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Good agricultural practices for sustainable cocoa production: a guide for farmer training

Manual no. 3: Conservation and biodiversity in and around cocoa farms

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Publication date:
2009

Document version
Early version, also known as pre-print

Citation for published version (APA):
Asare, R., David, S., & Sonwa, D. (Eds.) (2009). *Good agricultural practices for sustainable cocoa production: a guide for farmer training: Manual no. 3: Conservation and biodiversity in and around cocoa farms*. Forest & Landscape, University of Copenhagen. Development & Environment No. 12/2009

Download date: 13. Nov. 2026

FOREST & LANDSCAPE

Good agricultural practices for sustainable cocoa production: a guide for farmer training

DEVELOPMENT AND ENVIRONMENT - REVISION 2011 12 / 2010

Manual no. 3: Conservation and biodiversity in and around cocoa farms

By Richard Asare and Sonii David

FACULTY OF LIFE SCIENCES
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Good agricultural practices for sustainable cocoa production: a guide for farmer training

Manual no. 3: Conservation and biodiversity in and around cocoa farms

Compiled and edited by Richard Asare, Sonii David and Denis Sonwa

Contributions from:

Forestry Development Authority (FDA)

Environmental Protection Authority - Liberia

Fauna and Flora International, Liberia

Conservation International Ghana

The World Bank
East Nimba Nature Reserve (ENNR)

Ministry of Agriculture Liberia

World Cocoa Foundation

USAID - Liberia

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Title
Good agricultural practices for sustainable cocoa production: a guide for farmer training. Manual no. 3: Conservation and biodiversity in and around cocoa farms

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Cover Photo
Cocoa agroforest. Photo: Richard Asare

Publisher
Forest & Landscape Denmark
University of Copenhagen
Hørsholm Kongevej 11
DK-2970 Hørsholm

Press
Prinfo DK-9100 Aalborg

Series - title and no.
Development and Environment No. 12-2009

ISBN
ISBN 978-87-7903-420-4 (print)
ISBN 978-87-7903-421-1 (internet) Revised 2011

DTP
Melita Jørgensen

Citation
Asare, R., David, S. and Sonwa, D. (eds.) 2009. Good agricultural practices for sustainable cocoa production: a guide for farmer training. Manual no. 3: Conservation and biodiversity in and around cocoa farms. Development and Environment Series 12- Revised 2011. Forest & Landscape Denmark.

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About the Sustainable Tree Crops Program (STCP)

STCP is a public-private partnership and innovation platform that seeks to generate growth in rural income among tree crop farmers in an environmentally and socially responsible manner in West/Central Africa. This is achieved by introducing innovations to enhance productivity, increase marketing efficiency, diversify farmer income, and strengthen the institutional and policy environment. STCP, which is managed by the International Institute of Tropical Agriculture (IITA), provides a framework for collaboration between farmers, the global cocoa industry, local private sector, national governments, NGOs, research institutes, and development investors.

About International Institute of Tropical Agriculture (IITA)

Africa has complex problems that plague agriculture and people's lives. We develop agricultural solutions with our partners to tackle hunger and poverty. Our award winning research-for-development (R4D) is based on focused, authoritative thinking anchored on the development needs of sub-Saharan Africa. We work with partners in Africa and beyond to reduce producer and consumer risks, enhance crop quality and productivity, and generate wealth from agriculture. IITA is an international non-profit R4D organization since 1967, governed by a Board of Trustees, and supported primarily by the CGIAR.

Contributors and acknowledgements

Financial contribution for this document comes from the World Bank and USAID-Liberia. The World Bank-supported East Nimba Nature Reserve (ENNR) project implemented by Sustainable Tree Crops Program (STCP) of the International Institute of Tropical Agriculture (IITA) is part of a wider program to support the development of the forestry sector in Liberia through the Forestry Development Authority (FDA).

Many people contributed to this manual. Yaw Osei-Owusu (Conservation International-Ghana) developed the technical bulletins on biodiversity and wildlife conservation. Richard Asare (Forest and Landscape Denmark and IITA/STCP) and Denis Sonwa (IITA/STCP) developed the technical bulletins on cocoa agroforestry and tree diversification.

The farmer learning group exercises contained in this manual were initially developed by participants at a workshop organized by STCP in February 2008 in Monrovia, Liberia. These exercises have since been revised and new ones added. Workshop participants represented the following institutions:

- Forestry Development Authority (FDA), Republic of Liberia
- Environmental Protection Authority (EPA), Republic of Liberia
- Ministry of Agriculture, Republic of Liberia
- Conservation International, Liberia
- Fauna and Flora International, Liberia
- International Institute of Tropical Agriculture

Lastly, we gratefully acknowledge technical input provided by reviewers from UTZ Certified, Fairtrade International and Rainforest Alliance. Their input helps ensure that STCP curricula comply with the certification standards on good agricultural practices.

Acronyms

CGIAR	Consultative Group on International Agricultural Research
ENNR	East Nimba Nature Reserve
EPA	Environmental Protection Authority, Liberia
FDA	Forestry Development Authority, Liberia
FFS	Farmer Field School
HWC	Human wildlife conflict
ICPM	Integrated crop and pest management
IITA	International Institute of Tropical Agriculture
NGO	Non-Governmental
STCP	Sustainable Tree Crops Programme
ToT	Training of trainers

Glossary

Biodiversity: the variety of all living things on earth

Buffer zone: this is a defined natural or artificial strip of undisturbed area that serves the purpose of separating two land uses from each other

Cocoa agroforestry: a shade grown cocoa farm that have timber trees, fruit trees and food crops grown together with cocoa

Ecology: the relationship between organisms and their environment

Ecosystem: a community of living and non-living things that interact and affect one another

Endemic species: Species found only in a particular environment or habitat

Habitat: a location that supplies all that an animal, plant or other organism needs to survive – air, light water, food shelter and space.

Nature Reserve: this is an area kept for biodiversity conservation. It is important for wildlife, flora, fauna or geological characteristics and other special interest

Population: the total number of individuals or items that live in a specified area and share one or more characteristics

Protected area: this is land especially dedicated to the protection and maintenance of biological diversity, natural and associated cultural resources, and managed through legal or other effective means

Species: a group of organisms with special characteristics that enable them to produce young ones. Any given species cannot successfully reproduce with any other

Totem: In traditional African belief systems, any thing, being or creature that watches over or assists a group of people such as a family, clan or tribe or individuals

Preface

While cocoa has been grown in West and Central Africa since the early 1990s, using participatory approaches to train cocoa farmers is relatively new in this region. Cocoa extension programs have used traditional top down approaches such as the training and visit approach based on the "technology transfer" model. Typically, the results have been disappointing, with relatively few farmers adopting the promoted practices. By the 1990s, most national cocoa extension systems had collapsed.

To meet the objective of training farmers to become "experts" in their own fields, STCP has developed a series of manuals on specific topics:

Manual no. 1: Planting, replanting and diversification in cocoa systems
Manual no. 2: Integrated crop and pest management for mature cocoa farms
Manual no. 3: Conservation and biodiversity in and around cocoa farms
Manual no. 4: Preventing and reducing injuries and ill health in cocoa production
Manual no. 5: Methods for training farmers on sustainable cocoa production

In addition, two illustrated guides, *Improve your cocoa production* and *Protecting your safety and health on cocoa farms*, designed for use by low literacy farmers are available.

All manuals and related extension materials can be downloaded from the STCP website (www.treecrops.org). Many are also available in French.

The curricula outlined in the STCP manuals can be adapted to different training methodologies including, but not limited to, farmer field schools (FFS), farmer learning groups (FLG) and participatory demonstrations. Regardless of the training method used, the objective should be to allow farmers to make their own discoveries about the topic concerned through carrying out field and discovery leaning exercises. It is therefore important that training programs adopt a participatory approach whereby farmers' existing knowledge is acknowledged (and corrected where necessary) and used as the starting point for learning. Learning should be facilitated by a trained facilitator and where possible, farmers should have the opportunity to be involved in selecting the training topics.

The STCP training manuals are intended as guides for trainers involved with participatory training of cocoa farmers. Trainers may be extension agents or farmers who have gone through a comprehensive training of trainers (ToT) program on participatory training of cocoa farmers. Although the exercises contained in the manuals have for the most part been field tested, they should be treated as guides to be used flexibly and creatively by trainers. The content of each curriculum should be adapted to the context and situations of farmer training by, for example, changing the names of case study characters, currencies, pesticide dosage etc.

Introduction to conservation and biodiversity in and around cocoa farms

Numerous studies and initiatives in recent years indicate that cocoa production constitutes both a threat and opportunity for biodiversity conservation in West and Central Africa. Because the crop is a major income earner for smallholder farmers in these areas, farmers have traditionally expanded their cocoa farms by cutting down forests. On the other hand, shade grown cocoa farms can reduce encroachment into forests and protected areas, provide ecological connectivity among protected areas and provide on-farm habitats for certain wildlife species. In addition, well-managed shade grown cocoa farms can also maintain soil and hydrological services as well as act as carbon sinks.

To counteract current conditions and market forces that are motivating cocoa farmers to encroach on forests, there is an urgent need to educate and sensitize cocoa farmers on how they can play a positive role in biodiversity conservation while at the same time improving productivity on their cocoa farms. In 2007 the Sustainable Tree Crops Program (STCP) initiated a project in the East Nimba Nature Reserve (ENNR) in north-western Liberia to promote sustainable cocoa production. A distinguishing feature of that project was the focus on training farmers on two interrelated issues: cocoa integrated crop and pest management (ICPM) and biodiversity and wildlife conservation, based on the premise that cocoa farmers can play a proactive role in conserving nature if they have technical knowledge to improve cocoa productivity in a sustainable manner and have a good understanding of interactions between cocoa and the wider agro-ecology.

To improve farmers' knowledge on biodiversity and wildlife conservation and strengthen their decision making capacity, STCP uses the farmer learning group (FLG) approach. The manual on biodiversity and wildlife conservation in cocoa landscapes near protected areas helps farmers to understand:

- The importance of biodiversity and wildlife conservation,
- Their role as ecosystem managers,
- Develop strategies for mitigating human-wildlife conflict,
- The national laws on biodiversity conservation and
- Develop an appreciation of the economic and conservation value of cocoa agroforests.

Although the training exercises were specifically developed for use in Liberia, they can easily be adapted to other contexts.

This publication was developed by STCP as a guide for trainers involved in participatory training of cocoa farmers on biodiversity and wildlife conser-

vation near protected areas. Trainers may be extension agents or farmers who have gone through a comprehensive training of trainers (ToT) program on participatory training of cocoa farmers.

The manual is divided into two sections. Section one contains bulletins that provide trainers with technical information on key topics related to biodiversity and wildlife conservation in cocoa landscapes near protected areas. Section two consists of learning exercises for use in participatory farmer training. The content of this manual, particularly the farmer learning protocols in section two, should be adapted to the context and situations of farmer training by, for example, changing the names of case study characters, currencies etc. The exercises should be treated as guides to be used flexibly and creatively by trainers. The exercises can also be used in cocoa certification training as they satisfy the standards for the Rainforest Alliance certification codes.

Because the training materials are very much a work in progress, feedback and comments on this publication are therefore warmly welcome and should be sent to:

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As we integrate new materials, this manual will be updated periodically

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July, 2011

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Part I: Technical bulletins for trainers

What is biodiversity and wildlife conservation?

Biodiversity is life

The word biodiversity is the short form of the term *'biological diversity'*. Biodiversity is the variety of all living things on Earth. This includes the millions of species (people too) that live on land, freshwater systems and oceans. It also includes the tiny organisms that we can see only with a microscope as well as fungi, plants, the trees, ants, beetles, butterflies, birds and the large animals (elephants, whales, bears, etc).

Weaver ant (*Oecophylla longinoda*)

A species is a group of organisms with special characteristics that enable them to produce young ones. Any given species cannot successfully reproduce with any other.

But biodiversity is much more than the large variety of species that exist on earth. It includes individuals that form populations, populations that form species and the relationship that exist between species that form what is called communities. It is also the many functions that natural systems perform – like producing clean water and fresh air – which are essential to wild species and humans.

Biodiversity conservation refers to the conservation of gene, species and different habitats. Each plant or animal needs good habitat and food resources to grow, develop and reproduce. Forest is a suitable habitat for many plants and animals. In the forest, the mixture and composition of different forest plants, contribute to the creation of wide variety of shelter, nesting habitat and food resources.

Biodiversity provides the following benefits

- *Production of soils and maintenance of soil fertility*
- *Maintenance of air quality*
- *Maintenance of water quality*
- *Pest control*
- *Decomposition of wastes*
- *Pollination and crop production*
- *Climate stabilization*
- *Prevention and mitigation of natural disasters*
- *Provision of food security*
- *Provision of health care*
- *Income generation*
- *Spiritual / cultural values*

How does biodiversity help us?

Biodiversity is the foundation of human society. It provides the basic need of humans. It provides the air we breathe, the water we drink, the food we eat, the medicine we use to heal ourselves, and the shelter we need to protect us from the weather. For example, about 30% of all medicines on the market have been developed from plants and animals. All organisms have value, whether we can see their direct benefit or not.

Where is biodiversity?

Wherever there is life, there is biodiversity. It exists in the largest cities and your own farm and backyard. Even where humans have difficulties surviving such as in the frozen Arctic or dry deserts areas, other species live. Tropical habitats contain a large number of species and the relationship between the species is complex. Other habitats

Buttress roots of tropical tree

such as deserts are equally important but less complex. And oceans, coral reefs, estuaries and inlet harbour life are as important as life on land.

No matter where we look and no matter where we choose to develop natural resources, there are numerous life forms that must be considered. They all play a role in maintaining the environment and create many of the resources that we use for development.

How many species exist?

Around the world, scientists are still identifying new species. So far they have identified about 1.75 million species. The largest group of species is insects and some 600,000 of those insect species are beetles. But scientists estimate that there are between 30 and 100 million species of plants, animals and microorganisms (tiny bacteria and other animals) on Earth that have not yet been identified. Many of these yet unknown species are likely to be found in the tropics.

The number of species includes:

- *4,500 mammals*
- *10,000 birds*
- *1,500 amphibians and reptiles*
- *22,000 fishes*
- *270,000 plants*
- *960,000 insects*

Endemic species and their habitat

Some species are common around the world. But others, called endemic species are found only in a particular environment or habitat. Endemic species are so used to their specific habitat that they cannot survive elsewhere. An example of an endemic species is the *Nimba flycatcher* bird (*Melaenornis annamarulae*) found only in Nimba County, Liberia.

A habitat is a home that supplies all that an animal, plant or other organism needs to survive – air, light water, food shelter and space.

Because the existence of endemic species may be a sign of an unusual habitat, endemic species are of great scientific importance. Changes in their numbers may indicate that changes in their special habitats are occurring.

Is biodiversity in trouble?

Changes in habitat are caused by activities such as farming, mining, logging, development of roads and new settlements. In most parts of West Africa logging and agriculture are the principal cause of habitat destruction. In this way, plants and animals which previously used such places are displaced or destroyed, leading to loss of biodiversity.

Habitat destruction is currently ranked as the most important cause of species extinction. When a habitat is destroyed it can no longer provide food for plants, animals, and other organisms that live in that habitat. Therefore the population of these species either go down or the species are lost completely (become extinct) leading to loss of biodiversity.

Slowing down biodiversity losses

There are many ways to reduce biodiversity loss. One way is to observe good agricultural practices on farm. Another way to slow down biodiversity losses is to establish protected areas with the goal of conserving both species and natural systems. Examples of protected areas in Liberia include the Sapo, Lofa-Mano, and

Burnt field

Tienpo National Parks

There are many highly diverse unprotected habitats that are threatened by human activities. In some countries governments, NGOs and scientists work with local communities and the private sector (for example mining and logging companies) on how best to conserve biodiversity by developing strategies to ensure that development projects do not cause biodiversity loss. Communities play an important role in developing these strategies.

Traditional practices for biodiversity conservation

Traditional Beliefs

Biodiversity conservation finds its root in the traditional African belief. Africans generally hold the view that all things were created by God to live in harmony. Thus according to African traditional belief systems, all aspects of the ecosystem and the environment have a strong spiritual meaning.

Traditional conservation practices

Traditional African beliefs are expressed in various practices that have enabled Africans to keep people and biodiversity links active. Such practices include:

- Preserving certain trees because they are considered to house spirits
- Creating sacred areas where access is restricted (for example sacred forests or sacred groves, elephant forests, monkey forests, etc.,)
- Attributing a tribe's existence to a particular species and making it an offence to destroy that species (totem)
- Banning activities (for example hunting, farming and/or fishing) in certain areas for certain periods of time
- Cultivating and breeding certain species of plants and animals
- Farming to conserve biodiversity
- Protecting streams and rivers
- Land tenure system
- Forests and groves serving as cultural and social spaces and as a source of livelihood products and services
- Deity worshiping
- Festivals

Preserving certain trees because they are considered to house spirits

Being aware of the need for sustainable forest exploitation, rural Africans have preserved certain trees because they are believed to house spirits or possess certain spirits. Felling trees of cultural or spiritual value without performing certain rituals is considered a taboo in many African communities. This custom has led to the protection of some trees such as Iroko (*Chlorophora excelsa*), and Ceiba (*Ceiba pentandra*).

Creating sacred areas where access is restricted (sacred forests, sacred groves, elephant forest, etc)

Sacred groves are pieces of land set aside for spiritual purposes. They are found all over Africa. They range from a few square meters to several hectares. Apart from using such areas to collect medicinal herbs and as burial grounds for chiefs, sacred groves are untouched and protected by traditional laws. Farming, hunting, burning, tree cutting and firewood gathering in

those areas are prohibited. Sacred areas tend to have rich biodiversity. The animals in those areas are regarded as sacred and therefore protected from hunting. The traditional Sande and Poro (secret) societies in Liberia carry out their rituals in sacred groves and rivers.

Attributing a tribe's existence to a particular species and making it an offence to destroy that species (totem)

Totem:
A totem is any thing (or being or creature) that watches over or assists a group of people such as a family, clan or tribe, or individuals.

In many African societies, people and even individuals have totems. It is considered by both categories as a »thing of possession«, »thing of birth«, »thing of the back of men«. These phrases express the idea that the totem always accompanies and guides a person, belongs to that person, and warns him/her of dangers. Totems may be animals, plants or natural phenomena.

It is believed that the totem punishes anyone who goes against a taboo and that a close relationship exists between the totem animals and the people. The group totems, especially the animal totems, are considered to be the residence of the ancestors. They are therefore respected and given offerings. Group members are forbidden to kill or trap these animals. In some cases, persons with the same individual totem may come together to form societies. The Leopard Society, a secret association, found in Liberia, Côte d'Ivoire and Sierra Leon is an example of groups of people with the same individual totem.

Banning activities in certain areas for certain periods of time (hunting, farming and/or fishing)

In many African communities, certain activities are banned in certain areas during certain period of time as a way of protecting habitat. For example, in Ghana farm activities and fishing are not allowed on Tuesdays. Also in some parts of Liberia in the past, hunting and farming in dense forests was prohibited while fishing was restricted to certain portions of river. To prevent overfishing, fishing by individuals in communal streams was discouraged and fish was only harvested once a year during the dry season.

Hunting of certain animals including leopards, chimpanzees, and lions was strictly forbidden. In this way communities were able to protect wildlife population. For instance, traditional management practices prevent over fishing and habitat damage in the Gwainyea area. Also leopards and chimpanzees are not allowed to be killed in Jedepo (Sinoe) and Waja (Sapo) all in Liberia.

Cultivating and breeding certain species of plants and animals

All over Africa, indigenous plants are used to prevent and cure diseases in domestic animals and humans. For instance, in Liberia, *Pygeum africanum* (a herbal medicinal plant found around Mt. Nimba), is used for curing urinary disorders. Also trees like *Alstonia boonei, Pycnanthus angolensis, Khaya ivorensis,* etc., are used for medicinal purposes. Most medicinal plants are cultivated near houses and in home gardens to make them easily available and protected from the wild. In some societies some plants can only be harvested after certain rituals are performed. This reduces the widespread harvesting of those plant species and therefore helps to conserve them.

Farming to conserve biodiversity

Traditional farming practices often support sustainable land and water management. Food crop production in most parts of West Africa is not mechanized, but done by family members using basic tools. In some parts of the region, such as Liberia, farmers practice bush-fallow system of agriculture. This allows land to lie fallow for several years to restore its natural fertility. The traditional practice of growing several different crops on the same piece of land ensures optimum utilization of nutrients.

Protecting streams and rivers

In some African communities, it is forbidden to clear vegetation along a strip of 30 m on the banks of streams and rivers. This practice helps prevent seasonal drying of streams and rivers and ensures continuous water flow throughout the year. In some areas, logging and farming near river banks are not allowed to protect the rivers. In some communities, rivers and streams are treated as sacred and it is considered a taboo to use poisonous chemicals to fish. For instance, it is forbidden to fish in the Torgwu Creek in Zor Clan in Nimba County, Liberia but people are allowed to drink the water.

Land tenure system

Traditionally in most parts of Africa, land and other natural resources are considered to be common, communal, clan or extended family property. This means that every member of the family has the right to use and manage these resources with respect to hunting, collecting firewood, harvesting fruits, nuts, leaves and farming or livestock grazing. Traditional regulations governing the use of communal land have ensured long term conservation of plants for common use. Taboos also exist against hunting certain species of wild animals.

Most traditional conservation practices are enforced by tradition and traditional means. For example, not respecting a fishing ban may be punished by a fine in the form of a sheep and two bottles of local alcohol. Such traditional means of enforcement have been effective and account for the continued protection of biodiversity. In recent times, the role of local people in protecting and enriching biodiversity and landscapes, rather than destroying them, has been recognized and now development actors prefer to take a community based approach to conservation.

Farmers as Ecosystem Managers

What is an ecosystem?

A woman planting cocoa seed

Everything in the natural world is connected – living and non-living. Every species affects the lives of those around it. An ecosystem is a community of living and non-living things that interact and affect one another. It has no particular size - it can be as large as a desert or a lake or as small as a tree or a puddle.

An ecosystem includes **soil**, **atmosphere**, **heat** and **light** from the sun, **water** and **living organisms.**

Ecosystem Management is a management practice that preserves and sustains the ecosystem while providing a range of goods and services to present and future generations. The purpose of a good ecosystem management is to carefully use what is in the ecosystem without losing parts of it.

Ecosystem management provides solution to many local, regional, national, and international forest management practices when adopted. It also protects the environment, maintains healthy ecosystems, permits sustainable development and preserves biodiversity.

How do farmers manage the ecosystem?

Farmers play an important role as ecosystem managers since farming is the largest managed ecosystem in the world.

As a result farmers hold the power to stopping or reversing rapid ecosystem destruction through good farming practices. Farmers are therefore seen as good ecosystem managers if they produce food continuously on a piece of land without causing irreversible damage to the ecosystem.

Farmers show their abilities in ecosystem management through the following activities:

- Land preparation and planting
- Farming systems – agro forestry, mixed cropping, crop rotation etc
- Soil and water management
- Diseases and pest management, including integrated pest management
- Local climate management

Land preparation and planting

All over Africa farmers have used their experiences over centuries to develop farming systems that yield good economic returns and also keep the environment in a good state.

A farmer holding a cutlass

For instance, African farmers use simple tools like machetes (cutlasses), hoes, axes etc., to clear small area of land and leave the rest of land to serve as habitats for wild-life. Farm animals when allowed to graze freely in the fields after harvest or before land preparation can improve soil fertility by their droppings (manure). Sometimes farmers develop local crop varieties that produce good yields.

Agroforestry practices can help to stabilize the ecosystem

A cocoa farm with different plant species

Agroforestry is a land-use system in which trees, shrubs, palms and bamboos are deliberately planted together with agricultural crops or on grazing land. For example, farmers in most parts of Africa, keep a number of forest tree species, fruit trees and shrubs on their farms. These trees provide fruit, fuel and fodder, give shelter to birds and animals, improve soil fertility and maintains the general ecosystem of the farm. A shaded cocoa farm for example supports up to 180 species of birds that help control insect pests and disperse seeds.

Traditional mixed cropping system

Alley cropping of a tree crop with an arable crop

Some farmers plant two or more crops on the same piece of land. By so doing they maximize available land space and this helps to reduce soil erosion and increase the different kinds of plants on the land. When farmers allow some crops to remain on the land after others are harvested, soil erosion is checked. Erosion can damage the quality of rivers, streams and lakes through deposits of sediments. It can also damage the places where fishes lay and hatch eggs.

Rotational cultivation

Under a rotational system, farmers grow different crops after each other on the same piece of land. Rotating crops when done well, add nutrients to the soils. Crop rotation is also used to control pests and diseases that can become established in the soil over time and helps to check soil erosion because the land is not allowed to lie fallow.

Soil and water management

Farmers have developed various methods to improve or maintain soil fertility thereby preserving the ecosystem. Some use ant refuse to fertilize crops such as tomatoes, chili and onions. In the process of farming they ensure the protection of the ants that provide them with 'fertilizer'. Farmers also allow leaves, seeds, fruits and husks that fall to decay to serve as organic matter to enhance soil fertility and water retention.

Diseases and pest management

Pest infested cocoa farm

Integrated pest management (IPM) is a system whereby farmers use various methods to control pests and diseases. These include good farming practices (growing a combination of different crops, managing shade etc), using chemical pesticides carefully and only when necessary and protecting non-harmful insects and insects that feed on harmful insects.

This combination of methods to control pests reduces the need to use agro-chemicals which are for the most part harmful to the environment. For example, the combination of maize and groundnut reduces corn borer damage to corn, and attacks by the diamond-backed moth on cabbage fall sharply when cabbage is intercropped with tomatoes. Also oil palm trees can be used as a barrier against the transmission of the swollen shoot disease virus in cocoa.

Microclimate management practices

Local climate can play an important role in the lives and incomes of smallholders in Africa. Farmers have therefore developed several ways of influencing microclimate so as to improve the conditions under which crops and animals can grow. The effects of strong winds, dry air and high temperatures on plants and animals can be negative.

A young IPM cocoa farm

When crops and animals are protected against these harsh weather conditions, yield is increased and losses reduced. Farmers influence microclimate by retaining and planting trees which reduce temperature, wind speed, evaporation and direct exposure to sunlight, and intercept rain. Farmers also use mulch to reduce excessive heat from the sun on soil surfaces and reduce soil moisture losses.

A typical cloudy day in Liberia

Ecological importance of the forest

What is ecology?

Ecology refers to the interaction among living and non-living things in a particular area. In the case of forests, living things include trees, shrubs, vines, grasses, herbaceous plants, mosses, algae, fungi, insects, mammals, bird, reptiles, amphibians, and micro-organisms living on plants/animals/soil. In the forest, such organism inter-act among themselves and also with non-living components such as soil, water and minerals.

What is a forest?

The forest structure is made up of a variety of plants at different heights, ages and morphologies. The forest comprises an underground part, forest floor, and several layers of plants (from herbs at ground level to shrub level/canopy strata/high trees).

A forest consists of many different aspects that help to provide many types of habitats and food species for several types of species. This structure also helps in modulating nutrients and water flow in the forest. A forest is a dynamic industry composed of 3 main groups of plants and animals, namely:

- Producers
- Consumers and
- Decomposers

Producers (mainly green plants) manufacture food (plant parts such as leaves, roots, the trunk, fruits etc.) from sun, water and minerals.

Consumers feed directly or indirectly on producers (plants). First order consumers include herbivorous (»plant eating«) animals, such as pest insects, which eat plants directly. Second order consumers include carnivorous animals, such as spiders, frogs, but also insect parasites, which eat the consumers of the first order. The third order consumers are carnivorous animals, such as snakes, which eat the consumers of the second order. The last group of consumers in this chain, including human beings, elephants, eagles etc., is called the top order consumers.

Decomposers help to destroy producers and consumers, e.g. soil micro-organisms.

All these groups together contribute to the maintenance of healthier forests. Destroying one group eliminates the role that it plays in the system. The result of interactions between organisms and within organisms is a stable forest structure/habitat, which plays several roles:

i. Providing habitat for organisms,
i. Regulating the flow of water
i. Contributing to soil conservation.

Organisms found in forests are useful for the dynamics of the system. Examples include:

- Bats and certain insects for example are pollinators both inside and outside forests.
- Certain trees growing on farm lands do not reproduce if they are not pollinated by these organisms with pollen from trees in nearby forests.
- Birds and squirrels disperse seed and contribute to the regeneration of plants in and outside forests, thus contributing to the regeneration of forest trees in the landscape.
- Some birds help control insects that attack plants inside and outside forests.
- Consumers (mainly those that eat only plants) convert plants into nutrients that are necessary for the growth of other trees/plants.
- Large, dead trees serve as habitats for birds.
- Forest organisms also play an important role for human populations as food, timber and non-timber products

Since all organisms are sensitive to habitat change, destroying one group of animals/organisms directly or indirectly through destruction/modification of their habitats can lead to the reduction/elimination of its existence in the habitat and its function.

Importance of forests

Trees and forests capture water from the ground and release it into the atmosphere. This water comes back as rain water which is important for agriculture, forests and human beings.

Absorbing rainwater

Forests retain certain quantities of rainwater, gradually releasing this water in the landscape. Without forests acting as a sponge, large quantities of water would flow in the landscape and cause floods and erosion.

Water reservoir

Most rivers have their source in forests. Often in the dry season, the only streams that flow are found in forests.

Soil protection along streams

Forests help to reduce erosion along streams and thus help in protecting soil and maintaining »clean« water.

Forest and climate change events

During unusual climate changes such as long dry periods, extreme rainfall, forests provide habitats for wildlife and reduce the effects of fire on the landscape.

The role of forests comes from the combined effect of the various species that make up the forest. Each species thrives because the forest habitat provides food and allows it to grow, develop and reproduce. Farmers need to

maintain a healthy forest. Farmers generally know that forests are important because they can gather timber and non-timber products but they also need to be aware that those products result from the dynamics going on inside forests and that forest also provides other products in the form of services/ utilities.

Human-Wildlife Conflict

What is human-wildlife conflict?

Human-wildlife conflict (HWC) is a term that describes problematic situations between wild animals and people. Conflicts come about when wildlife and humans compete for the same resources. The result of this conflict is that wildlife species destroy the food and property of humans and people shoot or trap to kill them.

Human-wildlife conflict occurs across all continents and takes a wide variety of forms. Some examples of conflict between wild animals and people in Africa include:

- Chimpanzees destroying crops around Tai National Park in Cote d'Ivoire
- Baboons damaging forest plantations in Zimbabwe
- Honey badgers raiding commercial bee hives in South Africa
- Crocodiles killing up to 2 tourists every year in national parks in Zimbabwe.
- Elephants destroying crops around Kakum Conservation Area and Bia National Park in Ghana
- Jackals in Southern Africa killing small livestock and poultry.

While both large and small animals including insects are involved in HWC, large mammals such as the elephant, buffalo, hippopotamus, lion, leopard, cheetah, spotted hyena, wild dog and crocodile are traditionally defined as problem-causing animals and are responsible for most of the conflicts.

- Human deaths and injuries
- Destruction of crops
- Killing of domestic animals
- Transmission of diseases (e.g. rabies) from wildlife to livestock and/or humans
- In reaction to HWC, humans kill wildlife.

Causes of HWC

The following are some causes of HWC:

- Competition between human populations and wildlife for the same space and resources
- Migration by humans into wildlife habitats due to wars, civil unrest, natural disaster (drought, floods etc) or food scarcity
- Some people's attitude and perception of wildlife as dangerous and only useful as food means that they do not respect the rights of animals to live in their own habitats
- Increasing human presence in protected areas creates conditions for conflicts between humans and wildlife

- The loss of habitats as a result of human activities such as farming, logging, mining etc., is a major cause of conflict between humans and wildlife
- The very nature of wildlife makes them behave in a manner that results in conflict with humans. For example, palatable crops attract wildlife.

Effects of HWC

- Human deaths and injuries
- Destruction of crops
- Killing of domestic animals
- Transmission of diseases (e.g. rabies) from wildlife to livestock and/or humans
- In reaction to HWC, humans kill wildlife.

A few rules can help prevent lion attack: (i) wearing bush-coloured clothes when carrying out activities in the field; (ii) check for the direction of the wind when approaching a risky area; (iii) increase one's size by wearing a backpack or heavy clothing to appear larger; (iv) avoid movements at night; (v) take small children off the ground when travelling with them

How can HWC be successfully managed?

There are several approaches to managing human wildlife conflicts. Prevention should always be the first step before taking action towards addressing its root causes.

1. Human Management

- Community Awareness – Communities can be educated about the causes and methods for reducing conflict with wildlife. It is important to create this awareness among children through schools and among adults through sensitization programs. Communities should be involved in developing actions that can help prevent HWC
- Compensation – In some countries money is paid to households or communities for the loss of livestock or human life by environmental organizations or governments
- Moving communities to a new location – this can only be done where there is enough land and other resources, funds to pay for the move and where communities are willing to move

Traditional fences:

- *Plant thorny hedges such as Opuntia sp. Fences made of dead thorny branches are erected as kraals for cattle but also against elephants*
- *Trenches covered or not, have been widely used in Africa to keep elephants from cultivated crops*
- *Stone walls have been used to exclude buffalo from invading cultivated fields*

2. Production Management

- Farmers watch over crops and livestock – Farmers keep watch over their crops or livestock particularly during the time when wildlife visit the farm or field where livestock are kept. Fear of humans normally prevents wildlife from damaging property
- Use of guard animals – Guard animals such as dogs can help protect homesteads and livestock from attack by wildlife
- Fencing – Fencing the pen where animals are kept or the farm will prevent wildlife from getting to them. Types of fences may include thorny hedges, trenches (covered or uncovered) stone

3. Problem Animal Management

(i) Non Lethal Methods

- Deterrent methods – This is aimed at keeping the animals away from the problem area. The methods are grouped according to the senses of the

animal they affect, e.g., hearing, sight, smell, taste, and touch

- Translocations - Move a number of animals from the problem area to a new location.

(ii) Lethal Methods

This option means killing the problem-causing animals. However, it is often difficult for wildlife managers to obtain permission to shoot an animal quickly. Where permission is given, it is often difficult to identify the animal causing the problem and an innocent animal may be killed.

(iii) Environmental Management

This involves planting crops that are not preferred by the animals. For instance, planting pepper instead of corn in the field will reduce the presence of elephants to the farm.

4. Land Use Planning

Land use planning is the best method for reducing conflict between humans and wildlife. The most practical land use planning method to managing human-wildlife conflicts with farming communities are: (i) relocating farming activities out of wildlife range; (ii) changing the location of crop fields from the forest edge to be close to home; and, in a general way, (iii) reducing human settlement towards wildlife range.

Cocoa Agroforestry

What is cocoa agroforest?

Cocoa agroforest refers to a shade grown cocoa farm in which other plants, including timber trees, fruit trees and food crops, are grown together with cocoa. Cocoa agroforests are not forests but they look like forests in structure and can therefore complement forest functions in the landscape.

Cocoa agroforest

Cocoa agroforests need to be managed to increase connectivity between forest stands. They can serve as a buffer for forest stands. The role of cocoa agroforest depends on its floristic composition and structural pattern. As much as possible, it will be important to keep forest components inside cocoa agroforests for them to serve the intended purpose.

How to create a cocoa agroforest

A cocoa agroforest is generally created by providing a forest-like environment for cocoa by:

(a) Leaving all or a substantial number of upper storey forest trees in the area where cocoa is to be planted to allow adequate shade for the cocoa seedlings

(b) Increasing the density of the upper and middle storey by planting or retaining useful plants such as timber and non-timber plants alongside cocoa; and

(c) Reducing the ground vegetation, planting cocoa and other useful forest trees and carrying out regular weeding of unwanted vegetation

(d) Maintaining forest trees that regenerate from the soil (seed bank) or by taking cuttings from trees which were there before the cocoa farm.

The result is a cocoa agroforest with some trees/plants that were left in the farm and some that were planted. Generally, the higher the number of regenerated forest trees, the more the cocoa agroforest resembles a forest habitat. A cocoa agroforest habitat is therefore a modified forest habitat which satisfies farmers' needs to grow cocoa and other useful trees and improves the micro environment.

Cocoa agroforests can also be a transitional land use between human settlements and natural forest stands. In this way cocoa agroforests can connect remaining forest stands.

At the landscape level, cocoa agroforests can provide secondary or additional habitats for the animals. Even though not all the animal and plant components found in primary forests may be found in cocoa agroforests, those that exist may represent a significant proportion.

In a cocoa agroforest, the animal and plant components contribute significantly to ecosystem processes such as nutrient recycling, biological pest control, natural regeneration, seed dispersion, gene distribution and contribute to help improve the micro-climate. The movement of animals and plants in the cocoa agroforest landscape can also help to facilitate cross pollination between plant species and help in the movement of pollinators and seed dispersers across the landscape.

Many species that are found inside cocoa agroforests may still depend on the nearby forest habitat. The number of animal/plant communities may be affected by the size, proximity and degree of connectivity with the remaining forest cover in the landscape. The bigger the cocoa agroforest, the more the proximity with the forest, the more the connectivity with forest stand the larger the wildlife community.

Importance of cocoa agroforests

Cocoa agroforests have both ecological and economic benefits to farmers, communities and at the country level.

Ecological	Economic
Forest-like environment that promotes the well-being of animals and plants	Improves and sustains cocoa yields over a long period of time
Provide habitats and resources to plants and animals in fragmented landscapes or degraded forest areas and maintains connectivity between different land uses.	Income from other plants/trees found in the system

However, a major disadvantage of cocoa agroforests to farmers is lower cocoa yields per hectare/acre compared to yields in non-agroforestry systems because there are fewer cocoa trees and the cocoa trees are in competition with other trees for water and nutrients.

To make cocoa agroforests attractive to farmers, it is important to make sure that farmers can benefit from a balance between any economic losses they may experience from cocoa production and the ecological benefits to the community and country.

Landscape around protected areas

Understanding the landscape near protected areas

Protected areas are influenced by the surrounding area which may include the buffer zone, farm land, and villages. Rural people living near protected areas need to have a clear awareness and understanding of the different land use systems in terms of land use proportion and location in order to define the type of management to apply in each system. For example, farmers may decide to plant crops far from the protected area and develop cocoa agroforests near the buffer zone.

What is a landscape map?

A landscape map is a tool that helps rural dwellers to understand how their individual farms and villages relate to the wider landscape and the protected areas. The purpose of the map is to show all the things/features found in the area, including villages, topography, natural boundaries, farm land, the buffer zone and the protected area.

What should be in a landscape map?

A landscape map near a protected area should show:

- Location of the protected area
- Habitat of important animal/plant species (ex endemic/threatened species)
- Location of forest stands outside the protected area.
- Location of the buffer zone
- Location and names of nearby villages
- Type and location of farm lands

In addition local communities have to have an idea of the following features and dynamics in the landscape in order to establish the various relationships that exist in the area. These are:
The topography, which is the shape of land in a given location which includes hill, slopes,
The location of natural boundaries: physical things that divide the landscape such as rivers, creeks, hills, mountains, forest, bushes etc.,
Soil suitability: the ability of land to properly grow crops,
Animal habitat: an area where wild animals including birds, bats, frogs, snakes live and move about,
Endemic species: animals and plants found only in a particular place (is the opposite of cosmopolite species which are found everywhere),
Threatened species: plants and animals which would disappear gradually if not protected,
Location and type of vegetation: e.g. grassland, secondary forest, primary forest, swamp, etc.,
Local uses of the forest: this allows farmers to become aware of how they use the forest and to discuss how their use impacts on the plants and animals in the forest.

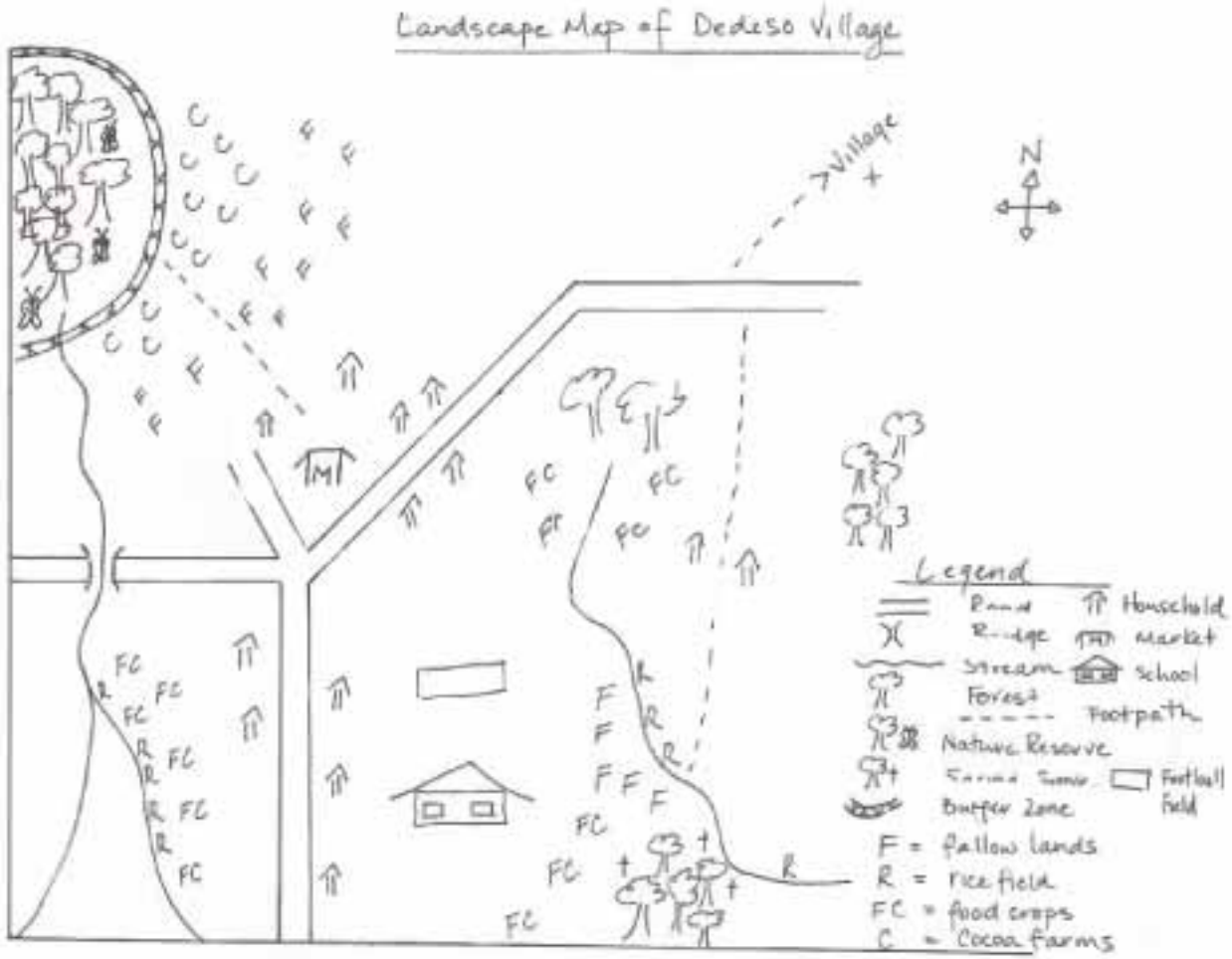

Figure 1: An example of a landscape map

Laws on biodiversity conservation in Liberia

All countries have laws and policies on the use of natural resources such as trees, animals and water bodies in protected areas, community forests and agricultural lands. These laws and policies are put in place by the government or traditional authorities to ensure the careful and sustainable use of these resources. These laws help people to know what they can and cannot do in different land use areas.

Laws and policies can stop or control the use of certain resources depending on how threatened/vulnerable a particular resource is. The Liberian government is in the process of revising or developing laws on biodiversity conservation. At present there are only a few guidelines on what farmers can or cannot do in protected areas. The guidelines are as follows:

Protected areas

A protected forest area is a land dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, which is managed through legal or other effective means.

The only activities that can be carried out in protected areas are: tourism, recreation (having fun) and research.

In a protected area, no one is allowed to:

- Mine
- Hunt
- Fish
- Cut down trees for timber
- Live

Buffer zone

In a buffer zone, all activities including farming, hunting, fishing and other human activities are regulated by the Forestry Development Authority (FDA). Written permission is required before any activity can be carried out in a buffer zone.

Protected animals

For instance, the government of Liberia has classified the following animals as protected:

- Pigmy hippopotamus
- Leopard
- Elephant

- Crocodile
- Zebra duiker
- Bongo antelope
- Giant forest hawk
- Giant pangolins
- Rack fowl
- Chimpanzee
- White breasted guinea fowl

This means that these animals can not be hunted or kept (dead or alive). Do you know the protected animals in your community?

Tree species

A number of valuable tree species that exist in and near protected areas have been over exploited for commercial and domestic use. As a result the Liberian government has declared these species threatened. Threatened tree species in and near protected areas in Liberia include:

- *Diospyros gracilis* (African ebony)
- *Entandrophragman* sp.
- *Khaya* spp. (African mahogany)
- *Milicia excelsa* (Iroko)

Before harvesting any planted or retained timber tree for commercial purpose, one must obtain permission from the right authorities and pay taxes if the tree is going to be used for commercial purpose. This rule also applies to naturally occurring trees both in plantations and on cocoa farms.

Desirable characteristics of non-cocoa trees grown with cocoa farms

Although most cocoa farmers leave non-cocoa trees in their farms, they often do not make careful decisions about which trees to leave and which to remove based on the beneficial and non-beneficial characteristics of the trees. This is not because farmers don't have good knowledge about trees. Rather it is because they often do not carefully apply their knowledge of trees in the decision-making process.

The role of the facilitator when doing the exercise »Selecting desirable non-cocoa trees for cultivation in cocoa farms« is to facilitate the decision-making process.

Although farmers are knowledgeable about trees and should make the decision about tree characteristics, facilitators also need to have good knowledge about trees and their characteristics. Important characteristics of trees grown in association with cocoa include:

- shade quality
- soil fertility
- moisture stress
- weed growth
- wind breaks
- air circulation
- branch shedding (that might damage cocoa trees)
- host to pests and diseases,
- economic value
- social value

The following are some important tree characteristics:

Shade quality

Shade quality consists of crown size, crown density and compactness of the crown.

- For crown size use the diameter to describe it – relatively large crowns have a negative shade effect
- Crown density should be determined by number and size of the leaves per unit area on the branch - relatively broad leaves and extensive branches negatively affect shade quality
- For compactness of the canopy use the size of leaves on the branches. Relatively small leaves with a lot of space between them promote an open canopy that allows enough sunlight to penetrate to crops beneath the canopy. Broad, closely spaced leaf arrangements block most of the sun light resulting in a close canopy that promotes high humidity under

the canopy. This condition can create optimal conditions for Black Pod.

Soil moisture

- Deep rooted trees which can facilitate recycling of water to the soil surface compared to shallow rooted trees, which will compete with cocoa for soil moisture
- Leaf shedding pattern of the tree - trees that maintain most of their leaves in the dry season and shed them in the wet season control desiccation in the dry season and high humidity in the wet season.

Soil fertility

- The rate of leaf shedding – high rate promote organic mater accumulation in soil
- Time it takes for leaves to decompose. A short period for decomposition means that nutrients will be released into the soil quickly
- Softness or hardness of the leaves: a tree that has a high rate of leaf shedding and has soft leaves that decompose quickly promotes soil fertility.

Other characteristics are described in the table below:

Some tree characteristics

	Weed suppression	Mechanical damage to cocoa	Wind break ability	Good aeration for cocoa
What to look for	How frequently a farmer weeds around that particular tree	The self pruning ability of the tree and how often this occurs. Trees with this characteristic can be described as having soft or hard branches	The strength of the root system and the softness or hardness of branches	Height of the tree
Notes	Trees that drop a lot of leaves are good at reducing weeds since the leave act as mulch and prevents weed germination	Self pruning trees tend to have soft branches while trees that are not prone to self pruning have hard branches	Deeply rooted trees with hard branches serve as a good wind break for cocoa.	Relatively tall trees allow for better aeration under the canopy and are suitable as permanent shade while relatively short trees restrict.

Part II: Farmer learning exercises

Understanding biodiversity conservation in cocoa farming

The protection of living things around us is important since destruction of one species goes a long way to affect others. Farming activities depend on nature for most of the processes that go on to influence production. For instance, cocoa trees will not produce pods if there are no insects to pollinate the flowers and human beings cannot survive if we cut down all the forest and pollute our water bodies.

Learning objectives

- To help farmers understand the meaning of biodiversity conservation
- To help farmers understand the importance of biodiversity conservation in farming activities

Materials

- Flip chart
- Markers

Procedure

Beginning by explain the meaning of biodiversity conservation and list the names of some living things around the farm. Start a discussion of living things and how we depend on each other for our survival. Discuss about how insect pollinate flowers to produce fruits and how micro-organisms help dead materials to decompose to release nutrients to the soil for plant growth. Discuss how trees protect water bodies and how easy it is for human being to destroy all these in our quest to produce food.

Mention also that it is possible for farmers to maintain the natural process of life and promote biodiversity conservation through good agricultural practices like rational use of fertilizers, creation of farms on non-forested areas, planting cocoa under shade, protecting wildlife, planting more trees around water bodies. In the process ask participants to describe how they can protect biodiversity.

Guide questions for discussion

- What is the meaning of biodiversity conservation and give 5 examples of some species you can find around you?
- When we say something is endemic to an area what do we mean?
- What causes destruction of biodiversity in our community?
- How can we reduce biodiversity loss in our community?
- How do we stop our neighbours from killing wildlife?
- What are some of the good agricultural practices we can do in order to protect nature?

Drawing a landscape map

Most African farmers living near protected areas are not aware of their role and responsibilities in ensuring that their farming activities make meaningful contribution to preserving natural resources

Leaning objectives

- To raise farmers' awareness about the different features of the landscape and how their management affects each other
- To sensitize farmers about their roles and responsibility towards conserving natural resource near the protected area

Materials

- Flip chart paper
- Markers
- Local materials such as sticks, stones, leaves to show characteristics (if drawing on the ground)

Procedures

Explain the purpose of the map. Agree on the scale of the map. Divide the group into two. Request participants in group 1 to draw a map showing the landscape in the 1970s (use an important event that took place as a reference period). Ask participants in group 2 to draw a map of the landscape today. Both maps should show the following:

- Villages
- Roads
- Sacred groves etc.
- Major zones of land use and topography (rivers, hills, plains, agricultural land)
- Protected area (indicate type of wildlife)
- Main habitat of important species including endemic/threatened species
- Forest stands outside the protected area

The map can be drawn first on the ground and then transferred to paper so that it can be used later. It is best to have about 8 participants actually draw the map; the rest can contribute verbally. Change the people drawing to make it more interesting. The map should indicate what activities go on in the forest and agricultural land.

Once the map is completed, use the guide questions to discuss.

Guide questions for discussion

- What were the key natural resources in this area (natural boundaries, vegetation, protected areas, forest, rivers, creeks, mountains etc) in the 1970s and now? What has changed over time? Why?
- How do people use the resources in the area? What has changed over time? Why?
- What are the main land use changes that have occurred since the 1970s? How have these changes affected wildlife?
- Today, what proportion of the land use is under closed forest? Was that the case in the 1970s?
- Which proportion of the closed forest outside the protected area will disappear if the current trend of land use change is maintained?
- What will be the effect of these changes on wildlife?
- What effect does agriculture have on the forest?
- What effect does hunting have on the forest?
- What are some problems in managing the different land use zones (river, forest, agricultural land)?
- What do you think will happen if certain resources (wildlife, forest, rivers etc) are no longer available in future (for wildlife, indicate endangered species such as elephants, chimpanzees, Diana monkey, deer, forest frog, wild birds, etc)?
- What can the community and individuals do to make sure that these resources (wildlife, forest, rivers etc) continue to exist?

Laws that protect nature

Local practices and traditions as well as laws developed by government exist to control the use of plants and animals. Rural people living near protected areas need to be reminded of both sets of laws to ensure that they are respected and that they know their rights and responsibilities.

Learning objectives

- To raise awareness of the importance of conservation
- To educate rural people on the laws and policies of the country on biodiversity conservation
- To promote local practices and traditions that promote the conservation of natural resources

NOTE: This protocol assumes that farmers have already been sensitized about the importance of the protected area

Materials

- Flipchart
- Markers
- Case studies

Procedure

Introduce the topic by making reference to what the Forestry Development Authority has told communities about the protected area. Read each case study and facilitate a discussion using the guide questions. Write important points on the flip chart.

Case study 1 (the decline of bush meat):

Gegbah (also known as GB, a type of fufu) is the staple food of the people of Kporlay village. The soup eaten with GB is prepared with plenty of bush meat. In the past, the villagers had no problem getting bush meat for their soup as their village is near a forest (insert name of protected area). But due to reckless and intensive commercial hunting of bush meat, the numbers of wild animals have declined. Nowadays, bush meat is not easily available and is very expensive.

Due to this situation, Mr. Gweh and family have not had meat for their soup in many months. Because of the lack of meat, Mr Gweh's three small children have developed malnutrition and suffer from other illnesses. Mr Gweh and his wife are forced to spend the little money they have to take their children to hospital and buy medicine.

Guide questions for discussion

- What animals do you commonly use for GB soup?
- How easy is it to find these animals in the forest now compared to 2-5 years ago? Explain the change.
- How much do you pay for bush meat now compared to 2-5 years ago?

- Is there a difference in the size of animals caught today compared with 10 years ago? Why?
- What other foods provide protein?
- What role does wildlife play in maintaining forest stands?

During the discussion, inform participants about the following:

- Which animals cannot be killed or captured/transported in the buffer zone and protected area
- Penalties for breaking the law on killing/capturing wildlife.

Case study 2 (excessive logging)

The people of Yolowee village, living around the Nimba Nature Reserve have always depended on trees from the forest to build their houses, for firewood, medicine, bowls, ladles etc. through sustainable harvesting practice. Over the past twenty years, the number and type of trees in the forest have reduced and changed due to increased logging activities, farming of cocoa and other crops. These days, people have to travel long distances to get firewood, wood and medicine.

Guide questions for discussion

- What trees and plant species do people use for building?
- What trees and plant species do people use for traditional medicines, furniture, and household utensils like ladles and bowls?
- What parts of the plant (bark, fruits, leaf, etc) are used? What effect does removing this part have on the life of the plant? How can these negative effects be avoided?
- Are these species easily available? If no, why not? What can be done to restore the depleting species?

During the discussion, inform participants about which trees cannot be cut down in the buffer zone and protected area.

Case study 3 (pollution in water bodies)

In the past, people from Zorgowee village were able to get clean water from the Yar River. Women and children walked short distances to fetch clean water and it took less than ten 10 minutes to fill a barrel. In the past 10 years, rivers and creeks near the village have either dried up or have become polluted. Many people now get sick from drinking unclean water from rivers and creeks.

Another problem faced by the villagers is the water table in the area has dropped so low that hand-dug wells dry out easily. This situation is due to bad farming practices such as farming near water sources, cutting down trees growing near rivers, washing dirty cloths and cooking utensils in the waste, defecating into water bodies. Because there are few trees and plants growing along the banks of rivers, the whole area gets flooded in the rainy season. Flooding makes the water muddy and therefore it cannot be used for drinking and other household uses.

Guide questions for discussion

- What is the condition of the water sources in this area: is the water clean?
- Is water available throughout the whole year?
- Which human activities (for example, washing clothes, farming) affect the quality of water?
- What animals live in the wetlands/rivers/creeks? At what time of the day/year do you find these animals?
- How important are the rivers/wetlands for wildlife and humans?
- Do you have flooding in the rainy season? If so, what are the causes?
- Is there a relationship between forest stands, presence of wetlands for regulating water? How does this work?
- What can be done to make sure clean water is available for all?

Dealing with conflicts between humans and wildlife

Any crop land near protected areas is likely to be invaded by wild animals, including protected species. It is important for farmers to know how to handle such situations by preventing damage to farms, while at the same time not harming the wildlife.

Learning objectives

- To sensitize farmers to issues related to human-wildlife conflict
- To expose farmers to some strategies that may allow them to manage wildlife

NOTE: It is assumed that local forestry authorities will work with communities to develop specific conflict management strategies

Materials

- Flipchart
- Markers
- Story

Procedure

Introduce the subject of human-wildlife conflict. Define what type of wildlife you are talking about. Ask farmers to share their experience with wildlife conflict. Discuss the methods farmers use to protect their farms against wildlife, for example, fencing and scaring. Use the below table to discuss each practice mentioned by farmers, which species it is used against, whether the practice is effective and the positive and negative aspects.

Human-wildlife conflict management practices

Traditional practices	Species	Effectiveness	Strengths	Weaknesses

Guide questions for discussion

- Have wild animals ever damaged crops in your village? Describe what happened and what villagers did.
- Are there certain trees or crops that attract animals?
- Where (areas in the landscape) does human-wildlife conflict generally occur?
- What are some practices farmers use to prevent wild animals from damaging their crops?
- Which species of animals is this practice used for?
- How effective is the practice in controlling wild animals?
- What are some positive aspects of this practice? What are some negative aspects of this practice?

Read the case study presented below (several times if necessary). Ensure that all the participants understand. Participants can also be asked to recite the story.

Case study on resolving human wildlife conflicts

Mr. Nyahu lives in Zortapa, and owns a cocoa farm close to the East Nimber Nature Reserve. He always encounters chimpanzees on his farm any time there are mature pods on his cocoa trees. These chimpanzees eat most of the pods on the trees and cause him great losses and so he decided to find a solution to this problem once and for all. One evening Mr. Nyahu went to his farm with a head lamp and a single-barrelled gun and waited till the chimpanzees had entered his farm. He aimed at the leader of the group and shot it right in the head. This shooting incident scared the rest of the group, which then run back into the forest. Mr. Nyahu was happy thinking that he had succeeded in driving the chimps away for ever only to find out the following morning that his whole farm has been destroyed by the animals.

Guide questions for discussion

- Was it appropriate for Mr. Nyahu to shoot the chimp? What should have been the proper way of handling the situation?
- To whom should you report such an incident to in order to avoid human-wildlife conflict to?
- What have you learnt from the story?
- Based on this story, what new laws would you propose to the Government to help farmers whose farms are damaged by wild animals? Explain what is needed to make this system work.

During the discussion, inform participants about the following:

- How to report human-wildlife conflicts (who to report to, what type of information is needed)
- Compensation provided for loss of crops, if it exists

Promoting traditional practices for biodiversity conservation

Traditional practices such as taboos, respect for ancestors and prohibitions have helped to preserve many useful plant and animal species in many part of Africa but are now disappearing. Useful traditional practices should be encouraged to promote biodiversity conservation

Learning objectives

- Promote awareness and pride in the positive aspects of traditional practices in biodiversity conservation
- Develop strategies for promoting traditional practices for biodiversity conservation

Materials

- Flipchart
- Markers
- Case study

Procedure

Read the case study presented below (several times if necessary). Ensure that all the participants understand. Participants can also be asked to recite the story.

Case study

There was once a serious famine in Gbahplay village. One day, Flumo, a young hunter, decided to go out hunting to get food for his family. On his way to the forest, he met an old man who asked him where he was going. Flumo told the old man that he badly needed to shoot a chimpanzee to feed his family. The old man then told Flumo the following story about how chimpanzees had helped the village.

Once upon a time, the old man explained, a farmer named Mulbah got lost deep in the forest. After some days, when Mulbah was nearly dead from thirst and starvation, he was rescued by chimps. The chimps brought Mulbah to a creek close to the town. A woman, who was going to the creek to fetch water, saw the chimps with the man and raised the alarm for people to come. To the amazement of the people, Mulbah told them how the chimps had led him out of the forest where he had been lost for several days. They fed and took good care of him. From that day onwards the people of Gbahplay decided to revere chimpanzees and made it a taboo for anyone who tries to kill them.

Facilitate a discussion on lessons learned from the case study. Ask participants to identify other traditional practices that conserve nature. Use the table below to discuss the positive and negative aspects of the practices identified.

Traditional practices for biodiversity conservation

Cultural practices that protect nature	Positive aspects	Negative aspects

Guide questions for discussion

- What are the main lessons of this story?
- What might have happened to the chimpanzees in this village, if the taboo had not been enforced?
- Do you know other traditional practices that protect nature?
- What are some positive and negative aspects of each practice?
- Are these practices still being carried out today? If no, why not?
- How can we bring back traditional practices that no longer exist?
- What can we do to promote the positive aspects of the practices mentioned?
- What can we do to discourage the negative aspects of the practices mentioned?

Understanding the advantages of cocoa agroforests for biodiversity conservation

Introducing cocoa agroforests near protected areas has several advantages including buffering the protected area fringe, offering alternative habitats for wildlife and connecting protected areas to forest stand outside the reserve.

Learning objectives

To increase farmers' awareness about the advantages of cocoa agroforestry for biodiversity conservation

Materials

- Flip chart
- Markers

Procedures

Divide participant into 2 groups and assign one group to discuss the cocoa farm while the other will discuss the forest.

Ask each group to identify all plants and animals (using local names) that live in the following storeys in the cocoa farm and in the forest:

- Upper storey
- Middle storey
- Cocoa storey
- Under storey

Ask each group to record their observations on a maximum of 10 species for each category using the below table.

Species in cocoa agroforests

Storey	Species	Cocoa farm	Forest
Upper storey	Animals		
	Plant		
Middle storey	Animal		
	Plant		
Cocoa storey	Animals		____
	Plants		____
Under storey	Animal		
	Plant		

Guide questions for discussion

- Is there a difference between plants and animal species in the cocoa farm and forest?
- In which storey can you find most animals living in the forest and cocoa farm? Why?
- In the cocoa farm, is there a difference between the number and type of plants and animals found in different storeys? Why?
- Is there a difference between the area of open canopy in cocoa farms and the forest?
- What is the reason for this difference? What is the result of this difference in the canopy between cocoa farms and forest?
- Which of these two areas (cocoa farm and forest) is better for encouraging more plants and animals species?
- Is it useful to have more animals and plants in your cocoa farm? Why or why not?
- What can farmers do to increase the number of animals and plants in their cocoa farm?
- What is likely to happen to cocoa yields if there are more trees and plants in a cocoa farm?
- What can you conclude from this exercise?

Selecting desirable non-cocoa trees for cultivation

It is difficult to characterize what farmers perceive as a »desirable« non-cocoa/shade tree in association with cocoa and what they believe to be the beneficial characteristics such trees posses. This exercise provides a way to stimulate discussion about the precise economic and environmental benefits farmers obtain from shade trees using a combination of farmers' and scientific knowledge about timber tree-cocoa combination.

Learning objectives

- To improve farmers' knowledge on desirable tree characters

Timing: August

Location: Mature cocoa farm with shade trees

Materials

- Flip chart
- Markers
- Note books and pens for sub-group

Procedure

Explain the objectives of the exercise. Divide participants into small groups of 5-6 and ask them to walk through the farm, identifying non-cocoa trees on the farm and noting their desirable characteristics;

Draw the table below on the flip chart. Explain attributes as the desirable characters farmers look for.

Selecting good trees for cocoa cultivation

Attributes	Tree species				
	Species 1	Species 2	Species 3	Species 4	Species 5

Ask each group to do the following:

- List the desirable characteristics of each non-cocoa tree species identified that make them compatible with cocoa.
- Arrange the qualities into different headings and present them in the first column of the table under **Attributes** on the flip chart.
- Indicate 5-10 desirable tree species identified on the farm other than cocoa and represent these species in the first row of the same table under **Tree species**. The named species should be agreed upon by all participants so that consensus can be reached with regards to attributes.
- After filling in the species names and characteristics on the table, facilitate a discussion to get each group to rate each tree species using numbers from 1 to 9, with 1 being the least desired and 9 the highest.
- Complete the rating for each species before going on to the next one. Continue until the table is completed.
- Show one example before starting group work.
- Once the table is completed, ask each group to present their list of species and characteristics to the larger group and facilitate a discussion using the guide questions.

Guide questions for discussion

- Why are the mentioned tree found on this farm desirable for cocoa cultivation?
- Are you satisfied with the ratings?
- Explain the measures you have taken yourself in your field to ensure this?
- What do you think about these measures?
- Has anybody tried out the same measures or are there different ways to ensure positive interactions between cocoa and shade trees?

Additional reading

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Mapping Communities Ethics, Values, Practice. East-West Center. 126 pp.

OECD Publications 2002.
Handbook of Biodiversity Valuation, a Guide for Policy Makers. Centre francais d'exploitation du droit, 20, rue des Grands-Augustins, 75006 Paris, France.

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Biodiversity in the Atewa Range Forest Reserve, Ghana. Conservation International, Arlington, VA, USA.

Annex:

Using this manual for cocoa certification training

Many companies purchasing cocoa in West Africa and people who eat chocolate products in developed countries are concerned about the effects of cocoa production on cocoa farmers, their communities and the environment. They want to make sure that cocoa farmers are receiving higher incomes and have a good living standard. One way to make sure this happens is to provide cocoa farmers who produce cocoa following certain requirements such as good agricultural practices, responsible labour practices etc with a certificate. Cocoa farmers and communities that receive this certificate can then get a higher price for their cocoa from buyers. To receive a certificate, farmers must meet all the requirements established by certification bodies. There are currently several cocoa certification systems or standards such as UTZ Certified (*www.utzcertified.org*), FairTrade International (*www.fairtrade.net*) and Rainforest Alliance (*www.rainforest-alliance.org*).

Topics covered by most cocoa certification codes include:

Good agricultural practices

- Good agricultural practices and post-harvest handling
- Cocoa farm maintenance
- Soil management and fertilization
- Integrated pest management

Social issues

- No forced and child labour
- Payment of minimum wage
- Transparent and accountable group management
- Equal opportunities for men and women
- No discrimination, respectful treatment of workers
- Access to health care
- Access to education
- Good relations with the community
- Good living conditions
- Health and safety training
- Safe and healthy working conditions
- Accident and emergency procedures

Environmental issues

- Responsible use of agrochemicals
- Biodiversity protection and strengthening
- Prevention of soil erosion
- Protection of water sources

- No deforestation of primary forest;
- Use of shade trees
- Protection of endangered species
- Conservation plan for natural habitat
- Minimized environmental pollution, waste management

(Adapted and modified from UTZ Certified Code of Conduct for Cocoa- Summary)

Many of the training exercises covered in this and other manuals in the STCP Good Agricultural Practices series address the requirements of certification standards. Topics not addressed by the STCP manuals include labour practices, gender equality, group management, access to education and health care. Using the Rainforest Alliance (RA) code as an example, the following table shows which training exercises correspond to specific control points.

Certification codes and STCP protocols

RA standards	STCP protocols
Social and Environmental Management System	Laws that protect nature
	Promoting traditional practices for biodiversity conservation
Ecosystem conservation	Understanding biodiversity conservation in cocoa farming
	Drawing a landscape map
	Understanding the advantages of cocoa agroforests for biodiversity conservation
	Selecting good trees for cocoa cultivation
Wildlife protection	Dealing with conflicts between humans and wildlife
	Human-wildlife conflict management practices

Development and Environment

No. 1 • 2005	Seed sources of agroforestry trees in a farmland context - a guide to tree seed source establish ment in Nepal
No. 2 • 2005	The map of potential vegetation of Nepal - a forestry/ agro-ecological/biodiversity classification system
No. 3 • 2006	Conservation of valuable and endangered tree species in Cambodia, 2001-2006 - a case study
No. 4 • 2007	Learning about neighbour trees in cocoa growing systems
No. 5 • 2007	Tree seedling growers in Malawi - who, why and how?
No. 6 • 2007	Use of vegetation maps to infer on the ecological suitablility of species ..... Part I: Description of potential natural vegetation types for central and western Kenya
No. 7 • 2007	Use of vegetation maps to infer on the ecological suitablility of species ..... Part II: Tree species lists for potential natural vegetation types
No. 8 • 2007	Do organisations provide quality seed to small holders?
No. 9 • 2007	Sources of tree seed and vegetative propagation of trees around Mt. Kenya
No.10 • 2007	A review of direct sowing versus planting in tropical afforestation and land rehabilitation
No.11 • 2008	Medicinal plants, their conservation, use and production in southern India
No.12 • 2009	Conservation and biodiversity in and around cocoa farms. Learning about sustainable cocoa production: A guide for particpatory farmer training
No.13 • 2010	Planting, replanting and tree diversification in cocoa systems (Electronic version revised 2011)

FOREST & LANDSCAPE

DEVELOPMENT AND ENVIRONMENT - REVISION 2011 12 / 2010

The manual on biodiversity and wildlife conservation in cocoa landscapes near protected areas aims at improving farmers' knowledge on biodiversity and wildlife conservation in order to strengthen their decision making capacity. It helps farmers to understand the importance of biodiversity and wildlife conservation; understand their role as ecosystem managers; develop strategies for mitigating human-wildlife conflict; understand the national laws on biodiversity conservation and; develop an appreciation of the economic and conservation value of cocoa agroforests.

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