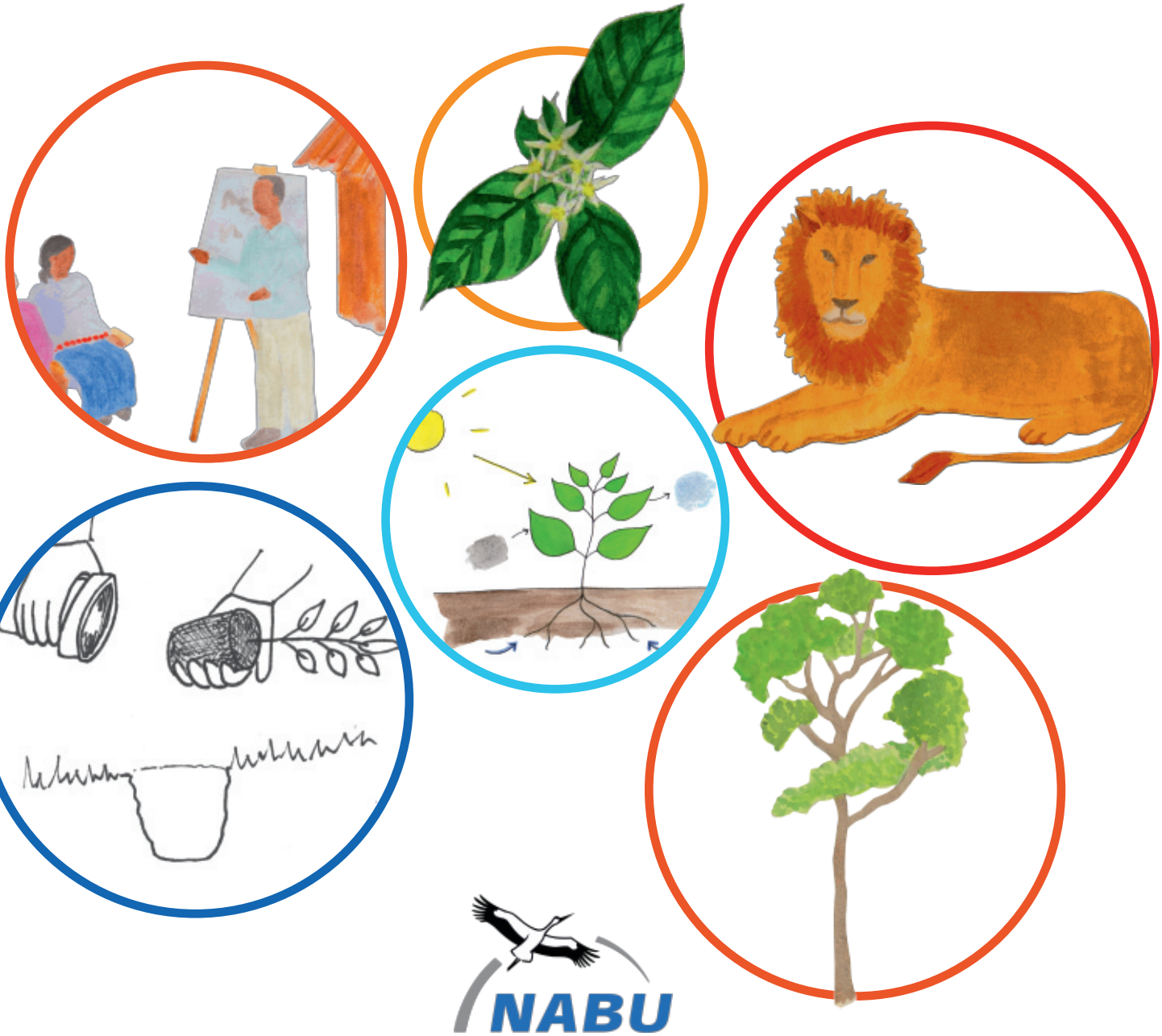
Kafa Biosphere Reserve, Ethiopia

Manual for Youth to Youth Training

Raising Environmental Awareness



NABU

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"Climate Protection and Preservation of Primary Forests – A Management Model using the Wild Coffee Forests in Ethiopia as an Example"

This project is part of the International Climate Initiative. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety supports this initiative on the basis of a decision adopted by the German Bundestag.

List of abbreviations

°C	degrees celsius
%	percent
BR	biosphere reserve
CO_2	carbon dioxide
FAO	Food and Agriculture Organization of the United Nations
ha	hectare
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
kg	kilogram
km	kilometre
m	metre
mm	milimetre
MAB	Man and the Biosphere Programme
NABU	Nature and Biodiversity Conservation Union
NGO	non-governmental organisation
PFM	Participatory Forest Management
UNESCO	United Nations Educational, Scientific and Cultural Organization

Contents

Key Note

UNESCO places people at the centre of its Man and the Biosphere concept. Consequently, all steps for planning, implementing and running of a biosphere reserve critically need thorough support and active involvement of the local people living in and around that area.

In June 2010, Kafa Biosphere Reserve was officially designated by UNESCO – an inspiring success after only two and a half years. Kafa Biosphere Reserve has been one of Ethiopia's first biosphere reserves and is an attraction for coffee lovers worldwide.

NABU, which stands for 'The Nature and Biodiversity Conservation Union' has been supporting the designation of the area as biosphere reserve with other German partners from the private and NGO sector. NABU is the oldest and biggest environmental conservation organisation in Germany and brings together 500,000 members and supporters who support NABU in its work for threatened habitats, flora and fauna, climate protection and energy policies. About 30,000 volunteers play an active role in practical nature conservation work in Germany being organized in 1,500 local NABU groups. But nature knows no borders, which is why NABU takes on the responsibility for conservation of biodiversity internationally.

The designation of Kafa Biosphere Reserve has only been made possible due to the broad acceptance and support of the communities living there. In order to keep this very strength alive NABU would like to invite you to be part of the movement

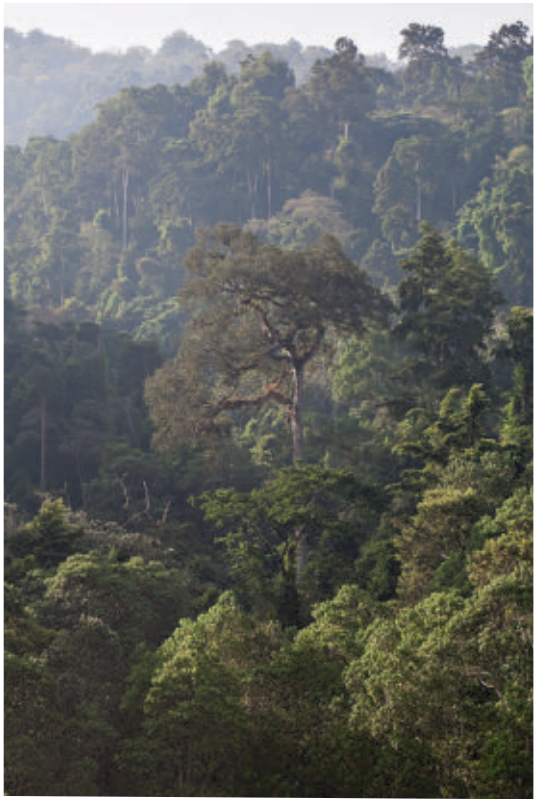
Let's save the environment, the livelihood of people – for our common future

The unique wild coffee forests in Kafa Biosphere Reserves, the impressive wetlands and grasslands and its diverse flora and fauna can only be preserved by you, the wise people of Kafa. It is your home and heritage which you should maintain as a gift to your children and grandchildren – and to the world. This Manual may guide and support you for the achievement of this goal.

We would like to thank you in advance for your involvement!

NABU – *for People and Nature*

Introduction



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Ethiopia is one of the most fascinating countries in the world, but is also one of the poorest. It offers impressive landscapes and unique biological diversity, however is facing an enormous growth in population, which is leading to a consumption of natural resources that is no longer sustainable.

The highland rainforests of the south-western plateau of Ethiopia are considered to be the origin of Arabica coffee and still bear many wild coffee varieties which are an invaluable genetic resource. However, due to deforestation, the diversity of what is estimated to be around 5,000 varieties is in danger of being irretrievably lost. The establishment of the UNESCO Kafa Biosphere Reserve in 2010 brought the opportunity to merge both the preservation of the remaining unique coffee forests and the sustainable development of the region.

The forests are very important, not just locally, but on a national and global scale. Their trees store vast amounts of carbon - the release of which would greatly contribute to climate change. The forests, also called 'Ethiopia's green lungs', produce fresh air and regulate the water supply for the whole region and provide many non-timber products to the local communities.

Unfortunately, they are in danger of being destroyed. Deforestation has caused the area covered by forest to shrink: 40 years ago almost half of Ethiopia was covered in forest. Now this is just around 3% with devastating consequences. People have lost the basis of their livelihoods and the carbon stored in the forests is being released, leading to more rapid climate change. Other environmental consequences are also occurring including the drying up of streams, loss of shade and an increase in soil erosion.

Local communities are key to reversing this worrying trend. Learning about the importance and value of their natural environment will equip the inhabitants of the Kafa Biosphere Reserve to contribute towards its protection.

Thus, this manual is an essential tool to help protect the natural environment of the Kafa Biosphere Reserve together with its inhabitants and local communities.

The concept of the manual

The conservation of the forests in the Kafa Biosphere Reserve (Kafa BR) requires the local community to understand the importance of the environment, forests, biodiversity and climate change and to actively support and participate in their protection. The aim of the manual is to pass on information about the Kafa BR, its natural environment and conservation. At the same time tools and methods to share this knowledge with other members of the community are provided to encourage them to get active for conservation.

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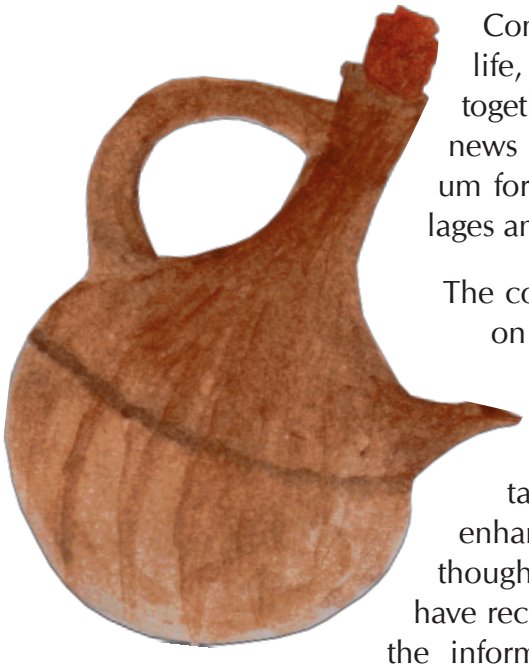

Communication and discussion are important parts of Ethiopian life, especially in rural areas outside of the big cities. People come together several times a day to exchange information and discuss news at traditional coffee ceremonies. This presents an excellent forum for sharing information and knowledge on a local level in the villages and settlements.

The concept of this programme is to train members of the community on the inforamtion in this manual so that they can in turn pass it on to their family, friends and the wider community at the coffee ceremonies. It is intended that this peer-to-peer approach will facilitate the delivery of the information in a way that is tailored to the culture and society of the communities, enhancing the understanding of the participants. Although not all members of these communities have received education in a school setting, the informal discussion sessions and informative approach as part of a coffee ceremony should enable all participants to learn, regardless of educational background.

The manual has been developed to be easily understandable, comprehensive and user friendly. All complex scientific terms and concepts are explained using simple language and illustrated with diagrams. This didactically-orientated approach equips the trainer to deliver the programme in the local setting.

How to use the manual

The manual contains six sections that are to be covered by the trainer in at least seven coffee ceremonies. Each section contains information and scientific concepts, as well as topics for discussion and activities to help the participants understand their role and relationship to the environment and natural resources, in particular the link between certain actions and the resulting environmental deterioration.

The best method to deliver the material is for the trainer to first read through and learn the information so they are in a position to be able to explain and teach it to the other community members. The pictures and diagrams can be used to help the understanding of the participants.

At the end of each chapter there are a series of activities and exercises which can be done together with the participants. These exercises help the participants to understand the information from the chapters, and to relate it to their own personal situation and context. These activities are highlighted by this picture of two coffee beans.

Information specifically about the Kafa Biosphere Reserve is highlighted by this official logo.

Hello!

I'm Marcel! I'm a Black and White Colobus Monkey and your guide through this manual. I'm very curious and like to ask questions when new topics come up.

Manual overview

1. The first section explains about **biosphere reserves** and how they are established and managed.

2. The second section provides information on different types of **forests**, explaining the structure within a natural forest, as well as the different plants and animals that are found there. It also outlines the importance and threats posed to the forests in the Kafa Biosphere Reserve and aims to address harmful activities.

3. The third section deals with the topics of **water and wetlands**. It gives an introduction to the water cycle and the importance of water in general. The differences between and value of different types of wetlands and rivers are explored, as well as the consequences of destructive human activity.

4. The forth section provides information on the **wildlife** found in the Kafa Biosphere Reserve and explains concepts such as food webs.

5. **Coffee** is the focus of the fifth section, in particular Arabica Coffee. The conditions needed for its growth as well as its cultural and economic significance are explained, in addition to the environmental impact of different methods of cultivation.

6. The sixth and final section addresses the issue of **climate change**. First introducing scientific concepts such as the carbon cycle and the greenhouse effect, the section then discusses the consequences of climate change, and also adaptation and mitigation measures.

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Section 1

UNESCO Biosphere Reserves

1. Basic knowledge on biosphere reserves

What is a biosphere reserve?

A biosphere reserve (BR) is an area created to conserve the biological and cultural diversity of a region while promoting sustainable economic and social development. An area is given the title of biosphere reserve by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as part of the Man and the Biosphere (MAB) Programme.

All of the biosphere reserves around the world form a global network, called the "World Network of Biosphere Reserves". This network allows the exchange of knowledge and experience, discovering which obstacles have to be overcome for sustainable development and which strategies can be successful.

A biosphere reserve is a place for people and nature to co-exist and interact with each other for their mutual benefit. The inhabitants may use the area's natural resources in a sustainable way, and, at the same time, contribute to conserving precious habitats. It is a place for cooperation, education, research and experimentation to better understand man's impact on nature. It is a demonstration area to test new and innovative ideas for sustainable development. All members of society, including local communities, environmental groups, and economic parties are involved and work together to address conservation and development issues.

The UNESCO definition

Biosphere reserves are areas of terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity with its sustainable use. They are internationally recognized, nominated by national governments and remain under sovereign jurisdiction of the states where they are located. Biosphere reserves serve in some ways as 'living laboratories' for testing out and demonstrating integrated management of land, water and biodiversity. Collectively, biosphere reserves form a world network: the World Network of Biosphere Reserves (WNBR). Within this network, exchanges of information, experience and personnel are facilitated. There are over 500 biosphere reserves in over 100 countries.

Source: UNESCO FAQ – Biosphere Reserves

Biosphere reserve functions

Biosphere reserves are required to fulfil three basic functions. These functions are all interrelated and depend on one another for success.

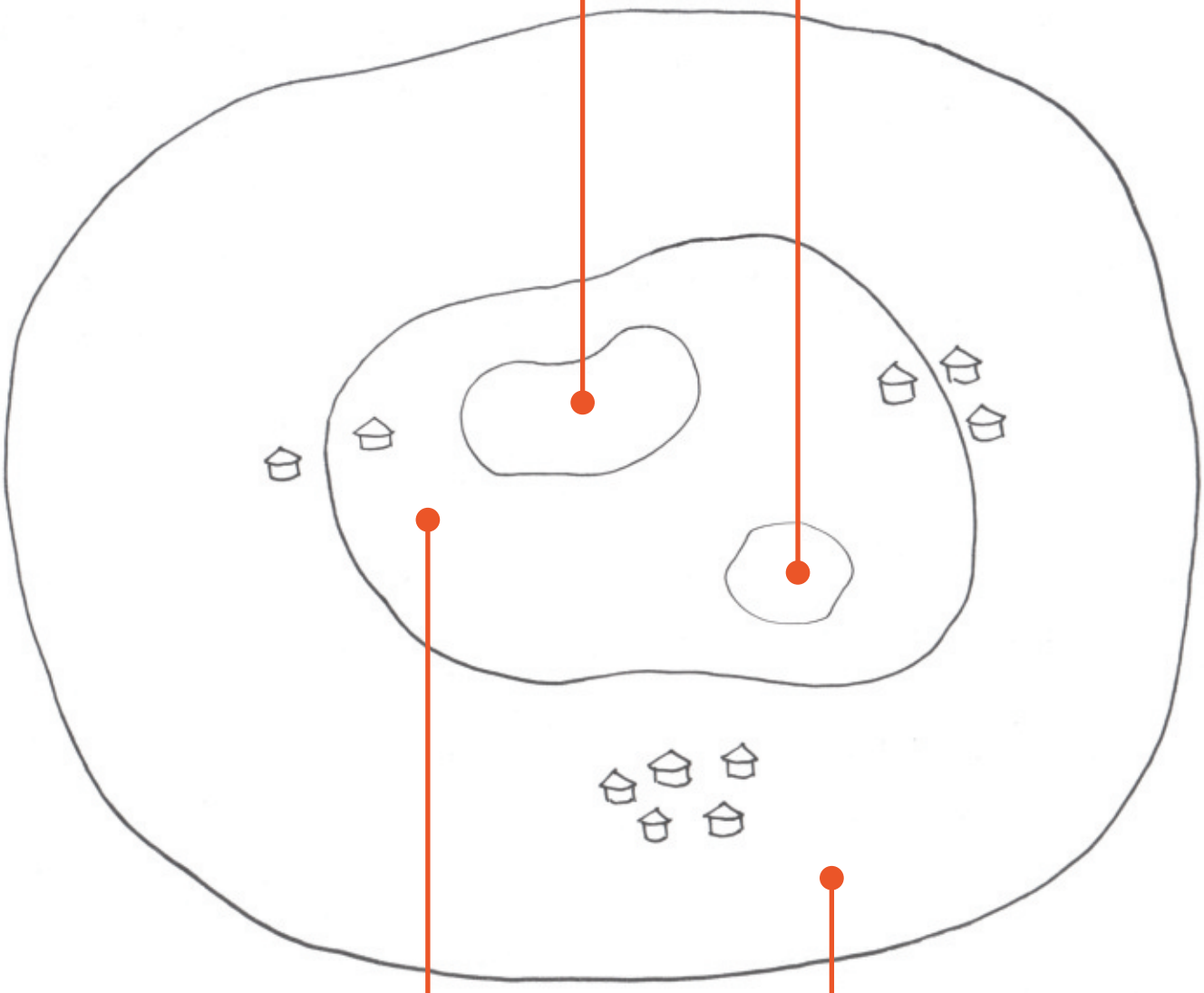
i) **Conservation function:** To contribute to the conservation of cultural diversity and biodiversity, including genetic variation, species, ecosystems and landscapes, and securing services provided by such diversity

ii) **Development function:** To encourage economic and human development that is environmentally and socially sustainable and culturally appropriate

iii) **Logistics fuction:** To provide logistical support for research, monitoring, demonstration projects, education and the exchange of information related to local, national and global issues of conservation and development

Zonation of a biosphere reserve

Biosphere reserves aim to manage their resources in an integrated manner through taking conservation into consideration in land and resource planning and use. This is achieved through dividing the reserve into three types of areas, known as "zones".



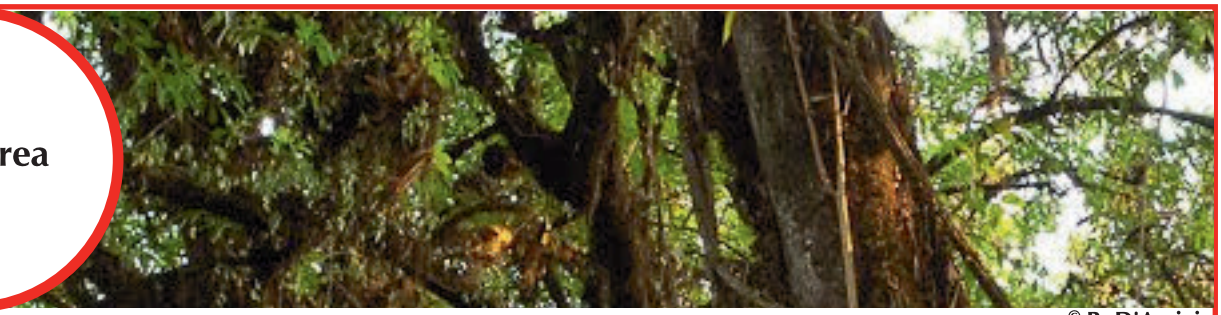
Core areas...
for nature protection.

Buffer zone...
for conservation and sustainable development.

Transition area...
for sustainable development and settlement.

What activities are allowed in the zones?

Core area



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Every biosphere reserve must contain one or more core areas. These have strong legal protection and serve as a refuge for wild plants and animals free from human disturbances. Only activities that do not have any kind of impact on the environment, i.e. that are non-destructive and non-consumptive, are allowed in these areas. In Ethiopia the core area must comprise at least 3% of the total area.

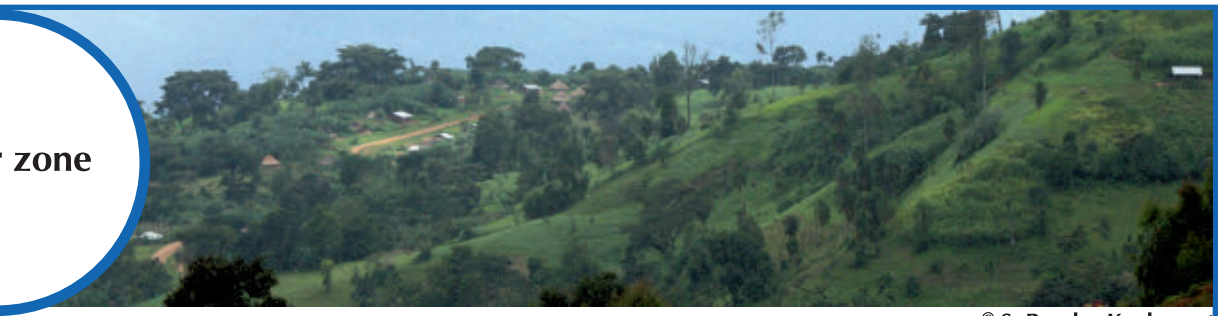
Activities that are **allowed** in the core area:

- Monitoring
- Research
- Traditional non-destructive uses

Activities that are **not allowed** in the core area:

- Farming or agriculture
- Settlement construction
- Grazing domestic animals
- Harvesting products of any sort e.g.:
  - Cutting down trees
  - Collecting firewood
  - Hunting
  - Bee keeping

Buffer zone



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Buffer zones, as their name suggests, buffer, i.e. surround and protect the core areas from the impact of human activity. They function as essential ecological corridors, connecting the core areas to allow the movement of wildlife.

Activities in the buffer zone must be compatible with the conservation of the core areas and contribute to research, education and the conservation of traditional land-use practices. In Ethiopia, the buffer zone should comprise at least 10% of the total area of the biosphere reserve.

Activities that are allowed in the buffer zone:

- Tourism
- Recreation
- Research
- Education and training

Transition area

© P. E. Ball

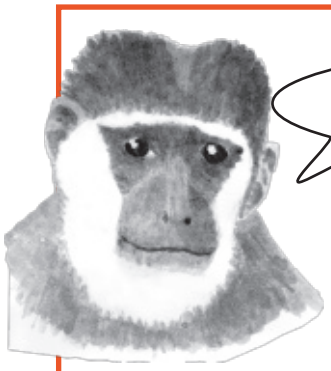
The transition area has a central role in enabling sustainable development. It is a place where people live and make a living. It accomodates more high-impact and economic land uses and may contain a variety of agricultural activity, settlements and other land use types. The transition area can contain towns, farms, fisheries and other activities. It is in this zone where local residents, non-governmental organisations, scientists, cultural groups, economic stakeholders and others work together to manage and sustainably develop the area's resources. In Ethiopia, the transition area comprises around 45% of the total area.

Activities that are **allowed** in the transition area:

- Farming and agriculture
- Fishing
- Tourism
- Bee keeping
- Human settlements eg. urban areas and villages
- Industry and enterprise

Economic practices

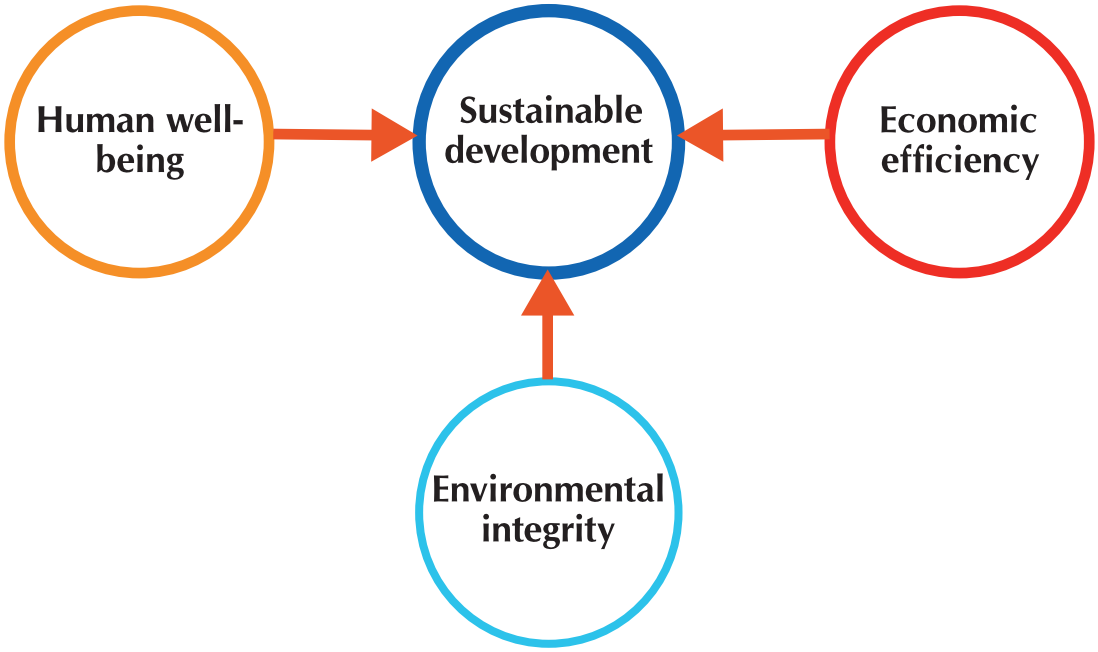
One of the three functions of a biosphere reserve is to promote sustainable economic development activities for the local communities living in the area. The aim is to improve the living standard of the local communities, while ensuring that the environment is not damaged and the communities' traditions and cultures are preserved.



What is sustainable development?

Sustainable development is development that meets the needs of the present generation, without compromising the ability of future generations to meet their own needs. (Source: Our Common Future, Report of the World Commission on Environment and Development, 1987)

Sustainable development focuses on improving the quality of life for all of the world's citizens without increasing the use of natural resources beyond the capacity of the environment to supply them indefinitely. There is a need for harmony and balance between the environment, society and the economy.



How does an area become a biosphere reserve?

When a country nominates an area to become a new biosphere reserve, it must meet a minimal set of criteria and conditions before being accepted by UNESCO. It must be characteristic of a certain type of ecosystem or landscape, and it must demonstrate a good example of sustainable development. In addition, it is essential that the inhabitants of the area support the area's designation as a biosphere reserve because UNESCO does not allow any resettlements.

In Ethiopia, there are several criteria that are used to help determine whether the requirements for designation of a biosphere reserve are fulfilled at the time the application is submitted. Only applications that fulfil all application criteria are forwarded to UNESCO by the National MaB Committee. Some of these criteria include:

- The biosphere reserve must contain landscapes and habitats which, to date, are not sufficiently well-represented in biosphere reserves and protected areas' systems of Ethiopia and which, by virtue of their natural, cultural and social features, are especially suitable for the exemplary implementation within Ethiopia of the UNESCO MAB programme and for representation of the programme internationally.
- To fulfil its functions the biosphere reserve should, as a rule, comprise at least 50,000 hectares. Biosphere reserves that cross regional state boundaries may have a total area larger than this, if adequately staffed.

How is a biosphere reserve managed?

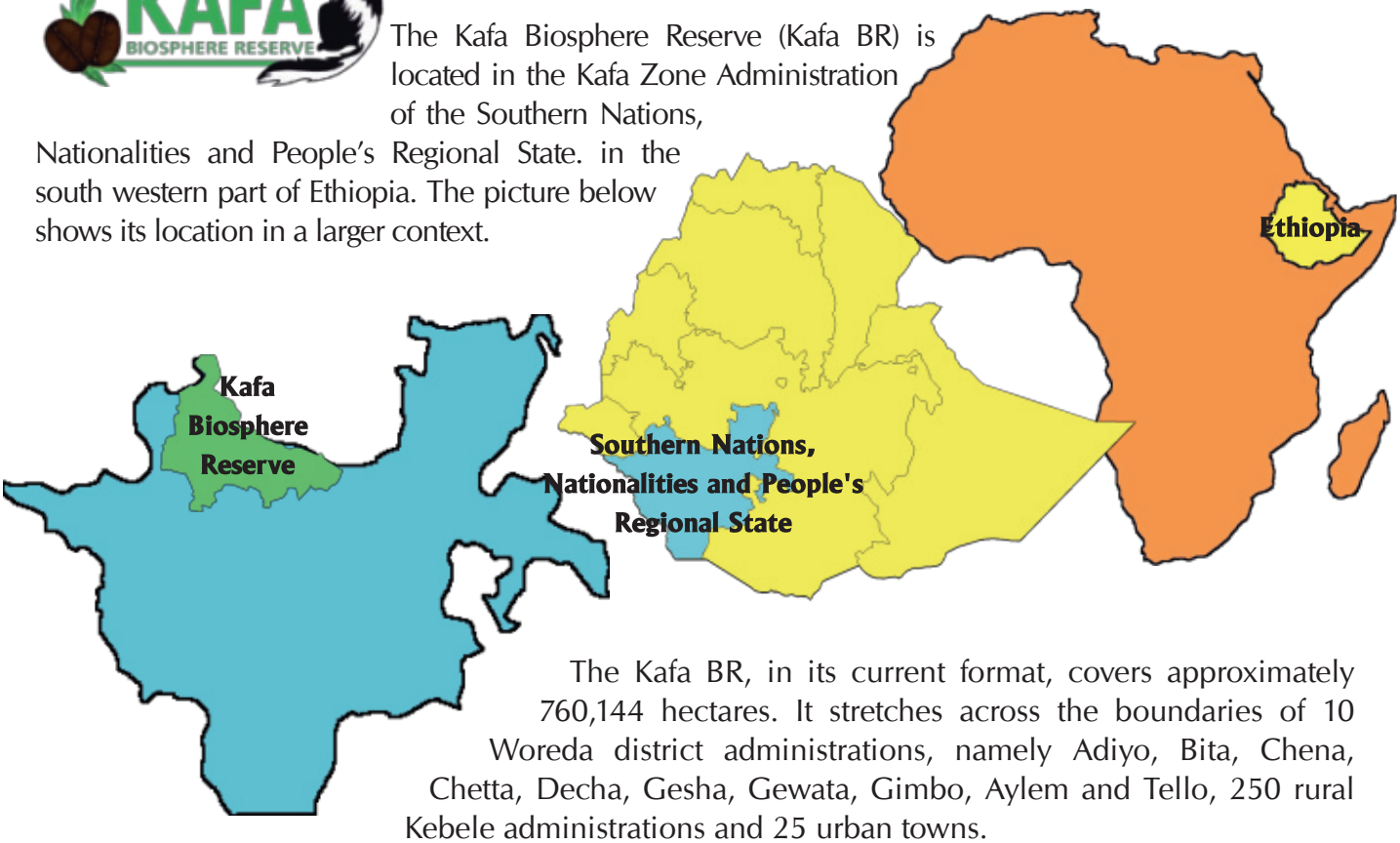
After its designation, a BR remains under the legal power of the state or country where it is situated, yet it shares its experience and ideas nationally, regionally and internationally within the World Network of Biosphere Reserves. A national MAB committee was established in Ethiopia in 2009 with the aim of implementing the Man and the Biosphere Programme at national level. The national committee is made up of representatives from various ministries, agencies, research and academic institutions of the Federal Government and some regional states, and is chaired by the Ministry of Science and Technology.

Each biosphere reserve has its own management system to ensure it is on course to achieving its functions and objectives. Often a committee or a board is established to plan and coordinate all of the activities of the stakeholders within the biosphere reserve, Often a biosphere coordinator is appointed to be a contact person for all biosphere reserve-related issues. A management plan is developed for each reserve to guide its implementation and management.

2. Introducing the Kafa Biosphere Reserve

The location of the Kafa Biosphere Reserve

The Kafa Biosphere Reserve (Kafa BR) is located in the Kafa Zone Administration of the Southern Nations, Nationalities and People's Regional State. in the south western part of Ethiopia. The picture below shows its location in a larger context.



The Kafa BR, in its current format, covers approximately 760,144 hectares. It stretches across the boundaries of 10 Woreda district administrations, namely Adiyo, Bita, Chena, Chetta, Decha, Gesha, Gewata, Gimbo, Aylem and Tello, 250 rural Kebele administrations and 25 urban towns.

Location	Kafa Zone in Southern Nations, Nationalities and Peoples Regional State, Ethiopia
Total extension	760,144.1 ha
Core area	41,391.1 ha (including 11 National Protected Forest Areas)
Candidate core zone	219,441 ha (no statutory conservation status)
Buffer zone	161,427 ha
Transition zone	337,885 ha
Area covered with forest	422,260.01 ha (=55.55% of the total surface)
Major ecosystems & habitats	Sub-Afroalpine habitats with moist evergreen montane cloud forest with wild Coffea arabica, bamboo thickets and grasslands Combretum-Terminalia bushlands, aquatic habitats (river systems, wetlands)
Population	657,780 (44% aged 14 and younger)
Ethnic composition	Kafecho (81.4%), Amhara (5.5%), Oromo (2.35%), others and indigenous groups like Maja (5.38%)
Persons per household	4.4
Population growth rate	2.9%

The significance of the Kafa Biosphere Reserve

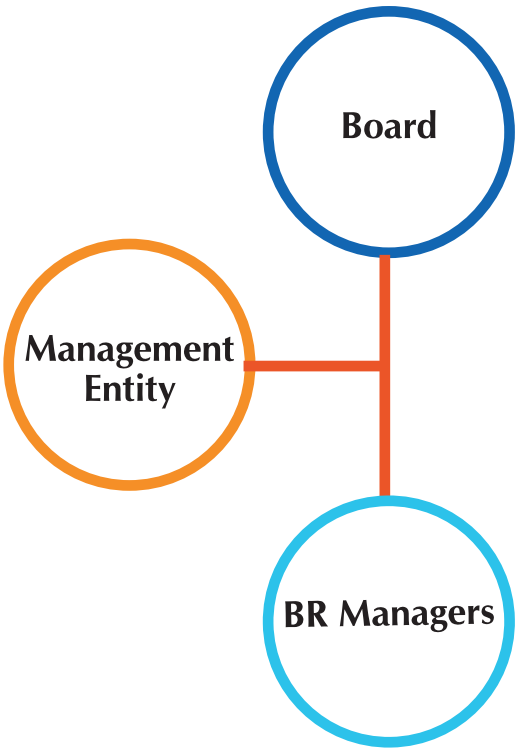
The Kafa BR was established in 2010 and, alongside the Yayu and Sheka Forest Biosphere Reserves, is one of the first three biosphere reserves in Ethiopia. It is an area of local, national and international significance. The area's Afromontane cloud forests are home to Arabica Coffee the most popular type of coffee in the world. The forests are also home to more than five thousand wild varieties of coffee, as well as many other important plant and animal species including the Colobus monkey. Some of the plant and animal species are unique to the area and cannot be found naturally anywhere else in the world.

The forests and wetlands in the Kafa BR are also very important carbon stores. It is important to protect them to prevent global warming and climate change from occurring. In addition to this, they are crucial in regulating the region's water supply as the forests ensure rainfall in the region and feed water into many of the region's river systems including the Gojeb, Sharma and Omo Rivers.

The local communities living in the Kafa BR have a strong and distinct cultural identity and long-standing traditions, such as the coffee ceremony, that have evolved over centuries. The people in the Kafa BR have lived harmoniously with nature for many centuries, and have developed traditional land-use and agricultural practices and knowledge.

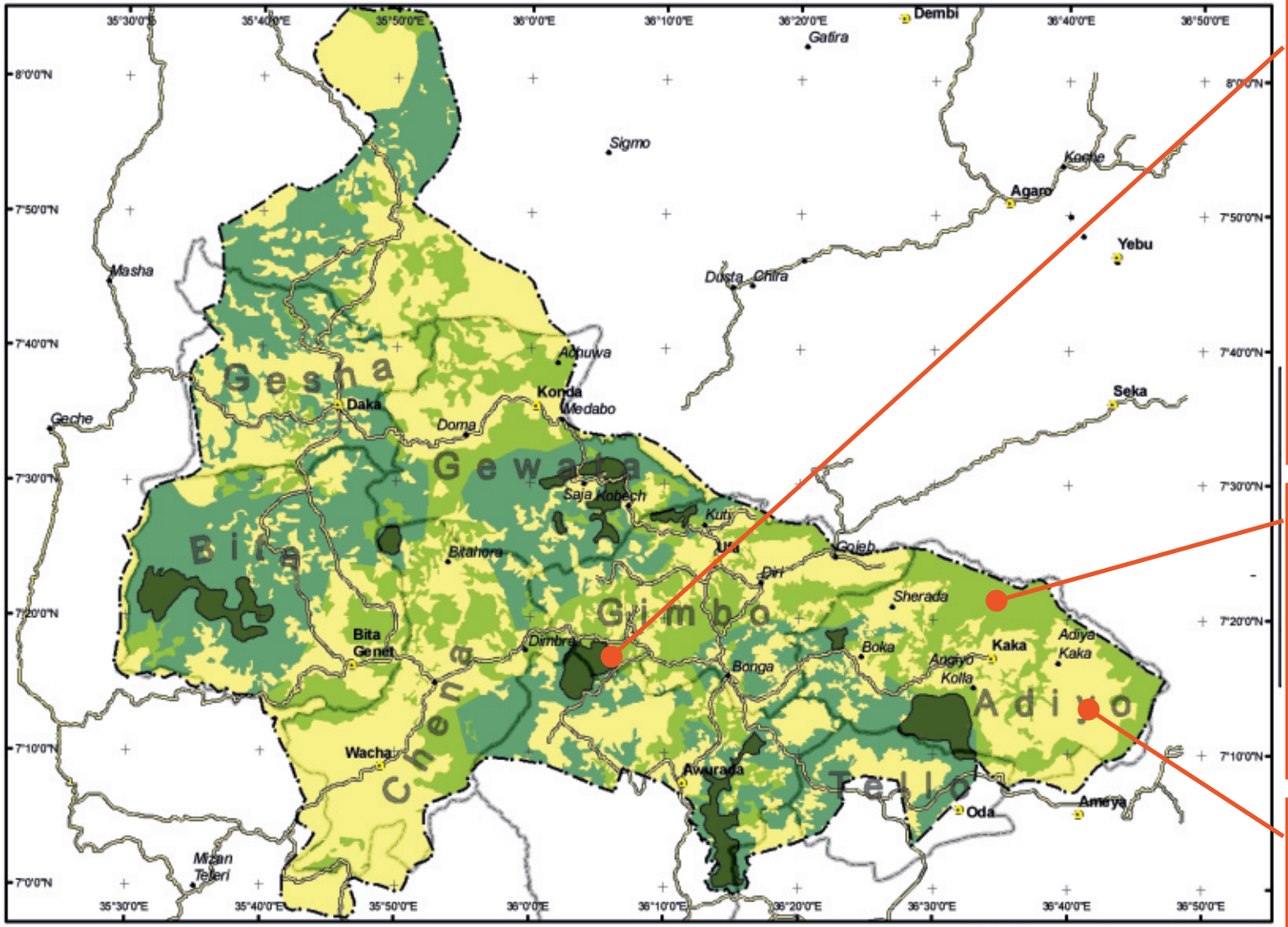
How is the Kafa Biosphere Reserve managed?

Kafa BR's own administration is currently being established. It will have representatives from all stakeholders including all levels of government from the Kafa Zone, the relevant Woredas and Kebeles, conservation agencies, economic representatives, non-governmental organisations, traditional authorities agencies and representatives from the communities. The authority will have permanent staff that are responsible for the planning and co-ordination of all the activities in the Kafa BR. The administration's offices will be based in Bonga. Below is the management's structure as planned and partly functionning.



Name of management entity	Who?	Role/ responsibility
Board	Scientists, VIPs etc.	Strategic planning, marketing, fundraising
Management entity	Representatives of all related administrational levels	Quarterly meeting for local decision making
BR Managers	2 employees (financed by NABU till Oct 2013) based at Dept. of Agricultural Development	Implementation of decision and general management

Zonation of Kafa Biosphere Reserve



A larger map is included at the end of this manual.

Core Areas

Core Areas are areas of high conservation importance that are protected. There are eleven core areas in Kafa BR. They are located within eleven protected forests, which have statutory conservation status. They cover around 41,391 ha.

Buffer Zones

These areas surround the core areas and protect them from the negative impact of human activities. They cover a total of 161,427 ha.

Transition Area

The transition area in the Kafa BR mainly consists of urban areas (e.g. villages) and cultivated, agricultural land. The transition area covers an area of 337,885 ha.

3. Tourism in the Kafa Biosphere Reserve

The Kafa BR has a massive potential for attracting tourists. People from around the world are interested in seeing the unique wildlife and natural environment as well as experiencing the culture and traditions of the communities living in Kafa BR. The tourism industry in Kafa is steadily growing. The majority of tourists that visit the Kafa BR are domestic visitors as they come from within Ethiopia, but international tourists make up around ten percent of visitors. Tourism, when carried out sustainably, can bring real benefits to Kafa BR. Here are some of these benefits:

Promoting environmental conservation

Tourists are attracted by the unique natural resources of the Kafa BR. This increases the incentive for local communities to conserve them. Increasing the knowledge and awareness of the natural environment amongst the local community ensures that the opportunities for tourism are promoted and good quality, educational services are provided.

Benefiting the rural communities

Tourists appreciate and value learning about the traditional culture, knowledge and skills of the local communities living sustainably in the Kafa BR.

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Enhancing the local economy

Tourism brings income into the local community. It can help boost local businesses such as tourist accommodation providers, restaurants and wildlife tours, as well as local craftsmanship.

Providing employment

Tourism can provide local communities with employment opportunities. Both skilled and unskilled workers are needed as wildlife guides, healthcare professionals, cleaning and catering staff.

What attracts the tourists to Kafa Biosphere Reserve?

The Kafa BR has unique wildlife and beautiful natural scenery for tourists to enjoy, including:

- Unique opportunity to see and experience the wild coffee forests.
- Hiking and walking trails in the mountains and surrounding forests.
- Excellent bird and game watching in a natural habitat.

Some tourists are also interested in learning about the unique culture in Kafa, including:

- The traditional coffee production systems such as forest coffee harvesting and home gardens as well as the traditional coffee ceremony.
- Unique rural landscapes in the Ethiopian highlands with scattered tukul dwellings.

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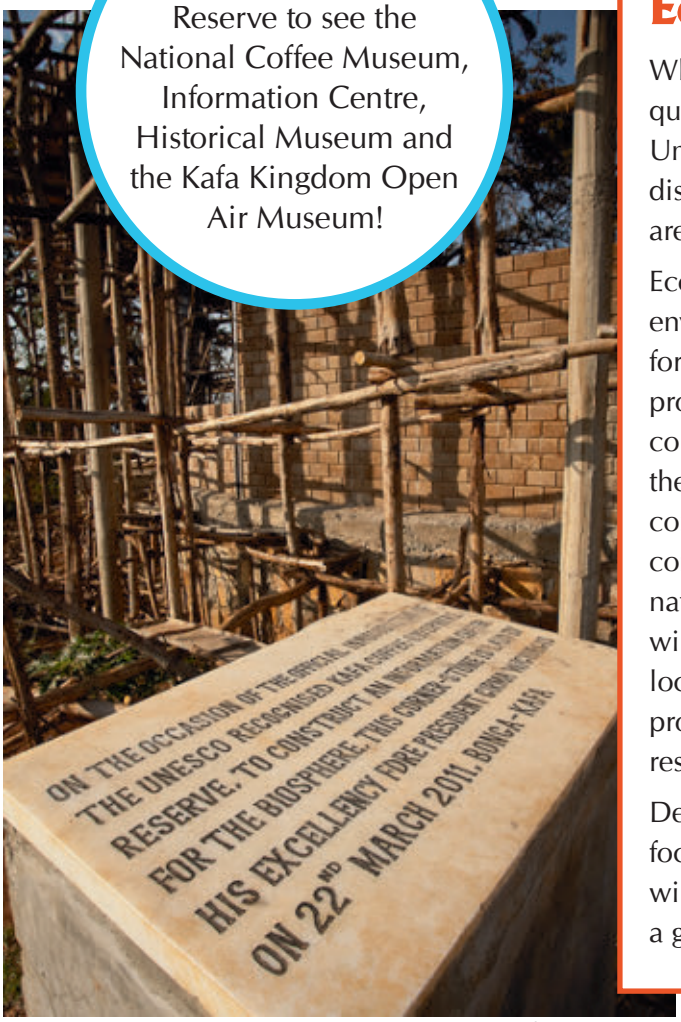
Visit...

the Kafa Biosphere Reserve to see the National Coffee Museum, Information Centre, Historical Museum and the Kafa Kingdom Open Air Museum!



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Ecotourism

When poorly planned and implemented, tourism can quickly turn into a social and environmental disaster. Unattractive hotels, overuse of water resources, disrespect for local traditions, litter and deforestation are all the unhappy outcomes.

Ecotourism is a viable way to protect the natural environment and create social and economic benefits for local communities. It is a more appropriate tool for promoting sustainable development in developing countries than mass tourism. The aim is to minimise the impact of tourism, promoting environmental conservation and the empowerment of local communities. Tourists are encouraged to appreciate the natural environment, ecosystems, landscape and wildlife, as well as to gain an understanding of the local community's traditional culture. Ecotourism provides economic advantages while ensuring natural resources and the local way of life are protected.

Developing tourism that caters for small groups and focuses on specialist topics such as bird watching, wildlife safaris, cultural experiences or photography, is a good way to develop an area.

4. Activities

Biosphere Reserve Zonation

Here is a list of all the core area sites in the Kafa BR:

Core Area	Area (hectares)
Ufa-Mankira Forest	4,426 ha
Komba-Daga Forest	3,736 ha
Dadiban Forest	1,001 ha
Shocha Forest	1,500 ha
Saja-Boginda Forest	5,100 ha
Shana Tura Forest	2,650 ha
Kasha-Tagera Forest	2,350 ha
Chomecha Forest	1,087 ha
Woshero-Grecho Gechiti Forest	11,000 ha
Boka-Buta Forest	7,000 ha
Mera-Kalisha Forest	1,540 ha

- Can you find them on the map? Which Woredas are they located in?
- Is your village in the Core Zone, the Buffer Zone or the Transition Zone?
- Is cutting wood allowed in the Core Zone?
- Is collecting coffee allowed in the Buffer Zone?

Conflicts

The people who live in biosphere reserves may have conflicting interests if the resources they depend upon are used by someone else in an incompatible way. People often have very different understandings of what is fair and right.

This role play example is just one example of a conflict that can happen. It is not uncommon for people to disagree about the way they use land. It is important to understand the different groups in a biosphere reserve and to see how they interact with one another. Whatever people are disagreeing about, a way has to be found to resolve these conflicts.

Role play!

Ask two members of the group to play the roles of Kanito and Kochito in the following role play.

Kochito has always used the trees in the patch for his beehives. Kanito is not aware of this and cuts down the trees to plant a small crop of enset.

© S. Bender-Kaphengst

Kochito and Kanito have conflicting interests – Kochito needs the trees for his beehives, but Kanito needs the land to grow enset so he can sell it at the market to buy food for his family. It is not possible for both Kochito and Kanito to use the land. One of the activities prevents the other from happening. There is a conflict between the two of them, and neither wants to give way!

How can this conflict be resolved?

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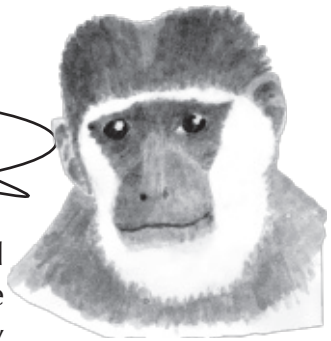
Section 2
Forest

1. Basic knowledge on forests



What is a forest?

A forest is a large area covered with continuous and dense trees, shrubs and undergrowth. Forests are complex ecosystems that, in their natural state, are home to a large number of animals and plants. Humans also get many benefits from forests in many ways that will be explored in this chapter. There are many different types of forest all around the world but this chapter deals specifically with the forest types in the Kafa BR.

Types of natural forest

Just like the agro-ecological zones, where different crops grow in different altitudes and climates, different types of forest and natural vegetation grow at different altitudes and climatic conditions. The type of vegetation found in the Kolla zone is different from that found in the Weyna Dega and also different to that found in the Upper Dega and Dega zones resulting for the formation of different forest structures.

An official definition...

Land spanning more than 0.5 hectares with trees higher than 5 meters 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 use.

Source: Food and Agriculture Organization of the United Nations (2010): Global Forest Resources Assessment 2010. Terms and Definitions

Types of natural forest that can be found in the Kafa BR include:

Upland Humid Forest

This type of forest, often called cloud forest, is found at quite high altitudes ranging between 1800-2600 metres above sea level in the wet Upper Dega and Dega zones. It is characterised by tree and shrub species such as African Redwood (*Hagenia abyssinica*), Cape Beech (*Rapanea melanophloeos*), False Assegai (*Maesa lanceolata*) and Winged Bersama (*Bersama abyssinica*).

© B. D'Amicis

Upland Rainforest

This type of forest is found at a lower altitude ranging between 1500 – 1800 metres above sea level in the wet Weyna Dega zone. It is characterised by big tree species such as Elgon Olive (*Olea welwitschii*), Euphorbia (*Euphorbia obovalifolia*), Broad-leaved Croton (*Croton macrostachyus*), Forest Long-pod Albizia (*Albizia schimperiana*), Red Stinkwood (*Prunus africana*), Waterberry (*Syzygium guineense*) and Parasol Tree (*Polyscias fulva*). It has smaller trees and shrubs such as the Birbira Tree (*Millettia ferruginea*), Small-fruited Teclea (*Teclea nobilis*), Afromontane Dragon Tree (*Dracaena afromontana*) and Arabica Coffee (*Coffea arabica*). Ground vegetation includes the spice False Cardamom (*Aframomum corrorima*).

Bamboo Forest

Another type of natural forest is bamboo forest that is found for example in Boka Forest. This type of forest is also found at higher altitudes in the wet Upper Dega and Dega zones. It is characterised by the bamboo species *Arundinaria alpina*, which is an Afromontane species that grows naturally at higher altitude ranges. It needs fertile volcanic soils and requires a temperature of 10-20°C and annual rainfall between 1,500 and 2,000 mm. Its roots are very good at holding the top layer of soil

in place and preventing erosion. The bamboo may grow by itself (in pure stands) or it may exist in a mixed forest where it is mixed with other trees, including African Redwood (*Hagenia abyssinica*), Cape Beech (*Rapanea melanophloeos*) and Hypericum (*Hypericum revolutum*).

Types of man-made forest

Forest plantations

A forest plantation is an area where trees of just one or two species are planted (often in rows). It is established on land where there was no forest before, or areas are specially deforested to make space for them. Forest plantations are intensive systems with just one or two species planted for maximum productivity. The trees planted in forest plantations are usually fast growing. Mexican White Cedar (Cupressus lusitanica), Patula Pine (Pinus patula), Monterey Pine (Pinus radiata) and Eucalyptus are examples of tree species often grown on plantations.

Plantation forests can be grown for construction, firewood, conservation purposes and to provide shade for coffee and spices to grow. A plantation is very different to a natural forest as the trees are usually harvested before they have reached full maturity. Plantation forests do not fulfil the same functions as natural forests. They cannot support as many different animal species and affect the water cycle and the soil differently. Unlike a natural forest, which does not rely on any external input, the plantation trees require constant input as they have to be nurtured and protected from pests.

Community plantations have been established on 1,500 hectares in the Kafa BR. Fast growing tree species have been selected for the plantations to ensure that communities are supplied with firewood, removing the need to destroy the natural forest.

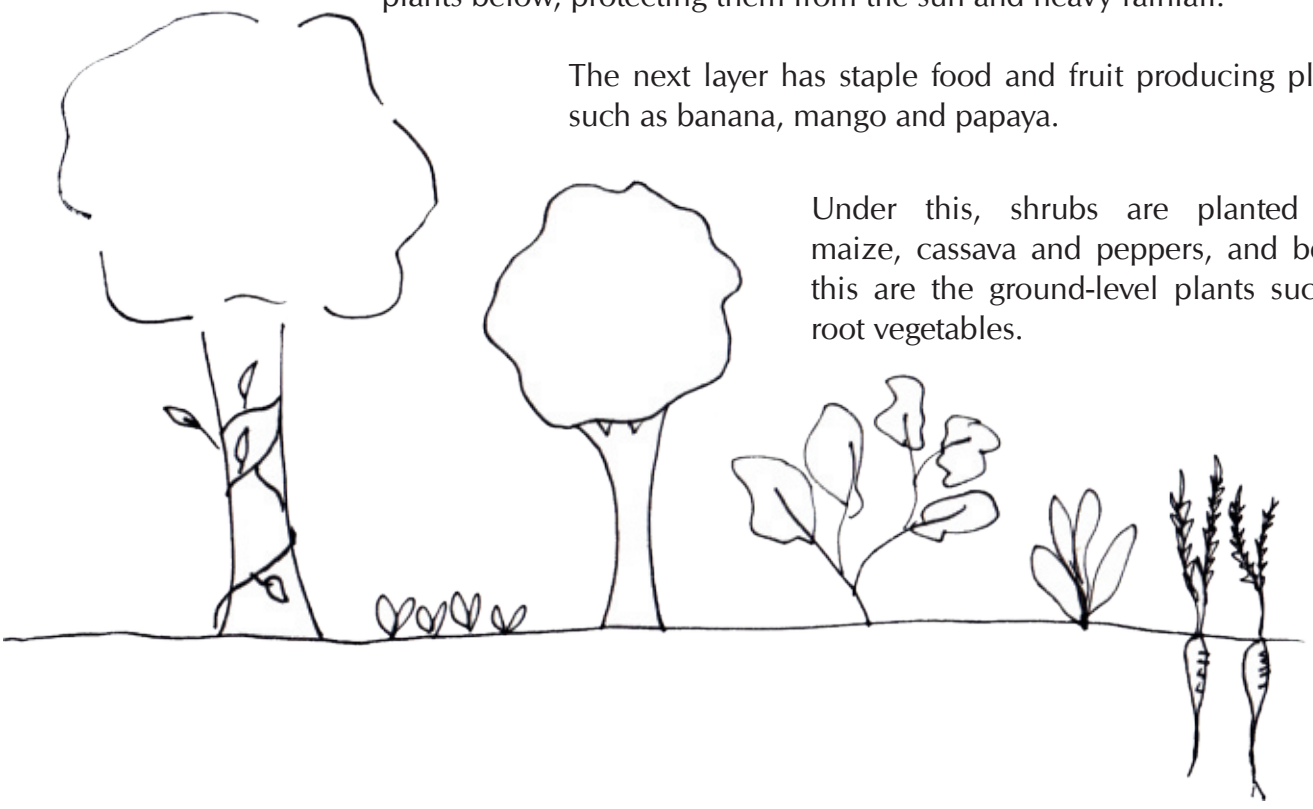
Agroforestry

Agroforestry (agricultural forestry) is a system where trees or shrubs are grown deliberately alongside other crops and/or livestock farming. Homegardens/ homestead plantations are a type of agroforestry characterised by vegetation layers, which have been planted to copy the natural forest structure.

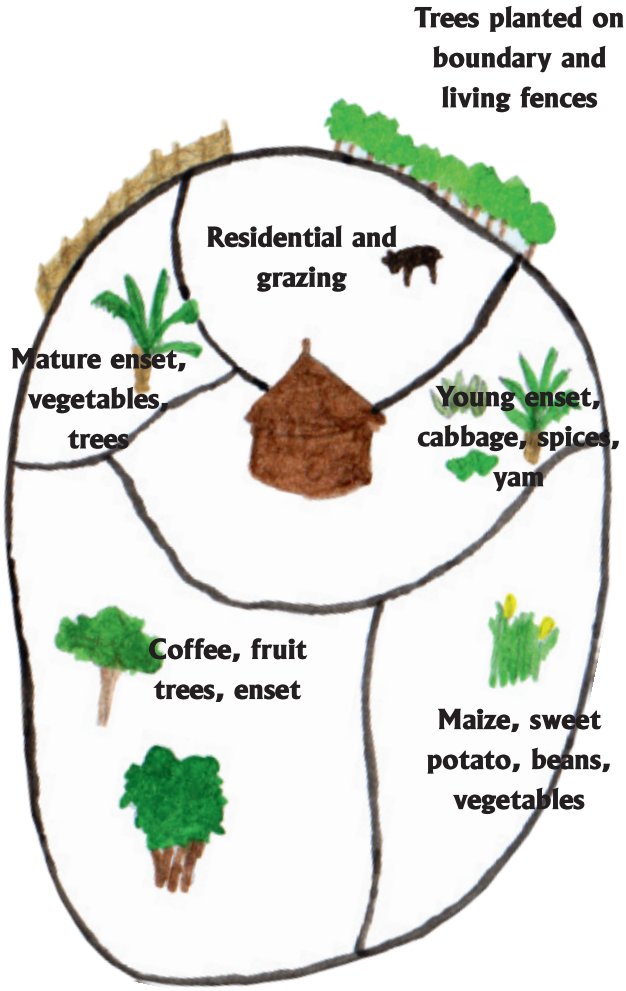
The top layer is similar to a canopy in a natural forest, and shelters the plants below, protecting them from the sun and heavy rainfall.

The next layer has staple food and fruit producing plants, such as banana, mango and papaya.

Under this, shrubs are planted e.g. maize, cassava and peppers, and below this are the ground-level plants such as root vegetables.



The plant and tree species are selected based on their requirements for growth, e.g. space, water, nutrients and light. They are planted so they can benefit one another. Some people develop homegardens from natural forest, maintaining some of the large canopy trees, but clearing the undergrowth to plant species such as coffee , enset, fruit crops and spices like cardamom. Gradually more and more crops are introduced, replacing the natural vegetation over time. Sometimes a few of the canopy trees might be cut for firewood and to allow more light to reach the plants growing below. This changes the forest into agricultural/ settled land and leads to its destruction.



Example of a homegarden with different units/plots. Based on study by Tesfaye Abebe.

Reforestation and afforestation

Reforestation is the term used for the replanting new trees in areas where they have been removed due to natural or human causes. Is is a way of helping the forest to recover and improve its quality, restoring its natural functions. Afforestation is when land, that was not previously a forest or has not been forested for a long time, is planted with trees so it becomes a forest.

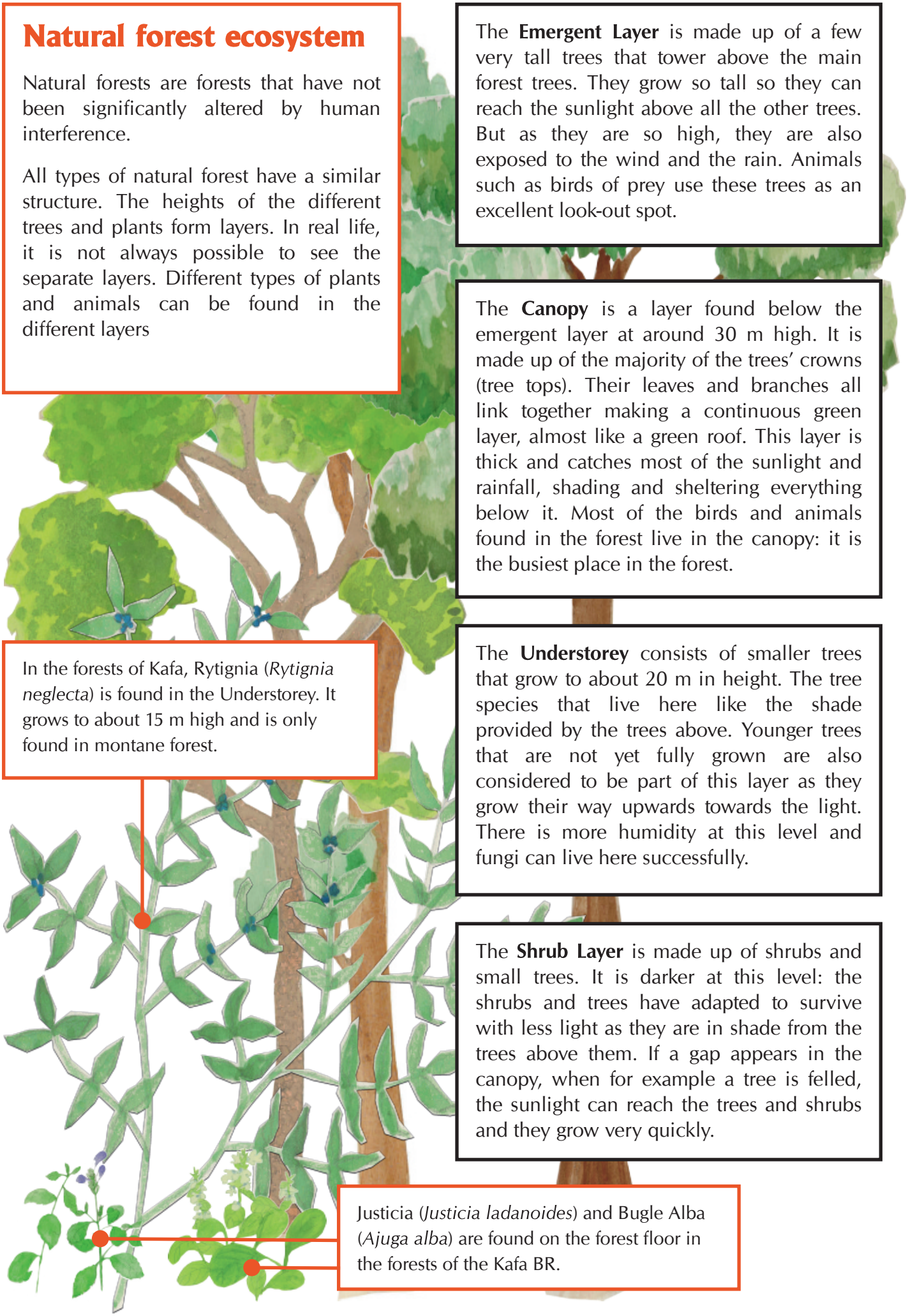
Deforested areas can be restored through growing trees in nurseries and then planting them in areas where there was previously forest. The quality of degraded and fragmented forests can also be improved by planting trees.

In Kafa BR,it is intended to plant about 350,000 trees to restore the forests. 500 hectares of degraded forest will be planted with indigenous tree species and 200 hectares of farm land with native multi-purpose agroforestry trees and crops.

Natural forest ecosystem

Natural forests are forests that have not been significantly altered by human interference.

All types of natural forest have a similar structure. The heights of the different trees and plants form layers. In real life, it is not always possible to see the separate layers. Different types of plants and animals can be found in the different layers



The **Emergent Layer** is made up of a few very tall trees that tower above the main forest trees. They grow so tall so they can reach the sunlight above all the other trees. But as they are so high, they are also exposed to the wind and the rain. Animals such as birds of prey use these trees as an excellent look-out spot.

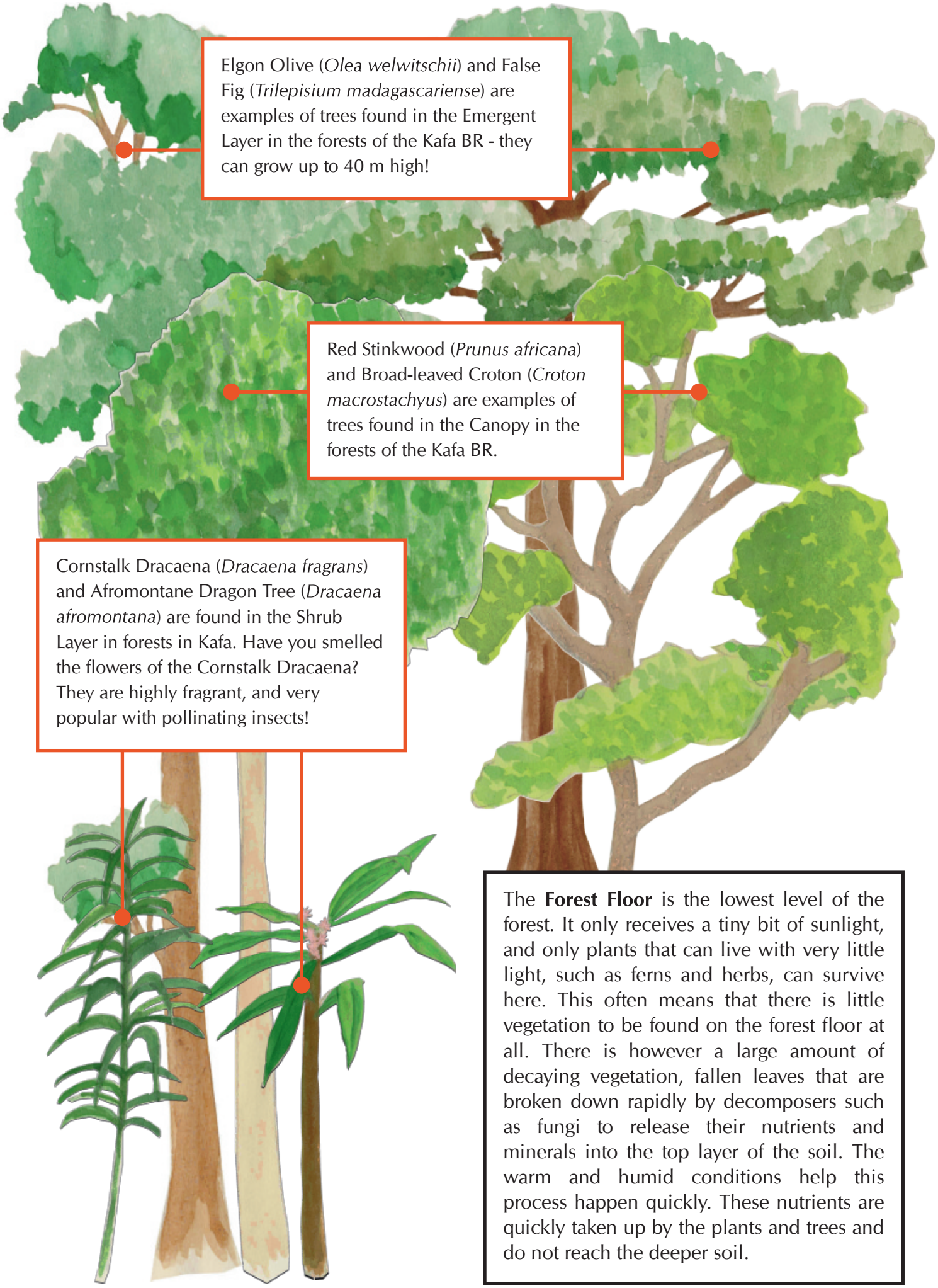
The **Canopy** is a layer found below the emergent layer at around 30 m high. It is made up of the majority of the trees' crowns (tree tops). Their leaves and branches all link together making a continuous green layer, almost like a green roof. This layer is thick and catches most of the sunlight and rainfall, shading and sheltering everything below it. Most of the birds and animals found in the forest live in the canopy: it is the busiest place in the forest.

In the forests of Kafa, Rytignia (*Rytignia neglecta*) is found in the Understorey. It grows to about 15 m high and is only found in montane forest.

The **Understorey** consists of smaller trees that grow to about 20 m in height. The tree species that live here like the shade provided by the trees above. Younger trees that are not yet fully grown are also considered to be part of this layer as they grow their way upwards towards the light. There is more humidity at this level and fungi can live here successfully.

The **Shrub Layer** is made up of shrubs and small trees. It is darker at this level: the shrubs and trees have adapted to survive with less light as they are in shade from the trees above them. If a gap appears in the canopy, when for example a tree is felled, the sunlight can reach the trees and shrubs and they grow very quickly.

Justicia (*Justicia ladanoides*) and Bugle Alba (*Ajuga alba*) are found on the forest floor in the forests of the Kafa BR.



Elgon Olive (*Olea welwitschii*) and False Fig (*Trilepisium madagascariense*) are examples of trees found in the Emergent Layer in the forests of the Kafa BR - they can grow up to 40 m high!

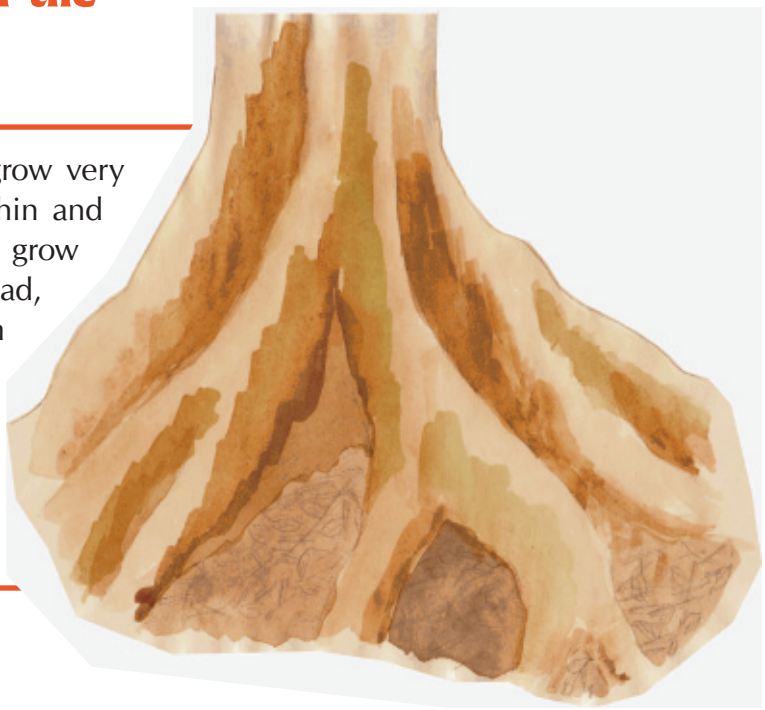
Red Stinkwood (*Prunus africana*) and Broad-leaved Croton (*Croton macrostachyus*) are examples of trees found in the Canopy in the forests of the Kafa BR.

Cornstalk Dracaena (*Dracaena fragrans*) and Afromontane Dragon Tree (*Dracaena afromontana*) are found in the Shrub Layer in forests in Kafa. Have you smelled the flowers of the Cornstalk Dracaena? They are highly fragrant, and very popular with pollinating insects!

The **Forest Floor** is the lowest level of the forest. It only receives a tiny bit of sunlight, and only plants that can live with very little light, such as ferns and herbs, can survive here. This often means that there is little vegetation to be found on the forest floor at all. There is however a large amount of decaying vegetation, fallen leaves that are broken down rapidly by decomposers such as fungi to release their nutrients and minerals into the top layer of the soil. The warm and humid conditions help this process happen quickly. These nutrients are quickly taken up by the plants and trees and do not reach the deeper soil.

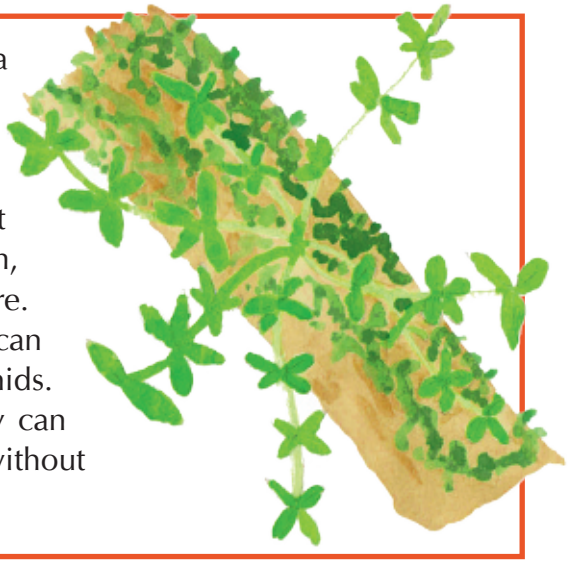
Adaptation of plants to live in the forest

The majority of trees in the forest have to grow very tall to reach the sunlight. Their trunks are thin and without many branches. Their roots do not grow deep into the soil, they have thick bases instead, known as **buttress roots** to stop them from falling over. The roots stay near the top layer of soil to absorb the nutrients that are found there. The Spiny Macaranga (*Macaranga capensis*) is an example of a tree in Kafa that has buttress roots.



Tree trunks provide support to climbing plants to reach the sunlight. Some of the climbing plants have woody stems, commonly known as **lianas**, while some do not. African Paddle-Pod (*Hippocratea africana*) is an example of a liana. It has roots in the ground, but can climb up to 15 m in height using trees as support to reach the forest layers with more light. While lianas can help many animals, such as primates and lizards, to get around the forest canopy, they are also very heavy for the tree and can significantly affect the tree growth and stands.

Other plants, such as the Four-leaved Peperomia (*Peperomia tetraphylla*) have adapted so they do not grow with roots in the soil, but rather grow on the trunks, branches and even on the leaves of other trees and shrubs. These plants, known as **epiphytes**, do not cause their 'host' any harm, but just attach to them, obtaining nutrients and water from the air and air moisture. They are abundant in the canopy of the forest and can include mosses and lichens as well as ferns and orchids. Through not needing to put their roots in the soil, they can live in higher layers of the forest to reach the sunlight, without having to grow as tall as a tree.



2. The importance of forests

Ecological importance of forests

Clouds and the water cycle

Forests are very important in regulating the water supply for whole regions. The forests of the Kafa BR are almost always covered with cloud and fog, which conserve the soil and air moisture.

- When air rises, it cools. The moisture in the air also cools and condenses to form clouds. The forests of Kafa are at a high altitude and the forest tree canopy captures the moisture in the air. The fog condenses on tree leaves which then drip onto the ground below. This dripping is very important in collecting water for stream flow and also important in the recharge of groundwater. Many rivers, such as the Gojeb, Woshi and the Sharma originate from the high altitude forests in Kafa. If the forest is cleared, this water stays in the air and can lead to drought.
- The roots of the trees in the forest also help the soil to take in and hold more water. They help to make the soil full of tiny spaces which allow water to soak into the soil and maintain the soil moisture holding capacity. The water then continuously replenishes the ground water system, helping to prevent drought occurrences while ensuring enough water downstream for agriculture, livestock and human uses.

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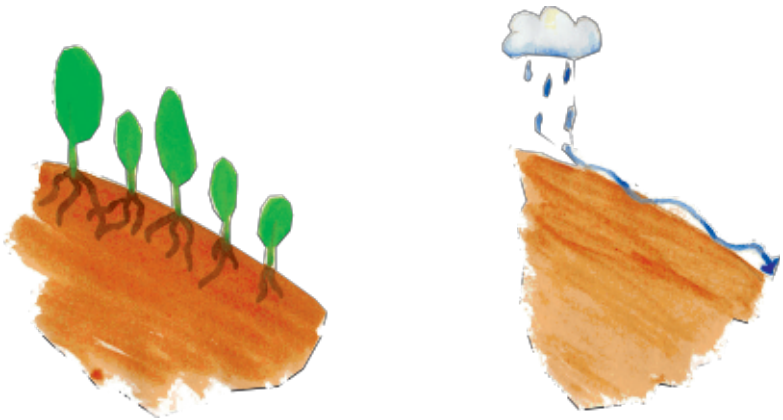
Preventing land slides

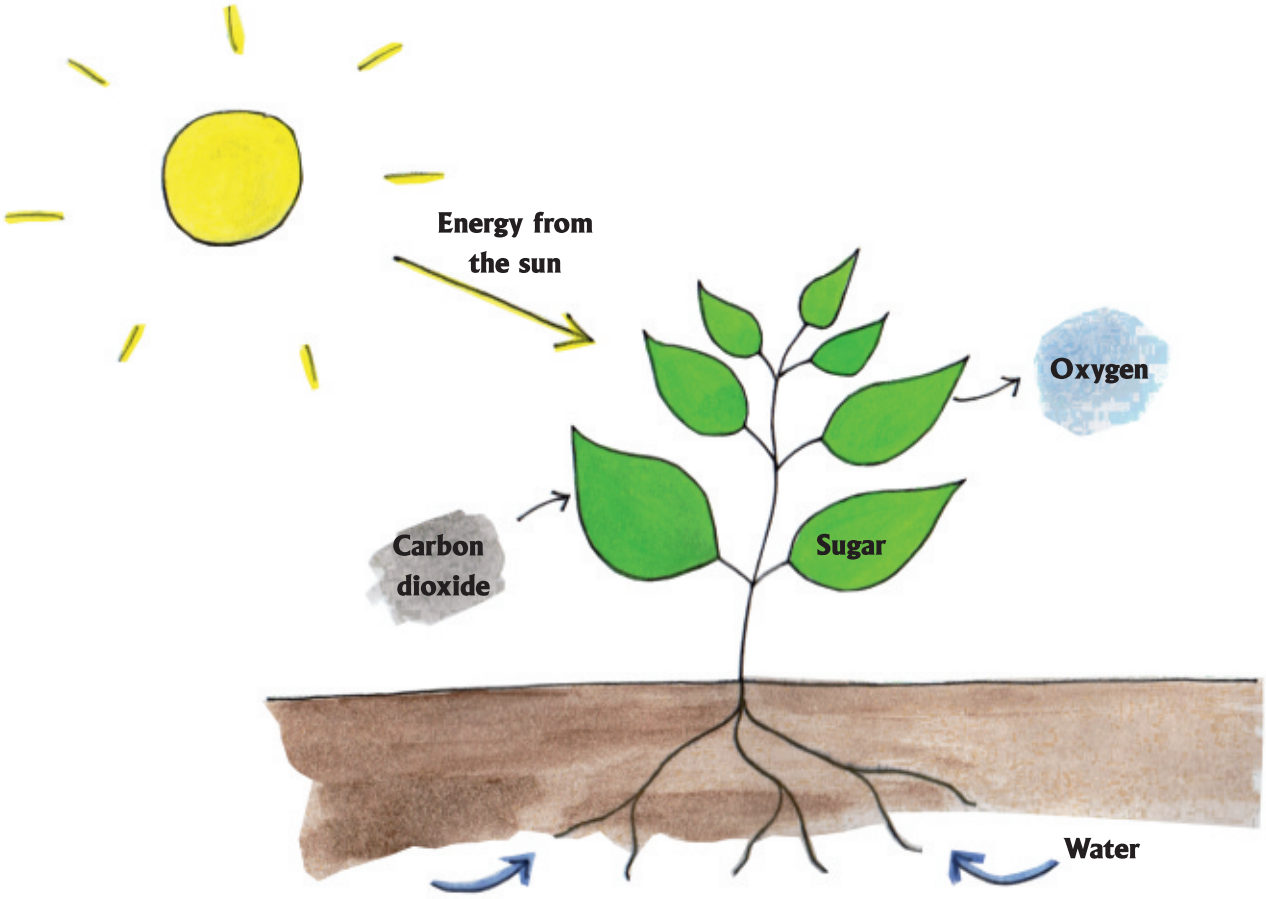
The vegetation and trees in forests prevent soil erosion. As you can see in the diagram below, the roots of the trees hold the top layer of the soil in place, stopping it from being detached and washed away into streams. This is especially important for areas of forest cover on steep slopes. All of the soil nutrients are contained in the top layer of soil and if it is exposed through deforestation, cutting or fire, the nutrients are exposed to the wind and rain and get washed away. Bamboo forests are especially good at preventing soil erosion as they have a complex root system that is especially good at holding soil in place.



Leaf litter and other dead plant materials decompose into organic matter. This improves the soil's nutrient content and maintains its fertility. The organic content of the soil also helps it to 'stick together', meaning the soil particles will not be easily detached and eroded.

Carbon Storage

Plants produce their own food through a process called photosynthesis. In doing so they absorb a gas called carbon dioxide from the air. Plants use the sun's energy to convert water and carbon dioxide in the air into sugar and oxygen.



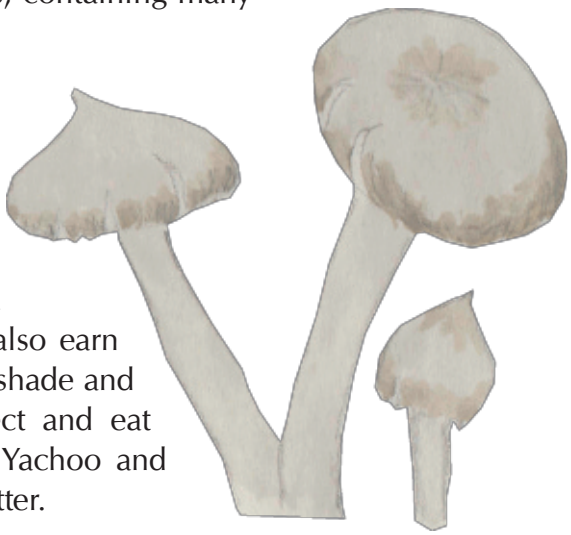
Plants use this sugar as a source of energy to grow, and in doing so, store the carbon dixide in their leaves, stems, roots and trunks. Fully grown trees are very big plants and therefore have a large amount of carbon stored in them.

Benefits forests provide to people

Communities that live in and next to forests obtain many products and services from them. There are many products that are obtained from a forest: firewood, fuel, building materials, honey and beeswax, spices, coffee and furniture to name just a few which will be explained hereafter:

Food plants

The forest provides a very wide variety of plants, nuts, seeds and fruits that are eaten as well as sold at market. They make up an essential part of people's diets, containing many essential nutrients.



Some examples of fruits that are obtained from the forest include: Waterberry (*Syzygium guineense*), Senegal Date Palm (*Phoenix reclinata*), Rubus (*Rubus apetalus*) and Air Potato (*Dioscorea bulbifera*). Some examples of important vegetables from the forest include Black Nightshade (*Solanum nigrum*), Bamboo (*Arundinaria alpina*) and Peponium (*Peponium vogelii*). Some people also earn an income from selling plant products such as Black Nightshade and Bamboo at local markets. Local communities also collect and eat mushrooms of different types such as Kotto, Tachi-koyo, Yachoo and Eroo that grow in the forest soil which is rich in organic matter.

Some plants, such as Angolan Fagaropsis (*Fagaropsis angolensis*), known locally as Yayoo, whose fruit is added to coffee, can earn a high amount of profit if they are sold at market. The fried and ground seeds and twigs of the Yayoo tree are used to feed dairy animals as an appetizer and to improve milk yields during the lactation period. Yayoo grows in the highland mountain forests of the Kafa BR in areas like Saja and Mankira. Farmers living around the forest also use forest plants as food for their livestock.

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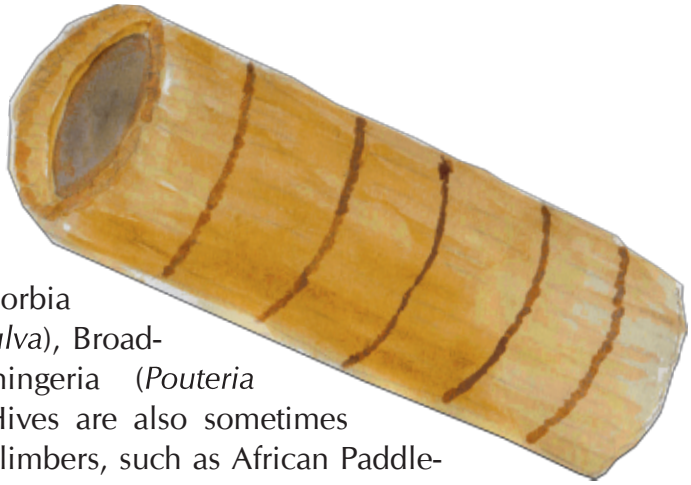
Spices

Some plant species are collected from the forests to be used as spice and add flavour to food. These include: False Cardamom (*Aframomum corrorima*), Wild Pepper (*Piper Capense*), Lippia (*Lippia adoensis*), Basil (*Ocimum basilicum*) and Ginger. False Cardamom can be used as a substitute for Indian Cardamom, and Wild Pepper can be used as a substitute for black pepper. Both of these spices grow in the natural forest layer called the Understorey. False Cardamom is endemic to the forests of South-West Ethiopia, meaning it is native only to this area and not found growing naturally anywhere else in the world. Lippia and Basil are gathered from the forest edge and disturbed areas. The spices are used in home cooking, and they are also sold at the market.

Honey and wax



Honey produced by bees in forest is of great significance to the local communities. The honey is used both as a source of food, as well as a source of income through selling it at the local and national market.

People sometimes keep the bees in man-made beehives using wood from trees such as Euphorbia (*Euphorbia abyssinica*), Parasol Tree (*Polyscias fulva*), Broad-leaved Croton (*Croton macrostachyus*), Aningeria (*Pouteria altissima*) and Broom Cluster Fig (*Ficus sur*). Hives are also sometimes made out of Bamboo or are woven from forest climbers, such as African Paddle-Pod (*Hippocratea africana*). Sometimes people find wild honey from bees that nest in hollow tree trunks and also in the ground.

Flowering plants in the forest are very important for bees to make their honey. The bees prefer some species of plants such as the Cape Ash (*Ekebergia capensis*), Broad-leaved Croton (*Croton macrostachyus*) and Ehretia (*Ehretia abyssinica*). Bees are important pollinators especially of coffee, and field crops like Faba Beans and Peas.

Wood for construction

© J. Schormann

Forest trees are often used as main source of construction materials to construct houses. This is illegal in protected forests, but can be done by permit for domestic use from some community plantations.

Some of the species used in construction include: African Redwood (*Hagenia abyssinica*), Aningeria (*Pouteria adolfi friederici*), Bamboo (*Arundainaria alpina*), East African Cordia (*Cordia Africana*), Smooth-barked Flat-crown (*Albizia gummifera*), Black Ironwood (*Olea capensis*), Spiny Tree Fern (*Cyathea manniana*) and Waterberry (*Syzygium guineense*). Some of the tree species are very useful because they are resistant to attack by termites, as is the Spiny Tree Fern. Wood from some species is very durable, such as the African Redwood and the East African Cordia and is therefore used to make windows and doors. Mature bamboo stems are used for constructing house walls and younger stems are used for roofing.

House roofs are also thatched with products that grow in the forest, such as the sedge species *Cyperus latifolius* and bamboo bark. Climbers, such as African Paddle-Pod (*Hippocratea africana*) and Landolphia (*Landolphia buchanani*) are also used in construction.

Wood used to make household utensils and farm implements

Some tree species, including African Redwood (*Hagenia abyssinica*), Aningeria (*Pouteria adolfi friederici*), Red Stinkwood (*Prunus Africana*), East African Cordia (*Cordia africana*) and Waterberry (*Syzygium guineense*) are carved and shaped to be used as household utensils and farm implements. People prefer these species due to their strength, durability, simplicity for shaping which makes them convenient to make various goods such as plates, spoons, saddles, mortars (for grinding grain), handles of axes and drums. The leaves of Forest Rothmannia (*Rothmannia urcelliformis*) are used for colouring household utensils.

Some trees and shrubs are preferred by farmers to make farm implements such as 'Maresha', 'Mofer', and 'Kenber'. Typical species that are used include African Redwood (*Hagenia abyssinica*), Waterberry (*Syzygium guineense*), Aningeria (*Pouteria adolfi-friederici*), Fringe Tree (*Chionanthus mildbraedii*), Ehretia (*Ehretia abyssinica*), Red Stinkwood (*Prunus africana*), Black Ironwood (*Olea capensis*) and Bitter Leaf (*Vernonia amygdalina*) due to their strength, capacity to resist termite attack, availability at close proximity and light to be pulled by oxen. The buttress roots from large trees are cut to be used as ploughs.

Firewood

Firewood is the most popular energy source for cooking, light and heating in rural Ethiopia. It is illegal to gather firewood from protected forests.

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Medicine/medicinal plants

There are many forest plants with medicinal properties that play a very important role in local health care. Ranging from Horsewood (*Clausena anisata*), a plant whose stem is used to brush teeth to treatments for more serious illnesses like Sickle-leaved Yellowwood (*Podocarpus falcatus*) that is used to treat malaria, the forest has many important medicines to offer.

Many types of veterinary medicines are also obtained from plants in the forest and used to treat a wide variety of disease in livestock. These medicines are very important to local communities as they often cannot afford to pay for trained veterinary doctors or medicines. The provision of natural medicines by the forest is essential to ensure the animals get better.

Tourism

Forests offer a huge potential for attracting tourists interested in seeing and experiencing the unique nature found there. Many tourists seek a break from their day-to-day lives in towns and cities. Attractive landscapes and rare plants and animals make forests a valuable tourist destination, providing there is sufficient infrastructure for them. The wild coffee forests of the Kafa BR are a major attraction for national and international tourists, particularly bearing in mind the popularity of coffee around the world.

Cultural importance of forests

Culture

Some of the products derived from the forest are very important for people's culture and identity. Coffee, for example, is a very important part of Ethiopian culture. Angolan Fagaropsis (*Fagaropsis angolensis*) is another example of a forest plant that, as it is only drunk in very specific localised areas of Ethiopia, it is an iconic cultural identifier.

Other cultural items such as musical instruments can be made using forest products such as drums, flutes (shumbiro) and local music instruments (hinoo) made from the stems of bamboo.

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Spiritual belief

Forests are of great cultural importance in the Kafa BR. Some of the plants found in the forest have cultural and spiritual functions. Cape Ash (*Ekebergia capensis*) for example is a plant used in rituals under which elders gather, discuss community affairs and pray. Some plants can only be managed by the "spiritual leader".

There are also holy forest patches, known as "Guddo" in sacred groves in the forest. A few times a year, a spiritual worshipping event is held to honour the spirits and to ensure good harvests, ward off evil spirits and promote the well-being of the people that depend on the forests for survival. Every clan has its own Guddo, a shrine to worship. One of the main skills of the guddo leader (sometimes called Gepitato) is to stop torrential rain that damages crops and animals and disrupts village life.

3. Threats to forests

Deforestation, degradation and fragmentation

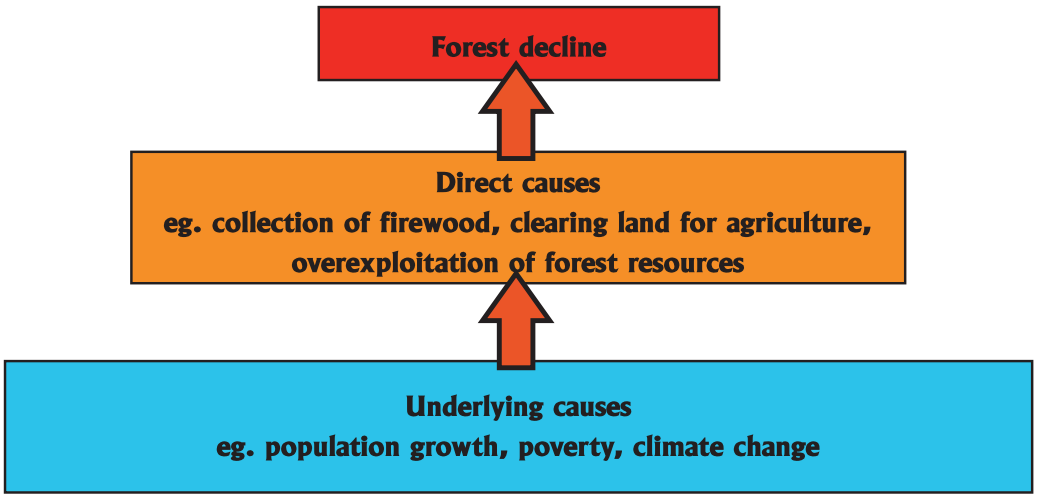
Although forests are important and vital in many different ways, they are being destroyed at an alarming rate.

- **Deforestation** is the cutting down and removal of most or all of the trees in a forested area and has a significant impact on the environment.
- When a forest is unhealthy, it is described as being **degraded** as although some of the trees are still there and have not all been cut down, the rest of the forest has been changed and it is not in a good condition. There are gaps in the forest canopy, often created to let light through.
- **Fragmentation** is also a form of forest degradation. It is the process of dividing a continuous forest into smaller patches or 'islands' through dividing it with roads or settlements. This division into smaller patches impacts the habitat of many animals, limiting the area they can live in. It makes it harder for animals to find a mate, to find enough food and to establish their natural territory size.

There are different reasons why people deforest areas and change the condition of forests. In this section we will look at these various causes and their consequences.

Causes of forest decline

People overexploit forests and cut them down for different reasons that can be divided into two groups: direct causes and underlying causes. Direct causes are the immediate reasons or gains that people obtain from exploiting the forest. The underlying causes are the bigger problems behind the direct causes. This is a causal relationship where one thing leads to another.



Underlying causes

First, let's explore some of the underlying causes for the decline of the forest.

- As the population increases, the demand for food, energy, construction materials and living space increases, which puts the forest resources under pressure, leading to both deforestation, as more land is cleared, and forest degradation, as more products, such as firewood, are taken from the forest.
- Poverty is one of the root causes of forest decline. Poor rural communities depend on the forest and its ecosystems for their survival.

Direct causes of forest decline

Now let's look at the direct causes:

Overharvesting of forest products

If the products obtained from forests are overexploited, they are harvested in an unsustainable way. The product is taken at a rate quicker than it can regenerate. This can cause it to run out and upset the balance of the forest. Here are a few examples of forest products that are currently being overharvested in the Kafa BR:

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- As Yayoo fetches such a good price at market, people often harvest the fruit while it is still unripe on the branch before it falls to the ground. This leads to the tree being unable to regenerate as the seeds cannot germinate and grow into new trees.
- The extraction of lianas and bamboo stems to make products such as furniture and beehives is harmful to the forest if it is done excessively.
- Cutting down trees for construction materials leads to deforestation and is illegal in protected forests.

Agricultural expansion

Clearing forest to plant agricultural crops is one of the main causes of deforestation. Farmers cut down the trees, or burn the forest to make space to plant their crops. As a direct result of population growth, there is a steady increase in the number of people who do not have land holdings. They clear the land, often on the edge of forests and settle there. Although this activity is illegal and very damaging to the forest, it is increasingly happening within the Kafa BR.

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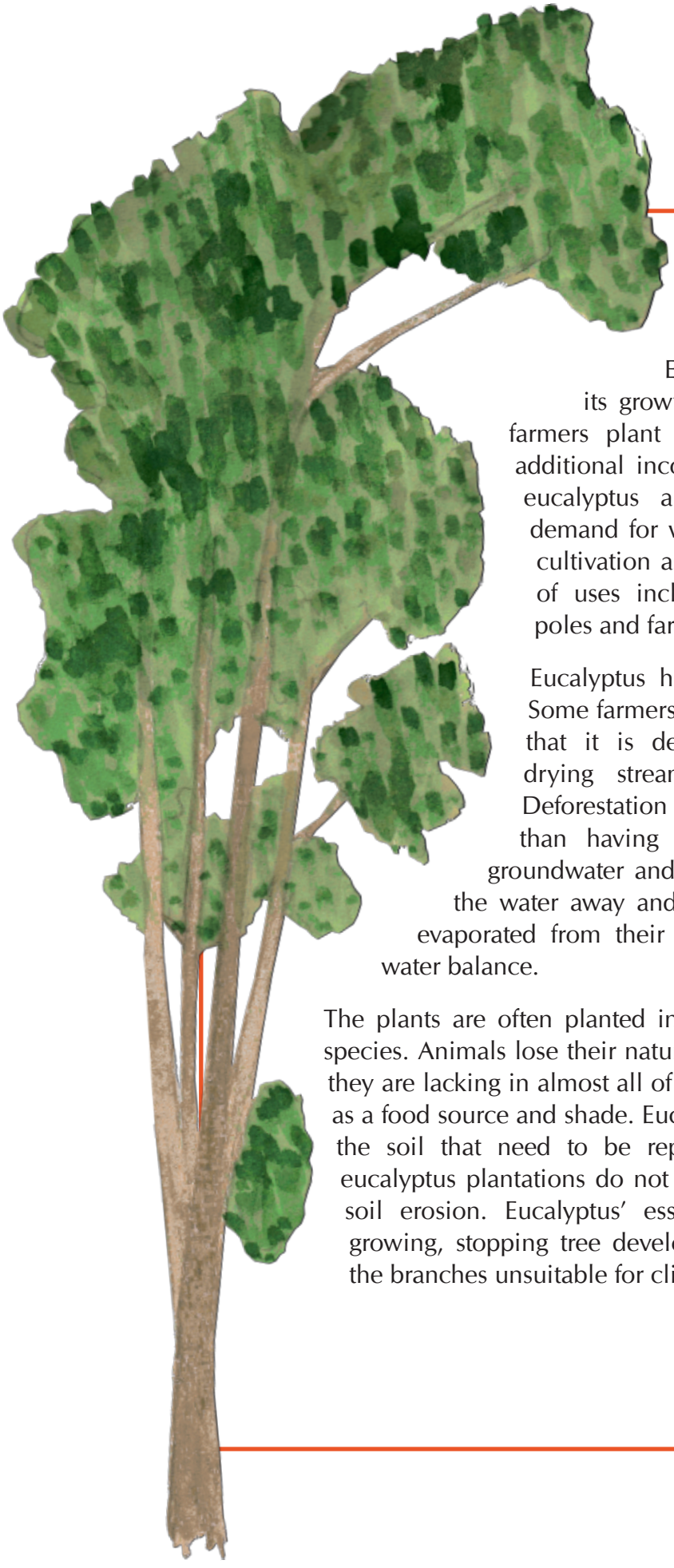
Only the top layer of soil in a forest contains nutrients needed for plant growth. Once the first generation of crops planted in this soil have taken the nutrients, it is necessary to use chemicals such as fertilisers and pesticides to protect and nourish the crops. These are very harmful to the soil, groundwater and to people's health. They are also harmful to insects such as bees that make honey and fertilise other plants and crops. It has been observed that honey bee colonies are declining in Mankira due to insecticides used.



Fast growing species: Eucalyptus

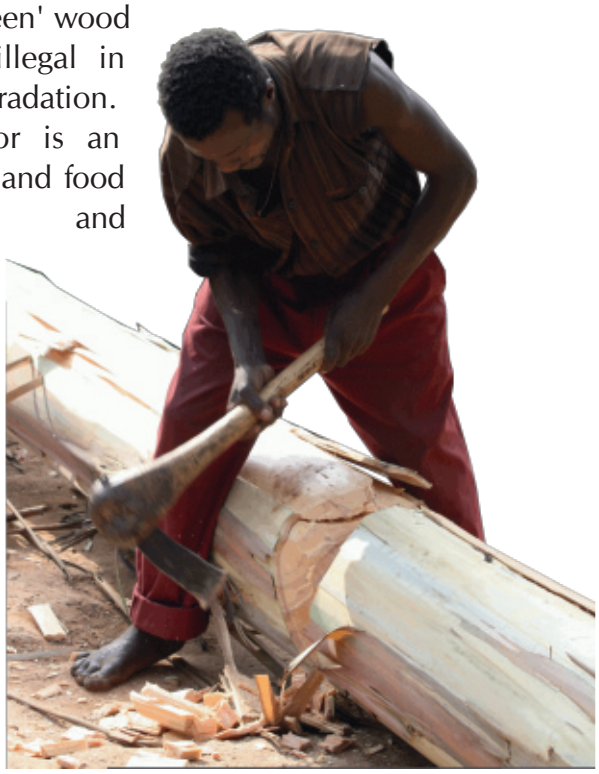
Eucalyptus is not native to Ethiopia, but its growth has rocketed since the 1970s. Many farmers plant it because it can be sold to obtain additional income. The attraction to farmers to plant eucalyptus are several: to satisfy the increasing demand for wood due to its speedy growth, ease of cultivation as well as its suitability for a wide range of uses including as building material, firewood, poles and farm timber.

Eucalyptus however needs a lot of water to grow. Some farmers in the highlands of Ethiopia have found that it is detrimental to water resources causing drying streams and sinking groundwater levels. Deforestation makes the situation worse, as rather than having natural forest which replenishes the groundwater and helps rain to fall, the eucalyptus takes the water away and increases the amount of water that is evaporated from their leaves, leading to an overall negative water balance.

The plants are often planted in monocultures, plantations of just one species. Animals lose their natural habitat. They cannot survive there as they are lacking in almost all of the forest characteristics they need such as a food source and shade. Eucalyptus also takes a lot of nutrients from the soil that need to be replaced artificially using chemicals. As eucalyptus plantations do not have leaf litter, they contribute towards soil erosion. Eucalyptus' essential oils prevent other plants from growing, stopping tree development in the shrub layer and making the branches unsuitable for climbers or mosses.

Firewood

Firewood is often obtained through collecting dry wood found on the forest floor, or harvested as living trees, known as 'green' wood which is later dried. Although these practices are illegal in Ethiopia, they are still carried out, leading to forest degradation. Dead and decaying wood found on the forest floor is an important part of the ecosystem as it provides a habitat and food source for many types of small animals, such as insects and frogs, as well as storing moisture and enriching the soil when it is broken down by fungi and moulds. If this is collected and used as fuel, it is no longer part of the natural system, leading to poorer soil quality, an upset in the soil moisture levels and a significant decrease of the habitat for many animals.



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Harvesting living trees, 'green' wood, has a negative impact on the forest. When more living trees are cut down, animals' habitats are destroyed and the benefit of the tree as a carbon store is lost.

The more firewood collected, the scarcer it becomes. This means that women have to walk further and search for longer to find enough wood to burn. This increases the rate of deforestation as more trees are cut down to provide fuel to burn. The scarcity causes a massive increase in the price the firewood can fetch at markets, which then encourages more people to harvest it to sell for money. This is like a vicious circle, the resource becomes scarce pushing the price up. In addition, firewood collection is a time consuming and health affecting burden for women who carry 40 kg and more over long distances. Young girls are not able to attend school when collecting firewood which limits their basic education.

Road construction

The construction of roads, such as the road from Jimma to Bonga, gives people access to remove the timber from forests. This means that logging activities can take place on a larger scale and more commercially than prior to the road being built. The road system itself requires large stretches of land to be cleared. This can be devastating for the forest as it is fragmented, habitats are divided and the rate of soil erosion and water sedimentation increase.

Participatory Forest Management

Participatory Forest Management (PFM) is a government and stakeholder joint programme that aims to maintain the forest by handing over forest management responsibility and use rights to formally organised community groups of the villagers. It is a method that helps communities and local administrations, such as the forest department, to work together to define who has the right to use forest resources, who has the responsibility to care for and manage the forest and how to share the benefits gained from the forest. It is a joint programme between the government and stakeholders that aims to maintain the forest by transferring user rights to the community. This legally enables the community forest management group to manage the forest resources sustainably. The potential income of farmers can be increased through the sustainable use and sale of forest products.

The FAO definition

The Food and Agriculture Organization of the United Nations (FAO) defines participatory forestry as "processes and mechanisms which enable people with a direct stake in forest resources to be part of decision-making in all aspects of forest management, including policy formulation processes."

A community group works together with government services to set up the PFM system. They carry out an assessment of who uses the forest and how they use it. Tools to do this can be techniques called Forest Area Mapping or a Historical Trend Analysis. This assessment is essential to develop the Forest Management Plans and the Forest Management Agreement that lay the basis for the successful management of the forest and its resources.

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- The Forest Management Agreement is a legally binding contract. It clearly sets out the rights and responsibilities of the community-based institution and the government.
- The Forest Management Plan details the specific forest management actions, organised into four sections: (1) Forest protection, (2) Forest utilisation, (3) Forest development and (4) Forest monitoring.

A number of areas in the Kafa BR are already implementing PFM. Forest User Cooperatives were established and each was assisted to develop 'Forest Conservation and Development Plans', which set out provisions for forest use and development as well as monitoring and evaluation. Some of the communities have been able to carry out activities such as buying chickens, coffee seedlings and crops seeds thanks to the project. Others have been able to obtain credit for sheep, oxen and panga.

4. Activities

Testing the group's understanding

Test the group's understanding of the concepts discussed in the forest section. Questions you can ask include:

- What are the layers of the forest called?
- Which plants can be found in the forest?
- If gaps are made in the tree cover, what happens to the vegetation underneath?
- What are the different types of forest in Kafa? Name some of them.

Visit to an energy saving stove producer

Organise a trip to visit someone who produces energy saving stoves. Before the visit ask the person if they are happy to explain the work they do to the group participants.

Before the group visit, it is a good idea to introduce them to the topic of energy saving stoves. Discuss with participants how much firewood they use every day and do they think an energy saving stove would make any difference to this amount?

When visiting, ask the stove producer questions such as:

- Where is the clay sourced to make the stoves sourced?
- What are the advantages of having such a stove?
- Who buys the stoves?

Ask if they would show the group some of the steps in stove production. It might even be possible for the group to try some of the steps themselves.

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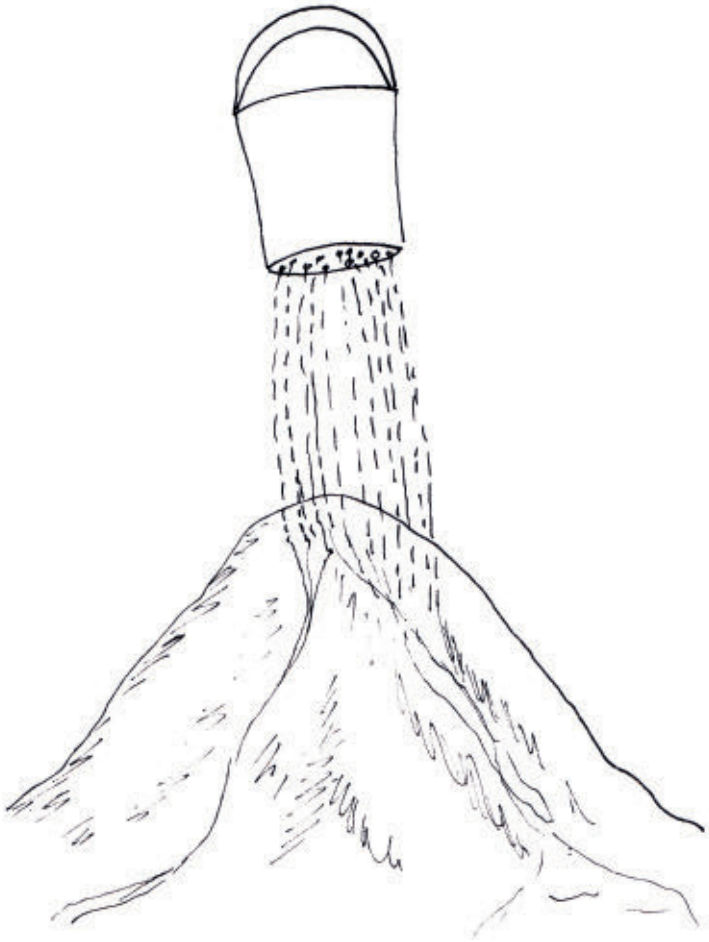
Soil Erosion Demonstration

Participants will help to understand the process of soil erosion if they can see it themselves. First it is necessary to build a model hillside using stones, soil and twigs. Then you will simulate rain through pouring water on the model. The water can be seen washing away the soil, just as occurs on a deforested hillside in nature. Here is how to prepare the demonstration. This will need to be done a day before you want to show it to the training participants. It is also a good idea to practice the demonstration before showing it to the training participants to make sure everything works as you want it to!

1. Gather together several stones of different sizes and put them together in a pile about as high as your knee.
2. Cover them with a layer of wet soil and pack it down onto the stones. It is important that the sides of your model hill have different slopes so it is like an actual hill.
3. If possible, dig up some plants (keeping the soil on their roots) and incorporate them into one side of your hill to act as an area that is forested.
4. Allow the model hill to dry, but try to keep it shaded so the surface does not crack.
5. Now the model is ready. Ask the participants to gather around it and explain what it represents.
6. Fill a watering can or a container with holes in the bottom with water and allow the water to fall onto the model hillside.



It should be observed that on the slopes that are just covered with bare soil, the soil is washed away. The rock that is exposed represents 'parent rock'. On the slopes with plants, the soil should remain, or not be washed away as much. Can the participants see the soil collecting at the bottom of the hill? This represents the soil that is washed into streams and rivers. The nutrients in the top soil are washed away as well. Can the participants see how the plants' roots keep the soil in place? These plants represent the natural forest. If slopes are deforested, soil erosion is very likely to occur.

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Section 3
Water and Wetlands

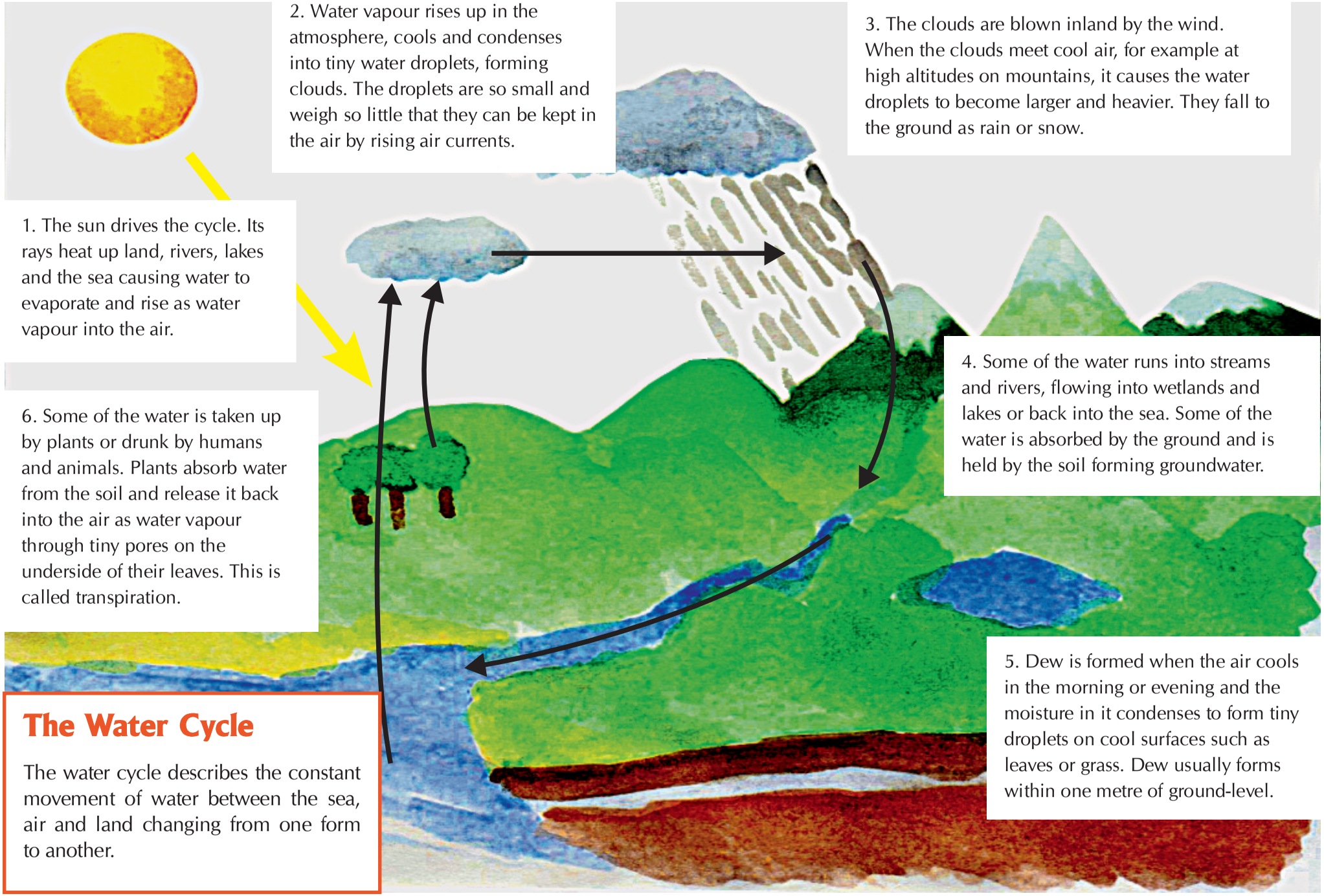
1. Basic knowledge on water and wetlands

This chapter is of special interest to communities living close to wetlands. It explains the role and importance of water and wetlands on a global scale as well as in the Kafa BR. It also explains the threats currently posed to wetlands in the Kafa BR.

What is water?

Water is essential to all forms of life on Earth. Humans, plants and animals need water to survive. Our body can only survive for a matter of days if we do not drink and we need water for many vital biological processes such as sweating to keep us cool or urinating to rid our bodies of waste. Water is also necessary to grow the food we eat - without water our food crops and livestock die.

Although there is a lot of water on Earth, most of it is not in a drinkable form and not readily available for plants, animals and humans to use. Just over 97% of the Earth's water is found in oceans but this water has a high salt content, making it not useful to most life forms. Just over 2% of the remaining water is found as snow and ice in the Earth's Polar Regions. This leaves less than 1% of water that is considered fresh and is available for plants, animals and humans to use.



1. The sun drives the cycle. Its rays heat up land, rivers, lakes and the sea causing water to evaporate and rise as water vapour into the air.

2. Water vapour rises up in the atmosphere, cools and condenses into tiny water droplets, forming clouds. The droplets are so small and weigh so little that they can be kept in the air by rising air currents.

3. The clouds are blown inland by the wind. When the clouds meet cool air, for example at high altitudes on mountains, it causes the water droplets to become larger and heavier. They fall to the ground as rain or snow.

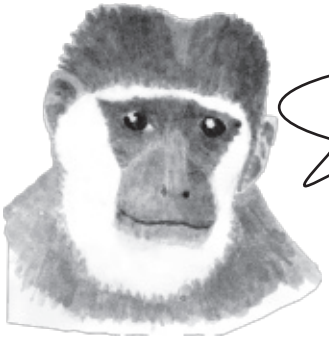
4. Some of the water runs into streams and rivers, flowing into wetlands and lakes or back into the sea. Some of the water is absorbed by the ground and is held by the soil forming groundwater.

5. Dew is formed when the air cools in the morning or evening and the moisture in it condenses to form tiny droplets on cool surfaces such as leaves or grass. Dew usually forms within one metre of ground-level.

6. Some of the water is taken up by plants or drunk by humans and animals. Plants absorb water from the soil and release it back into the air as water vapour through tiny pores on the underside of their leaves. This is called transpiration.

The Water Cycle

The water cycle describes the constant movement of water between the sea, air and land changing from one form to another.



What is a wetland?

Wetlands are areas of marsh, fen, peat land or water, including areas of marine water with a depth at low tide not exceeding six metres. They can be natural or man-made, permanent or temporary. The water in them can be static (not moving) or flowing. It can also be fresh, brackish (slightly salty) or salty.

In simple terms, wetlands are areas where the ground is saturated with water, and/or covered with shallow water, for all or part of the year. They are known by lots of different names such as marshes, swamps, bogs, fens, mires, moors, mangroves, lagoons etc. Wetlands are neither truly terrestrial (land) nor aquatic (water), but are both, either at the same time, or at different times. They can develop in low-lying areas where water drains or collects and can also form a transition between land and water, for example at the edge of a lake.

Wetland characteristics

All wetlands have three common characteristics:

1. Hydrology

Wetlands are wet! The most important driving force behind wetland formation is water. The term 'hydrology' is used to describe the circulation and distribution of water. The water source as well as its amount and flow, influence the wetland's type of soil, vegetation and nutrients.

Water can enter the wetland in a number of different ways. Rain, dew and snow can replenish it with water. Similarly, water can seep into it from groundwater, springs or underground wells. Streams and rivers also feed water into a wetland, as does floodwater and tides in coastal areas.

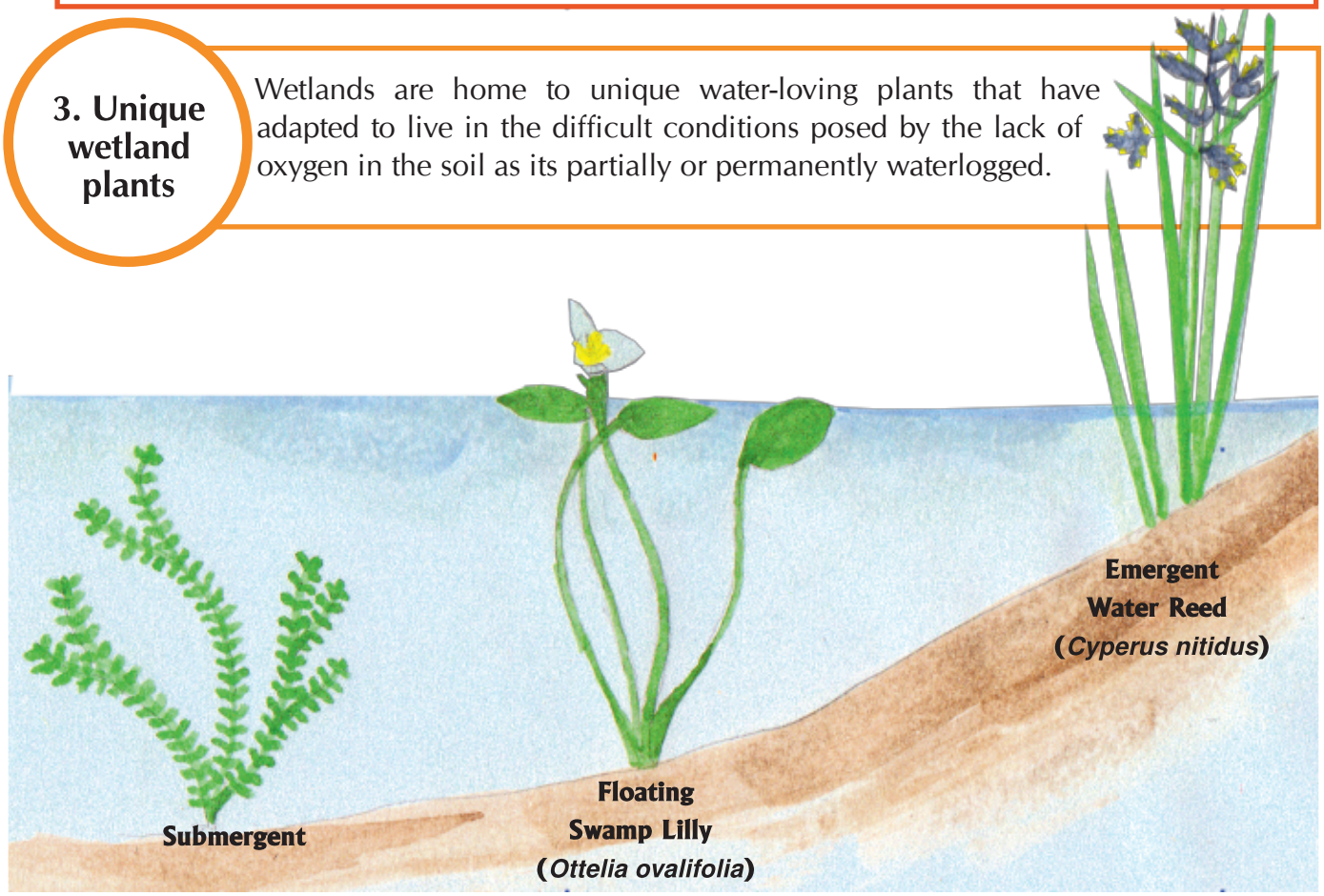
2. Unique wetland soils

When soil is formed, air is needed by microorganisms to break down vegetation. As a result of the wetland being partially or permanently waterlogged, water fills the spaces between the soil particles instead of air, preventing the microorganisms from breaking down the vegetation properly and causing unique wetland soils to form.

Peat is one example of a unique wetland soil. It is very dark brown or black in colour and you can still see some of the plant fibres in it if you rub it between your fingers. Peat forms when vegetation and organic material cannot be broken down completely due to a lack of oxygen. Peat and other wetland soils are very important in storing carbon and preventing climate change as they contain so much organic material.

3. Unique wetland plants

Wetlands are home to unique water-loving plants that have adapted to live in the difficult conditions posed by the lack of oxygen in the soil as its partially or permanently waterlogged.



Types of wetland

Wetlands can be classified into different categories based on these characteristics. Here are some examples of the types of wetlands that can be found in the Kafa BR:

Freshwater marshes

Freshwater marshes have non-woody plants (not trees or shrubs) that may emerge above the water surface, float on it or be completely submerged under the water. They usually have a source of water in addition to rain, such as a stream. The water level can be as deep as one metre. These marshes are perennial or permanent as they are waterlogged throughout the year. An example of this type of wetland is found at Medabo.

Wet meadows

Wet meadows, like the one located in Gesha, are dominated by grasses. The water is generally not visible for most of the year. They sometimes occur alongside rivers or on the shores of large lakes. They also occur if an area does not drain well or if it is deluged with a large amount of rain or snow. Wet meadows do not tend to have standing water, but instead have periods of flooding and periods where the ground is wet. For this reason, they do not usually support aquatic animals (e.g. fish) but provide a rich habitat for many types of wetland plants, insects and birds.

Wet meadows provide excellent feeding grounds for many birds such as this Hadeda Ibis

Swamps such as this one are essential for filtering the water from pollutants and silt

Swamps

Swamps can be identified by the trees or shrubs that grow on them and are found in sunken areas or alongside rivers, lakes, ponds and streams. Their water input comes from flooding, groundwater or rain and they dry out in the summer. They are always waterlogged in winter and spring. During the dry season these seasonal swamps are used for grazing, fodder collection and even some crop cultivation. The Alemgono wetland is an example of a swamp that is fed by a stream flowing into it.

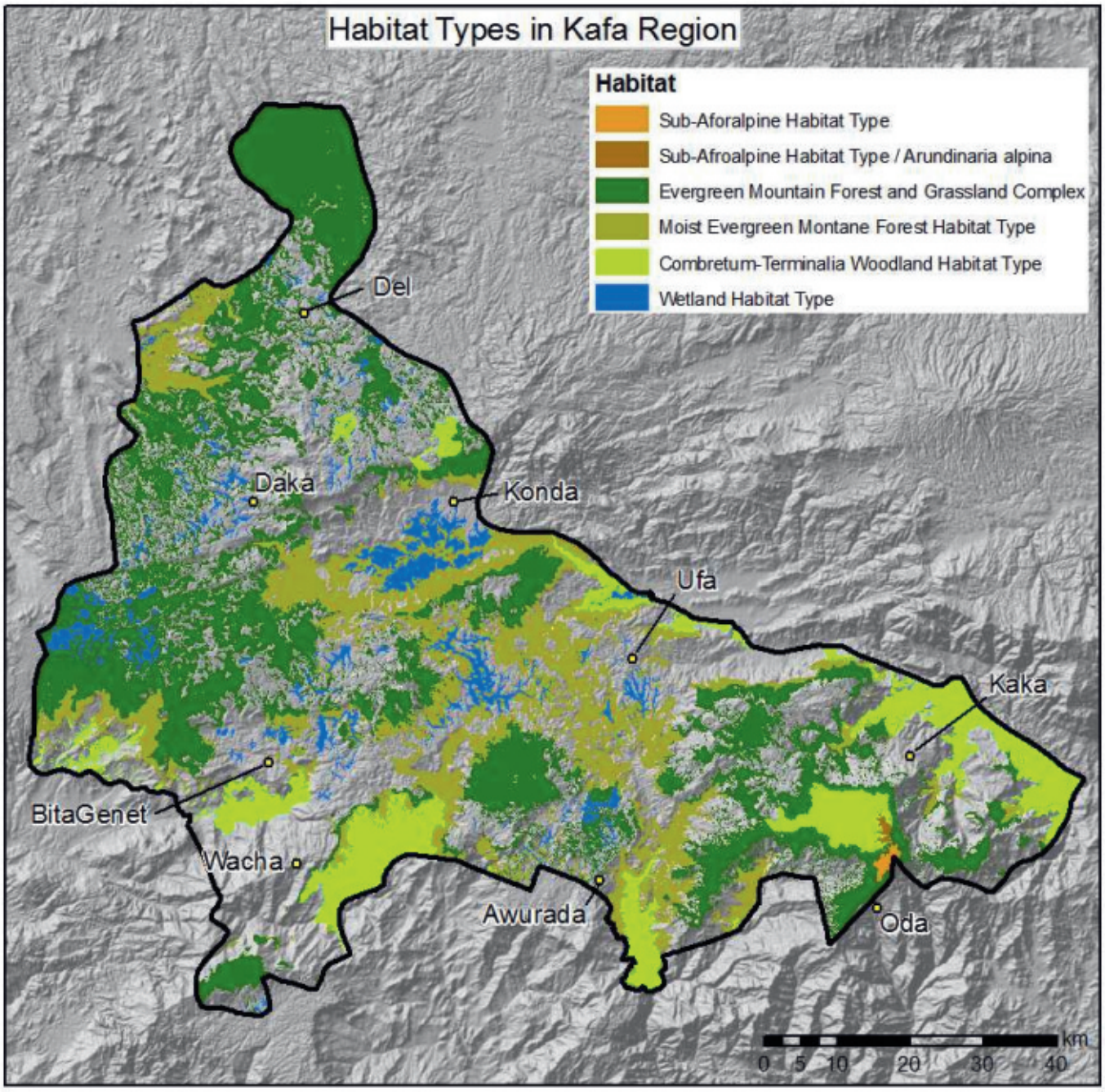
Peatlands – bogs and fens

Bogs only receive their water from rain. They never dry out and the soil is saturated with water all year round, which causes peat to form. They have a very low nutrient level. Fens receive their water mostly from groundwater, with a small amount from rain. This means they have more nutrients than bogs. An example of a peatland is the wetland found at Garina (Gojeb-Minch).

Wetlands in the Kafa Biosphere Reserve

Due to its varied landscape and high rainfall, the Kafa BR has a wide range of wetland systems including river floodplains, swamps, marshes and peatlands. Approximately 5% of the Kafa BR is covered by wetlands, the primary ones being the Gojjeb, Ghibe and Alemgono wetland systems. You can see the location of the wetlands in the diagram below (the wetlands are shown in blue).

Some of the wetlands in the Kafa BR are found in the highlands, 2,700 metres above sea level. They are mostly shrub dominated peatlands. The wetlands found in the mid-highlands (1,700 metres above sea level) are mostly permanent freshwater marshes. The lowland wetlands (less than 1,500 metres above sea level) include river floodplains and swamps.



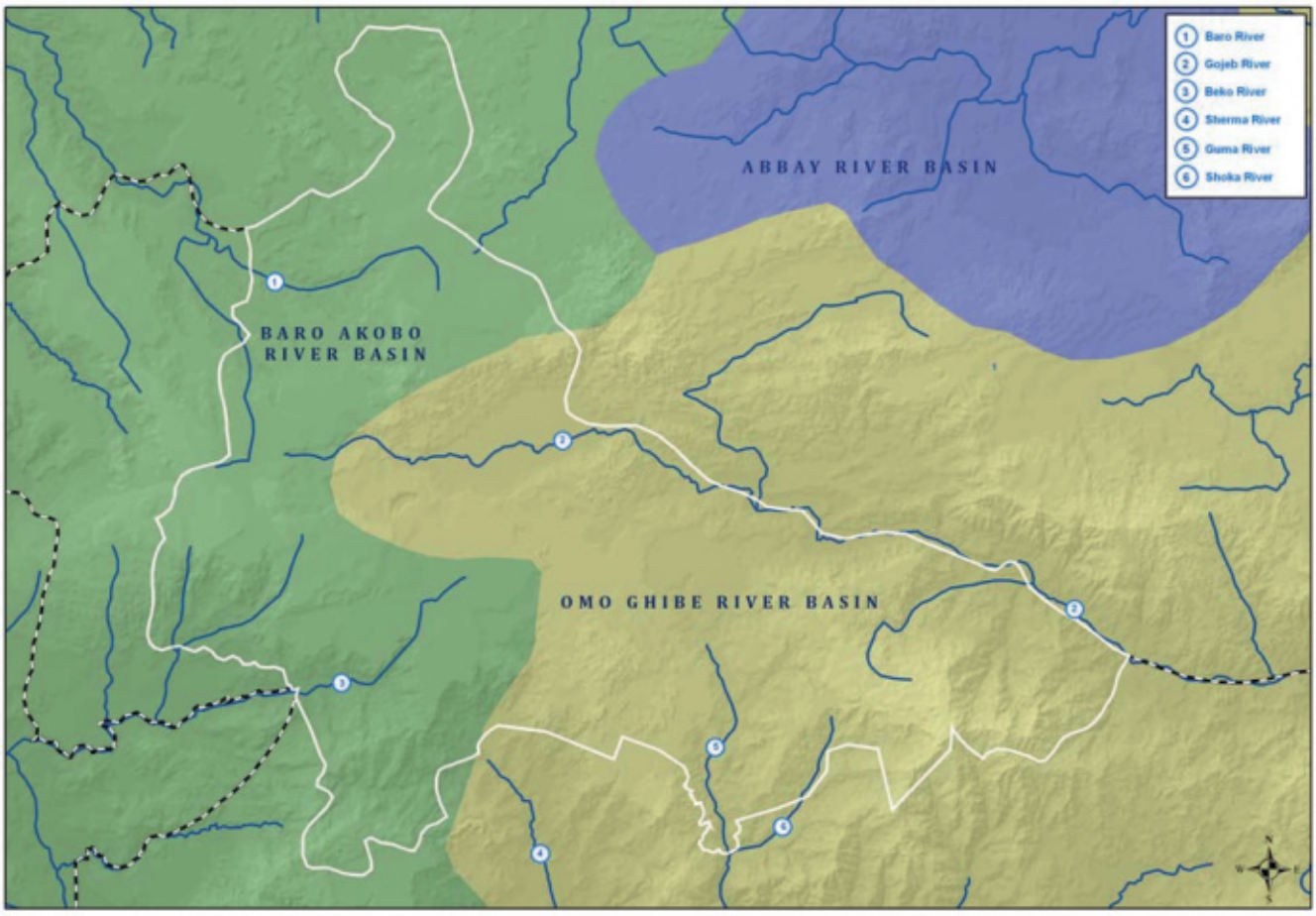
Habitat Types in Kafa Biosphere Reserve

Rivers

The water in rivers and streams always flows in one direction, downhill. They start off as small streams in the mountains that join up with other streams and eventually are so big they are classed as a river. In the rainy season, these rivers can become full of water and have to overflow onto neighbouring areas, the floodplains. These provide a habitat that is very fertile and rich. Forested riverbanks provide a habitat for many animals.

Many rivers have their origins in the highlands of the Kafa BR as shown in the picture below. It is for this reason that the highland forests are called the "Water Tower of Ethiopia." The Gojeb River is one of the largest rivers in Kafa BR. It is one of the largest tributaries to the Omo River and flows eastwards through Oromia and finally into Lake Turkana in Kenya. The Gojeb River is also the location of the Gojeb Dam which started operation to provide electricity in 2004. The other important rivers in the Kafa BR are the Sharma, Gumi and Omo.

The area that drains into a river is called a river basin (sometimes it is also called a catchment and a watershed). This is usually defined by an areas mountains and slopes. The Kafa BR is located in two river basins, the Baro-Akobo River Basin and the Omo-Ghibe River Basin.



2. The importance of water, wetlands and rivers

In Ethiopia, wetland ecosystems have traditionally been considered as wastelands that have little or no value at all. In part, due to this misconception, they are often drained and converted to land for agriculture and grazing. They have been considered as the source of several water-borne diseases both to humans and domestic animals.

However they should be valued and protected as we will investigate in this chapter. The wetlands of the Kafa BR are critical for sustaining the livelihoods of local communities and play an important role in environmental processes. They are vital in the conservation of freshwater in the region and countless species of plants, birds, mammals, reptiles and insects depend on them for survival. They are important grazing land for local communities during the dry season, and provide water and medicinal plants for humans and livestock. This section will explore the functions and importance of wetlands in more detail.

Ecological importance of wetlands

Flood control

Wetlands located along lakes, rivers and streams play a crucial role in flood control as they act like a sponge, temporarily storing the flood water and then slowly releasing it back into the water system over time. The sudden flow of a large amount of water is slowed by the trees, shrubs, reeds, rushes and other plants in the wetland, allowing it to sink into the soil rather than continuing downstream to flood further areas. Therefore wetlands protect people's homes and fields from flooding.

Water purification

Wetlands filter and clean the water that flows through them by trapping pollutants in their soil and vegetation. They are particularly effective in removing high levels of nitrogen and phosphorous which are waste products from agriculture. Some plants can even store toxic heavy metals and bacteria that can damage human health. However, wetlands have their limitations and can only cope with certain levels of pollutants. Overloading a wetland reduces its ability to purify water with the consequence that humans have less clean water available to drink.

Sediment and nutrient retention

When rainwater runs across an area of land, it picks up little particles of soil, known as sediment. This is carried by rainwater into streams, rivers and lakes. The sediment accumulates in large amounts and can smother fish or other aquatic animals. The sediment could also be carrying pollutants such as pesticides, which could damage the aquatic ecosystems. Wetlands slow the passage of water and encourage the sediment to settle and bind to the roots and stems of plants.

Groundwater replenishment

Wetlands are essential in regulating the quality and quantity of groundwater in the soil and rocks underground. The water in a wetland slowly seeps downwards through the ground to recharge or ‘top up’ the groundwater. This ensures it does not run out and is available for plants, animals and humans e.g. water for drinking and agricultural irrigation. Alternatively, if there is too much groundwater, the wetland may act as an overflow.

Climate change prevention

Wetlands are vulnerable to changes in climate, such as changes in the timing and amount of rain and snow, as well as changes in the length, frequency and intensity of the wet and dry seasons. Increases in droughts or flooding can affect wetlands, and may even threaten their existence.

While being some of the most threatened ecosystems, wetlands are also essential in the fight against climate change. Healthy, intact wetlands store a high amount of carbon in their soil in the form of vegetation that has not been completely broken down due to lack of oxygen. They are referred to as 'carbon sinks'. If the wetland is drained to be used for growing crops or grazing cattle, oxygen enters the soil and the vegetation starts to break down. This releases the carbon into the atmosphere in the form of the gas carbon dioxide. Carbon dioxide is one of the major gases that cause the greenhouse effect (see Section 6). Protecting wetlands from damage or destruction can prevent the release of even more greenhouse gases into the atmosphere.

As well as helping to prevent climate change, wetlands are also key to our ability to cope with the effects of climate change. As described above, wetlands are vital in regulating the water supply. They help to protect areas from destructive flooding, essential where it is predicted that the frequency and intensity of extreme rainfall will increase. They also recharge stores of groundwater, which is of utmost importance for areas where more drought is predicted. Therefore, wetlands will help humans, plants and animals avoid the most negative consequences of climate change.

Important habitat for plants and animals

Wetlands provide essential habitat to an enormous amount and variety of plant and animal species. They are specially adapted to living in the particular conditions that the wetland provides. Some species, such as fish and birds thrive in the unique habitat. Some animal species spend most of their lives on the wetland, while some, for example migrating birds, occasionally visit for food, water and shelter. Another important characteristic of wetlands is that they support a high number of endemic species, which are animals and plants that are found nowhere else in the world.

Wetlands attract such a high amount of species for a number of reasons:

- Animals can shelter from predators in the vegetation.
- They provide ideal nesting and feeding conditions for many water/aquatic birds.
- They provide migratory birds with a safe place to stop over and rest during long migrations.
- They provide good habitat to fish for spawning (laying their eggs) and as a nursery.
- They are rich in food sources for animals and humans.

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The Half-collared Kingfisher (*Alcedo semitorquata*) is always found near water and eats almost exclusively fish.

Wetlands are particularly important habitats for birds. In Ethiopia around 25% of all bird species are wetland-dependant. Birds use wetlands for breeding, nesting, and rearing young, as well as for feeding, resting, shelter and social interactions. Floating waterplants provide an important food source for water birds.

Importance of wetlands, water and rivers to human well-being

Human health

About two thirds of the human body consists of water, and without access to water to drink, it is not possible for humans to survive for more than a couple of days. Water is essential to the functioning of the human body. One of its most important roles is in allowing us to regulate our body temperature as it is very important for producing sweat. Sweat evaporates from the skin surface and cools us down. Water is also essential for us to wash and stay clean.

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Natural defeat of diseases

Wetlands are associated with being places that spread water-borne and vector-borne diseases. Many of them have been drained and destroyed in an attempt to manage these diseases.

However wetlands play an important role in naturally defeating diseases. For example, a healthy wetland provides a good habitat for the natural enemies of mosquitos. It also prevents and reduces flooding, avoiding the formation of stagnant water, the perfect breeding ground for mosquito larvae. A link between disease outbreaks and disturbed freshwater wetlands has been identified. It has also been found that deforestation can increase malaria infections by a significant amount.

Wetland products

Wetlands are also important for providing humans both directly and indirectly with food. They are used agriculturally for growing food crops and are a source of fresh fish and edible wild fruit. They provide pasture for livestock to graze as well as the water for them to drink which is important especially during the dry season when the green pasture lands have dried. Wetlands in Kafa BR are used by landless youngsters for rearing animals and as nursery sites for growing tree and agroforestry seedlings (such as coffee, fruit, fodder, firewood and timber) in dry seasons. Other products such as grass and reeds are used in the construction and thatching of houses, wrapping beehives and making sleeping mats. The wetland's clay soil is used for brick making and pottery. Medicinal plants to cure humans and livestock are obtained from wetlands. Wetlands support honey production as they are a source of flowers and water for honey bees.

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Recreation, tourism and cultural heritage

Wetlands can be a key part of a community's cultural traditions. Local craft making often requires the use of natural resources, such as grass, obtained from wetlands to create objects such as mats, hats and bags. Sedge is used to provide a floor covering for festivals and the leaves of the Senegal Date Palm (*Phoenix reclinata*) are collected for ceremonies and to make woven mats and baskets used in coffee production, which is an important cultural tradition in Ethiopia. These can only continue if the ecological processes of wetlands are allowed to continue functioning.

Many tourists are interested in the recreational activities that can be carried out on wetlands, such as bird watching, fishing and boating. They can generate considerable income both for the local area as well as on a national level, but it is important that tourism is developed in a sustainable nature-friendly way such as by establishing certain infrastructure facilities such as the bird watching towers in Alemgono Wetland.

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3. Threats to water, wetlands and rivers

As a result of wetlands mistakenly not being valued as an essential part of the ecosystem, water cycle and element in people's livelihoods, they are often used for agriculture and their natural resources are overexploited. Here we will look at some of the current threats to the wetlands in the Kafa BR.

Drainage and ploughing for agriculture

Draining wetlands to convert them to agricultural land is a practice which poses a threat to wetlands. This is often driven by population growth and finding land for landless youth as well as the large scale planting of agricultural crops such as eucalyptus and sugar cane. The drainage has many consequences and prevents the wetland from supporting the wildlife and plants that depend on it. Just a few of the problems caused by wetland drainage include:

- An increase in stream flow after heavy rainfall, particularly in the lower reaches of the floodplains. This leads to heavy flooding.
- Draining the soil allows air to enter the soil pores. This causes the decomposition of organic material, releasing carbon dioxide into the atmosphere. Carbon dioxide is one of the main gases that cause climate change.
- Cultivated crops use more water than typical wetland vegetation. Eucalyptus is well known for its effect in drying out soil, upsetting a region's water reserves. This causes streams to dry up and affects the water available for other uses such as drinking.
- Digging drainage ditches lowers the level of the groundwater for all of the surrounding area. This can lead to wells and streams drying up and to serious water shortages for humans and animals.
- The cultivation of plants such as eucalyptus or sugar cane, which are not native to Kafa BR, introduces non-native genes which may upset the natural balance of the ecosystem.

Grazing

As wetlands are communally owned, they are free and accessible for all members of the communities around them. As the population increases, and the demand for grazing land becomes even greater, wetlands are often used for livestock grazing pastures. Overgrazing of wetlands can lead to a loss of habitat and food source for the animals that live there. The livestock eat or trample the wetland plants, impacting the other products obtained from the wetland such as grass and reeds for thatching houses. This compacts the soil and contributes to increased soil erosion. Their urine and dung can increase the level of nutrients in the wetland, causing an imbalance and pollution. Grazing animals also disturb birds that are breeding, sometimes causing them to abandon their eggs and young.

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Wetland fires

People burn wetlands to prepare the land for cultivation and to stimulate the sprouting of soft shoots, as well as to eradicate vermin, hunt, harvest honey and make charcoal. This destroys the habitat of the wildlife that live there and their food source. The burnt land is vulnerable to introduced, non-native plants. The carbon stored in wetlands is released into the atmosphere when they are burned. This release is a significant factor in causing climate change which will be explained in more detail in Section 6.

Increasing nutrients

The use of fertiliser from agriculture can lead to an increased level of nutrients like nitrogen and phosphorous in the wetland. These upset the delicate balance and encourage invasive plant species which would not normally be able to cope with the unique wetland conditions. The urine and dung from livestock also increase nutrient levels, as does waste from human settlements. Sediment carried by rainwater in streams also deposits nutrients.

One major source of pollution in the water system is the waste water from coffee washing. If the water containing the coffee hull is discharged untreated into streams, it causes a variety of problems including an increase in nutrients, muddiness of the water and pungent smells. These problems come from badly managed coffee hulling stations.

These extra nutrients from all of these sources cause a process called eutrophication to take place where algae feed on the nutrients to grow more quickly than usual. This results in a large amount of algae which blocks out the sunlight needed by other plants, causing them to die and pollute the water in the wetland. This removes the oxygen from the water causing fish and other water wildlife to suffocate and die.

Soil destruction

There is a growing demand for bricks made with clay soil from the wetlands. The removal of soil to make bricks leaves large holes and destroys the vegetation and landscape. This disturbs birds and animals and hinders ecotourism activities. Wetland draining to access the soil releases the carbon stored in it. This is a significant factor causing man-made climate change to take place.

Sand extraction

Sand extraction for construction is very damaging to the river bed. People dig a hole and allow it to fill with sand. The river will flow more quickly and its increased speed will pick up yet more sand and soil, as it flows further downstream. This actively contributes to further soil erosion.

Soil erosion

Cutting the forests that grow along the riverside causes soil erosion and landslides. As trees and plants stabilise the riverbanks, this means that the forest loses its most fertile top layer of soil. This is disastrous for the people and animals that depend on this unique habitat.

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Water pollution

Waste and wastewater from settlements is often dumped into the rivers without being treated. This pollutes the water and leads to the death of fish and other aquatic animals. It makes the water no longer safe to drink. Waste is unsightly and discourages tourists from visiting.

4. Activities

A Guided Trip to a Wetland

Take the group on a guided trip to visit a wetland that is near to your settlement. It is important to visit the site beforehand so you can prepare for the visit. Here are some topics to talk about with the group while you are visiting the wetland.

- Discuss the resources and benefits provided by wetlands to the community. Can each of the group members name one and point to it to show everyone else?
- What type of wetland do the group members think it is? Is it there all the year round? Is it on the banks of a river or lake?
- Encourage the group to discuss the different local names for wetlands (for example: Gocho, Daro, Nito, Baraho, Nurifo, Sheko, Yebero, Dabo, Eno, Dacho, Tapo and Shocho). How do these wetlands differ and what kind of wetland do they think they are?
- Encourage the group to discuss if they have noticed any changes e.g. have the wetlands dried out?
- Can the group see any threats to the wetland from human activity? Possible activities could include grazing, reed harvesting, brick making etc. Can they explain why these activites could pose a threat to the wetland?

The Animal Sound Competition

Which animals do you know that live on or visit wetlands? Divide the group into two teams. One member of the team should make a sound of an animal or bird that lives on a wetland, and the other team members should guess what it is and where it is found. If the team cannot guess correctly, then the other team can try. Keep point scores and find out who knows the most!

Water Purification Experiment

Wetlands filter the water flowing through them, removing sediment and pollutants. You can demonstrate this to the group using a plastic bottle filter.

Take a big 2 litre clear plastic lemonade bottle.

Cut it in half and put the bottle neck without the cap on top down into the bottom half.

Place several layers of a tightly woven fabric in the bottle neck.

Ask a group participant to make some "polluted water".

Take a jug of water and ask them to add a handful of earth to represent sediment.

First stir the dirty water, and then let it stand for five minutes to let the sediment settle. Show the participants so they can see what sediment actually is.

Then stir the water again and pour it into the filter and see what the water looks like. Is it cleaner? Explain to the group that the fabric acts like a wetland in filtering sediment out of the water

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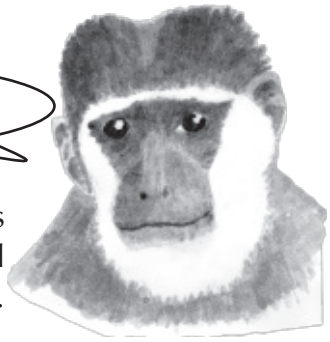
Section 4
Wildlife

1. Basic knowledge on wildlife

What is wildlife?

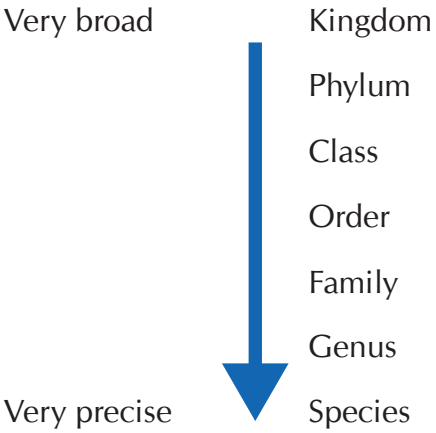


Wildlife is a term that can be interpreted in several ways. Sometimes it is used to refer to both wild plants and animals, and sometimes just to wild animals alone. In this section it will be used to refer to just wild animals, i.e. animals that have not been domesticated.

Wildlife is very valuable to us, supporting the environment where we live, providing us with food and income and is the basis of many of our cultural beliefs. But our relationship is not always a harmonious one, resulting in many sources of conflict. Its disappearance would have disastrous consequences. In this section, we will explore what wildlife is and find out about some of the different types of plants and animals found in the Kafa BR as well as its importance to us and the threats it faces.

Classification of living things

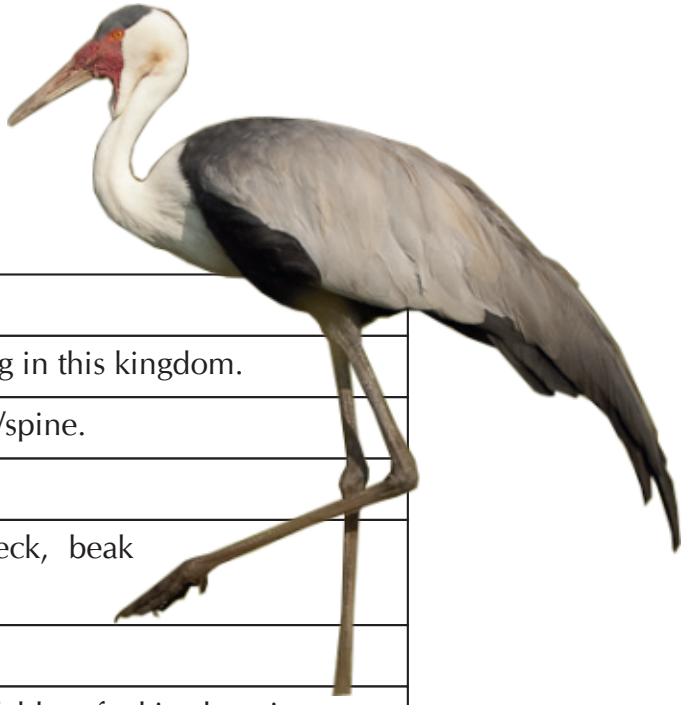
There are many different plants (flora) and animals (fauna). To help us understand all of the different types, scientists have invented a classification system based on the distinguishing characteristics of a plant or animal. This allows us to categorise it into a group with other organisms with the same characteristics. This system, the so-called 'classification tree', has 7 levels, starting with a very broad classification, and getting more and more precise the lower you go. You could think of it as a filter, each level filtering out other types of animals with different characteristics.



Scientists have classed all living creatures into five kingdoms: Animals, plants, fungi, bacteria and some types of sea weed (algae).

Classification example

As an example of this, we will look at the classification of a Wattled Crane:



Category	Name	Characteristics
Kingdom	Animalia	All animals belong in this kingdom.
Phylum	Chordata	It has a backbone/spine.
Class	Aves	It is a bird.
Order	Gruiformes	It has a long neck, beak and legs.
Family	Gruicae	It is a crane.
Genus	Bugeranus	It has wattles: folds of skin hanging below its beak.
Species	Bugeranus carunculatus	It is the Wattled Crane.

Animals

The kingdom of animals will be looked at in more detail on the following pages. The five most well known classes of animals are mammals, birds, reptiles, amphibians and fish. These animals all have a backbone. There are also lots of animals without backbones such as spiders and insects, but we will not go into detail on them in this training programme.

Now we will look at the five most well known classes of animals with a backbone: mammals, birds, reptiles, amphibians and fish.

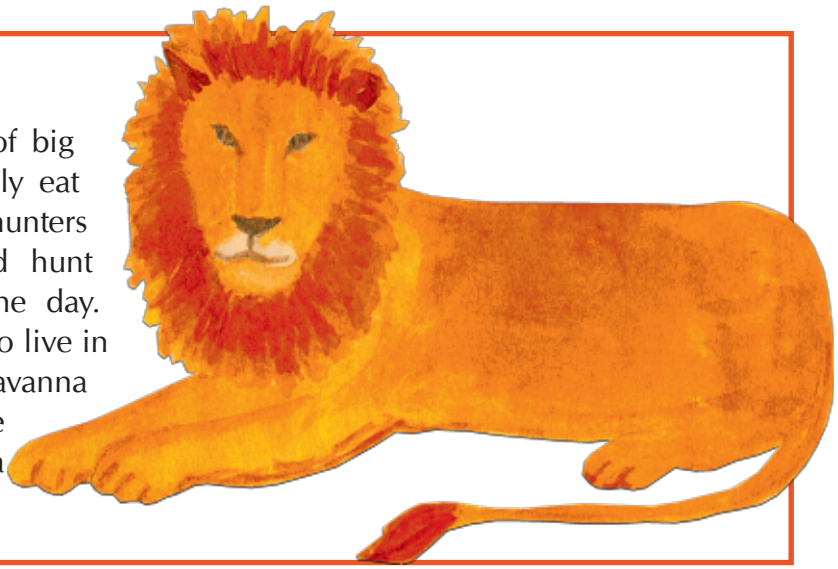
Mammals

Mammals' bodies are covered in hair (although sometimes the hairs are so small they are hard to see). They are warm blooded, which means they can regulate their body temperature to keep warm on cold days. Almost all mammals bear live young, they don't lay eggs. They feed their young on milk that they produce themselves. This milk contains many vital proteins and fats that the young need to grow quickly. Mammals can be found in many different habitats: in forests, deserts, on land, in the sea and in the air.

Scientists have identified at least 61 species of mammals in the Kafa BR including bats, shrews, hedgehogs, squirrels, porcupines and rats as well as larger mammals such as primates, lions, hippos and leopards. While some of these species are abundant, others are rare. Fourteen species of carnivore have been identified, including leopards, lions, mongoose, genet, civet and hyena. Some examples of these are:

Lion

Lions *(Panthera leo)* are a species of big cat. They are carnivores as they only eat meat. Lions are very talented hunters thanks to their good eyesight and hunt mostly at night, sleeping during the day. They are the only species of big cat to live in a pack. Lions are usually found in savanna habitats. It is very rare for lions to live in the rainforest, as they do in Kafa BR.

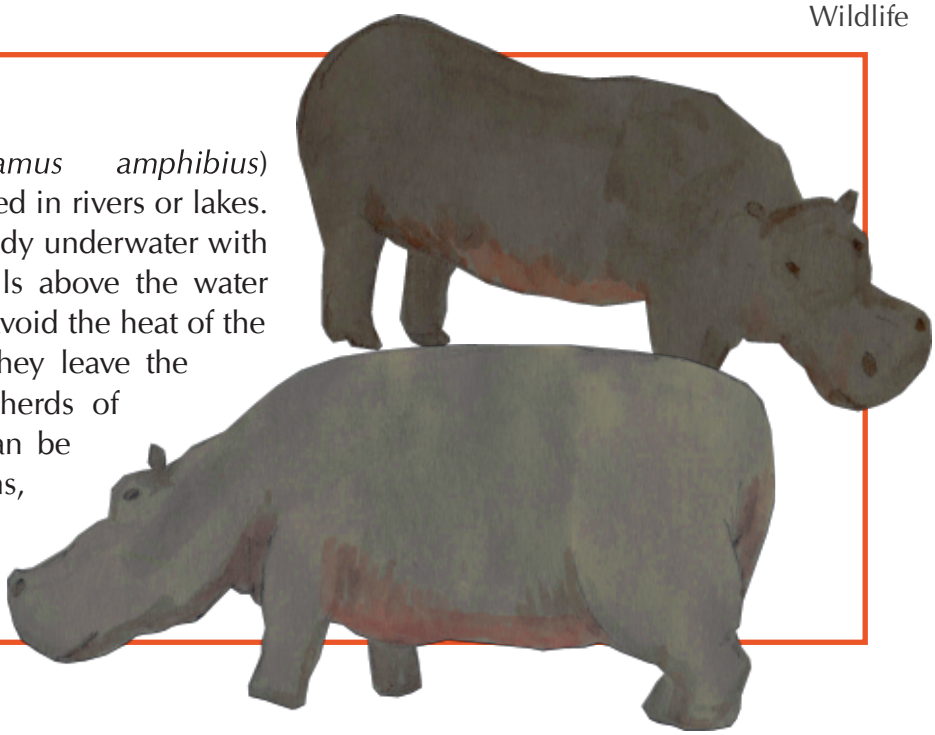


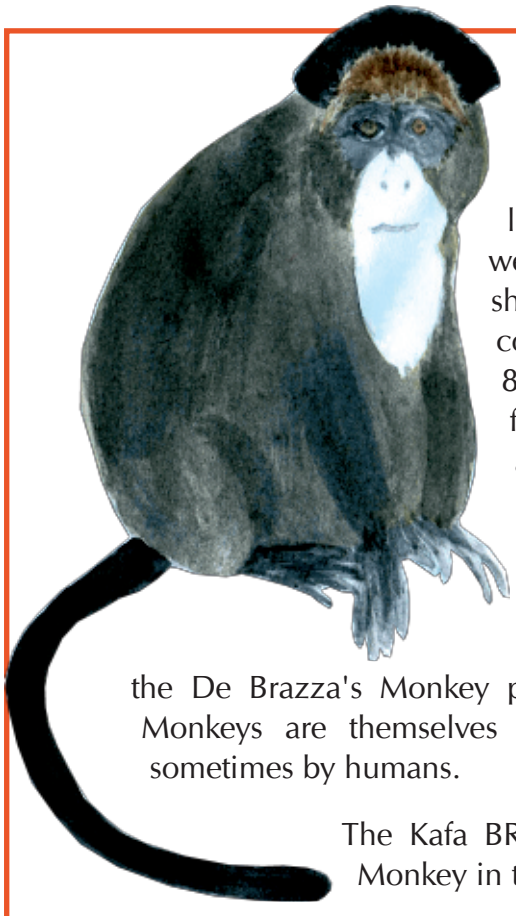
African Buffalo

African Buffalo *(Syncerus caffer)* are herbivores as they only eat plants. They graze on grassland, swamps, floodplains and forests, primarily feeding on grass. By feeding on tall, coarse grasses, they can clear large areas to make way for more selective grazers. Female buffaloes make up the core of the large herds of more than 50 animals, whilst males generally live on their own or in small bachelor groups. Buffalos are very protective of the other animals in their herd and as a group they can drive away a whole pride of lions. Buffaloes are said to be one of the most dangerous animals with a reputation for unpredictable behaviour.

Hippopotamus

Hippopotamuses (*Hippopotamus amphibius*) spend most of the day submerged in rivers or lakes. They keep almost all of their body underwater with just their ears, eyes and nostrils above the water surface. The water helps them avoid the heat of the sun and keep cool. At night they leave the water to graze. They live in herds of around 10-15 animals. They can be aggressive towards humans, particularly if they are protecting their young.





De Brazza's Monkey

De Brazza's Monkey (*Cercopethicus neglectus*), also sometimes known as a Swamp Monkey, is a primate that lives in bamboo and montane forests close to rivers, wetlands and waterways in Central Africa. They are quite shy animals, but make deep, booming calls to communicate with other members of their group of around 8-10 animals. De Brazza's Monkeys live in trees in the forest, where they are mostly found in the tree canopy, but also in the understorey and on the forest floor.

They eat mainly fruits and seeds, sometimes eating leaves, mushrooms, small reptiles and insects as well. They have cheek pouches to store their food while they forage and take it back to a safe place to eat. In doing so, the De Brazza's Monkey plays an important role in seed dispersal. De Brazza's Monkeys are themselves eaten by large eagles, leopards, other monkeys and sometimes by humans.

The Kafa BR is the only area in Ethiopia to have the De Brazza's Monkey in the Tropical Afromontane Highland Biome.

Birds

Birds have feathers and lay eggs. They are warm blooded, have wings, two legs and a beak with no teeth.

Birds can eat different types of food depending on their species. Most are carnivorous, meaning they eat meat, such as insects, fish, reptiles and mice, yet some such as parrots, are herbivores and just eat seeds and fruit. The size and shape of a bird's beak is determined by the type of food it eats. Birds that feed on nectar have long, thin beaks, while birds that eat nuts have strong sturdy ones to crack the nutshells. Birds play a very important role in dispersing seeds from the nuts and fruit they eat. Most birds can fly. They have extra lightweight bones and strong muscles in their wings to flap and push their way through the air. They can also glide using air currents without flapping. Some birds, like ostriches, cannot fly but they can run very quickly to escape their predators.

Endemic species

Scientists have recorded at least 300 bird species in the Kafa BR. There are 5 endemic bird species that are only found in Ethiopia and nowhere else in the world: Rouget's Rail (*Rougetius rougetii*), Yellow-fronted Parrot (*Poicephalus flavifrons*), Abyssinian Longclaw (*Macronyx flavicollis*), Abyssinian Slaty Flycatcher (*Dioptrornis chocolatinus*) and the Abyssinian Catbird (*Parophasma galinieri*).

A further 6 species are considered near-endemic as they are only found in one other country: Wattled Ibis (*Bostrychia carunculata*), Black-winged Love Bird (*Agapornis taranta*), Banded Barbet (*Lybius undatus*), Abyssinian Woodpecker (*Dendropicos abyssinicus*), Abyssinian Black-headed Oriole (*Eurocephalus rueppelli*) and the Thickbilled Raven (*Corvus crassirostris*).

Migration

Many bird species are migratory. This means that they fly huge distances around the world according to the season. Many birds travel to northern areas such as Europe or Russia in the spring and summer seasons to breed and have their young, and then travel long distances south to spend the winter in warmer areas such as Africa or India.

Kafa BR is used by at least 24 migratory bird species birds as a place to rest and feed over winter, while they spend the summer in Europe. The Blackcap (*Sylvia atricapilla*) is an example of a bird that breeds in Europe in the summer and rests and feeds in Ethiopia in the winter. Some species of migratory birds just stop off in Kafa BR on their way to a different destination. The European Bee-Eater (*Merops apiaster*) for example, breeds in Europe or Asia and passes through the Kafa BR to feed in the forests on its way further south.

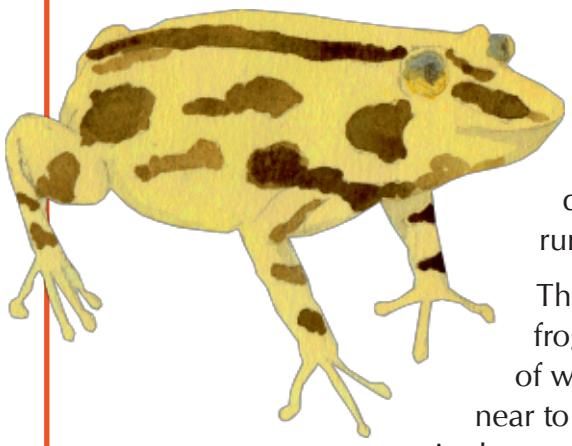
Rouget's Rail

Rouget's Rail (*Rougetius rougetii*) is an endemic bird species that is only found in Ethiopia and Eritrea. During breeding season it is found mainly in marshy areas and moorlands at high altitudes. When it is not breeding it is also found on dry heaths and lawns in urban areas. It eats a varied diet including seeds, inscect, snails and earthworms. It is currently being threatened by habitat loss due to intensive grazing and the mowing of wet pasture for building material. The conversion of grasslands to cereal fields and drought have also had an effect on the species.

Amphibians

Frogs, toads and newts are examples of amphibians. They are cold blooded, meaning they cannot regulate their own body temperature. They lie in the sun to get warm. The young of amphibians go through a process of metamorphosis, changing their form. Frogs, for example, lay their eggs in water, which then hatch into tadpoles. Tadpoles have oval bodies and a long flat tail for swimming. They can only live in water. They slowly develop into their adult form, first growing back legs, then front legs, their tail disappears and they are fully grown frogs.

Adult amphibians can live both in fresh water and on land. Their skin is permeable allowing them to breathe through the skin as well as using their lungs. This means they can spend a very long time underwater without having to come to the surface to breathe. It also enables them to hibernate (sleep through the winter) underwater at the bottom of a pond. An amphibian's skin is always moist. As adults, amphibians are carnivores and eat meat, such as insects, worms and spiders. Frogs, can be very loud especially during the breeding season.



Bubbling Kassina

The Bubbling Kassina (*Kassina senegalensis*) is a small terrestrial frog that lives on the ground. It is usually found in grassy areas and mates in shallow wetlands. It does not hop like most other frogs, but instead walks or runs as it has quite short back legs.

The little frog has been given its name due to the male frog's call, which sounds like a bubble bursting, or a drop of water landing on a metal surface. It can be heard at night near to ponds and swamps, where the male frogs sit disguised in the grass at the side of the water.

Reptiles

Reptiles are cold blooded. They rely on external sources of heat, like the sun, to get warm. Their horny skin is watertight and has scales of hard skin plates that overlap. Most reptiles are carnivorous, meaning they eat meat. Almost all reptiles lay eggs either in hollows in the ground or in nests. The majority of reptiles' eggs have a leathery shell, but the eggs of crocodiles, tortoises and geckos have a hard shell. While most reptiles have four legs, snakes have developed so they do not have any legs. Snakes, geckos, chameleon and crocodiles are all types of reptile.

African Rock Python

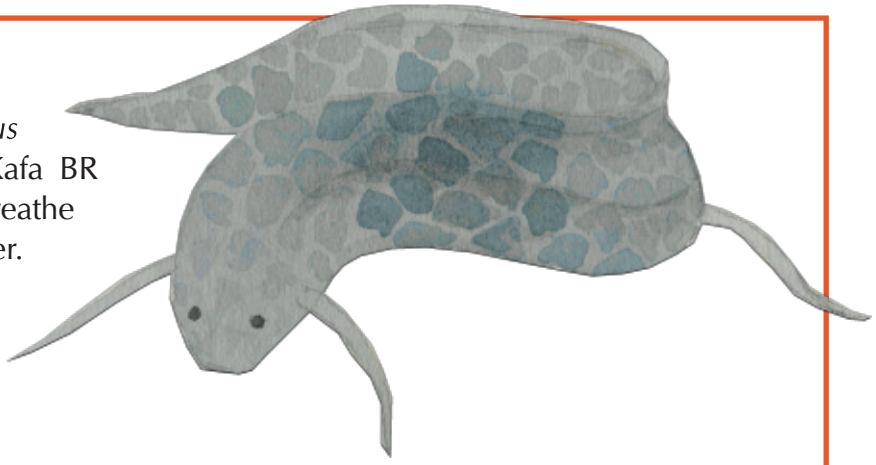
The African Rock Python (*Python sebae)* is Africa's largest snake and can grow up to six meters in length. It is mostly found in Southern, Central and Western Africa, but it is only found in some places in Eastern Africa, including Ethiopia.

The African Rock Python is non-venomous and kills its prey by constriction, crushing it and preventing it from breathing. It tends to feed on rodents, monkeys, warthogs, bats and lizards.

Fish

Fish live in water. They suck water into their mouths and let it flow over the large surface area of the gills, absorbing the oxygen. Fish are cold blooded and their skin is covered with scales which are tiny hard plates of skin. They have fins to swim around and the streamlined shape of the fish's body allows it to move effortlessly through the water.

Marbled Lungfish



The Marbled Lungfish (*Protopterus aethiopicus*) which is found in Kafa BR has developed lungs so it can breathe the oxygen in air as well as in water. It can survive in streams that dry up for long periods during each year and use its fins to 'walk' along land. Lungfish dig themselves into the mud at the bottom of streams before the dry season comes. They stay buried underground until the rains come again. Sometimes they stay buried for a few months, and sometimes longer. It has been known for the fish to spend as long as 3/4 years underground before emerging to resume its life as a fish.

Food chains

All living things need food to get energy to survive. Plants, animals and humans rely on each other for their source of food. Food chains help us understand this relationship as they show the process of eating and being eaten. The energy and nutrients stored in plants is passed on to the animals that eat them, and then on to further animals that eat those animals and so on.

When plants and animals die, they are broken down by decomposers such as bacteria, fungi and some types of insects. This releases nutrients and minerals into the soil that are absorbed and used by plants to make their own energy. They also produce humus, partially decomposed plant material that makes the soil very fertile and helps it retain water. The decomposers obtain energy from the process of breaking down organic materials of the dead plants and animals.

Some terms and definitions...

Plants are **producers** as they make their own food. They use the sunlight to convert carbon dioxide from the air and water from the soil into sugar and oxygen. This process is called photosynthesis.

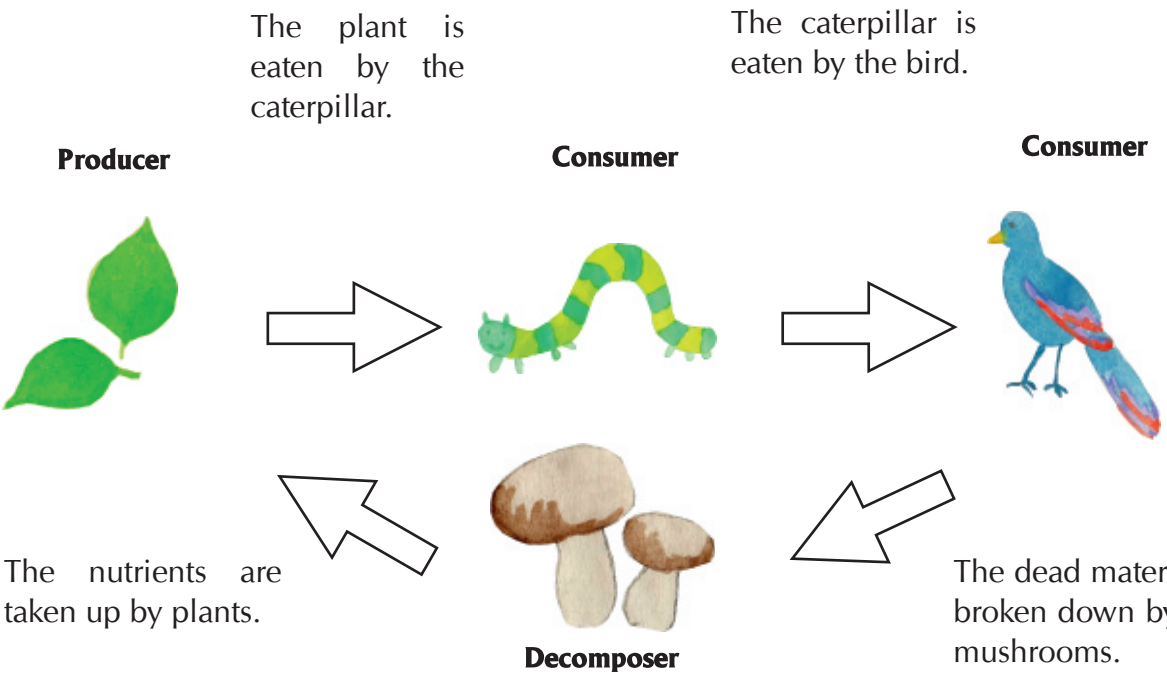
Animals are **consumers** as they cannot produce their own food and need to eat plants or other animals to survive.

Herbivores only eat plants. A cow is a herbivore.

Carnivores only eat meat. A leopard is a carnivore.

Omnivores eat both plants and animals (meat). Humans are omnivores.

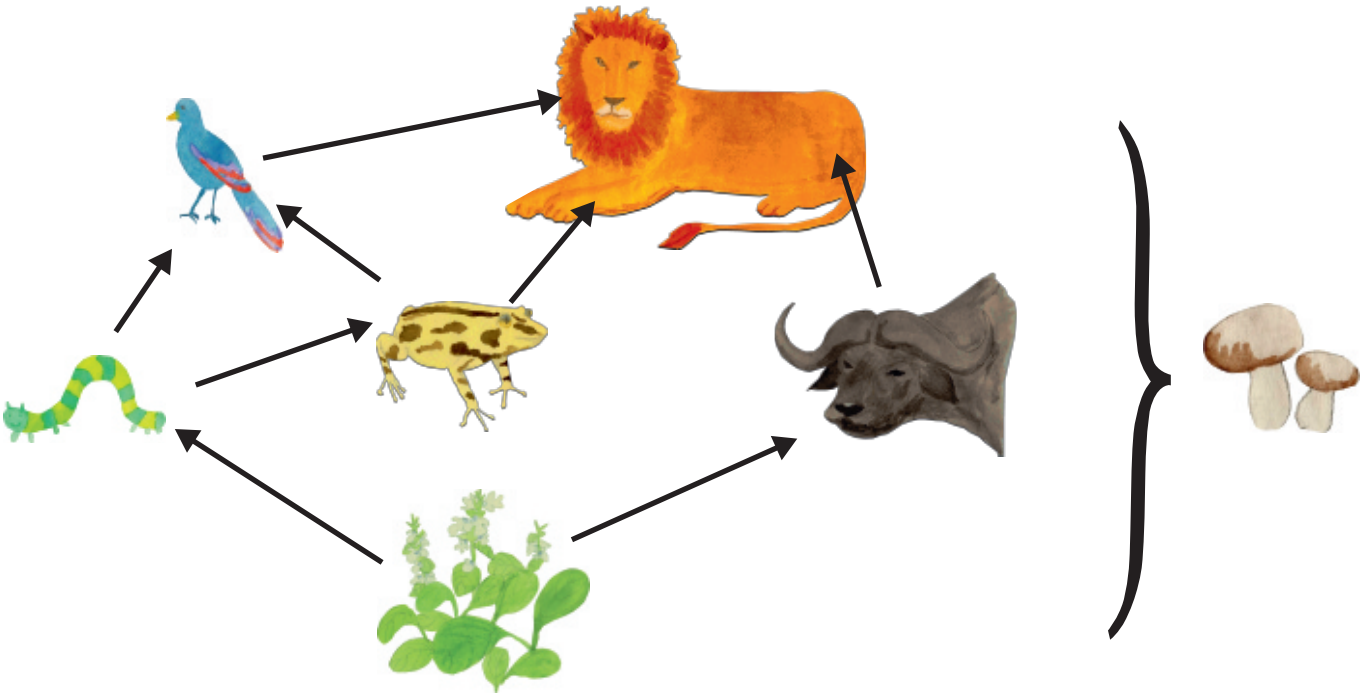
A **predator** is an animal that lives by capturing and eating other animals.



If one part of the food chain alters, it affects the other plants and animals in the chain. For example, if the caterpillars are killed by overuse of pesticides, the bird is not able to feed on them.

Food webs

There are many different food chains that overlap and interlink with one another. This is called a food web. There is a simple food web illustrated in the following diagram:



Due to the high complexity of these food webs it is impossible to find where one web stops and the next one begins. All life on earth is linked to each other in one enormous food web.

Habitats

A habitat is a place where a group of plants and animals live, get food and shelter. The group of plants and animals that live there are called a community. An example of a habitat could be a forest. It is home to a large community made up of different plants including trees, shrubs and animals such as monkeys and birds.

Plants and animals are well adjusted to their habitats. They need the conditions found there to survive. An ostrich would, for example, not be able to survive in a wetland. It is specially adjusted to withstand long periods without water and would not be able to run away from predators on the wet ground. Alternatively, a tree frog cannot live in the desert as it would have no shelter from the heat and not enough water to survive.

If a habitat changes, for example through human activity such as deforestation or climate change, it may no longer be suitable for the plants and animals that live there and they might not be able to survive.

Ecosystems

An ecosystem is a way of describing a community of living things that interact with each other and their environment (e.g. air, water and rocks) in a largely self-contained unit. The main feature of an ecosystem is that it works as a system i.e. its components interact with each other. Ecosystems can be of any size. They can be the size of a pond or of a complete rainforest and many smaller ecosystems can be found within larger ones.

2. The importance of wildlife

Wildlife has an intrinsic value, a value in its own right. It is extremely important as it is the fundamental backbone of all basic ecological processes and services, such as pollinating our crops and keeping the soil fertile. We will look at its ecological and cultural importance in this section.

Ecological importance of wildlife

Natural processes

Wildlife plays a key role in ensuring essential natural and biological processes take place. Mushrooms, for example, break down dead plants and animals through the process of decomposition. Worms break down dead leaves as they eat organic matter in the soil releasing the nutrients so plants can use them.

Food web

Wildlife species are part of the food web. If one species becomes extinct, the balance of nature is upset. Some animals will lose their food source and starve, while others lose their natural predator and the population becomes too large.

Fruit-eating Hornbills are very effective seed dispersers

Seed dispersal

Birds, monkeys and bats eat fruit and the seeds contained in it. They then fly or go to a different area and leave the seeds behind in their faeces. Many trees and plants need animals to disperse seeds so that new generations survive.

Species diversity

A wide and very rich variety of different wildlife species is known as biodiversity. As Ethiopia has such a rich variety of species, it is known as a biodiversity hotspot. This variety is partly due to the diverse types of landscape features that are found in the Kafa area, which provide many different habitats and food sources enabling different animals and plants to survive and coexist.

Endemic species

Endemic plants and animals are native to one specific area and cannot be found naturally anywhere else in the world. This means they are unique and rare. Rouget's Rail is an example of a bird that is endemic to Ethiopia and is not found naturally anywhere else in the world.

Shaping the landscape

Some species play an important role in shaping the environment where they live. Elephants, for example, eat the vegetation on savannas and stop the growth of trees. If elephants were not there, the vegetation would grow, and a forest would develop, changing the landscape drastically.

Pollination

Flowers produce a fine powder, known as pollen. The plant needs this pollen to be taken to other flowers of the same species so they can be fertilised and produce fruit and seeds. When flowers are visited by insects and animals such as bees, butterflies and bats who want to feed on the sweet nectar in the flower, a little bit of the pollen rubs off onto them. They then leave some of this pollen at the next flower that they visit, fertilising it. The pollinated flower develops into a fruit or seed.

Cultural importance of wildlife

Ecosystems are highly valued for their cultural, recreational and spiritual services to improve physical and mental health and well being.

In Ethiopia many religious and cultural practices are connected with nature and the natural environment. The massive flowering of 'yemeskel abeba' and the appearance of a bird known as 'yemeskel wof' marks the 'maskel' celebration.

Wildlife Tourism

Wildlife and traditional cultures are essential to supporting the tourist industry in Kafa. Tourism, when it is carried out in a way that does not damage the environment or disrupt local peoples' culture, is a good reason to protect the natural environment and contribute to people's way of life. Many tourists are interested in seeing the wildlife of Kafa, and it is the main support of the tourism industry in the region.

Wildlife tourism can be very profitable for local communities. Many areas earn a substantial income through tourism, and if it is carried out correctly in a participatory way sharing the benefits with the local communities, it can boost the sustainable development of the Kafa BR. Particularly the presence of endemic species that cannot be found anywhere else in the world can attract tourists.

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3. Threats to wildlife

Despite the importance of the various wildlife species found in the Kafa BR, they are under threat from human activity. The extinction of just one species has a dramatic effect on the rest of the ecosystem, and it is of utmost importance that this is prevented from happening.

Loss of habitat

The population is expanding rapidly, which is putting increased pressure on the environment. Population growth means more resources are required including more food, firewood, land to grow food and livestock. This encourages people to cut down forests to make more space for agricultural land and settlements and to get wood for fuel and construction. In clearing land for a coffee plantation for example, the whole area is cleared and the forest floor is destroyed, causing the loss of seedlings and saplings of important tree species. Larger trees are also cut down to increase the level of sunlight reaching the coffee.

Habitat fragmentation

If a habitat is not destroyed, but is instead divided into sections by the construction of a road or a settlement, animals cannot migrate as easily. Buffaloes and lions that usually migrate from lowland areas to higher elevations may become cut off (as has happened in Saja) or hampered (as is the case in Mankira). Some animals need a lot of space to live in and habitat fragmentation reduces this.

Invasive species

Invasive species are plants and animals that are not native to an area but are introduced by humans deliberately or accidentally. They do not have any natural predators and disrupt the natural balance by dominating the area. This forces out the native species and can lead to the beoming extinct. Water Hyacinth (*Eichhornia crassipes*) is an example of an invasive species that is currently rapidly overwhelming native plants in lakes and waterways in Ethiopia.

Overexploitation

The use of natural resources beyond their ability to regenerate is known as overexploitation. If a species is havested excessively, it may not be able to recover. Hunting by humans for food, medicinal and ornamental purposes has caused a significant impact to the survival of many species. If the exploitation happens at a quicker rate than the species can reproduce, this leads to a decrease in their numbers.This is particularly the case for larger animals, such as elephants, gorillas and other primate species that have a slow reproduction rate.

Pollution

Pollution is the contamination of the soil, air and water. It alters the physical and chemical nature of the environment in ways that impair the survival of many species and thus causes the loss of animals and plants. Pollution can come from many sources, for example insecticides that are used to protect crops. It has been noticed that insecticides and fertilisers can have a serious affect on honey bees. Recently, the honeybee colonies in Mankira are declining as a result of use of insecticides on crops.

The International Union for Conservation of Nature

The International Union for Conservation of Nature (IUCN) is a global organisation that works to conserve biodiversity. One of their activities is to assess the conservation status of plant and animal species around the world. The aim of this is to highlight species threatened with extinction, and therefore promote their conservation before it's too late.

The IUCN List of Threatened Species

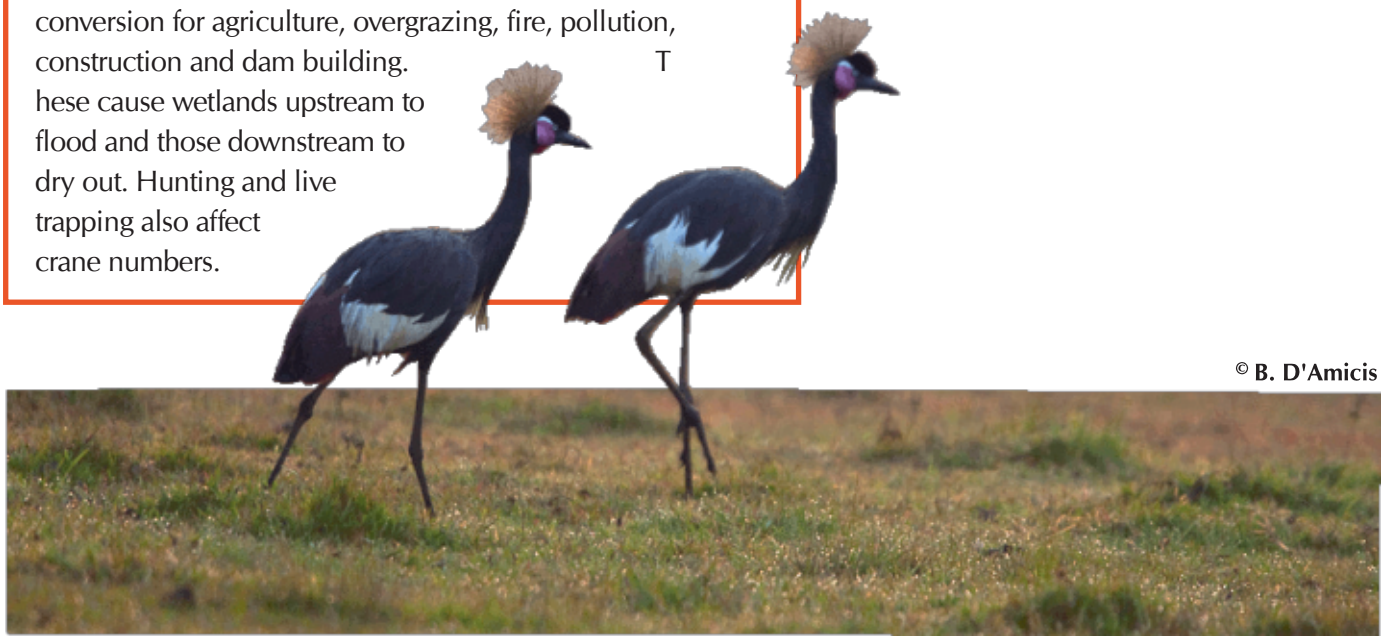
The IUCN evaluates and categorises every species into one of seven categories to determine whether it is at risk of extinction and whether urgent action has to be taken.

LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	EXTINCT IN THE WILD	EXTINCT

Categories:

- Least concern
- Near threatened - Plants and animals whose numbers are low or becoming low very quickly. These species are likely to become endagered in the future if nothing is done.
- Vulnerable
- Endangered - Species is at high risk of becoming extinct.
- Critically endangered
- Extinct in the wild
- Extinct - There are no more individuals of a species anywhere in the world . It is gone forever.

The population of Black Crowned Crane (*Balearica pavonina*) is rapidly decreasing. It is classed as "Vulnerable" by the IUCN. It lives on freshwater marshes, wet grasslands, and the banks of rivers and lakes. These habitats are being lost and degraded through drought, wetland drainage and conversion for agriculture, overgrazing, fire, pollution, construction and dam building. These cause wetlands upstream to flood and those downstream to dry out. Hunting and live trapping also affect crane numbers.



4. Activities

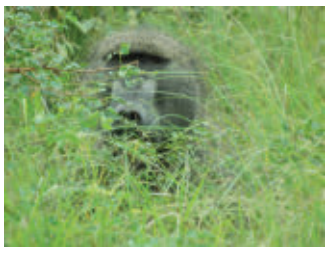
Animal discussion

Talk about different characteristics of animals that you know. Do the animals have characteristics in common?

The Food Web Activity

Ask group members to construct some food webs of their own. Prepare some cards with the photos of plants and animals below and ask the participants to rearrange the cards and draw arrows to show what is eaten by what. You could make two examples showing different ecosystems for example a wetland or a forest.

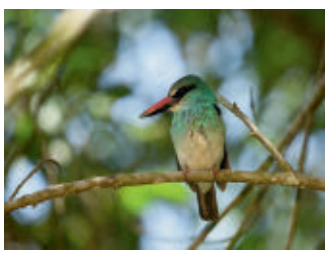
When this is finished, remove one or two of the cards giving a reason why the plant or animal is no longer there, e.g. poaching, drought or disease. Ask participants what the effect would be on the rest of the food web. For example, if the crocodile is made extinct as a result of illegal poaching, what would be the consequence on the other plants and animals in the web?

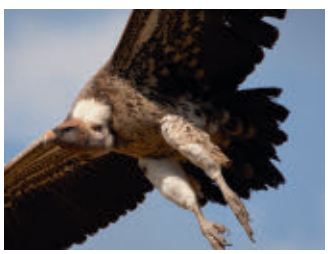










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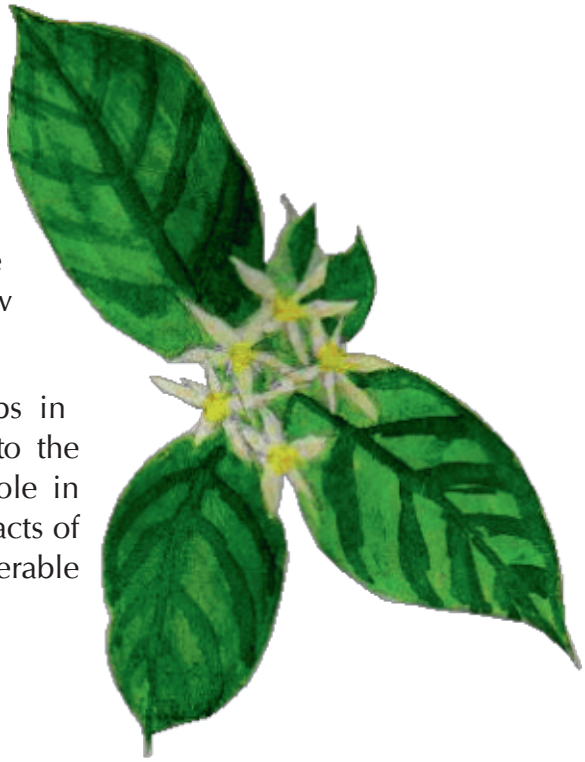
Section 5
Coffee

1. Basic knowledge on coffee



The cloud forests in southwest Ethiopia are considered to be the birthplace of Arabica coffee, one of the most popular coffee varieties in the world. The coffee shrubs grow wild in the undergrowth of the cloud forests. It is the only place in the world in which coffee continues to grow naturally in the forest.

Arabica coffee is one of the most important cash crops in Ethiopia and as such is of vital economic importance to the country and the Kafa BR. It has played an important role in shaping people's culture and traditions. However the impacts of climate change and economic considerations pose considerable threats to this valuable crop.

Origin of Arabica Coffee

Ethiopia is considered to be the centre of origin and diversity of Arabica coffee. This species of coffee is indigenous to the highlands of south western Ethiopia. It is geographically isolated from the other coffee species in the world and is naturally restricted to two isolated mountain forests on the western and eastern sides of the Great Rift Valley.

Specific features of Arabica coffee

Arabica coffee naturally grows to a height of 7-8 m, but cultivated plants are usually pruned to reduce the plant height for management and easy access to the coffee cherries. It takes about 4-5 years for a coffee plant to mature and start producing fruits. The plant usually flowers and produces fruit 3-4 times per season. Coffee is self-fertilising, but insects such as bees pollinate the flowers as well. The fruits take around 6-7 months to mature and ripen. Birds are the main agent in seed dispersal, but monkeys and rodents also eat the cherries and spread the seeds. Coffee plants can live to over 100 years old.

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Coffee plants contain a chemical called caffeine in their leaves, stems, roots and beans. This protects the plant from attack by insects and fungus and the germinating seeds from bacteria. Caffeine is a stimulant to humans, it can make us more active and stay awake for longer.

Conditions needed for growth

Arabica coffee grows at a range of altitudes between 1000 - 2000 metres above sea level, but is most suited to growing in the wet Woyna Dega zone, 1500 - 1800 metres above sea level. Flat land or slightly rolling hills offer the best landscape for coffee growth.

Coffee can grow in a wide range of soil types, but grows best in slightly acidic soils, such as deep reddish-brown clay soil of volcanic origin with medium-high fertility. It likes growing in permeable soils that allow water to drain, and porous soils with small holes between the particles having a high water holding capacity. The soils in the Kafa Zone are ideal for coffee growth as they can both hold water and drain well due to their rich organic humus content.

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Arabica coffee grows naturally in the shaded understorey of the forest. The plants have adapted to thrive in these low light conditions. They can be grown in full sun, and some say the plants are more productive, but as we will discuss below, this practice reduces their natural resistance to many pests and diseases and does not produce as high quality coffee beans as shade-grown plants.

Temperature is also an important factor in the growth of the coffee trees with the optimum temperature lying between 18-21ºC. If the temperature rises above 23ºC, the development and ripening of the coffee cherries is accelerated, leading to coffee that is of a lower quality. Temperatures of above 26°C strongly reduce the rate of photosynthesis. Continuous exposure to temperatures of 30ºC can cause the coffee plant to suffer stress leading to desiccation and growth abnormalities such as yellowed leaves and the growth of tumours on the stem. Growth is affected if it is too cold and frost can damage both leaves and fruits.

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The coffee plants require a minimum of 1200-1500 mm rain annually, however too much rain can cause damage. The water enters the empty spaces in the soil and forces the air out. The plants' roots need this air to function properly and waterlogged soil causes them to drown and rot. Plants affected by this start losing their leaves, becoming yellow and drooping. This is a particular problem for young plants and during the early growing stages.

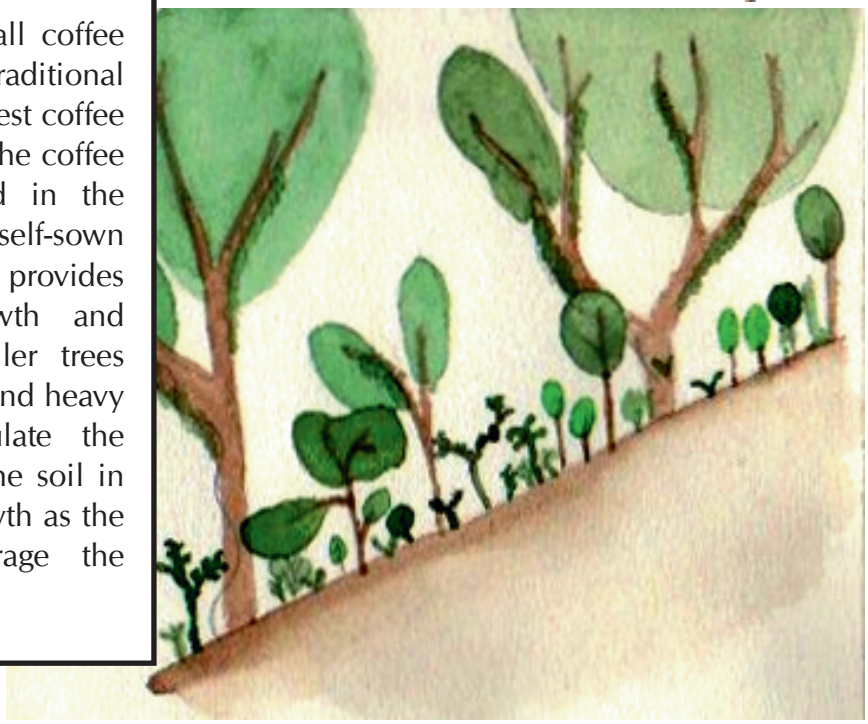
Coffee production systems

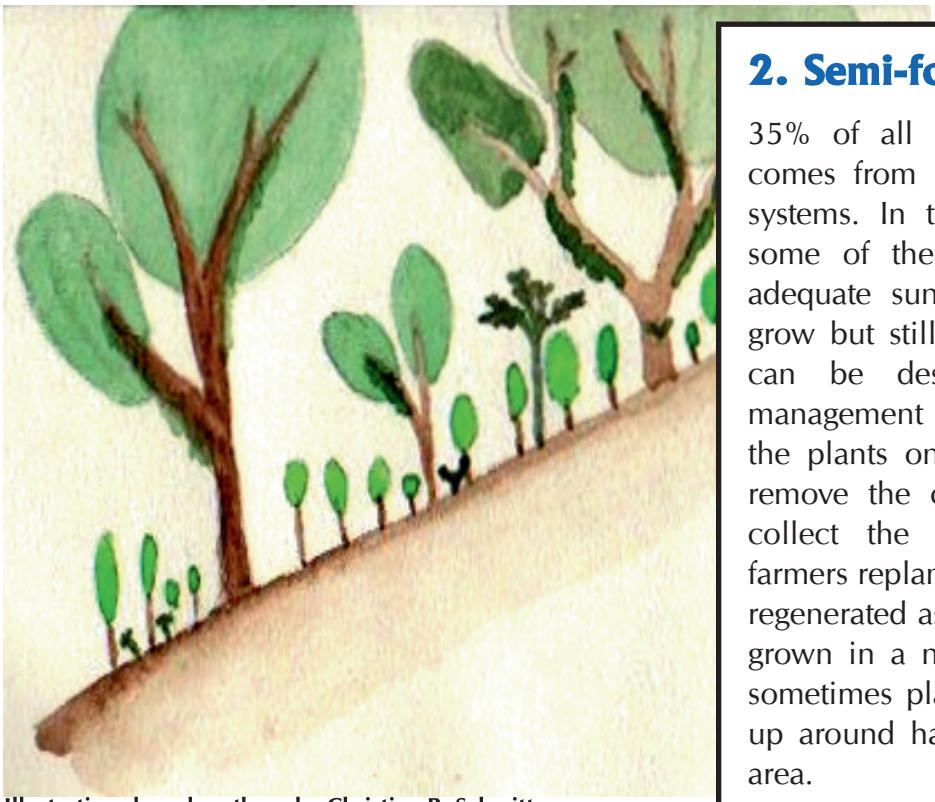
Coffee grows naturally in the forests of the Kafa BR. It is also cultivated and produced commercially by farmers and plantation owners. There are four types of coffee production systems in Ethiopia: Forest coffee, semi-forest coffee, garden coffee and plantation coffee. These four systems make coffee production in Ethiopia unique. Now we will look at the different characteristics of each production system.

1. Forest coffee

Forest coffee makes up 10% of all coffee production in Ethiopia and is a traditional approach to coffee cultivation. Forest coffee grows in unmanaged forests with the coffee plants being sparsely distributed in the forest understorey. The coffee is self-sown and self-regenerating. The forest provides ideal conditions for the growth and production of coffee as the taller trees shelter the plants from direct sun and heavy rain. They also help to regulate the temperature around the coffee. The soil in the forest is perfect for coffee growth as the leaf litter and humus encourage the retention of soil moisture.

Coffee plants indicated by this symbol





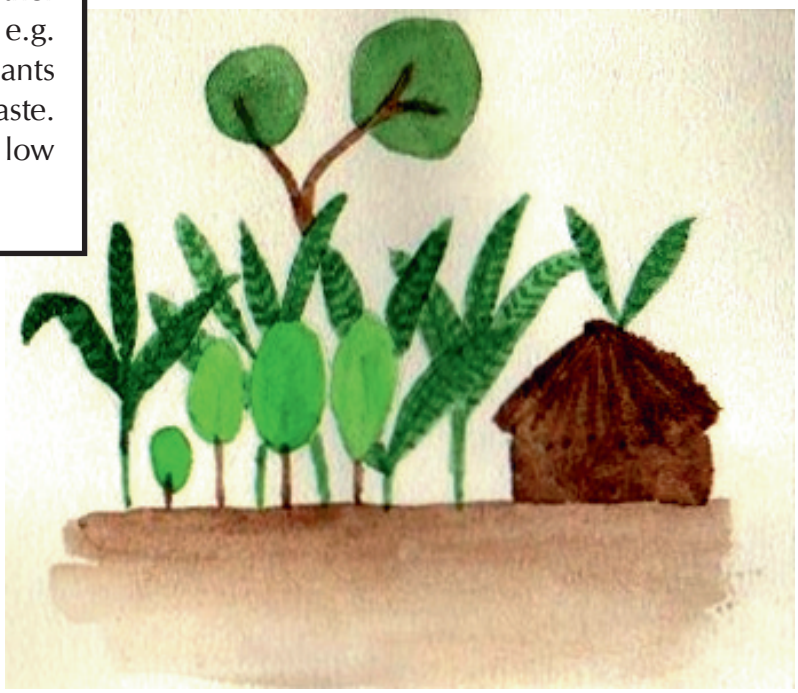
Illustrations based on those by Christine B. Schmitt.

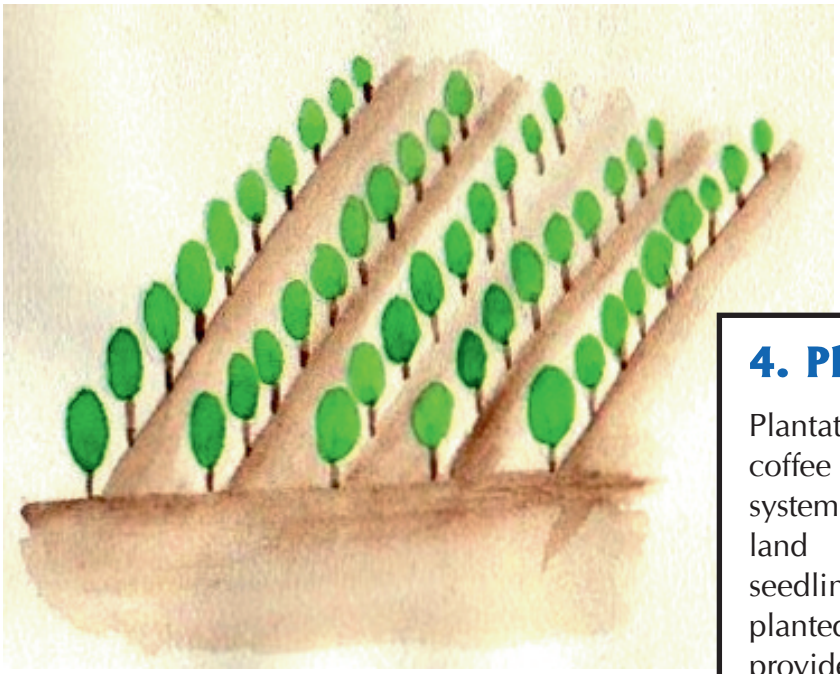
2. Semi-forest coffee

35% of all coffee produced in Ethiopia comes from semi-forest coffee production systems. In this system, the farmers thin some of the trees and shrubs to allow adequate sunlight for the coffee trees to grow but still provide them with shade. It can be described as having a low management intensity as the farmers visit the plants only a few times each year to remove the competing vegetation and to collect the coffee cherry harvest. The farmers replant seedlings that have naturally regenerated as well as those that have been grown in a nursery. The coffee plants are sometimes planted very densely and make up around half of all of the plants in the area.

3. Garden coffee

Around 35% of coffee produced in Ethiopia is grown in farmers' homegardens around their houses. The coffee trees are planted under the shade of other crops, such as enset. They are interspersed with other crops such as maize or fruit trees e.g. avocado, papaya and banana. The plants are usually fertilised with organic waste. This method of coffee cultivation has a low environmental impact.





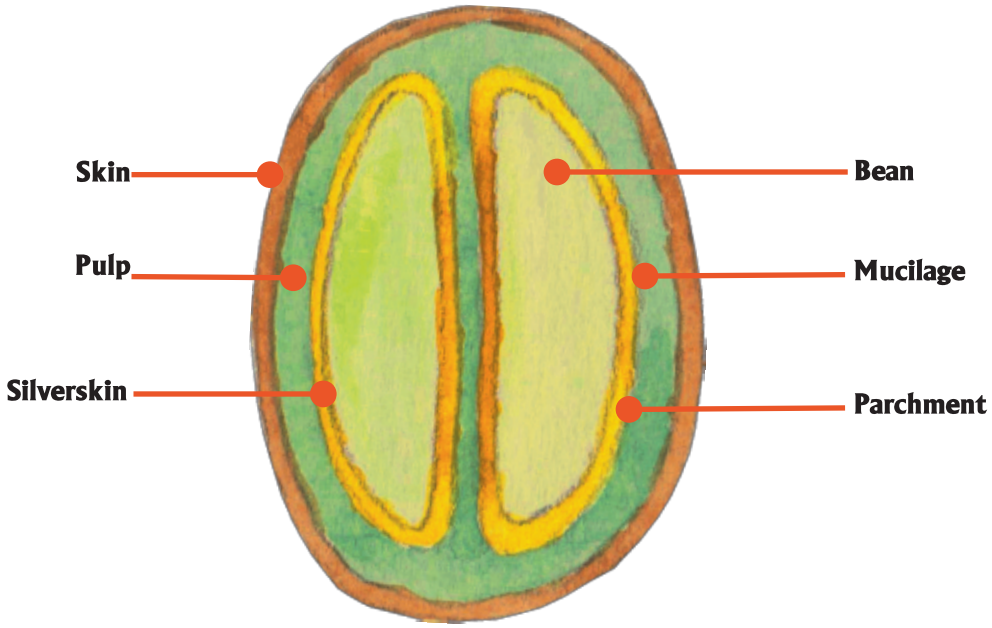
4. Plantation coffee

Plantation coffee makes up about 20% of coffee production in Ethiopia. In this system, forest is sometimes cleared to make land free for coffee production. The seedlings are raised in nurseries and often planted together with taller plants to provide shade. The plants require a lot of care, time and attention as they need mulching, manuring, weeding, shade-regulation and pruning.

Coffee Harvesting

Traditionally, farmers harvest the coffee by either shaking the trees and picking the fruits up from the ground, or pick them directly from the tree known as "strip harvesting". The mixture of ripe and unripe cherries are then dried on a raised screen or mats made from locally sourced materials.

The coffee cherries contain the beans, coated by a silverskin and parchment, surrounded by a fleshy pulp layer. These layers have to be removed to get to the beans in the middle. They are removed either by dry or wet processing.



Cross-section of a coffee bean cherry

2. The importance of coffee

Economic Importance of coffee

International, national and local markets

Coffee is the world's second most traded commodity after oil. Arabica coffee, the coffee species which originates in Ethiopia's montane rainforest, is a highly valued commodity worldwide and is of great economic importance, contributing to 90% of the world's coffee market.

Coffee is very important to the Ethiopian economy. It is its largest export commodity accounting for around 60% of the country's exports to international markets. More than 200,000 tonnes are exported to the international market each year. Coffee production provides employment to over 15 million people in Ethiopia. An entire industry has developed around its transport, processing, trade and export. About 25% of Ethiopia's population are dependent on coffee for their livelihood and it is the most important source of income to farmers in Kafa. They are highly dependent on the production and sale of coffee to generate an income. The local population also rely on their own coffee cultivation for private consumption.

© E. Ball

Genetic Importance

All living beings have genes. These are tiny strings of chemicals that determine what type of plant or animal the life form is as well as its individual characteristics. They are like instructions that tell the organism how to grow. Truly wild coffee trees have a wide variety of different sizes, shapes and characteristics such as resistance to various diseases. This shows that they have a broad and varied genetic diversity. Cultivated coffee on the other hand has mostly just one or two gene sets. Of the 6,000 species of coffee that are known to exist in the world, only four: *Coffea arabica, Coffea robusta, Coffea liberica* and *Coffea excelsa* are currently regarded as having economic importance.

The genetic diversity of wild coffee can help it to be more resilient to environmental change and resistant to disease. It has been observed that while cultivated coffee crops are seriously affected by disease outbreaks, such as Coffee Berry Disease (a disease caused by a fungus that attacks and destroys the green coffee cherries), many wild plants are not affected because they have a slightly different genetic make-up that provides them with natural resistance. In the 1971 outbreak of Coffee Berry Disease, it was possible to find a new variant that was resistant by looking at the wild population of Arabica coffee plants. There may be wild coffee variants that are resistant to the fungus that causes Coffee Leaf Rust and Coffee Wilt Disease. The preservation of wild coffee forests can contribute towards protecting this diversity by ensuring that the genetic diversity and natural resistance is maintained.

This will become especially important with the onset of climate change. New varieties will have to be found that can exist under different climatic conditions, so that they can survive an increased temperature or altered rainfall patterns.

Tourism

The Kafa BR, being the origin and birthplace of Arabica coffee, has an incredible potential to attract international tourists. Coffee is the most popular drink around the world and there is already a thriving tourism industry based on it. People are interested in travelling to see coffee growing in the wild in the cloud forests and to experience the traditional coffee culture and ceremony. This tourism is essential for the sustainable development of the Kafa BR. If the wild coffee no longer exists, or the area is degraded and deforested, tourism will decline.

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Cultural importance of coffee

Coffee Ceremony


© B. D'Amicis

In Ethiopia, coffee is more than a drink - it is a tradition that transcends societal barriers and that is passed from generation to generation. Ethiopia is the only country in Africa with a traditional coffee drinking culture. The traditional coffee ceremony plays a significant role in people's everyday lives. It is a daily ritual performed several times a day, as well as to welcome visitors to the household and at times of celebration. The ceremony is an opportunity for the village to come together to share and discuss news, to show respect to elders and to give thanks for blessings.

All the utensils used in the ceremony are traditionally made by hand such as the clay kettle. Before the ceremony begins, frankincense is burned to drive away bad spirits. A bed of long grass is laid on the floor to symbolise fertility and abundance. The woman of the house or a young woman performs the ceremony wearing traditional clothes, first roasting the green coffee beans in a flat clay pan over a traditional open fire stove, shaking them frequently to avoid burning. Sometimes spices such as Angolan Fagaropsis (*Fagaropsis angolensis*), known locally as Yayoo, and cardamom are added to the coffee at this stage. Each member of the household is given the opportunity to smell the aromatic smoke from the roasted beans. The beans are ground in a wooden mortar and pestle and put into a clay kettle and boiled several times. When ready it is sieved, poured into small cups made of bamboo and served to guests. The youngest child traditionally serves the first cup of coffee to the oldest person. Small snacks such as roasted peas, beans, maize, and baked kocho are served as an accompaniment to the coffee. The coffee is served three times, each time adding water and boiling the coffee again. Each serving is said to be more blessed and transform the spirit.

3. Threats from coffee production to the environment

Deforestation and loss of habitat

The Ethiopian coffee forests are undergoing a process of rapid destruction and depletion. This process can be primarily attributed to the increase of smallholder agriculture, traced back to increased land pressure due to population increase and strained living conditions. Forest resources are being overused. Farmers alter the forest structure to allow for a more productive coffee harvest or cut the trees completely to clear the land for plantation establishment.

© B. D'Amicis

Semi-forest coffee produces a relatively high yield, but requires the farmer to slash the vegetation and thus change the forest quite significantly. The forest is not in its natural state, but is degraded and unable to fulfil all of its natural services and functions. Animals that live in the forest are affected by this change in their habitat and forced to seek new areas in the forest.

Plantation coffee produces a high yield of coffee. It is the most intense of the four systems and produces the biggest harvests, however the plants need more care from the farmers such as the intensive application of chemical fertilisers and pesticides, mulching, shade regulation and pruning. Often forest is cleared to make space for the plantation which leads to the negative impacts of deforestation, including changes to the water cycle and the loss of habitat for animals.

Pollution to streams from coffee washing

When coffee cherries are processed for use and sale, often the waste water is released directly into streams and rivers without being treated first. The water from pulping, washing and fermenting causes water pollution. The pulping water contains a high amount of sugars that are quickly fermented into alcohol and then vinegar. This makes the wastewater acidic. The water contains a lot of organic material, i.e. the pulp and mucilage that surround the coffee bean. Some toxic chemicals are found in the water including tannins and caffeine.

Once the organic material is washed away into streams and rivers, it begins to be broken down by bacteria and microbes, rotting the material and producing a bad smell. These bacteria use the oxygen in the water, which upsets its natural oxygen content. This, combined with the increased acidity, cause fish and other aquatic animals to die. The water may change to a blackish colour due to the chemicals in the coffee cherries.

If waste water is released in large quantities from the washing stations directly into streams and rivers, local communities will not be able to use the water for washing, drinking, cooking and watering crops.

4. Threats to wild and cultivated coffee

Climate change

Climate change will have a very serious impact on coffee production, in particular because it is sensitive to small changes in temperature, water and shade during the seedling stage, flowering and seed maturation. By 2080, scientists predict the loss of at least half of the areas that are suitable for coffee cultivation, if they are not lost completely. Increases in temperature to over 23°C cause the coffee cherries to develop and ripen too quickly, affecting the quality of the coffee as a beverage. High temperatures also cause the leaves to become yellow and the plant does not grow as well as it should. Lower temperatures also affect the growth and frost reduces the yield.

Conflict between coffee production and wildlife

Some farmers find that their coffee crops are damaged by raids of bushpigs and primates such as monkeys and baboons. Baboons are in competition with people and livestock for food and resources. When the natural forest is destroyed and cleared for agriculture, such as coffee plantations, the animals loose their habitat and natural food source. They therefore need an alternative food source, and the farms close to the forest edge are at risk of being raided.

© P. E. Ball

To protect their crops, farmers may try to kill the animals through trapping them or leaving out poisoned food. While this may seem effective in the short term, this tactic does not work in the long term, as the animal, or group of animals is just replaced by another. It is also illegal in Ethiopia for anyone to hunt and kill wildlife such as baboons and killing them carries heavy fines. Another approach is non-lethal and consists of scaring the animals away, for example by beating drums. This is very time consuming and requires the farmer to spend most of their time watching over their fields to avoid raids. Planting non-food crops such as firewood species nearest to the forest edge may assist in reducing damage to food. The best method however, is to preserve and improve the animals' natural habitat, removing the need to raid the crops in the first place. Through planting more trees the baboons and other animals are provided with food such as nuts, fruit and leaves. The farmers' crops are safer if the natural habitat is protected rather than destroyed.

5. Activities

Discovering coffee varieties

Have you seen or heard about different varieties of coffee in the wild? Where and under what conditions do they grow?

Get a variety of coffee seeds from lots of areas in the forest, in particular areas that have different environmental conditions (e.g. cooler and wetter areas, hotter and drier areas). Plant them all in a small nursery (but make sure you mark the pots so you can remember which one is which). Can you spot any difference in the appearance of the plants?

Coffee Tourism Role Play

Pretend that some of the group members are tourists. Can the other group members tell them the story of how coffee was found? How can the tourists be involved in the coffee ceremony?

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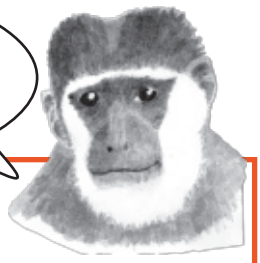
Section 6
Climate Change

1. Basic knowledge on climate change

The world's climate has never been fixed as it has always been changing very slowly over a very long period of time. The change is natural and is caused by many things such as volcanic eruptions. However it has been observed by scientists that this normally very slow process has become a lot quicker in recent decades. It is thought that human activity is causing this to happen. There is a lot of concern around the world about the consequences of an altered climate.

This chapter explains the causes of climate change and the effects it will have. It also looks at possible ways to prevent or slow down the change and ways of coping with the changes once they have occured.

What is the difference between the weather and the climate?



The 'weather' is a term used to describe the behaviour of the atmosphere over a short period of time and includes sunshine, clouds, wind, rainfall, humidity and temperature.

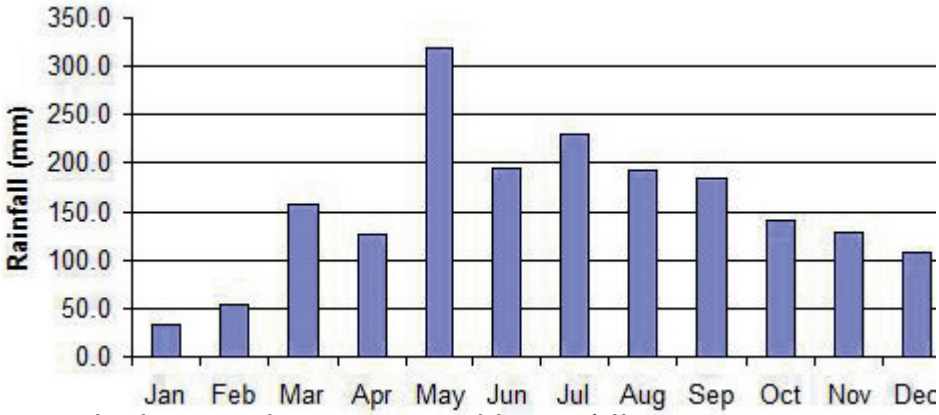
'Climate' is used to describe the weather patterns over a longer period of time, ranging from months to thousands or millions of years. It describes the weather conditions that are characteristic of a certain region.

The climate in Ethiopia

Ethiopia's climate is influenced by its location in the tropics, near the Equator (the imaginary line around the middle of the Earth), and its mountains and lowlands.

The Kafa BR gets most of its rain from May to October from moisture-laden winds originating from the Atlantic Ocean. From November to March, the winds originate from the Indian Ocean and the Red Sea and bring very little moisture.

The Kafa BR is located in one of the wettest parts of Ethiopia and receives over 1500 mm rain a year. This means the area has a continuous growing period of 330-360 days. Although the Kafa BR receives rain all year round, most of it falls in the summer season of Kremt (Meher).

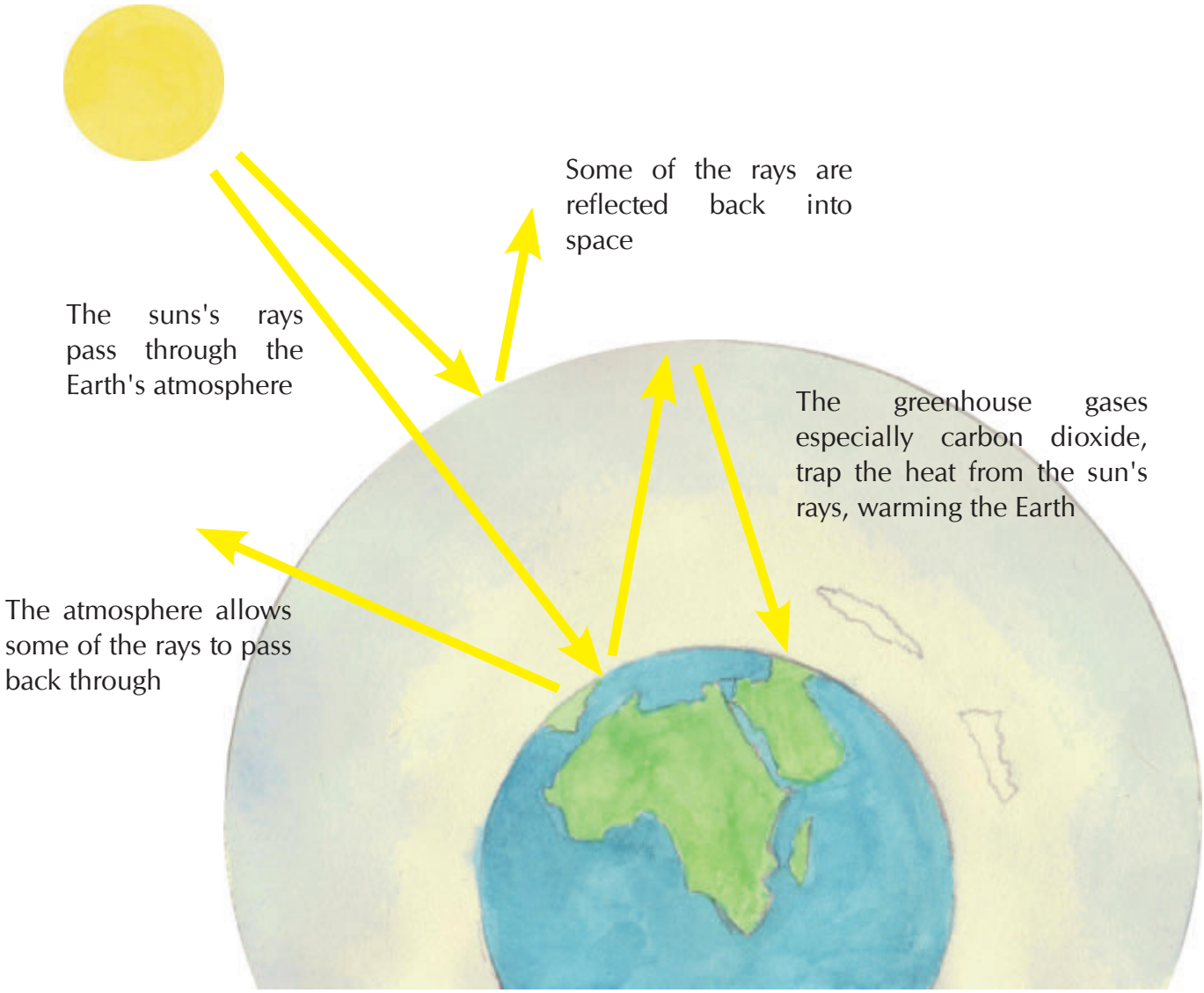


A graph showing the mean monthly rainfall (mm), Bonga station (SRMA)

The Greenhouse Effect

The atmosphere is a layer of gases all around the Earth. It is made up of a mixture of different, transparent gases, including nitrogen, oxygen, water vapour, carbon dioxide and ozone - the so-called 'greenhouse gases'. It also contains dust that reflects some of the sunlight and radiation and helps the water vapour to condense to form clouds.The atmosphere allows some of the sun's ray through, but the gases, in particular carbon dioxide, do not let all the heat back out again. They act in a way similar to a greenhouse, where the glass allows the sunlight through, but traps the heat inside. Just like in a greenhouse, this is making the Earth warm up. This is a natural and normal process, but the increased amount of carbon dioxide in the atmosphere from human sources is causing more heat to be trapped, and the Earth is warming up quicker than it should be.

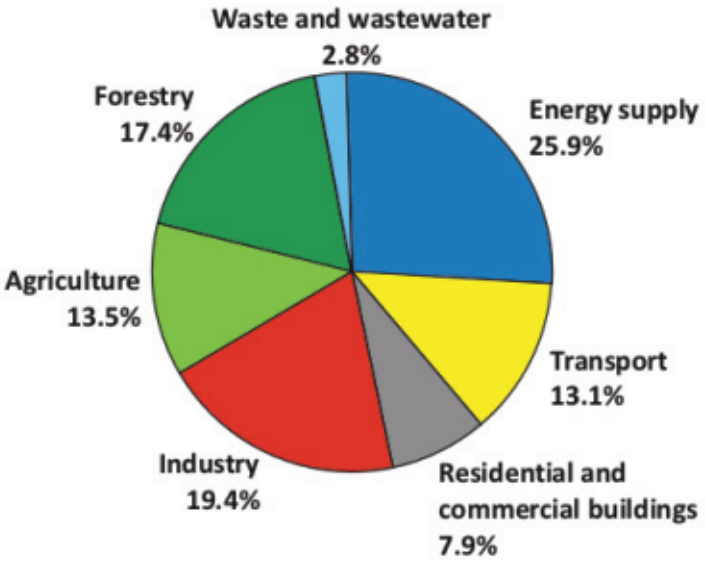
The rise in the Earth's temperature is causing the ice in the polar regions to melt and sea levels to rise. The increased volume of water is disrupting the water currents in the ocean, affecting weather patterns. This is referred to as 'climate change'. Some of the global consequences can already be seen including increased flooding, droughts and heavy rain, as well as more frequent and extreme weather, such as storms and heat waves.



What are the sources of these gases?

Carbon dioxide is the most significant of the greenhouse gases. It is released as a gas from its solid form (carbon) when fossil fuels, e.g. coal, oil and gas are burned. Organic material, such as wood also releases carbon dioxide when it is burned and when it decomposes. Humans and animals breathe out carbon dioxide, and plants release it when they create their own energy (a process called photosynthesis).

Human activities are responsible for the increased amount of greenhouse gases being released. In the diagram on the right, we can see which sectors produce the most greenhouse gas emissions.



Share of greenhouse gas emissions according to sectors in 2004 in CO_2 equivalents.

Source: IPCC4 Assessment Synthesis Report Summary for Policymakers (2007)

Where is carbon stored?

Forests and wetlands store carbon and are therefore called 'carbon sinks'. Forests are some of the biggest carbon sinks, storing it in both the trees and soil. Deforestation causes a lot of carbon dioxide to be released into the atmosphere. Wetlands also store a large amount of carbon as the waterlogged soil prevents organic material from decomposing. Peat, for example, contains a very large amount of carbon. When wetlands are drained, the decomposition process resumes and carbon dioxide is released into the atmosphere. The ocean is also an important carbon sink as it contains a lot of carbon dioxide dissolved in the water.

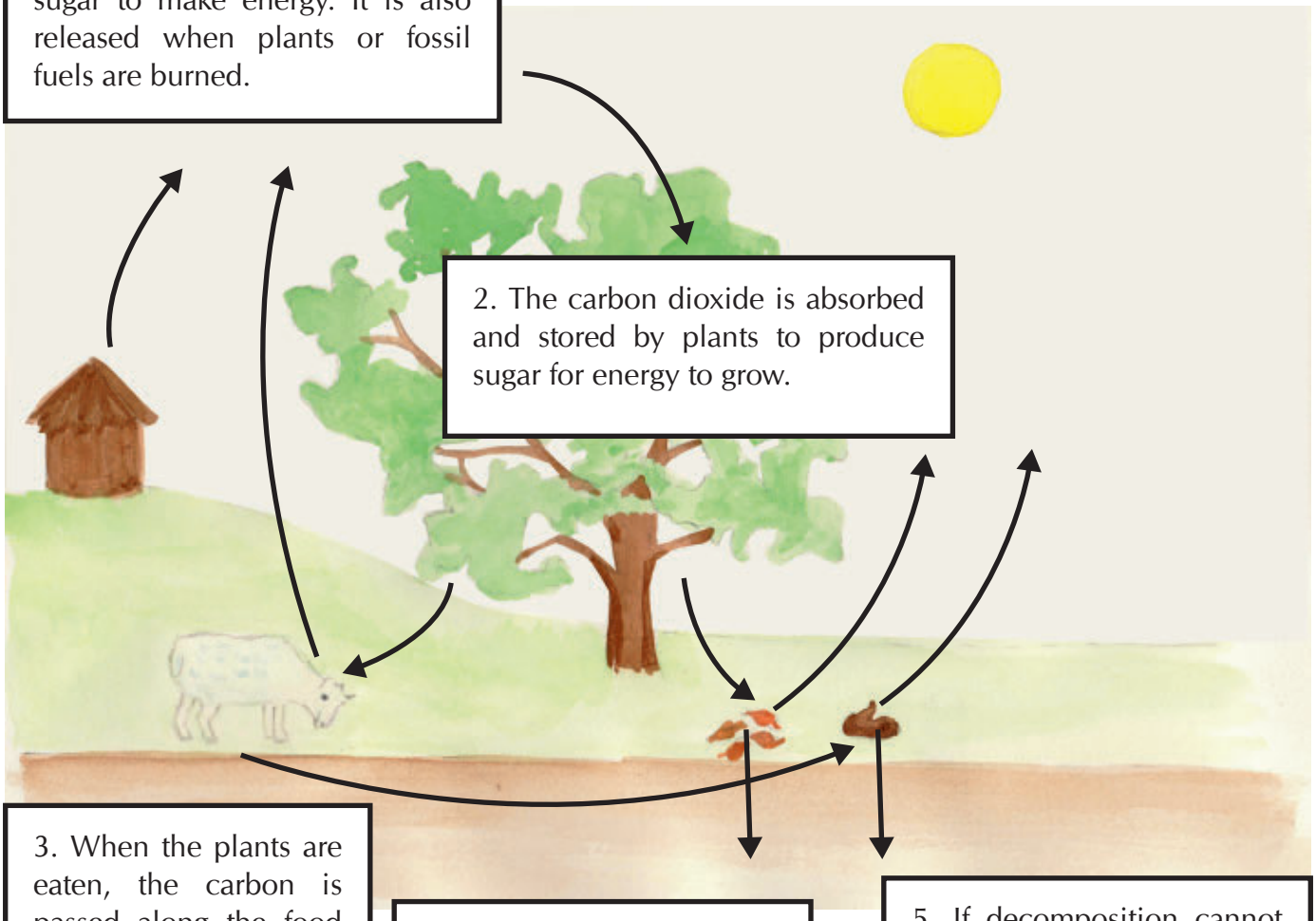
The Carbon Cycle

All living things contain carbon. Carbon is found in many different forms. It continuously circulates and changes between different states.

What is carbon dioxide?

- It is a colourless, odourless and tasteless gas
- It is soluble in water
- It is not poisonous
- It is in the air we breathe out
- In its solid state it is known as carbon

1. Carbon enters the atmosphere as the transparent gas carbon dioxide. It is released when people and animals breathe out, and when plants break down sugar to make energy. It is also released when plants or fossil fuels are burned.



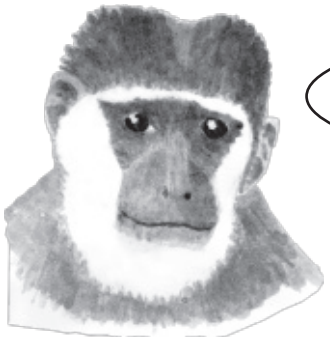
2. The carbon dioxide is absorbed and stored by plants to produce sugar for energy to grow.

3. When the plants are eaten, the carbon is passed along the food chain.

4. When the plants and animals die, they are broken down by bacteria and organisms that then release the carbon back into the atmosphere as carbon dioxide.

5. If decomposition cannot take place (e.g. a lack of oxygen), the carbon can be converted into fossil fuels such as coal and oil. When these are burnt, the carbon is released back into the atmosphere.

2. The impact of climate change



What are the effects of climate change?

While some of the effects of climate change are already being felt, further changes in the climate will affect humans and the environment significantly. Here we will explore some of the possible effects of climate change.

Changing seasons

Many plant and animal species depend on certain seasons for important stages of their life cycle, such as flowering or having young. If these seasons are disrupted, they may start this cycle at the wrong time. This can be disastrous for the species, for example causing birds to migrate too early so there is no food available at their destination, or the late birth of young so they are not fully developed in time for winter.

Some species will not be able to adapt to the changes and will become extinct. This will upset the food chain and leave the animals that feed on them hungry and at risk of starvation.

Changing seasons will also significantly affect agriculture, changing the times of year suitable for harvest and sowing crops and affecting the yield at harvest. It may also force farmers to change the crops that they plant to ones more suitable to the changed climate.

Increase in rain intensity

Heavy rain damages plants and leads to seasonal flooding. The raindrops cause leaves, stems and branches to snap, and if the water does not soak into the soil, the standing water can cause significant problems, for example through creating the perfect conditions for root rot. Teff is one example of an agricultural plant that cannot cope with such deluges of water. The yield of other crops like maize, sorghum, peas and beans will decrease significantly.

Heavy rain and flooding also wash away soil, removing its nutrients and polluting streams and rivers downstream and cause a build up of siltation. Soil erosion can involve just the top layer of soil being washed away (where all the nutrients are), or it can involve whole mountainsides as in the case of landslides. Steep slopes are particularly susceptible, as are areas that have been deforested or stripped of vegetation, e.g. those that are used for agriculture. Changes in land use (e.g. changing forest to agricultural land) can cause several meters of soil to be lost in just a few years.

Changes in temperature

Heat waves will have an impact on both humans and the environment. They could lead to an increase in heat stroke, a particular problem for children and the elderly. Respiratory (breathing) and cardiovascular (heart and circulation) diseases also increase.

Water scarcity

A reduction in the water content of soil can damage plants, especially if the air is warm, or if the plant is in direct sunlight. Plants actively absorb water from the soil with their roots. They release this water as water vapour into the air through their leaves. If the air temperature is high, and there is not much water in the soil, they release more water through their leaves than they can take in through their roots. This also takes place if the sun is shining directly on the leaves. Unless the plant is adapted to dry conditions, for example with roots that go very deep into the soil or thick, fleshy leaves, this lack of water causes the plant to wilt (droop) and die.

Changes in the climate on a long-term basis could directly affect the amount of drinking water availability. An increase in temperature could mean a reduction of moisture in the air and also in the soil. This would mean there is a reduction in the amount and duration of dew due to both high release of water from plant leaves and evaporation from the soil surface. It would also further exacerbate the drying up of streams.

Water shortages lead to decreased productivity or loss of livestock. It can make both crops and livestock weaker and more susceptible of falling ill to disease. In poorer households the effects will be felt particularly strongly – they may have to resort to selling their belongings to buy water for themselves and their livestock.

Migration

Environmental disasters, such as famine, land degradation and drought, force people to move from their homelands in search of a place where they can survive.

Plants and animals may also be forced to migrate if they cannot adapt to the changed environmental conditions. For example, species may have to move to higher altitudes where it is cooler to cope with temperature increases.

Spread of disease

Changes in climate may increase the spread of disease affecting both humans and livestock. Many insects and microorganisms that carry disease are limited by temperature and humidity. They stay in a 'geographic range' that is warm and humid enough for them to survive. If the temperature increases, this range becomes larger and expands to areas that do not usually have the disease. For example, cases of malaria can occur in an area where the disease has previously not been known. Increased temperatures allow mosquitoes to reach higher altitudes.

Food insecurity

Subsistence farmers and those living on the poverty line are particularly vulnerable to changes in the climate. While agriculture can be seen as one of the main contributors to the change in climate, e.g. when people clear the forest to grow crops, a change in the climate can affect agriculture drastically. The plants that farmers choose to plant are generally suited to that area's climatic conditions. If these conditions change, the crops will not thrive and this leads to food insecurity.

3. Climate change in the Kafa Biosphere Reserve

Some changes to the climate have already been observed in the Kafa BR. Scientists have predicted what further changes lie in store for the future.

It is thought that in 50 years time, the temperature in Kafa will have risen by an average of 3°C. A rise in temperature such as this would increase the amount of water on the soil surface that evaporates and the amount of water released by plants from their leaves. This would in turn reduce the amount of water that is available to recharge the groundwater. Furthermore, this would have an effect on streams causing them to dry and further reducing the total amount of water available in the region. As the Kafa BR feeds water into the Baro-Akobo and the Omo-Ghibe River Basins, it provides a large region with a plentiful water supply. The hydroelectric dam on the Gojeb River may not have enough water to generate energy, leading to energy shortages.

Scientists have also predicted that the rainfall patterns will change. In certain months there will be an increase in the amount of heavy rain and surface run-off (the water that is not absorbed by the soil, but rather flows along the surface). This, combined with deforestation and the degradation of pastures and agricultural areas, will speed up soil erosion, leading to worsened water quality downstream and increase the likelihood of flooding.

Heavy rain washes away the top layer of unprotected soil.

It has been observed that the rainy season in the Kafa BR is much colder in the daytime and the sun is much stronger in the dry season. The rainy season is now longer than in previous years and very strong heatwaves are being experienced in December. This change in the seasons is a clear sign of climate change. It affects the times when crops can be harvested as well as the crop varieties that can be planted. It is also bad for farmers as it is exhausting to work in extreme heat.

4. Mitigation and adaptation

Faced with all of these serious and devastating problems caused by climate change, it is obvious that we need to do something, and now! We have to address the problem in two ways: first by stopping climate change from happening and slowing it down (called 'mitigation'), and secondly to try to adapt to what can not prevented ('adaptation'). Here we will learn about these two approaches.

Mitigation

Mitigation measures aim to prevent and slow down climate change by tackling its causes. By reducing the amount of greenhouse gases that are being released and removing them from the atmosphere. It is hoped that climate change will be slowed down or stopped and the serious consequences avoided.

Reduction of forest loss

Trees in forests can help to mitigate climate change through absorbing and storing carbon. When these trees are cut down and burned, the carbon is released as carbon dioxide. In fact, deforestation is one of the biggest sources of the greenhouse gases released into the atmosphere. To prevent this from happening it is essential that all efforts are made to prevent deforestation and to maintain the current amount of forest. Community plantations with fast growing trees for fuel wood production help to reduce the pressure on natural forests to satisfy the energy needs of the local population, stopping deforestation and climate change.

Reforestation

Forests can be strengthened and enhanced through planting trees (reforestation). This is important as trees take carbon dioxide from the air through the process of making the energy (photosynthesis). Reforestation, for example through growing trees in nurseries and then planting them out, can make the forest more resilient to climate change and ensure that future generations have access to essential forest products. Additionally reforestation enables the soil to store more water and also prevents soil erosion, essential for people's livelihood.

Reduction of energy consumption

Most of the population in Ethiopia burn wood for heat and food preparation. It is however essential to reduce the amount of wood consumed to prevent deforestation and climate change. Measures such as using energy-efficient stoves instead of an open fire to cook food play an important role in this. They can help households to significantly reduce their wood consumption requirements, enabling food to be cooked quicker using less wood more effectively.

© D. Tunger

Energy-saving stoves reduce the need for firewood.

Protection of wetlands

Wetlands are very important carbon sinks. If they are drained, the carbon dioxide and other greenhouse gases that are stored in them are released.

Adaptation

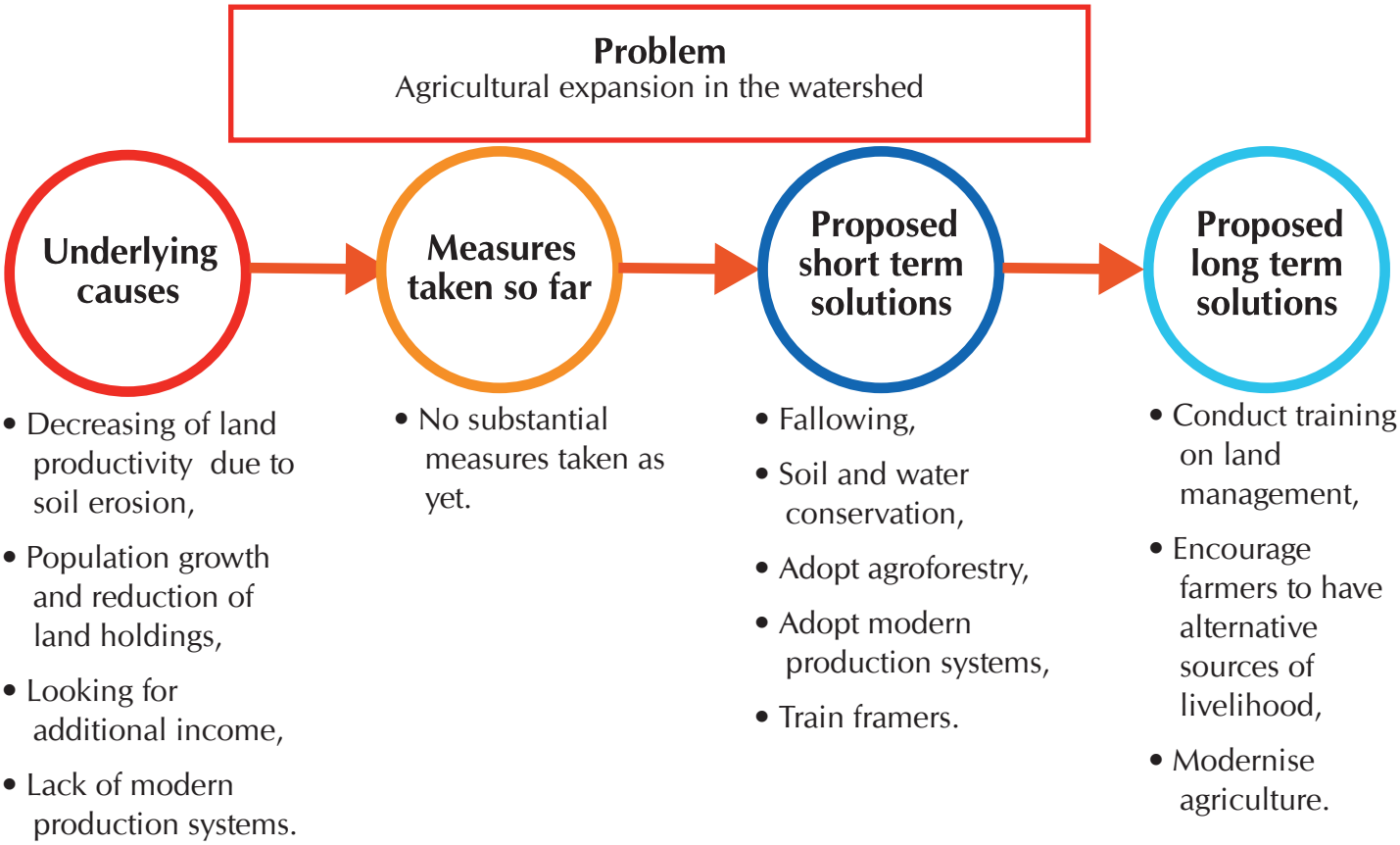
Humans and the environment will need to adapt to cope with the changes in climate. Adaptation is a way of lowering our vulnerability to the changes.

Integrated Watershed Management

An integrated approach to water management can ensure that water resources are available under uncertain future climate conditions. Integrated Watershed Management is the sustainable integration of natural resource management combined with social measures into community livelihoods. The whole of the water catchment area is taken into account so as to include the activities that take place upstream of a water body or wetland in the planning process. Participatory planning is key to this as there are many stakeholders upstream, who are not fully aware of their impact downstream. Technical and financial constraints and opportunities are also taken into consideration. Issues to be tackled via Integrated Watershed Management could be the expansion of eucalyptus cultivation which aggravates wetland degradation by using up groundwater, leading to wetland dryness and soil erosion. Reduction of the pressure on freshwater resources is beneficial regardless of the scale of the future impact, whereas activities such as river regulation, wetland drainage, intensive agriculture, and deforestation degrade freshwater habitats.

Integrated Watershed Management in Alemgono

In Alemgono the local communities and stakeholders have got together to produce a community-based wetland management plan. The most important activity of developing the management plan was to identify and find solutions for the major problems in the Alemgono watershed. An example of a problem identified is the agricultural expansion in the watershed. In the diagram below you can see the short and long term measures that were identified to allow the community to address the problem.



Sustainable land use forms and techniques

Through employing sustainable land use methods, it can be possible to adapt to the impacts of climate change. The traditional homegarden is a good example of sustainable land management. Through combining enset, fruit crops and coffee in the garden, the plants can work together to contribute towards control of pests and diseases, control soil erosion, provide shade and maintain soil nutrient levels while providing the different food crops to harvest. This means that the garden is less dependent on care and fertiliser.

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Introduction of local, old and adaptive food species

The food species that we now grow may not be able to cope with the changed climate. The price of the available food will increase dramatically, limiting its accessibility to those with low income. To ensure uninterrupted food supply, it is necessary to find alternative species that can survive in different climatic conditions. One option is the introduction of local, old food species.

Reduction of forest loss

Natural forests provide 'safety nets' during periods of food shortage. Food from the forest can be life saving during times of drought or famine when people can go into the forest to find roots, leaves, fruit and honey to provide them with energy.

Shade

Farmers and their livestock benefit from shade to rest and shelter from the hot midday sun. Shade from trees can help people to cope with long heatwaves.

5. Activities

Talking about the future

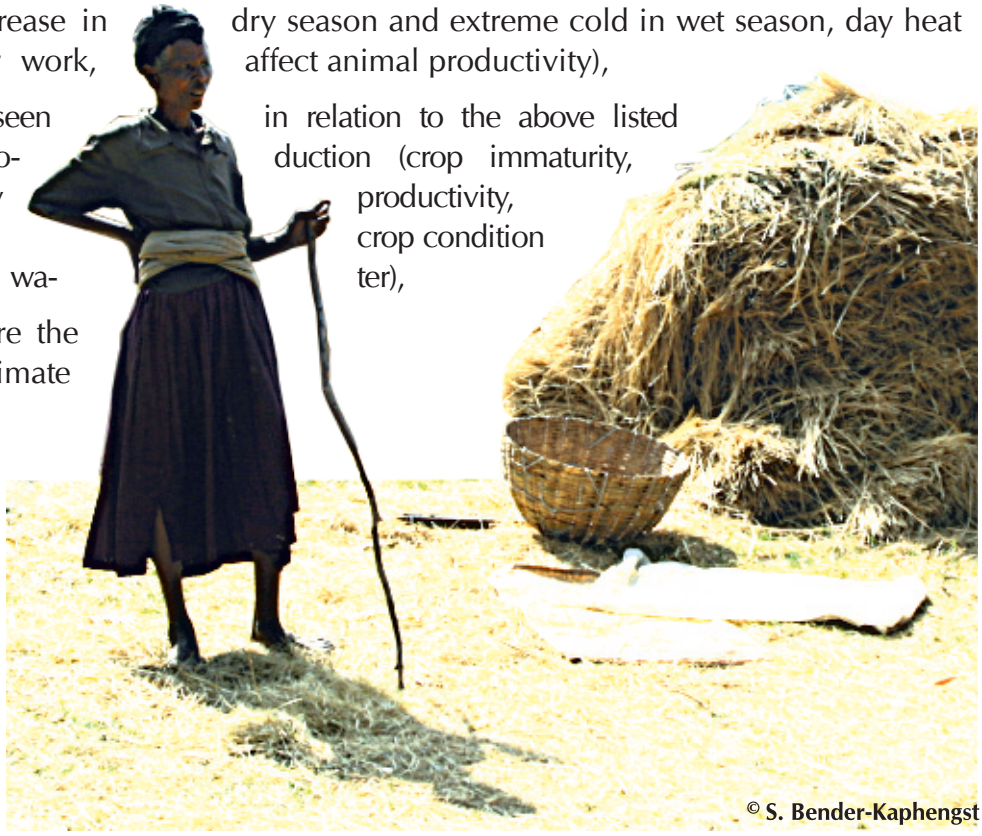
Ask your participants to discuss with a partner what they imagine their future to be like in ten years time. How do forests play a role in their lives now, and how will they play a role in the future? What will the climate be like?

Talk from an elderly member of the community

The main idea of this activity is to invite an elderly member of the community to talk about their experience of a changing climate. It is important to talk to the guest beforehand and explain the aims of the activity. Then they can think about what they want to say in advance. Ask them to talk about issues such as:

- What do they know about climate change?
- Which agro-ecological category does your area belong? Which crops are normally grown in this type of ago-ecology? What type of animals are generally kept in your community?
- Have you noticed climate change in your area? What is changing? Some examples could be temperature, heat/cold, wind, rain, diseases for humans, plants and animals, soil moisture, soil fertility, animal fodder, insects and pests). How quickly are these changing?
- What are the major climate change induced problems that exhibited in your area? e.g. disease (crop disease, pests and predator outbreak, animal related disease, human disease), Water shortages (drying streams/rivers, soil moisture stress, air moisture reduction, decline amount and duration of dew), soil condition (fertility change, soil moisture, soil structure, soil temperature), rain (irregularity/unpredictability, shortage, late coming and early stop, high intensity, short duration, affect crop drying, affect animal fodder availability), temperature (heat increase in dry season and extreme cold in wet season, day heat inhibits, field/outdoor work, affect animal productivity),
- What impacts have you seen in relation to the above listed problems? e.g. crop production (crop immaturity, post-harvest loss, low productivity, weed, planting time, crop condition related to sun, soil and water),
- What do you think are the main causes of climate change?

Thank the speaker at the end and ask the participants what their own experiences are. What can be done to stop or slow down climate change?



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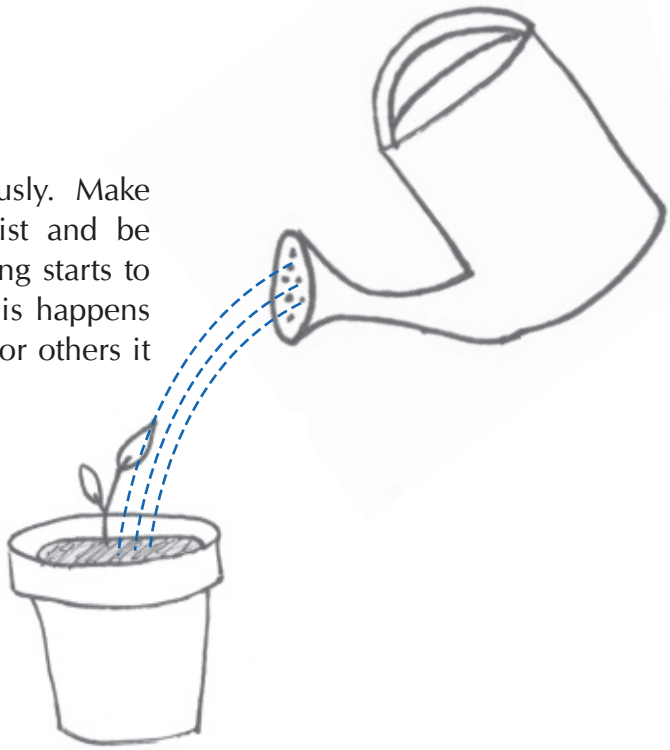
Plant a tree

Here the participants learn how to plant and take care of a tree. In doing so, you will improve the quality of forests in you local area. Ask your local ranger for support if required.

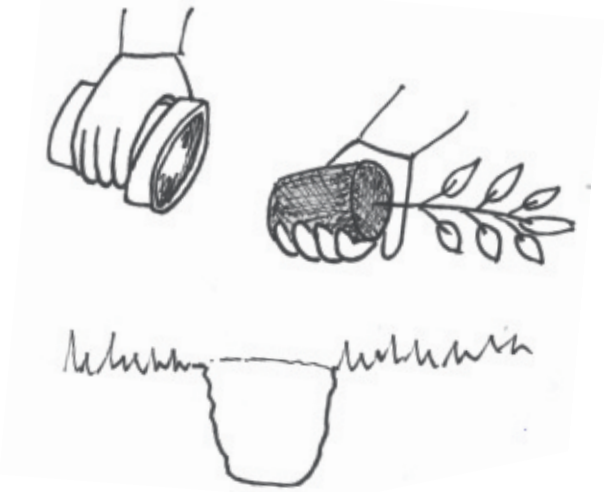
First you need to choose your tree species and collect the seeds. It is always a good idea to plant tree species that are native to your area, for example the Broad-leaved Croton (*Croton macrostachyus*).

Prepare a small pot of soil for the seeds and make a hole. Drop the seeds in and cover them lightly with soil.

Water the soil generously. Make sure the soil stays moist and be patient while the seedling starts to grow. For some trees this happens within a few days, but for others it can be longer.



Once the tree has reached the size of your palm, it should be taken out of the pot and planted in the ground. Choose a good spot and dig a hole the size of the pot. Loosen soil from the pot and put it in the hole. Don't forget to water it well.



The tree will need care and attention for the first few years. It will need to be watered, particularly in dry periods and has to be kept free from weeds that may take its sunlight. It might be necessary to protect the young tree from being eaten by animals.

Glossary

Afforestation	The conversion of open land into forest
Agroforestry	A system where trees or shrubs are grown deliberately alongside other crops and/or livestock farming
Biome	An area of similar climatic conditions
Biosphere reserve	A biosphere reserve (BR) is a protected area created to conserve the biological and cultural diversity of a region while promoting sustainable economic and social development.
Buffer area	The area surrounding the core area in a biosphere reserve
Caffeine	A protective chemical in the coffee bean. A stimulant for humans
Canopy	A layer found below the emergent layer of a forest at around 30 m high
Carbon dioxide	A colourless gas that is responsible for the greenhouse effect
Carnivore	An animal that eats meat
Climate	Long term behaviour of the atmosphere
Core Area	The central most protected area in a biosphere reserve
Decomposition	The rotting or breaking down of organic material
Deforestation	The cutting down and removal of most or all of the trees in a forested area
Ecosystem	An ecological community with its environment, functioning as one unit
Ecotourism	Tourism to travel to areas of natural or ecological interest
Emergent Layer	The top layer of a forest
Endemic	Native to a certain region
Eutrophication	When nutrients enter a water body and cause a dense growth of plant life
Food chain	A system of living beings that are consumed by each other
Food web	A system of interlocking food chains
Forest	A large area covered with continuous and dense trees, shrubs and undergrowth
Forest Floor	The lowest level of the forest
Gene	A collection of chemicals inherited that determine a particular characteristic of a child organism
Greenhouse Effect	The trapping of heat from the sun by atmospheric gases
Groundwater	Water present in or below the ground surface
Habitat	An area where a plant or animal usually lives and grows
Habitat fragmentation	The division of a habitat into non-connected areas
Herbivore	An animal that eats only plants
Humus	Partially decomposed plant material in soil
Hydrology	The study of water movement in the environment
Hydrophytic vegetation	Water-loving plants
Invasive species	A species- often non native, that takes over and crowds out competition
Mitigation	The reduction or compensation for an environmental harm
Omnivore	An animal that eats both meat and plants
Overharvesting	The taking of a product at a rate faster than it can regenerate
Participatory Forest Management	A government and stakeholder joint programme for managing a forest
Photosynthesis	The conversion of carbon dioxide and sunlight into sugars carried by plants
Plantation Forest	Commercial forest with few species
Predator	An animal that lives by catching and eating other animals
Reforestation	Planting trees on an area that was previously forested
Shrub Layer	A forest layer made up of shrubs and small trees
Soil Erosion	The loss of components of the soil due rainfall, or wind.
Sustainable development	Development that meets the needs of the present generation, without

	compromising the ability of future generations to meet their own needs
Transition Area	A place where people live and make a living in a biosphere reserve
Understorey	A forest layer that consists of smaller trees that grow to about 20 m in height
Watershed	The region draining into a river, river system, or other body of water
Weather	Short term behaviour of the atmosphere
Wetland	An area where the land is saturated with water
Wildlife	Animals that have not been domesticated
Zonation	The division of an area into zones according to some criteria

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Map of the Kafa Biosphere Reserve