, C. K., Birnie, A. & Tengnäs, B. 2002. *Edible Wild Plants of Tanzania. Technical Handbook No. 27.* English Press, Nairobi.
4. Shin, W.S., Yeoun, P.S., Yoo, R.W. & Shin, C.S. 2010. *Forest experience and psychological health benefits: the state of the art and future prospect in Korea. Environmental Health and Preventive Medicine, 15(1): 38–47.* Available at https://europepmc.org/abstract/med/19844774.
5. Sunderland, T., Powell, B., Ickowitz, A., Foli, S., Pinedo-Vasquez, M., Nasi, R. & Padoch, C. 2013. *Food Security and Nutrition: The Role of Forests.* Discussion Paper. Center for International Forestry Research (CIFOR). Bogor.

module

4

AGROFORESTRY

4.1 Learning Objectives

Upon completion of this module, the learner should be able to:

i. Define and understand agroforestry systems
ii. Describe agroforestry management practices
iii. Link agroforestry to sustainable food security and nutrition

4.2 Contents

- ✓ Concept of agroforestry
- ✓ Classification of agroforestry systems
- ✓ Agroforestry management practices
- ✓ Linkage between agroforestry systems and food security and nutrition

4.2.1 Concept of agroforestry[38]

The agroforestry system is a significant source of local commodities such as fuelwood, timber, fruits and fodders for livestock, as well as global ones such as coconut, coffee, tea, rubber and gum. Almost half the world's agricultural land has at least 10 percent tree cover, making agroforestry critical to the livelihoods of millions. Agroforestry serves to improve the resilience of farmers, increasing productivity and household income through the harvesting of diverse products at different times of the year. It also brings job opportunities from the processing of tree products, expanding the economic benefits to rural communities and national economies. In towns and villages, its positive outcomes can be seen in food, fuelwood and watershed management, contributing to a more resilient food system.

Agroforestry:
- helps protect and sustain agricultural productive capacity
- ensures food diversity and seasonal nutrition security
- diversifies rural incomes
- strengthens resilience to climatic fluctuations
- helps perpetuate local knowledge and social and cultural values.

Therefore, advances in agroforestry also can contribute significantly to the achievement of the Sustainable Development Goals, especially Zero Hunger by 2030.

4.2.2 Classification of agroforestry systems

Agroforestry systems can be grouped in two broad categories[39],[40]: *simultaneous systems*, where trees/shrubs and crops are grown together in the same land unit in different spatial arrangements (e.g. trees on croplands, hedgerow intercropping, intercropping in perennial-tree–crop stands and multi-strata systems); and *sequential systems,* where trees and crops are grown in rotation (e.g. rotational bush fallow or planted tree fallows followed by crops). However, some

38 Content of this section has been excerpted from: FAO. 2013. *Advancing Agroforestry on the Policy Agenda*. Available at http://www.fao.org/3/i3182e/i3182e00.pdf.

39 Sanchez, P. A. 1995. *Science in agroforestry. Agroforestry Systems, 30 (1–2): 1–55.*

40 Kimaro, A. A. 2009. *Sequential agroforestry systems for improving fuelwood supply and crop yield in semi-arid Tanzania.* Thesis for Award of PhD Degree at University of Toronto, Canada. 124 pp.

systems merge the characteristics of both systems, such as *Taungya*[41], rotational hedgerow intercropping, rotational woodlots and relay-planted tree fallows in crops.[42] Tree-crop interaction in agroforestry systems refers to the effect of one component on the performance of another component and/or the overall system based on pattern of utilization of spatial, temporal and physical resources.[43] Interactions in agroforestry systems are continuous, rather than seasonal as in annual systems, and are determined by the system's tree/shrub component.[44]

4.2.3 Agroforestry management practices

Agroforestry management practices often aim to ensure that trees/shrubs capture only those resources not used by field crops. As a general rule, pruning can be expected at the age of above three or four years. In order to ensure balanced tree growth, the guiding principle is that the maximum pruned height from the ground should not exceed one third of the total tree height. Tree/shrub management practices such as root and shoot pruning[45] and selection of deciduous tree/shrub species with deep root system that use little water during the dry season[46] can minimize competition among crops.

4.2.4 Linkage between agroforestry systems and food security and nutrition

Agroforestry systems have the potential for tree domestication since they can cultivate different tree species from the wild. Such systems can enhance the productivity of staple crops and yields by increasing soil fertility and ensuring efficient nutrient cycling and nitrogen fixation. Agroforestry systems also increase the resilience of farming systems through diversified production and microclimate improvements, thereby ensuring stable production even where

41 A form of agroforestry system in which short-term crops are grown in the early years of the plantation of a woody perennials species in order to utilize the land, control weeds, reduce establishment costs, generate early income and stimulate the development of the woody perennials species.

42 Nyadzi, G.I. 2004. *Nutrient and water dynamics in rotational woodlots. A case study in western Tanzania.* PhD thesis. Wageningen University, The Netherlands, 194 pp.

43 Jose, S., Gillespie, A.R., Seifert, J. R. & Biehle D.J. 2000. *Defining competition vectors in a temperate alley cropping system in the mid-western USA. 2. Competition for water. Agroforestry Systems, 48 (1): 41–59.*

44 Rao, M.R., Nair P.K.R. & Ong, C.K. 1997. *Biophysical interactions in tropical agroforestry systems. Agroforestry Systems, 38 (1-3): 3–50.*

45 Ong, C.K., Anyango, S., Muthuri, C.W. & Black, C.R. 2007. *Water use and water productivity of agroforestry systems in the semi-arid tropics. Annals of Arid Zone, 46 (3-4): 255–284.*

46 Huxley, P.A., Pinney, A. & Gutama, D. 1989. *Development of Agroforestry Research Methodology Aimed at Simplifying the Study of Potential Tree/Crop Mixtures. Final Report, Project No. 1-432-60005613.* ICRAF, Nairobi, 109 pp.

weather and seasonality are highly unpredictable. Thus, agroforestry has been found to be an essential climate change mitigation and adaptation strategy through climate smart agricultural practices.[47] Apart from conventional products, trees in agroforestry systems provide important ecosystem services, including: soil conservation; spring, stream and watershed protection; animal and plant biodiversity conservation; and carbon sequestration and storage. These benefits leading to improved agricultural productivity, diversified income generation, access to fuelwood and nutrition diversity, are strongly linked to the enhancement of food security and nutrition and beyond (see Boxes 4 and 5).

Box 4: Case study 4

Agroforestry for better food security and nutrition and beyond

The importance of agroforestry for food security can be witnessed through a variety of ways, including improving rural incomes and nutrition, protecting biodiversity and environmental services, and helping the rural poor to adapt to climate change. There are scores of definitions of food security, and the vast majority include references to good health. This is why fruit trees - which are a major source of vitamins - are so important. Expanding fruit tree cultivation can have a significant impact, particularly on the quality of child nutrition. In Africa, around 600,000 children are estimated to die annually from diseases caused by vitamin A deficiency. By growing several species of indigenous and exotic vitamin-rich fruit trees around their homesteads, households can have access to fresh fruits year-round. This will go a long way to ensuring that their children have a healthy diet. The scaling-up of these "household fruit-tree portfolios" deserves much more attention by national and international development initiatives.

Further, approximately two-thirds of medicinal plants used worldwide are derived from trees and play important roles in the health of poor people throughout the developing world. In Africa, for example, more than four-fifths of the population depends on medicinal plants. They also provide important ingredients for a large number of drugs used in

47 Jamnadass, R., Place, F., Torquebiau, E., Malézieux, E., Iiyama, M., Sileshi, G.W., Kehlenbeck, K., Masters, E., McMullin, S., Weber, J.C. & Dawson, I.K. 2013. *Agroforestry, food and nutritional security. ICRAF Working Paper No. 170*. Nairobi.

Western medicine. Unfortunately, many trees are now seriously over-exploited, and some are even threatened with extinction. Research on medicinal tree germplasm conservation and characterization has been increasing, particularly work to develop herbal combination therapy for malaria treatment. Meeting the expanding demand for tree-derived medicine will only be assured through much greater efforts to domesticate these trees and promote their cultivation on farms. Therefore, more vigorous collaboration and support by Government with all stakeholders, such as local communities, research institutions, community-based and non-governmental organizations, are required for such initiatives.

Advances in agroforestry can also contribute significantly to the achievement of the SDGs, especially Zero Hunger by 2030. Unfortunately, the global food price crisis has meant that the chances of achieving this goal have been significantly reduced. This makes it all the more urgent that pro-poor efforts in agroforestry and other aspects of agriculture which can help to eradicate hunger, lift the rural poor out of poverty and improve nutrition, be vigorously promoted.

Source: Adapted from *World Agroforestry Centre. 2008. Annual Report 2007-2008: Agroforestry for food security and healthy ecosystems. Nairobi. World Agroforestry Centre.* Available at http://www.worldagroforestry.org/downloads/Publications/PDFS/RP15815.pdf.

Box 5: Case study 5

Indigenous knowledge of *Allanblackia stuhlmannii* in the East Usambara Mountains, Tanzania

Indigenous knowledge of the *Allanblackia stuhlmannii* tree species was studied and documented in five selected villages adjacent to the Amani Nature Reserve, East Usambara Mountains, Tanzania. The oil extracted from the tree has been traditionally used as cooking oil, dried leaves are used as medicinal tea against chest pain, and heated oil is smeared on aching joints, rashes and wounds. The majority of farmers have one to ten trees on their farms, which they have left for various uses. However, none of the respondents are raising or planting the *Allanblackia* tree in the study area, except for one farmer who has started raising the

tree through seeds. A total of 83 percent of respondents said that they were willing to plant this tree for agroforestry purposes on their farms.

Women expressed concern that they would need permission from their husbands to plant this tree, as most women in the study area do not own land. The difference between a male and female tree when they are not flowering was not established, although some characteristics were mentioned that the male tree has buttresses and the trunk has wrinkles while the trunk of the female tree is smooth. It was noted that the tree bears fruit each season and the number of the fruits per tree in each season was influenced by different factors such as age, canopy cover, predation and diseases. It was learned that the fruits fall any time of the day and it was not possible to tell a ripe fruit when still on the tree. The animals that depend on this tree for food include giant pouched rat, thick-tailed *Galago* and blue monkey. The giant pouched rat is also a problem to agricultural crops. The study has revealed important information that needs further investigation and monitoring to establish a scientific basis for future sustainable nut harvesting and agroforestry efforts.

Source: Meshack. 2014. *Indigenous knowledge of allanblackia stuhlmannii in the East Usambara Mountains, Tanzania*. Available at http://www.worldagroforestry.org/projects1/allanblackia/Report/Tech/Ik_Tz.pdf.

4.3 Approaches and Tools

Different approaches and tools could be used in imparting knowledge and skills to the learners. These include (but are not limited to): group discussions, plenary presentations, reflections, participatory mapping and excursions. Depending on the context, video presentations may be used to illustrate complex concepts and make the presentation livelier. Trainers are encouraged to use different methods to suit learners, with energizers used throughout the session to keep learners alert.

4.4 Guiding Questions

1. Can you describe the concept of agroforestry and its benefits, which vary from plots to farms to landscapes?
2. What are the characteristics of agroforestry systems?
3. How is agroforestry practiced in the country? What are the challenges?
4. What are the links between agroforestry and sustainable food security and nutrition in Tanzania?

4.5 Suggested Readings

1. FAO. 2013. *Advancing Agroforestry on the Policy Agenda.* Available at http://www.fao.org/3/i3182e/i3182e00.pdf.
2. Jamnadass, R., Place, F., Torquebiau, E., Malézieux, E., Iiyama, M., Sileshi, G.W., Kehlenbeck, K., Masters, E., McMullin, S., Weber, J. C. & Dawson, I.K. 2013. *Agroforestry, food and nutritional security. ICRAF Working Paper No. 170.* Nairobi.

module

5

CONTRIBUTION OF WOODFUEL TO FOOD SECURITY AND NUTRITION

5.1 Learning Objectives

Upon completing this topic, the learner should be able to:

i. Understand the links between woodfuel and food security and nutrition

ii. Understand the energy mixes in the country context

iii. Understand different sources of energy, including woodfuel in Tanzania

iv. Understand woodfuel production options in Tanzania

5.2 Contents

- ✓ Woodfuel for food security and nutrition
- ✓ Energy mixes and the role of woodfuel in Tanzania
- ✓ Woodfuel and alternative energy sources in Tanzania
- ✓ Woodfuel production options in Tanzania

5.2.1 Woodfuel for food security and nutrition

> Woodfuel has a major role in the food security and nutrition of one-third of the world's population. With improved forest and tree management, it can help ensure sufficient, safe and nutritious food for a growing population, especially for those who are food-insecure.

One of most important contributions of forests to food security is the provision of woodfuel for cooking and for boiling water. Cooking enhances the uptake of nutrients and makes food more digestible. Cooking or reheating food also increases food safety by eliminating dangerous micro-organisms and toxic elements. In many forest-dependent communities, woodfuel is the only means for sterilizing water to ensure its safety for drinking and food processing. It is also used in food preservation (e.g. smoking, drying), prolonging shelf-life beyond the growing season. Commercial woodfuel production can contribute to household income diversification and can act as a safety net for households during periods of food shortage by providing cash to purchase food. Income from woodfuel sales also provides capital that can be invested in agricultural activities.[48]

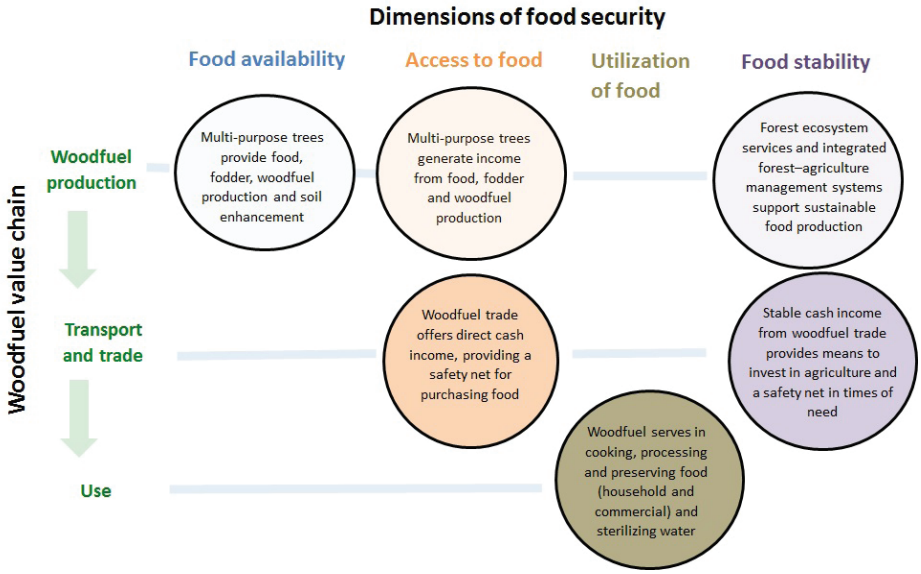
Woodfuel is still the predominant fuel for rural households in much of the developing world, especially in Africa and South Asia. It is of particular importance to the poorest people, for whom it is often the cheapest, most available and most easily accessible fuel. Woodfuel dependence varies largely between urban and rural areas, reflecting different levels of development and the availability of alternative energy sources. In most regions, woodfuel dependence has declined or remained steady over time but in sub-Saharan Africa, consumption continues to increase.

Depletion or degradation of forests and trees puts at risk the multiple benefits that they provide for people's food security and nutrition. Where such degradation limits the availability of, and access to, woodfuel for household use, hunger and poverty are likely to be exacerbated. When sustainably managed, woodfuel holds potential to

48 FAO. 2017. *Sustainable Woodfuel and Food Security and Nutrition.* Rome. Available at http://www.fao.org/3/i7917en/I7917EN.pdf.

serve as a renewable and affordable energy source that can contribute to improved food security (Figure 2), environmental protection, and climate change mitigation in both rural and urban areas. In addition, in Tanzania, charcoal contributes more than USD 650 million to the national economy annually, representing a productive sector of the economy with significant potential to contribute to overall national development and poverty reduction.

Figure 2: Links between the sustainable woodfuel value chain and food security



Source: FAO. 2017. *Sustainable Woodfuel and Food Security and Nutrition.* Available at http://www.fao.org/3/i7917en/I7917EN.pdf (full publication) and http://www.fao.org/3/a-i7894e.pdf (Factsheet).

5.2.2 Energy mixes and the role of woodfuel in Tanzania

For a long time, Tanzania's energy sector has been characterized by a low per capita consumption of commercial energies such as kerosene and petroleum, and a large dependence on wood energy in the form of fuelwood (see Box 6 for definitions), charcoal and agricultural waste, as well as human and animal waste. The most important rural domestic fuels are fuelwood and charcoal, with the number of people

dependent on it expected to increase over time.[49] Access to woodfuel provides people with more flexibility in what they can eat, including foods with better nutritional profiles that require more energy to cook.[50] Trade in woodfuel, particularly in the charcoal sector, provides income to rural people, who can use the income to purchase food and thus contribute to their household's food security and nutrition (see Figure 3).

BOX 6: Definitions of woodfuel, fuelwood and charcoal

Woodfuel is defined as all types of fuels originating directly or indirectly from woody biomass. The main types of woodfuel in less-developed regions of the world are **fuelwood** (wood in its natural state, including residues from wood-processing industries) and **charcoal** (the solid residue derived from the carbonization, distillation, pyrolysis and torrefaction of wood).

Source: FAO. 2017. *Sustainable Woodfuel and Food Security and Nutrition.* Available at http://www.fao.org/3/i7917en/I7917EN.pdf (full publication) and http://www.fao.org/3/a-i7894e.pdf (factsheet).

In urban areas, people tend to use a mix of different energy sources for cooking certain foods or for other activities that require energy such as lighting or heating. Despite the common notion that charcoal is an energy source primarily for the poor, the reality is that charcoal is the preferred fuel of many middle-income families due to its higher energy content, ease of storage and transportation, and lower smoke emissions. Accordingly, the notion that charcoal use for cooking will decrease automatically as a country becomes more developed is not always true.[51] Therefore, it is important to note that the sustainable production and use of woodfuel from forests (and woodlands) and trees in Tanzania, supported by adequate policy interventions, would be key in mitigating the negative impact of woodfuel on forest resource degradation, as well as on food security and nutrition (see Box 7).

49 International Energy Agency. 2014. *World Energy Outlook 2014*. Paris.

50 Njenga, M., Karanja, N., Munster, C., Liyama, M., Neufeldt, H. & Kathinji, J. 2013. *Charcoal production and strategies to enhance its sustainability in Kenya. Development in Practice, 23(3): 359–371.*

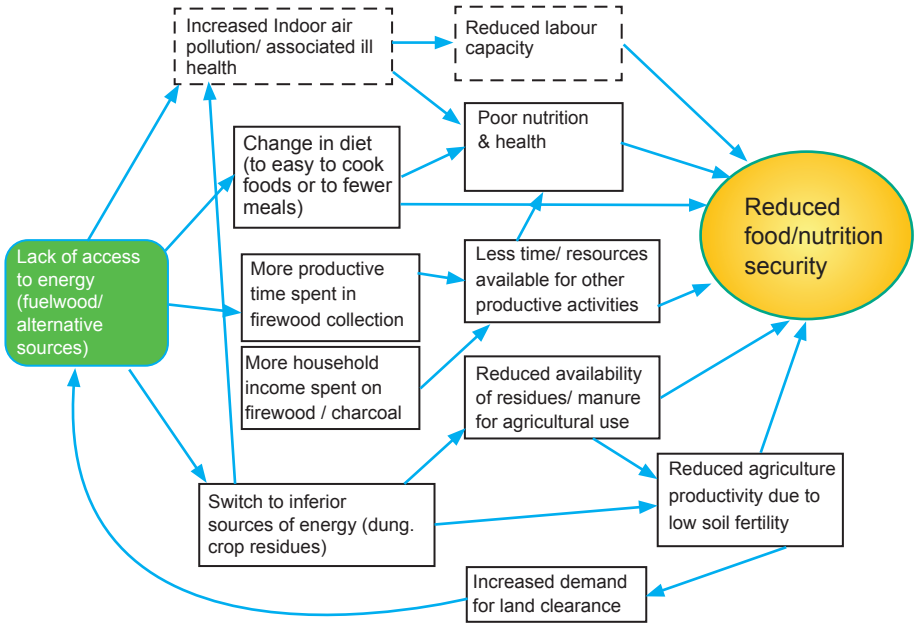
51 FAO. 2017. *Sustainable Woodfuel and Food Security and Nutrition.* Available at http://www.fao.org/3/i7917en/I7917EN.pdf (full publication) and http://www.fao.org/3/a-i7894e.pdf (factsheet).

Box 7: Issues regarding forest resource degradation and woodfuel

- Between 2010 and 2015, the net annual loss of forest cover amounted to 3.3 million hectares worldwide.
- Agricultural conversion, not woodfuel use, is the main cause of global deforestation, accounting for 80 percent of total forest loss.
- It is estimated that 27 to 34 percent of woodfuel harvesting in tropical regions is unsustainable.
- Around 275 million people live in "woodfuel depletion hotspots" where more than 50 percent of woodfuel harvesting is unsustainable.
- In Africa, unsustainable fuelwood collection and charcoal production – favoured by open access with a lack of clear and secure forest and tree tenure – currently constitutes the main cause of forest degradation, accounting for as much as half of it.
- Where urban demand for woodfuel is high, it creates pressure on peri-urban forest and tree resources, contributing to land degradation which can have a negative impact on food availability, as these lands are also needed for agricultural production to feed the urban populations.

Source: FAO. 2017. *Sustainable Woodfuel and Food Security and Nutrition.* Available at http://www.fao.org/3/i7917en/I7917EN.pdf (full publication) and http://www.fao.org/3/a-i7894e.pdf (factsheet).

Figure 3: Possible links between energy access and food security



Source: Sola, P., Ochienga, C., Yila, J. and Liyama, M. 2016. *Links between energy access and food security in sub-Saharan Africa: An exploratory review. Food Security, 8 (3): 635-642.*

5.2.3 Woodfuel and alternative energy sources in Tanzania

Woodfuel is a renewable energy source since its supplies are not restricted. Charcoal, fuelwood, dung and other traditional fuels are the main energy sources in Tanzania.[52] They are produced unsustainably, mainly from the Miombo woodland, leading to forest degradation. The major part of woodfuel consumed is used for domestic purposes, tobacco production, brick-making, and tea-drying, as well as to meet the most basic needs (e.g. cooking, boiling water, lighting and heating) of both urban and rural populations. The use of alternative energy sources such as liquefied petroleum gas and biogas is negligible compared to the traditional energy sources when it comes to cooking traditional foods – woodfuel often remains the preferred option for

52 Blomley, T. & Iddi, S. 2009. *Participatory forest management in Tanzania: 1993–2009 lessons learned and experiences to date.* Ministry of Natural Resources and Tourism, Forestry and Beekeeping Division, Dar es Salaam.

cooking traditional foods.[53] The use of energy-efficient charcoal stoves in Tanzania is minimal due to their high initial installation cost,[54] inadequate support from the Government, and lack of woodfuel policies. The Government has been striving to promote the use of woodfuel through the establishment of a rural energy agency. The concurrent promotion of woodfuel and alternative energy sources would be important to meet the overall energy needs in Tanzania.

5.2.4 Woodfuel production options in Tanzania

Current sources of woodfuel in the country include natural forests and woodlands, forest plantations, trees outside the forests, and industrial wood waste. Charcoal has been produced through clearing of the natural forests and woodlands, especially the Miombo,[55] posing significant threats to the trees and forests. The national forest resource assessment recorded[56] severe negative human impacts on the natural forests and woodlands in the eastern and western zones due to the combined effects of charcoal production and shifting cultivation.

An open-fire stove using woodfuel for cooking. Kigoma, Tanzania. ©FAO/Simon Maina / FAO

53 FAO. 2017. *Sustainable Woodfuel and Food Security and Nutrition*. Available at http://www.fao.org/3/i7917en/I7917EN.pdf (full publication) and http://www.fao.org/3/a-i7894e.pdf (factsheet).

54 Malimbwi, R. E. & Zahabu, E. 2009. *The analysis of sustainable charcoal production systems. In: Rose, S., Remedio, E., & Trossero, M.A. (eds.). Criteria and indicators for sustainable woodfuels: Case studies from Brazil, Guyana, Nepal, Philippines and Tanzania.* Rome, FAO Forestry Department. Available at http://www.fao.org/docrep/012/i1321e/i1321e09.pdf.

55 Ibid.

56 United Republic Of Tanzania. 2015. *National Forest Resources Monitoring and Assessment of Tanzania Mainland: Main Results.* Dar es Salaam.

Firewood gathering in Kigoma, Tanzania.
©FAO/Simon Maina / FAO

The plantation forests in Tanzania supply wood mainly for timber and pulp production. Fuelwood is collected from dead branches free of charge by women and children in the villages adjacent to the plantations. Occasionally, non-merchantable trees (crooked, deformed and smaller ends of the stem) can be staked and sold as fuelwood to urban customers for use in bakeries and households. Tanzania has very few forest plantations established solely for the production of woodfuel, and most are privately owned.

Trees planted around the homestead and farm boundaries have also been used to supply fuelwood in the country (e.g. cashew, mango and Jack fruit trees in coastal areas). Wood waste, mainly sawdust, deformed stems, slabs, off-cuts and tree bark, are also used as a source of fuelwood in some places (e.g. in the wood-based industries for their boilers, brick burning, briquetting and domestic cooking, especially by forest-adjacent communities).

5.3 Approaches and Tools

Approaches include group discussions, plenary presentations and reflections. Depending on the context, video presentations may be used to illustrate complex concepts, and make the presentation livelier. Energizers may be useful to keep the learners alert.

5.4 Guiding Questions

1. Why is woodfuel important for food security and nutrition? What are the key challenges in ensuring sustainable woodfuel production and use?
2. What are the energy mixes in the Tanzanian context?
3. Can you describe the characteristics of the different woodfuel types used in Tanzania, focusing on the social, economic, technical and environmental aspects?
4. What are the different woodfuel sources and what are some of the alternatives relevant for the Tanzanian context?
5. How can we promote sustainable production of woodfuel energy in Tanzania?
6. Are there any additional challenges regarding transport, trade and use of woodfuel (e.g. charcoal)?

5.5 Suggested Readings

1. FAO. 2017. *Sustainable Woodfuel and Food Security and Nutrition.* Available at http://www.fao.org/3/i7917en/I7917EN.pdf (full publication) and http://www.fao.org/3/a-i7894e.pdf (factsheet).
2. FAO. 2011. *Forests for Improved Food Security and Nutrition Report.* Rome. Available at http://www.fao.org/docrep/014/i2011e/i2011e00.pdf.
3. Gumbo, D.J., Dumas-Johansen, M., Muir, G., Boerstler, F. & Xia, Z. 2018. *Sustainable management of Miombo woodlands – Food security, nutrition and wood energy.* Rome, FAO.
4. Neufeldt, H., Langford, K., Fuller, J., Iiyama, M. & Dobie, P. 2015. *From transition fuel to viable energy source: improving sustainability in the sub-Saharan charcoal sector. ICRAF Working Paper No. 196.* Nairobi. DOI:http://dx.doi.org/10.5716/WP15011.pdf.

module

6

ECOTOURISM FOR SUSTAINABLE FOREST MANAGEMENT AND FOOD SECURITY AND NUTRITION

6.1 Learning Objectives

Upon completing this topic, the learner should be able to:

i. Understand ecotourism and its practices

ii. Explain the benefits accrued from ecotourism in relation to sustainable forest management

iii. Link the implementation of ecotourism to food security and nutrition

iv. Understand the challenges of sustainable ecotourism

v. Understand the importance of sound ecotourism planning as part of sustainable forest management practices

6.2 Contents

- ✓ Ecotourism and its practices
- ✓ Benefits of ecotourism
- ✓ Linking ecotourism to sustainable food security and nutrition
- ✓ Planning for ecotourism
- ✓ Challenges of sustainable ecotourism

6.2.1 Ecotourism and its practices

The environmental concerns associated with tourism have given rise to the need for new forms of sustainable tourism. For sustainable tourism, where the aspects of environmental, social and economic sustainability need to be looked at comprehensively and holistically, forests can play an important role. Ecotourism, one of the ways in which sustainable tourism can be promoted, can satisfy the human need for relaxation and physical and mental recovery, and at the same time not overlook the protection or conservation of the natural environment.[57] Ecotourism holds greater potential for local communities, including indigenous peoples who live in or near to forests, and for the visitors who wish to enjoy the unique diversity of nature and culture based on traditions and history, while preserving both natural and human heritage.

6.2.2 Benefits of ecotourism

Understanding ecotourism as a nature-based tourism with its greater environmental, social and economic benefits is important. Environmental benefits include minimal disturbances to forests and trees and the offsetting of carbon dioxide emissions generated by the tourism sector.[58]

Social and economic benefits include the alternative income generated from ecotourism, which form a subsistence income to support livelihoods, especially to those who lack capital to engage in other productive activities for welfare. At the country level, ecotourism practices may also add up to the contribution of the gross domestic product through the tourism sector. Particularly in many tropical countries around the world (e.g. Côte d'Ivoire, Dominican Republic, Honduras, Madagascar, Niger, Papua New Guinea, Saint Lucia, Togo), ecotourism is promoted as part of a poverty reduction strategy. The potential for ecotourism to contribute to poverty alleviation is high in Tanzania, bringing new sources of income in rural areas due to prominent diversity in culture and natural resources that are found. Sound forest management practices considering the benefits of ecotourism can contribute to long-term sustainability by providing

57 Zolfani, S., Sedaghat, M., Maknoon, R. & Zavadskas, E. 2015. *Sustainable Tourism: A comprehensive literature review on frameworks and applications. Economic Research, 28 (1): 1–30.*

58 Tourism is responsible for about 5 percent of global carbon dioxide emissions; when managed sustainably, forests can absorb about 10 percent of global carbon emissions.

socioeconomic incentives including food security and nutrition benefits to forest-dependent communities and local people.

6.2.3 Linking ecotourism to sustainable food security and nutrition

Tourism in general can spur sustainable agriculture, forestry and fisheries by promoting the production and use of local products in tourist destinations. Ecotourism can generate additional income, through the sale of ecotourism products and services, while enhancing the value of the tourism experience. Ecotourism also provides alternative income to households and communities to purchase food, contributing directly to their food security and nutrition (Box 8).

Box 8: Case study 6

Linking ecotourism to food security and nutrition

The expanded definition of ecotourism incorporates ideas of profit linkage and the sustainable development of local communities, by encouraging local employment and small business development that ensure that traditional lifestyles and community values are respected. Ecotourism-related jobs have positive direct and indirect impacts on the economy of the local community, as well as on sustainable food security and nutrition by providing sustainable means of income.

Food also serves as an important part of tourism by providing a unique cultural experience. Recent research has found that in addition to the environmental quality of a destination, good local food also has an effect on tourists' satisfaction and experience. Many aspects are considered when a tourist chooses a destination; among them is the type of local food available at the destination. Through the ecotourism industry, the nutritional value of certain local foods - particularly those that come from forests and trees, can be widely promoted among both domestic and foreign tourists.

Source: Adopted and modified from Alias, A., Isa, S., Muhammad, S.A.K. & Isa, S.S. 2015. *Local food consumption at ecotourism destination. In: Adventure and Ecotourism in Malaysia.* Available at: https://www.researchgate.net/publication/301790459_LOCAL_FOOD_CONSUMPTION_AT_ECOTOURISM_DESTINATION

Processsed jams from wild fruits of the species Strychnos potatorum, found in the miombo woodlands. Tabora region, Tanzania. (© S. Augustino)

Addressing issues related to food security and nutrition will require diversifying livelihood options and developing non-farm sectors such as ecotourism and handicrafts to enhance household food purchasing power.[59] The contribution of ecotourism to the Tanzanian economy can be integrated with other segments of economy (e.g. wildlife),[60] including the agriculture sector through earnings from hunting, hotels and restaurants, transport and communication, and financial services. Highly nutritious forest foods can also provide an avenue to promote local cuisine and culture as part of sustainable ecotourism. Thus, the sector can have multiplier effects across many other economic activities in the tourism value chain. Through these multiplier effects, a close linkage between ecotourism and food security and nutrition can be realized within the context of sustainable forest management.

6.2.4 Planning for ecotourism

Ecotourism may offer greater economic opportunities in a sustainable manner by providing accommodations, and promoting sales of local products and services (e.g. handicraft souvenirs such as embroidery, wood carvings, shawls, blankets, carpets, baskets, gemstones, traditional foods, and many others). Such opportunities can be further

59 Rasul, G., Saboor, A., Prakash C., Tiwari, P.C., Hussain, A., Ghosh, N. & Chettri, G.B. 2009. *Food and Nutrition Security in the Hindu Kush Himalaya: Unique Challenges and Niche Opportunities. The Hindu Kush Himalaya Assessment.*

60 Ministry of Natural Resources and Tourism. 2002. *Tourism in Tanzania: Investment for Growth and Diversification.* Washington DC, Washington Multilateral Investment Guarantee Agency/World Bank Group.

increased if the relevant ecotourism activities are well integrated into sustainable forest management planning.[61]

A well-designed and managed ecotourism practice should involve all stakeholders, including the local communities who directly rely on forest and tree resources for their livelihoods from the planning stage. With the needs of the local communities fully taken into consideration, and with sound benefit-sharing mechanisms put in place, ecotourism can create diverse employment opportunities and ensure sustainable natural resource management, and thus generate a stable source of income for many of the communities who live in and nearby forests.

6.2.5 Challenges of sustainable ecotourism

There are several challenges that must be addressed during the planning and implementation of ecotourism programmes in order to realize sustainability in terms of the vested interests, beliefs and values of different and numerous stakeholders and at different scales. The key challenges relevant to sustainable ecotourism include: the reluctance of business operators to change from "business as usual" scenarios, in which they have already made previous investments in tourism infrastructure (e.g. airports, accommodations and attractions); the effects of climate change and variability on forest ecosystem services (e.g. rising sea levels, increased frequency of storms, beach erosion, coral bleaching and disrupted water supply); spread of tropical diseases; inaccessibility to safe water; and ensuring that benefits trickle down to poor people through the informal economy.

6.3 Approaches and Tools

Different approaches and tools may be used, including (but not limited to): group discussions, plenary presentations and reflections. Video clips can be used to vary the presentation of the learning material. Excursions to various historical / archeological sites and cultural tourism attractions in Tanzania will add value to the session learning.

61 *Rasul, G. & Hussain, A. 2015. Sustainable food security in the mountains of Pakistan: Towards a policy framework. Ecology of Food and Nutrition, 54 (6): 625-643.*

6.4 Guiding Questions

1. Can you define the concept of ecotourism in Tanzania and explain its evolution?
2. What is the value of ecotourism in in terms of the three dimensions of sustainable development? Can you give examples from Tanzania of ecotourism linking to sustainable forest management practices?
3. Using examples from existing natural and cultural attractions in Tanzania, can you talk about the linkage between ecotourism and the concept of food security and nutrition?
4. How well is ecotourism incorporated into current sustainable forest management practices in the country? How can its potential to increase food security and nutrition be realized and strengthened?
5. What are the challenges facing ecotourism in the country to contribute to sustainable forest management and food security and nutrition? What do you think are the possible options to overcome these challenges?

6.5 Suggested Readings

1. Goeldner, C.R., Ritchie, J.R.B. & McIntosh, R.W. 2000. *Tourism. Principles, Practices, Philosophies.* New York, John Wiley & Sons.
2. Mgonja, J.T., Sirima, A. & Mkumbo, P.J. 2015. *A review of ecotourism in Tanzania: magnitude, challenges, and prospects for sustainability. Journal of Ecotourism, 14(2 –3): 264–277.*
3. United Nations Development Programme & World Tourism Organization. 2018. *Tourism and the Sustainable Development Goals – Journey to 2030.* Madrid.

module 7

DOMESTICATION OF NON-WOOD FOREST PRODUCTS FOR FOOD SECURITY AND NUTRITION

7.1 Learning Objectives

Upon completing this session, the learner should be able to:

i. Explain the importance of NWFP domestication, applying knowledge to domesticate a particular organism in a specific environment

ii. Understand the NWFP domestication methods

iii. Describe the challenges of NWFP domestication linking to food security and nutrition benefits

7.2 Contents

- ✓ Importance of domestication of NWFPs
- ✓ Domestication methods for different NWFPs:
  - o Hands-on practicum in vegetative propagation
  - o Domestication methods and tools for plants and animals (including edible insects)
- ✓ Challenges in domestication of NWFPs to enhance food security and nutrition benefits

7.2.1 Importance of domestication

Domestication involves adapting wild plants and animals from the forest ecosystem for human use. Through domestication, NWFPs such as plants and animals have been genetically modified over time by humans for traits that are more advantageous or desirable.[62] Domestication may influence the genomes of cultivated species, leaving behind a mark to be identified. Overall, domestication of forest food and tree crops provides an opportunity to combat poverty and malnutrition of many rural communities, mitigate and adapt to changing climate, improve energy security, and conserve biodiversity.

> As the loss of forests continues to be on the rise, forest food crops are disappearing, prompting the need for domestication in order to increase productivity, resilience to disturbances and the value of their products in socio-ecological and economic contexts.

Variability in desirable traits, such as fruit size, vitamin content, oil composition and pulp proportion, is an important factor for domestication, in order to develop cultivars from phenotypically superior trees.[63] Furthermore, genetic diversity in crops' wild relatives, including forest and tree species, could enable breeding with the aim to increase the nutritional value (bio-fortification) and in turn, improve food security and nutrition.[64]

7.2.2 Domestication methods

Domestication is an evolutionary process, in which humans promote the adaptation of wild species to agro-ecological niches and to local preferences.[65] It is a complex multi-stage process that involves

62 Akinnifesi, F.K., Kwesiga, F., Mango, J., Chilanga, T., Mkonda, A., Kadu, C.A.C., Kadzere, I., Mithofer, D., Saka, J.D.K., Silashi, G., Ramdhani, T. & Dhliwayo, P. 2006. *Towards the development of miombo fruit trees as commercial tree crops in Southern Africa. Forests, Trees and Livelihood, 16 (1): 103-121*.

63 Leakey, R., Schreckenberg, K. & Tchoundjeu, Z. 2003. *The participatory domestication of West African indigenous fruits. International Forest Review, 5: 338–347.*

64 Toledo, Á. & Burlingame, B. 2006. *Biodiversity and nutrition: A common path toward global food security and sustainable development. Journal of Food Composition and Analysis, 19: 477–483.*

65 Larson, G., Piperno, D.R., Allaby, R.G., Purugganan, M.D., Andersson, L., Arrollo-Kalin, M., Barton, L., Vigueira, C.C., Denham, T., Dobney, K., Doust, A.N., Gepts, P., Gilbert, M.T., Gremillion, K.J., Lucas, L., Lukens, L., Marshall, F.B., Olsen, K.M., Pires, J.C., Richerson, P.J., Rubio de Casas, R., Sanjur, O.I., Thomas, M.G. & Fuller D.Q. 2014. *Current perspectives and the future of domestication studies. Proceedings of the National Academy of Sciences of the United States of America, 111 (17): 6139-6146.*

several steps,[66] such as: pre-domestication, in which humans start to purposely plant and look after wild plants with favourable traits; and artificial selection, to determine the plants to be adopted based on favourable traits. Domestication of NWFPs for food security and nutrition needs to be understood as a scientific conservation approach that includes a wide range of activities, with the main focus on *in situ* or *ex situ* conservation of genetic resources.[67] Exploration and collection of natural populations, evaluation and selection of suitable species and provenance, breeding to develop suitable cultivars, development of propagation techniques, multiplication and dissemination of germplasm, development of management techniques, utilization and tree product marketing, and development and dissemination of relevant technical information are crucial[68] to the domestication of NWFPs.

7.2.3 Domestication challenges to enhance food security and nutrition benefits

Despite the potential of domestication, some challenges exist and limit implementation to a wider scale. The issue of linking the conservation of high-value forest goods is constrained by cultivation technologies. Another challenge is the unavailability to local communities to superior germplasm, alternative species or material available in the forests. The growth patterns of the useful local species from trees and forests within an ecosystem pose challenges to domestication which require further research (e.g. domestication to attain a tree that is straight in order to produce uniform fruits in terms of shape and size). Local indigenous knowledge on valuable forest food species has been disappearing due to the pressures of modern life and to forest degradation and deforestation.[69]

66 Meyer, R.S. & Purugganan, M.D. 2013. *Evolution of crop species: genetics of domestication and diversification. Nature Reviews Genetics, 14 (12): 840-852.*

67 Further information on the importance of bushmeat and edible insects for food security and nutrition can be found within the document: 'Background Material on Forests and Trees for Food Security and Nutrition in Tanzania' (February, 2019).

68 Akinnifesi, F.K., Kwesiga, F. Mhango, J., Chilanga, T., Mkonda, A., Kadu, C.A.C., Kadzere, I., Mithofer, D., Saka, J.D.K., Silashi, G., Ramdhani, T. & Dhliwayo, P. 2006. *Towards the development of miombo fruit trees as commercial tree crops in Southern Africa. Forests, Trees and Livelihood, 16 (1): 103-121.*

69 Onyekwelu, J.C., Olusola, J.A., Stimm, B., Mosandl, R. & Agbelade, A.D. 2015. *Farm-level tree growth characteristics, fruit phenotypic variation and market potential assessment of three socio-economically important forest fruit tree species. Forests, Trees and Livelihoods, 24 (1): 27-42.*

7.3 Approaches and Tools

Different approaches and tools can be used, including but not limited to group discussions, plenary presentations, reflections and participatory mapping. Depending on the context, video presentations may be used to illustrate complex concepts and make the presentation livelier. Trainers are encouraged to use different approaches to suit the target group; energizers may be useful to keep the learners alert.

7.4 Guiding Questions

1. What are the different approaches to domesticate NWFPs for improving food security and nutrition?
2. What is the importance of domestication of NWFPs in the country context?
3. What are the challenges facing domestication of NWFPs, especially linking to enhancing food security and nutrition benefits in Tanzania? How can they be overcome?

7.5 Suggested Readings

1. Augustino, S., Mataya, B., Senelwa, K. & Achigan-Dako, G.E. 2011. *Non-wood forest products and services for socio-economic development. A Compendium for Technical and Professional Forestry Education.* Nairobi, The African Forest Forum.
2. FAO. 2011. *Manual for Community-based tree and forest product enterprises: Market Analysis and Development.* Available at http://www.fao.org/3/i2394e/i2394e00.pdf.
3. FAO. 1996. *Domestication and commercialization of non-timber forest products in agroforestry systems.* Proceedings of an international conference held in Nairobi, Kenya, 19-23 February 1996 (Eds) R.R.B. Leakey, A.B. Temu, M. Melnyk and P. Vantomme. Rome.
4. Global Water for Sustainability. 2015. *Module 6: Community-based Tree Planting. Global Water for Sustainability Program.* Florida City, Florida International University.

module

8

GENDER

8.1 Learning Objectives

Upon completing this session on gender, the learner should be able to:

i. Understand the different needs and priorities of women and men, as well as gender roles in natural resources management

ii. Explain gender roles in the context of sustainable forest management and food security and nutrition

iii. Understand how to mainstream gender in forestry

8.2 Contents

- ✓ Gender in the context of natural resources management
- ✓ Gender issues in sustainable forest management and food security and nutrition
- ✓ Mainstreaming gender in forestry for sustainable food security and nutrition

8.2.1 Gender in the context of natural resources management

Gender is a socially constructed notion. Understanding gender relations within the context of natural resources management is important. First of all, it must be kept in mind that men and women do not have equal access to and control over natural resources due to sociocultural norms and often to existing laws and policy frameworks. Moreover, they have different work burdens and roles based on divisions of labour and priorities. This results in distinct exploitations of natural resources and may lead to different outcomes in terms of benefits that forests and trees can generate for men and women.[70] Knowledge, skills and practices of both women and men are determining factors in the outcomes of the overall conservation, management and improvement of natural resources, which directly and/or indirectly affects the level and sustainability of food security and nutrition of households and communities. It is therefore necessary to take into consideration the different needs of both men and women, their different roles, knowledge, capacities and possible contributions to sustainable management of natural resources, in order to improve food security and nutrition.

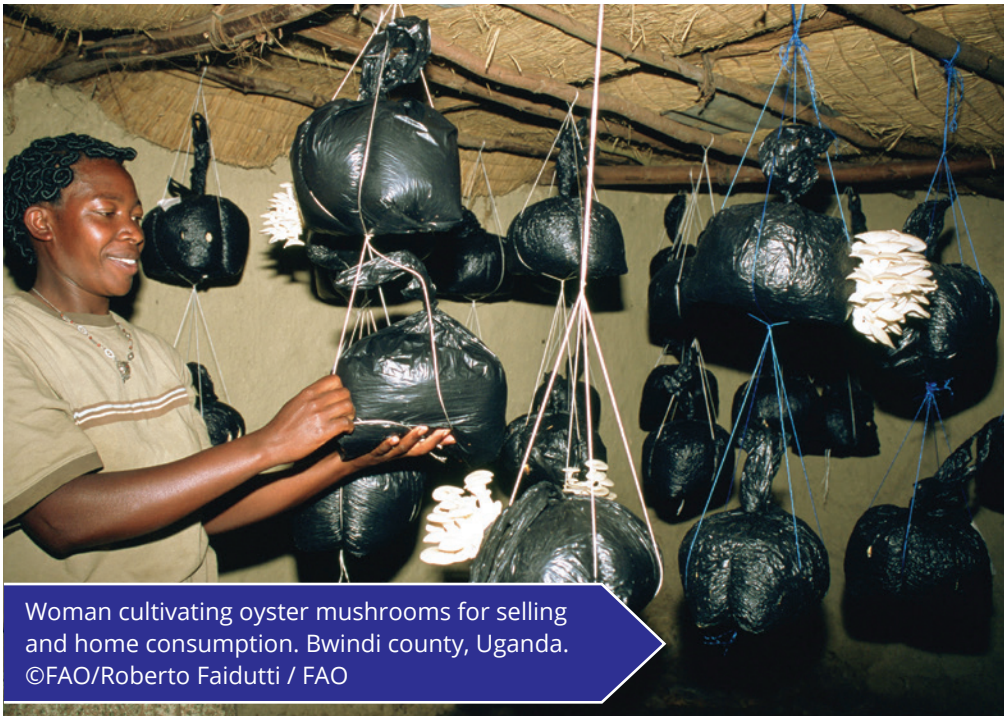
> The knowledge, skills and practices of both women and men contribute to the overall conservation, management and improvement of natural resources, and thus to the level and sustainability of food security and nutrition.

8.2.2 Gender issues in sustainable forest management and food security and nutrition

Women and men have different tasks and responsibilities in food production and food provision, as well as in the generation of cash income. This also means that they have different needs, opportunities, priorities and concerns. Forestry activities are typically gender-differentiated: while men are usually interested in trees for commercial purposes, women are more inclined to use forest products for subsistence, such as for food, fuelwood, fodder and soil fertility improvement. Although women tend to commercialize forest products less than men, the sale of forest products could be an essential source of cash income for women, who lack many of the opportunities for generating cash

70 International Development Research Centre. 2000. *Gender and Natural Resource Management in Latin America and the Caribbean: A MINGA Perspective*. Ottawa.

income commonly available to men.[71] Also, women often have highly specialized knowledge of forests and trees in terms of species diversity, management and use for various purposes, and a good understanding of conservation practices. Compared with men, women's knowledge tends to be linked more directly to household food consumption and health, which can be particularly important during food crises, when the collection and sale of forest products may be critical for household survival. However, women's knowledge is rarely recognized (See Box 9) in formal and informal forest management plans, and there is a need to support women's knowledge in the context of sustainable forest management to improve rural livelihoods, strengthen household resilience, and improve food security and nutrition.[72]



Woman cultivating oyster mushrooms for selling and home consumption. Bwindi county, Uganda. ©FAO/Roberto Faidutti / FAO

Gender bias and the unequal distribution between women and men of forest benefits (including food security and nutrition) should be analysed in a holistic manner. Some of the key issues for analysis

71 Sunderland, T., Achdiawan, R., Angelsen, A., Babigumira, R., Ickowitz , A., Paumgarten, F. & Reyes-García, V. 2014. *Challenging perceptions about men, women, and forest product use: a global comparative study. World Development, 64 (Supplement 1): S56–S66.* Available at www.sciencedirect.com/science/article/pii/ S0305750X14000692.

72 Excerpted from FAO. 2013. *Forests, food security and gender: linkages, disparities and priorities for action.* Available at http://www.fao.org/3/mg488e/mg488e.pdf.

include: women and men's unequal access to and control over natural resources; women and men's different work burdens and tasks; gender discrimination in terms of opportunities, education, training, skills and potential contributions to the forest sector; intersections with other areas of discrimination based on ethnicity, culture, class, age and disability; availability of sex-disaggregated data; and missing data that prevent stakeholders from drawing conclusions on gender-related priorities in the forest sector. Hence, activities aimed at improving sustainable forest management (Box 9) need to take into account gender analysis and data, as well as the integration of gender-transformative approaches to bring about changes in norms and behaviours that limit equal and full participation of both men and women.

Box 9: Case Study 7

Women and forest vegetables in Tanzania

Across Africa, vegetable consumption is lower than the recommended dietary intake. In the East Usambara Mountains in northeast Tanzania, the consumption of traditional leafy vegetables is the best predictor of children's overall micronutrient intake. The majority of leafy vegetables consumed in the area are wild, and collected by women from fields, field margins, fallows and agroforests. Survey data shows that, in the wet season, 46 percent of children aged two to five years consume vegetables on a daily basis, while in the dry season only 22 percent of children are able to do so. Proximity to the forest is a key determinant of vegetable consumption, particularly in the dry season. Local women reported that those who are poor and live far from the forest must spend a significant amount of time collecting vegetables. In addition, even though they have legal access rights, many women were hesitant to enter reserved forests to collect vegetables for fear of being suspected of illegal activities or of encountering others engaging in such activities (e.g. pit-sawing, mining or hunting). In this setting, having areas with tree cover on the family farm and near to the home supports year-round access to vegetables, with the potential to decrease women's workload and improve the nutrition of their families.

Source: Powell B., Hall, J. & Johns, T. 2011. *Forest cover, use and dietary intake in the East Usambara Mountains, Tanzania. International Forestry Review, 13(3): 305-317.*

8.2.3 Mainstreaming gender in forestry for sustainable food security and nutrition

As previously discussed, women and men experience life differently, have different needs and priorities, and development policies and interventions affect them differently. These differences are evident in forestry and natural resources management. Understanding the relationship between forest resources and food security requires attention to gender disparities at the local level, as well as the broader political and economic context in which these disparities are reinforced.[73]

The process of gender mainstreaming consists of: (i) conducting a gender analysis; (ii) identifying key opportunities for gender mainstreaming; and (iii) taking follow-up actions. Gender-responsive projects and programmes must be defined and justified by gender and social mapping and analysis grounded in outreach to women and men in affected communities in developing the project concept and parameters. The gender-analysis is a participatory process that seeks to collect and interpret as much information as possible on the different roles of women and men, while identifying their specific needs, priorities, activities and responsibilities. It relies on the collection and analysis of quantitative and qualitative sex-disaggregated data and gender information and can be a standalone activity, or it can be included as a key component of broader stakeholder analyses or social and situation assessments. The most useful gender analysis for project development not only describes gender disparities and how men and women are affected differently, but also analyzes why these differences exist and persist and what would be needed to overcome them. This process specifically addresses the gender inequalities that disproportionately undermine women's effectiveness as agents of change.

Using this practical tool at the outset of a project or programme can help ensure an equal participation of women and men, as well as ensure women's genuine contributions to stakeholder engagements by accounting for gender imbalances in power and access to information, and requires the inclusion of gender-sensitive indicators and sex-disaggregated data to accurately monitor progress.[74]

73 Asher, K. & Shattuck, A. 2017. *Forests and food security: What's gender got to do with it? Social Sciences, 6(4): 1–16.*
74 FAO. 2016. *How to mainstream gender in forestry.* Available at http://www.fao.org/3/a-i6610e.pdf.

Some practical questions can be asked during this analysis:

- **Who does what? How? Where? When? Why? (labour)**
- **Who uses what? How? Where? When? Why? (access)**
- **Who controls what? How? Where? When? Why? (power over decision-making and control)**
- **Who knows what? How? Where? When? Why? (power over and access to information)**
- **Who benefits from what? How? Where? When? Why? (benefit-sharing)**
- **Who is included in what? How? Where? When and Why? (participation)**

Based on the preliminary gender analysis conducted, the following technical areas – participation, capacity development, institutions and data collection – can be examined further, as they may provide key entry points for taking the next steps in helping to mainstream gender.

This section can be further elaborated by referring to the 2016 FAO Practical Field Guide on "How to mainstream gender in forestry". Available at http://www.fao.org/3/a-i6610e.pdf.

8.3 Approaches and Tools

Approaches and tools in this session may include (but are not limited to): group discussions, plenary presentations and reflections, role-playing and participatory mapping. Depending on the context, video presentations may be used to illustrate complex concepts and make the presentation livelier. Trainers should use different methods to suit the target group; energizers may be used to keep the learners alert.

8.4 Guiding Questions

1. What do you understand by different gender roles in the context of forestry and natural resources management?
2. What are the key gender issues in forestry activities that lead to different outcomes in terms of food security and nutrition?
3. What are the different gender roles and responsibilities in the context of sustainable forest management for better food security and nutrition in Tanzania?
4. What are the obstacles in gender mainstreaming in forest and natural resources management? What are some of the options to overcome these challenges?

8.5 Suggested Readings

1. CARE International Gender Network. 2012. *Good Practices Framework: Gender Analysis*. Brief. Available at www.care.org.au/wp-content/uploads/2015/02/Good-Practices-Brief.pdf.
2. CIFOR. 2015. *The landscape of gender research at CIFOR 2013 to present*. Bogor.
3. FAO. 2016. *How to mainstream gender in forestry: A practical field guide*. Available at http://www.fao.org/3/a-i6610e.pdf.
4. FAO. 2013. *Forests, food security and gender: linkages, disparities and priorities for action.* Background paper for the International Conference on Forests for Food Security and Nutrition. Rome, 13–15 May 2013. Available at www.fao.org/docrep/018/mg488e/mg488e.pdf.
5. FAO webpage on gender. 2019. Available at http://www.fao.org/gender/.

module

9

CHALLENGES AND OPPORTUNITIES: FORESTS AND TREES FOR FOOD SECURITY AND NUTRITION

9.1 Learning Objectives

Upon completing this session, the learner should be able to:

i. Understand the key challenges to ensuring the contribution of forests and trees to food security and nutrition

ii. Discuss forest governance as an important aspect of sustainable forest management and food security and nutrition

iii. Describe the effects of climate change and variability on forest ecosystem goods and services

iv. Apply knowledge to mitigate the challenges to sustainable food security and nutrition

9.2 Contents

- ✓ Governance challenges
- ✓ Deforestation
- ✓ Climate change and variability

9.2.1 Governance challenges[75]

At international and regional bodies in forestry (e.g. FAO Committee on Forestry, United Nations Forum on Forests), the role of forests in food security and nutrition has been addressed with increasing importance. However, the lack of food security and nutrition objectives in national forest policy, legal and institutional frameworks remains; conversely, the importance of forestry and sustainable forest management can also be neglected in national food security and nutrition objectives. This may lead to adverse effects on both sustainable forest management and food security and nutrition.

Some specific factors that contribute to food insecurity and malnutrition[76] include: unclear and insecure legal tenure rights; weak governance; unequal distribution of forest benefits and gender bias; inadequate services for forest-dwellers; absence of concrete guidance and knowledge on how best to manage forests to maximize food security and nutrition outcomes.

Further, lack of intersectoral coordination, especially between forestry and agriculture, can have negative impacts on land and forest management and consequently on food security and nutrition. For example, agriculture is the single largest driver of deforestation, yet land-use decisions resulting in conversion of forests to agriculture generally fall under ministries and jurisdictions other than forestry. Food security policies in general fall under the purview of the ministry of agriculture, and often directly encourage the expansion of agriculture into forest lands, with little appreciation of the role of forests in providing food security and supporting agriculture. Nutrition policies are typically under the purview of the ministry of health or under a stand-alone council, secretariat, or similar, which have little to no coordination with the ministry responsible for forestry.

9.2.2 Deforestation

Despite forests and trees having greater potential for improving food security and nutrition in Tanzania, loss of biodiversity and a decline in environmental benefits and services through deforestation

75 This section has been excerpted from *FAO. 2017. Strengthening sector policies for better food security and nutrition results – forestry.* Rome. Available at http://www.fao.org/3/a-i7215e.pdf.

76 FAO. 2013. *Forests and trees outside forests are essential for global food security and nutrition.* Summary of the International Conference on Forests for Food Security and Nutrition. Rome, 13-15 May 2013.

and degradation remain major challenges. Deforestation is a major problem in Tanzania for the forestry and other related sectors, with the deforestation rate estimated at 372 000 hectares per annum.[77] Among others, learning emphasis should be on sustainable harvesting of forest goods and services, improving land tenure, and controlled use of fires to achieve food security and nutrition objectives through forests and trees. Promotion on use of efficient kiln as an intervention to improve charcoal production is needed in order to realize significant outcomes in combating forest degradation and deforestation in Tanzania.[78]

Miombo woodlands being cleared for charcoal production in Tabora region, Tanzania. (© S. Augustino)

77 FAO. 2011. *Forests for Improved Food Security and Nutrition report.* Rome. Available at http://www.fao.org/docrep/014/i2011e/i2011e00.pdf.

78 Vermeulen, S.J., Campbell, B.M. & Ingram, J.S.I. 2012. *Climate Change and Food Systems. Annual Review of Environment and Resources, 37: 195–222.*

Overgrazing is a challenge in managing forests sustainably. (© S. Augustino)

9.2.3 Climate change and variability

The positive and negative effects of climate change and variability on food security and nutrition need to be understood. Forest foods have inherent resilience to rapid climate change and variability, as opposed to exotic food species and most agricultural crops. This enables the forest foods available for consumption to serve as buffers against food stress in periods of low agricultural productivity due to adverse climate events such as prolonged drought.[79] Forests and trees can also have positive effects to climate change and variability, as they absorb about 10 percent of global carbon emissions when managed sustainably, thus mitigating the negative impact of carbon emissions on sustainable agriculture and food security and nutrition. The long-term impact on diminished agricultural production and productivity created by a loss of forest ecosystem services that are critical for supporting agriculture (e.g. regulating water flows, stabilizing soils, maintaining soil fertility, regulating the climate and providing

79 Arnold, M., Powell, B., Shanley, P. & Sunderland, T.C.H. 2011. *Editorial: Forests, biodiversity and food security. International Forestry Review, 13 (3): 259-264.*

habitat for wild pollinators and predators of agricultural pests), will significantly affect the greater population beyond those who live in and near forests.

9.3 Approaches and Tools

Group discussions, plenary presentations and reflections, participatory mapping and ranking, are approaches to be used. Energizers may be used to keep the learners alert. Particularly when identifying challenges and opportunities in the country context, small-group work discussions can take place followed by plenary presentations.

9.4 Guiding Questions

1. What are the key challenges to ensuring the contribution of forests and trees to food security and nutrition?
2. How is forest governance an opportunity to contribute to food security and nutrition in Tanzania?
3. Using evidence, can you discuss the effects of climate change and variability on sustainable food security and nutrition in Tanzania?
4. What measures can be taken to mitigate the challenges facing forestry for food security and nutrition in Tanzania?

9.5 Suggested Readings

1. Augustino, S., Eriksen, S., Makonda, F.B.S., Ishengoma, R.C., Gillah, P.R. & Migunga, G.A. 2016. *Climate Change Impacts on Livelihoods and Adaptation Strategies within the Non-timber Forest Products Resources Context: REDD+ lessons for Tanzania*. In: *Book on Tanzania Experiences with REDD+: Lessons Learnt. Climate Change Impacts, Adaptation and Mitigation Project, Sokoine University of Agriculture Tanzania.*
2. FAO. 2017. *Committee on World Food Security Policy recommendations on sustainable forestry for food security and nutrition.* Available at http://www.fao.org/3/I8877EN/i8877en.pdf.

3. FAO. 2017. *Strengthening sector policies for better food security and nutrition results – forestry.* Available at http://www.fao.org/3/a-i7215e.pdf.

4. FAO. 2013. *Towards food security and improved nutrition: increasing the contribution of forests and trees*. Available at http://www.fao.org/3/i2969e/i2969e.pdf.

5. Ministry of Natural Resources and Tourism. 2015. *National Forest Resources Monitoring and Assessment of Tanzania Mainland: Main Results.* Dar es Salaam.

Definitions

Agriculture: the cultivation of crops and animal husbandry as well as forests, fisheries, and the development of land and water resources.[a]

Agroforestry: all land-use systems or forms of technology where woody perennials are deliberately used in the same land management unit as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence, valorizing both ecological and economic interactions between the various components.[b]

Biomass energy: energy obtained from burning wood plants, and other organic matter.

Carbon sequestration: the process by which atmospheric carbon dioxide is taken up by trees, grasses and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils; the sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide to the atmosphere, such as deforestation, forest fires and fossil fuel emissions.[c]

Climate change: a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability.[c]

Climate change adaptation: the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Climate change mitigation: consists of actions to limit the magnitude or rate of long-term global warming and its related effects.

Climate variability: variations in the mean state and other statistics of the climate on all temporal and spatial scales, beyond individual weather events.

Commercialization: the process of making a product or service available for sale to the public for profit maximization.

Culture: the system of shared symbols, behaviours, beliefs, values, norms, artifacts and institutions that the members of a society use to cope with their world and with one another, transmitted from generation to generation through learning.

Deforestation: the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.[c]

Domestication: the act or process of converting plants/animals from their natural habitat, introducing them to a modified habitat, and providing the means for them to maintain themselves in the new location.

Ecotourism: travel undertaken to witness the unique natural or ecological quality of particular sites or regions, including the provision of services to facilitate such travel.[c]

***Ex situ* conservation:** the management and protection of a species or its populations or individuals outside their native or original environment either as seed gene banks or field gene banks. This approach is preferred in situations where the populations are in real danger of physical destruction or genetic deterioration due to excessive pressures in their natural habitat.

Food security: a state in which all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Forest: land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land.[c]

Forest degradation: the reduction of the capacity of a forest to provide goods and services.[d]

Forest governance: the way in which forest stakeholders negotiate, design and enforce binding decisions about the management, use and conservation of forest resources.

Forest product: any material derived from the forests, whether natural or plantation, for direct consumption or commercial use.

Gender: the socially constructed norms, roles and relations that a given society considers appropriate for women and men; determining what is expected, permitted and valued in a woman or a man in a determined context.

Gender bias: unequal treatment in terms of opportunity and expectations due to attitudes based on the sex of an individual or group of individuals.

Gender mainstreaming: the process of assessing the implications for women and men of any planned action in all areas and at all levels; making both the concerns and experiences of women and men an integral dimension of all agriculture and rural development efforts.

***In situ* conservation:** the deliberate management and protection of a species or its populations or individuals in the natural habitat. Emphasis in conservation of forest genetic resources has been on *in situ* conservation, in contrast to crop genetic resources, which put more emphasis on *ex situ* conservation.

Indigenous knowledge: the knowledge acquired through frequent interaction with the local environment, driven by culture and the need to pursue daily subsistence strategies for food and economic provision.

Land tenure system: the relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land and associated natural resources (including water, trees, minerals and wildlife); rules of tenure define how property rights in land are allocated within societies and may determine who can use what resources, for how long, and under what conditions.[(d)]

Malnutrition: a condition resulting from nutrient deficiency or overconsumption; it can be categorized as undernutrition when deficiency of nutrients or over nutrition results in stunting growth or obesity.

Non-wood forest products: goods derived from forests that are tangible and physical objects of biological origin other than wood.[(c)]

Nutrition: the intake of food, considered in relation to the body's dietary needs.

Resilience: the ability of a human or natural system to adapt or adjust to climate change, including to climate variability and extremes; to prevent or moderate potential damages; to take advantage of opportunities; or to cope with the consequences.

Shrub: a woody perennial plant, generally more than 0.5 metres and less than 5 metres in height at maturity and without a definite crown. The height limits for trees and shrubs should be interpreted with flexibility, particularly the minimum tree and maximum shrub heights, which may vary between 5 and 7 metres.[(c)]

Trees: woody perennials with a single main stem, or in the case of coppice with several stems, having a more or less definite crown.[(c)]

Trees outside forests: all trees and/or shrubs on agricultural/urban land, irrespective of plant height, patch area, width or canopy cover; they may be planted or not, and occur with various densities and spatial patterns.

Value chain: the series of processes in a manufacturing system that adds value to an end product.

Woodfuel: all types of fuels originating directly or indirectly from woody biomass.[c]

Note:

The definitions came from the following sources:

[a] FAO. 2003. Multilingual thesaurus on land tenure. Rome, FAO. Also available through FAO TERM PORTAL: http://www.fao.org/faoterm

[b] FAO. 2013. *Advancing Agroforestry on the Policy Agenda: A guide for decision-makers*, by Buttoud, G., in collaboration with Ajayi, O., Detlefsen, G., Place, F. & Torquebiau, E. *Agroforestry Working Paper no. 1*. Rome, FAO.

[c] FAO. 2012. *Forest Resources Assessment (FRA) Terms and Definitions*. Rome, FAO.

[d] FAO. 2016. *State of the World's Forests 2016. Forests and agriculture: land-use challenges and opportunities.* Rome, FAO.

FAO Representation in the United Republic of Tanzania
House H Sida, Ali Hassan Mwinyi Road - Ada Estate
P.O.Box 2, Dar es salaam
Tel.: +255 22 2664557-9
E-mail: FAO-TZ@fao.org

ISBN 978-92-5-132028-0
9 789251 320280
CA7249EN/1/04.20