HFS HOUSEHOLD FOOD SECURITY
UNISA | SAIDE | WK KELLOGG

Module 3: PHFS03M
Sustainable Natural Resources Use

UNISA college of agriculture and environmental sciences

Module 3
Sustainable Natural Resources Use

■ Module code: PHFS03M

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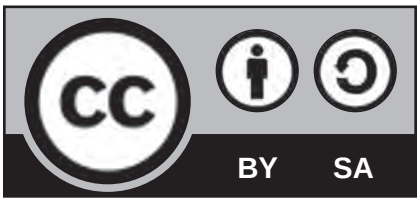

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This study guide for the module *PHFS03M Sustainable Natural Resources Use* is the third of six modules in the programme to be piloted with groups of community development workers linked to local government and volunteers linked to non-governmental organisations (NGOs) in the Eastern Cape. The Eastern Cape NGO Coalition (ECNGOC) has supported the strategy through advocacy and helping to link organizations with the project, thus enabling the recruitment of practising volunteers or community development workers who want to be trained and specialise in Household Food Security. The ECNGOC organized consultative meetings between the UNISA-SAIDE project team and a number of interested NGOs wishing to participate in the pilot project.

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The teams were involved in the writing of study materials for each module and need to be acknowledged for their dedication to the task of developing the study packages. Their names are listed on the front page of each study guide. In addition acknowledgements go to a team of people involved in developing a resource package for Homestead Farming and Water Management for the Water Research Commission which was also involved in the curriculum design and development process and writing of this module.

The Programme in Household Food Security is an approved UNISA Short Learning Programme that serves to promote community engagement with UNISA by linking curriculum and tuition, research and community service with the delivery of higher education. This is in line with the UNISA vision:

“The African University in the service of humanity”.

The refrences uses to develop and design the study materials are acknowledged for the use of their material, content, illustrations, ideas and activities. The material have been used for educational purposes to design and develop this material study package to train household food security facilitators for educational purposes in the writing of this study material:

Articles and illustrations have been adapted for use in this training material. These have been taken from publications where the publishers indicated that parts of publications or illustrations may be used for educational purposes provided that the sources been acknowledged. Where this has not been done and recognised as such, the writing team does acknowledge the relevant publications.

The publications used are:

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Introduction to the module

Water is a vital natural resource without which we cannot live. How we use water so that there is enough for everyone today and in the future is a challenge we face in South Africa and in other parts of the world. But water is not the only natural resource we need and use.

For thousands of years local people have used indigenous plants as a source of food. As you know, some of these plants can also serve as medicine. An interesting example that will be known to many of you is the ghowa or Hoodia plant, which is eaten by many South Africans, and is also used as a medicine. Many cultural groups in South Africa look in a holistic way at human well-being. What does this mean? A traditional healer will not only prescribe medicines (various plant materials), but will often also provide some psychological help to his patients. Refer back to the four dimensions of healing in Module 2: the physical, social, psychological and spiritual dimensions.

Figure 1.1 The ghowa/ghoba plant *(Hoodia spp.)*

In this module you will find out about the natural resources that are available in your area, how people are using them to obtain food, and how their use affects the environment and the community. You will also examine different and improved ways in which the natural resources in the area can be used so that people can continue to get food that will keep them healthy.

Purpose of the module

In this module your main task is to plan and carry out a set of activities with selected households in the community to help them gain a good understanding of their current and possible future use of natural resources in their area. Why is this important? As people become informed and take actions to manage their use of resources responsibly to obtain food, they will be able to sustain themselves and their families. These actions will help to break the cycle of poverty and protect the environment at the same time.

To prepare you for working with households, you will learn about the issues around the use of natural resources and strengthen your ability to use some participatory techniques and methods. What you learn in this module will also help you with Module 5 when you start a homestead garden, and with Module 6 when you look at food resource management.

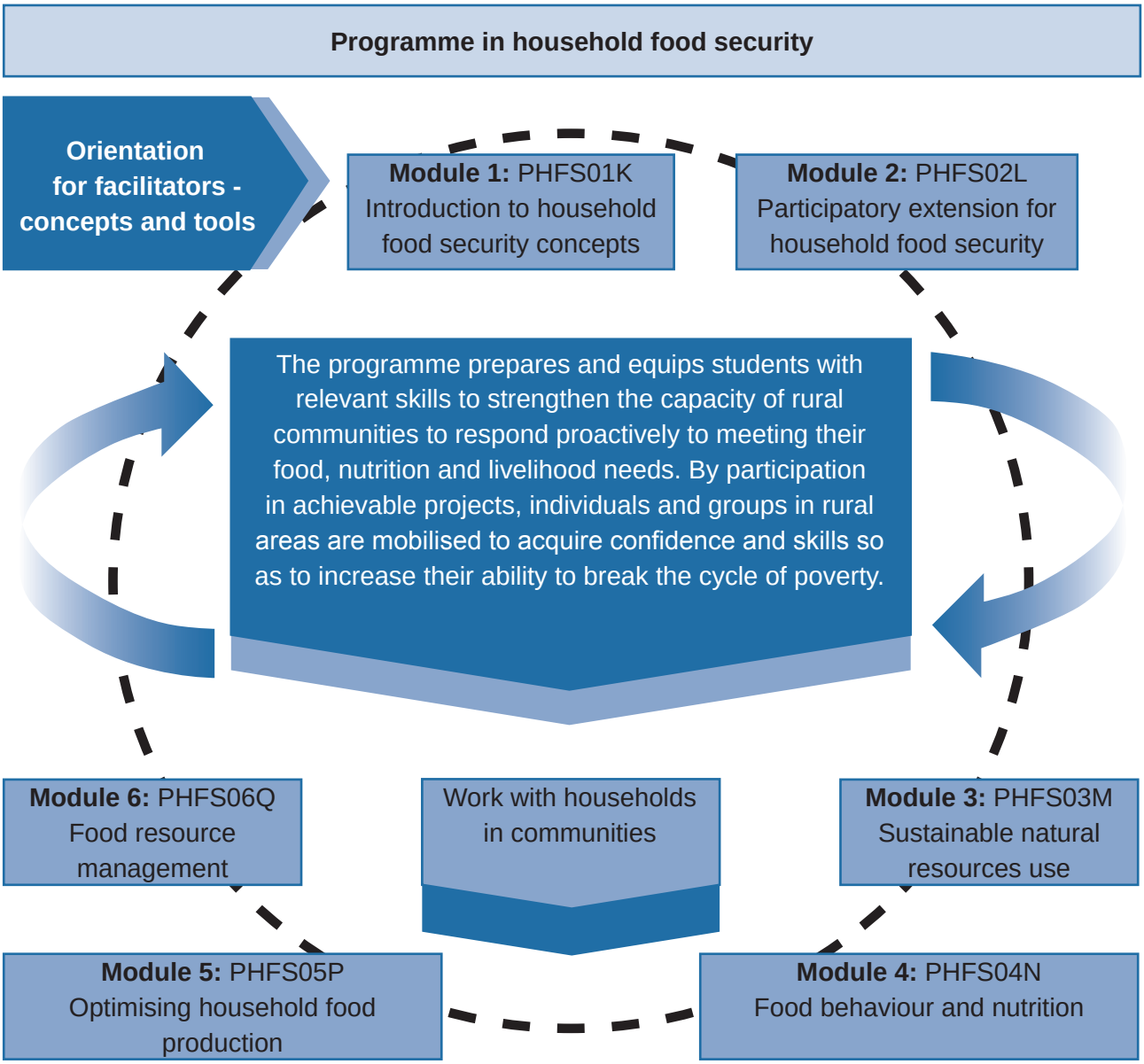
How Module 3 fits into the programme

Each module is an important part of the Household Food Security Programme.
The modules for the programme are the following:

Module 1	**PHFS01K**	Introduction to household food security concepts
Module 2	**PHFS02L**	Participatory extension for household food security
Module 3	**PHFS03M**	Sustainable natural resource use
Module 4	**PHFS04N**	Food behaviour and nutrition
Module 5	**PHFS05P**	Optimising household food production
Module 6	**PHFS06Q**	Food resource management

The modules are linked and what you learn in one module will also help you in another. The diagram given below is a *programme map* that will provide you with an overall picture of the programme. It shows you the main purpose of the programme and what each of the six modules focus on.

Overview of modules



Module 3 outcomes

The table below shows the topics of the four units in Module 3 and gives you a good idea of what you are expected to know and do. The assessment in this module is closely linked to the outcomes. It includes two assignments, portfolio activities and workbook activities. You will find detailed information about the assessment activities in the General Tutorial Letter.

Unit		Specific Learning Outcomes	Assessment
1.	**Natural resources and their importance**	Assess resources in terms of their contribution to food security	**Assignment 1** (10%)
2.	**Linking natural resources and food security**	Assess the availability, accessibility, utilisation and stability of natural resources with individuals and groups in an area Consider constraints regarding natural resources	**Assignment 2** (20%)
3.	**Using natural resources wisely**	Determine the impact of natural resources use on the environment and on people. Explore various knowledge systems for an alternative resource management option.	
4.	**Taking action for household food security**	Develop solutions with households for improved natural resource use and livelihood strategies	**Portfolio activities** (60%)
			Workbook 10% Selected activities from all units

Brief outline of the units

Unit 1 – Natural resources and their importance

We examine the natural resources in the environment such as water, soil, biodiversity, and natural energy resources in order to gain an understanding of how they fit together to create a natural system. Understanding how natural systems work and your own place in these systems will help you to find out how best to use natural resources so they will not be depleted (used up).

Unit 2 – Natural resources and food security

The link between natural resources and food security is explored. We need to have enough natural resources available, we need to access them and we need to utilise them wisely. This will ensure stability and will therefore, enhance food security. We examine participatory tools and methods to find out which resources are available in your area and how the people living there are using them for obtaining food. We conclude the unit by looking at some of the constraints regarding natural resources including disease and gender-related issues.

Unit 3 – Using natural resources wisely

The impacts of our use of natural resources on the environment and on other people are examined. We focus on the importance of using the natural resources that are available to us in a sustainable way to ensure stability and thus contribute to food security. In this way, you can find out the strengths and weaknesses of present resources use practices. You will get a good idea of what is working well, what is not, and what can be done to improve the situation. The low input principles examined in the unit are used to design a plan for a homestead garden which will be implemented in Module 5.

Unit 4 – Taking action for household food security

The work you undertake in Units 1, 2 and 3 prepares you for working with households in your community. You will plan and carry out an intervention in which you invite them to participate fully. With your guidance they will assess their use of natural resources in obtaining food, they will analyse their current practices and come up with possible actions that will help them to improve their use of natural resources. Your work with the households consists of portfolio activities.

What is in your study pack?

Check your study pack for this module. It should contain the following:

This study guide	✔
A module workbook	
Tutorial Letters 101 and 103, with your assignments and by when you should submit them	
A general information letter, Tutorial letter 301, on the programme	

During the year you will receive additional tutorial letters that give you general feedback on the assignments submitted.

The teaching approach for this programme

What we do flows from the **plans we make,** it is based on **information we have** at the time, and **how we understand** that information. As we start implementing our plans, we learn more and can therefore **improve our plans and actions**. The approach that we will use, not only in this module, but also in all the other modules, is the "Triple A" Approach.

The "Triple A" Approach guide your learning by engaging you in a cyclical process of **assessing**, **analysing** and **acting** based on the new information which you have been given.

The "Triple A" is one of many ways in which this ongoing planning and re-planning process is described. We gather information (assess), think about it and use it to come up with plans (analyse), implement those plans (act), all the while gathering new information.

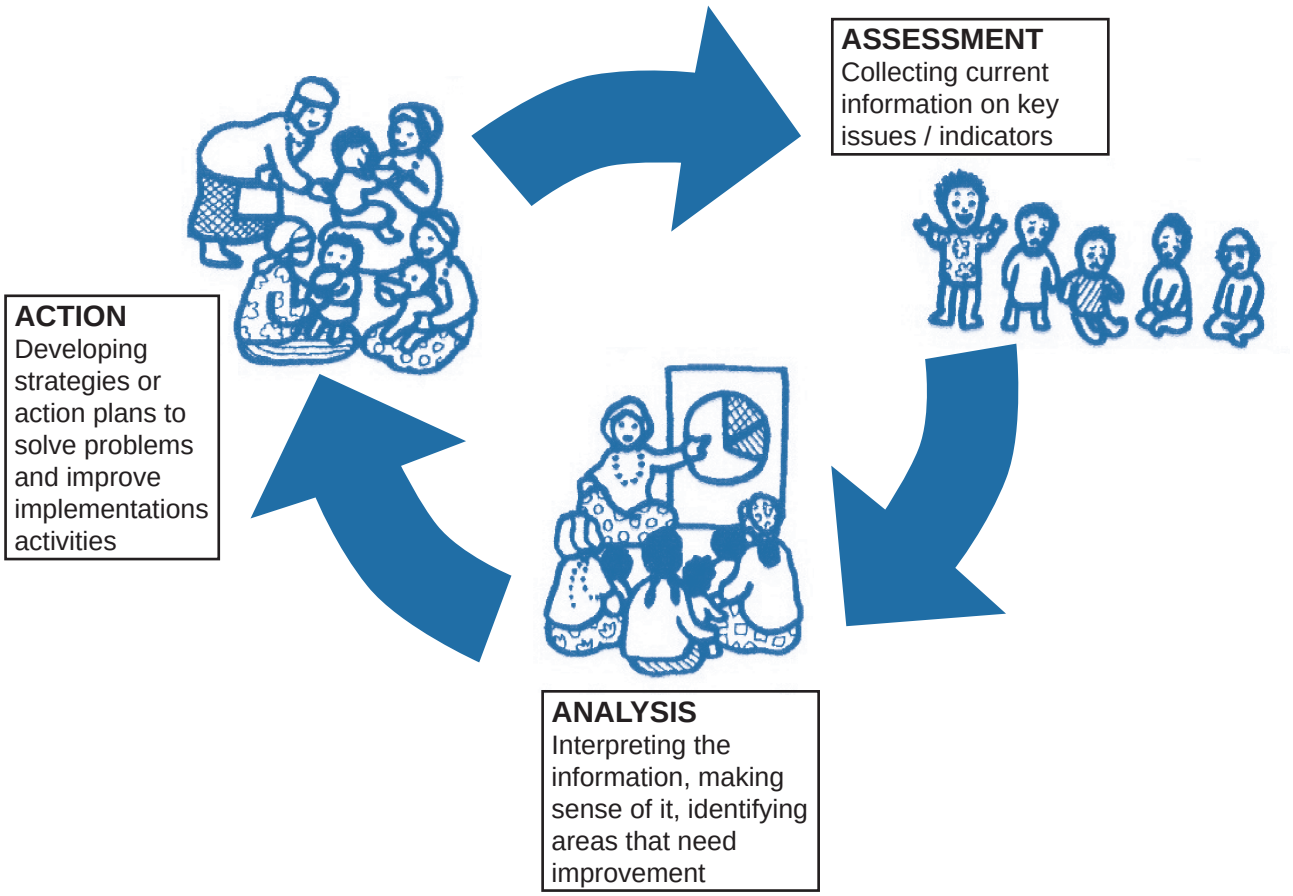


Figure 1.2 The "Triple A" Approach
(Adapted from FAO, 2005)

How will you know what to do in the study guide?

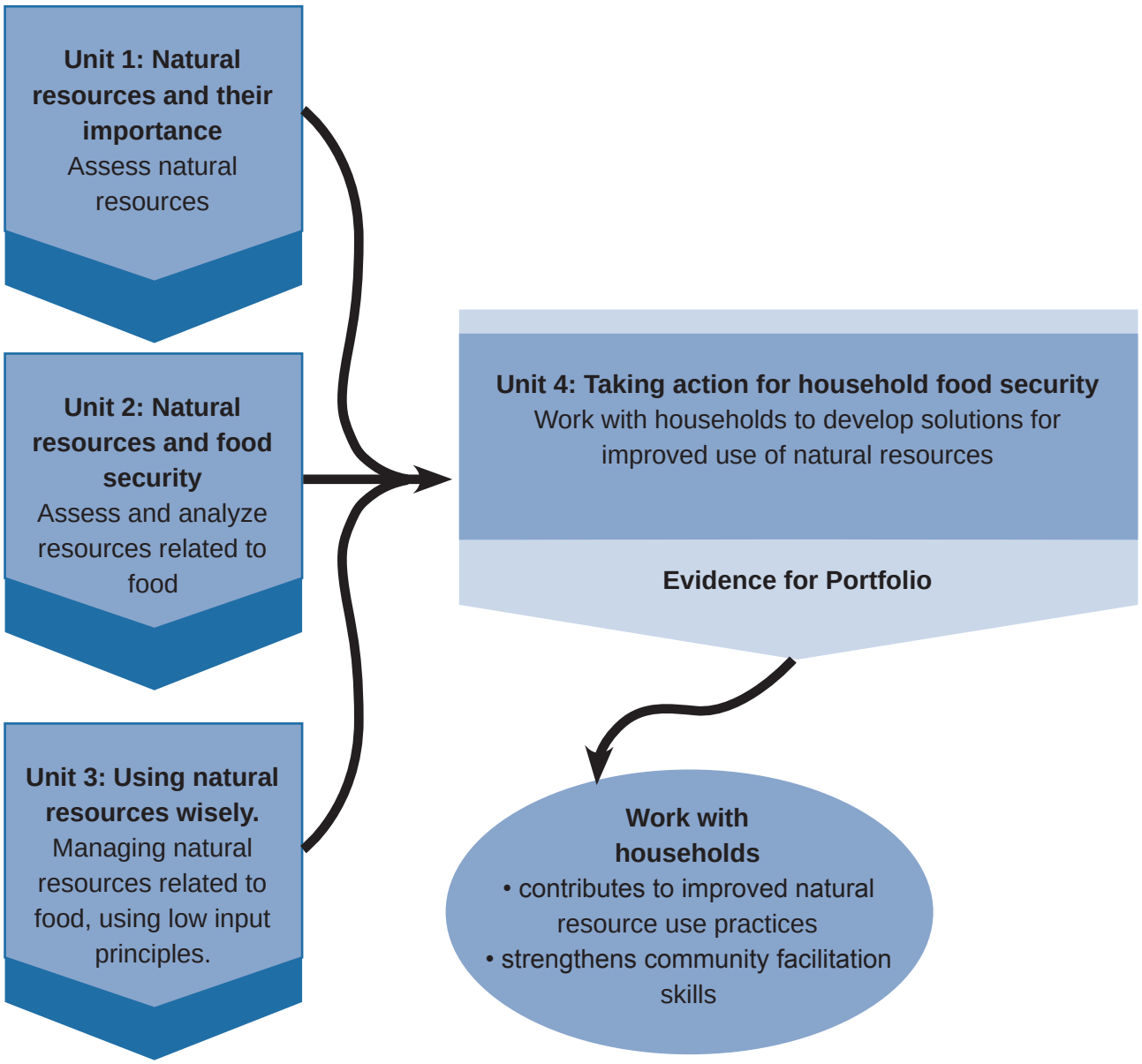
We make use of symbols or icons to show you what you are expected to do.

Text activities 	These are learning activities that encourage you come up with your own ideas as you read the text.
Workbook activities 	Some activities have been selected to help you to reflect on your own context and deepen your understanding of the main issues dealt with in the module. You will either do these activities by yourself or in a group. These are activities which are provided in the study guide but which should **only** be completed in the workbook.
Case studies in blocks 	We have included a number of short case studies that reflect what is happening in practice in different parts of South Africa and in other parts of the world. The case studies serve two main purposes: to give you examples of what people are doing in different contexts and to invite you to reflect on these experiences as they will help to strengthen your insight and understanding of the issues to be addressed.
People's voices 	Boxes in the text give quotes of experiences of household members and other people on food security and descriptions of other events.
Portfolio activities 	The activities with the households in Unit 4 are portfolio activities. They are practical activities and you will be required to produce specific evidence for your portfolio in order to complete them.
Concept boxes	Boxes in the text give definitions and explanations of concepts.

The module map

The module map gives you an overall picture of what Module 3 is about. The map appears before each unit to remind you of the purpose and direction of the module and to show you how the individual units are linked.

Module 3 Map



Unit 1:
Natural resources and their importance

Introduction

When people use a piece of land to grow crops such as maize, sorghum or wheat, they are using soil and water to obtain food. A natural resource is a supply of something from the natural environment that people use because of its particular value to them. For centuries people have used the resources available in their immediate environment for food, shelter and clothing. Our planet has huge supplies of natural resources that we need in order to survive. However our biggest challenge is to use resources without destroying or degrading the environment. Our quality of life and survival depend on our ability to use, rather than abuse, the environment.

We start this unit by examining what natural resources are and continue by focusing on water, soil, biodiversity and energy as natural resources.

This unit consists of the following sections:

1.1 What are natural resources?
1.2 Water as a natural resource
1.3 Soil as a natural resource
1.4 Biodiversity as a natural resource
1.5 Natural energy resources
1.6 How nature works

Specific outcome and learning outcomes

The specific outcome for this unit is to assess what natural resources are available for human use.

Learning outcomes	Assessment Activities	Actual time spent
	Workbook activities	
1. What are natural resources? 2. Water as a natural resource 3. Soil as a natural resource 4. Biodiversity as a natural resource 5. Natural energy resources 6. How nature works	1.3 A simple model of the water cycle. (Ih) 1.5 Finding out about rainfall in your area. (2h) 1.6 Make your own terrarium. (1h) 1.8 Water use in your management area. (1.5h) 1.10 Considering aspects, ridges and valleys (Ih) 1.11 Identifying soil types. (2h) 1.12 Identifying soil texture, structure and depth. (5h) 1.13 Biodiversity as a resource (1h) 1.16 Your place in the cycle of nature. (30 min)	
	Assignment Assignment 1: Information for this assignment is contained in Tutorial Letter 101. (3h)	

Key concepts

Strategy
Natural resources
Renewable resources
Non-renewable resources
Habitat
Solar energy
Recycling
Water cycle
Evaporation
Evapotranspiration
Transpiration
Condensation
Precipitation
Infiltration
Groundwater
Water table
Water shed
Aquifers
Catchment
Drainage basin
Perspective
Fossil fuel
Indigenous
Organisms
Soil texture, stucture and type
Humus
Biodiversity
Cycle of nature
Food chain
Food web
Trophic (feeding) levels
System
Ecosystem

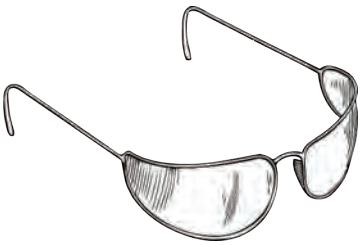
Start-up activity

Complete this activity on your own in this study guide

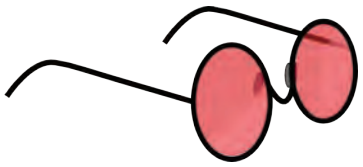
Thandi, whom you met in previous modules, was listening to a group of people arguing under the shade of a Marula tree. The argument was on whether soil, air, water, wild plants and animals are only for the benefit of people. What are your immediate thoughts on this issue?

When we think of this or any other issue, we need to think scientifically and look at the issue from different perspectives (ways of thinking) before coming to a conclusion. A man by the name of Edward De Bono developed a strategy, called the *Six Hat Thinking* strategy. According to this strategy, you put on different coloured hats that each represent a different perspective on the issue. When you wear a specific coloured hat you think of the issue only from that perspective. Only after you have worn all the different coloured hats will you be able to reach a scientific conclusion on the issue.

We have adapted De Bono's strategy and will look at the issue not by putting on different coloured hats, but by looking at the issue through spectacles with different coloured lenses. What does each of the different coloured lenses represent?



White lenses: White is the colour of the paper in this study guide. This lens means that a person would look at the facts (just as books represent facts).



Red lenses: Red is the colour of blood and the heart, and the red lens in a similar way represents emotion. What are my feelings (emotions) on the issue?

Yellow lenses: Yellow is a sunny and bright colour, and the yellow lens represents a view where one looks at the positive side of something. Think about the points in favour of the issue.

Purple lenses: Think critically about the issue, without allowing your emotions to dominate. What are the weaknesses in an issue? What are the problems associated with the issue?

Green lenses: Green is the colour of new growth in plants, and the green lens represents a creative look at things. Think creatively and suggest new solutions for the issue.

Blue lenses: Blue is the colour of the sky. The blue lens represents a big-picture view. Evaluate all the arguments and think about the bigger picture.

Figure 1.3 Looking at an issue from different perspectives
(Adapted from Edward de Bono's Six Hat Thinking Strategy)

Note: You may wish to use different coloured hats for the activity by using coloured sheets of A4 paper that you fold and staple to form the hat.

What you must do

1. Work in groups and discuss the issue specified in the block below to formulate your immediate thoughts.

Soil, air, water, wild plants and animals are only for the benefit of people.

2. Each group now looks at the issue from the perspective represented by the:

- white lenses
- red lenses
- yellow lenses
- purple lenses
- green lenses
- blue lenses

After your discussion, complete the following table:

Table 1.1 De Bono's lenses

White lenses/hats (facts)	**Purple lenses/hats** (positive arguments)
Red lenses/hats (emotions)	**Green lenses/hats** (problems or weak points)
Yellow lenses/hats (creative look)	**Blue lenses/hats** (big picture)

3. Discuss each perspective and write the group's ideas on the flipchart.

4. Come to a final decision on where *you* stand on the issue and write this down in the space below.

……

……

……

You will gain a much better insight on this issue and other issues as you work through this unit and the other units in this module.

1.1 What are natural resources?

Almost everything that people use comes originally from nature. This includes cars, aeroplanes and computers. Most of these items have gone through many different manufacturing and industrial processes before we get to use them as resources. Have you ever thought that the money in your pocket is a resource that has its origin in nature? Today special paper is used to print notes and coins are made from various metals. Each country in the world has its own currency, which represents its trading unit. Did you know that in the past people in Africa used a variety of items from their environment to trade with, such as shells, ivory, gold and silver ingots and bracelets? In the late 1800's right up to 1918 people in Sierra Leone, Liberia and Guinea used thin twisted iron wires, known as Kissi twists, as money. The Kissis were 25 to 40 centimetres long and bundled in groups of 20 to 50 pieces. In those days you would have needed about 1000 Kissis to buy one bull. Money has always had a social and financial dimension and it is communities that decide on the value that their money represents.

When we refer to **natural resources** in this programme, we include those that come **directly from nature** or are still in a natural form. Wood to make fires and cook food is a natural resource, but paraffin is not. Paraffin and petrol are not natural resources as they are by-products of a refining process of the natural resource called crude oil. Vehicles, roads, and houses are also not natural resources as they are made by people and are referred to as **physical** resources.

There are two broad categories of natural resources: renewable and non-renewable.

1.1.1 What are renewable resources?

Renewable resources are resources that can grow again or replenish themselves. Trees, grass, other plants and animals are **organic** (living) resources. Water and certain gases like oxygen are **inorganic** (non-living). But are renewable resources always renewable? If renewable resources are used in an unsustained (unwise) way, will they continue to be renewable? Look at the following facts:

Table 1.2 Threats to renewable resources

Renewable resources	Possible threats to renewable resources that can make them non-renewable
Fresh water	We are only able to use ¼ of the Earth's groundwater as the rest depends on steady rainfall over long periods of time. People can use up the groundwater in an area because of drought and insufficient rainfall to restore it. Water can be polluted by humans through improper sewage management, and by chemical spills. This makes the water unsafe and unusable.

Land/soil	The land can be overgrazed or the nutrients in the soil can be used up through improper farming practices. Natural vegetation can also be removed to make way for building projects. In these cases the soil cannot renew itself and plants cannot grow. This makes it easy for the rain to wash away the soil and for the wind to blow it away. We refer to this as **soil erosion**.
Oxygen/clean air	The rainforests are often called the lungs of the world because the trees absorb carbon dioxide, which cannot be used by the human body, and release oxygen into the air. When forests are destroyed or die through pollution they are not able to carry out this important function. As a result the quality of the air decreases. When chemicals pollute rivers the oxygen in the water is depleted and living things in the water die.
Trees and other pants (vegetation)	Trees and other plants play a vital role in maintaining the balance in an environment. Where trees and other plants are cut down and not replanted, the soil and climate of the natural environment change. As a result plants may die and animals may lose their **habitat** (the natural conditions or environment in which living things live).

Activity 1.1 Renewable resources under threat

Complete this activity on your own in this study guide

1. What renewable resource in your area is under threat?

……

……

2. Why do you think this renewable resource is in danger of becoming unusable or not renewable?

……

……

……

3. Do you think something can be done to prevent this renewable resource from becoming unusable or not renewable? Give a reason for your answer.

……

……

……

Comments on Activity 1.1

Human actions can have a positive or a negative effect on renewable resources. One of the resources under severe threat in many areas of South Africa is water. This is due to low rainfall and high water pollution levels in many places. Levels of pollution are often high in urban areas where there are factories and industries and where large numbers of people live together. This situation puts a lot of pressure on natural resources. We will discuss the impact of people and their actions on the environment in more detail in Unit 3.

Today we are beginning to realise that renewable resources cannot be taken for granted. We cannot afford to think that we can use as much as we like because a resource is renewable. Renewable resources are capable of being replaced **only** under the right circumstances and conditions and if we manage their use by respecting the laws of nature.

1.1.2 What are non-renewable resources?

Non-renewable natural resources are those that can be used up or finished and cannot be produced, re-grown or replenished in a reasonable amount of time. Examples include **fossil fuels** such as coal, crude oil, and natural gas. Minerals that are taken out of the Earth through mining such as diamonds, gold, silver and copper are also considered non-renewable. All these resources exist in a fixed amount in nature and they cannot be replaced as fast as they are being used up. The time will come in the near future when the world's oil reserves will be used up. It is for this reason that countries around the world are looking at alternative and renewable sources of energy. For example energy from the sun or solar power, wind power, and power from the movement of water (hydropower) are possible new sources of energy that are practically infinite and that cannot be used up.

The following pictures show the kind of natural resources people use in a rural and in an urban area.

Picture 1 - A household in a rural area

Picture 2 – A household in an urban area

Figure 1.4 Utilising land as a natural resource in rural and urban areas

Activity 1.2 – Renewable and non-renewable natural resources

Complete this activity on your own in this study guide

It is important to distinguish between renewable and non-renewable natural resources, since you will need to make this distinction when you investigate and assess the available resources in your area.

1. Look at the two pictures in Figure 1.4 and identify the resources used by a household in an urban and one in a rural area. Pick out the items that you consider to be renewable and non-renewable resources.
2. Write the items in the table below.

Natural resources			
Renewable resources (Urban area)	**Renewable resources (Rural area)**	**Non renewable resources (Urban area)**	**Non renewable resources (Rural area)**

Comments on Activity 1.2

Renewable resources do not only include **biological resources** such as plants and animals but also water, and solar (sun) energy. Energy from the sun is renewed daily and will continue in this way until the sun burns out millions of years from now. Soil is a very important resource for growing crops and it can be improved and renewed through good soil management and land use.

Most non-living resources such as metals and fossil fuels cannot be replaced when they are used up. People will have to learn to live without them or to improve techniques for **recycling** them.

The diagram below gives a helpful summary of the ideas discussed in this section.

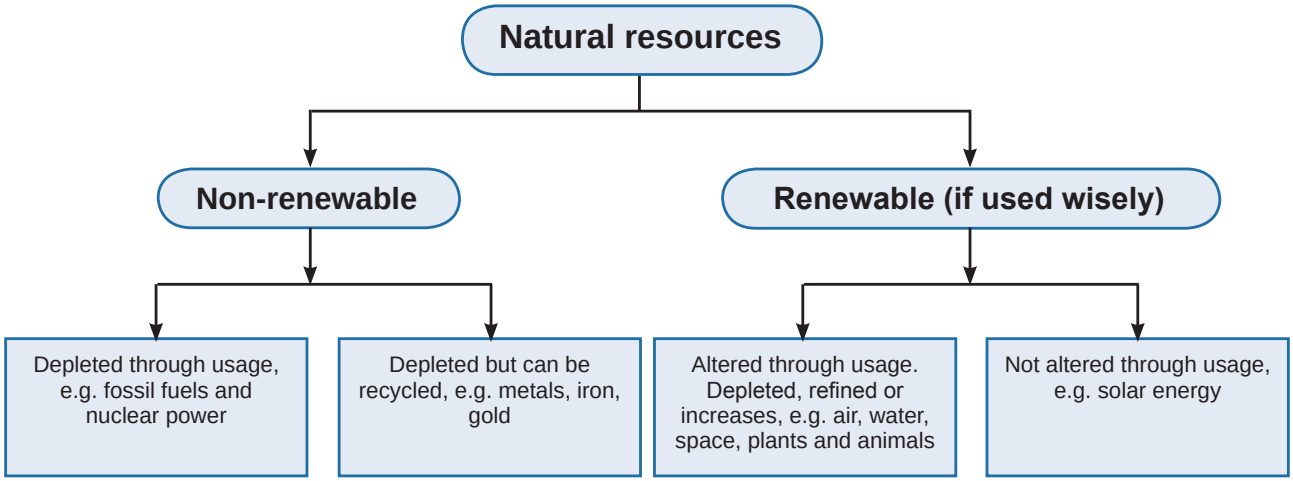


Figure 1.5 Classifying natural resources
(Adapted from Hugo, 2004)

1.2 Water as a natural resource

Without water no life is possible. Why is water so important to life? Most living things are primarily composed of water. The human body, for example, is made up of 70% water. All the chemical reactions of life, which happen inside the bodies of living things, take place in water. About 96% of the water on Earth is found in oceans, salt lakes and rivers. Less than 1% occurs in the atmosphere and about 3% is found as fresh water on land and in underground reservoirs (natural storage places). As most of this fresh water is locked up in the polar ice caps and as glaciers, only 0.3% of all fresh water is available for humans to use. What does this tell us about using water wisely?

What are polar ice caps and glaciers?

Ice caps are thick layers of ice and snow that permanently cover an area of land, usually the area around the North and South Poles.
A glacier is a huge mass of ice which moves very slowly, often down a mountain valley.

1.2.1 The water cycle

Where does the water on Earth come from? Water constantly circulates around our planet moving from the oceans to the skies to the land and back to the oceans again in a process called the **water cycle.** This cycle is driven by heat energy from the sun, as you can see in the figure below.

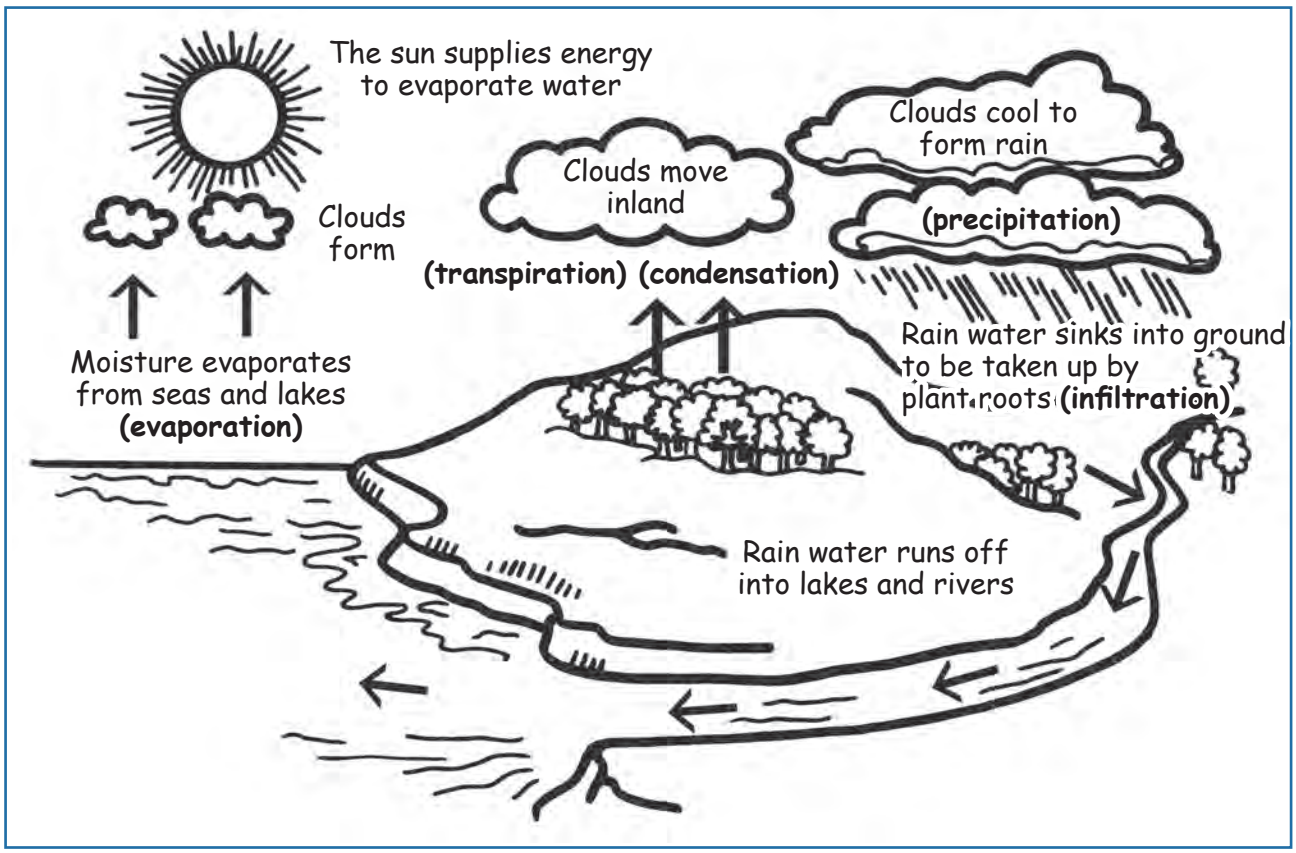


Figure 1.6 The water cycle.

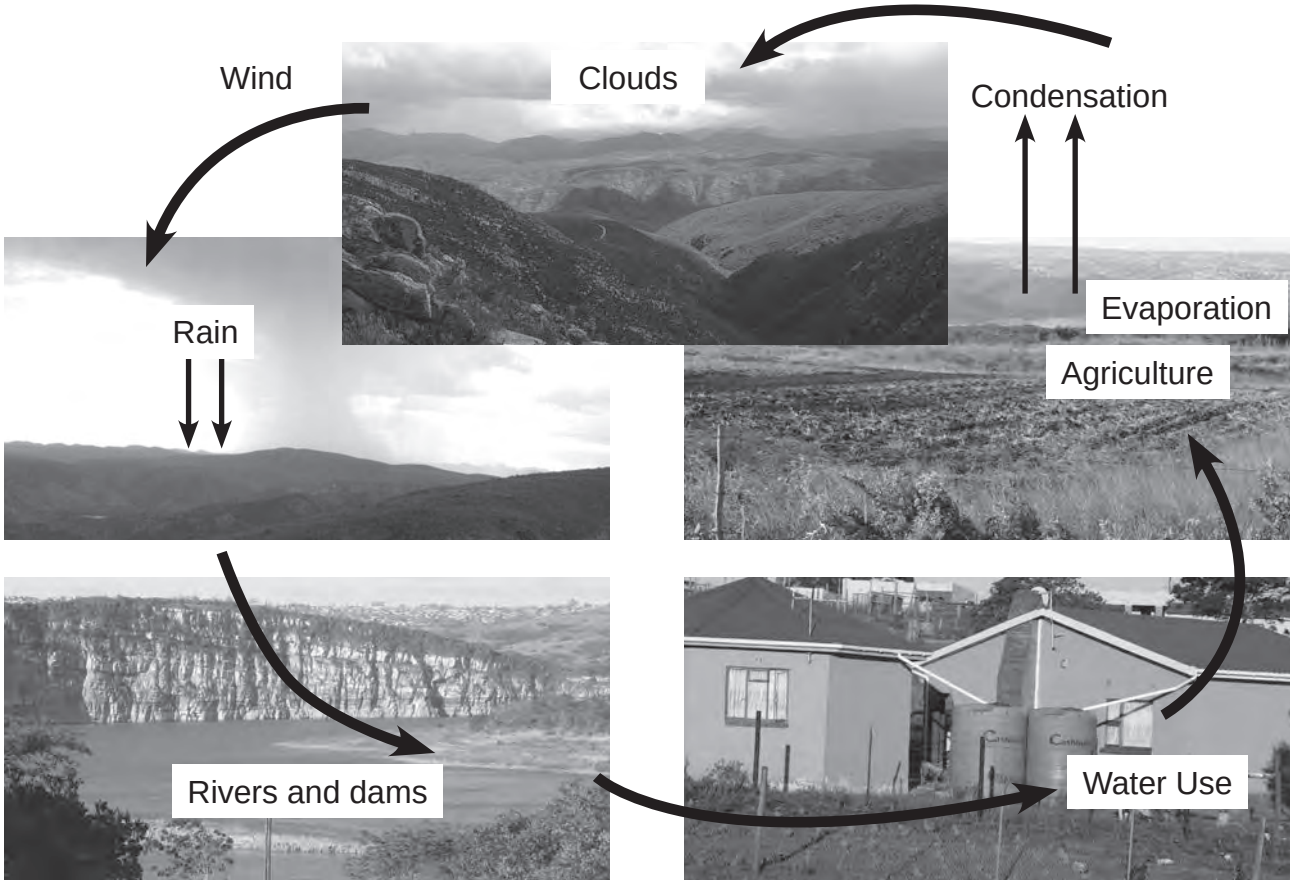


Figure 1.7 The water cycle in Kouga (Eastern Cape)

What happens in the water cycle? A number of inter-linked processes take place:

1. **Evaporation:** Heated by the sun, water evaporates into the atmosphere from the surfaces of any open body of water such as oceans, lakes, rivers and dams. Because oceans cover three quarters of the Earth's surface, evaporation from the oceans contributes most of the water to the atmosphere. On land, as much as 90% of the water that reaches the atmosphere, comes from plants as they release water vapour into the air during a process called *transpiration.* Find out more about this process in the next section.

2. **Condensation:** The water vapour in the air condenses back into water when it cools down there. Clouds are formed that consist of very small droplets of water.

Groundwater and pollution

Much of the groundwater in South Africa is polluted and the situation is getting worse. Pesticides are one reason for this. They are washed from the surface of plant leaves and the topsoil, to reach underground water. You will find out more about how human activities impact on the water cycle in Unit 3.

3. **Precipitation:** Water falls from the clouds back to Earth through rain, hail, sleet and snow. Dew, frost and mist are formed when water vapour condenses directly onto the land without first forming clouds.

4. **Infiltration:** Water falls on the land and infiltrates the soil until all the soil pores/openings are filled and the soil is saturated. The water that infiltrates the soil becomes groundwater. Further rainfall runs off into puddles, streams, rivers, lakes and finally into the ocean. Ultimately all water will end up back in the ocean to start the whole process again. No new water therefore enters the cycle and no water ever leaves the cycle.

Something to think about
In what ways is the water cycle important to people in communities, especially those who want to start a homestead garden? You need to start thinking about this question, but it will become clear to you as we progress through this module.

You will gain a much better understanding of how the water cycle functions by completing the next activity.

Activity 1.3 A simple model of the water cycle

Complete this activity on your own in your workbook

Aim: Build a simple model of the water cycle to gain an understanding of the interlinked processes that take place.

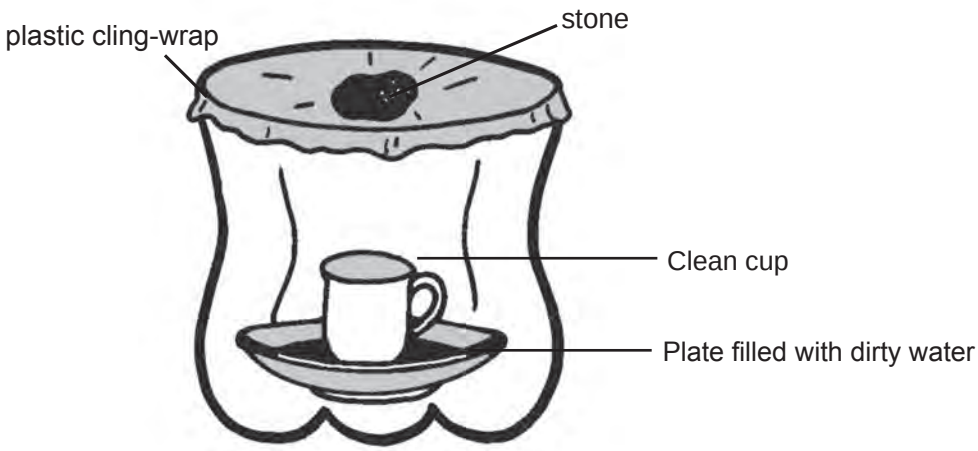
Time: 1 hour

What you will need

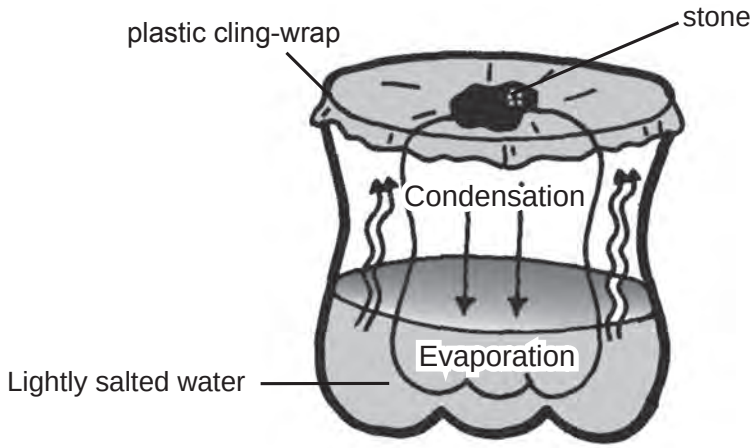
Transparent (see through) container, cup, plate, dirty water, plastic cling wrap, small stone.

What you must do

1. Build your model of the water cycle as shown in any one of the figures below. Make sure that the cling wrap seals tightly along the edge of the container.
2. Once your model is set up, place it outside in the sun and observe it over a period of a few days.
3. Answers the questions below in your workbook in the spaces provided.



A. An evaporation/condensation chamber to simulate the water cycle.



Taste the water that condenses and drops into the middle container

B. Another way of doing this experiment

Figure 1.8 Models of the water cycle

Questions

1. Describe your observations. (What did you see?)
2. How does your model represent the water cycle? Make a drawing of your model with arrows connecting the different processes that form part of the water cycle.
3. We have seen that most water is stored in the oceans. This water is saline (salty). Is rainwater saline or fresh? Give a reason for your answer.
4. Which human activities have a negative impact on the water cycle?
5. Reflect on how we can lessen our negative impact on the water cycle.

South Africa is a water-poor country and we are therefore very dependent on rainfall. What is the average rainfall for different parts of the country?

1.2.2 Rainfall in South Africa

You are aware that the amount of rain in your area varies from one year to the next. Rainfall may also be concentrated over a short rainy season or spread over a longer period. However, it is possible to get a general idea of the amount of rainfall in your area from maps that have been developed for this purpose. These maps show the *mean annual rainfall*. The amount of rain which falls in a year is measured for a number of years and then an average is taken which gives the mean annual rainfall.

The two maps below will help you determine:

- the average annual rainfall
- the season in which the rain falls
- the months of the year when there is the most rain.

For example, the eastern parts of the country, have an annual rainfall ranging from 600 to 800 millimeters (mm), concentrated in the midsummer months. The northern areas average 400 to 600 mm, concentrated again in the midsummer, while in the West the rainfall averages 200 to 400 mm and peaks later, namely in March to May.

What does mm stand for?

Rain is measured in millimeters (mm). There are 10 millimeters in a centimeter. There are 100 centimeters in a meter. Use a school ruler to determine the size of one mm and one cm.

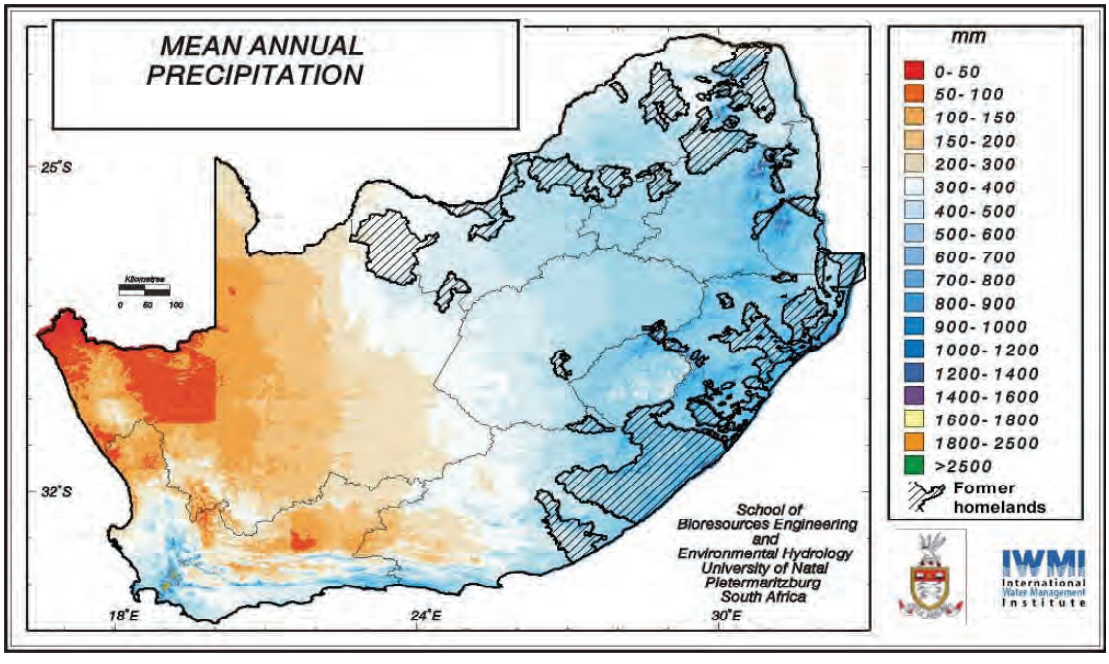


Figure 1.9 Average annual rainfall for South Africa (see Annexure A for colour maps)

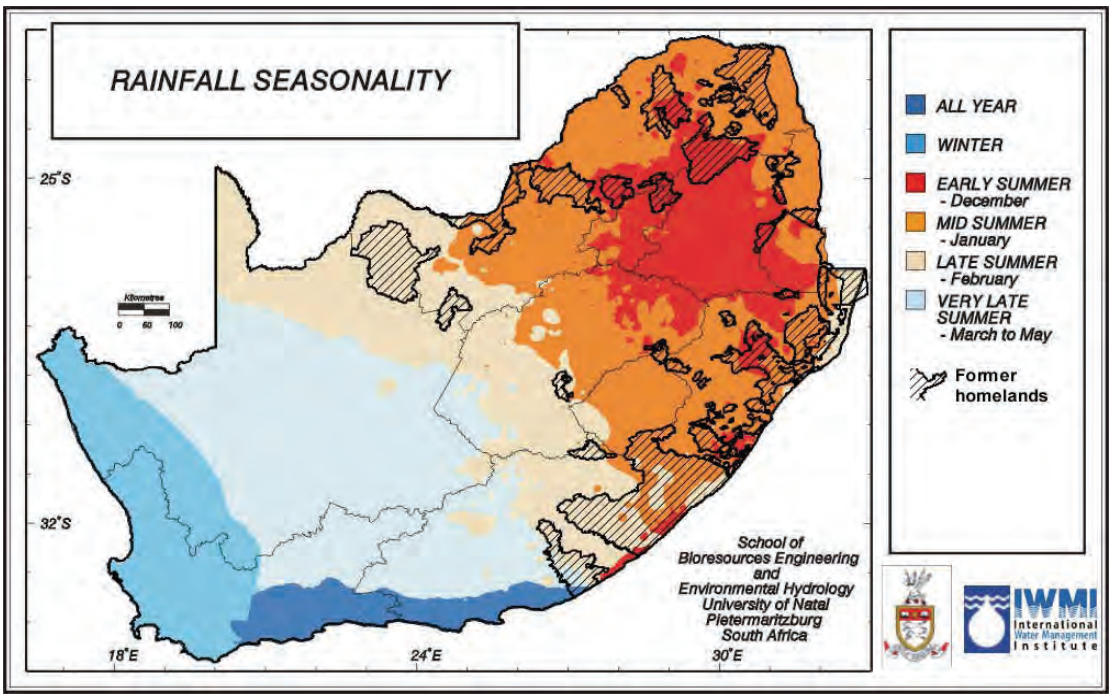


Figure 1.10 Seasonality of rainfall in South Africa (see Annexure A for colour maps)

Activity 1.4 Finding out about rainfall from maps.

Complete this activity in groups in this study guide

1. In groups of three to five people, look at the two maps in Figures 1.9 and 1.10. (See Annexure A)
2. Use the maps to identify where your group members are from and what the mean annual rainfall is for your area. (You can use another more general map of South Africa to pinpoint your position if it is difficult from this map)

……

……

3. Which months have rain and when does the rainy season occur in your area?

……

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4. Discuss in your group whether the values given on the maps are similar to what you have experienced in the past few years. Does it rain more or less at the times suggested?

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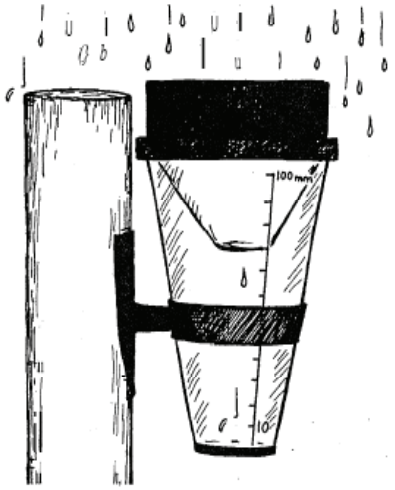


Note: *It is also possible to use information from agricultural extension staff, local people in your area or to even measure the rain for yourself. You can measure rainfall for your area by using a* **rain-gauge** *and keeping a record of it.*

Figure 1.11 Rainfall is measured in millimetres in a rain-gauge

Activity 1.5 Finding out about rainfall in your area

Complete this activity in groups in your workbook

Aim: Get rainfall data in specific areas using local sources.

Time: 2 hours

What you must do

1. Find out from knowledgeable people in your area:
   - what the average rainfall for the area is.
   - what the seasonality of the rainfall is (which months of the year have rain and which month has the most rain).
   - the average minimum and maximum temperatures for your area. (You need to know whether there is frost, or you have very high temperatures and how long these conditions last)

Temperature is measured in degrees centigrade (also known as Celsius). We use the symbol ° for degrees. We use the symbol C for centigrade or Celsius.

0°C is freezing point
20°C is mild
35°C is very warm

Who are knowledgeable people whom you can consult about rainfall?
You can speak to older farmers who have been living in the area for a long time.
You can speak to the local agricultural extension officer in your area.
You can consult books or the Internet (Here you may need help from your tutor).

2. Once you have spoken to people and looked at other sources, you need to write a short report, which includes the following information:
   - Who you spoke to.
   - What each person said about average and seasonal rainfall and minimum and maximum temperatures. Present this information in a small table).

- Compare this information with the general rainfall data you worked out in Activity 1.4.
- Comment on similarities and differences.
- Specify why it is important for an HFS facilitator to be aware of average rainfall and seasonality of rainfall.

1.2.3 What is evapotranspiration?

You may have read about, or have heard people talk about, **evapotranspiration**.
But what does this mean?

> Evaporation on the ground surface + transpiration by plants
> = evapotranspiration from a given piece of land

You know what evaporation is but what is transpiration? Plant roots take up water which slowly moves through the soil. The plant loses part of this water as vapour which is emitted into the air through pores (small holes) in the leaves by means of a process called **transpiration.** Plants and in particular forests and grasslands play an important role in contributing to water vapour in the air and thus in maintaining rain in the landscape. This is one more good reason to protect our trees and other plants, especially our **indigenous plants**! Evapotranspirated water in the air accounts for about 90% of our atmospheric water from land. The water vapour forms clouds and these, in turn, form rain.

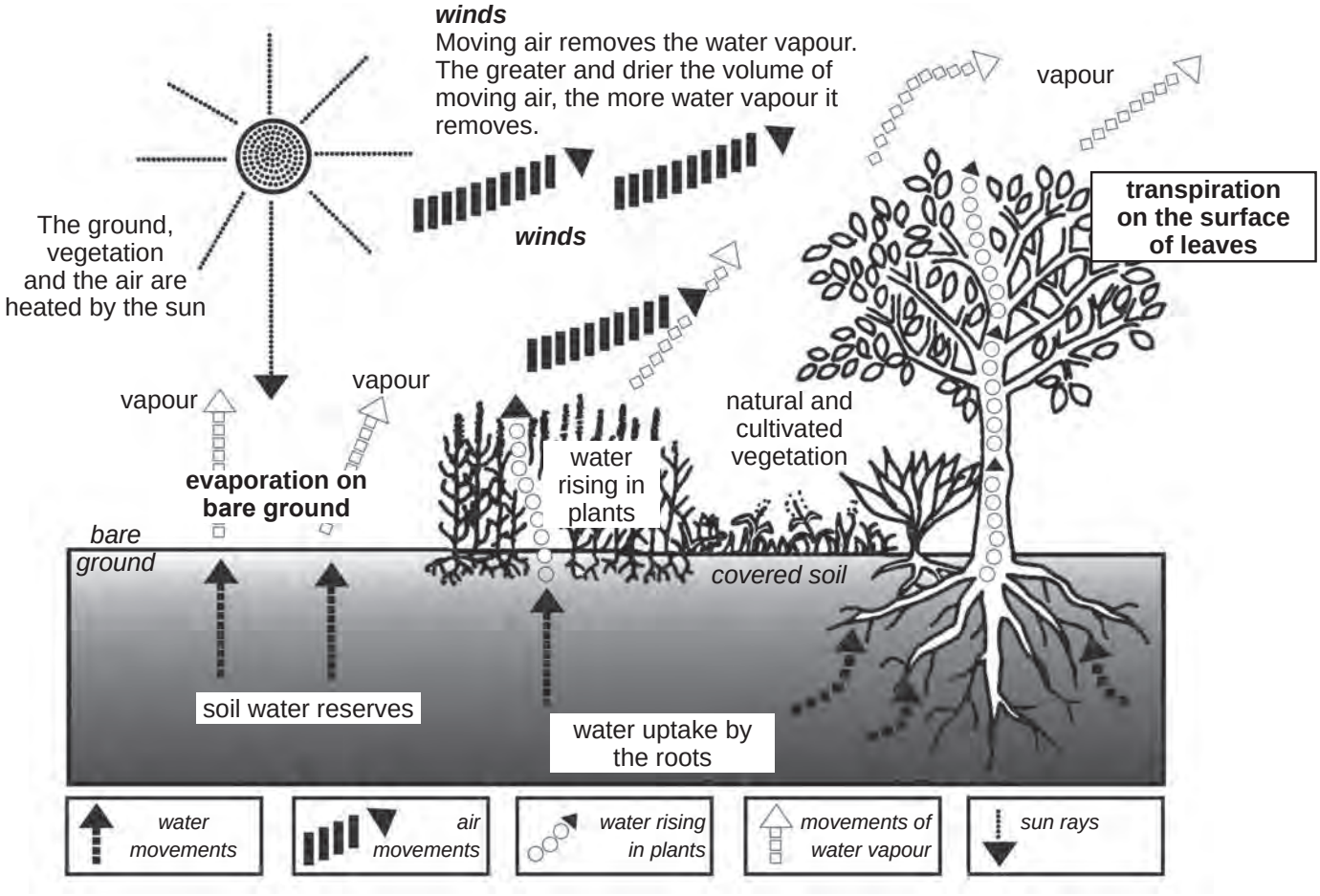


Figure 1.12 How evapotranspiration works
Carry out the experiment in the next activity to find out how evapotranspiration takes place.

Activity 1.6 Make your own terrarium

Complete this activity in groups or on your own in your workbook

Aim: Build a terrarium to gain an understanding of evapotranspiration

What you will need

A large glass or clear plastic container (spray bottle) with a lid, soil, sand, pebbles, compost, seeds, small plants, a small dish or cup, spray bottle.

Time: 1hour

What you must do

1. Build the terrarium (a very small garden inside a container) as follows:
   - Place the sand and pebbles at the bottom of the container which has been tipped on its side
   - Place about 3 to 4 cm of soil and compost on top of the sand and pebbles..
   - Plant the small dish firmly in the ground and fill it with water.
   - Create a small landscape by building small hills and valleys.
   - Plant the seeds and the small plants in the soill.
   - Moisten the soil and plants, using a spray bottle.
   - Seal tightly and place the terrarium in indirect sunlight, for example on the veranda (stoep) away from the sun.

2. Look at your terrarium (small world) every day for one to two weeks and write your observations in your workbook.
   - What is happening inside the terrarium?
   - What has changed over time? (Give the date and the event)
   - Why do you think the changes have happened? (Give the reason for the changes.)

3. Try some of the following experiments:
   - Add other life forms, for example, insects.
   - Plant some more seeds or small plants of your choice.

7. In what way does this model represent the water cycle? Make a drawing with arrows connecting the different elements of your terrarium in the space provided in your workbook.

8. Explain why is it important to know about evapotranspiration.

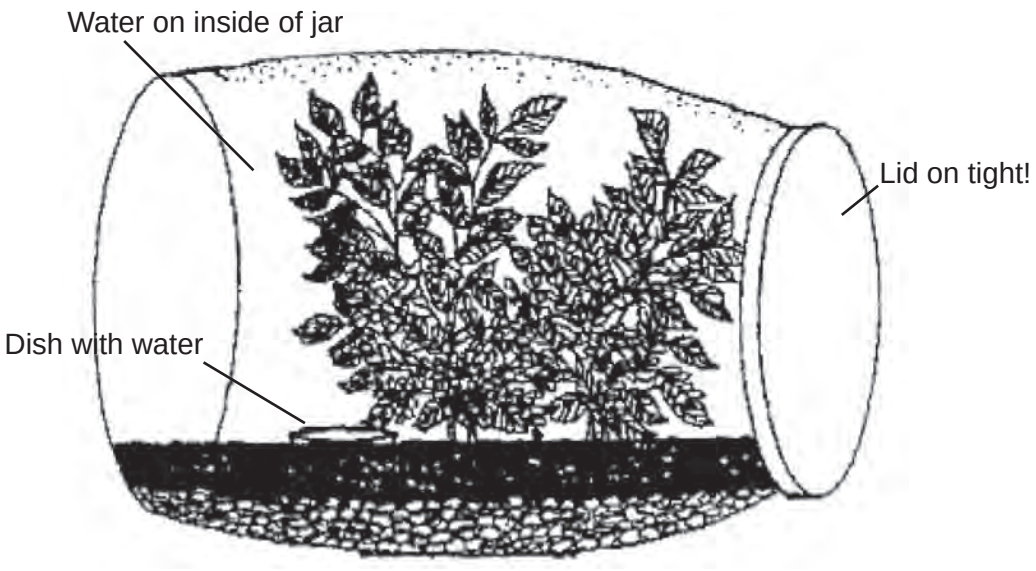


Figure 1.13 A terrarium to demonstrate evapotranspiration

Comments on Activity 1.6

Understanding evapotranspiration is an important concept in growing vegetables and other crops. Plants wilt and become stressed if they transpire more water from their leaves than they can draw from the soil.

What is stress?

Plants suffer from stress when conditions are difficult (e.g. a lack of water or light), just as when people do when facing difficult situations.

Something to think about

- How can a gardener limit the rate of transpiration by plants and evaporation from the soil, i.e. how can evapotranspiration be inhibited?
- Why should a person be selective regarding the type of crop or vegetables he or she plants in a garden?
- Which factors would determine what plants are cultivated in a garden?

You need to start thinking about these questions. The answers will become clear to you as we progress through this module.

Activity 1.7 Reading maps on evapotranspiration

Complete this activity on your own in this study guide

Look at the two maps below (also see Annexure A for coloured maps) and answer the questions that follow.

- The **first map** shows you the *potential evapotranspiration* (written in mm) during December, the peak rainfall month in the summer rainfall areas of South Africa.

- The **second map** shows you the potential *evapotranspiration* for July, which is mid-winter.

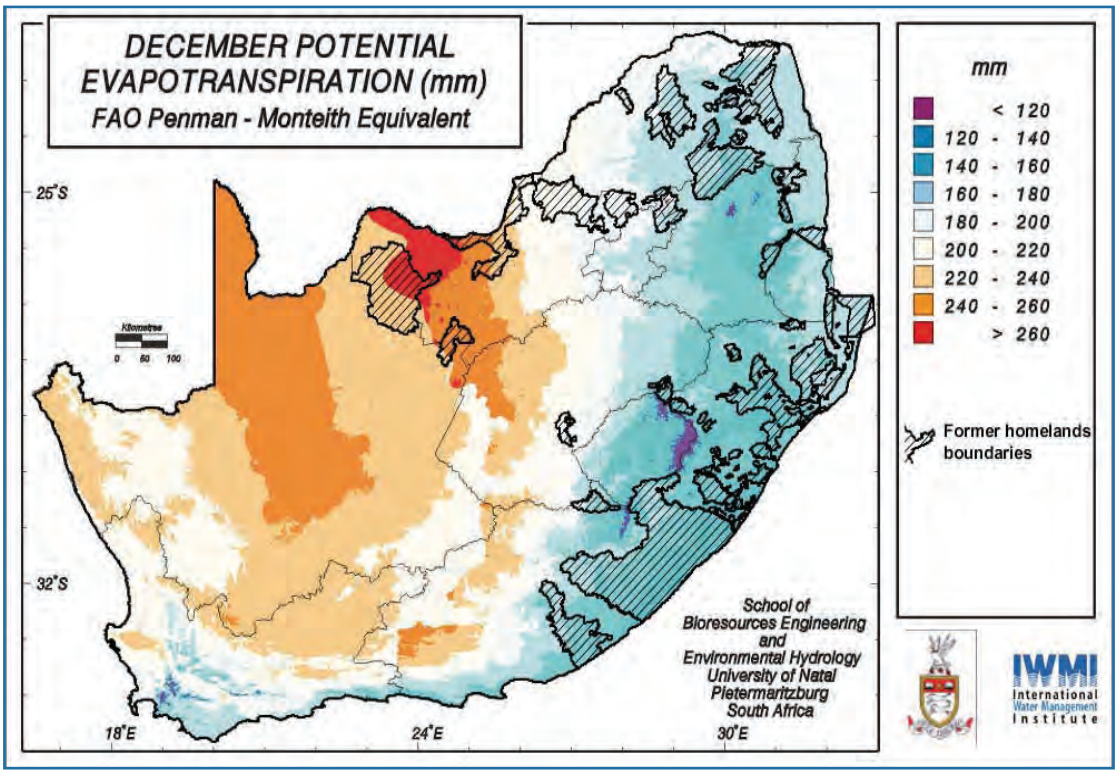


Figure 1.14 Map showing December evapotranspiration potential in South Africa
(See Annexure A for coloured map)

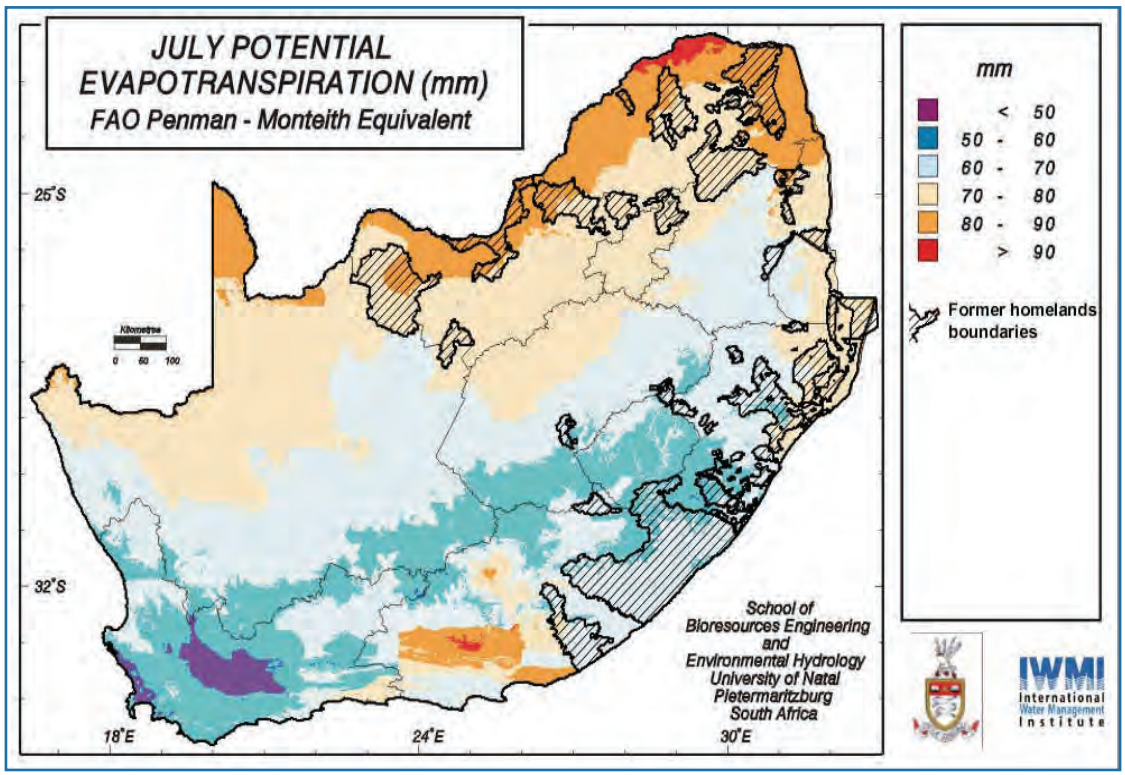


Figure 1.15 Map showing the July evapotranspiration potential in South Africa
(See Annexure A for coloured map)

Questions

1. What does the symbol >, and the symbol < on the maps mean?

……

……

2. Why do you think the reference evapotranspiration for the area shown in red is so high for December? See Annexure A for coloured map.

……

……

……

3. Why is it useful to know about the reference evaporation for the area where you are living if you are a farmer or gardener?

……

……

……

4. Identify on the map where you are from. What is the evapotranspiration in December and July in your area?

……

……

……

Comments on Activity 1.7

The symbol >, means more than. Example; the evapotranspiration is more than (>) 500mm.
The symbol <, means less than. Example; the evapotranspiration is less than (<) 500mm.
The area shown in red (see Annexure A) is in the interior with a very hot and dry climate, which causes the evapotranspiration to be very high.

Why is it useful to know the evaporation for the area where you are living and farming? This information will give you an idea of the amount of water you will require to grow crops. The agricultural planning sector in your area can work out the evapotranspiration of any crop that you may want to grow. This is then compared with the amount of rainfall expected, which, in turn, indicates the amount of water that you will need to provide for your crops through irrigation or rainwater harvesting.

The annual reference evaporation ranges from 1300 mm (1,3 metres) on the east coast, and 1500 mm (1,5 metres) in the North and interior, to 1800 mm (1,8 metres) in the West. Annual means for a period of one year.

Remember that the evapotranspiration values are higher than the rainfall values. Therefore the main function of irrigation and rain harvesting is to close the gap between low rainfall and high evapotranspiration. Crops need to get at least as much water as they lose in evapotranspiration in order to produce high yields.

1.2.4 What happens to water in the soil?

As you are aware, infiltration is one of the inter-inked processes that take place during the water cycle. With enough rainfall the water that falls on the ground will infiltrate (move deeper into the earth) to become groundwater that is stored in aquifers. These aquifers could be in cracks inside other rocks or in huge caves or channels. The upper boundary of the underground water is called the **water table**. About 98% of all fresh water in the world is stored as groundwater. Figure 1.16 shows you what happens to water beneath the ground.

What is an aquifer?

Aquifers are cracks in rocks or huge caves under the ground that are usually filled with water.

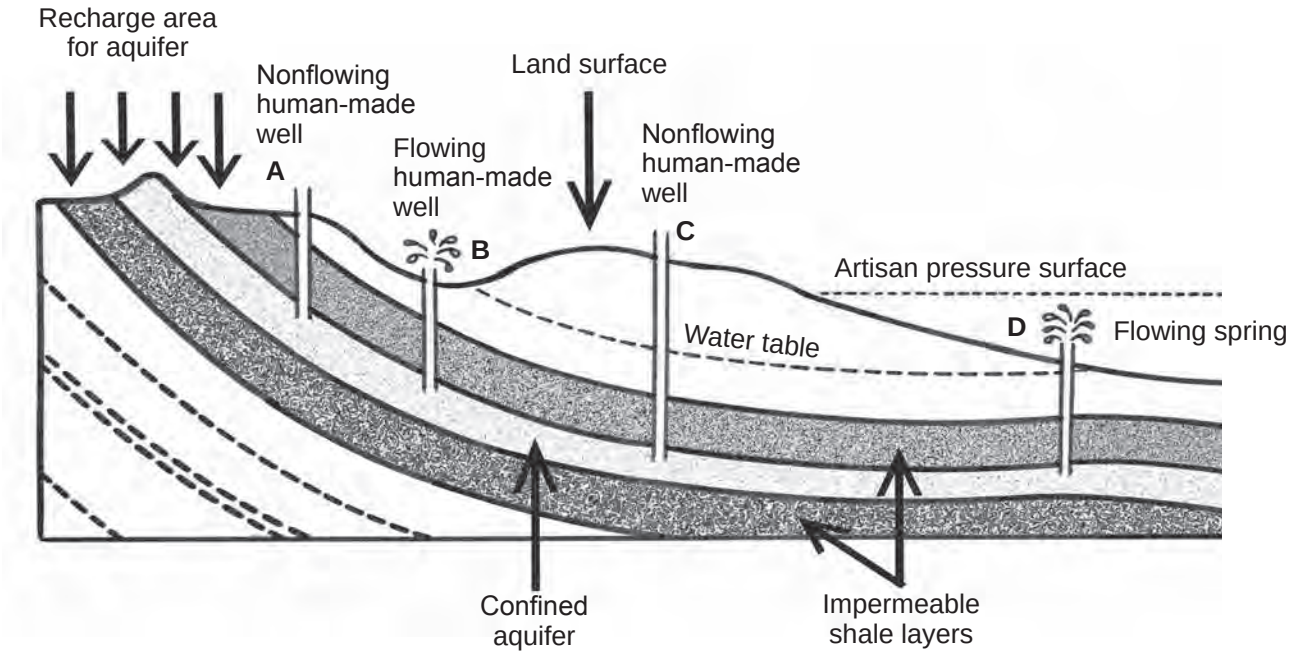


Figure 1.16 What happens to underground water?

When water that seeps into the soil reaches an **impermeable** layer of rock such as shale/mud stone, which is a layer of rock that doesn't let water through, it will follow the slope and can eventually emerge on the surface as a spring or the source of a stream or river. Rivers have a sustained flow, because most of the water is actually stored in the soil, where it slowly releases into the drainage basin or stream.

1.2.5 What are watersheds and catchments?

A watershed is an area of higher elevation (such as the top of a mountain) that separates two **catchment areas** from each other, so that water flows down from the watershed into one or the other catchment area. All the streams in one catchment flow into one river and those in the other catchment flow into a different river.

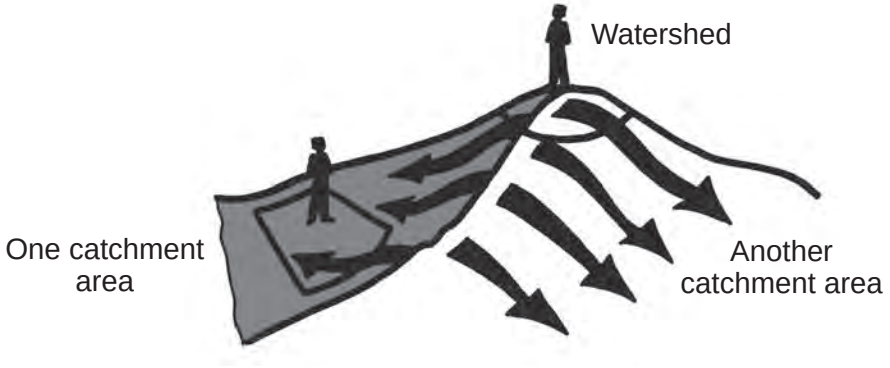


Figure 1.17 The top of a watershed with two catchment areas

Plants in catchments

Indigenous vegetation (plants) are very important in catchment areas (catchments) for the following reasons:

- Plants slow down water as it flows over the land (runoff) allowing much of the rain to soak into the soil and replenish underground water (aquifers). Water seeps from these aquifers into rivers.
- Plants prevent soil erosion as their roots hold soil in position, preventing it from being washed away.

In disturbed **watersheds**, *the slow and sustained release of water is disrupted. Water runs rapidly off the ground's surface, rather than soaking in. This process creates floods followed by drought.*

- Vegetation (plants) in wetlands and on the banks of rivers is of particular importance. The roots of the reeds, sedges, shrubs and grasses growing in wetlands and next to rivers bind the soil and prevent erosion. At the same time these plants clean the water by filtering impurities and regulating water flow.

Something to think about
Why are watersheds and catchments important to communities and people who want to start gardening projects?

It is of the utmost importance that our catchments are well managed because if this does not happen, all the people in the community will suffer. Reflect on how you can contribute to good management of catchments.

1.2.6 Water management areas in South Africa

On a larger scale your land (your local government/ local municipal area) will almost surely be part of a larger watershed or catchment. These are combined for local areas to form **regional drainage basins/catchments** that drain thousands of square kilometres of land, creating streams and rivers. In South Africa the **quarternary catchment** (about 100 square kms) is the smallest unit at which national planning is done. These quarternary catchments make up the units of even larger areas known as **water management areas,** of which there are 19 in South Africa.

These water management areas contain the larger rivers and dams in the various regions of South Africa and provide the basis for regional planning. This planning includes water requirements and allocations for various uses such as irrigation, mining, cities, industry and rural areas.

Where are the 19 water management areas in South Africa and what are the water requirements for these areas?

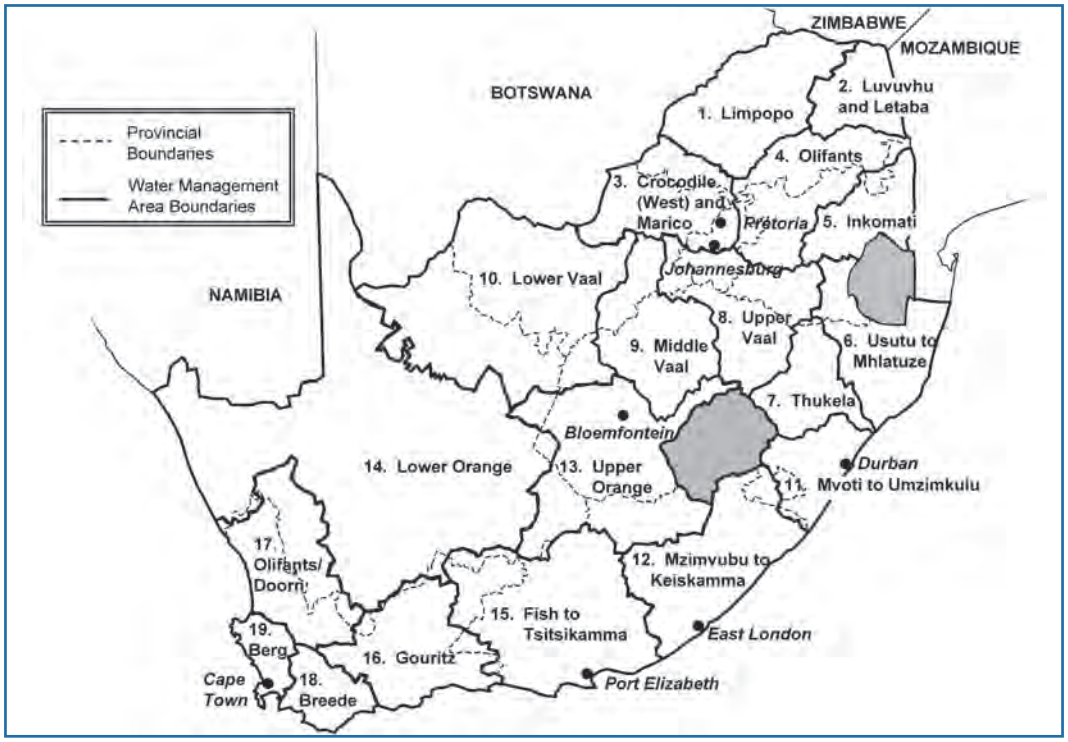


Figure 1.18 The 19 water management areas in South Africa
(Adapted from Oosthuizen, 2004)

Do each of the 19 water management areas use water for the same purpose? Do they use different amounts of water? Table 1.3 below gives you an overview of how water is used in each water management area.

Table 1.3: Water requirements for the 19 water management areas based on statistics for the year 2000 (million m^3/ year)

Water Management Area	Irrigation	Urban	Rural	Mining and Bulk Industrial	Power generation	Aforrest-ation	Available balance in 2000	Potential water require-ments in 2025	Total local requirements
Limpopo	238	37	28	14	7	1	(24)	8	325
Luvuvhu/Letaba	248	11	31	1	0	43	(37)	102	334
Crocodile west and Marico	445	691	38	127	27	0	11	0	1 328
Olifants	557	92	44	94	181	3	(196)	239	971
Inkomati	737	65	24	24	0	198	(253)	114	1 048
Usutu to Mhlathuze	404	54	40	91	0	104	235	110	693
Thukela	204	56	31	46	1	0	(97)	598	338
Upper Vaal	114	795	42	173	80	0	481	50	1 204
Middle Vaal	159	112	32	86	0	0	(2)	0	389
Lower Vaal	525	78	44	6	0	0	48	0	653
Mvoti to Umzimkulu	207	438	44	74	0	65	(267)	1 018	828
Mzimvubu to Keiskamma	190	100	39	0	0	46	480	1 500	375
Upper Orange	777	129	60	2	0	0	486	900	968
Lower Orange	780	28	17	9	0	0	(9)	150	834
Fish to Tsitsikamma	763	116	16	0	0	7	106	85	902
Gouritz	254	57	11	6	0	14	(66)	110	342
Olifants/Doring	356	7	6	3	0	1	(35)	185	373
Breede	577	43	11	0	0	6	29	197	637
Berg	301	423	14	0	0	0	(34)	210	738
Total for Country	**7 836**	**3 332**	**572**	**756**	**296**	**488**	**504**	**5 576**	**13 280**

Activity 1.8 Water use in your management area

Complete this activity in groups or on your own in your workbook

Aim: Interpret information on water management in your area.

Time: 1.5 hours

What you must do

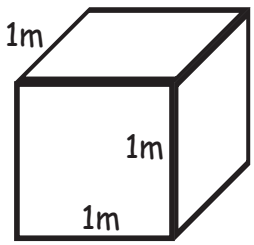
1. Look at the map in Figure 1.18 above.
2. Identify on the map where you live. You may want to look at another more general map of South Africa to help you situate where you are and what the names of the major rivers are that are close to you.
3. Find out the name of the water management area where you are and list the names of the major rivers.
4. Now look at Table 1.3. Look under your water management area and summarise the water requirements information by answering the following questions:

Questions

1. What does million m^3/ year mean?
2. Which water user, uses the most water in your water management area? Look at the headings across the top of the table to help you find this information.
3. Which water user uses the least water in your water management area?
4. Why are the water requirements for rural users much lower than for the *urban* users? Think of at least three possible reasons.
5. Is the "Available balance in 2000" for your water management area in brackets? What do you think this means?
6. Compare the "Available balance" in your water management area with the "Potential water requirements in 2025". What do these figures mean to you?
7. Suggest at least three potential options of how to solve the problem of too little water.

Comments on Activity 1.8

The metric unit **m^3** indicates cubic meters.
A cubic meter is a measurement of volume which is 1m x 1m x 1m in size.



The million m^3/ year in the heading of Table 1.3 therefore means that a million cubic meters of water is used every year.

Water use will depend on where you live. For example in the Mzimvubu – Keiskamma region: Irrigation uses the most; mining and power generation uses the least water.

We can summarise by saying that the main consumption of water is for:

- **agricultural use.** Agriculture is the largest user of water in South Africa where water is mainly used for irrigation. Irrigation in our country leads to a tremendous waste of water. Unwise irrigation, the choice of crops and inefficient management techniques are mainly responsible for this wastage. In the next unit we will examine how water should be managed.
- **industrial use.** In developed countries almost as much water is used for industrial purposes as it is for agriculture. However, in industry a large part of this water is used over and over again.
- **domestic use.** Unfortunately a tremendous amount of valuable purified water for domestic purposes is wasted every day. The people of South Africa will have to be made aware of the necessity to conserve water.

You are now aware of the importance of catchments and their management, but is it important to also consider the shape of the land when you plan a homestead garden? This is the topic for our next section.

1.2.7 What is topography?

Topography tells you about the shape of the land. It is important to take the shape of your land into consideration, as this will affect your farming/ gardening and how you use the land.

For example:

- If you cultivate steep **slopes,** you could cause soil erosion.
- Valley bottoms are often not suitable for farming as there may be a problem with frost or there may be a wetland. **Wetlands** are lowlands that are seasonally or permanently waterlogged (wet).
- If your crops are planted in a flood plain, they can wash away during heavy rainfall.
- If you are at a high altitude you may have cold winter temperatures.

What is a slope?

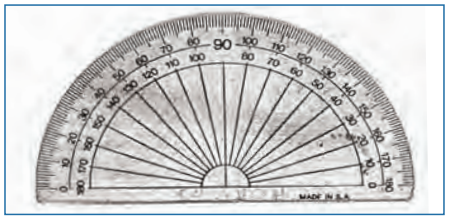
A slope tells us how steep or flat our land is. Steep slopes are vulnerable to erosion when used for cropping and grazing. Bare soil is easily washed away on slopes. Slope is measured or estimated, so that it is possible to work out how far apart to make **contours** or erosion control structures on the slope or hillside so that slopes may be cultivated without being eroded.

What are contours?

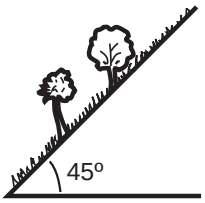
Contours are imaginary lines that are on the same level (at the same height or elevation), across a slope as indicated on the picture below.

Figure 1.19 Contour lines drawn on a hill to show the areas that are level

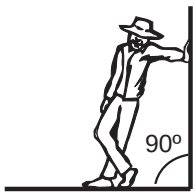
To measure the angle of a slope, professional people use an instrument called a **theodolite**. However, as we do not have such an instrument available, we can practise measuring the angle of the slope by using a small instrument called a **protractor** which measures in degrees (°). The small sketches on the right give you an idea of the angles of three different slopes.



Flat land is 0º



This slope is 45º



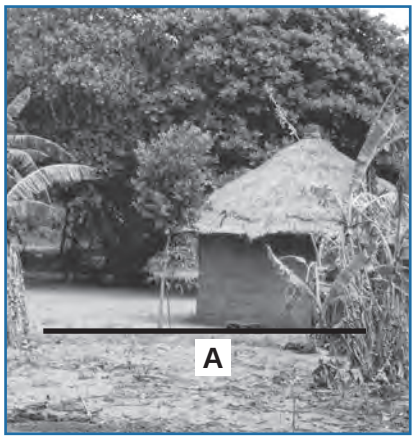
A vertical wall is 90º

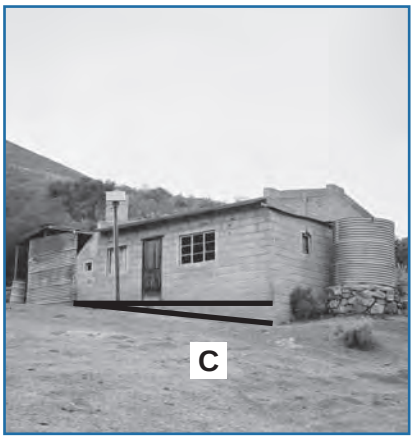
Figure 1.20 A protractor

Activity 1.9 Measuring angles using a protractor

Complete this activity on your own in this study guide

1. Measure the following angles with a protractor.





A .....The ideal is to have no slope and the soil is level.

B ..... Note the filling added to improve the slope forming part of the foundation.

C ..... Note the filling to add if you want to level the soil for a garden.

2. Look at Table 1.4 below that provides recommendations for land use, depending on the slope. Go outside and look at the land. Guess the degrees (steepness) of three different slopes you notice in the environment.

Table 1.4 Recommendations for land use, depending on slope

Slope º	*Description of slope*	*Recommendations for land use*
Less than 12º	Gentle slope	Can be ploughed and used for commercial cropping
12º - 20º	Moderate slope	* Can be ploughed and used for commercial cropping. * Include contour plantings and structures. In areas including Eshowe in KZN and Alexandra, Albany, Bathurst, Komga and East London in the Eastern Cape ploughing of slopes more than 12º is not recommended, because the soil is likely to erode. * Home gardens also need contour plantings, structures or terraces. It is better to plant crops that cover the ground such as sweet potatoes and cowpeas. * It is best to plough and plant perennial (long living) plants such as trees, pasture, sugarcane, etc.
20º - 30º	Moderately steep slope	Plough for perennials (plants that carry on growing for years and years and do not die after one season).
30º - 50º	Steep slope	This slope is too steep for crops. You can plant fruit or timber trees. However you will need to dig holes by hand.
> 50º	Very steep slope	Not recommended for planting,

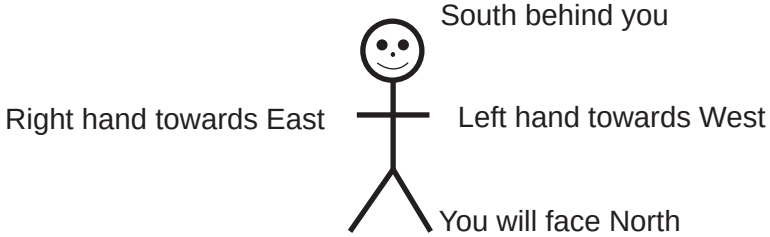
In Unit 3 you will measure the actual slope of your land, using a line level.

1.2.8 What are aspect, ridges and valleys?

Aspect tells you whether your land faces North (N), South (S), East (E) or West (W). In South Africa, north-facing slopes tend to get the most sun. They are sunny and can often be hot and dry. You may find aloes on these slopes. The South-facing slopes are cooler and wetter. This is where you would find indigenous forests.

Do you know how to find out where N, S, E and W are? If you are confused; just think where the sun comes up – that will be East. Where the sun goes down – is West.

Something to do
Go outside and stand with your left hand towards the West and your right hand towards East. You will be facing North and South will be behind you. If it is Midday (12 o'clock) your face should be facing the sun to estimate north.



You can also use the direction of N, E, S, and W and the sun to tell the time as the shadow of the pole moves from one point to the other corresponding with time on a watch.

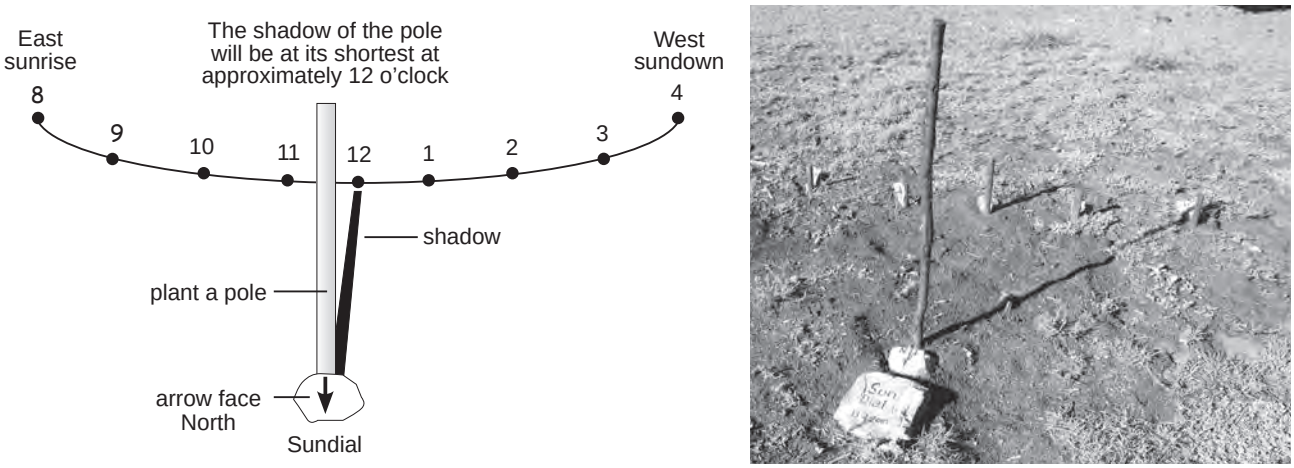


Figure 1.21 A sundial (sun clock)

Plant a pole and measure the end of the shadow at every hour and mark with a stone. The position of the shadow will be different in summer and winter.

Ridges are at the tops of hills or slopes. **Valleys** are at the bottom of hills or slopes. There can be a large difference in temperature between ridges and valleys. Valleys can become very cold at night and hot during the daytime. Frost is often found in the valleys. Ridges can be cold and windy.

The best places for cultivating plants are generally on the mid- and lower slopes, but not on top of ridges or in valley bottoms, as you can see from the figure below.

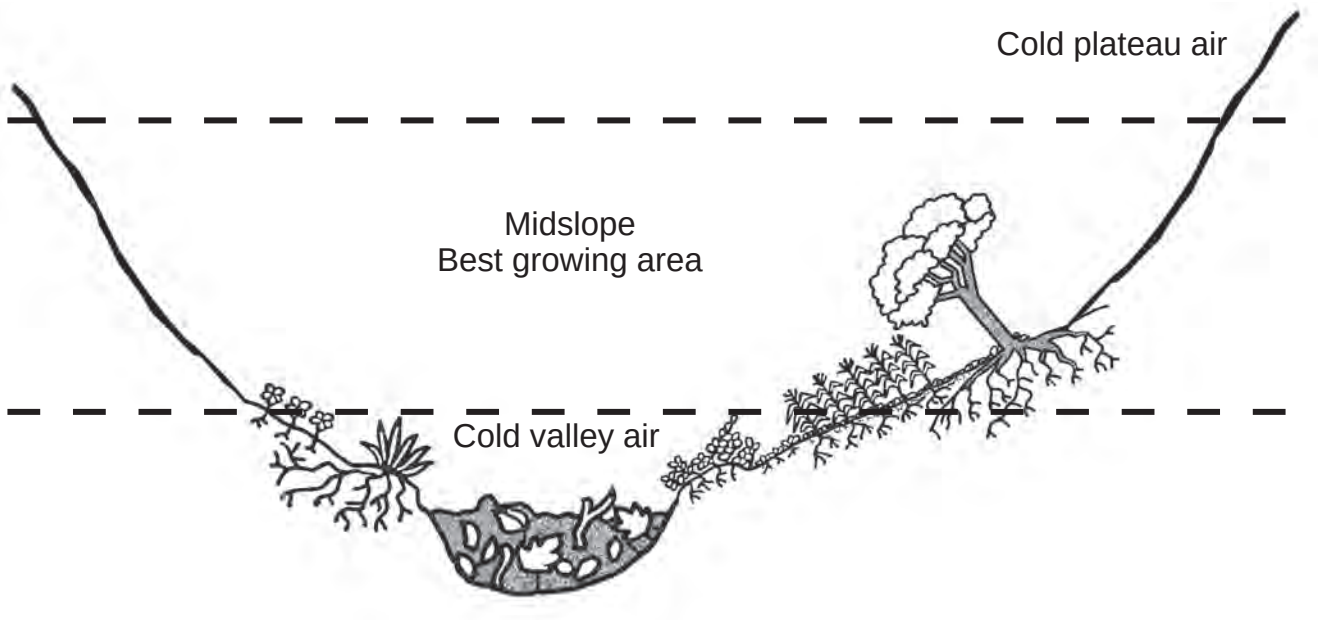


Figure 1.22 Ridges and valleys in a part of your catchment showing the mid-slope area that is best for farming.

Activity 1.10 Considering aspects, ridges and valleys

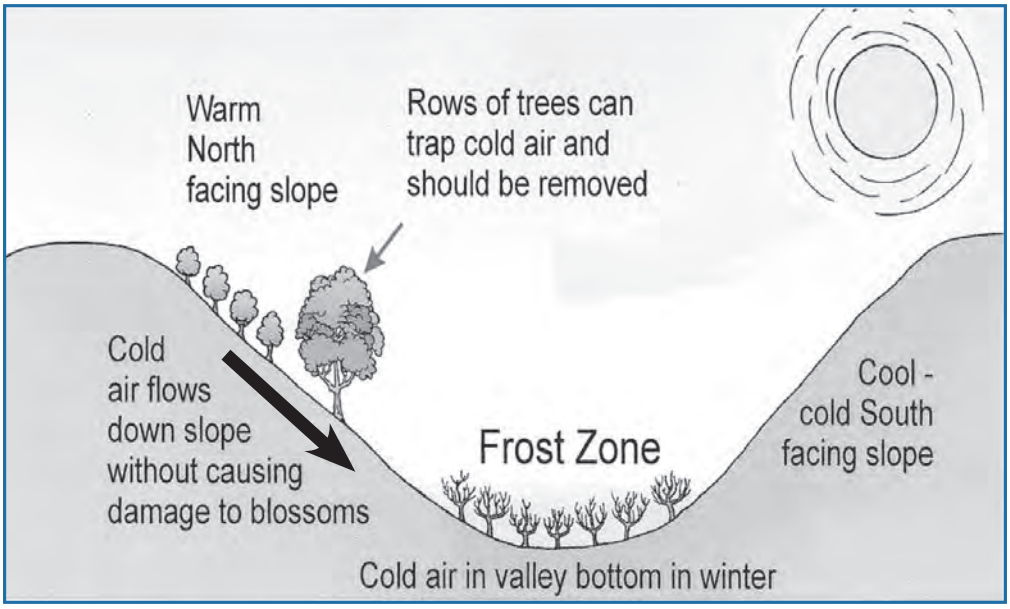
Complete this activity in groups or on your own in your workbook

Aim: Analyse a figure on aspect, ridges and valleys for land use options.

Time: 1 hour

What you must do

1 Look at the figure below. It gives an indication of where to plant fruit trees taking the aspect, ridges and valleys into consideration.



Note the aspect and the movement of air as shown in the drawing. Then answer the following questions.

Questions

1. Where it the best place to plant trees and crops? Give two reasons for your answer.
2. Why have no fruit trees or other trees been planted on the cool, cold south-facing slope?
3. What is the difference between the fruit trees planted on the north-facing slope and the fruit trees planted in the valley bottom?
4. A comment on the drawing states: *Rows of trees can trap cold air and should be removed*. Discuss what this statement means.
5. Where is the cold air coming from and where is it going?
6. Where will the cold air be trapped?
7. If you would want to plant rows of trees to protect your fruit trees from cold air where would you plant them?

1.3 Soil as a natural resource

Soil together with temperature and the availability of water is one of the most important resources in the environment.

1.3.1 What is soil?

Soil is the growth medium that supports almost all plant and animal life on land. Soil can be defined as the uppermost weathered (broken down) layer of the Earth's surface that contains gases, water, mineral salts, living organisms and their remains (organic matter). Soils begin with the weathering of rocks and their minerals. What do we find when we examine each component in soil?

Soil air and soil water

In a good soil, about two thirds of the spaces between the soil particles contain air after the excess (extra) water has drained.

The air in these spaces, provides oxygen for plant roots. Water occupies the remaining soil space. The relation between the amount of air and water is, however, not fixed.

After heavy rain all the spaces may be filled with water. If some of the excess water does not drain from the soil, plant roots may die from lack of oxygen.

On the other hand, if there is not enough soil moisture, plants wilt from lack of water. Soil moisture and air are also important in determining the numbers and kinds of organisms present in the soil.

Soil organisms

Healthy soil is living soil, with many different organisms living and working in it.

Protozoa, nematodes, earthworms, insects, bacteria and fungi are typically found in soil. What are the functions of these organisms in soil?

What are organisms and organic matter?

Any living thing is an organism. For example, bacteria, protozoa, fungi (mushrooms), plants and animals, including humans are all organisms. Bacteria are very small organisms and are therefore called microorganisms.

Dead organic matter in soil, is the remains of plants (leaves, fruits or grass), and animals (manure or dead organisms)

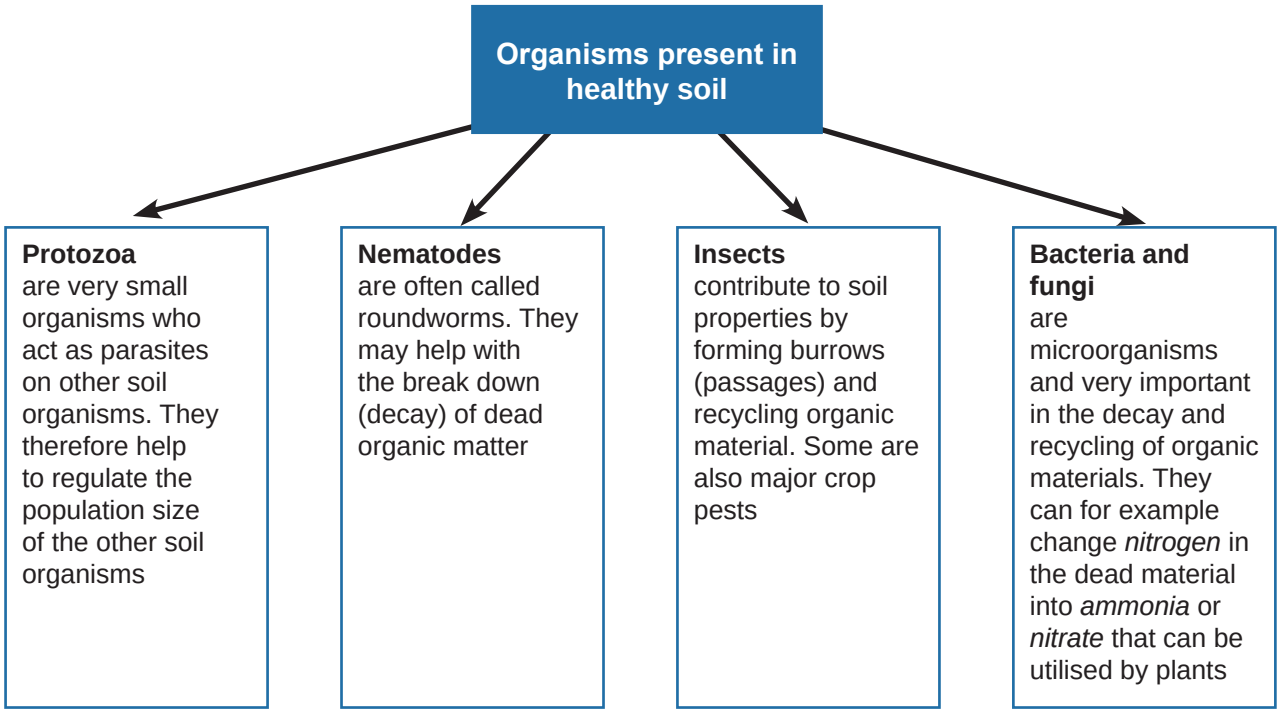


Figure 1.23 Organisms present in soil

Mineral salts in soil

Mineral salts can be visible (in the form of crystals, powder or granules) or invisible (dissolved in the water). They can also be combined with organic matter. Ashes spread on the ground are visible salts, as are fertiliser granules or crushed shells. When they are dry these salts remain on the surface of the ground. As soon as it rains some of these salts dissolve and are carried away between the soil particles. We use the word **leaching** to describe water moving through the soil which dissolves and removes the salts to layers lower down.

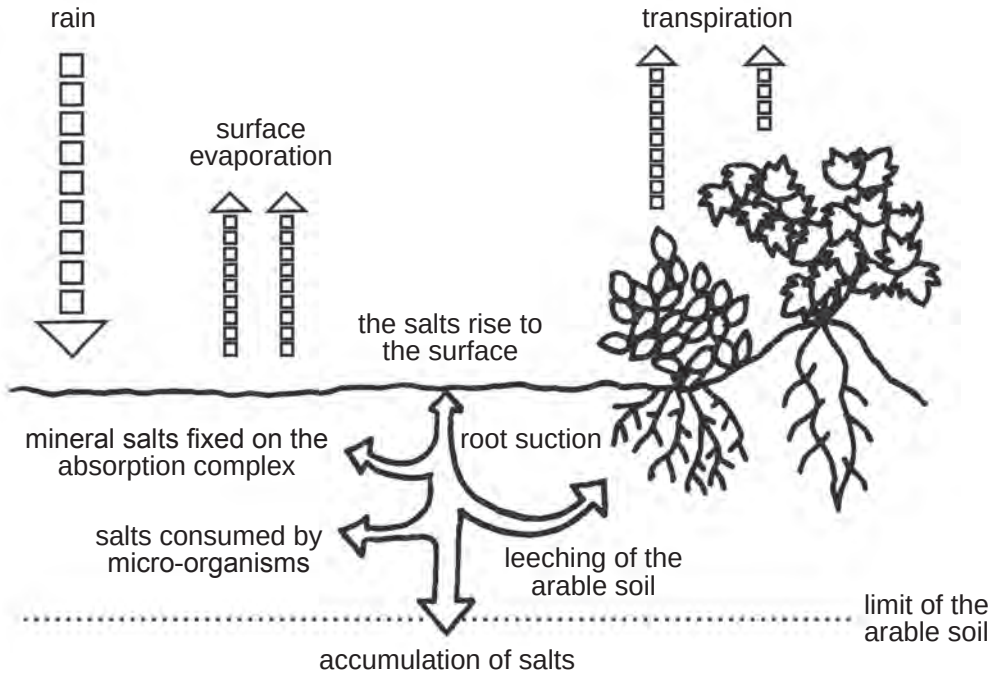


Figure 1.24 The movement of water and minerals in the soil
(Adapted from Du Preez *et al*. 1992)

1.3.2 What is soil texture?

Soil is made up of individual particles or clusters of particles, with small spaces (pores) between them that contain air and water. A good soil has pores of many different sizes, large and small. The texture of soil is determined by the size of the rock particles (pieces) in the soil. The following table shows you how soil is classified, based on the size of the particles.

Table 1.5 Soils classified on the basis of particle size

Soil type	Particle size
Gravel	Between 0.05 and 2.0 mm
Sand	Between 0.05 and 2.0 mm
Silt	Between 0.002 and 0.5 mm
Clay	Less than 0.02 mm

Gravel and sand

Large particles like gravel and sand feel rough between the fingers. Water and air easily infiltrate this kind of soil because of the spaces between the particles. Water drains from this kind of soil very rapidly, often carrying valuable **soil nutrients** out of the soil where they cannot be reached by plant roots**.**

Silt

Silt is a fine sandy soil. Silt holds water and **plant nutrients** better than a coarser sandy soil. Silt is easily washed out of the soil into rivers and dams.

Clay

Clay consists of very tiny particles. They are so small that you cannot feel them with your fingers. That is why clay feels slippery and sticky. There are very small pores or spaces between the particles. The particles stick together in lumps or clods. Clay holds onto water and nutrients in the soil. Certain types of clay will swell when they are wet and shrink and crack when they are dry. They can be difficult to work with.

Which type of soil is the best? The best soils are called **loams,** which combines the good aeration and drainage properties of large particles with the ability of clay particles to retain **nutrients**. Loams contain more or less equal mixtures of sand, silt and clay.

How can you tell your soil type?

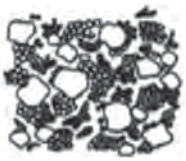
We need to touch, see and smell soils so that we can use our knowledge to discuss different soil types. We want to use peoples' own ways of distinguishing between soils and their own management practices as the basis for our discussions. We can use the bottle and soil sausage tests below to guide a discussion on soil types, soil characteristics and good and bad soil management practices.

Soil Structure Examples

SAND - light soil, no water-holding capacity

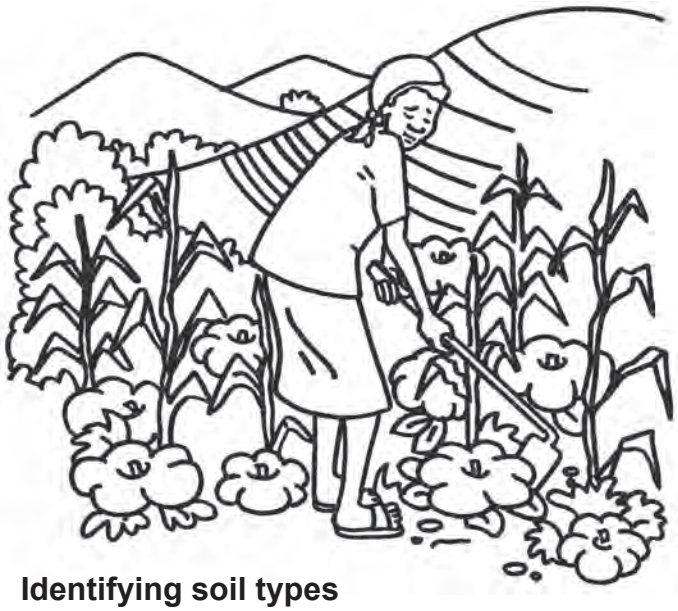
CLAY - heavy soil, holds water, difficult for root penetration

SANDY CLAY - holds water, easy for root penetration



LOAM - optimum water holding capacity, optimum for root penetration, contains organic matter

Something to think about
When you start a homestead garden, why is it important to determine what kind of soil you have available?



Group Activity 1.11 Identifying soil types

Complete this activity in groups or on your own in your workbook

Aim: Identifying different soil types by touch and observation

Time: 2 hours

What you need

For the sausage test: At least three types of soil (about a handful of each) and some water. These can be collected from the river (sand), low lying wet areas (clay) and good cropping fields (silt). Look for soils that have a different colour and texture so that you can compare them.

For the bottle test: Three clear plastic or glass bottles (for each small group), such as 1-litre coke bottles, with caps. Handfuls of three different types of soil from the area or of the three main soil types there are.

Use the space provided in the workbook to complete this activity.

What you must do

Tell by touch: You can tell how much sand, silt or clay is in your soil by how it feels.

1. Wet some soil and roll it into a ball between your hands.
2. Now roll this ball into a sausage.
3. Use the table below to identify your soil type.

Table 1.6 Identify soil type by touch

What soil looks like	What soil feels like	When rolled into a sausage		The soil is
Very Sandy	Very rough	Cannot be rolled into a sausage		Very Sandy 0-5% clay
Quite Sandy	Rough	Can be rolled into a sausage but it cannot bend		Sandy 5 - 10% clay
Half Sandy & half smooth	Rough	Sausage can bend a little		Sandy Loam 10 - 15% clay
Mostly smooth	A little sandy, quite smooth but not sticky	Sausage can bend about half way around		Loam or Silt Loam 15 - 35% clay
Mostly smooth	A little sandy, quite smooth and sticky	Sausage can be bent more than half way round		Clay Loam or Sandy Clay 35 - 55% clay
Smooth	Smooth and sticky	Sausage can bend into a ring		Clay More than 55%

(Adapted from Stimie, *et al*. 2010)

Tell by observation.

1. Fill a bottle one third full of soil.
2. Almost fill the bottle with water and shake vigorously for several minutes to separate the soil grains.
3. Leave the bottle with its contents to settle and observe what takes place.
4. Make a labelled drawing and write a description next to it in the space provided in your workbooks.
5. Use the examples below to guide your comments.

Examples

- The substances settle in layers, the heaviest at the bottom and the lightest at the top. Others remain suspended (float) in the water. Some substances are lighter than water and float on its surface. These are pieces of organic matter such as leaves, seeds, fruit or insect litter and fungus spores. Other heavy substances such as gravel, pebbles and sand quickly fall to the bottom.
- The finer substances then accumulate (stick together); first the silt, followed by the fine and very fine clay. These layers vary in consistency and colour. The layer of water above the settled material remains cloudy for a long time. It contains clay particles so fine that they stay suspended in the water.
- If some salt crystals were added to the soil before the bottle was shaken, we notice that they have now disappeared. They have dissolved in the water and can no longer be seen. Some soil components are visible and others are invisible, because they are dissolved in the water.

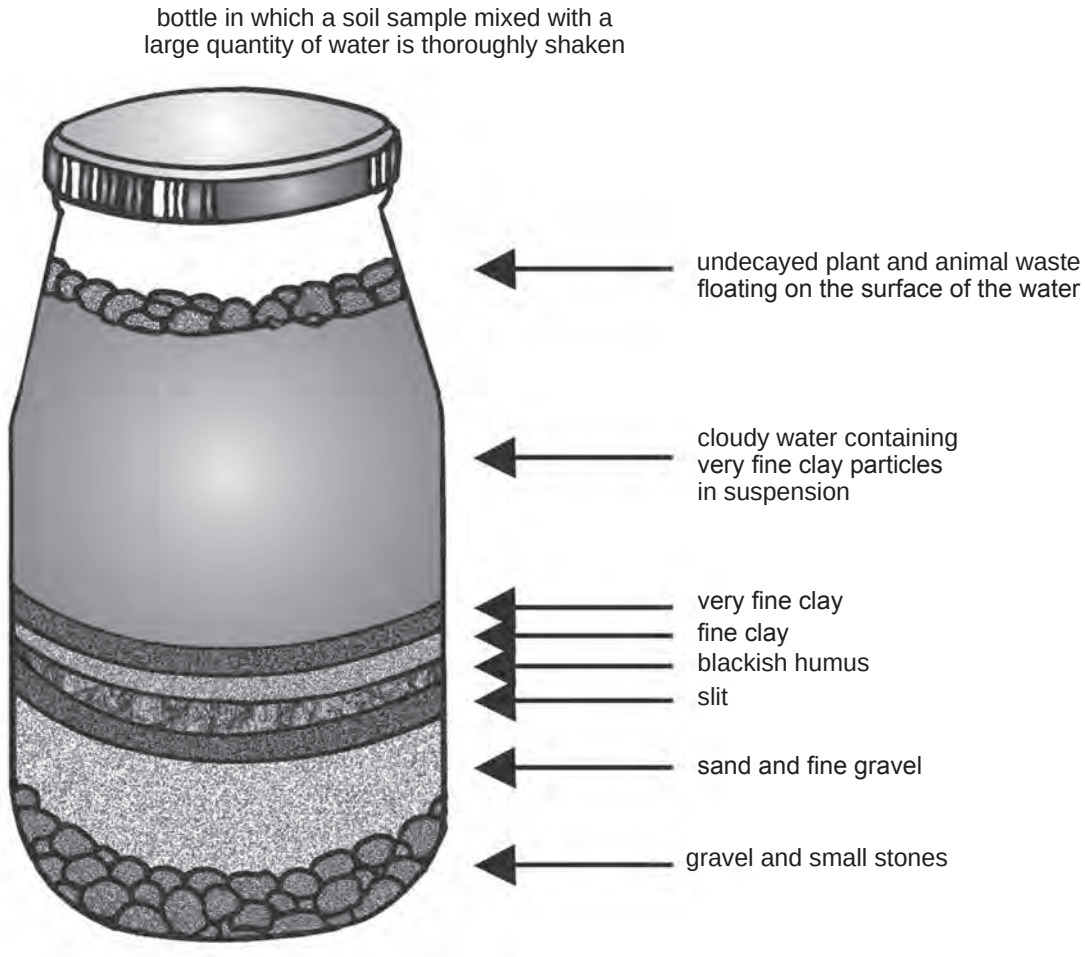


Figure 1.25 Soil sample mixed with water to show layers

6. Once you have decided on your soil types, use Table 1.6 below which gives an indication of good soil management practices for each of your soil types.

1.3.3 What is soil structure?

Soil structure tells us how the soil particles are mixed or grouped together. It also tells us how well the smaller particles stick together in clusters. This influences how easily water and air (and plant roots) can move through the soil.

The structure of soil depends on the following:

- The type and proportion of the different materials that make up the soil
- The way in which the soil was worked by tillage implements, water and microorganisms.

Table 1.7 Characteristics of soil types

SANDY SOILS	
Good things about this type of soil	Bad things about this type of soil
• It is easy to dig and work with	• It gets dry quickly
• It warms up quickly in spring after winter	• It does not keep much fertility
• It is good for root crops	• It does not hold water well
• Water and air can get into the soil easily	
LOAM SOIL (Mixture of sand and clay)	
Good things about this type of soil	Bad things about this type of soil
• It holds water well	• It is hard when dry
• It is best for root growth	
• It contains organic matter	
CLAY SOIL	
Good things about this type of soil	Bad things about this type of soil
• It holds water well and for a long time	• Its hard to work; heavy
• It holds fertility well and for a long time	• It is slow to warm up in spring
	• It is sticky when wet
	• It is hard when dry

Why is it important to know about soil structure? Soil structure plays a critical role in soil water management. The fact that organic materials and minerals are mixed together creates a balance:

- In a sandy soil where water will quickly run through, the addition of organic matter and humus promotes water retention (holding onto water). The soil will then not dry out so quickly,
- In a clay soil the addition of organic matter is good for drainage because it creates water channels in the soil.

Note: If you want to identify soil structure when you are in the field, you do so by means of observation and by touch. Below is information which you can use for this identification.

Structureless soils

Here the grains of sand or silt are not bound together. A dry, structureless soil will slip through your fingers like sorghum grains when they are poured into a container. These soils are infertile unless they are rich in **humus**. They are unable to hold water and are easily leached as the water flowing through carries away mineral salts in large quantities. These soils are susceptible (at risk) to water and wind erosion as there is no sticky matter to keep them in place.

What is humus?

Humus is dead organic, decomposed material which enriches the soil and enables plants to grow well

Compact soils

These soils contain a lot of clay. They are sticky when wet. Neither people nor plants work compact soils easily. The plants must use a lot of energy to allow their roots to penetrate this type of soil. When these soils dry out, they harden so much that neither roots nor farm implements can penetrate them. They contract and cracks appear.

Granular or aggregate soils

These soils are composed of a mixture of well-proportioned (good balance of the different kinds) elements**.** They are divided into little clods of Earth. These clods are divided into crumbs in which clay, humus and minerals stick the coarse granules of sand and gravel together. Between the crumbs there are spaces (pores) openings (gaps) and free spaces where water and air can circulate.

The crumbs are formed by everything that works the soil, including farm implements, plant roots, micro-organisms, earthworms, moles, ants and termites. These soil organisms are constantly moving, decomposing and producing material in the soil.

Activity 1.12 Identifying soil texture, structure and depth

Complete this activity in groups or on your own in your workbook

Aim: Digging a soil pit to tell different soil textures, structures and depth.

Time: Five hours

What you will need

Tools to dig a hole, a tape measure or ruler to measure depth and paper to record your results on.

What you must do

Complete this exercise in your home garden or in the garden of a member of the community. Make drawings and, if at all possible, take a few photographs.

Note: Digging a soil pit is quite hard work. You may want to dig this pit in a spot in a garden where other activities will take place later. For example this pit can form the beginnings of a trench bed which you will use in Module 5, or it can become the planting hole for a fruit tree.

1. First look at the general environment. Are the plants growing there doing well? Are all the plants of the same kind, growing the same? If not, describe the differences.

2. What does the soil look like? Is it cloddy (lumpy), sandy or granular? What colour is it? Can you see any organic matter or humus in or on the soil?

3. What life forms can you find that are working the soil? Describe them and give an idea of what you think they are doing in the soil in terms of moving material, decomposition and production. Make drawings of your life forms (or take some pictures, if possible).

4. Dig a pit about 40 to 50 cm wide and 40 to 50 cm deep. Keep on digging until there is a change in soil colour and consistency (that is, when you move from the top-soil into the sub-soil).

Now carry out the following activities:

- Check and record how deep the topsoil is.
- Check for root growth and comment on the kinds of root you find and how they are growing.
- Are there any impermeable layers in between the topsoil and subsoil? Describe what they look and feel like.

5. Make a drawing of the soil profile, or take a photograph.

6. Use the *Telling by Touch Table* (see Activity 1.11 above) to assess the texture of your topsoil and subsoil. Record the percentage of clay in each.

7. Describe the structure of your top- and subsoil. Does your soil come out in clods (lumps) or is it crumbly?

8. Will the topsoil support plant growth? What effect will the subsoil have on plant growth? Give reasons for your answers. What could be done to overcome some of the restrictions?

9. What can be done to overcome some of the negative effects of soils on plant growth?

1.4 Biodiversity as a natural resource

What is biodiversity? The word "*biodiversity*" is made up of two words, *bio* and *diversity.*

Bio means **living**
Diversity means a **large number of different things.**
Biodiversity therefore means the large number of different organisms (living things) on Earth.

There are millions and millions of different kinds of organisms on Earth. Organisms that are similar are placed into groups, such as the bacteria group, the fungi group, the plant group and the animal group.

Did you know that humans are also included in the animal group? Each one of these groups has members called *species* that are different from other species in the group. Each species has a

relationship with other species. Each one of these species has a role to play.
Here are some of the roles they play in nature:

- Some species of bacteria clean the water, while other species of bacteria change substances in the soil to other forms, which can be utilised by other organisms. However, some bacteria are less useful and cause crop diseases.
- Some species of fungi break down waste materials to form humus in the soil. Other species of fungi can be used as food by other organisms. Some fungi cause plant diseases.
- All plant species clean the air. How do they do this? They use up the carbon dioxide which humans and other animals breath out as a waste gas, and in the process put oxygen into the air. Plants also cover the soil and prevent erosion and floods.
- Some species of insects pollinate plants, including crop plants. Other insect species control pest populations. Some insects are pests, and can destroy crops.
- Animals like jackals and vultures are called scavengers and clean the environment of dead organisms.

The list of roles can go on and on. Nobody in the world knows how many roles are carried out by the species that live on Earth. However we do know, that if we destroy biodiversity, natural systems will not be able to work properly. Without biodiversity, we would have no air to breathe, no clean water to drink, no crops to eat and we would be buried under a huge pile of waste material!

People have depended on the Earth's biodiversity as a natural resource since the very beginning. They have hunted animals and caught fish for food. They have harvested plants for food, medicine and building materials. Even today people in rural areas rely on thousands of different species of plants and animals, to secure their food and keep them healthy.

Modern society has become separated from biodiversity as a resource. People in cities eat food that is grown with modern farming techniques. Farmers and scientists have taken plants and animals from the wild and bred them to become agricultural crops. Most things that we use in our lives are made in factories. However, even factories require raw materials from plants and animals. Many modern medicines are synthetic (man-made) but they are often copies of medicines from plants that are found in the wild.

Activity 1.13 Using biodiversity as a resource

Complete this activity in groups or on your own in your workbook

Aim: Interpret information in a case study on the use of biodiversity as a resource.

Time: 2 hours

Do you remember Lesedi, the son of the local business man, whom you met in Module 1? Lesedi's uncle, Jan Baadjies, lives in Calvinia in the Northern Cape, where he practises as a traditional healer. During the last school holidays, Lesedi went to visit his uncle, and was surprised by how different this

community is compared to the one that he comes from.

What you must do

1 Read the following case study of the Hantam community in the Northern Cape, and follow the instructions.

Lesedi is walking in the foothills of the Hantam mountains with his uncle, Jan. He is very interested in the plants that are able to grow the very dry and quite harsh conditions of the Northern Cape. He is also very impressed with his uncle's knowledge of the plants, and how they are used. His uncle encourages him to collect small samples of the plants, and Lesedi makes notes on all the different plants his uncle tells him about. He also takes photos with a new camera that his mother brought him from money she got by selling produce from her homestead garden. Jan explains to Lesedi that, as a traditional healer, he needs to harvest the plants very carefully and not to take too many at once. The veld offers a variety of foods and medicines, but we should use these resources responsibly, Jan tells his nephew. That evening, Lesedi records all the plants he collected that day in a table like Table 1.8 below:

Table 1.8 Indigenous plants used by the Hantam community

Key: S=Scientific name; E=English name; A=Afrikaans name

Name of plant	What it looks like	What it is used for
Rhus lancea (S) Karee (A)		Fruit is eaten by people in Calvinia
Hydnora africana (S) Jakkalskos (A)		Edible fungus

Sutherlandia frutescens (S) Cancer bush (E) Kankerbossie (A)		Medicinal uses- boosts the immune system, used to build an immune system amongst people suffering from cancer and HIV/ AIDS
Hyobanche sp (S) Soetprop (A)		Plant's nectar (syrup) is drunk by people
Galenia africana (S) Geelbos (A)		Medicinal plant used for toothache, skin infections and inflamed eyes.
Aloe spp (S)		Put in drinking water of chickens, to ensure their good health; placed on human wounds

Questions

1. Which plants that Lesedi recorded are used as food?
2. Which plants that he recorded are used for medicine and other purposes?
3. Do any of the plants Lesedi collected grow in your area? What does this tell you about the climate (temperature and rainfall) in your area? Refer to the rainfall maps in Figure 1.9.
4. If you do recognise the plants that Lesedi collected, what are they used for, or what other plants that you know are used for similar purposes?
5. Why did Lesedi's uncle tell him to harvest the plants carefully and not to take too many?
5. In these modern times, why should we consider using plants from the wild to plant in homestead gardens?

Commenting on Activity 1.13

The climate in the western regions of our country where the Hantam is located, is generally drier than the climate in the eastern regions of our country. Climate has an influence on the kinds of plants and animals found in an area. Therefore, if you live in an area with more rain, you may not recognise the plants collected by Lesedi.It is therefore very important to plant the plants and keep animals that are best suited to the climate of an area. We will explore this topic in depth in Unit 3.

1.5 Natural energy resources

Everything we do on earth depends on energy. We use a lot of energy without really thinking of where it comes from. We get food from the shop or garden, petrol from the petrol station, and electricity through power lines. But where does the energy in these things come from in the first place? Green plants store the energy received from sunlight as food, during a process called **photosynthesis.** (Refer to the last section of this unit). Animals which eat these plants use most of the energy for their body activities and store the rest. Animals which eat plants and other animals are therefore using stored energy that came originally from the sun.

Most of our electricity comes from power stations, which burn coal to produce steam. This steam is then used to turn turbo-generators, which produce the electricity. The petrol which we use in our cars, buses and lorries is produced by the distillation of crude oil. Some people also use natural gas for heating. Coal, oil and natural gas are called **fossil fuels**, which formed from plant and animal remains millions of years ago.

What is distillation?

Distillation is a process, which involves evaporating a liquid; then condensing the vapour in a separate container

1.5.1 Non-renewable energy sources

There is a major problem in using fossil fuels as a source of energy. They are non-renewable. They take millions of years to form from energy that originally came from the sun. However, once they are burnt in our cars, buses and other vehicles or in power stations, or homes they are gone forever. This is why we say they are non-renewable. The process of obtaining energy from fossil fuel is also not very efficient. More energy reaches the Earth in ten days of sunlight than is locked up in all the fossil fuels on Earth! This makes the sun an important source of energy that we can use.

1.5.2 Renewable energy sources

Instead of using non-renewable energy sources it makes better sense to use renewable energy sources that can be replaced as they are used. What are some sources of renewable energy that we can use to our advantage?

Table 1.8 Renewable energy sources

Source of energy	Comments	Advantages	Disadvantages
Solar (sun) energy	We now have the technology to capture (catch) the sun's energy directly for our use.	The largest potential source of renewable energy at present as we have abundant sun in South Africa.	The technology to capture the rays of the sun is expensive at present but it will be cheaper soon.
Wind energy	Windmills to extract water from boreholes are well known. New technology uses wind turbines which generate electricity	Holds promise for large parts of the interior of South Africa as well as along the coast	Cost of wind turbines very expensive at present.
Water energy	Electricity generated by water is known as *hydro-electricity* and requires the building of dams	We get electricity generated at Cahorra Bassa dam in Mozambique, at the Lesotho Highlands project and Tugela-Vaal scheme in South Africa.	Building of dams means many people must be relocated and natural ecosystems are destroyed.
Burning of organic resources	Organic resources include wood, animal droppings, agricultural waste such as sugar cane and charcoal from wood.	Most rural households in South Africa rely on firewood as an energy source, which is collected free from natural woodlands.	Causes large scale environmental degradation by destroying woodlands and causing major pollution.

Something to do
Under what circumstances is a renewable resource such as wood no longer renewable? Reflect on this question and write a paragraph on your thoughts in the space below.

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There are a number of creative ways in which natural resources can be used for energy. Figure 1.26 below gives some examples of how this can be done.

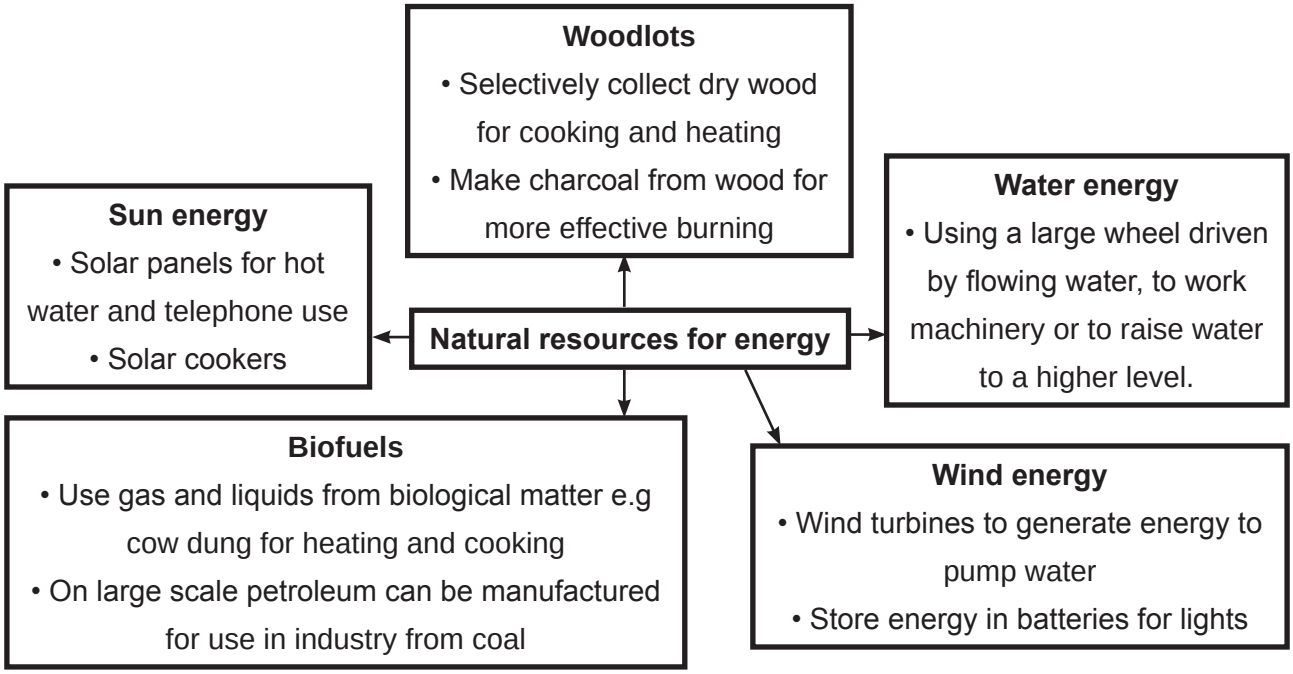

Figure 1.26 Creative ways of using natural resources for energy

Conclude this section on water, soil, biodiversity and natural energy resources by doing the next activity.

Activity 1.14 Making choices regarding natural resources

Complete this activity on your own in this study guide

1. Read the following case study on the children, Peace and Sarah, whom you met in the previous modules.

Sarah's household tried to make a homestead garden, but found the water too expensive to use. They planted vegetables that were not suitable for their area, since they required a lot of water. All the members of Peace's household use their water sparingly, and make use of their used household water for their garden. They have also saved money to buy a good second-hand water tank, to collect rainwater. They plant traditional beans and other vegetables that do not need a lot of water. Peace's household also uses all kitchen leftovers as well as leaves from trees in the garden, to make a compost heap. This provides them with organic matter that they work into the soil of the homestead garden to improve its fertility and water holding capacity.

Sarah's household throws all the kitchen waste away, and every day, sweeps the area that can be used as a homestead garden. This compacts the soil to such an extent, that the soil cannot be used for gardening because it is to hard.

Peace's household made a fence from branches collected in the veld to protect the vegetable garden. Sarah's household did not build a fence, so the chickens and rabbits started to eat the vegetables.

Sarah's household uses non-renewable fossil fuels to cook their food. She has to collect firewood from the nearby forest every day and as dry branches are becoming scarce, she takes live branches from the trees. Peace's grandmother saved enough money from selling her produce from the homestead garden to buy a solar cooker, which uses energy from the sun to cook their food.

Questions

1. Which of the two households show best practices regarding the use of natural resources?

Practices	Peace's household	Sarah's household
Best planting practices		
Bad planting practices		
Best soil practices		
Bad soil practices		
Best energy choices		
Bad energy choices		
Best water practices		
Bad water practices		
Best gardening practices		
Bad gardening practices		

2. Suggest other ways in which households can manage soil, water and living resources, which will contribute to food security.

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3. Discuss the best and bad practices of the two households in your groups and write a paragraph explaining how natural resources should be used wisely to enhance food security.

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1.6 How nature works

When we look at the bigger picture, we see that the sun and the Earth provide us with all the natural resources, as well as important processes that we need for survival.

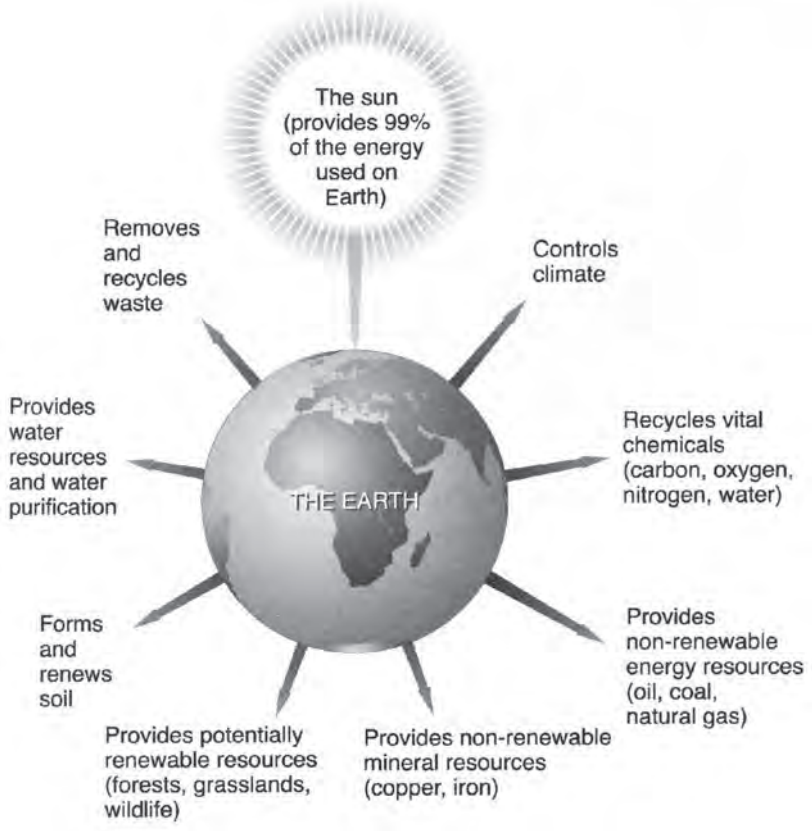

Figure 1.27 The sun and the Earth as providers
(Adapted from Bowen, *et al*. 2005)

Activity 1.15 Natural resources and processes provided by the sun and the Earth

Complete this activity on your own in this study guide

Look at the figure above and answer the following questions:

Questions

1. What natural resources does the Earth provide us with?

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2. What important processes are we provided with by the sun and the Earth?

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3. Reflect on why we should understand and respect nature.

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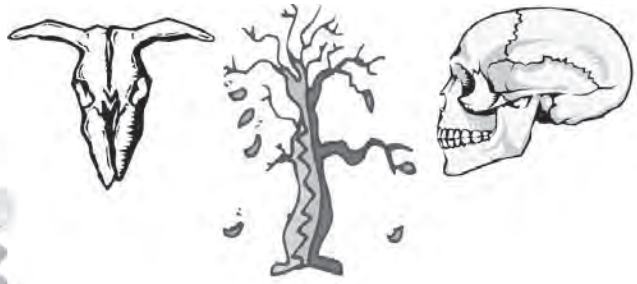
1.6.1 The cycle of nature

Are the natural resources and processes provided by the sun and Earth just for our direct benefit as humans, or do they also play a vital role in nature? Before we can give attention to producing and eating healthy food, we need to understand the role of natural resources, such as water, soil, air, plants, animals, including insects and other living things such as fungi and bacteria, in nature. Even though we use all of them as resources for our own well being, they work in a system in nature where they interact with each other to form a cycle, which plays a very important role in keeping nature in balance.

See figure 1.28 on page 49.

Why is it important for us to understand and respect the interactions in nature? Let's use a simple example. Many flowers need pollinators such as bees to produce seed. We need seeds to grow crops that provide us with food. What would happen if the bees died in large numbers because of pollution, in the environment? Understanding how natural systems and cycles work helps us to live and work in a natural environment without disturbing the balance in the system. Then it is possible for us to have continued access to the resources that we need to stay alive.

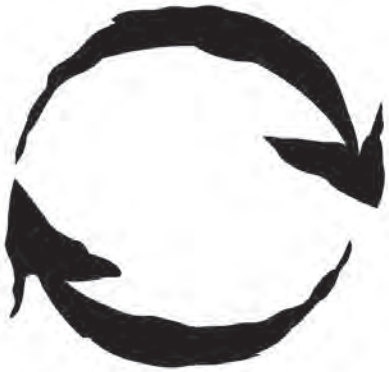
The Cycle of Nature



DEATH
All things in nature eventually die. This process of death is not the end of the cycle, it is only the beginning. Without death there would be no life. Humans are not exempt from this cycle, we are part of it.

LIFE
As the cycle of nature is strengthened, life begins to sustain and renew itself. As life passes on to death, it not only continues the cycle, but enriches and nurtures it.

DECOMPOSITION
When organic matter dies, insects, animals and microorganisms break it down into smaller parts. This decomposition releases nutrients into the soil.



PLANT USE
All living things use plants and trees for food, shelter, fuel, building supplies, medicines and more! Plants give nutrients back to the rest of the nature cycle.

NUTRIENTS
As decomposition releases nutrients they are changed into a form that can be used by plants. The plants absorb these nutrients through their root systems.

PLANT GROWTH
The healthier that the cycle of nature is, the healthier the plants will become. This allows them grow up strong, fight off pests and disease, and produce offspring with these same traits.

SUN, WATER, AIR
Some of the nutrients must combine with other things before they can be used. Plants use nature's gifts of sun, water, and air to convert their nutrients into energy. This energy allows plants to grow.

Figure 1.28 The cycle of nature
Adapted from Nordin, 2005

Activity 1.16 Your place in the cycle of nature

Complete this activity on your own in your workbook

Aim: Understanding the place of humans in the cycle of nature.

Time: 30 minutes

What you must do

1. Draw yourself in the centre of an A4 sheet of paper. Draw or write on the paper:
    - all the different foods you eat.
    - where your food comes from.

2. How do these things (that have become your food) get their own food? Use arrows to show the links between the different elements.

3. What will happen if one of these links is broken or damaged?

Comments on Activity 1.16

Your drawing will have made you more aware of how humans, plants, animals and other organisms of the Earth depend on each other to stay alive. In a natural system all the elements such as soil, water, plants, animals, wind and rocks interact to create the system. The system gets *inputs* such as energy from the sun, gases such as carbon dioxide and nitrogen from the air, water from rain and minerals from broken-down rocks. A natural system does not need artificial (human-made) inputs from the outside, such as chemical fertilisers or pesticides. The system produces waste material but recycles and reuses most of its own *outputs*. Although the system releases water, carbon and energy, these will be taken up by other systems in nature.

What is an ecosystem?

All the living things such as plants, animals and bacteria in a certain area in nature and the non-living things such as soil, water and air interact, through a flow of energy and a cycling of materials, to form a system called an ecosystem.

A natural system is called an **ecosystem.** According to Starr & Taggart 1987, an ecosystem can be defined as follows:

"An ecosystem is a community of organisms functioning together and interacting with the physical environment (soil, air, water) through a flow of energy and a cycling of materials."

1.6.2 Feeding relationships in ecosystems

What did you eat for breakfast this morning? The food you eat supplies you with material for growth, and energy for your daily activities. Let's find out where your breakfast food might have come from. Let's take eggs as an example. Eggs are made by chickens (hens), which eat grains. The grains come from plants such as mealies, sorghum or wheat.

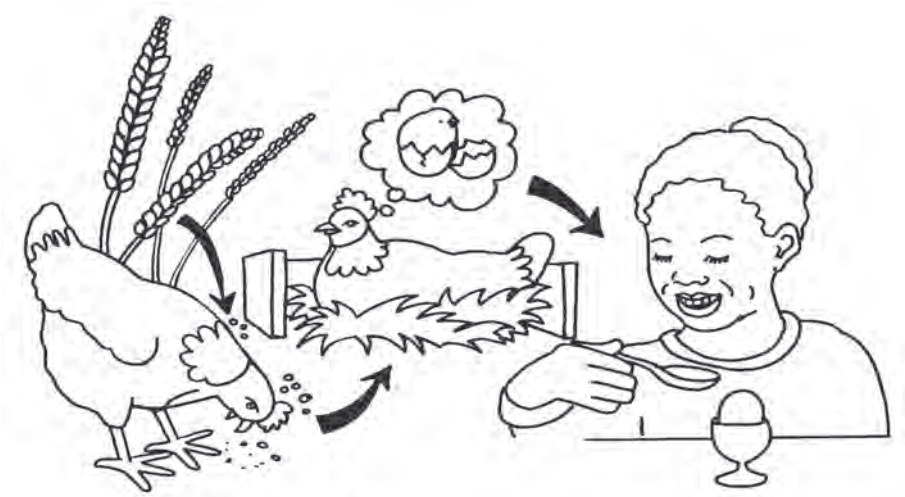


Figure 1.29 A simple food chain

The figure above gives a **food chain**, which shows you the feeding relationships among organisms. One organism provides the food for the second. The second organism provides the food for the third, and so on. The food chain can be written simply as:

Grain (from plants) → Egg (from hen) → Human

The arrows show the direction in which the food passes.

In an ecosystem organisms feed on one another transferring energy and nutrients. How does this work?

What are herbivores and carnivores?

Plant eaters are called **herbivores.**
Meat eaters are called **carnivores.**

- Green plants are able to capture the energy from the sun that falls on their leaves and to change it into a form of energy that can build the plant body. Together with the energy from the sun they also need carbon dioxide gas from the air, water and nutrients from the soil. No other organism on Earth can do this and that is why green plants are called **producers.** The crops in our example above (sorghum, mealies and wheat) are therefore producers.
- Animals that feed directly on plants get some of the energy from these plants to build their own bodies. Plant eaters are called **primary consumers.** Chickens, as indicated in our example, are therefore primary consumers.
- Animals that eat primary consumers get energy from these animals to build their own bodies. These animals that feed on primary consumers are called **secondary consumers.** If you were to eat the chicken in our example, you would be an example of a secondary consumer.
- Animals that eat secondary consumers get energy from these animals to build their own bodies. These animals that feed on secondary consumers are called **tertiary consumers.** If a jackal were to eat the chicken who fed on small worms, the jackal would be a tertiary consumer.
- Living things produce waste and eventually die, but why is the Earth not piled high with waste material and dead organisms? Organisms called **decomposers** break down the dead material into smaller and smaller bits, releasing nutrients into the soil, which can again be used by the plant. If any of the organisms in our example of a food chain were to die, decomposers such as small insects, fungi and bacteria would break down their bodies.

All these feeding levels (producer, primary, secondary and tertiary levels) are called **trophic levels**. Organisms from each trophic level, feeding on one another in a linear series, make up a food chain.

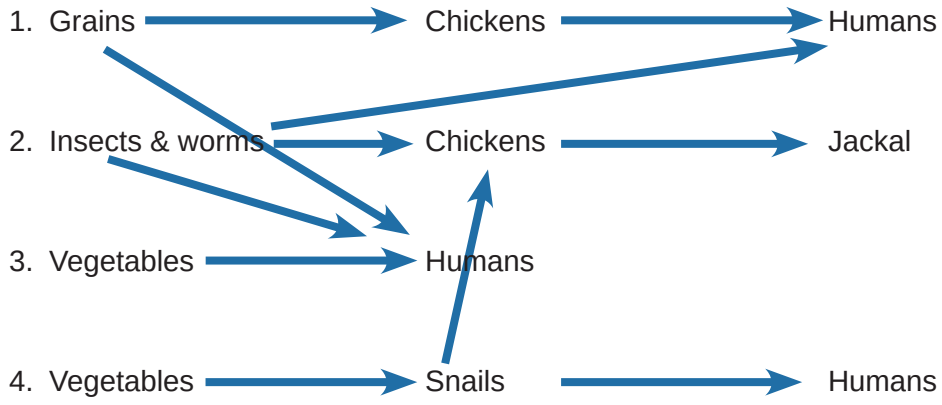
Living in a food web

Let us take a look at the household of Peace. Her household has a vegetable garden, as we have seen in Module 1. A family member also surprised them with a lovely gift; a goat, and a few chickens. Peace was given a project from school, in which she had to draw a food chain that she had observed in her community, and one that she had observed in the natural environment. She observed that the chickens did not only eat grain, but also worms and other small insects. Peace's grandmother was very upset when two of the chickens got into the vegetable garden, and fed on some seedlings. Disaster struck when a jackal caught one of the chickens.

We can show these events as a number of food chains:

1. Grains (Producers) → Chickens (Primary consumers) → Humans (Secondary consumers)
2. Insects & worms (Primary consumers) → Chickens (Secondary consumers) → Jackal (Tertiary consumers)
3. Vegetables (Producers) → Humans (Primary consumers)

Peace then realised that there are connections between these food chains. She made the following connections:



To get a more complete picture of the feeding relationships, Peace observed that the food chains can be combined. In the natural environment we do not find single food chains but interconnected food chains which form a **food web**.

Activity 1.17 Feeding relationships in a dam

Complete this activity on your own in this study guide

Peace observed the feeding relationships between the organisms in a dam and her grandmother's vegetable garden.

She identified the following organisms:

Dam: Fish, frogs, snails, tadpoles (baby frogs), water insects, water plants

Garden: Plants, earthworms, snails, termites, birds and chickens, humans, water

1. Draw a food web, of either the dam or the garden, using the organisms Peace observed.
2. Use arrows to show what eats what, just as we have done in the example above.
3. Also identify which organisms are producers, and which are primary, secondary and tertiary consumers.

Draw your food web in the space below.

Questions

1. Which organisms in the dam or garden will be decomposers and on which trophic levels will we find them?

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2. What will happen when human actions remove all the producers from an ecosystem?

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3. What will happen when human actions remove all the consumers from an ecosystem

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4. How do healthy feeding relationships in ecosystems benefit humans?

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Comments on Activity 1.17

Below is an example of the relationships between organisms that are present in and around an Acacia tree (thorn tree). These relationships keep the ecosystem in balance. The interaction between organisms in a dam is similar to those that occur in the Acacia tree.

The *Acacia sieberana* (umKhamba or paperbark tree)

Acacia sieberana is an indigenous African tree that is found in bushveld and grassland. Let us take a look at some of the relationships that exist around this tree.

- Cattle herders and cattle rest under these shady trees.
- Humans use dry branches for firewood.
- Many animals feed upon the tree:

  The flowers attract beetles, bees, wasps and butterflies. These animals provide food for birds and lizards.

  Buck, cattle and even elephants love to eat the seed pods, which are rich in nitrogen.
- When a browsing animal moves away the seeds are carried away from the parent tree to where there is more space to grow
- The seed is dropped on the ground in a pile of dung. The stomach acids of the animal that ate the pods have broken down the hard seed coat of the seed. Now it can germinate. And the seed has plenty of nutrients in the pile of dung to enable it to germinate. Dung beetles roll the dung into balls. They lay their eggs in the dung balls. The young beetles hatch and feed on the dung balls. Baboons and honey badgers dig up the dung balls to eat the larvae of the beetles. Guinea fowl also search the dung for seeds and insects.
- The dung is decomposed by decomposers and becomes part of the soil nutrients. Micro-organisms also feed on the dead leaves that fall off the tree. The roots of the tree obtain nitrogen in a form it can use with the help of certain bacteria that live in association with the tree roots. This nitrogen is released into the soil when the tree dies.
- The tree provides nesting holes for birds such as barbets.
- The tree also provides oxygen (clean air) for people and other organisms.

There are probably many more relationships that we do not even know about.

Humans can upset the fine balance that exists between all the organisms in and around the tree, when they:

- remove live branches from the tree
- remove or kill any of the animals that feed directly on the tree or on other animals
- pollute the environment in which the tree lives by using poisonous chemicals to kill pests and weeds
- cut down the tree.

Concluding remarks

So far you have become aware that soil, water and air form the basic building blocks of our ecology. We need healthy soil, clean water and clean air to produce the next level of building blocks; healthy plants and animals. With water, soil, air, plants and animals, people can live a good life.

If the soil is damaged or washed away, if the water or air is polluted, then plants and animals become weak and diseased. Their numbers in the ecosystem will no longer be balanced. Since people depend on the natural environment, they too can become weak and diseased. If nothing is done to restore the balance it will just be a matter of time before the whole ecological pyramid collapses. The cholera epidemic which swept through Zimbabwe at the end of 2008, and which is still claiming the lives of hundreds of people, shows what can happen if people do not have access to safe water. Where water is contaminated, due to waste that is not treated and managed properly, bacteria such as the *Vibria cholerae* bacteria can grow and multiply. This bacterium causes cholera, by infecting people's intestines and causing diarrhea, vomiting and leg cramps.

When we as people live, garden and farm in an environment, we change it to suit ourselves and make use of the resources available to us. When we are managing a resource, we are consciously looking at, thinking about and caring for that resource. We need to find the warning and danger signs of overuse or incorrect use. In Unit 3 we will explore the topic of using resources wisely in more detail. However, we first need to zoom in to the link between natural resources and food security which is the topic for Unit 2.

Unit 2:
Natural resources and food security

Introduction

You are aware that healthy soil, clean water, balanced biodiversity and energy all form part of natural ecosystems and that all of these components of ecosystems are vital to ensure balance and stability in nature. They also serve as natural resources for people. We now need to ask three important questions:

1. Is there a link between the availability of, access to, and use of natural and other resources and food security?

2. What is your role as an HFS facilitator in helping households:
   - To find out what natural resources are available in their area?
   - To gain access to the resources that they need?
   - To help them use resources wisely so that they will enhance food security?

3. What are the constraints with regard to resources?

Reflect for a moment on these questions and write your thoughts in the space below.

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This unit consists of the following sections that take into consideration the questions listed above:

2.1 Linking availability, access and use of resources to food security
2.2 Finding out about resources; participatory methods
2.3 Constraints regarding resources

Specific outcomes and learning outcomes

The specific outcomes for this unit are to first of all **analyse resources** in terms of their contribution to food security and then to **assess the state of natural resources** with groups and individuals in an area.

The table below shows you the **learning outcomes** that you will notice are linked to the four sections which are addressed in this unit. They are also linked to the list of assessment activities for this unit. A time estimate is shown for the completion of each activity. This will help you to plan the use of your time. When you have completed the activities, write down the actual time you spent on them.

Learning outcomes	Assessment Activities	Actual time spent
	Workbook activities	
2.1 Linking availability, access and use of resources to food security 2.2 Finding out about resources; participatory methods 2.3 Constraints regarding resources	2.2 Find out about the resources of two villages (2h) 2.4 Draw a resource map of an area (2.5h) 2.6 Draw a transect walk diagram (2.5h) 2.8 The rapid transmission (spread) of HIV/AIDS (1h) 2.10 The inheritance rights of women (1h) 2.11 Gender-related use and control of resources (1h)	
	Assignment Assignment 1: Information for this assignment is contained in Tutorial Letter 101. (3h)	

Key Concepts

Resources
Access to resources
Control of resources
Ownership of resources
Gender
Intra-household dynamics
Macro-level factors
Complementary
Intervention
Technological environment
Socio-cultural environment
Natural environment
Beliefs, attitudes and values
Indigenous knowledge
Constraints
TB
Malaria
Protozoa
Route of transmission
Inheritance laws
Resource mapping
Transect walks
Ranking
Scoring
Physiology
Psychology

Start-up activity

Complete this activity in groups or on your own in this study guide

Do you remember the household of Dikgang whom you met in Module 1? The father has Grade 10, and the mother has few privileges in the household. Dikgang's father was arguing with other male members of the family. The argument was about whether women should have access to and own all resources in a household. What are your immediate thoughts on this issue?

As we have seen in Unit 1, when we think of this or any other issue, we need to think scientifically and look at the issue from different perspectives before coming to a conclusion. You now know how to use the adapted version of Edward De Bono's *Six Hat Thinking Strategy*. We used this adapted strategy in Unit 1 when we looked at an issue through different coloured lenses.

White lenses: White is the colour of paper**.** This lens means that a person would look at the facts (just as books represent facts).

Red lenses: Red is the colour of blood and the heart, and the red lens in a similar way represents emotion. What are my feelings (emotions) on the issue?

Yellow lenses: Yellow is a sunny and bright colour, and the yellow lens represents a view where one looks at the positive side of something. Think about the points in favour of the issue.

Purple lenses: Think critically about the issue, without allowing your emotions to dominate. What are the weaknesses in a issue? What are the problems associated with the issue?

Green lenses: Green is the colour of new growth in plants, and the green lens represents a creative look at things. Think creatively and suggest new solutions for the issue.

Blue lenses: Blue is the colour of the sky. The blue lens represents a big-picture view. Evaluate all the arguments and think about the bigger picture.

You will now use this adapted strategy for the second time, but this time for looking at a different issue.

What you must do

1.Work in groups and discuss the issue below to get your immediate thoughts.

Should women have access to and own all the resources of the household?

2. Each group now looks at the issue from the perspective represented by the:

- white lenses/hats
- red lenses/hats
- green lenses/hats
- yellow lenses/hats
- purple lenses/hats
- blue lenses/hats

3. Discuss each one and write the group's ideas on the flipchart.

4. Come to a final decision on where *you* stand on the issue and write this down in the space below.

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You will gain much better insight on this issue as you work through this unit and the other units in this module.

2.1 Linking availability, access and the use of resources to food security

In Module 1 you learned that food availability, food access, food utilisation and food stability form the basic dimensions of the food security framework that we developed there. Figure 2.1 below reminds you of this framework and shows it as a structure (like a table) with the first dimensions as the three pillars (legs of the table).

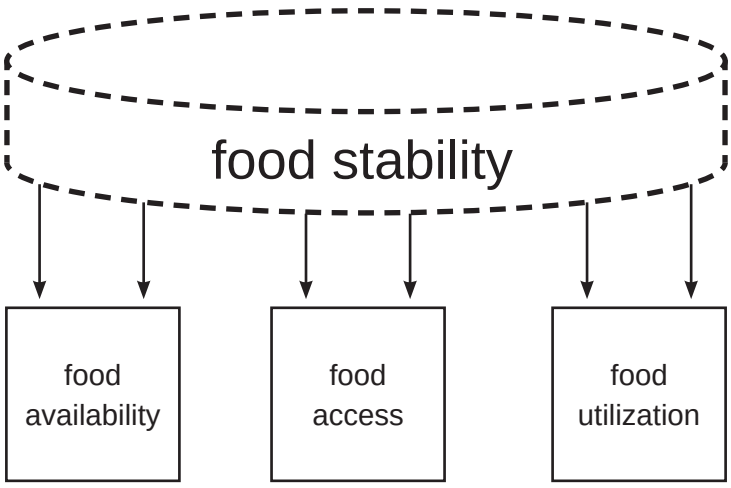

Figure 2.1 The dimensions of food security: necessary and complementary
Refer to Module 1 for definitions of food availability, access and utilization.

All three pillars in the framework shown in Figure 2.1 are necessary and none can sustain food security by itself. All three pillars must also act in a complementary way (be linked) to ensure stability. This means that any interventions that aim to strengthen any one pillar must also enhance or complement the other pillars. If this does not happen, food security will be compromised.

Let us consider the following example: A household increases its food production and income. However, this happens at the expense of taking proper care of the children in the household. The children's food utilisation and health may therefore become at risk. The result will be that the children's food security is compromised. (Source: Local capacity-building in Title ll Food security Projects: a framework). The same is true for natural and other resources. The availability of, access to and sustainable use of resources need to complement each other to ensure stability and therefore enhance food security.

Although our focus in this module is on natural resources, you need to be reminded that the natural environment is but one component of the environment which influences what food people eat and therefore their food security.

2.1.1 The environment and food security

Why do the Sothos, who originally settled in the western parts of the country, and the Nguni's, who settled in the eastern parts of the country, eat different food and follow different customs?
To answer this question you first of all need to remember that both external environmental and internal environmental factors contribute to what people eat and therefore influence food security.

Activity 2.1 Environmental components that influence food security

Complete this activity on your own in this study guide

Look at the mind map below that gives you an overview of the components of the external and internal environment and answer the questions, that follow.

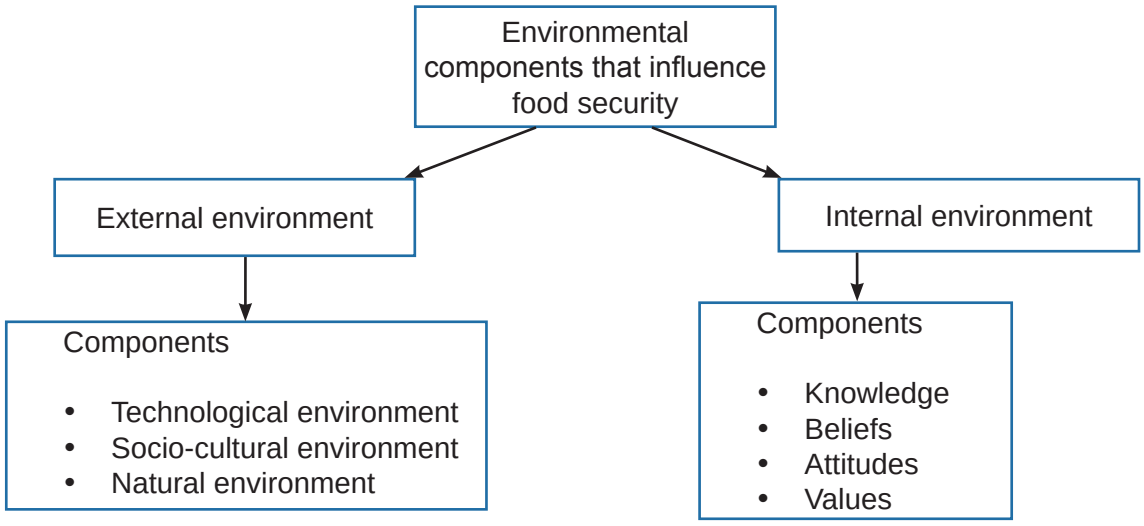

Figure 2.2 Components of the environment that influence food security

Questions

1. What aspects regarding food, do you consider form part of the technological, the socio-cultural and the natural environment?

   The technological environment:

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   The socio-cultural environment:

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   The natural environment:

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2. What is your understanding of *knowledge, beliefs, attitudes and values* regarding the food people eat? How do these influence food security?

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3. Does any one of the components of the environment function on its own, or do all components influence each other with regard to what people eat? Give a reason for your answer.

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4. What is your role as an HFS facilitator in ensuring that all the components of the environment are taken care of?

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Comments on Activity 2.1

The technological environment includes aspects such as food processing, storage, and distribution, which will influence food availability.

The socio-cultural environment includes aspects of:

- *culture* which influences what people eat, especially during special events
- *economy* which will determine what types of food households can buy
- the *educational level* of the household members and its influence on food habits and;
- the *social organisations* within and outside the community and how they affect access to and use of natural resources.

Food processing, storage, and distribution, will be examined in detail in Module 6.

The natural environment in an area will determine whether there is availability of natural resources such as land, water, soil and biodiversity, which, in turn, will influence food production.

Knowledge, beliefs, attitudes and values are important internal environmental factors, which influence what people eat.

- *Knowledge*, for our purposes, refers to a person's range of information gained by experience. Every person has indigenous knowledge about food. People learn about food from other people. They learn about their natural and social environments and build a store of knowledge, which determines what they eat.
- *Beliefs* about food are closely associated with ideas about sickness, health, social and emotional feelings and a physiological state such as pregnancy or breastfeeding.

What is the difference between, physiology and psychology?

Physiology *studies the functions of the body parts of living things, e,g your body parts such as your heart and kidneys.*
Psychology *studies the functions of the human mind especially those affecting behaviour .*

- *Attitudes* toward food, determine whether a person will like or dislike a certain food.
- A *value* is a permanent belief resulting in certain actions being preferred instead of others. The values of a person or group will usually be part of the value system of the society in which they live. Some foods might be valued because they provide prestige, security, and/or hospitality. These values often differ from culture to culture.

What is your role as an HFS facilitator in ensuring that all the components of the environment are addressed?

All of the components of the environment, which we discussed above, influence each other. Therefore, when we examine the influence of the natural environment on food security, we cannot neglect the socio-cultural or the tecnological environments. When we work with households we thus need to consider the following factors:

- Households are different, in both composition and in socio-economic status.
- They may belong to different cultures, within a single community.
- The knowledge, beliefs, attitudes and values of household members.
- Which resources are available to them.
- Who has access to the resources.
- Who manages/uses the resources.
- Who controls the resources.
- Who benefits from the resources.

2.1.2 Availability of, access to and use of resources

Certain areas of South Africa such as where the Sothos settled, have a dry climate with little rainwater or other water available. There are specific wild plants, animals and other organisms adapted to live there. Other areas in our country, such as where the Ngunis settled, have a wetter climate with more rain and a large variety of wild plants, animals and other organisms adapted to live there. The natural environment in which people live needs to be considered when we look at the natural resources that are available to them. What natural and other resources are available in your area? You will have an opportunity to find out later in this unit when you use participatory tools specially meant for the purpose.

Thandi's neighbour has twin daughters. The twin daughters married men from two different villages. The one twin moved with her husband to Village A. The second twin moved with her husband to Village B. We will use the case study of the villages in which the two sisters live to help you explore the availability of, access to and use of resources in different areas.

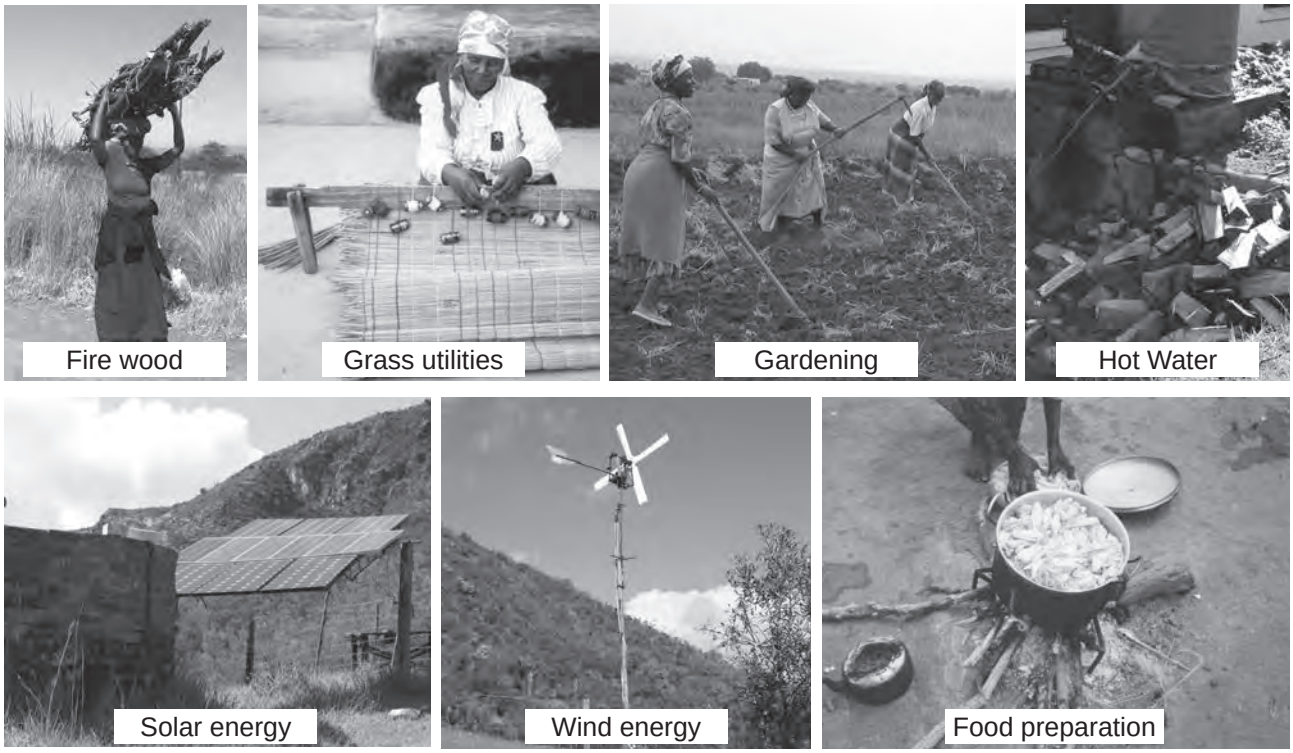

Figure 2.3 Different ways of using resources

Activity 2.2 Finding out about resources of two villages

Complete this activity on your own in your workbook

Aim: Assess and analyse the availability, access and utilisation of the natural and other resources of the two households in the different villages.

Time: Two hours

What you must do

1. Read the case studies below of Village A and Village B.

Village A

Overview

There is no headman or chief ruling the people, but the nearby municipality is responsible for the village in terms of issues such as land allocation for residential, business and project purposes. The village is partly peri-urban in the sense that a small number of households have homestead gardens in their yards.

Natural environment

The climate of the area is warm in summer and cold in winter. There is a good infrastructure and access to basic resources such as electricity and safe water, which is free. Most of the projects running in the village are funded and are successful. Some households have homestead gardens, which form part of a project. This is a way of producing food and the vegetables are sold to other people in the village. Households who participate in the homestead garden project are food-secure because they produce and sell the food and other products and get money to buy other necessities for the household.

Household activities

The household activities are the activities, which household members perform on a daily basis from the time they wake up until they go to bed in the evening. Most villagers are involved in project work during the day, from Monday to Friday. There are nine projects, which consist of the bakery, carpentry, dairy, sewing, poultry, egg and vegetable, brick-making, glass fitting and pillow making projects. In the evenings the women do the household chores, watch TV and socialise with their families.

Household food supply/acquisition

Most households buy their food from the local shops. Only a few households produce their vegetables in the yard. The food mostly purchased is maize meal, rice, flour, sugar, tea, meat (chicken) eggs, milk, vegetables (potatoes, cabbage, onions, tomatoes), tinned foods (fish, baked beans and spices). No indigenous wild fruit, vegetables or indigenous animals are used as a source of food.

Nutritional and indigenous knowledge (IK)

The primary caregivers (women), have little or no nutritional knowledge, and, in addition, have little indigenous knowledge about edible and non-edible plants in the environment. They prefer store-bought foods and do not consult with the older people who still have knowledge of indigenous foods.

Village B

Overview

One chief governs this rural village. External environmental factors play a very important role in the availability, production and distribution of food at the household level. Lack of access to the most important resources such as fuel (firewood) and water is a problem, which affects their food habits negatively. Without access to water, food production remains impossible. Many people are unemployed and depend on other household members to provide money to buy food. Lack of funds (sponsorship) prevents the development of gardening projects, which, in turn, delays development in the village.

The natural environment

The climate of the area is very warm and dry in summer and cold in winter. The villagers can only depend on rain, which has been scarce in the previous year. The people therefore use water from wells, but they are exposed to infection, because the well water is contaminated.

There is limited electricity in the village and firewood is still used as the main source of energy for preparing food. The women collect firewood in the bush (two hours there and back), but, since dry wood is scarce, they are using live branches from the trees or sometimes even cutting down the trees themselves. This is illegal and if the local authority catches them, they are fined.

Communal land around the village is used as grazing land for the animals. Only the households that have formed part of the village for a long time own a piece of land. The chief allocates land, but for newcomers there is no more land.

Household activities

The women face a number of specific constraints that prevent them from increasing their income. In order to prepare food they have to buy paraffin, gas or electricity or they have to steal wood. With the high unemployment rate their only hope for survival is the local forest, which is becoming more and more depleted. Apart from collecting water and firewood, the women are engaged in farming activities (seasonal) such as planting, harvesting and processing. The harvested crops are owned and controlled by their husbands.

Household food supply/acquisition

Basic food such as maize meal, sugar, tea, flour, potatoes and cabbage, is bought from the local shops and the nearest town. The women depend on money from their husbands and their mothers-in-law who are pensioners. Crops such as maize, sugar cane, cowpeas, njugo beans and pumpkin are planted. The food source is supplemented by indigenous foods, some of which are shown in Table 2.1 below.

Nutritional and indigenous knowledge (IK)

Although the women do not have nutritional knowledge, they have IK about edible wild foods. This IK was learned through socialising rather than from formal education. They depend heavily on wild foods, as resources are scarce. Foods prepared such as 'tshima' (sorghum), cow pea and njugo, which is a bean dish, are typical examples of foods, which form part of a balanced diet.

Table 2.1 Indigenous foods eaten by members of Village B

Foods	Sotho/Pedi name	Xhosa/Zulu name	English name
Vegetables	Lerotho Mokolonyane		African cabbage Black jack
Fruit	Mahlatswa Marula		Wild plums Marula
Wild animals	Mmutla Pela		Hare Rock dassie
Birds	Kgaka Mokowe		Guinea fowl Grey lourie

(Adapted from Masekoameng and Molotja, 2003)

2. Draw a table in your workbook, to compare the availability of, access to and utilisation of resources by the households of the two villages under discussion.
3. In your groups, discuss your findings and then individually write a summary of your findings.

Questions

1. Which village can be regarded as the most food-secure? Justify your answer.
2. What benefits are there in collecting indigenous foods from the natural environment?
3. What negative impact can the collection of firewood and indigenous foods have on the natural environment?
4. How can the negative impacts that you gave in Question 3 be reduced?
5. Assume that a major economic disaster strikes, that all the shops close down, and the transport is discontinued. Which of the two villages will be the most food-secure? Justify your answer.
6. Suggest long-term strategies to address the challenges faced by Village B.

Reflect

7. Reflect on your assessment and analysis of resources in the above activity and write down your answers to the following questions:

- What worked well?
- What did you find the most difficult?
- What changes would you make to this activity in the future?
- What have you learned from your experience?

2.2 Finding out about resources; participatory methods

In this section you will find out about a number of participatory methods and tools that can be used to assess the natural and other resources in an area. These are methods and tools that have been designed for use with groups of people to help them analyse their situations and come up with potential actions for change and improvement.

Initially your study group will practice using the participatory methods and tools among yourselves. Once you are thoroughly familiar with them they can be applied at the household and community levels. You can even use them as an individual to help you to understand people's situations.

We use the term **assess** to mean observing, describing and recording the present local situation. As an HFS facilitator you will use a variety of skills such as observing, listening, interviewing, discussing and reflecting, in order to get a clear picture of the current situation. To assess and analyse the issues and relationships within resources use (e.g. availability, access, utilisation), we will look at two participatory methods and tools that you could use with your households.

- Resource mapping and
- Transect walks

Why are these methods important to you? In Unit 4 you will have to work together with a few households to help them assess available resources in their area, analyse their use of resources and come up with workable solutions to improve their use of natural resources.

2.2.1 Resources mapping

We examined the general principles of mapping in Module 2. Now you have an opportunity to apply it to resources by drawing a resource map. Resources might be available in a community, but they may not be accessible to households for reasons such as cultural taboo or ownership.

What is a resource map? A resource map is simply a drawing of the area, which can be used for different purposes. Resource maps can be used to achieve the following:

- To obtain a clear picture of the **physical features** of the area (hills, rivers, wetlands, roads and erosion.)
- To indicate the **natural resources** that are present (forests, grasslands, grazing areas, fields, land-use, types of crops planted, areas under cultivation and irrigation).
- To indicate problems in land-use and resource availability, or access of different groups to different resources.
- To compare the same area at different times. This is called a **historical resource map.**
- To show where actions can be taken to improve the situation. In this case the resource map can be used as a **planning too**l.

The following example shows a resource map of Nthunzi in KwaZulu-Natal.

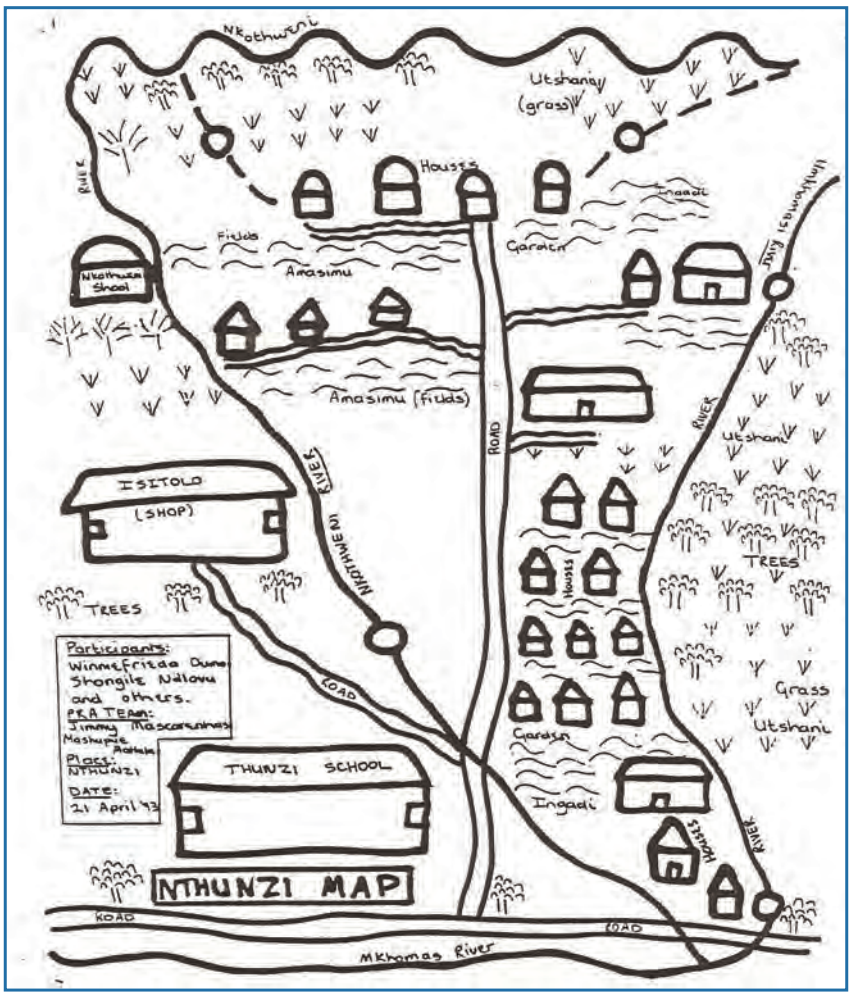

Figure 2.4 Resources map drawn in Nthunzi
(Adapted from Cousins & Kruger, 1993)

Activity 2.3 Read a resources map

Complete this activity on your own in this study guide

Examine the Nthunzi map to find answers to the following questions.

Questions

1. From how many rivers can the community draw water?

……

2. Which natural resources are present in the community?

……

……

3. What physical features are shown on the map?

……

……

4. What do you think was the purpose of drawing this resources map?

……

……

Comments on Activity 2.3

Making a resources map can help people in an area gain a clear picture of the physical features and resources that they consider important. Maps drawn by local people can show their perspective and reveal much about local knowledge of resources and their use of the land, settlement patterns and who controls and makes decisions about the use of resources. The primary concern is not to draw an accurate map but to get useful information about local perceptions of the natural resources.

Drawing the map is only the beginning of the process of finding out about availability and present use of resources. The map is a tool that can be used to stimulate discussion. It is when members of a household or community discuss the issue that real learning takes place that can lead to improved use of resources.

By completing the next activity, you will be practising making a resource map of an area which you know well. This is a group activity.

Activity 2.4 Draw a resources map of your area

Complete this activity in groups or on your own in your workbook

Aim:

Practising in a group of three to five people how to make a resources map that focuses on specific features and issues.

Time: 2.5 hours

What you must do

Here are suggestions to guide you.

A. Plan

1. Decide on a suitable place where you can make your resources map. It can be one of the group member's home villages or an area that all the group members know.
2. Discuss in your group why you want to draw this map. What is its purpose? **Choose two or three features and issues** that you will show on your resources map. If you try showing too many features and issues, it will become confusing. Look at this list for ideas:
   - Physical features: hills, valleys, large rocks, erosion
   - Types of natural vegetation such as grassland, bushes, trees
   - Cultivated areas and agricultural lands showing cropping and crop types
   - Land-use such as gardens, fields, grazing areas, forests
   - Rivers and water points
   - You can also include the village infrastructure such as the boundary, roads, houses, schools, markets, clinics, churches, special places such as sacred sites.
3. Draw up a list of questions to which you want to find answers. Here is a list to give you an idea:
   - What resources are plentiful?
   - What resources are scarce?
   - Where do people go to collect water and who collects it?
   - Where do people go to collect firewood and who collects it?
   - Do people have vegetable gardens and who looks after their gardens?
   - Do people have livestock and who looks after them?
   - What kind of livestock is there?
   - Where do the livestock go to graze?
   - Which resource do people have most problems with?
   - What are these problems?
   - Why are there these problems?
   - What is the community doing to solve these problems?
   - What are households doing to solve these problems?

B. Do

4. Take a walk through the area and make notes of the features and resource issues that you want to investigate. Also note the resources important to your household?
5. As a group, you can make a drawing of the map on the ground first. Mapping on the ground has a number of benefits:
   - It is easily visible to the group.
   - It encourages a lot of discussion.
   - It allows for a lot of detail.
   - It can be changed or corrected easily.
   - You can add to it as the space on the ground is not limited.

   Of course the big disadvantage is that you cannot take your map away. If you want to keep a copy you have to copy it onto paper. If you have access to a camera, you can of course take a photograph of the map on the ground. The diagram below shows a group creating a resources map on the ground and it gives an idea of what it looks like on paper.

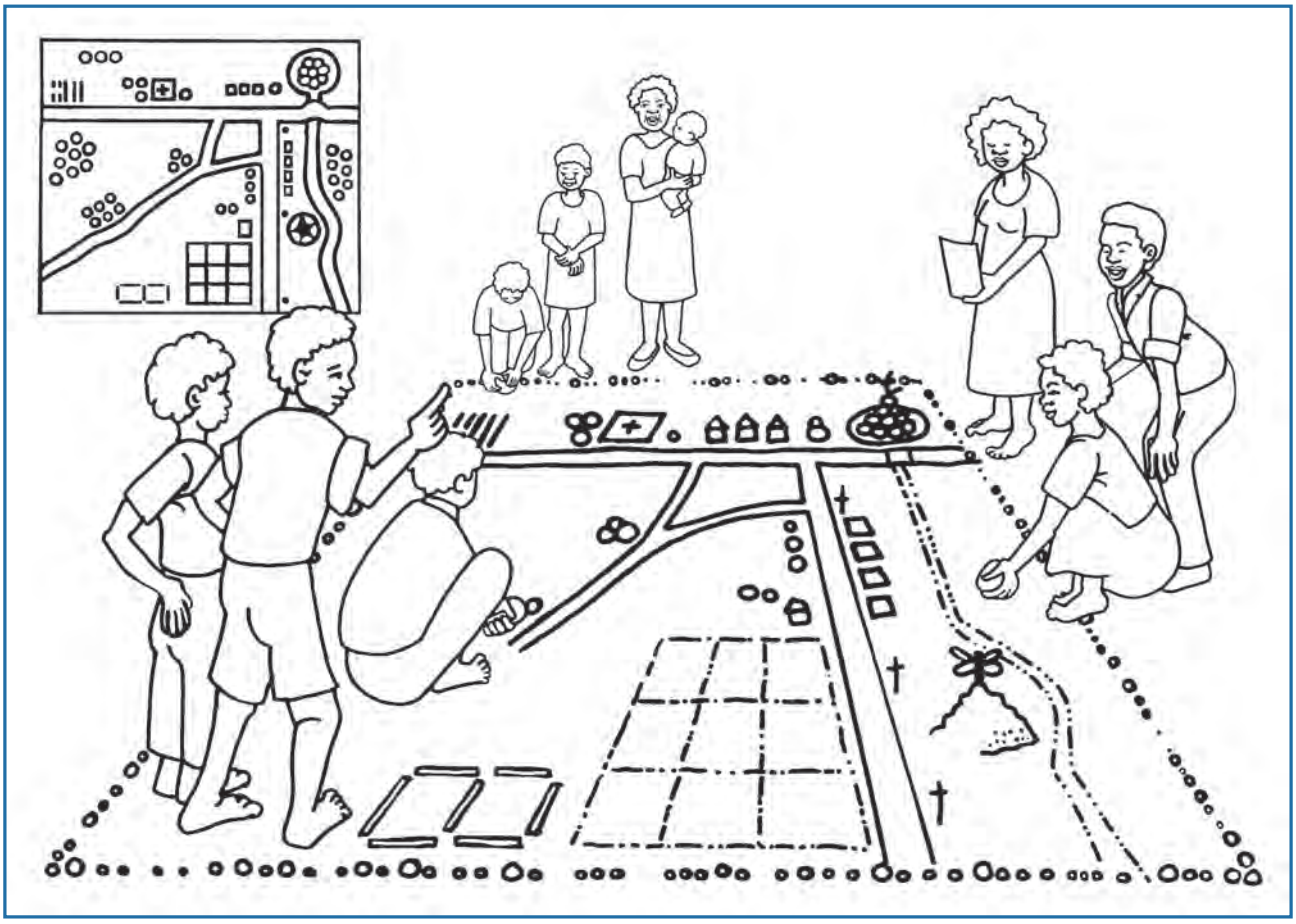

Figure 2.5 A group creating a resources map on the ground

6. Draw your map on paper. You can use colours to show different features.
7. The map is a tool, which should lead to a discussion about resources. When the map is completed, discuss in your group what you have observed about the present availability and use of resources in the area. Use the set of questions you formulated to guide the discussion.

C. Reflect

8. Reflect on your resources mapping activity and write answers to the following questions:
    - What worked well?
    - What did you find the most difficult?
    - What changes would you make to a resources mapping activity in future?
    - What have you learned from your experience?
    - What can your households do to use resources better?

Comments on Activity 2.4

The resources map is a good tool to begin a process with because it is an easy exercise that initiates dialogue among the community members and the facilitation team members. A large open space should be found and the ground cleared. It is easiest to start by placing a rock or leaf to represent a central and important landmark. Participants are then asked to draw other things on the map that are important in the village.

Participants should not be interrupted unless they stop drawing, in which case questions can be asked such as whether there is anything else of importance that should be added.

Finally, the facilitator may want to ask participants to indicate some things that they would like to see in their village that are not currently on the map – in other words to draw a picture of what they would like the future to look like. This allows for some initial planning ideas and encourages people to begin contributing their thoughts at an early stage in the participatory process.

2.2.2 Transect walks

A very useful participatory method for collecting information about an area is to take a transect walk. As you are aware from the information that was provided in Module 2, a transect walk consists of walking through an area and paying attention to specific environmental features, resources and human activities, as well as issues such as water scarcity, soil erosion or any other problem.

Transect walks are sometimes referred to as *observational walks*, because they give the people who participate in them an opportunity to observe, discuss and identify issues of concern to the community. The word *transect,* means a straight line that cuts across a piece of land or area.

Transect walks may be taken in a straight line using the compass points, e.g. north, south, east or west; whichever is the most suitable. Walks can also meander and follow a particular feature in the landscape such as dongas, trees, and water points.

Here is an example drawing or diagram of a transect walk in an area called Tsupaneng in KwaZulu-Natal.

The transect walk for household food security should include the homestead area(s) of the households and features that influence their homestead area and natural resources use.
See Module 2.

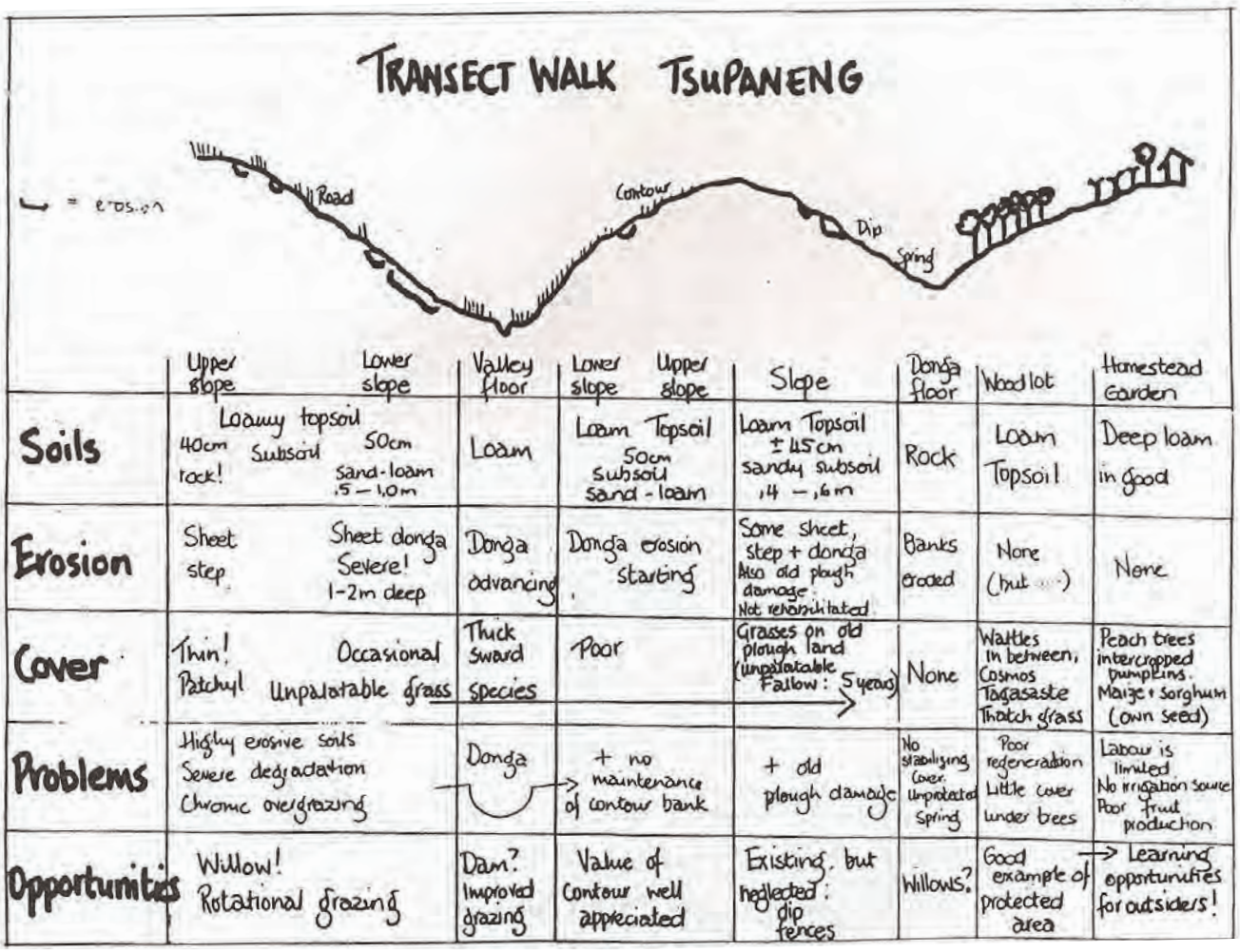

Figure 2.6 An example diagram of a transect walk in Tsupaneng KwaZulu-Natal
(Adapted from Cousins and Kruger, 1993)

Activity 2.5 Read a transect diagram

Complete this activity on your own in this study guide

Examine the Tsupaneng transect diagram to find answers to the following questions.

Questions

1. What kind of soil did the group find in the valley floor, the donga floor and the homestead garden?
2. What kind of trees and plants can be found in the woodland?
3. What crops are grown in the homestead garden?
4. What are the problems occurring on the upper and lower slopes?
5. What suggestions did the group have for the valley floor that is currently a donga?
6. What features and issues did the group focus on in their transect walk?
7. Did you have any problems answering the above questions? Elaborate.

Purpose of transect walks

Before a transect walk is undertaken you have to be clear about the information you want to gather. The group in Tsupaneng, for example, decided to focus on observing and recording soils and soil erosion, which was a big problem in their area. They therefore recorded the natural vegetation and cultivated plants that are growing there. In any transect walk people discuss problems, opportunities and possible solutions and then they record these in their diagram.

Transect walks can be useful for the following reasons:

- They can identify issues related to land, such as land use, crops cultivated, local cultivation patterns, local technology used for irrigation, water/plant/soil conservation, erosion, soil types, local vegetation, use of wild plants, resources in disrepair, and dip tanks.
- They can identify issues related to other resources/facilities, such as the condition of the roads, problems and opportunities relating to water points, plotting water gravity systems.
- In a village or homestead area, they can encourage the discussion of land drainage, sanitation, use of the back yard space, the location of taps, household chores, the state of the dwellings (houses), and interactions between them.

You can use transect walks at any point during an intervention or project cycle:

- as an assessment to establish what the present situation is.
- as a planning device to identify what needs to be done to improve things.
- as a means of monitoring and evaluating resources management, and
- as a development tool to check how successful a project has been.

Activity 2.6 Draw a transect walk diagram

Complete this activity in groups or on your own in your workbook

Aim: Practise in a group of three to five people how to do a transect walk and finalise a transect diagram that focuses on specific features and issues.

Time: 2.5 hours

What you must do

Here are suggestions to guide you.

A. Plan

1. Decide on a suitable place where you can do your transect walk. It can be one of the group member's home villages or an area that all the group members know.
2. Discuss the purpose of the transect walk in your group and decide upon what information you want to gather. Choose two or three features and issues that you want to explore. Look at this list given below for ideas:
    - Land use: crops cultivated, local cultivation patterns, local technology used for irrigation,

water/plant/soil conservation, erosion, soil types, local vegetation, use of wild plants, resources in disrepair or are no longer in use such as dip tanks.

- Resources or facilities: state of roads, problems and opportunities with water points or plotting a gravity water system.
- Village or homestead areas: drainage and sanitation, use of back yard space, location of taps, household chores, state of dwellings and interactions between different groupings.

3. Write a list of questions to which you want to find answers.

B. Do

4. Take a walk across the area in a straight line and make notes on relevant features that you observe. The idea is to stop at regular intervals, say every 500 meters, or every 10 minutes, or whenever a particularly interesting feature is observed. Use the opportunity to get clarity about the issues and discuss the problems and opportunities.
5. After the walk, share the notes you have made with the rest of the group and refine your ideas on the problems for household food security and possible solutions.
6. Involve everyone in the group to help make a transect walk diagram. During this time you will continue to discuss the issues and sharpen your ideas. Check the final diagram. Does it reflect adequately what you have observed?

C. Reflect

7. Reflect on the transect walk and the making of the diagram.

- What worked well?
- What did you find the most difficult?
- What changes would you make to a transect walk activity in future?
- What have you learned from your experience?

2.2.3 Ranking and scoring

We examined the participatory methods and tools of *ranking* and *scoring* in Module 2. However, you need to keep these methods in mind and refer to them when you work with your households. It is important to know which resources are used most and which are scarce.

2.3 Constraints regarding resources

The resources map and transect walk which you carried out in the community have made you aware that there are many constraints regarding access to, control over and the use and management of resources. These constraints affect the livelihoods of individuals, households and communities. Some constraints are difficult to address by households or by the HFS facilitator. Other constraints can be overcome more easily as you will find out when you work through the next section.

Examples of factors that cause constraints include macro-level policies, HIV/AIDS and other chronic diseases, as well as gender-linked constraints. Let us examine each of these in more detail.

2.3.1 Macro-level constraints

Policies, laws, regulations, decisions on **pandemics** (major epidemics such as HIV/AIDS and cholera) and the management of resources such as land, water and the natural environment are made on a macro-level and can cause constraints to food security. The individual, the household and even the HFS facilitator, have little control over these decisions. Refer to Module 1.

So what role can you, as a facilitator, play? Your role is that of a front-line worker who can observe first-hand the effects of macro-economic and other policies on households' management of resources. Whenever possible you need to share your knowledge with higher management advising them on the safety nets required and on groups that are at particular risk of food insecurity.

2.3.2 Diseases and resources

Many of us know of households where the bread winners suffer from serious diseases that impact on the ability of these people to work and their ability to use natural resources effectively and efficiently. These problems affect the food security of such households. HIV/AIDS, malaria and tuberculosis (TB) are three of the major public health challenges facing the world today that impact on food security. While TB is common among adults, it is more serious in children and the youth. Children and unborn babies are very vulnerable to malaria. Early recognition and treatment increase the possibility of recovery without permanent damage. HIV/AIDS, presents its own challenges.

Activity 2.7 Interpret information on major diseases

Complete this activity on your own in this study guide

Look at Table 2.2 which shows statistics on three major global diseases that influence the sustainable use of resources and then answer the questions that follow.

Table 2.2 Major diseases of the world

	Tuberculosis (TB)	Malaria	HIV/AIDS
What causes the disease	The TB bacterium	The malaria protozoan parasite	The HI-virus
Main route of transmission	Air, (cough,sneeze and spit) by people with TB bacterium in their body	Bites of a mosquito with the malaria parasite in its body	Unprotected sexual intercourse (80%)
Vaccine	Yes	No	No
Cure	Yes	Yes	No
Globally infected	2 billion	300 million	42 million

(Adapted from FAO/WHO. 2002)

Questions

1. Which disease has infected the largest number of people?

……

2. What does *route of transmission* mean?

……

3. Is malaria caused by a mosquito? Give a reason for your answer.

……

……

3. Reflect on the impact of HIV/AIDS and other major diseases on the macro and meso levels.

……

……

4. Reflect on the impact of HIV/AIDS and other major diseases on the household and its ability to use resources..

……

……

5. In your groups discuss cultural practices with regard to HIV/AIDS. Write down one of these practices that you do NOT agree with, and one that you DO agree with, in the space provided below.

……

……

……

6. Discuss the link between major diseases and food security and write your response in the space below.

……

……

Commenting on Activity 2.7

Route of transmission means how the disease is spread from one person to the next or from one organism to the next. Chronic diseases have a great impact on all levels of society. On a macro level they cause a reduction in the labour force and a slowing of economic growth. Rural livelihoods often depend on managing resources such as livestock, smallholder agriculture, fishing and/or forestry and HIV/AIDS and other diseases affect production among the labour force and the staff of institutions and support services especially in the rural areas.

At the household level, HIV/AIDS and other diseases have a great impact on households and how they manage their resources and can cause:

- the loss of on- and off farm labour, leading to loss of productivity
- a decline in household income, and loss of assets, savings and remittances
- an increase in household expenditure (medical treatment, transport)
- the loss of indigenous farming knowledge and specialised skills, practices and customs.
- an increase in the number of dependents who rely on a smaller number of productive family members and a few scarce resources.

Cultural practices and HIV/AIDS

'Dry sex" in which the vagina is not lubricated, is desirable in some cultures. However, dryness increases the risk of bleeding during intercourse, leading to increased risk of HIV transmission

So what do you as a facilitator have to do with HIV/AIDS and other chronic diseases?
Your role is first and foremost to listen to the affected men, women and youth, to assess their needs, such as the need for a balanced diet, safe water and appropriate care. Then decide who you can contact for help. You also need to create awareness and provide information on preventing and managing the diseases. The medical aspects should be left to people with expert knowledge in the field.

All of us are aware of the serious threat of HIV/AIDS. The following activity demonstrates just how rapidly HIV/AIDS spreads.

AIDS = *Aquired Immune Deficiency Syndrome, caused by the Human Immuno-deficiency virus* **(HIV)**, *which attacks the immune system.*
People die of AIDS and therefore we refer to their offspring as AIDS orphans.

Activity 2.8 The rapid transmission (spread) of HIV/AIDS

Complete this activity on your own in this study guide

Aim: Gain an understanding of the rapid transmission of HIV by doing an experiment

Time: 1 hour

What you need

A base solution such as NaOH, $Ca(OH)_2$ or KOH; phenolphthalein; test tubes or small glass bottles, water and a little milk.

What you must do

Part A
Read the following information and answer the questions that follow.

The AIDS crisis in Africa

It is estimated that 84% of the world's deaths from HIV/AIDS have been in Africa. Some 90% of HIV-positive babies born are born in Africa. In 1999, the number of new cases of HIV infection in Africa was 300% higher than in the next worst area (Southeast Asia). More than 14 million Africans have already died of HIV/AIDS.

An ever-growing number of children are becoming AIDS orphans. These are children whose parents have died of HIV/AIDS and who have no one to care for them. One of their more serious problems therefore, is food insecurity. According to a former UN Secretary-General, Kofi Annan: 'By overwhelming the continent's health and social services, and by creating millions of orphans, AIDS is causing social and economic crises which, in turn, threaten political stability.'

Questions

1. In groups discuss what can be done to reduce the spread of HIV/AIDS in South Africa.
2. What can be done to help AIDS orphans?
3. Why do we talk of AIDS orphans and not of HIV orphans?

Part B
During the contact session you will be given a small bottle or test tube filled with a solution. As you know, HIV is transmitted through the exchange of body fluids. The liquid in the test tubes or glass bottles **represents** body fluid.

1. Choose four people in your class with whom you are going to share your 'body fluid'. Go to the first person and pour your liquid into his or her test tube or bottle.

2. Shake this liquid in the test tube or bottle of the other person (to mix it), and pour half of it back into your test tube or bottle.

3. Do another three such 'exchanges'.

4. Your tutor will now put a few drops of phenolphthalein in your test tube or beaker. Phenolphthalein is an indicator that colours a base solution pink. All people with pink test tubes or bottles will be considered 'HIV-positive'.

Questions

1. How many learners were 'HIV positive' at the start of this activity?
2. How many learners were 'HIV positive' after exchanging 'body fluids'?
3. Write the increase in the number of people 'infected' with HIV as a percentage.
4. What did you learn from this activity?

Comments on Activity 2.8

An interesting way to discuss the sensitive topic of HIV/AIDS in your groups is to use De Bono's *Six Thinking Hats Strategy.* The table below gives you examples of what you can do.

Table 2.3 De Bono's hat strategy to look at the issue of HIV/AIDS

White lenses/hat (facts, questions)	**Red lenses/hat (feelings, intuitions)**
• Brainstorm high-risk activities (multiple sexual partners, drug users sharing needles, etc.) • Research statistics: How many people in South Africa/my province/ our city/community are HIV-positive? • What is being done to help people who suffer from HIV/AIDS?	• Feelings of anger because many people (maybe close relatives or friends) suffer from HIV/AIDS, sometimes because of unfortunate circumstances such as rape. • Feelings of frustration because government is not seen to be doing enough to help people who are HIV-positive. • Feelings of guilt: I may be part of the problem and not the solution. I might be HIV-positive, but I am still sexually active.
Yellow lenses/hat (positive, why it will work) • Greater focus on educational programmes to advise people about HIV/AIDS. • Assisting people with HIV/AIDS (and their families) to cope with their status.	**Purple lenses/hat (caution, weak points)** • The pandemic poses a serious threat to society and therefore to food security. We are losing many skilled people, and many children become orphans because both parents have died. Children become food-insecure.
Green hat/lenses (creative, alternatives) • People should be educated to avoid high-risk activities. • Anti-retroviral medicines could be made available to all HIV/AIDS patients.	**Blue hat/lenses (overview, holistic)** • Everyone has the responsibility to practise safe sex. • We should support people with HIV/AIDS. It is **our** problem.

2.3.3 Resources and gender-linked constraints

Have you ever had to fill out a form where they ask what sex you are? The word *sex* in that regard is incorrect and they should ask what your **gender** is. *Gender* therefore refers to whether a person is male (man) or female(woman). *Gender roles* refer to the socially constructed roles of, men and women. For example, in certain parts of the world women collect only non-wood products such as herbs, mushrooms and medicinal plants, while the men collect firewood.In other parts of the world men and women

Gender relations *are women's roles in relation to those of men (and vice versa), rather than women's or men's roles separately considered.*

both harvest all these products.

When we zoom in on the role of women in rural households we see that they play a triple role: reproductive, social and productive.

- **The reproductive role**, performed almost exclusively by women, includes child bearing and rearing, household maintenance such as cooking, fetching water and wood for fuel.
- **The social role** or community building is mostly dominated by women and includes arranging funerals, weddings and social events.
- **The productive role**, performed by both women and men, focuses on economic activities.

Why is it important to look in particular at the role of women? If we take into consideration the major roles women perform in households and communities and we want to enhance food and nutrition security in households, then the active engagement of women is absolutely necessary. To make this happen we need to understand who uses and controls the different resources.

Access to resources and services varies greatly among different household members and socio-economic groups. Women, youth and the landless are often at a disadvantage in terms of access to both resources and services. Constraints can therefore be gender-linked and decreased productivity is often the result of gender-linked differences in access to resources.

Activity 2.9 Gender-related use and control of resources

Complete this activity on your own in this study guide

At a household resource management workshop held in Namibia in November 1998, participants from various countries in Southern Africa came up with the information shown in the table below. It shows general **consensus** regarding the roles of men and women in terms of ownership, control, use, management and access to resources in rural areas.

Key
M= men
W= women

Table 2.4 Gender-related access to and control over resources

Resources	Owned by	Controlled by	Used by	Monitored by	Accessed by
Land	M	M	W/M	M	M/W
House	M	M/W	M/W	W	M/W
Water		W	M/W	W	W/M
Wood for fuel	W	W	M/W	W	W
Livestock	M	M	M/W	M	M/W
Finances	M	M	M/W	M	M/W
Labour	M/W	M	M/W	W/W	M/W

Discuss the information in the table in your groups and individually answer the following questions:

Questions

1. According to the table above, are more resources owned by men or women?

……

2. Who controls most of the resources?

……

3. At the household level, who do you think should have more say over resources? Give a reason for your answer.

……

……

4. Should the government play a role in deciding on gender-related access to resources? Give a reason for your answer.

……

5. If the information in the table above were for an urban (city) or peri-urban (outskirts of the city) area, how would the management of the resources differ for men and women?

……

……

6. Discuss and give one example of gender-linked issues concerned with HIV/AIDS

……

……

……

……

"We as women and girls are often unable to negotiate safer sex with our partners. We often take on the role as care-takers of AIDS patients and orphans, which reduces our time to perform other tasks."

Comments on Activity 2.9

Your group may have different ideas as to who should manage resources on a household level. However, we cannot address the issue only from our own point of view. We need to look at it from a more scientific perspective. For example when we look at the access to, and management of water and land and inheritance rights, we find the following:

Water: In many parts of the world, women and girls assume much of the responsibility for carrying water for household use. The lack of water often limits production, and the dry season increases the time women spend on collecting water, especially when it has to be carried long distances. There can be conflicting demands for water within villages and households. For example, there may be a situation where water is needed for both household gardens and the irrigation of larger fields.

Many villages have water users' committees, which are responsible for managing water. The committees should have representatives from different levels and gender in the community, and try to agree on compromises over water needs. The importance of women's water needs compared with those of other activities requiring the same water supply, should be taken into consideration when decisions are made. There should be structures in place to ensure that water resources are not mainly for the benefit of only certain groups of people.

Land: Access to land is a highly sensitive issue, politically, religiously, legally and culturally. The poor in a community typically do not own land but can use it. In many countries, women have less access to and control over land than men. In some cases, legislation says women have a basic right to land, but customary laws and practices continue to prevent woman from exercising that right. In other cases, legislation has undermined women's access to land (FAO, 1998). Women's access is often limited to household and personal crop use through a male family member, and their landholdings are typically smaller than that of men.

Weak inheritance rights: People with weak inheritance rights are particularly disadvantaged if they lose a spouse (for example through death or divorce). Many households affected by HIV/AIDS have had their homes, land and other assets taken from them following the death of the household head. This worsens the situation of poor households, as you can see in the following case study.

Activity 2.10 The inheritance rights of women

Complete this activity in groups or on your own in your workbook

Aim: Identify constraints to and opportunities for better management of household resources.

Time: 1hour

What you must do

1. Divide into small groups of three to four people.
2. Read the case study below and discuss the questions that follow in your group.
3. Each person then answers the questions in the workbook.

The Kantono case study

Kantono was a prosperous farmer in Naboa village, Pallisa, Uganda. He owned large tracts of land on which he grew a variety of crops and kept hundreds of cattle, sheep and goats. He had a large family to support, most of whom were relatives that could not maintain themselves. The family however, provided the labour that his farm required.

In 1998, Kantono's health started deteriorating seriously. He was sickly, very weak and could no longer supervise work on his farm. His relatives blamed it all on his wife Balike, whom they accused of bewitching him to steal their clan's wealth. Despite all the pressure imposed on her by her husband's relatives, Balike remained committed to her 30-year old marriage, which had yielded thirteen children and seven grandchildren.

After some persuasion, Kantono agreed to visit Pallisa Hospital where he was diagnosed with HIV, the virus that causes AIDS, locally known as O'silimu. He calmly accepted his fate but his relatives still blamed Balike for being a Malaya (prostitute) who had brought the disease into the home. Kantono's health worsened and everything in the once well-to-do home, fell to ruin. The crop harvest declined and disaster loomed around the home.

Kantono died at the beginning of 2000 and no sooner had his body been lowered into the ground than his relatives, who had come from various parts of Pallisa, started wrangling over the property he had left behind. Balinke watched the scenes as they unfolded until after Kantono had been buried.

The Kantono case study, including questions for discussion, is reproduced with the permission of Household Agriculture Support Programme (HASP), Uganda (HASP, 2002).

Questions

1. What is the Kantono case study all about?
2. What factors may explain the decline in farm productivity in this case-study?
3. Why do you think Balike was treated in this manner by Kantono's relatives?
4. What can be predicted for the future of the following people and property after Kantono's death:
   a) Balike?
   b) Kantono's thirteen children?
   c) Kantono's farm?
5. What lessons can we learn from this case-study?

Comments on Activity 2.10

You know that a real-life situation as presented in a case study, is a useful way to develop skills, discuss issues or find solutions to specific problems. For example, case study exercises can help to identify constraints to and opportunities for better management of household resources.

The Kantono case study gives people the opportunity to discuss and understand the socio-cultural and economic effects of HIV/AIDS on some of the most vulnerable members of rural households (women and children in particular). People are usually very touched by the Kantono story; many male participants have reacted by saying that they were going to call a family meeting to tell all their relatives what they wanted their wives to inherit in the event of their deaths – in other words, the men wanted to make sure that their wives inherited their land and houses. The following table gives you an overview of common constraints faced by women.

Table 2.5 Common constraints faced by women in relation to financial services and income generation activities

CONSTRAINTS	At the individual and household level	At the intermediary level	At the national level
Economic	• Tend to work in the invisible sectors: casual work, piecework, seasonal work, home-based work	• May lack access to banks/financial services in their own right	• Lack of access to markets if mobility is constrained • Perception of men as controllers of money/loans
Political	• Lack confidence to claim political and legal rights • Lack leadership and lobbying skills • Tend to have a weak bargaining position and to be isolated and less organised	• Women and men do not equally share power and authority in institutions • The overall banking environment is hostile towards women	• May have no legal rights to household assets, hence cannot use these as collateral • Lack political positions to establish/ influence appropriate laws • Lack legal rights to land, both traditional and formal

Institutional	• Apart from access to credit, lack facilities for training, and counselling on what to do with credit • Often lack accounting and managerial skills, and have limited time for business development training	• Many technically competent implementing agencies have little or no experience of operating sustainable savings and credit programmes (are more used to dispersing grants) and lack business development skills	• National institutional procedures may entail bureaucratic delays for loan approval
Environmental	• Natural resources depletion and water scarcities mean women have to travel further to get water or fuel, hence they have less time for income-generating activities	• Governments are beginning to realize that it is impossible to separate development from environmental issues. Because of this interdependence, natural resource management is forming part of the economic decision-making	
Socio-cultural	• Mobility constrained by social norms • Have low self-esteem and may have difficulties valuing own work • Have to balance multiple roles as mothers, economic producers and community workers • View bankers as powerful and important • The language of commerce can be confusing • May not want to take risks • May be too modest and not good at marketing their abilities	• Banks and financial institutions do not view women as a potential market, women's entrepreneurial activities considered as hobbies • Advertisement about sources of credit and application procedures might not reach women	• Women's issues and constraints not viewed as a priority at the national policy level
Demographic	• Take greater responsibility for raising children	• Not enough banks per capita, not enough banks in remote or poor areas, so women have to travel to reach banks	• Large rural to urban migration, hence fewer people to serve in rural areas; policy-makers do not think rural areas require financial services

(Source: Murray and Boros, 2002)

Something to do
Reflect on how you, as a facilitator, will help address the constraints on the individual and household level.

What is your role as a facilitator in identifying and addressing gender-linked constraints?

As an HFS facilitator you will need a good understanding of the roles and responsibilities of both men and women and of the issues surrounding their access to and control over resources. The facilitator must pay particular attention to reaching and supporting the groups who face the constraints. Participatory tools such as **gender analysis** can be used to identify constraints of men and women regarding natural and other resources. Gender analysis tries to answer fundamental questions such as who does or uses what, why, and how. It also involves looking at the division of labour in and among households, examines the access and control that men and women have regarding resources, and reviews the benefits of their labour. Using gender analysis can therfore improve our understanding of who in the household has the over-all decision-making power over resource allocation and who has access to and control over these resources.

Activity 2.11 Gender-related use and control of resources in an area

Complete this activity in groups or on your own in your workbook

Aim: Conducting a gender-related exercise to establish the use and control of resources in your area

Time: One hour

What you must do

1. Brainstorm in your groups and compile a list of resources which you regard as important for your community.
2. Form a female and a male group.
3. Each group must compile a table similar to the one above (Table 2.5) Add columns to your table for different age groups (young, adult, aged) and disadvantaged groups.
3. Assign ticks to each of the resources according to the level of access and control for.

What is meant by *control of resources*?
Someone decides how the resource can be used and by whom. This does not necessarily mean that they own the resources
What is ownership of resources?
A resource such as land can be owned by someone while another person uses it or decides about its use.

Questions

1. Which resources do women and men (and the young and old) use? Are there differences in their use according to gender, age, social group? What access and control do disadvantaged people have?
2. Who decides about the use of these resources?

3. Who has ownership over the resources (the right to sell or give them away)?
4. What are the main differences between women and men when it comes to the type of resources they use, control, or have ownership over?
5. Among women and men of different socio-economic groups, who are the resource-rich? Who are the resource-poor?
6. What is the relationship between women's labour and their use and control of resources? What are the links between men's labour and their use and control of resources? Give information on other relevant groups.
7. How will the death of a male (or female) adult in the household change the access, control and ownership rights over resources, including land, of the surviving partner? What happens to the children in a household when both parents die?
8. What services and structures in the community can support rural women and men in managing resources and improving their livelihoods? Give the same information for disadvantaged groups, different socio-economic groups, grandparent or child-headed households, as well as households taking care of sick relatives or orphans.
9. Discuss your data in your male and female groups and each student should then write a conclusion in his or her workbook.

Reflect

10. Reflect on the gender-analysis activity and write answers to the following questions:
    - What worked well?
    - What did you find the most difficult?
    - What changes would you make to the activity in the future?
    - What have you learned from your experience?

If we do not have good quality natural and other resources available, or access to them or do not use them sustainably, it can lead to various degrees of food insecurity.

Jiggens et al. (1997), summarises the constraints faced by rural women as follows:

- The legal and cultural status of women which affects the degree of control that they have over productive resources, inputs such as credit and the benefits that flow from these.
- Property rights and inheritance laws, which govern access to land and other natural resources.
- Ecological factors such as the seasonality of rainfall and the availability of wood for fuel.
- Economic factors such as product market failures.
- Gender-determined responsibilities such as feeding the family, which leave less time for other activities that generate income

In Unit 4 you will get an opportunity to conduct a gender-related exercise regarding access to and control of resources with your households.

Concluding remarks

The main concern in this unit was to find the link between the natural and other resources and food security and to establish your role in using this link to contribute to food security of households. We use participatory methods such as resources mapping and transect walks to find out about the availability of, access to and use of resources in an area which is familiar to you.

An ongoing challenge for people in an area is to access and utilise the available natural resources in ways that are sustainable and which will contribute to the stability dimension of food security. There are many examples in South Africa and elsewhere of people in rural areas who have developed good practices and are using their resources responsibly. When you work with people in a community, try to find out as much as you can about their traditional or indigenous practices that are sustainable. There are of course also many examples of poor resource use actions and these will also become evident when you start to interact with people in an area. How to use our natural and other resources sustainably is the topic of our next unit.

Unit 3:
Using natural resources wisely

Introduction

In Unit 1 we examined the natural resources of water, soil, biodiversity and natural energy that we have available to use to our advantage. In this unit you will discover how to use these resources sustainably (wisely) not only in day-to-day living, but also when you design a food or other garden in your area. Why is this important? As the number of people increases, our effect on the Earth becomes bigger and resources are coming under more pressure. Abuse of resources is causing major problems which in turn is impacting on our lives on many levels, including that of food security.

When we reflect on how we use our natural resources at present and what we can do to use them more sustainably, one place that we can go to for answers is to the rich indigenous knowledge our ancestors passed on to us. They enjoyed food security, because they knew how to use their natural resources wisely. What did our ancestors for example know about managing water resources? Read the following story on *Sweet Water*, and decide for yourself!

Sweet Water ("Amanzi amnandi").
(Water fit for household use)

Even before the time of the Zulu King Shaka, sweet water was called "amanzi amnandi". Shaka's mother was called Nandi and it is said that because it was not considered respectful to use the queen mother's name in this way, Shaka referred to sweet water as "amanzi amtoti".
*(**Comment:** This is how the town of Amanzimtoti, south of Durban, got its name).*

Before they use it many people of Nguni origin will first sniff, smell and taste water, collected from a river, spring or well for their daily household needs.
*(**Comment:** Water quality scientists today still have people smell and taste household water. Our Human senses give us very good clue as to whether water is good, clean and fresh).*

Historically, water was usually collected in areas where people could hear it running over stones or dripping down rocks.
*(**Comment:** This water collects oxygen and well-oxygenated water helps natural biological processes that cleans the water).*

A water source would always be approached with care so as not to frighten crabs and other small water animals. When disturbed, their movement would stir up sediment (mud from the bottom of the stream or river) and the water collector would have to wait for the sediment to settle. The surface film (top) of the water was brushed aside for "sweet water" to be collected.
*(**Comment:** Sediments and surface films have a higher number of disease-causing bacteria than the middle waters of pools and rivers. Today scientists take water samples below the surface film, being careful not to suck up sediment. In this way, they obtain consistent (always the same) and reliable measures of bacterial contamination).*

Clay pots were filled with water and covered with a collecting bowl, a piece of skin or a mat made from incema grass. The water would thus stay cool and fresh.
*(**Comment:** Water absorbed through the sides of a porous clay pot will cool the contents. Most water bacteria cannot reproduce in cool, dark conditions. In earlier times, great care was taken to scour out the white build-up of calcium in water pots, so any harmful microorganisms living there were removed. Also of note is that when the grass "lids" and head rings for carrying pots became old they were simply thrown away (discarded) and new ones were woven. Discarded lids did not pollute the river like today's bottle tops and plastic waste).*

There were many other customs and traditional practices surrounding water. Children were warned that urinating in a river would change them to the opposite sex!
*(**Comment:** This myth was probably sufficiently frightening to prevent people urinating in streams and rivers. This would have limited a disease like bilharzia. The bilharzia parasite is passed on from human urine and faeces to small water snails. From these, its life cycle directs the disease back to people through the river water).*

It is also said that it was not advisable to collect water from a river after heavy rain at the start of the annual rainy season. Indigenous common sense told people to put out pots to collect rain-water. River water would again be collected four days after the rains stopped and the water had cleared.
*(**Comment:** Heavy rains wash human and animal waste into rivers. This means that the harmful bacteria in the waste are also washed into the water. When people drink it they become ill. In KwaZulu-Natal, health workers have to warn rural people not to collect river water after heavy rains since few remember the earlier Nguni practice of collecting rain-water only four days after the rains have stopped).*

Today human and livestock numbers have increased vastly, catchments have become degraded and rivers are often polluted dumping places. Why are the indigenous practices discussed above relevant for us today? Learning about historical water collection and storage practices can develop a respect for our ancestors and might also help our understanding of water quality issues.

(Adapted from Share-Net, 1996)

Reflect

Reflect for a moment on the Nguni way of managing water. Do your cultural group offer specific ways to manage water? Why is indigenous knowledge so important for us, even today? How can indigenous knowledge help us to manage our natural resources in such a way that it will enhance food security?

……

……

……

In this unit we are going to explore how you will be able to grow and eat more, using less!

This unit consists of the following sections:

3.1 Eating more using less (low input principles)
3.2 Water management
3.3 Soil management
3.4 Managing biodiversity
3.5 Managing energy resources
3.6. Thinking about a design plan for your homestead garden

Specific outcomes and learning outcomes

The specific outcomes for this unit are:

- to determine the impact of natural resource use on the environment and people, and
- to explore various knowledge systems for an alternative resource management option.

Learning outcomes	Assessment Activities	Actual time spent
	Workbook activities	
3.1. Eating more; using less (low input principles) 3.2 Water management 3.3 Soil management 3.4 Managing biodiversity 3.5 Managing energy resources 3.6 Thinking about a design plan for your homestead garden	Start-up activity (30 min) 3.2 Audit of catchment areas (1h) 3.3 Selecting water-wise plants and animals (30 min) 3.5 Make a line level (1h) 3.6 Using a line level to measure a slope (30 min) 3.9 Causes of soil erosion in your area (2 h) 3.10 The wise use of biodiversity in your area (1 h) 3.13 Making a solar cooker (1 h) (Optional) 3.14 Creating a design plan (4 h)	
	Assignment Assignment 1: Information for this assignment is contained in Tutorial Letter 101. (3h)	

The table above shows you the **learning outcomes** that you will notice are linked to the six sections which are addressed in this unit, and also to the list of assessment activities for the unit. A time estimate is shown for the completion of each activity. This will help you to plan the use of your time. When you have completed the activities, write down the actual time you spent on them.

Key concepts

Sustainable use of resources
Natural resources
Low input
Deforestation
Insulated
Solar energy
Greenhouse effect
Pollution
Fossil fuels
Acid rain
Erosion
Water table
Catchments
Riverine vegetation
Sink
Swales
Used water
Grey water
Irrigation
Soil erosion
Desertification
Tillage methods
Biomass
Green manure
Gulley
Mulch
Fire break
Fire guard
Perennial plants
Legumes
Compost
Permaculture

Start-up activity

Complete this activity in groups or on your own in your workbook

Aim: Gain an understanding that the Earth is as fragile as an eggshell, when the resources it provides us with are not used sustainably.

Time: 30 minutes

Fragile means it can break very easily, as the shell of an egg breaks when you do not work with it carefully

What you will need

Two balloons, a streamer, three pieces of string, each 30 cm long, an A4 sheet of paper, a paper clip and an uncooked egg (a whole raw egg).

What you must do

1. Work in small groups, and use the materials provided to build a structure to protect the egg.
2. This structure should be strong enough, so that when the structure, with the egg in it, is dropped from a height of 2 meters by a member from another group, the egg should not break.
3. After you have done this activity, each person should answer the following questions.

Questions

1. Did your egg break, or was the structure effective in protecting the egg during the fall?
2. An egg can easily break. Are there any lessons from this activity that we can learn regarding our Earth? What is the link between an egg that can easily break, and our Earth and its resources?
3. Why is it important that we take good care of planet Earth and its resources? Reflect on this question.

You will gain a much better insight into human activities that impact negatively on natural resource as you work through this unit. We'll also examine the sustainable management of natural resources and how this links to food security.

3.1 Eating more using less (low input principles)

Before we focus on how to implement low input methods when we are thinking about starting a homestead garden, a flower garden or any other project that uses natural resources, it is important to consider what *low input* means.

3.1.1 What does low input mean?

Low input is a way of thinking and living that encourages people to think about things and do in different ways than they have before. When we apply the low input method to the use of natural resources, this new way of thinking and living will result in using fewer resources, to get more and better results. Let us look at this more closely.

Life requires input – without input there wouldn't be life! We must have 'inputs' of food, water and air, or our bodies will not provide us with 'outputs'; for example, energy for life processes. We must ask the question, "Do we need to make a big input to get a big output?" The answer is *No*! For our purposes low input means using the natural resources that are available to us in such a way that they are sustainable (low input) for maximum benefit concerning food security (high output). In other words, we are going to examine how to use less (use fewer resources) and eat more by producing more food. Low input *is not* specifically for the poor or the rich. It is for anyone who cares about the Earth's resources and leaving this Earth a better place, not only for the next generation, but also for our own future.

The low input method considers all impacts from each system, including the psychological, social, environmental and economic systems on sustainability. In other words, the choices that we make in life can affect ourselves, other people, the soil, the water, the air, biodiversity, energy resources and the local economy. Your role as a facilitator is to empower the people you work with, by helping them to gain an understanding that we are part of the cycle of nature. This means that all things are connected, and that what happens to the Earth, happens to all the living things on the Earth.

> *Do you remember what **psychological** means? If you do not, refer back to Unit 2*

In 1885 the American Indian, chief Seattle, said the following, in a letter to the President (adapted):

What are people without the plants and animals in the natural environment? If all the plants and animals were gone, people would die from a great loneliness of spirit, for whatever happens to the plants and animals, also happens to people. All things are connected.

Examples of low input thinking

One example of a low input method would be to consider the impact of additional watering of your plants. If you put the additional time, energy and water into the plants, will they give you a higher yield? Is that higher yield worth your time, energy and water expenditures? Sometimes the answer will be *Yes.* At other times the answer will be *No.* It depends on your situation.

Another example is that you may decide to divert a stream to build yourself a fishpond that will improve your income, your diet and your water supply. However, if you divert the stream completely, without allowing the water to continue to flow in its original direction to people downstream, the impact on their lives could be very negative and their reactions may not be worth your inputs. Instead you may think of changing your design to eliminate or reduce such negative impacts.

3.1.2 Basic principles of low input

Before you start using the low input method, you need to consider a number of principles:

- **Focus on local resources**

You need to use what is available in your area, such as local trees and other plants and animals. Using local resources often takes less input (such as water, fuel, money and time). Resources such as local foods, trees, animals, and cultures are becoming lost and their importance is being forgotten.

- **Focus on solutions; not on problems**

It is easy to get side-tracked by problems concerning the availability of, access to and utilisation of natural resources. However, you need to stay focused on helping people move towards creative solutions for these problems. We will examine many solutions. Also, very often the people whom you work with will come up with creative solutions themselves.

- **Encourage creativity**

Help people think in different ways and develop common sense approaches when addressing problems regarding natural resources. You, and the people whom you work with, may discover new solutions to old problems through your creative thinking and discussions.

- **Help people explore different ways of thinking and doing**

There is an old saying: “There is more than one way to skin a goat”. This means that there is more than one way of doing things. When you consider natural resources for food security, take aspects such as the situation, the culture of the people, and the time of year into consideration. There are many outside influences that will guide you.

- **Look to nature for lessons**

Nature can teach us a lot from its systems, its way of interacting, its way of promoting health and survival without outside human inputs. We can gain ideas, understand issues better and build inspiration from time spent in nature.

- **Seeking diversity**

Natural ecosystems consist of many different plant and animal species interacting with one another. For example, different types of plants grow together to protect themselves against pest and disease attack. Animals feed off a variety of different plants at different times. We need to apply this principle of diversity when we decide on which plants to use for our homestead gardens.

When we want to successfully use low input methods, we need to consider all the resources in the area. We need to manage all the water resources including the grey water and potential roof catchments. We need to take into account the organic waste resources for soil health, the plants and animals from the wild and the alternative energy resources that are available. These topics are the focus of the rest of this unit.

3.2 Water management

Imagine it is the year 2015... and the Earth does not have sufficient fresh water. How will we and the natural environment that supports us, survive? Reflect for a moment on this question. What human actions might cause water to be so polluted and so unavailable that the Earth, and all things living on it will suffer? What can we do to manage this scarce resource?

3.2.1 How do we disturb the water cycle?

We explored the water cycle in Unit 1. Now we will look at human actions that cause the water cycle to be disturbed:

- **Polluted (poisoned) air**

  If we pollute our air with chemicals, the burning of plastics and tyres, veld fires, or exhaust gases from cars, then precipitation (rain, dew, snow) will pick these harmful particles up along the way.

- **Clearing the land**

  Removing all the ground cover by cutting trees and other plants, means that the rain does not slowly seep into the soil, but runs off the surface of the soil instead. Water is also unable to evaporate into the air without trees and other plants. Sweeping the soil is another problem that can cause it to become compacted and hard and also preventing rainwater from seeping into the soil. Covering the earth with tar and cement surfaces also prevents the water from sinking into the soil.

What are some of the results of disturbing the water cycle?

- **Acid rain**:

  Precipitation that combines with certain pollutants (poisonous substances) in the air, causes the rain water to destroy plants, buildings, and is also bad for human health. The term *acid rain* is mostly used in 'industrial' countries that use a lot of fuel and chemicals, of which South Africa is one. Acid rain caused by industrial countries also affects other countries as well, as it moves along with the air currents.

- **Erosion and floods**

  When plants are removed and surfaces are covered with tar and cement, or the soil is compacted, water runs off the earth, taking with it the top layer of soil. Some of this run-off, fills up our drainage ditches, causes dirt and chemicals to build-up in our rivers, and poisons our unprotected wells.

- **Low water table**

  In Unit 1 you learned that the water table is defined as the upper boundary of the underground water. What should the normal water table in South Africa look like?

  - **Normal rainy season water table:** The water table differs depending on the season for example during the rainy season in South Africa the soil should become completely saturated by the end of the rainy season. At this point, the water table would reach as high as the soil's surface.

  - **Normal dry season water table:** During the dry season, the water table eventually lowers as water is lost to evaporation and absorption. Many deep-rooted plants and trees, such as perennials, are able to tap into the water table to survive until the arrival of the next rains.

What is the impact of human activity on the water table? The water does not have time to sink into the soil because of the impact of human beings and the design of buildings. The result of this is that the ground water does not fill up, leaving living organisms, including humans, without sufficient water.

Activity 3.1 Healthy and unhealthy water tables

Complete this activity on your own in this study guide

Look at Figure 3.1 below, and answer the questions that follow.

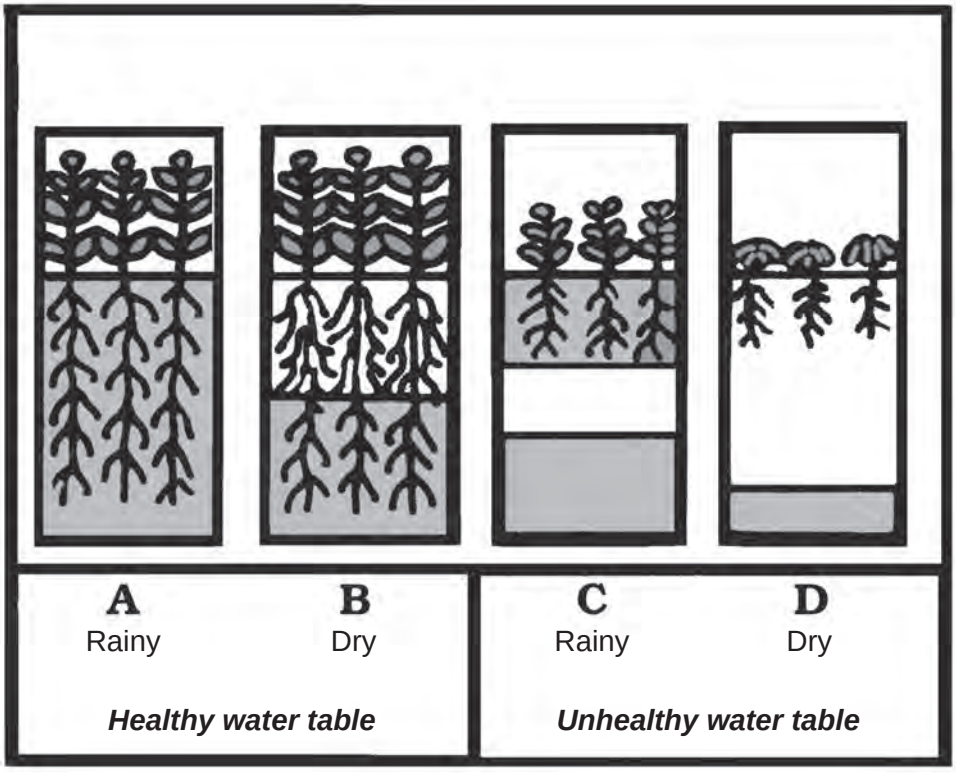

Figure 3.1. Human impact on the water table

Questions

1. Write a paragraph in which you interpret the figure above.

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2. Name at least five factors that could lead to the unfortunate situation depicted in sketch D.

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3. Suggest ways to prevent the unfortunate situation shown in sketch D.

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Comments on Activity 3.1

The shaded area in each box represents the level of the water table:

- **Box A** shows how the soil *should* look towards the end of the rainy season. The water table is fully saturated and the roots are able to go deep into the earth.
- **Box B** shows the dry season when the water table begins to lower. However deep rooted plants and trees can still survive.
- **Box C** shows the water table at the end of the rainy season, where there has been a lot of human interference. You can see that the soil's surface has absorbed some moisture, but it has not seeped to the bottom layers. This results in plants not being able to grow successfully, because of limited water. These trees and other plants are very vulnerable in any dry period.
- **Box D** shows what problems result during the dry season when not enough water seeps into the soil during the rainy season. The plants and trees have not had a chance to reach the lower levels of the water table so they can't survive dry periods. In this situation the water table and ground water have not had a chance to fill up which will create problems such as wells drying up and rivers running dry. This makes it more difficult to find useable sources of water.

3.2.2 How do we disturb catchments?

In Unit 1 you learned that a watershed and its catchment consist of the land from which rainwater flows into wetlands, streams or rivers. What happens when we disturb our catchments?

Activity 3.2 Audit of a catchment in your area

Complete this activity in groups in your workbook

Aim: Use a checklist to identify the human activities in a catchment in your area

Time: One hour

What you must do

Work in groups and use the checklist in your workbook to observe what happens in your catchment area.

Example of a checklist

1. Describe the settlement pattern in the catchment (developed, developing or informal).
2. List land activities in the catchment (what people do and how the land is used)
3. Note the distance of human activities from the banks of rivers, streams or erosion gullies.
4. Note the condition of the riverbank vegetation. Observe any **alien plant** and erosion problems)
5. How do people dispose of waste? Are there landfills or rubbish dumps?)
6. Note any loss of indigenous vegetation (in other words, changes due to farms and plantations such as pines and bluegums).
7. Note wetland and groundwater disturbance/contamination.
8. Other observations.

Questions

Answer the following questions in your workbook.

1. Has the catchment been changed and **degraded** over time?
   Speak to older community members to find the answer.
2. Do the wetlands release clean water all year long?
3. Explain how the **riverine vegatation** (plants along the river) provides flood protection.
4. Is there pollution that might be prevent the river from meeting human needs and from supporting animal life?
5. How do the people in the catchment dispose of waste?
6. Rank the quality of your catchment according to the following score.

What are alien plants?

Alien plants *are also called exotic plants. Examples are pines, bluegums and blackwattle. They were brought into an area by people.They grow in our natural areas and use large amounts of water.*

Indigenous plants *grow naturally in an area. They use less amounts of water than alien plants.*

BAD	NOT SO GOOD	GOOD

7. What influence can the quality of your catchment have on the quality of the lives of the people in your area?
8. How can the quality of the catchment in especially rural areas influence food security?

Reflect

9. Reflect on the above activity and respond to the following questions:
    - What worked well?
    - What did you find most difficult?
    - What changes would you make to this activity in the future?
    - What have you learned from your experience?

Comments on Activity 3.2

Many of the river catchments of southern Africa have been changed by historical land use practices, settlements and industrial growth to cater for a rapidly growing population. Why does it matter if catchments are abused? Wetlands in catchments filter and hold water, slowly releasing it into the surrounding habitats and communities. The natural riverine vegetation performs this function in catchments. The roots of the plants form an enormous sponge which serves not only to store the water in the rainy season but also to filter and release it during the dry season.

How does a **sponge** *work?*

Many people use a sponge to wash their bodies with. If the sponge is put into water it quickly absorbs the water and then slowly releases it.

A number of factors have contributed to degradation of catchments of waterways, these include:

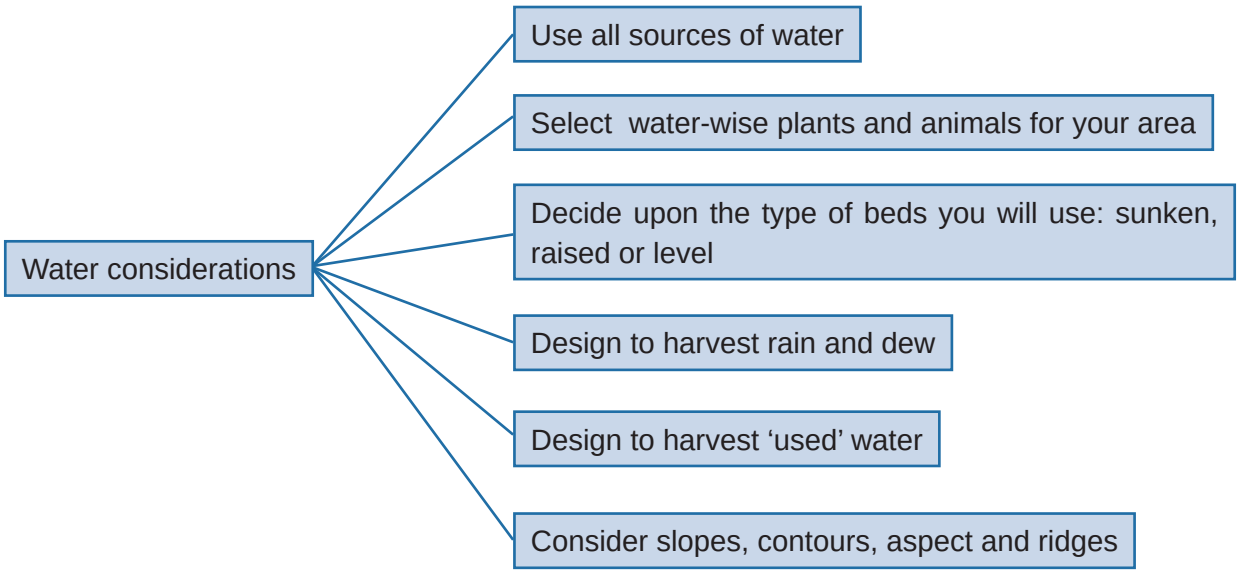
1. The drainage of wetlands
2. The destruction of vegetation in mountain catchments (through fires and farming)
3. The removal of riverine vegetation
4. The increase in erosion
5. The leaching of fertilisers from farmlands
6. The inflow of **effluent**

Catchments must therefore be managed carefully and a balance must be kept between land use and the conservation of sensitive areas. We therefore need to use catchments sustainably. Everybody can play a role in doing this. It is not only the responsibility of other people! This will ensure a good quality of life and a safe and healthy environment.

3.2.3 Water considerations when designing your homestead garden

In the final section of this unit you will design a plan for a homestead garden in your area. When you understand how to follow nature's lead in managing water you can use it to your own advantage. At the same time you will be protecting the water cycle so that it can continue to function effectively. In this section we will examine practical and wise water considerations to bear in mind when designing your garden.

You need to consider the following:



Something to do
Before you continue reading, discuss the six low input water considerations named above and suggest how each one can be implemented. Some of you may have valuable inputs to make in this regard. When you work with households encourage them to share their own valuable experiences. The next section includes suggestions for implementing the six low input water considerations.

Use all sources of water

First we need to consider all sources of water. What does this mean?
We normally think of sources of water as rain, dams, rivers, marshy areas (wetlands), and ground water. But are these our only sources of water? Think again! Can the water we use for washing dishes, clothes, our bodies, our homes, our cars, be used again? You therefore need to realise that we have many sources of water that could be used to help us grow foods.

Select water-wise plants and animals for your area

As part of water management, it is important to learn what types of plants and animals are suited to the area in which you live. Some plants need a lot of water. Others prefer dry sandy areas. People often blame other factors, such as the weather, or drought, crop failures or poor animal health, but often it is because people have selected a crop that will not do well under local conditions.

Activity 3.3 Selecting water-wise plants and animals for your area

Complete this activity on your own in your workbook

Aim: To identify suitable, water-wise choices of plants and animals in an area

Time: 30 minute

What you must do

1. In groups discuss and make a list of examples of crop plants and farm animals that have high, medium and low water needs.
2. Which of the plants and animals that you listed would be suitable for your area?
3. Do people in your area make water-wise choices in their selection of plants and animals? Give a reason for your answer.

Comments on Activity 3.3

High water needs (marshy areas such as wetlands)	Medium water needs	Low water needs
Bananas, sugar cane, fish, ducks  	Maize, exotic plants (from other countries), vegetables, most cattle    	Indigenous vegetables such as cowpeas, bambarra nuts, sorghum, millet, peanuts, pumpkins, tomatoes and many indigenous trees like the marula, chickens, Nguni cattle     

There are many more examples which you might have included in your answer.

Decide upon the type of beds you will use: sunken, raised or level.

You need to decide what type of beds you should make for dry or wet areas. Preferably you will design and make your beds at one go and never make them again, so some thought needs to go into what the area looks like in the dry and wet seasons.

Dry areas: Sunken planting beds (basins)	Wet areas: raised planting beds	Level planting beds
Basins help to collect water and guide it down to the roots of the plants. These can be large basins for larger trees and plants or small basins for smaller plants. Some people like to have sunken beds for their whole garden, but make sure that your soil can handle that, since there is a lot of rain that will gather in the beds which might flood and drown your plants! After digging a hole the size you need for your tree, seed or seedling, plant the item low in the hole so that the earth you replace in the hole is less than you took out of the hole. Adding compost to your bed means that even less of the hole's original soil goes back into the hole. Extra soil can be used to create a ridge around the basin, or you can use the displaced soil somewhere else. You can help to strengthen the basin by placing stones, soil or other material in a circle around the hole (or semi-circle, if you are on a slope), and/or by using a stone mulch in the basin, which is very useful when there are chickens around. Always add mulch as the last step so that the soil is always covered! If you are using a stone mulch, you could also add a layer of organic matter before putting on the stones, to add a little more nutrition for the tree or other plants.	If your soil has plenty of water, or the crops you have chosen do not like water, you would choose just the opposite of sunken beds. Raise your beds above the surface, so that the water runs away from the plants.	You may not need raised or sunken planting beds. Planting level with the earth, so that the whole area gets the same amount of water, may be the best option for your land. **What is mulch?** *Mulch is a layer of leaves, grass, husks or other organic matter that is placed on the soil between the plants. We will examine mulch in more detail in the next section.*

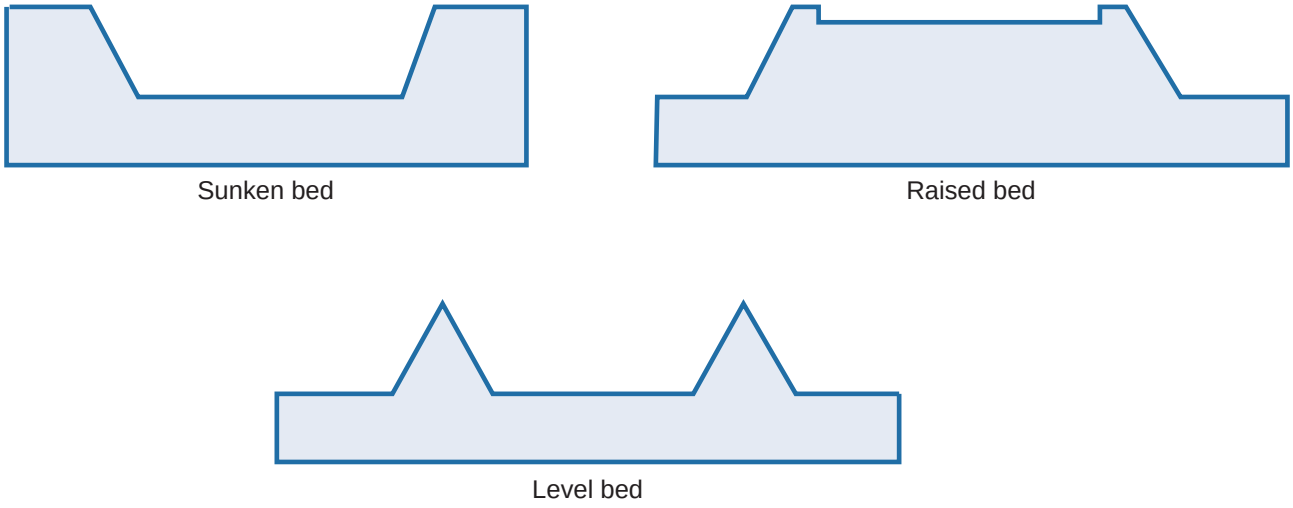


Figure 3.2 Sunken, raised and level beds

Design to capture rain and dew

A lot of water goes to waste in the rainy season, when it runs off our roofs, our roads and down our drains. This water can be captured! We have already given you some examples a little earlier. Here are a few more examples of the capturing of rain and dew:

- **Water tanks**: Houses and other buildings can be designed so that all the water from the roof flows into water tanks. The tanks can have a tap so that people can use the water from the tank. It is helpful to use roof gutters to catch the water off the roof and guide it into the tank.

- **Other containers**: If you cannot install a tank, capture the water in whatever you have – large clay pots or drums.

- **Pits or banana circles**: At the end of any drain, appropriately sized pits filled with organic matter and planted with bananas or other appropriate plants and trees around the edge will stop the water from flowing away. In this way a wet, fertile area for clumps of plants will have been created.

- **Road drains**: All roads should have drains at appropriate intervals to guide water into pits or trees or other areas that can soak up the water. Removing water as it goes down the slope prevents it from building up and causing flooding at the bottom.

Swales: Swales are trenches that are dug to capture and manage water runoff, and increase rainwater infiltration. How do you make a swale?

  - o Dig a trench along the contour of the land. The trench size and length will depend on the slope of the land. You will dig deeper, longer trenches for steep places.

  - o Make a ridge along the downhill side of the trench using soil from the trench.

- Fill the trench with organic matter to help cover the soil and absorb the rain water.
- Plant along the ridge using strong-rooted, permanent plant species, preferably foodplants! Continue planting permanent species to fill about a metre below the ridge, using smaller plants close to the ridge and larger plants, like trees or shrubs, further down.

  As rainwater flows down the slope it will enter the trench, spread out, and be allowed to sink into the soil. As this water is absorbed by the soil underground, it will provide the roots of the plants with the nourishment that they need, without washing the soil away in the process.

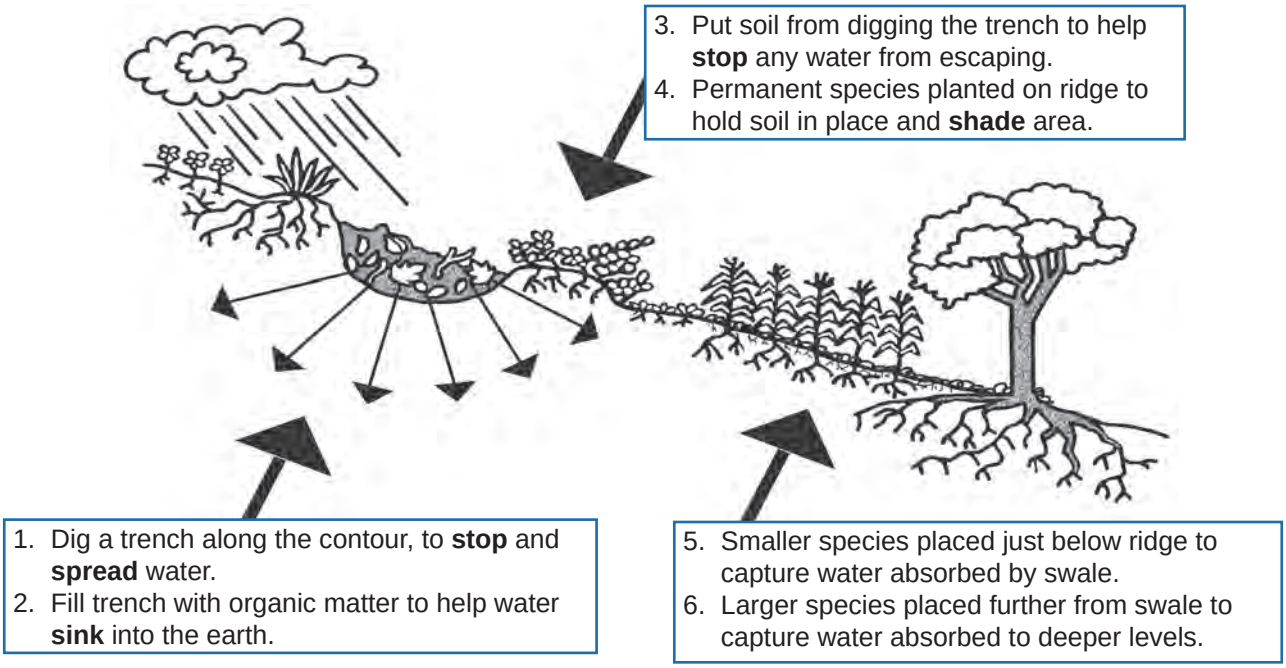


Figure 3.3 Water-wise with swales (Low Input, p 85)

Design to capture 'used' water

Used water is referred to as **grey water**. Take a look around your home, your place of work, and your community and ask: *Is there any water that is being wasted? Is there standing water anywhere? Is there water that could be used more than once? Is there any water that could be directed into a homestead garden or be used to water trees?* Often the answer to this is *Yes!* There is lots of water going down the drain or thrown on bare ground that could be used to produce food and perhaps make money! However before you use your grey water, bear in mind, at the very least, the following:

- **Consider what might be in the water.** If people are throwing dangerous chemicals down the drain, like chlorine bleach (Jik) or chemical cleaners (Vim and Handy Andy), the grey water might kill the trees and other plants. In this case you can change to natural cleaners such as natural soaps and wood ash that works like a scrubbing powder, sand, or other local solutions.
- **Consider the type of plants and trees to include in your design.** Do not use grey water on short leafy green vegetables such as spinach or marogo, since the leaves might then not be safe to eat. You can use grey water on climbing plants such as beans, or fruit trees and other plants where the food is not very close to the ground. The soil will filter the water and the roots of the plant will take up what they need and will produce delicious food!

- **Borehole / Wells / Taps**: Areas where people draw water will often have standing water or wet areas that can be used to grow plants. Standing water can breed malaria-carrying mosquitoes, so it is important to get this water to sink into the ground. By planting suitable plants you soak up the water, thereby preventing mosquitoes from breeding. Choose plants and trees that are suitable for moist conditions. If it is a community water site and there is a question over whose produce it will be, then the community can agree to sell it and put the proceeds towards the maintenance of the pump. They can also use all the produce for community projects, such as caring for orphans, widows, people with illnesses, and/or for the elderly.

- **Bath water**: Drains from bathing areas are very easy to convert into small gardens. Simply direct the flow to where you want it and plant! Even if people urinate in the bath, this urine is full of urea, which is something that many people buy and add to their fields! (Note: this does not mean that people should urinate on the plants, since this might kill them. Urea must be dissolved in water, and taken up by the roots first, for plants to be able to utilise it).

- **Wash water**: Many people travel long distances to collect water, which is then used once to wash the laundry or the dishes and then throw it away onto the bare ground. Don't waste this water! It can be used to grow food, clean your home or community, or water trees that can give you wood for fuel and building supplies. It takes the same amount of work to throw water onto growing plants and trees as it does to throw it on the bare ground, but you will get so much more from it.

How can you redirect water?

You can use plastic bottles, bicycle tire tubes, old garden hoses, and various other odds and ends that are often lying around

Activity 3.4 Be water-wise with dish drying racks

Complete this activity on your own in this study guide

Most people in Malawi build a tall 'Tandala' rack to dry their dishes. A Tandala rack is shown in the figure below.

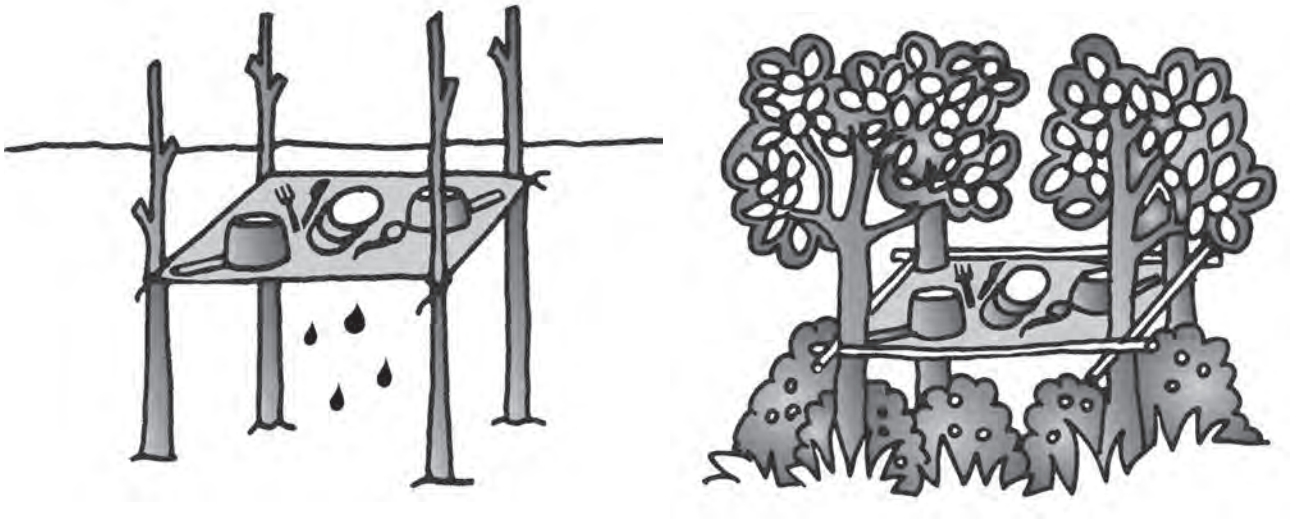


Figure 3.4 A Tandala Rack

Questions

1. Do people in your area a use similar structure to dry their dishes? Explain what they do.

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2. Describe how you will use this rack for growing food plants?

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.....

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Comments on Activity 3.4

People from Malawi put their dishes onto the Tandala rack soaking wet and the clean water drips onto the ground. This area is perfect for growing plants that like moisture and a bit of shade. The rack is a good choice for growing sweet potato vines. The water will drip down from the wet dishes, and allow the sweet potatoes to grow well until the next rainy season.

Consider slopes, contours, aspect and ridges when designing your homestead garden

You will recall that in Unit 1 we discussed contours, slopes, aspects and ridges. It is important to take the shape of your land into consideration, as this will affect your farming/ gardening and how you use the land. Now we will actually measure the slope using a line level. A line level is a home-made instrument that can be used to measure contours (the levels across a slope).

To practise working with a line level, you first have to build one. Then you will need to practise measuring contour lines. These are lines that are on the same level on a slope (that is, on the same elevation above sea level).

What are slopes and contours?

In Unit 1 we examined slope and contours. You will remember the following:
Slope tells us how steep or flat our land is.
Contours are imaginary lines across a slope, indicating the steepness of the slope.

Activity 3.5 Using a line level

Complete this activity on your own in your workbook

Aim: Make a line level to measure contours and slope

Time: 1 hour

What you will need

20m fish line; a line level; two lengths of wood about 2 metres long (marked at 30, 40 and 50 cm from one end; a measuring tape.

Note: A spirit or line level is a small plastic tube that you can buy from the hardware, and is often used by builders.

What you must do

1. Using a measuring tape and a pencil, mark each piece of wood (pole) carefully along its length in 10 cm marks. Number these marks from the bottom.
2. The two pieces of wood are then linked by exactly 10 meters of string (after you have tied the string to the poles), which should be tied to each pole so that it can be slid up and down the pole.
3. Hang the spirit or line level in the middle between the poles. When the string is horizontal, the spirit level is also horizontal or level and the air bubble will be in the middle of the transparent tube. When you have assembled your line level, it should look like the picture in Figure 3.5 below.

Note: To use the line level to mark contours the string is placed at the SAME HEIGHT (on the same mark) on both pieces of wood.

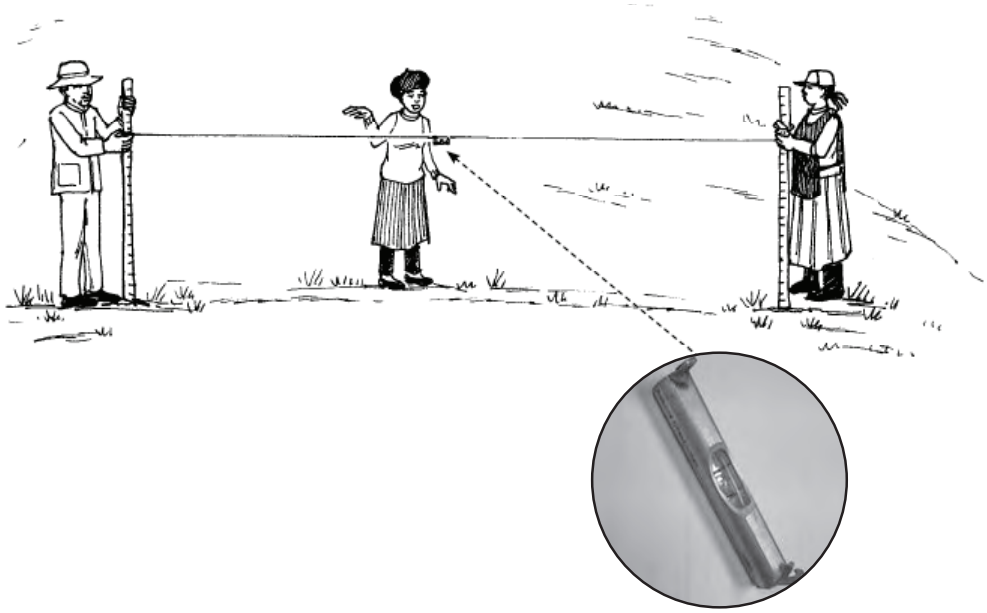

Figure 3.5 Using a line level to mark contours.
(Note that the string is tied at the same height on each pole. The bubble of coloured liquid in the line level is in the middle when the poles are at the same height.)

It is common to start marking contours at the top of the slope where you are working. You start by marking the first contour. Once you have done that, you need to move down to where you will make the second contour. How far apart the contours are depends on the steepness of the slope. Figure 3.6 below shows you how to mark contours in a field.

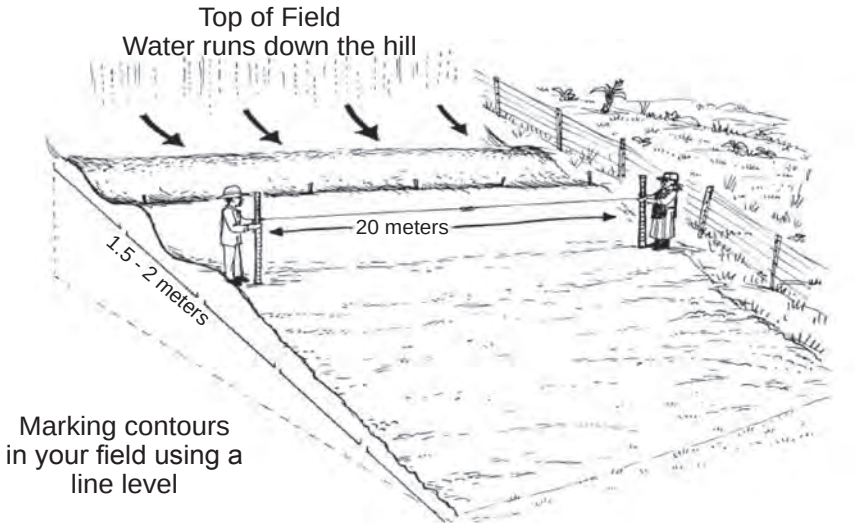

Figure 3.6 How to mark contours in a field

Activity 3.6 Using a line level to measure slope

Complete this activity on your own in your workbook

Aim*:* Use a line level to measure slope

Time: 30 minutes

What you must do

1. Two people should hold the poles you used in the previous activity.
2. Place the poles down the slope 20 metres apart.(See Figure 3.6 above) The string should be on the same mark from the bottom of the pole towards the top (on both poles) when you start. The people holding the poles must make sure that they keep the poles standing straight up (in other words, that they are upright).
3. One person now stands between the two poles in order to look at the spirit or line level.
4. The person on the higher ground moves the string down the pole until the line is level, that is, until the bubble is in the centre of the transparent tube of the spirit level.
5. When the line is level, count the number of marks you have moved the string down. Each mark shows a 1º slope. For example, if you have to move the string down five marks you have a 5% slope. Once you know the percentage you can go back and look at the table (See Annexure B - Conversion of angles to degrees of slope and distance between contours) to work out how far apart the contours need to be. For a 5º slope as in this example contours are about 19 meters apart**.**

The figure below gives you an indication of how to measure slope with a line level.

Figure 3.7 How to measure slope with a line level

Why is it important to measure slope? Land that has a slope needs special attention to make sure you do not cause erosion. Using a mulch helps to hold soil in place, but with steeper slopes you will want to make sure that you have some permanent contours or terraces using rocks and strong rooted plants to keep the soil in place.

Summary: The four S's in water management

To summarise the section on water considerations for your garden we can say that if we allow the water cycle to function properly, it will be able to give us all the clean water that we need to survive. How can we do this effectively? The answer is to remember the four S's:

- **Slow or Stop** – slowing down the speed of the water gives the water more time to enter the soil. Ways to slow water include using 'check dams' made from rocks, logs, sticks, old maize bags filled with dirt. Be creative! Another way to slow down water is to catch it from roofs, roads, or other surfaces from which the water is running off. It can be caught in drums, clay pots, pits, or pond. You will have to consider if the water is free from chemicals or other harmful substances or not. This will then determine how you will use the water.

The four S's

- *Slow or stop*
- *Spread*
- *Sink*
- *Shade*

Refer to the previous section for more information

- **Spread** – Now that the water has been slowed down, you want it to spread out enough so that there is not too much water in just one place. Spread the water out across the slope (along the contour) in preparation for the next step, which is a process known as sinking.
- **Sink** – If the soil is healthy with lots of insect tunnels, micro-organism activity, organic matter, and there are plenty of roots in the soil, the water will be able to sink into it. This sinking process helps to filter the water so that it is clean by the time it reaches the ground water table. Sinking will depend on the type of the soil – clay soil absorbs water slowly whereas sand absorbs it very quickly. Knowing where there is clay soil can be to your advantage if you want to create a pond or tank in which to collect the water.
- **Shade** – Now that the water has sunk into the soil, you want to keep it there by using mulch, ground covering plants, and bushes or trees that provide shade.

3.2.4 Low input irrigation

When the word *irrigation* is used, most people think of systems that need money, labour and time to lead fresh water to the plants. This might be an appropriate choice in some places, but for most places, you will first want to use the water capturing methods listed above. In addition to these, there are many low-input irrigation methods that have been tested and shown to work well. Whatever method you choose for irrigation, you will want to bear in mind the following guidelines:

Guidelines for low input irrigation

- Water where it counts; water the roots.
- Plants absorb most water from their roots. They can absorb some moisture from the air through their leaves, but the bulk of their water intake is through the roots.
- Avoid over- or under-watering.
- Using the correct amount of water will depend on the type of soil you have, what design you've made, what types of plants you've selected and the age of the plants and trees.
- Try to water just before wilting starts.
- Don't give plants frequent, short, shallow watering; rather water less frequently but give the plants a thorough soaking.
- Use furrows or paths to guide the flow of water.

Figure 3.8 Low input irrigation

Prevent the formation of salts

When using any irrigation method, you will want to prevent the water from evaporating into the air very quickly and leaving salts on the surface of the soil. These salts make it difficult for many types of plants to grow. In very hot, bare areas this risk of quick evaporation and salt deposits is the greatest.
Ideas to prevent salting include the following:

- Mulch garden beds to reduce evaporation by up to 90 percent.
- Improve soil water's holding ability by adding compost, which will attract worms.
- Plant the right trees in the right place to provide the garden with shade and wind protection.
- Do not over-water the area; only give it as much as it can absorb.
- Group plants according to their water needs to prevent under or overwatering.
- Water in the morning or evening to reduce water loss through evaporation.
- Deep watering once or twice a week is much more efficient than sprinkling every day. This will also make plants more drought-tolerant
- Avoid watering on very windy days.
- Avoid fine mist sprays or any sprinkler that sends water high into the air.
- Set up sprinklers and sprays to water plants at their base.

Low input drip irrigation methods

The following are some ideas for getting water to the roots of plants, to reduce evaporation of the water into the air, and to reduce the amount of time, water, and energy spent on irrigating. Most of these drip irrigation methods can be used from time to time with the green manure teas, compost tea or animal manure teas as described in the section on soil in this unit. Low input drip irrigation methods include the following:

- Using unglazed traditional clay pots buried in the ground up to their rim and then filled with water allows water to seep into the ground very slowly.
- Bottles without a lid, such as beer or wine bottles, can be filled with water and then pressed tightly into the ground, mouth side down. The water from the bottle will slowly enter the soil.
- Plastic bottles and tin cans can also be used in a similar way. For this method you make two or three very tiny holes in the bottom of a plastic bottle or tin can.

Figure 3.9 Drip bottles for irrigation

3.3 Soil management

Imagine it is the year 2015 and the Earth does not have sufficient healthy soil. How will we and the natural environment that supports us, survive? Reflect for a moment on this question. All living things rely on and eventually return to the soil. The health of our soil is directly connected to our own health. Whatever we do to the soil we are eventually doing to ourselves. If the soil becomes ruined, this will affect the nutritional value of our food. If we are able to learn from nature about methods that help the soil we will have taken the first step towards making our lives better.

How does nature keep soil healthy?

In undisturbed areas there is a natural cycle which keeps soil healthy. Refer to the cycle of nature in Unit 1.

In David Patient's *Positive Health Manual*, he compares the soil to a savings account. The more we put into it, the wealthier we become. But if we continue to take from it, without making any deposits, we will eventually end up broke and hungry.

3.3.1 How do we abuse soil?

You may be aware of practices that have a negative influence on soil. Complete the next activity to give structure to your thoughts on this topic.

Activity 3.7 Interfering with the balance in soil

Complete this activity on your own in this study guide

Take a minute to think what human beings are doing to interfere with the balance in soil.

1. Compile a list of these negative activities.

.....

.....

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2. Which of the negative activities, that you or the group listed, are relevant in your area?

.....

.....

3. Reflect on how these negative practices can be changed by household members.

.....

.....

Comments on Activity 3.7

Your list may include some of the following:

- Paving the earth
- Sweeping the earth
- Chemicals in the soil
- Unnecessary digging of the soil
- Disturbing useful insects
- Burning the bush or any organic matter
- Compacting the soil
- **Mono-cropping** forests and agricultural areas
- Clearing away plants and trees
- Overgrazing
- Soil erosion

What is mono-cropping?

Planting large areas with only one kind of crop, for example maize (mealies)

You may be aware of many more negative practices than those we discussed.
Please share your ideas with others in your group and suggest solutions that you know can work.

What do we find if we look closer at farming or gardening practices that affect soil structure?

Farming or gardening practices that affect soil structure

There are many practices that harm soil structure such as:

- Burning vegetation (plants), which causes ash to form, or using mineral fertilizers, results in the over-activity of the soil microorganisms. At first the microorganisms multiply quickly because they are stimulated by the ash or fertilizer. They then start dying from a lack of food. We can compare this to a grassy area that has a fence around it where too many goats are grazing. What will happen to the goats after a time? The herd will quickly decline for lack of fodder.

- Heating of the soil surface through fire or prolonged sunlight. The ground dries up and the microorganisms are killed.

- Destruction of the crumbly structure of the soil through the splashing of raindrops on bare soil that is subjected to the frequent traffic of heavy, wheeled machinery.

- Too much water, too often causes permanent flooding. In such circumstances soil organisms and plants die from lack of air.

Water plants without damaging the soil structure

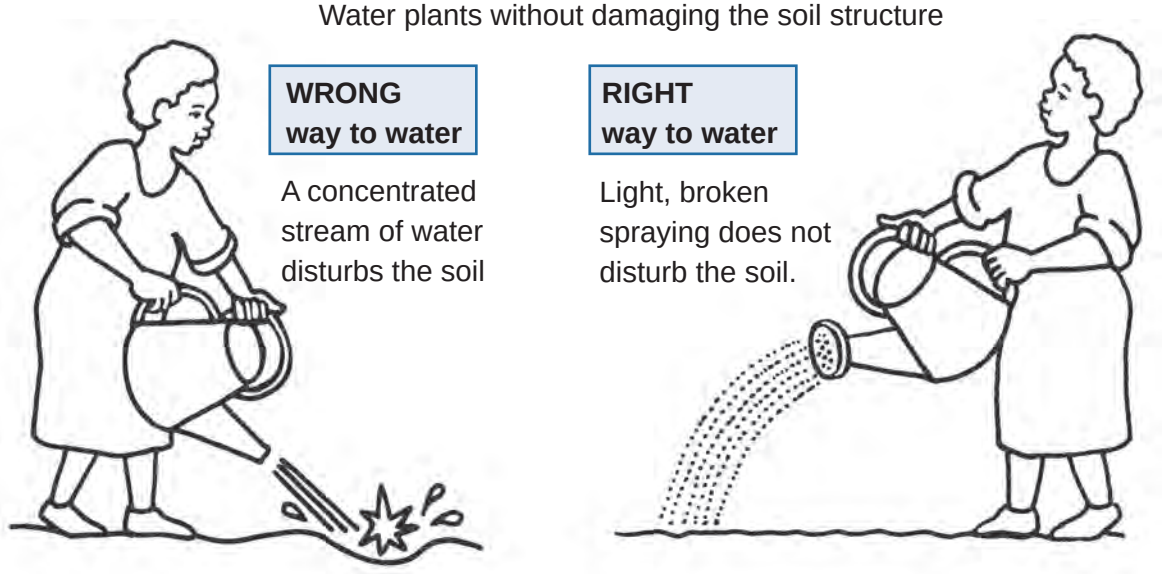


Figure 3.10 The potential destruction of soil structure through incorrect watering.

The unnecessary poisoning of the soil

Chemical products such as pesticides and fertilisers which many gardeners and farmers use to kill harmful organisms and weeds, poison the soil.

Activity 3.8 The effects of chemicals on soil

Complete this activity on your own in this study guide

1. Look at the statements below and decide whether they are true or false.

- ♣ Chemicals are expensive to make. During manufacturing a lot of the earth's resources such as fuel are used…….
- ♣ Chemical fertilisers do not feed the soil, they provide a treatment like 'medicine' for the plant or animal so it can survive in poor soil……
- ♣ Chemicals can be toxic to human beings, especially to children, the elderly and those with weak immune systems such as with HIV/AIDS sufferers…….
- ♣ Special training is needed in how to handle chemicals without getting poisoned or burned…….
- ♣ Chemicals can poison the environment, especially our water sources and soil…….
- ♣ Chemicals can kill beneficial insects, worms and micro-organisms either directly or by the effect that chemicals have on their environment……
- ♣ Insect pests can develop resistance to chemicals (pesticides) i.e they are not affected by them.....
- ♣ Chemicals build up in the food web (refer to Unit 1), and people as top level consumers, ingest these chemicals, thereby poisoning themselves. (This also applies to other animals)……
- ♣ There are better options for designing our agricultural systems and homes so there is no need for these chemicals in the first place!.....

2. Suggest options that are better than using chemicals for your gardening or farming activities.

……

……

……

Comments on Activity 3.8

Hopefully you said that all of the statements above are true. You will learn more about other options, instead of using chemicals, in Module 5.

What else can go wrong with soil, and what solutions are there?

Soil health is influenced by more than just soil structure. When people live and farm in an environment, they usually change it to suit themselves and use the resources available to them. When we are managing a resource, we are consciously looking at, thinking about and caring for that resource. We need to be able to identify the warning and danger signs of overuse or incorrect use.

3.3.2 Desertification and soil erosion

We often read of or hear about soil erosion and desertification, but what exactly are they and what causes them to happen?

What is desertification and how does it develop?

Desertification can be defined as land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including variations in climate and human activities.

What are arid regions?

Arid regions are very dry areas with little rainfall

How does desertification develop? It is usually said that desertification develops because of a poor climate. There are however, more important causes such as the following:

- Overgrazing and over cultivation
- Incorrect tilling methods
- Poor irrigation techniques
- Burning of the area
- The tilling of soils which are not suitable for agriculture
- The clearing of vegetation and deforestation (We will examine deforestation later in the unit.)

Vegetation (plants) plays several roles in controlling the movement of water, both in the ground and over the ground (known as run off). When vegetation is removed the soil is bare. When more and more plants are removed each raindrop hits the ground like a bullet. The raindrops then loosen the soil particles that are blown or washed away. First the topsoil is lost. This is full of nutrients. The subsoil that remains is less fertile and it is difficult for plants to grow in it. The land becomes like a

desert. We therefore place our environment and ourselves in danger of much more severe floods and droughts, more extreme temperatures and worse soil erosion when we promote or accept these practices.

What is soil erosion and how does it develop?

Soil erosion is the loss of soil and its nutrients which impact negatively on plant growth.

How does soil erosion develop? Erosion can be caused by water or wind. Erosion caused by water is a problem in the wetter parts of South Africa such as Kwazulu-Natal. Erosion caused by wind is a problem in the dry areas such as Limpopo Province and the Karroo.

There are several factors that make erosion worse and these include:

- Bare soil
- Steep slopes
- Heavy rainfall
- Cultivation on steep slopes
- Cultivation down the slope instead of on the contour
- Sandy soil, which washes away more easily than do clay soils)
- Soil that is ploughed too much, and washes away more easily.

Why are we concerned about soil erosion? South Africa loses almost three tonnes of soil from each hectare of cultivated land each year. Natural processes create only 0,7 tonnes of soil on each hectare. We are thus steadily losing soil, which is not being replaced (in other words, replenished). This affects farming and living in rural areas in a very profound (serious) and negative way.

Figure 3.11 Disadvantages of bare landscapes, compared to the advantages of having vegetation in the landscape

Forms of erosion

Erosion can take the form of:

- sheet and rill erosion
- gullies and dongas.

It is important that you are able to identify these types of erosion and then to be able to recommend protective and erosion control measures. Below are some examples of forms of erosion and the control measures that can be used.

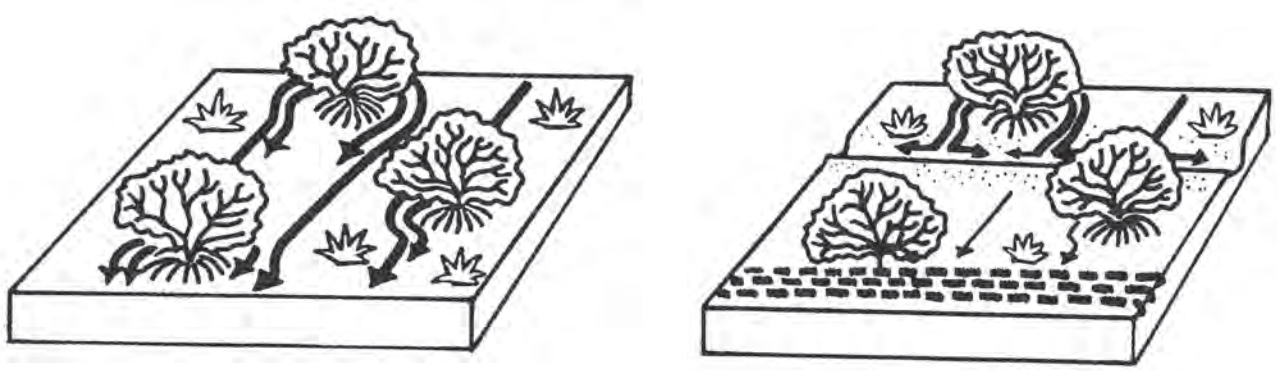
With **sheet flow and rill erosion** you will see bare earth that looks compacted. You will often also see collections of lines of organic matter and small stones, that look like **swales**. You may also see plants poking out of the ground with some of their roots exposed.

How can we address sheet flow and rill erosion? The lines of organic matter which you sometimes see, can help to show you where contour lines or structures can be built.

With the problem of exposed roots (plant pedestals) you will need to slow the run-off and increase infiltration of water into the ground. Examples of structures that can help you do this are:

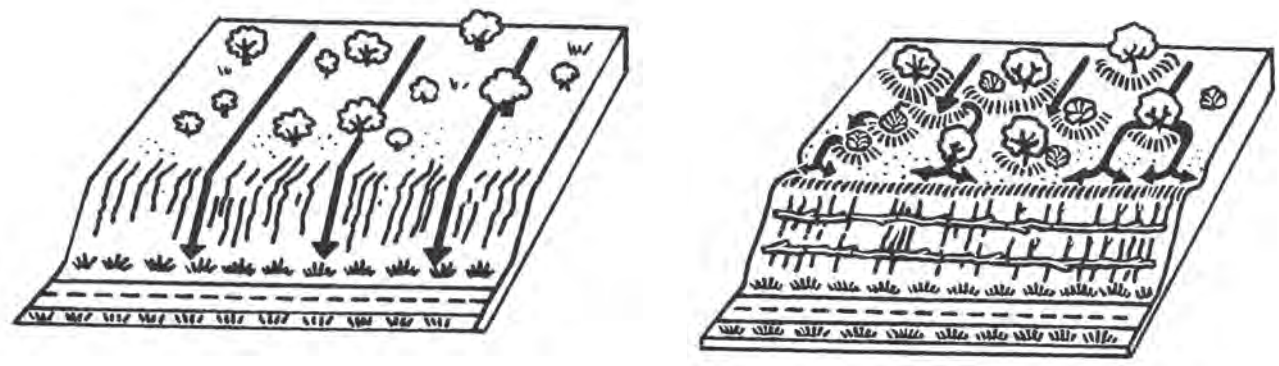
- Berms (contour bunds and ditches, swales)
- Basins and infiltration basins
- Imprinting (small hollows] created in the ground for seeds to germinate
- Increased vegetation.

First you need to ensure that the sheet flow (water running on the surface) is spread out and that it can infiltrate above the rills. Berms and basins, vegetation and mulch can all be effective. Then try to ensure that the water can spread out and infiltrate within the rill itself, with a series of very small check dams constructed of branches and rock piles laid across the cut.



A. B.

Figure 3.12 Sheet flow erosion
A. Sheet flow erosion indicated by arrows
B. A contour ditch and small infiltration pits that help to control sheet flow erosion.



A. B.

Figure 3.13 Rill Erosion
A. Rill erosion indicated by arrows
B. Berms and basins and small check dams that control this type of erosion.

With **dongas/gullies** the run-off concentrates in channels or drainages. Now you will see the more familiar patterns of erosion: rills, gullies or dongas, and the head points of dongas/gullies. You may also see the cutting and collapsing of banks, deposits of different sediment sizes and exposed roots.

Within the gully, the flow needs to be spread and infiltrated as much as possible using permeable barriers. In larger gullies or dongas, strong barriers like **gabions** need to be constructed.

Using gabions to control water flow in a donga or gully

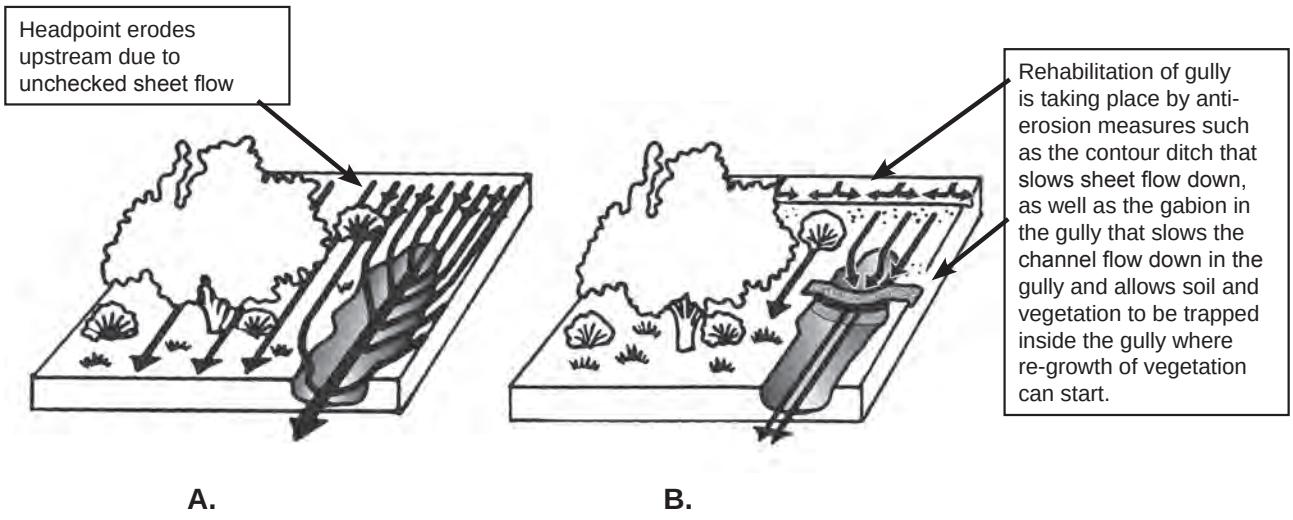


Figure 3.14 Rehabilitation of a typical gully

A. Formation of a typical gully with a head point that increases uphill over time
B. A contour ditch above the gully and gabion structures in the gully that help to control this form of erosion.

Activity 3.9 Causes of soil erosion in your area, and possible solutions

Complete this activity in groups in your workbook

Aim: Identify soil erosion in your area and suggest possible solutions

Time: 2 hours

What you will need

At least two people whom you can talk to and who will be prepared to walk around the areas with you and discuss causes of, and possible solutions to the problem of, soil erosion.

What you must do

Read through the notes on soil erosion and control measures above. Look for signs of soil erosion in your area. Look around the homesteads, croplands and grazing lands.

1. Using your notes, identify places where soil erosion happened. Make drawings and, if at all possible, to take a few photographs.
2. Describe the type of soil erosion that you can see. Is it sheet, rill or gully erosion?
3. What do you think are the causes of this erosion? Talk to people in your area about the erosion. Ask them for ideas about causes. Walk around the area and see if you can identify any causes.
4. Also talk to people about what can be done to control erosion. Make a list of their suggestions.
5. Write down some ideas of your own on how to control the erosion that you have seen. You will need to refer back to your notes as well.

Reflect

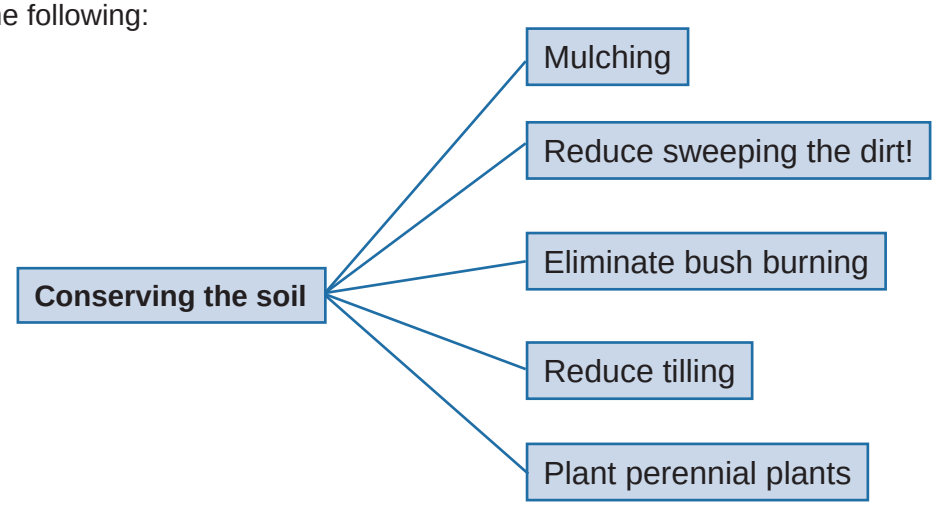
6. Reflect on the assessment and analysis of resources activity and write answers to the following questions:
   - What worked well?
   - What did you find most difficult?
   - What changes would you make to this activity in the future?
   - What have you learned from your experience?

3.3.3 Soil considerations when designing your homestead garden

You are now aware of soil problems concerning the structure of soil and are also aware of soil erosion. What positive soil practices can we apply that will conserve soil and also improve soil structure.

Practices to conserve soil

When we look at the bigger picture of how to conserve soil we can summarise this by saying that we need to do the following:



Mulching: Dead or alive nature is always covered!

Nature is always covered! You know that mulching means placing a layer of leaves, grass, husks or other organic matter on the soil in between the plants. Dried leaves, stones, sawdust, and /or live vines are examples of mulch.

Mulching has many benefits, as follows:

- It keeps the soil cool and moist, even when the weather is hot. This reduces the number of times that you need to water plants in the dry season.
- It creates a soft layer of soil that is easy to plant directly into during the rainy season or when irrigating. No digging is needed! You can just make a small hole for the seed or seedling, depending on the situation.
- It keeps the soil protected from rain and wind so that it is not washed or blown away.
- It keeps the plants protected from being splashed with soil when it rains or during watering.
- It retains water during periods of drought, and protects the soil against flooding in the wet season.
- A heavy layer of thick mulch prevents unwanted plants from growing in between the plants.
- Best of all, mulching means less work each day!

Why doesn't everyone mulch with all these great benefits?

Many people are very wary about mulching their soil for the following reasons:

- **They fear that mulch is dirty.** This is not true as uncovered soil is actually dirtier! It is dusty in the dry season and muddy in the rainy season.
- **They fear that mulch will bring snakes.** However snakes do not want to be around human beings. They prefer to be up in a tree, under a nice pile of rocks or sticks, or in a hole.
- **They fear that mulching will bring termites that will hurt our plants.** Think, for a moment, about termites and what they do in nature. Their job is to decompose the dead or dying organic matter and convert it back into soil. Their job is not to eat live healthy plants. However, if we sweep away and burn all the termites' food, they are going to look for the other things they can find to eat, such as wood!

Reduce sweeping the dirt!

Sweeping removes organic matter from the topsoil, which, in turn, removes the food and protection the soil needs to stay healthy. Sweeping makes the earth hard and does not allow water to sink into it, causing erosion through wind and rain. When large areas are swept, it reduces the amount of land that we can use for growing food.

Eliminate bush burning

Most people will agree that burning the veld is harmful to:

- the air that we breathe;
- insects and micro-organisms that are trying to keep the soil healthy; and
- plants that are used for foods, medicines, fuel and thatching.

I am afraid that a bush fire will destroy everything I have. I therefore need to construct a ***fire guard*** *or* ***fire break****.*

The hardest part is to get people to stop burning the bush! There are many ways to start reducing burning. We need to begin with ourselves, then next with the people who are closest to us. We need to help others understand the cycle of nature, the importance of the things that they are burning and the harm that the smoke does to organisms that breathe the air.

Reduce tilling

Hoes and other implements affect the decomposition stage of the cycle of nature. They disturb it by disturbing the insects, worms and micro-organisms that are busy working in the soil. So why would you want to disturb them? It is much better to feed the soil's creatures with organic matter and not to disturb them.

Nature does its own tilling by means of plant roots that grow down and let water and air into the soil. Soil organisms make tunnels in the earth. We can mimic what nature does by inter-planting trees and other deep rooted plants; interplanting root crops such as yams or ground beans (*nzama*); allowing chickens to scratch around the mature plants; and by keeping the soil covered with organic matter to protect and feed the insects and worms.

A good way to clear the land is to do it carefully. Try to protect useful plants, used for foods, medicines, crafts and building supplies. Also protect leguminous plants that feed the soil. Dig only where you have to, and dig only small sections.

Plant perennial plants

Another way to conserve soil is to have some plants and trees that stay in the soil every year without replanting. These are known as perennials and they are excellent for many reasons:

- You only plant them once, but harvest for many years;
- They are usually very tolerant of fluctuating weather conditions such as flooding and droughts;
- The roots help water go down deep into the water table, which helps to retain water in our soil throughout the dry season;
- Their roots hold the soil and their stems trap organic matter;
- The taller perennials can block the wind.

You are now aware of practices to conserve soil, but how can we improve soil structure?

Practices to improve soil structure

Control run-off.
Structures that can slow down run-off water and help the water sink into the ground are needed. (Refer back to the section on water management.)

Adapt tillage methods
As we explained above, it is possible to farm in such a way that ploughing is minimised (in other words, it is used less often). This is called minimum or no-till farming (farming without ploughing). This process reduces the damage caused by ploughing the land over and over again.

Make use of fallow intervals
This means leaving areas of land, which are unexploited (in other words, not used) during cropping. This will allow plant species to re-occupy the unused areas. After some years, any badly structured soil will improve considerably.

Cultivate soil-enriching crops such as legumes
One nutrient that all plants including food plants need, is nitrogen. A legume is a type of plant that co-exists with a special type of bacteria that grows on its roots. These bacteria are able to 'fix' nitrogen in the soil, and change it to a form of nitrogen that the plant (the legume) can use. Human beings and other animals eat these plants and obtain nitrogen in this way. Some of this 'fixed' nitrogen leaks into the soil, thereby enriching it for the next group of crops that will be planted.

Examples of legumes are:

- **Edible legumes**: beans, peas, ground nuts and ground beans (see Annexure C)
- **Non-edible legumes**: acacia species (*msangu, mtete, etc.),* tephrosia, leuceana, cassia (some of which can be eaten by animals), and the rooibos tea plant.

Spread animal manure

You can use animal manure to enrich the soil in a food or flower garden. You must always be careful when handling fresh manure, since manure is made up of the waste products that the body did not want or need, such as harmful bacteria and worms.

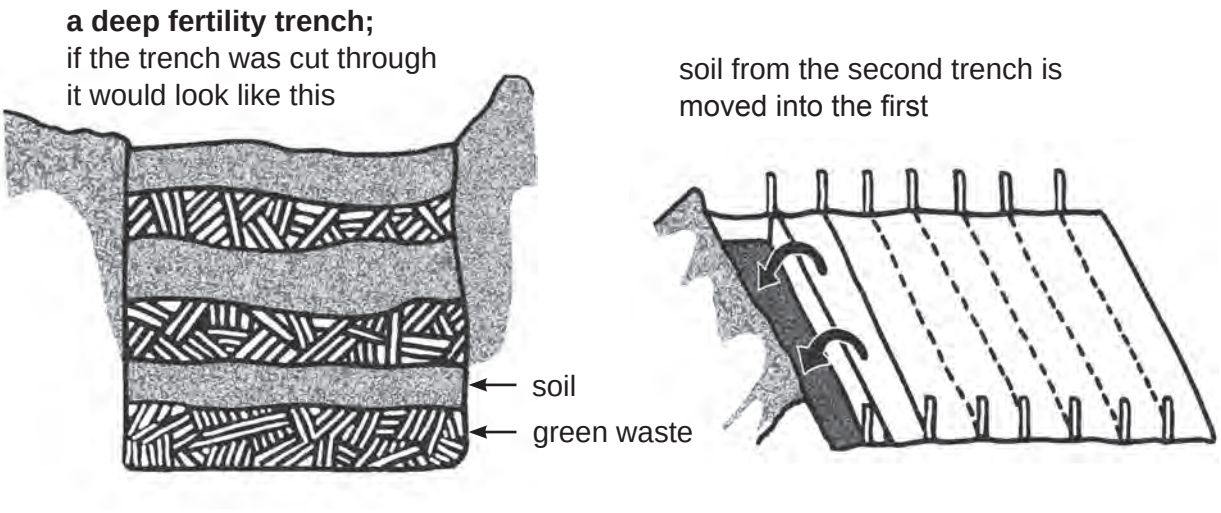
Encourage diversity (the growth of different kinds of plants).

Soil structure improves when the soil is occupied by the roots of many different plants.

- Roots move the soil around.
- Roots create a network of living matter that dies and rots to create humus (compost).
- Roots, when they die off, leave tunnels in the soil that increase the aerated areas and this helps with drainage (water moving through the soil layers) of the soil.
- Roots help to control leaching, which will increase and hold minerals in the soil.

Bury organic matter, straw and manure in the soil.

This produces humus, which improves soil fertility and soil moisture. This is an essential part of soil water management. Figure 3.15 shows you two ways in which you can add organic matter into the soil.



A. Fertility trenches **B. Double digging**

Figure 3.15 Two examples of incorporating organic matter into the soil:
A. Fertility trenches (left) and B. Double digging (right).

Use low input composting

Many projects and individuals decide to use compost to improve soil fertility and structure, but, there are many other ways to improve fertility and structure. Before choosing composting as a method for your land, consider other options and choose that which is best for the site. It may be better for you to combine mulching with a variety of materials, inter-planting leguminous plants and trees, integrating animals, and reducing tillage instead of composting. Most sites will have some level of composting

integrated into them, but composting alone is not the answer to most of the soil problems that we are experiencing! Composting is a way of copying natural decomposition. Nature mulches the soil with a variety of different dead plants, trees, animals, and insects and then when moisture is present from dew or rain, the organic matter disappears into the soil very quickly. There are many different ways to make compost. None is really right or wrong, so choose the way that works best for your lifestyle. Most importantly, just get all organic matter back into the soil!

What are pesticides and herbicides?

Pesticides are chemicals used to kill harmful insects and other organisms.
Hebicides are chemicals used to kill harmful plants, especially weeds

How does the soil work? Before talking about methods of composting, it is useful to review what happens inside the soil. Can we compare the process of composting, to digestion in the human body?

- **Breaking down:** Insects and animals break down the organic matter into smaller pieces just as we use our teeth to chew (in other words, break down) food into smaller pieces.
- **Digestion:** The smaller pieces mix with chemicals in the soil and release the nutrients from the food. This is similar to the chemicals (enzymes) in our saliva and other juices in our stomach that mix with our food.
- **Absorption:** The nutrients enter the plants and trees through the roots so that the plant can have energy to grow, breathe, and protect itself from disease. This is similar to the way in which we absorb nutrients in our intestines.
-

In Unit 4 you will make compost with your households. To prepare you for this, the figure below summarises how compost can be made.

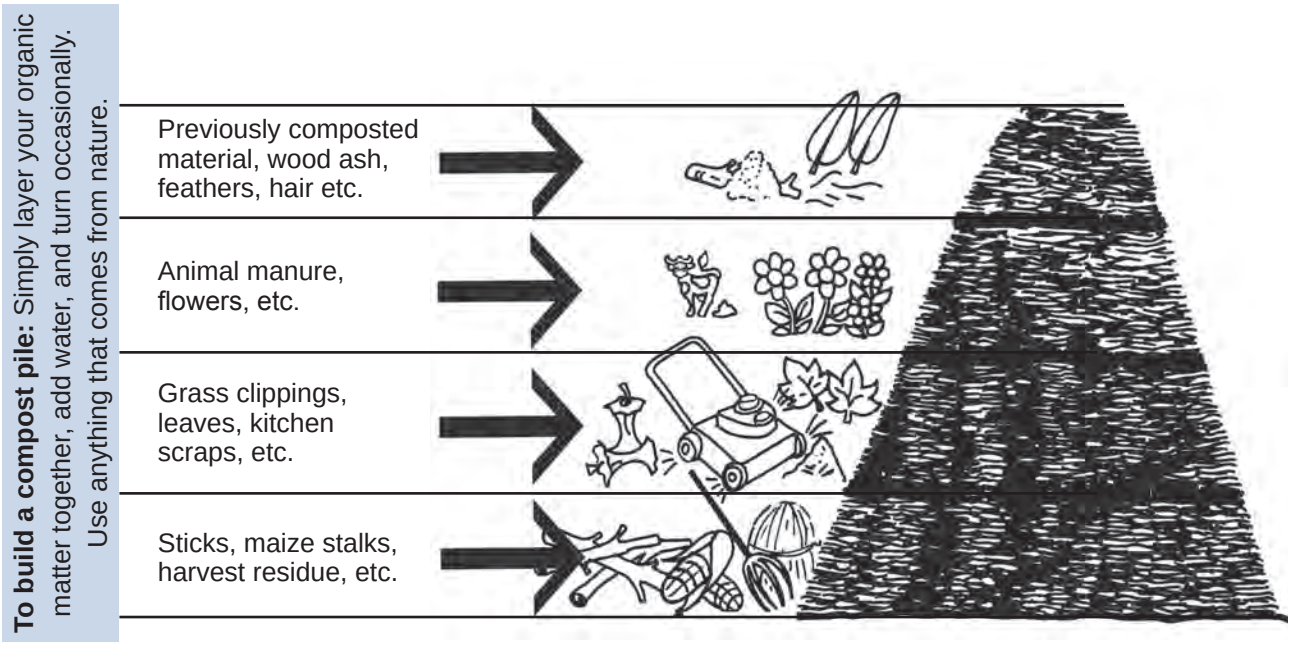


Figure 3.16 Making compost

3.4 Managing biodiversity

What happens when we do not use our biodiversity wisely? It can result in a loss of biodiversity, which is called *environmental degradation*. This will have a negative influence on many apects our lives including food security.

3.4.1 Abusing biodiversity

As you know, the Earth and the sun provide us with many resources and processes, including biodiversity. (Refer to Figure 1.27 In Unit 1). When we abuse (that is, do not use wisely) any of these resources or processes the balance in nature is upset which will impact in a negative way on everything we do. This includes our farming and gardening activities. Which in turn will influence food security. Remember, what we do to the creatures (plants and animals) of the Earth, we do to ourselves. All things are connected.

One of the serious problems concerning the abuse of biodiversity that we have to deal with in South Africa is deforestation.

What is deforestation?

The destruction of forests is called *deforestation.*

Forests are destroyed:

- for firewood
- to make way for urban development
- by logging companies for financial benefit, for the sale of wood for furniture and other products
- to make way for roads, tree plantations, farming and mining
- by flooding from human-made dams

What are plantations?

Plantations are large areas planted with one kind of exotic tree (mono-culture), such as pine trees and eucalyptus (bluegum) trees which are exotic (not from South Africa)

What happens when we cut down forests?

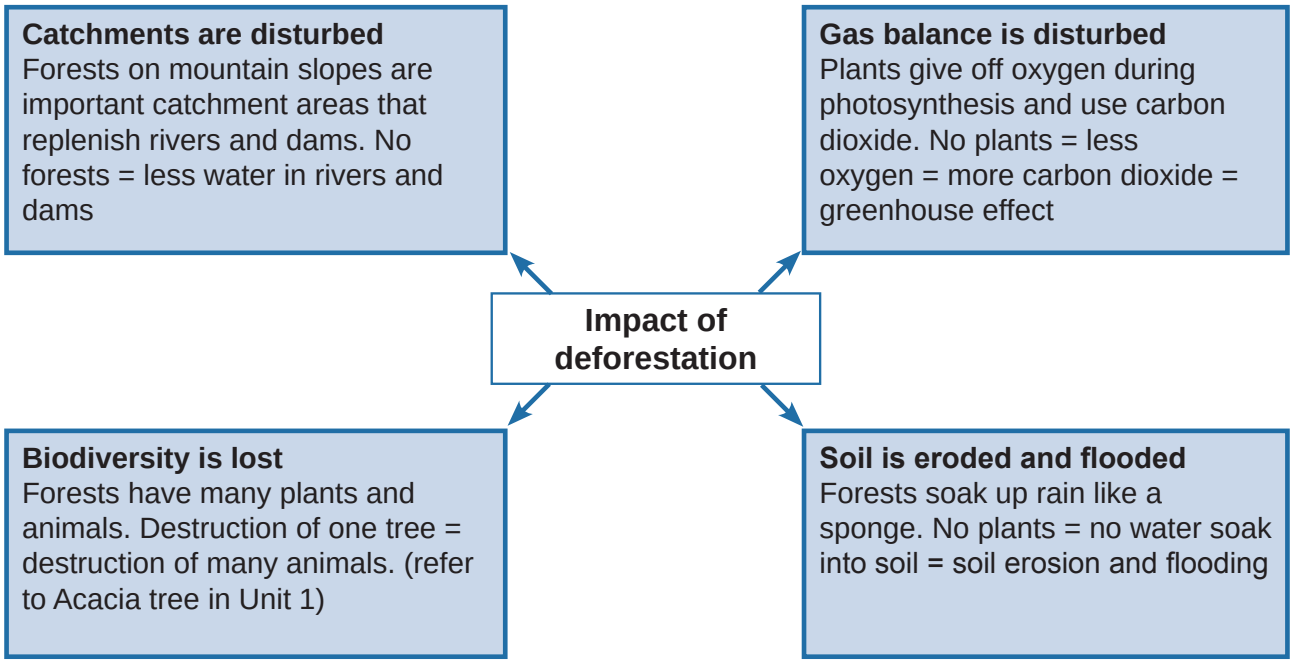


Figure 3.17 The disaster of deforestation

Human beings not only destroy forests, but also grasslands, wetlands, catchments and other natural areas. Why does this matter? When we destroy natural areas we destroy the habitats of plants and animals and their food chains which result in their death. This means that less biodiversity is available to provide us with resources for food, medicines and building materials.

3.4.2 Considerations when using biodiversity

In Activity 1.13 in Unit 1 Lesidi's visit to his uncle in Calvinia confirmed that the natural environment provides abundant indigenous plants, seeds and animals that can be used to enhance food security. Is this also true for the area in which you live? Consider those living resources that have traditionally been used in your area. The following activity will give you the opportunity to talk to older and other knowledgeable people in your community, to find out what living resources are available in your natural area and how you should harvest them wisely.

Activity 3.10 The wise use of biodiversity in your area

Complete this activity on your own in your workbook

Aim: Identifying wild plants, seeds and animals in your area which can be used to enhance food security, either directly or indirectly.

Time: 1 hour

What you must do

1. What plants do you and your family or households in the group use from the wild? Think about what you eat, what your animals eat, what you build with, what you use for craftwork, medicines, and traditional ceremonies.
2. If you do not use any plants from the wild, talk to an older person in your family, group or community and find out what kind of plants were used in the past and which of those are still available today.
3. Complete a table like the one below in your workbook, to indicate the utilisation of plants from the wild by you, your family, household, other group members or the community.

	Plants from the wild (English name)	Plants from the wild (traditional name)	How can the plant be used sus-tainably?	What are the plant's needs? How should I take care of it in my garden?
Food for humans				
Food for farm animals or pets				
Building material				

Craftwork				
Medicines				
Ceremonies				

Questions

1. Is there a difference in the way the plants are used at present and how they were used in the past? Why do you think this is so?
2. Are the plants from the wild still as plentiful as they were in the past? Give a reason for your answer.
3. Why have most people stopped using wild plants?
4. Reflect on how plants from the wild could be used to enhance food security.

Reflect

Reflect on the assessment and analysis of resources activity and provide answers to the following questions:

- What worked well?
- What did you find most difficult?
- What changes would you make to this activity in the future?
- What have you learned from your experience?

What do you regard as good and bad practices regarding biodiversity? (You have made a number of suggestions in the previous activity, but if we take a closer look at this issue, we may find many wrong perceptions!)

Activity 3.11 Good and bad practices with regard to biodiversity

Complete this activity on your own in this study guide

1. Look at the following practices related to biodiversity, and decide whether you think they are good or bad practices.

ACTIVITY	GOOD PRACTICE	BAD PRACTICE
Clearing for farmland, eg cutting down forests and other plants		
Clearing all plants around the house		
Collecting only dead wood as firewood		

Cutting live branches of trees for firewood		
Keeping too many animals in a small area		
Not hunting female animals who are nursing their young		
Removing an entire plant from the veld, when mass collecting food and medicinal plants		
Sweeping the area around the house every day		

2. Reflect on the influence the bad practices will have on people in communities and in particular on food security. Keep your place in the cycle of nature in mind when you answer this question.

.....

.....

Comments on Activity 3.11

There are many examples of good and bad practices that can have an impact on biodiversity. Discuss this in your groups, and decide which of the following are useful in your area:

Table 3.1 Examples of good and bad practices related to biodiversity

ACTIVITY	GOOD PRACTICE	BAD PRACTICE
Clearing for farmland, for example, cutting down forests and other plants		We are removing the habitats of wild plants and animals, and in this way we are upsetting the cycle of nature. Soil is left bare, which will wash away during heavy rains.
Clearing all plants around the house		Compacting the soil; soil erosion; soil becomes poor.
Collecting only dead wood as firewood	Do not harm the living trees. This shows respect for the cycle of nature and our place in it.	
Cutting live branches off trees for firewood		This will harm the tree, and lead to its death, influencing other organisms living off it as well. See Acacia example in Unit 1.

Keeping too many animals in a small area		Leads to overgrazing, which in turn will lead to a shortage of food for the animals and soil erosion.
Not hunting females animals who are nursing their young	Will allow the species to keep on producing young preventing it from becoming extinct.	
Removing the entire plant from the veld, when mass collecting food and medicinal plants		Can lead to the extinction (dying out) of species.
Sweeping the area around the house		Compacting the soil, causing soil organisms to die, and soil to become impoverished.

3.4.3 Consider permaculture groups when you choose plants for your area

Whether you decide to use plants or seeds from the wild or any other plants or seeds, or even a combination of wild and other plants, you should consider permaculture principles and permaculture groups.

What is permaculture? **Permaculture** is short for *permanent culture.* It can be defined as 'design of our environment based on ecological principles'. (Mollison, 1992). It is one method used in sustainable conservation agriculture.

Permaculture, if used correctly, provides the maximum yield for minimum effort and costs. We can copy what nature does, and plant a variety of plants, and keep a variety of animals. This means that you should choose plants for food, medicines, building materials and other uses, to assist you in staying healthy and prosperous. Permaculture encourages people to work together and help each other to grow better food.

Permaculture works according to the principle that there are seven groups of plants that need to be included in your homestead garden. Refer to table 3.3 on the next page.

These are:
- Food for us
- Food for the soil
- Diggers
- Groundcover
- Climbers
- Supporters
- Protectors

What is agroforestry?

Agroforestry is a form of agriculture using trees. It involves raising crops or grazing animals among mainly planted trees to conserve soil and improve crop yields. At the heart of any agroforestry project are multi-purpose trees which provide fruit, fodder, wood, other products and shade and which grow quickly on poor soil.

What is conservation agriculture?

It is a group of methods that include permaculture, organic and sustainable farming.

Table 3.2 Permaculture: Seven groups of plants for a garden

1. **Food for us**. Based on food groups that you have learned about in Module 1.
2. **Food for the soil**. We covered this in the section on soil. This includes legumes such as beans and peas and using dead plant and animal matter such as compost, mulch and manure in your garden.
3. **Diggers**. Deep rooted plants will reach deep into the earth's soil and bring minerals up to the surface. Examples of diggers include: cassava, sweet potatoes, yams and trees.
4. **Groundcover**. This protects the soil from the sun, and helps to hold moisture, and keep "weeds" (plants in the wrong place) down. There are many types of groundcover available. These include: sweet potato vines, pumpkin, cucumbers, and anything else that will vine or spread across the soil. Mulch is also a form of groundcover.
5. **Climbers**. These plants grow up and provide us with another area of food production. Examples of climbers that you can use include: beans, passion fruit, loofah, and cucumbers.
6. **Supporters**. These are strong plants that provide support for the climbers and make the most of the space available. They could be trees, bushes, crops with strong stalks such as maize or sunflowers. A supporter could also be a house, wall or fence on which other plants may grow.
7. **Protectors**. Anything that helps to protect your garden, such as thorns, smelly plants or other plants that could protect your produce from thieves or plant-eating animals. The protectors could also function to attract predators like frogs, birds and lizards that will eat the insect pests.

Keep these seven groups of plants in mind, when you design your garden.

Activity 3.12 Plants for the seven permaculture groups

Complete the following table, by providing examples of plants that you will use in the seven different permaculture groups. We have given you an example of each in the shaded column.

Food for us	Food for the soil	Diggers	Groundcovers	Climbers	Supporters	Protectors
Fruits	Lima beans	Sweet potato	Pumpkin	Tomato	Sunflower	Garlic

Comments on Activity 3.12

There are many examples, but the following figure will give you a good idea.

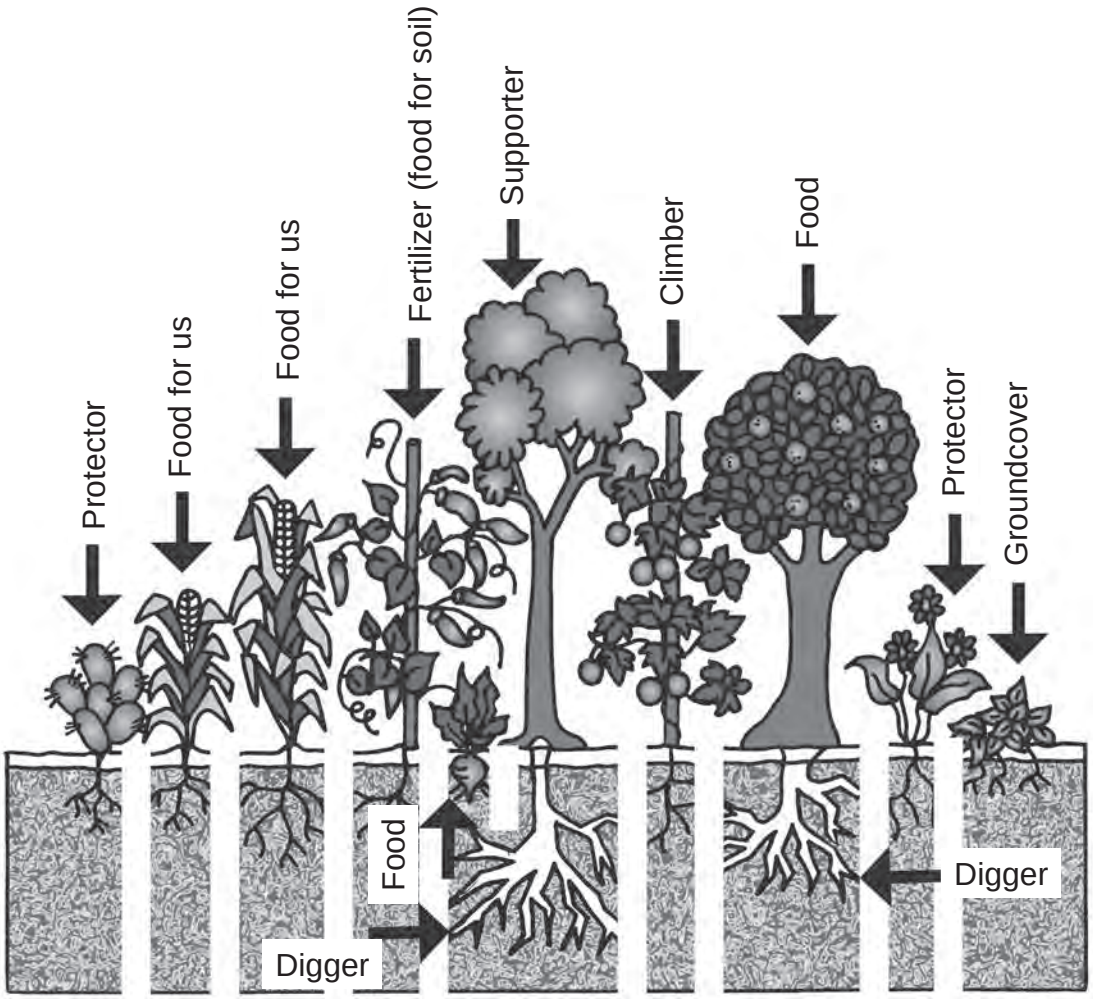


Figure 3.18 Planting according to permaculture principles

3.5 Managing energy resources

What happens when we do not use our energy resources wisely and what can we do to manage them in such a way that we will not run out of energy in the near future?

3.5.1 Abusing energy resources

We are fast depleting (using up) energy sources, such as coal, oil and gas. The use of these energy sources also contribute to serious environmental damage, such as the greenhouse effect**,** and widespread pollution of air, land and water. Using too much firewood, contributes to deforestation, which causes other environmental problems. If we want to look after our world, we have to conserve energy, we have to shift from using fossil fuels, which are non-renewable energy sources, towards renewable energy sources such as the sun, wind and water (refer to Unit 1).

You are aware of the serious energy crisis we are facing in South Africa. Who is responsible for adressing this issue? Is it only government, or the municipalities, or should every South African citizen contribute to saving energy? The answer is of course that government and municipalities should play a major role, but that every one of us needs to make a serious effort to minimise our energy use and to come up with creative ideas to do so.

3.5.2 Consider using renewable energy to cook your food

What are some creative ways to save energy when we cook our food?
The following are short descriptions of a few types of energy-saving options.

Paper charcoal "briquettes"

You know how important recycling is. In nature waste is recycled continuously. Here is an interesting way of re-using paper and other materials such as dried leaves to be used as fuel for cooking. You can make charcoal-like products using recycled paper:

- Soak the paper in a bucket of water until it is soft. This usually takes a half day. Thicker paper takes longer to soften, so soak it overnight.
- When the paper is soft, pull out a large handful and squeeze the water out and make it into a ball.
- Let the paper balls dry in an airy place, preferably in the sun to speed up the drying time. After 1-3 days, depending on the drying conditions, the balls should be dry. They become very light weight when they are ready. Store the paper charcoal in a dry place, in an old bag or basket until you need it.

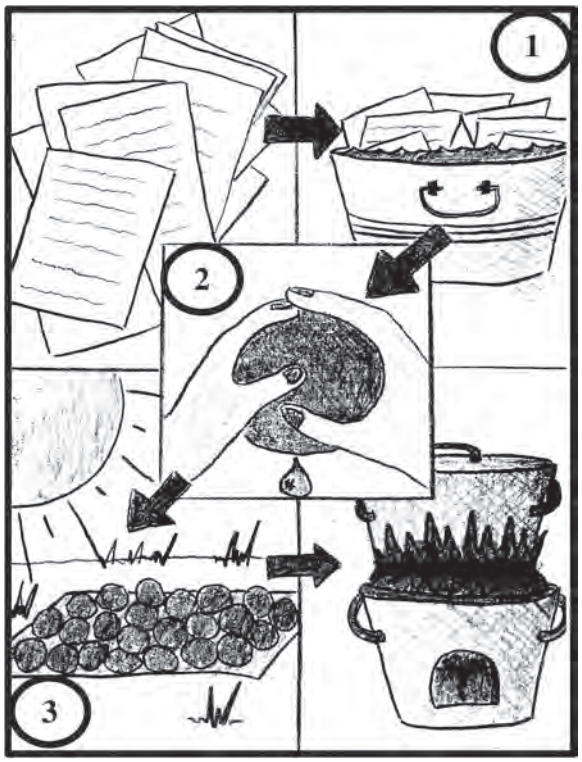
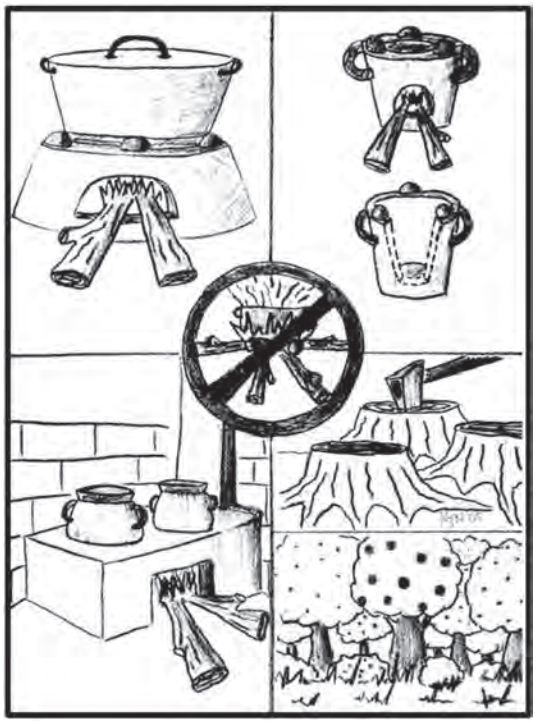


Figure 3.19 Making paper charcoal briquettes
(Adapted form Nordin, 2005)

Note: The paper charcoal produces a lot of ash, so using the type of stove that has holes for the ash to drop away from the fire is helpful. There are many things that you can cook with paper charcoal, but we recommend cooking food in a covered pot because of the amount of ash it produces. Do not use the paper charcoal for grilling food directly on the fire – there may be chemical ink on the paper.

Fuel efficient stoves



One problem is the way that wood is burned - burning wood can be done sustainably if we are careful not to overuse the supply.
There are many styles of improved wood stoves, the basic idea of any of the improved wood stoves are:

- to control the amount of air flowing toward the wood
- to guide the flames to the centre of the pot's base, and
- to hold the heat for as long as possible

Figure 3.20 Cooking with fuel efficient stoves
(Adapted form Nordin, 2005)

Basket cookers / food warmers / food coolers

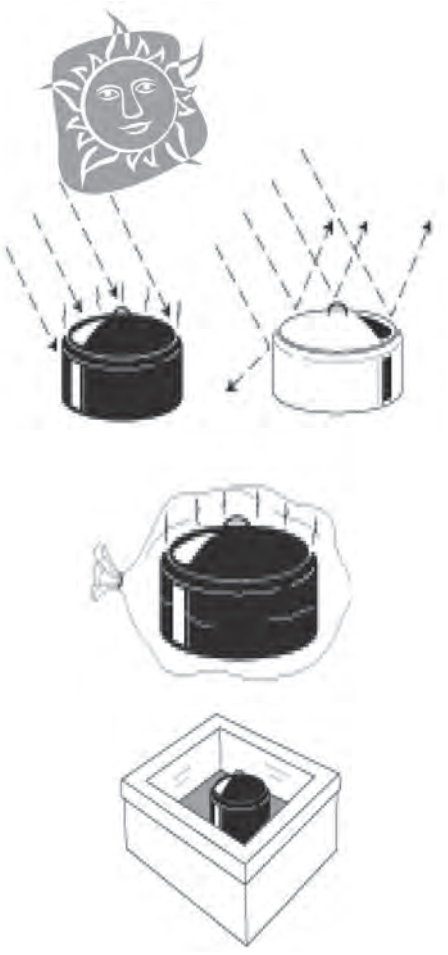
Basket cookers work by conserving the temperature of an item for a long time. You have to initially make the food the temperature that you want to keep it. Basket cookers can be used to keep hot food hot or to keep cold food cold – so these Food Warmers are also Food Coolers!

How do these warmers/cookers work?
The basic idea is to put the item to cool or heat into an insulated basket or box. For the basket cooker shown in this picture, use a woven basket and line the bottom and sides of the basket with clean, dry material – this could be dried banana leaves, clean used paper, dried grass, or scraps of cloth. Leave a space in the middle of the dry material for the pot or other item. Make an insulated cover, again using dry material. You can use an old sack, cloth, or anything that will hold the dry material. The cover will be tucked into the inside edges of the basket to trap as much heat as possible.

Figure 3.21 Basket cooker with insulated cover

Solar cookers

There is plenty of sun in Africa and much of it is under-utilised. Using the sun to cook is very simple and solar cookers can be made from a wide range of material.



- The sunlight is the "fuel". A solar cooker needs an outdoor spot that is sunny for several hours and protected from strong wind, and where food will be safe. Solar cookers don't work at night or on cloudy days.
- Convert sunlight to heat energy: Dark surfaces get very hot in sunlight, whereas light surfaces don't. Food cooks best in dark, shallow, thin metal pots with dark, tight-fitting lids to hold in heat and moisture.
- Retain heat: A transparent heat trap around the dark pot lets in sunlight, but keeps in the heat. This is a clear, heat-resistant plastic bag or large inverted glass bowl (in panel cookers) or an insulated box with a glass or plastic window (in box cookers).
- Capture extra sunlight with shiny silver: One or more shiny surfaces are used to reflect extra sunlight onto the pot, increasing the amount of sunlight hitting the pot. Shiny surfaces can be made from a sturdy support such as cardboard or tin sheet that are covered with anything silver such as that found on the inside of many types of food packaging or aluminium foil. Attach the silver material with glue, tape, a stapler or using other creative local ideas.

The next activity will demonstrate how the sun can be harnessed to heat water or cook food.

Activity 3.13 Making a solar cooker (Optional)

Complete this activity in groups or on your own in your workbook

Aim: Demonstrate how the sun can be used as an energy source to heat water

Time: 1 hour

What you will need

A cardboard box, aluminium foil (or silver paint), plastic (transparent) paper or clingwrap, a cold drink can that is painted black, water, scissors and glue.

What you must do

1. Decide upon a design for your solar cooker using the box, foil and plastic.
2. Fill the black can with water at room temperature, and place it in the solar cooker.

3. Decide upon a suitable place to put the solar cooker, where it will receive sufficient sunlight.
4. Leave it in the sunlight for 2 hours. Then touch the can with your bare hands, and feel the temperature. (Be very careful not to burn yourself. Some solar cookers are very effective!)
5. Answer the following questions:

Questions

1. What is the function of the aluminium foil?
2. What is the function of the clingwrap (or sheet of plastic)?
3. Why should the can be painted black?
4. Touch the can. What is your observation?
5. Write a paragraph on the advantages of solar cookers.

Figure 3.22 Making a solar cooker

Reflect

6. Reflect on the activity and write answers to the following questions:

- What worked well?
- What did you find most difficult?
- What changes would you make to this activity in the future?
- What have you learned from your experience?

3.6 A design plan for your area

You are now aware that you should consider improved water use, slope, aspect and ridges, healthy soil, wise use of biodiversity, permaculture groups, and alternative energy sources when you want to start a food or any other garden.

In this section we will look at farming practices that help farmers improve their natural resource management by using the principles, approaches and processes we have discussed so far in Module 3. The area being farmed could be your homestead, school or community garden.

Techniques for intensive food production and rainwater harvesting will be introduced through case studies and examples. These case studies will give you an idea of how natural resources can be used effectively and sustainably for the benefit of improving people's livelihoods.

Mr Phiri and MmaTshepho and a group of rural women used the concept of "their four corners" to make plans and take decisions to improve there livelihoods and provide better food for health. See below the simple concept of using "my four corners" for a homestead garden in a community.

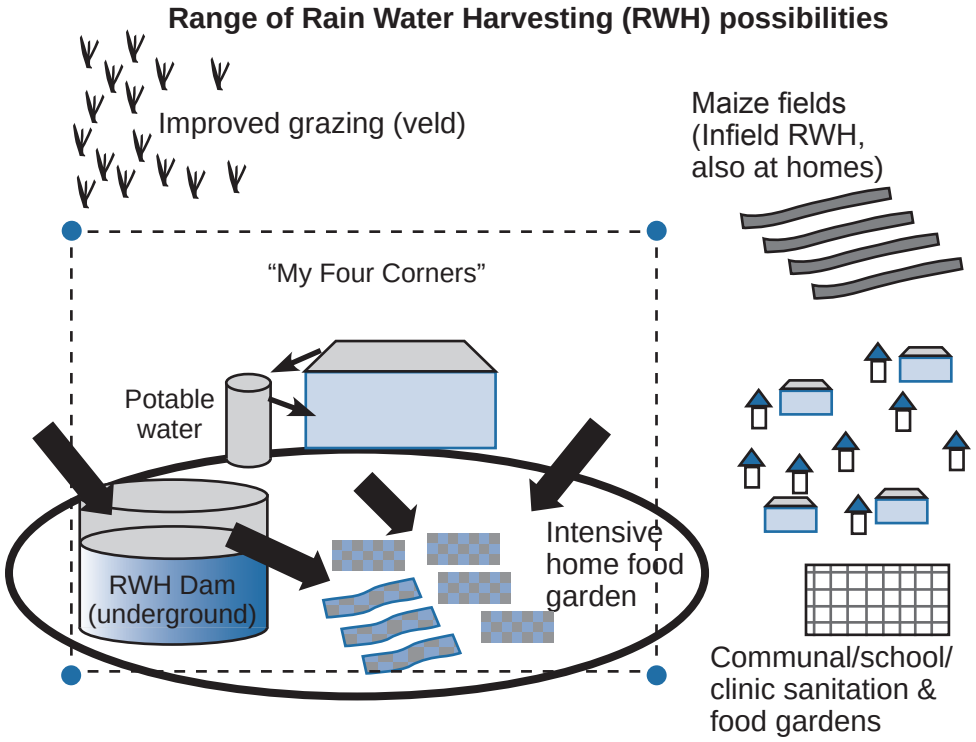


Figure 3.23 The four corners of every homestead and different ways of using resources.
(Adapted from DWAF, 2008)

The rural women's group, whom Mma Tshepho worked with, declared 'War on Hunger'. The first strategy involves what they call: 'My Four Corners', meaning their own homestead yards. They feel that in their own yards they are fully in control – they can take decisions without having to consult other members, and they can move at their own pace. In their 'four corners' their potential additional water sources and their uses are:

- recycling of household water (e.g. water used for washing can be used to grow plants);
- surface run-off can be turned into 'run-on' and channelled to ditches around her garden beds – preferably intensive beds like deep trenches;
- an underground Rain Water Harvesting (RWH) tank, as supported by DWAF (Department of Water Affairs and Forestry) can store enough water for year-round vegetable and fruit production of 100m^2, or for other productive uses; and
- clean water harvested from the roof into an above-ground water tank can be used for drinking and cooking.

The DWAF Homestead RWH Programme supports the rural household within its 'Four Corners.'

3.6.1 Farming with Water Case Study: Mr Phiri

Mr Zephaniah Phiri Maseko has lived and worked on his family land holding (3 hectares), in one of Zimbabwe's driest regions for over 30 years. He has created his own "garden of Eden" and over the years has taught many others to do the same.

The farm is on a north to east sloping face of a hill (providing good winter sun). The top of the hill is a large, exposed rock (a granite dome) that creates a lot of storm water run-off. The average annual rainfall in the area is around 570mm. Droughts occur often.

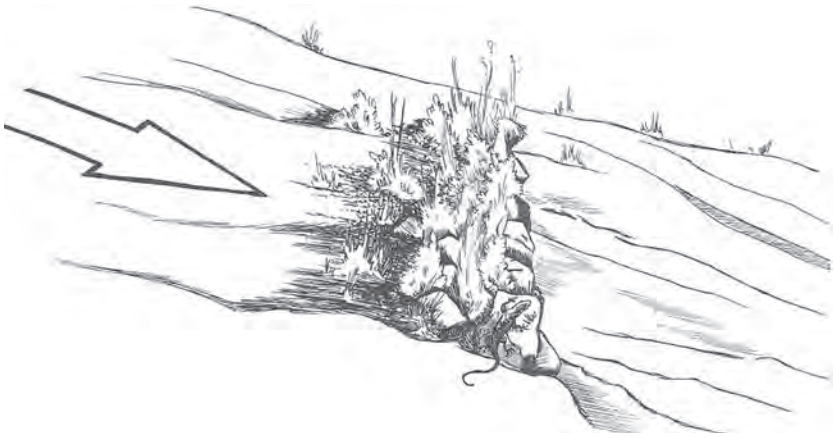


Figure 3.24 Water, soil, seeds and life gather where water flow slowly across the land.

When Mr Phiri began, it was very difficult to grow crops successfully, or make a profit. He had no money for deep wells, pumps, fuel and other equipment. Mr Phiri started his farming with long and careful observation. He noticed that where the run-off from rain went unchecked (not slowed down) very little infiltration took place. He then noticed that the soil remained moist for longer in small hollows/depressions. This also happened above rocks and plants on the slope (where the rainfall runoff is slowed down and can infiltrate between rocks and plants). He realised that he could copy this process and enhance areas of his land where soil was remaining moist for longer. Thus began his water farming.

Beginning at the top of his catchment, Mr Phiri built low stonewalls here and there on the contours. These 'check dam walls' slow down and spread the flow of storm run-off water. This controlled run-

off from the large rock (at the top of the hill) is then directed to two earth dams just below (one large and one somewhat smaller). These dams were dug out by hand.

The water in the larger dams seeps straight into the ground over a period of time. The overflow from the smaller dam is directed via a short pipe to an above ground ferrocement (steel reinforced concrete) tank that feeds the family's vegetable garden during dry times. Another tank, shaded and cooled by a granadilla vine, collects drinking water from the roof of the house. Besides these two tanks, all water harvesting structures on the farm directly infiltrate water into the soil.

Numerous water harvesting structures act as nets that collect the flow of the surface run-off and quickly infiltrate the water into the soil, before it can evaporate.

These include:

- Check dams (small stone walls placed within drainages across the waters' flow
- Vegetation planted on contours
- Terraces (built-up level fields or beds)
- **Berm-n**-basins (dug out basins with earth and plant banks, laid out on contour)
- Infiltration basins
- 'Fruition pits'. These are large basins dug out in the bottom of drainage lines (3 metres long, 2 metres wide and about 2 metres deep). When it rains, the pits fill up with water and the overflow fills one pit after another. Long after the rain stops, water remains in these pits, infiltrating into the soil. These fruition pits feed the **groundwater table** as well as the plants.

  Thatch grass, fruit trees and timber trees have been planted in and around the fruition pits. Mr Phiri explains with a smile: " I am digging fruition pits and **swales** to plant the water, so that it can germinate elsewhere."

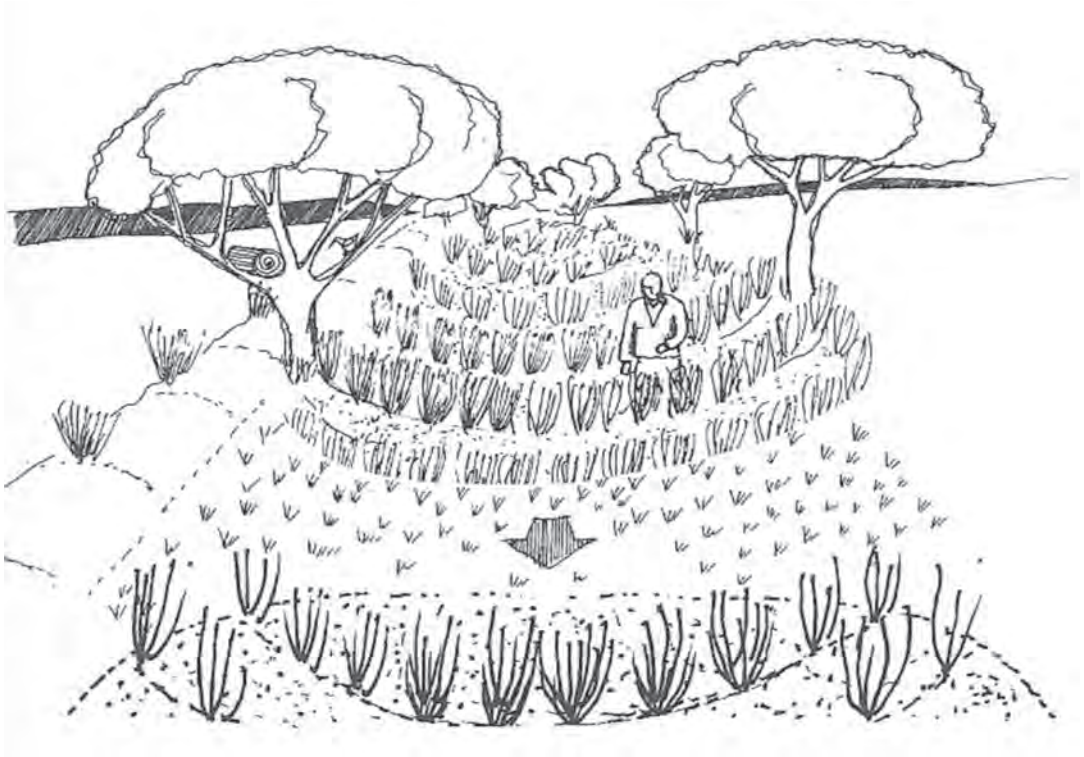


Figure 3.25 Sketch of Mr Phiri standing in a "fruition pit" full of thatch grass.

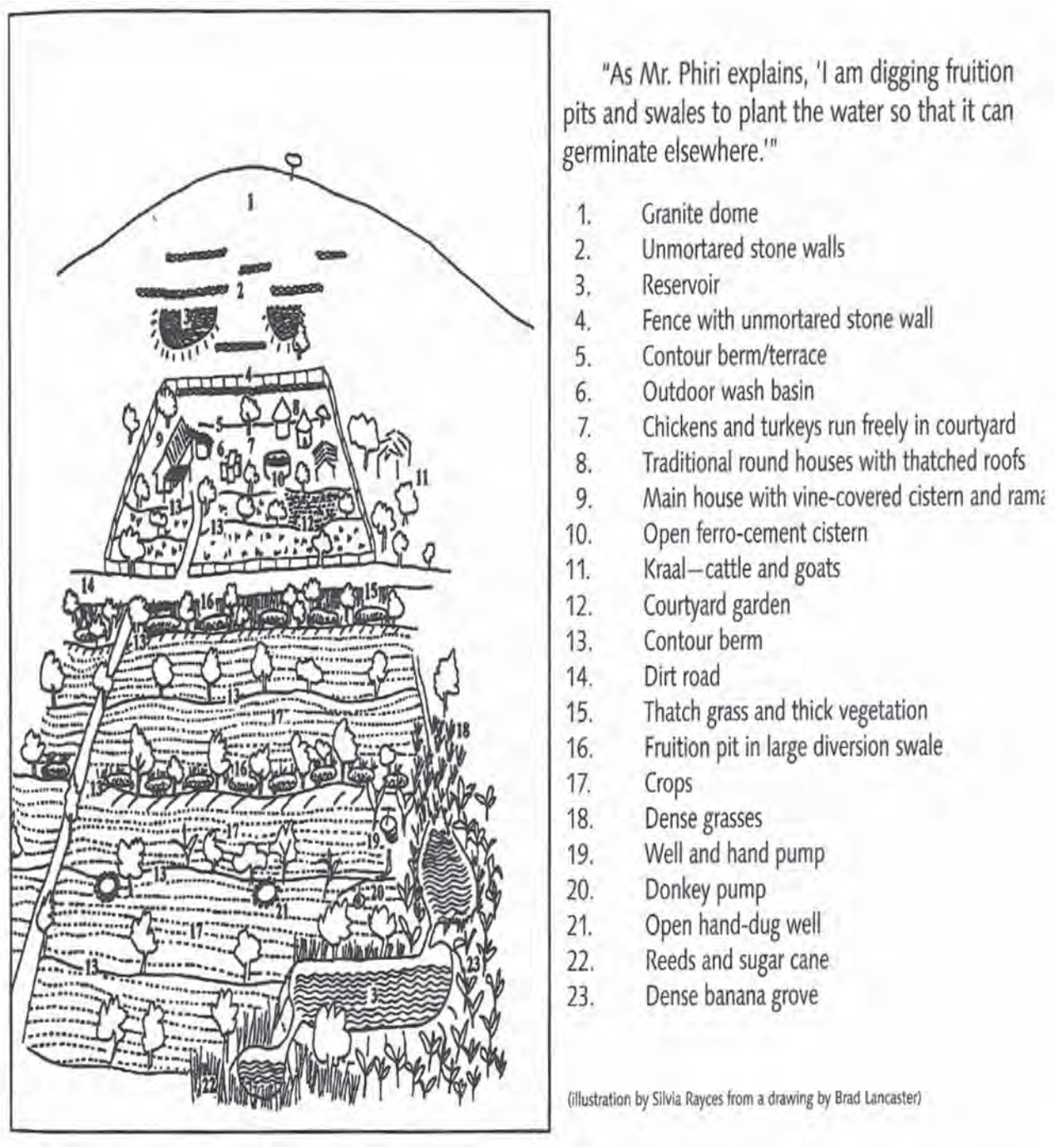


Figure 3.26 Layout of Mr Phiri's farm.
(Adapted from Lancaster, 2008)

Mr Phiri plants a diverse range of crops on his farm: basket reeds, pumpkin (squash), maize, peppers, eggplant, lettuce, spinach, peas, garlic, onions, beans, granadilla, mangoes, guavas and paw-paws, as well as a number of different types of indigenous trees. Indigenous trees are those that occur naturally in the area. They are the best suited to dealing with the particular natural conditions. (Exotic trees come from other places and may not grow as well. Sometimes exotic trees grow too well and compete with indigenous trees. They are then called invasive. This can be a big problem). Mr Phiri's crops are planted on the terraces formed between the contour bunds and the swales. This diversity provides food security for his family: even if some crops fail, others will survive.

He only uses **open pollinated varieties** of crops and collects, keeps and plants his seed from one year to the next. Over time these crops become adapted to the drier conditions on the farm.

Mr Phiri has found that soils amended (improved) with local organic matter and **nitrogen fixing** plants (such as Pigeon Peas) infiltrate and hold water a lot better than those amended with **synthetic/ commercial** fertilizers. He says: "You apply fertilizer one year but not the next and the plants die. Apply manure once and plant nitrogen fixing plants and the plants continue to do well year after year". Note that another advantage of manure is that it is usually free manure compared to the costs of synthetic, commercial fertilizers.

Towards the bottom (the lower lying areas) of the farm are hand-dug, unlined wells (except for one, which is lined and has a small hand pump, for household use). These wells are situated in the wetland in the low-lying area. The wetland helps to filter and clean the water. That is why it is good for household use as well. There is almost always water in these wells and even during a drought it is possible to pump water up from the wells for irrigation. Mr Phiri uses a donkey-driven pump for his purpose. Below, in the box on the next page, is a further explanation of how management of your resources influences the groundwater table.

A **wetland** lies below the wells at the lowest point. Here three aquaculture (fish-farming) ponds/dams are surrounded by a soil-stabilising grove of bananas, sugar cane and reeds. The fish are harvested for food and their manure enriches the water used to irrigate the fields. The taller vegetation creates a windbreak around the ponds (reducing **evapotranspiration**). The shorter grasses filter incoming run-off water into the ponds and feed his cows when in calf.

For years, Mr Phiri found himself in opposition to the international aid and government programs that were pushing for ground water extraction and export crops as opposed to rainwater harvesting and local food production and distribution. As a response Mr Phiri formed a non-government organisation called the Zvishavane Water Resources Project that is spreading his techniques well beyond his area. He says: "It's a slow process. But that's life. Slowly implement these projects and as you begin to rhyme with nature, soon other lives will start to rhyme with yours".

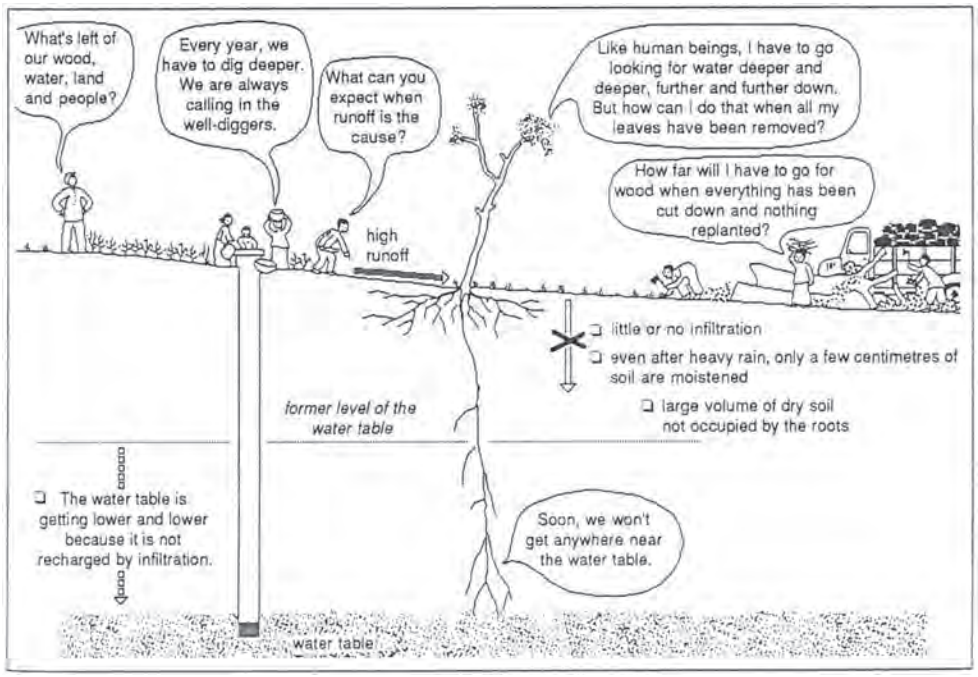


Figure 3.27 The water table and resource management.
A. The water table with deforestation and reduced groundcover.
(Dupreiz and De Leener, 1992)

Figure 3.27 A, illustrates what happens to the water table when resources in the environment are extracted or taken away without replenishing them. Because of the reduced groundcover the surface of the soil becomes hard and results in higher runoff rates and there is little or no infiltration of water. The area becomes drier all the time and it is difficult for plants and trees to survive, resulting in even less vegetation, again causing less infiltration. Boreholes and wells dry up. Other natural resource problems such as accelerated soil erosion, loss of fertile topsoil and the development of donga's are also results of this cyclical process – all initially caused by loss of vegetation.

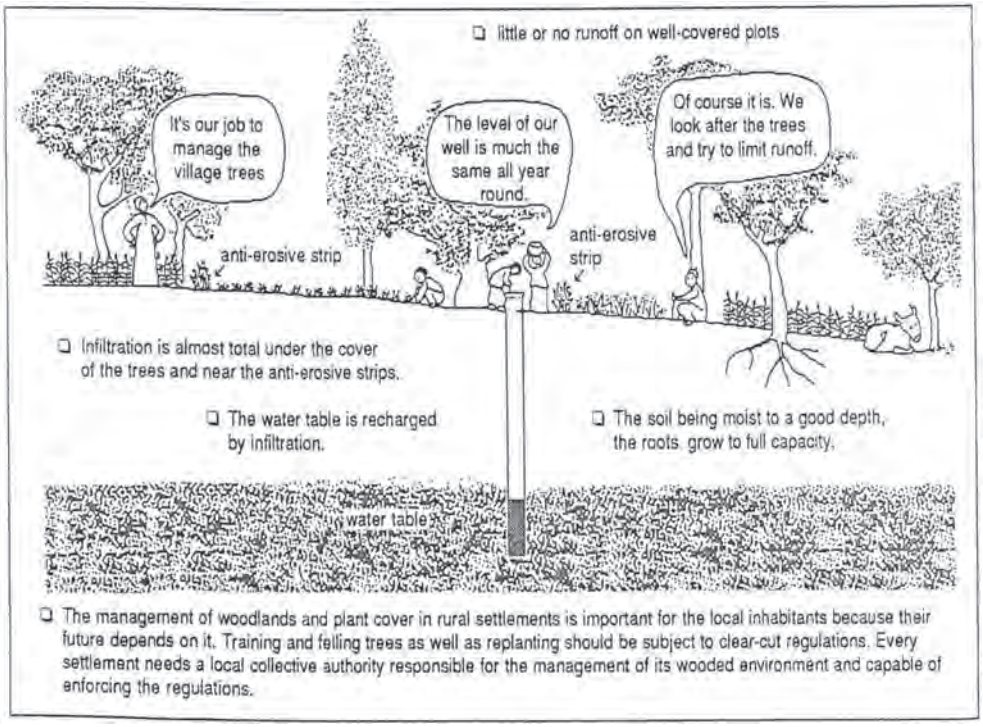


Figure 3.27 The water table and resource management.
B. The water table with improved plant growth and coverage.
(Dupreiz and De Leener, 1992)

Figure 3.27 B, illustrates the effects of plant cover on the water table: With good ground cover and management there is little or no run-off and good infiltration of water into the soil. The groundwater table is recharged and has enough water to support plant growth and provides a stable amount of water from wells and boreholes.

3.6.2 Water for Food Case Study: MmaTsepho Khumbane

MmaTshepo Khumbane has lived and worked in impoverished rural areas of South Africa for more than 30 years. These areas are mostly dry and prone to droughts. People suffer from hunger.

MmaTshepo realised through long and thoughtful observation, that run-off water is one of our most valuable resources and set out to harness (catch) run-off into run-on. Her method for designing her run-on system is described in detail in Module 6, Unit 2. A further explanation follows in the box entitled **Rainwater Harvesting**, below.

She also soon realised that people weakened by hunger and lack of success need to be motivated

to work and try out new things. Over the years, she developed her ”mind mobilization” process to celebrate the ability of people and the abundance they can create. (See Module 6, Unit 2 for a description of MmaTshepo’s mind mobilisation process) This concept has blossomed (grown quickly and beautifully) into the informal *Water for Food Movement* of women who share, celebrate and work together across deep rural areas of the country.

In her yard she slows down and spreads out water at the top of her catchment using a cut-off drain (trench). From there, overflow water from the trench is directed via sunken paths to her **fertility trenches** or **deep trenches** (see Module 6 Unit 3). Any further overflow is directed to the bottom corner of her homestead to be stored in an underground tank for later use.

She grows a diverse range of crops with the intention of always being able to provide a nutritious and balanced meal from the garden – right through the year.

Crops include:

- Annuals: onions, tomatoes, maize, sorghum, spinach, indigenous greens (imifino, morogo), peppers, eggplants, carrots, etc.
- Medicinal and multi-purpose plants: wormwood, garlic, chives, marigolds, bulbs, etc.
- Fruit: oranges, peaches, mangoes, bananas, paw-paws, etc.

All crops are **open-pollinated** and she selects, stores and replants her own seed. All the gardeners get together to share their different varieties of seeds among each other. In this way they ensure the survival of their crops. They also share recipes and have a celebration preparing food together and enjoying a meal.

The main aim of MmaTshepo’s gardening system is to have a diversity of food available in the homestead throughout the year.

Rainwater Harvesting: A system for classification

Water collection:

- Grey water collection (collecting used water from the house);
- *In-situ* rainwater collection (catching the rain where it falls and preventing it from flowing away/ running off);
- External storm water run-off collection (from neighbouring fields, roads or roofs);

Water storage: In the soil profile;

- In structures, like above- and below-ground water tanks;
- In groundwater, through recharge of groundwater;

Water use or application: Directly from the soil profile;

- Through irrigation, i.e., by applying water to the plants from storage.

MmaTshepo’s water harvesting system is probably unique, because it combines all the possibilities for collection, storage, and use, as follows:

- Collection: grey water and in-situ and external run-off collection;
- Storage: in the soil profile and in tanks and groundwater recharge

- Use: directly from the soil profile and through irrigation from storage tanks and groundwater pumped from a borehole.

MmaTshepo's rainwater harvesting system concentrates the runoff during a rainstorm directly into her vegetable beds, providing her crops with 'automatic irrigation'. Overflow runs into underground storage for use during the dry winter months. Her crops can survive longer periods between rainstorms than do crops planted conventionally (in the usual way), because the vegetable beds can hold more water, because of their high organic matter content.

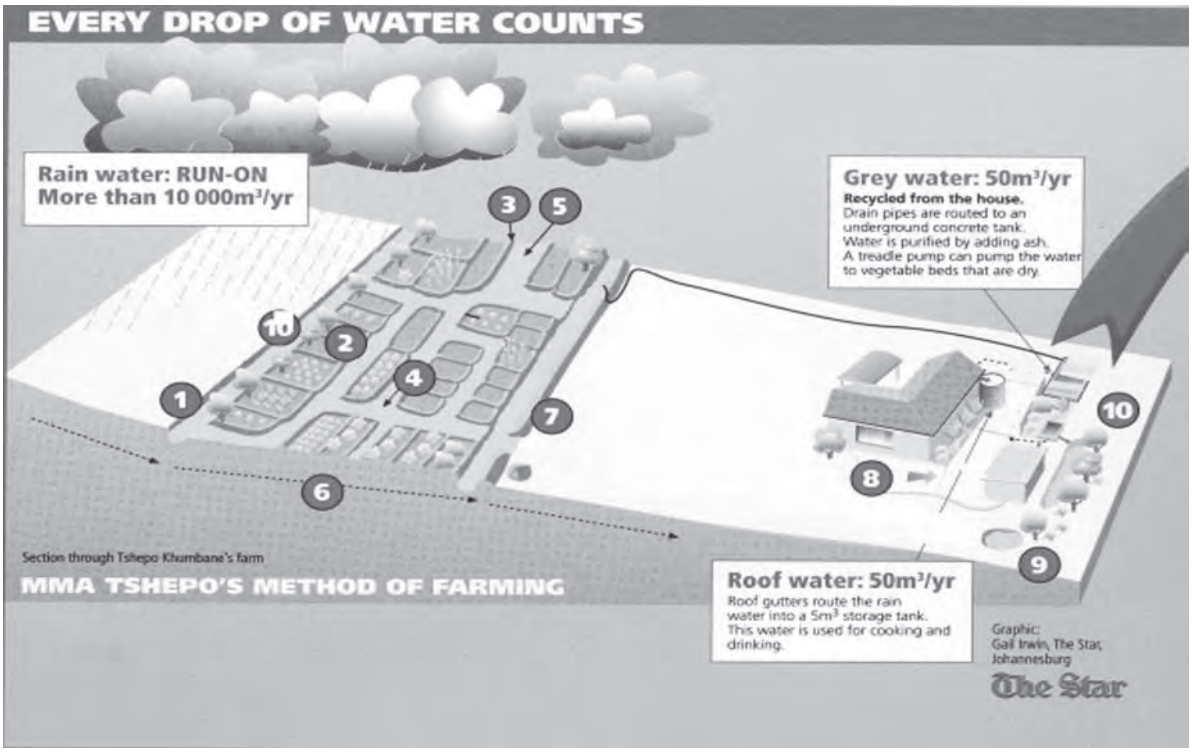


Figure 3.28 The multiple use of natural resources.

- A cut-off trench is dug across the runoff slope of the land to catch rainwater **(1)**.
- Beyond the trench, the vegetable beds **(2)** are dug 1m deep and filled with organic matter – grass, leaves, manure and ash – and mixed with soil. The beds are fertile and absorb and retain moisture.
- The beds are edged with ridges **(3)**. Some are reinforced with stones to stop the soil washing away.
- Between the beds, a network of depressions **(5)** connects the cut-off trench **(1)** to one lower down **(7)**. The water flows along these channels **(4)** during a rainstorm.
- These channels **(4/5)** are also the footpaths to access the beds without having to step into the vegetables.
- Between the trenches the gradient is shallower **(6)**, so that the water has more time to soak into the beds.
- If it rains too much, the second trench **(7)** is breached to prevent the beds from flooding.
- Catchment areas, concrete paving around the house is lipped and slopes to pipes **(8)** that lead to other deep trenches.
- Excess water flows into a water storage pit **(9)**.
- Fruit trees **(10)** are planted on the lower side of a trench so that their deep roots can benefit from the extra soaking

Similarities between the two case studies - Mr Phiri and MmaTshepo

Read through both of the case studies again carefully. Make notes of the main points of rainwater harvesting you can learn from each case.

The following questions will help to formulate your list of similarities.

- What was the first thing that both people did before they started harvesting rainwater? Where do they get their ideas?
- Where on the land did they start?
- What did they need to do to change the way that the water was flowing across the land?
- What was the aim of harvesting rainwater?
- Did they have lots of money to build their systems? How did money constraints affect the way they went about building their systems? (eg: where did they get labour?)
- What do they do with overflows?
- What kinds of plants/trees are used in the system? What purposes do the different plants serve (ie: only for food)?
- What varieties of crops are planted?

The 8 Rain Water Harvesting principles:

1. Start with long and thoughtful observation
2. Start at the top, or highest point of your watershed/catchment and work your way down.
3. Start small and simple.
4. Spread and infiltrate the flow of water.
5. Always plan for an overflow route and manage that overflow water as a resource.
6. Maximise organic and living ground cover.
7. Maximise beneficial relationships and efficiency by "stacking functions".
8. Continually reassess your system: the "feedback loop".

The above can be compared with the eight water harvesting principles given below:
In both cases:

- They decided to do the best they could within the limits of their available resources.
- They focused on a diverse and integrated land based livelihood strategy.
- They use plants with many different functions (such as nitrogen fixing shrubs/trees, that provide fodder and beans) along with their food crops.
- They decided on systems and methods that mimic natural processes that they have observed.
- They used practises that they could do themselves; they did the work themselves at a human scale – not waiting for larger interventions that they had no control over.
- They look after their environment, so that it can look after them. They do not extract or take resources out, but manage the resources sustainably.
- They produce foods first and then sell any surplus they have.
- They plant open pollinated varieties of crops adapted to local conditions.

The benefits of Communal Land and Restitution Act (CLaRA) will benefit households as they will have property rights. They can then invest in improvements to improve their livelihood on their 'four corners'.

3.6.3 Creating a design plan for your area

After reading and thinking about the ideas that we examined in this module and doing several relevant activities, you should be able to plan (design) a food or any other kind of garden around your **home, office, school or church** in a way that it will help you to grow more food and medicinal plants using fewer resources. *Design* means where you put things and how you arrange things. A good design will need careful planning.

The design plan is your vision of where the plants and animals (including you!) will live. It will show where the pathways, driveways, buildings, water tanks, solar panels, toilets, and other structures will be placed in your area. Everything that you've learned about low input must be considered in the design.

Some key questions to continually ask yourself are:

- Low Input – How can I make the best use of resources in the most efficient way?
- Diet Diversity – How can I get a diverse diet throughout the year?
- Soil Health – What do I need to include to make my soil healthy?
- Water Management – How can I make the best use of all my water?
- Permaculture principles - What does each plant, tree, or animal need to live healthily? Where is the best place to put it and what should it go with it?
- Considerations – I also need to consider resources, space, labour, lifestyle, availability and weather.

At first, as with any new skill or way of thinking, it will take some effort to remember all of these pointers. However, after a while it becomes your way of thinking with very little effort at all. In this next section you will have the opportunity to start thinking about a design for your area. Design plans may change as you put the plan into action and it may take years to complete the overall design plan.

3.6.4 Steps for your design plan

There are many ways to create a design plan. However it is important to work in a orderly and structured way. We therefore suggest six main steps to consider when you create a design plan. These steps form part of the next activity.

Note: In the next unit you will be following the six steps with your households, so make sure you understand and do every step as well as possible.

Activity 3.14 Creating a design plan for your area

Complete this activity on your own in your workbook

Aim: Create a design plan of a food or any other garden for your area taking low input principles into consideration.

Time: 4 hours

What you do

Follow the steps explained below, and use any relevant information in this module to design a plan of action to enhance food security in your area.

Step 1: Revisit your helicopter plan

In Unit 3 of Module 2 you had to draw a helicopter plan showing how you would like your area (yard) to look in five year's time. It is now time to revisit this helicopter plan to remind yourself of your expectations and to take them into consideration when you start your design plan.

Step 2: Revisit the map you compiled (Resources map and Transect walks)

In Unit 2 of this module, you used various tools to map your area. You will recall that we looked at resources mapping and transect walks. You now need to revisit this map to help you decide where you will make your garden.

Step 3: Decide where and how you will make your garden

Although you have a map of your community, and a list of your resources, you now need to decide on these important aspects:

1. Where will you make your garden?
2. How will you address the water needs?
3. How will you prepare your soil?
4. What plants you will you plant?

Where will you make your garden?

Walk around your own area, preferably with other people in your own household, You will want to do this several times at different times of the day to really understand the area. After ten years we still take what we call 'garden walks' to see how the designs are doing and to discuss what changes and additions we want to make.

You need to look at the following factors:

- The current layout of trees, the places where you keep your animals, and the buildings in your own area
- The life styles of your own household members
- The slope, aspect and ridges in your own area including where North, South, East and West are
- The direction of the usual winds and the position of trees throwing shade (which may change at different times of the year).

How will they address their water needs?

- Decide on how you will controll run-off
- How irrigation can be implemented in the most effective way
- How to address your water needs in the most sustainable way (capturing rainwater, dew and 'grey' water)

How will you prepare your soil?

- Establish the type of soil you have and how you can improve it (compostand/or manure)
- What will you use as mulch?
- What types of beds will you make; raised, sunken or level?
- How will you prevent soil erosion?

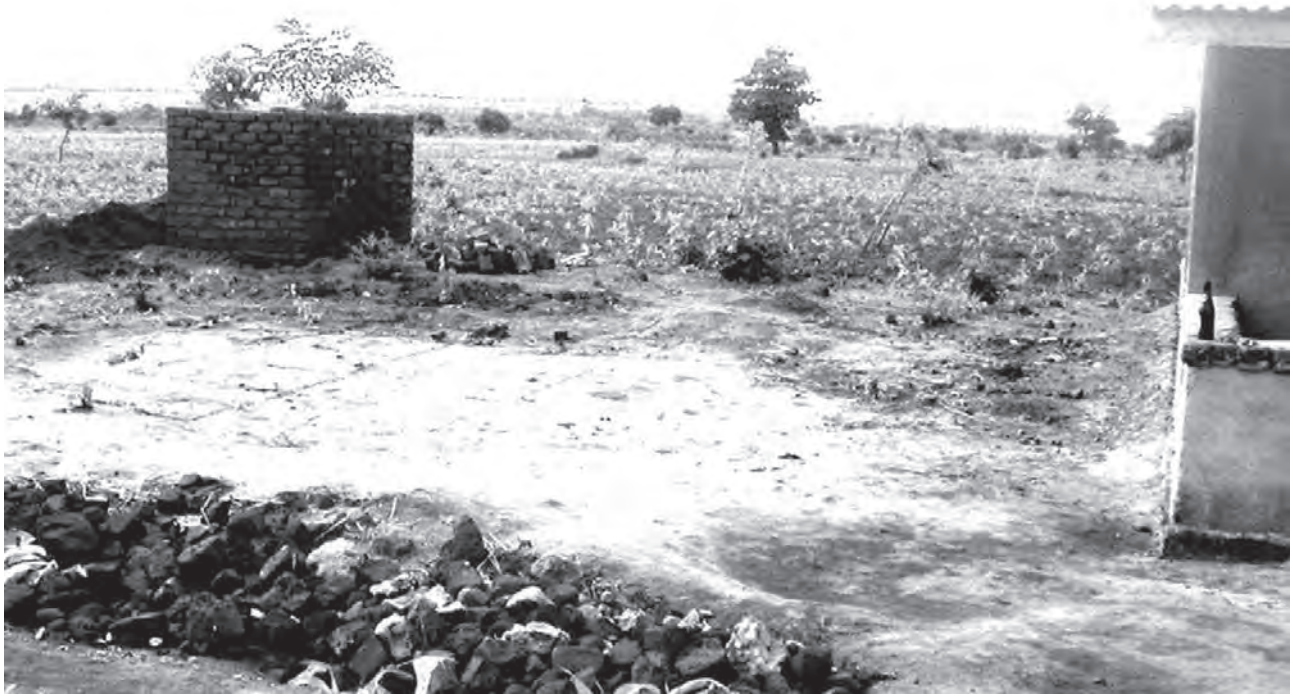
Which plants will you plant?

- Decide on the best plants and animals to use according to permaculture groups and to enhance food security directly or indirectly. For example, you will be directly enhancing food security by planting a variety of vegetables and fruits to eat. You will be indirectly enhancing food security by planting medicinal plants, food plants and flowers to sell.
- Consider using indigenous plants and seeds which you have harvested in a sustainable way from nature.

Step 4: Visualise or "draw" your plan:

There are several ways that you can visualize or "draw" your plan:

- in your head,
- on paper such as a notebook, flip chart, poster board, old cardboard or chalkboard,
- outside in the actual area with rocks, broken bricks, sticks, or other markings to help you see your ideas and make changes by moving them around as you think through your plan.
- by using all of these methods, which is the best way to do it.



A. The bare homestead plot

B. The garden design using bricks

Figure 3.29 An example of a design plan laid out with bricks

Step 5: Discuss your design plan with other people

You have worked hard and have designed a plan which you are very proud of**.** It is however very important to discuss your design plan with other people; not only with members of your group or household, but also with other knowlegeable people.There are numerous people with experience that will add value to your plan. After discussions, revisit your design and adapt it where necessary. Keep in mind that the success of your project depends on a good design which takes all low input principles into consideration.

Step 6: Action plan

After you have mapped your area and created your design plan, you have to write an action plan for your area. When you are working in a team or community situation, a written list helps to create clear communication. You can brainstorm all the activities that need to be done then put them in order into a plan. Remember, things may change when you get out there and start doing. This action plan will form the main topic of Module 5.

Questions

1. What were the major changes that you made to your original map for your area, after you had walked through the area a second time? What made you change your mind?
2. Was there agreement in your group, regarding the priorities that need to be addressed in the area? Is it important that every member should have a voice? Justify your answer.
3. What problems do you think you will encounter when you put your design into action? How can these be addressed?

Concluding remarks

In this unit we have explored how natural resources are abused and in danger of becoming so scarce that we will not have enough to satisfy our future needs. However, there is hope if we use our resources in a sustainable way. We have therefore looked at ways to manage our precious soil, water, biodiversity and energy resources efficiently without harming the natural environment, while still enhancing food security.

We also started planning a design for a homestead garden and other projects that will contribute to food security in our specific area.

In Unit 4 you will have an opportunity to apply what you have learned when you work with households.

Introduction

You have now completed Units 1-3 of this module and have gained the basic knowledge regarding natural resources and how it should be used. Well done! This means you can now '*speak the language'* used by people who work in the field of food security. You have also gained important skills, which you will need when you work in partnership with households as required in the modules that follow.

Before we continue, complete the table below and decide if you really do have a clear understanding of what you have learned in Units 1, 2 and 3.

Key concepts	**I still recall the basic definition and know the information can be found on page……. of this study guide**	
	Tick ( )	**Page number**
UNIT 1		
Natural resources		
Renewable resources		
Non-renewable resources		
Habitat		
Solar energy		
Recycling		
Water cycle		
Evaporation		
Evapotranspiration		
Transpiration		
Condensation		
Precipitation		
Infiltration		
Groundwater		
Water table		
Aquifers		
Catchment		
Drainage basin		
Fossil fuels		
Indigenous		

Organisms		
Soil texture, stucture and type		
Humus		
Biodiversity		
Cycle of nature		
Food chain		
Food web		
Trophic (feeding) levels		
Ecosystem		
UNIT 2		
Resources • Access to resources • Control of resources • Ownership of resources		
Gender		
Macro-level factors		
Technological environment		
Socio-cultural environment		
Natural environment		
Beliefs, attitudes and values		
Indigenous knowledge		
Constraints		
TB		
Malaria		
Protozoa		
Route of transmission		
Remittances		
Chronic diseases		
Inheritance laws		
Resource mapping		
Transect walks		
Ranking		
Scoring		
Physiology		
Psychology		
UNIT 3		
Sustainable		
Low input		

Deforestation		
Solar energy		
Greenhouse effect		
Pollution		
Acid rain		
Erosion		
Riverine vegetation		
Sink		
Swales		
Used water		
Grey water		
Irrigation		
Soil erosion		
Desertification		
Tillage methods		
Biomass		
Animal manure		
Gulley		
Mulch		
Fire break		
Fire guard		
Perennial plants		
Legumes		
Compost		
Permaculture		

In this unit you will get the opportunity to apply your knowledge and skills when you work in groups using certain tools and methods, that are commonly used in the field of food security.

4.1 Build good working relationships

No matter what path you take in your efforts to improve food security in your community, you will need to develop cooperative and constructive relationships with many different people. The people you engage may include politicians, public servants, people in your community, the media, policy makers, researchers, health professionals, and people in other organisations who are concerned about your issue.

To build good working relationships you need to consider the following:

4.1.1 Be honest

Be yourself and always tell the truth. Good relationships are built on trust. If the people you are working with or trying to influence think that they cannot trust you, you will not be effective. Honesty and sincerity are powerful tools.

4.1.2 Be calm and polite

Keep your temper in check and be polite to everyone you meet. Thank anyone who helps you. This includes secretaries, receptionists, administrators and other workers. People in these positions can be a big help if they are on your side so do not create a bad impression with them. Community action (for example, lobbying for policy change) can go on for a long time and you may see the same people again and again.

4.1.3 Be fair

If you are trying to influence people, lobby or change policy, there is great value in putting yourself in the shoes of the people you are trying to influence. Do not just ask them to see your side, try to see theirs as well. People will be more willing to listen to you if they see that you are willing to listen to them. You do not have to agree with their position, but you will be able to make your points more effectively if you understand their position. It is very effective if you can state your case as “we would like to work with you to solve this problem together”.

4.1.4 Be well informed

Many aspects of action on food security involve lobbying and advocating for changes in policy. Good policy is based on good information. Know your issue and come to meetings prepared to explain it clearly and answer questions. Advocacy is most effective when you not only bring a problem to the table, but you can also suggest a solution. Your insights, ideas and suggestions can contribute to good policy.

4.1.5 Be helpful

People will be more willing to help you if you are willing to help them. Look at activities like advocacy as an exchange. You want something from the people you are trying to influence. What can you offer in return? For example, public officials need to know about the outcomes and effects of the policies they are responsible for. You can offer information about the effects of policy on your community and people in your community from your group’s unique point of view.

4.1.6 Be patient, take the long view, and celebrate your small successes

Community action can sometimes be a long, drawn-out process. This is especially true of actions like lobbying or advocating for policy change, but applies to all kinds of community action. Before you start you need to be reasonably sure that you have the energy and enthusiasm to keep at the job for what could be a long time. Do not give up and do not expect things to fall into place immediately. Do not take conflicts and defeats personally. Keep talking. Keep coming back. Be willing to compromise as long as you’re still moving toward your goal. A small step in the right direction is better than no

step at all. Remember to celebrate your small successes along the way.

(Adapted from: Nova Scotia Women's FishNet, 2002)

4.2 Portfolio Activities and the "Triple A" Cycle

All the portfolio activities you do in this unit will be guided by the "Triple A" Cycle approach.

Do you still remember what the "Triple A" cycle approach is? To find out if you know the answer, complete the following sketch.

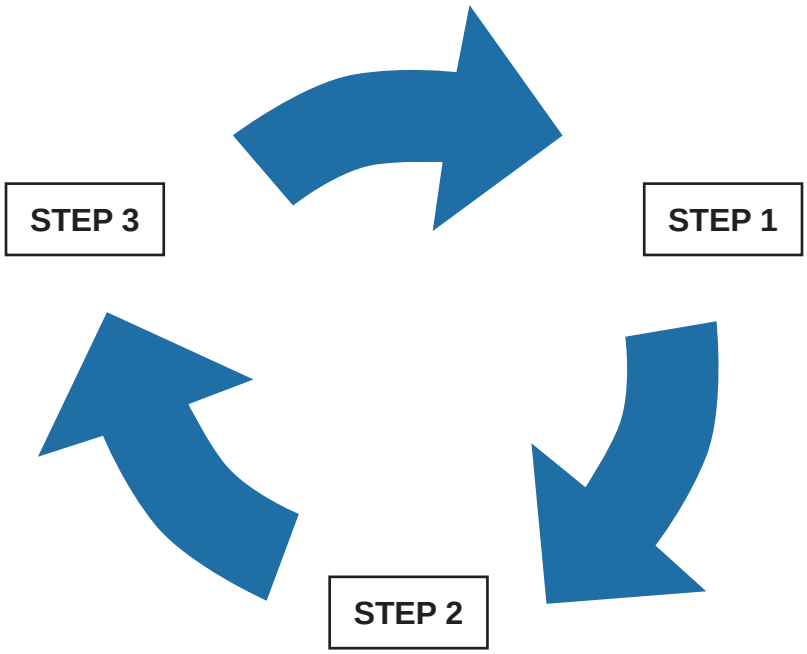


Figure 4.1 The "Triple A" Approach

Step 1:

……

……

……

Step2:

……

……

……

Step 3:

……

……

……

Your sketch should show the following:

Step 1: Assessment phase: Collecting current information on key issues/ indicators.

Step 2: Analysis phase: Interpreting the information, making sense of it, identifying areas of success and areas that need improvement.

Step 3: Action phase: Developing strategies or action plans to address identified problems and improve implementation activities.

4.3 Your main tasks in this unit are Portfolio Activities

What are your main tasks for this unit? Your main tasks are the four activities shown in the table below. These activities are **compulsory Portfolio Activities, which must be included in your portfolio**.

You should also include other items, such as reflection items in your portfolio. Use the portfolio file you received especially for the purpose, for filing your completed portfolio activities.

Note: It is very important that you refer to the portfolio section in the General Information Letter when you compile your portfolio.

Your task	Tools and methods	Portfolio activity
1. **Assessing information in partnership with your household (collecting information)**	• Gender-related use and control of resources • Draw a Resource Map with households for their area **or** draw a Transect Walk diagram	4.1 4.2
2. **Analyzing the information** you collected in partnership with the group and deciding which are positive and which are negative points	• Analyse best water, soil and plant practices with households	4.3
3. **Taking action** together by coming up with an action plan that will address food security issues	• Create a design plan with households for a homestead garden and make compost • Write a reflection report	4.4 4.5

How do you go about conducting (carrying out) the three tasks of gathering information, analysing information and taking action in partnership with your household for improved food security?

4.3.1 Assessing (collecting information)

You will need to collect a lot of information and there are several tools that make it easy to do so. You will be collecting information by using:

- a gender-related exercise to establish use and control of resources and

Then choose between

- doing a resource map

or

- doing a transect walk. (You may choose which one of these two methods you would like to use with your household).

Portfolio Activity 4.1 Gender related exercise to establish use and control of resources

Complete this activity on your evidence sheet in the portfolio file.

You have already done a similar activity in Unit 2 in your groups, but now will you get the opportunity to look at gender issues with your households. You may have to adapt this activity for the specific households you will be working with.

Aim: Conduct a gender-related exercise with your households, to establish use and control of resources in the area.

Time: One hour

What you must do

1. Brainstorm with your households and compile a list of resources which they regard as important in their community.
2. Form a female and a male group.
3. Interview the female group first. With their help, complete the table provided in the evidence sheet. Do the same with the male group.
4. If necessary, add columns to your table for different age groups (young, adult, aged) and disadvantaged groups.

Evidence sheet for Portfolio Activity 4.1 (Gender exercise)

This evidence sheet is ONLY an example. You have to complete the evidence sheet for Portfolio Activity 4.1, which is in your portfolio file.

Resources	Owned by	Controlled by	Used by	Monitored by	Accessed by
Land					
House					
Water					
Fuel Wood					
Livestock					
Finances					
Labour					

Questions

1. Which resources do women and men (and the young and old) use? Are there differences in their use according to gender, age, social group? What access and control do disadvantaged people have?
2. Who decides about the use of these resources?
3. Who has ownership over the resources (the right to sell or give them away)?
4. What are the main differences between women and men when it comes to the type of resources they use, control, or have ownership over?
5. What are the relationship between women's labour and their use and control of resources? What are the relationship between men's labour and their use and control of resources? Give information on other relevant groups.
6. How will the death of a male (or female) adult in the household change the access, control and ownership rights over resources, including land, of the remaining partner? What happens to children in a household when both parents die?
7. What services and structures in the community can support rural women and men in managing resources and improving their livelihoods? Give the same information for disadvantaged groups, different socio-economic groups, grandparent or child-headed households, households taking care of sick relatives or orphans.

Conclusion

Write a conclusion of your findings on this gender issue. What recommendations can you make?

Portfolio Activity 4.2 (Option 1) Draw a Resource Map of your area

Complete this activity on your evidence sheet in the portfolio file.

You have already done a Resource Map in your groups (Unit 2), but now you will get the opportunity to do it with your households. You may have to adapt this activity for the specific household you will be working with. Select only one option, Option 1 or option 2.

The Village/community Resource Map is a tool that helps us to learn about a community and its resource base. The primary aim is not to develop an accurate map, but to get useful information about local perceptions of resources. The household participants need to develop the content of the map, according to what is important to them.

The Village Resource Map is a good tool to begin with. It is easy and fun for the households to do. It helps start discussion among the household members and with you as a facilitator. We would like you to do this map with a separate men's and women's group. This is because women and men may use different resources as you have seen in the previous activity. The women will map the resources they think are important (like water and firewood). The men will map the resources they think are important, like grazing land and infrastructure.

Aim: Assess the households' perceptions of what natural resources are found in the community, and how they are used.

With whom: Female and male focus groups

Time: 2.5 hours

What you must do

1. Find a large open space to work.
2. Start by placing a rock or leaf to represent a central and important landmark in the community, such as a school.
3. Ask the participants to draw the boundaries of the community.
4. Ask the participants to draw other things on the map that are important. Do not interrupt the participants unless they stop drawing.
5. Once they have finished, ask whether there is anything else of importance that should be added.
6. When the map is complete, ask the participants to explain and describe it. Ask questions about anything that is unclear.
7. Use the key questions given in the example of your portfolio evidence sheet below, to guide a discussion on the use of resources in the village.
8. Complete the questions on your evidence sheet, and put the **completed sheet** in your portfolio file.
9. Include the **resource map** you drew on paper in Unit 2, as well as a **photograph of the village** resource map, as further evidence.

Note: You may add any other additional information you regard as important. Although photos are expensive, you may use a cellphone or camera, and print photographs, to enhance your portfolio.

Example ONLY

Evidence sheet for Portfolio Activity 4.2 (Resource Map)

This evidence sheet is ONLY an example. You have to complete the evidence sheet for Portfolio Activity 4.1, which is in your portfolio file.

Questions

1. What resources are abundant?
2. What resources are scarce?
3. Does everyone have equal access to land?
4. Do women have access to land?
5. Do the poor have access to land?
6. Do the disabled have access to land?
7. Who makes decisions on land allocation?
8. Where do people collect water?
9. Who collects water?
10. Where do people go to, to collect firewood?
11. Who collects firewood?
12. Where do people graze their livestock?
13. What kind of development projects/activities do you carry out as community? Where does this happen?
14. Which resource do you have the most problems with?

Examples of resources:

- Physical features: hills, valleys, large rocks, erosion
- Types of natural vegetation such as grassland, bushes, trees
- Cultivated areas and agricultural lands showing cropping and crop types
- Land-use such as gardens, fields, grazing areas, forests
- Rivers and water points
- You can also include the village infrastructure such as the boundary, roads, houses, schools, markets, clinics, churches, special places such as sacred sites.

Portfolio Activity 4.2 (Option 2) Draw a Transect Walk diagram

Complete this activity on your evidence sheet in the portfolio file.

Aim: Do a Transect Walk with your households and compile a diagram of their major issues regarding natural resources

Time: 2.5 hours

What you must do:

This activity has a Part A and a Part B. Here are suggestions to guide you on what to do in each part.

Part A: Plan

1. Discuss with your households what the purpose of the transect walk is and what information you want to gather. Choose 2-3 features and issues you want to explore. Look at this list for ideas:
   - Land use: crops cultivated, local cultivation patterns, local technology used for irrigation, water/plant/soil conservation, erosion, soil types, local vegetation, use of wild plants, resources in disrepair such as dip tanks.
   - Resources or facilities: state of roads, problems and opportunities with water points or plotting a gravity water system.
   - Village or homestead areas: drainage and sanitation use of back yard space, location of taps, household chores, state of living structures and interactions between different groupings.
2. Write a list of questions to which you want to find answers.

Part B: Do

3. Take a walk across the area in a straight line and make notes on relevant features that you observe. The idea is to stop at regular intervals, say every 500 meters, or every 10 minutes, or whenever a particularly interesting feature is observed. Use the opportunity to get clarity about the issues and discuss problems and opportunities with your households.
4. After the walk, share the notes you have made with your households and refine your ideas.
5. Involve everyone in the households in a making transect walk diagram. During this time you will continue to discuss the issues and sharpen your ideas. Check the final diagram. Does it reflect adequately what you observed?

The following example of your portfolio evidence sheet will help you to document in a structured manner, what you have discussed and decided upon.

Example ONLY

Evidence sheet for Portfolio Activity 4.2 (Transect Walk)

This evidence sheet is ONLY an example. You have to complete the evidence sheet for Portfolio Activity 4.2, which is in your portfolio file.

Land use:
Choose a few features you want to explore (see Part A: Plan above)

Resources or facilities:
Village or homestead areas:

Questions

1. What kind of soil do you have in the community?
2. What kind of trees and plants can be found in and around the community?
3. What crops are grown in existing homestead gardens?
4. If there are slopes in the community, what are the problems in the upper and lower slopes?
5. What features and issues did your households focus on in their transect walk?

NOTE: Include the transact walk diagram that you did in Unit 2, as well as a **photograph of the transect walk** that the households did, as further evidence in your portfolio.

4.3.2 Analysing information

You now need to analyse water, soil and plant use of households and discuss best practices. When you have completed the analysis, you have to come to a conclusion.

Portfolio Activity 4.3 Best water, soil and plant practices

Complete this activity on your evidence sheet in the portfolio file.

Aim: Analyse water, soil and plant use of households and discuss best practices

Materials: Flip chart and various coloured pens such as koki's

Time: 1,5 hours

What you must do

1. Look at the example below, of the evidence sheet you have to complete in participation with your household. We have partly completed the example of a fictitious (imaginary) household, to show you how it can be done.

2. You need to **complete the evidence sheet** in the portfolio file.
3. Refer to unit 3, before doing this activity.

Example ONLY

Household name:	Madiba
Where located:	Near Alice in the Eastern Cape
Date:	10 April 2011
Household members:	Single mother, three own children and an orphan

	How will you inform households and facilitate participatory discussion?	**What issues/ wrong practices did you identify?**	**How will you address these issues/wrong practices?**
Water management			
Is all waste water harvested? (All grey water should be used)	Discuss wet areas around boreholes, wells and taps, for plants. How can wash water be used to water plants? Discuss tandala racks.	Animals trample the area to get to the water.	Use fencing materials to keep animals out.
Is all rain water harvested? (No rain water should leave the area)	Discuss water tanks, other containers such as large clay pots or drums, pits or banana circles; swales.	No male member to climb on roof to install or fix gutters. Rubbish block road drains.	Form a community group to help with installation of gutters, e.g. for women and disabled people. Children can be asked to help clean road drains, and be rewarded with a story told by a gogo.
Is irrigation used? If so, what methods?	Discuss watering where it counts (the roots); avoid over- and under-watering. Use amount of water for soil type. Water just before wilting starts. Water less often, but give deep water. Discuss low input irrigation methods (refer to unit 3)	No irrigation tools, such as a watering can.	Use plastic containers with small holes for irrigation use low-input drip irrigation methods.

How much water is used for plants and animals? (e.g. 100 litres, or 20 cans). How much water is harvested?	Discuss whether there is harmony between the amount of water used and harvested.	More water is used than harvested.	Be creative in harvesting more grey water rainwater and dew.
When do you water the plants in your yard? (Morning, noon, late afternoon)	Discuss evapotranspiration, and that early morning or late afternoon is the best time to water.	Do not have time early morning or late afternoon, to water plants.	See how you can change daily activities to free time for watering plants early mornings or late afternoons.
Healthy soil			
Mulching	Brainstorm the importance of mulch, such as keep soil cool and moist, protect it from rain and wind, prevents unwanted plants from growing, etc.	Fears surrounding mulch- that it will bring snakes and termites	Lay fears to rest with case studies/ participatory discussions
Compost and animal manure			
Reduced sweeping	Discuss that sweeping removes organic matter from top soil, which removes the food and protection the soil needs. Makes the soil hard, and prevents water from seeping into soil, causing erosion.	If people don't sweep, snakes and mice will enter the house.	Discuss these issues, and get a cat!
Eliminate bush burning			
Reduced tillage			
Swales			
Consider slope aspects and ridges (and sunken, raised and level beds)			
Cultivate soil-enriching crops, such as legumes			
Use animal manure and compost			

Wise use of indigenous and other plants			
Use of indigenous plants and seeds	Brainstorm the value of planting indigenous plants, available in the area.	Don't have tools to collect plants, or don't have access to plants in the wild	Negotiate access through community structures.
Use permaculture groups when planting			
Harvest sustainably			
Are synthetic (man-made) chemicals used on plants (eg fertilizers and pesticides)			
Use of natural remedies for plant diseases			

4.3.3 Taking action

In Activity 3.14 in Unit 3 you had to create a design plan for your area in your class groups. You now have an opportunity to work with your households in creating a design plan according to their needs.

Portfolio Activity 4.4 Creating a design plan for a homestead garden in your area

Complete this activity on your evidence sheet in the portfolio file.

Aim: Work with your households to create a design plan based on their needs, for example, a homestead garden.

Time: 3 hours

What you must do

Use the following steps which we examined in Unit 3 with your households. Also use any other relevant information in this module when you work with your households to create a design plan to enhance food security.

Step 1: Revisit the households helicopter plan

In Unit 3 of Module 2 you had to draw a helicopter plan with households showing what they would like their area (yard) to look like in five year's time. It is now time to revisit this helicopter plan to remind them of their expectations and to take them into consideration when designing a plan.

Step 2: Revisit the map the household compiled (Resource map and Transect walks)

In Activity 4.2 you have used various tools to map the households area. You will recall that we looked at resource mapping and transect walks.
You now need to revisit this map to help them decide where they will make their garden.

Step 3: Decide where and how the household will make their garden

Although the household has a map of their community, and a list of their resources and issues regarding resources, they now need to decide on three important aspects:

1. Where is the best place to make their garden?
3. How will they address their water needs?
4. How will they prepare their soil?
5. What plants do they want to plant?

Where is the best place to make their garden?

Walk around your own area, preferably with other people in your household, You will want to do this several times at different times of the day to really understand the area.

You need to look at:

- The current layout of trees, places where you keep your animals, and buildings in your own area
- The life styles of household members
- The slope, aspect and ridges in your own area including where North, South, East and West are
- The direction of the usual winds (this may change at different times of the year)

How will they address their water needs?

Together with the household decide:

- How the household will controll run-off and
- How irrigation can be done in the most effective way
- How to address their water needs in the most sustainable way (capturing rainwater, dew and ‘grey’ water)

How will they prepare their soil?

- Decide what type of soil they have and how to improve it (compost and/or manure)
- What will they use as mulch?
- What types of beds will they make- raised, sunken or level?
- How will they prevent soil erosion?

What plants will they plant?

- Decide on the best plants and animals to use according to permaculture groups that will enhance food security directly or indirectly. For example, directly enhance food security by planting a variety of vegetables and fruits to eat. Indirectly enhance food security by planting medicinal plants, food plants and flowers to sell.
- Consider using indigenous plants and seeds which have been harvested in a sustainable way from nature.

Step 4: Households visualize or "draw" their plan

There are several ways that households can visualize or "draw" their plan:

- On paper such as a notebook, flip chart, poster board, old cardboard or chalkboard,
- Outside in the actual area with rocks, broken bricks, sticks, or other markings to help you see your ideas and make changes by moving them around as you think through your plan. (Refer to Figure 3.23 in Unit 3)
- Or by using all of these methods, which is the best way to do it.

Examples of natural materials for composting

Feathers, fur or hair
Bones
Dry leaves or grass
Branches from plants
Unwanted plants such as weeds
Torn paper or cardboard
Tin cans or other material that rust
Kitchen scraps; peels, any inedible skins (eat all edible skins), unwanted pieces of food
Manure (any type)
Anything from nature

Step 5: Discuss the households design plan with other people

You and your household have worked hard and have designed a plan which you are very proud of**.** It is however very important to discuss their design plan with other knowledgeable people.There are numerous people with experience that will add value to their plan. After discussions, revisit the design and adapt it where necessary. Keep in mind that the success of this gardening project depends on a good design which takes all of the low input principles we examined in this module into consideration.

Step 6: Action Plan

After the household has mapped their area and created a design plan, you have to help them write an action plan for their area. When you are working in a team, a written list helps to create clear communication. You can brainstorm all the activities that need to be done then put them in order and form a plan. Remember, things may change when they get out there and start doing. Implementing this action plan will form the main topic of Module 5.

Questions

1. What were the major changes that households made to their original map for their area, after you walked through the area a second time? What made them change their mind?
2. Was there consensus in your household group, regarding the priorities that need to be addressed in the design plan? Is it important that every member should have a voice? Explain your answer.
3. What problems do you think households will encounter when they put your design into action? How can these be addressed?

You have to complete the evidence sheet for Portfolio Activity 4.4, which is in your portfolio file.

Making compost with your households

In Unit 3 we briefly examined compost but now you now have to make compost with your households so it will be ready for use when they start planting plants or seeds in their prepared gardens in Module 5.

Basic Principles for making any type of compost

1. **Use a variety of different natural items** – anything natural can go into compost. The key is variety and balance. The compost needs a variety of foods to be healthy just like we need to eat a variety of foods to be healthy!

2. **Balance the amount of air, water and heat** to make the compost work quickly. With too much air or too little water the pieces will break down slowly, with too much water the pieces will become waterlogged and the composting process will slow down. Luckily, it is easy to learn this balance with a little practice

3. **Do not use plastic or other items made from chemicals,** commonly referred to as 'man-made' terms. You will have to think about where the items came from – paper, leather, and cotton clothes all come from natural materials and will eventually be food for the soil (you will also have to think what happened to the item along the way, such as whether it was painted or dyed with chemicals).

4. **Put the compost pile where it will be most useful**. Do you have a tree you can put the pile near so the tree can protect the compost from sun and so the tree can benefit from the nutrients in the compost? Is it better for you to have your compost in your field or around your home? Or, better yet, have many compost piles/pits in many places! Be creative compost can go anywhere and can be any size!

You should recognize the following figure which is in Unit 3 and which shows you how to make compost. We repeat the figure here to make it easier for you when you make compost with your households.

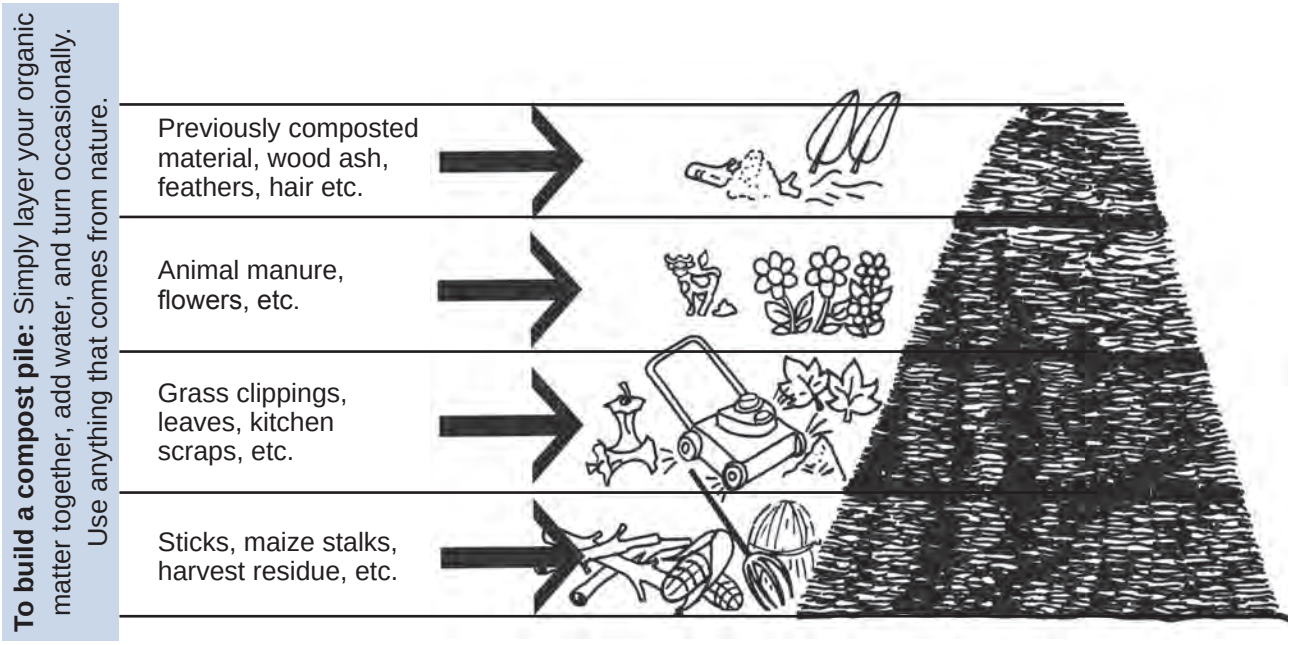


Figure 4.2 Making compost

Now that you understand the basic principles of making any type of compost, you may choose to make pile compost or pit compost, or make the compost in your trench bed.

Pile composting

Making compost in a pile usually takes the least work as you just pile items on top of each other. However, to finish quickly they need a bucket or two of water every week in the dry season. You can just let the compost sit, but it will take longer and the process will slow down until there is moisture.

1. Start with the largest pieces to allow air to enter the pile from the bottom.
2. Layer different items changing from dry materials to wet materials (like fresh food, fresh manure, freshly cut grass). Always cover the wet materials well with dry materials so insects are not attracted to the pile. (Optional: Some people like to cut up items which will speed up the compost, but this means more work for you. Decide how quickly you need your compost!)
3. Keep layering until about chest height then stop adding new materials (start another pile with new materials). You can add a bucket of water in between layers if you have it (this can be 'grey' water, like from washing).
4. If it is a very dry area you can cover the pile with large fresh leaves (like banana, palm or papaya), or with mud to help keep moisture in the pile.
5. Heat monitoring pole. The compost should get hot inside after a few days. You can put a pole in the middle of the pile then pull it out after a few days. The pole should feel warm when touched.
6. After about 3 weeks turn the pile over and add water (if you have it and if the pile needs it). Observe the pile as you turn it. Use it after 1-2 turns (6-9 weeks). Allowing chickens or other animals to scratch through your pile will make a mess, but they also mix the materials up for you. Just pull together the pile with a rake, your hands, feet, or another tool.

Pit composting
Pit composting generally needs more input than pile composting, although this is not always the case.
1. You have to dig a pit, or use an existing pit, such as where bricks were made, or an old burning pit (since you are now making compost so you will burn a LOT less!).
2. Use the same concepts as for pile composts, layering a variety of different natural materials.
3. Add a bucket or two of water while it is being made, depending on how moist the area already is.
4. When the pit is filled, cover it with a layer of dirt and then mulching to help trap moisture and protect from sun and wind.
Pit composting may be the right choice for you, depending on your situation, but a few points to consider before digging a pit are:
• The pits require reaching down and getting the compost back out of the pit when it is done, which is more work than using the pile compost.
• This compost is not turned over; it just sits until it is ready. It also does not need water to be added after it is made as the pit prevents water from escaping as quickly from the compost.
• It takes longer for the compost to become ready
Many people find it most useful out in their fields so they just layer in organic matter at harvest time and cover it, then it is ready for use in the next planting season.

Using compost: The nutrient levels in the compost will vary depending on what you used to make the compost. Compost can be used as:

- Food to fill planting stations for seeds, seedlings, pots, or planting tubes (or reused bags!).
- **Top dressing** for plants and trees (then add mulch to protect and hold the compost nutrients)

Portfolio Activity 4.5 Write a reflection report

Complete this activity on your evidence sheet in the portfolio file.

Aim: Reflect on your participation with households, and develop a plan for your own professional development as a facilitator in communities

Time: Two hours

What you must do

1. Read the following background information on reflection (and reflective practice), and answer the questions that follow.

What is meant by reflection?

It is important that you should strive to make the work that you do with households, more effective. We all make mistakes from time to time. However, it is important to learn from these mistakes you may have made when you worked with households, and prevent similar mistakes in future. On the other hand, you may realise that a certain way of approaching people, or brainstorming ideas with the households, are effective. You should build on this strength. We call this process, where you think about your own practice (way of doing things), *reflection*.

We examined the concept of reflection in Module 2 and now you have an opportunity to apply your understanding of reflection to your work with households in Module 3. In this activity you will have to reflect on your own practice.

When reflecting, keep the following questions in mind:

- What exactly happened during my participatory sessions with households?
- What could the reasons be for what happened?
- How did I respond? Why did I respond in this way?
- What are the key issues that I need to be aware of?
- Do I have the information available that will help me to act differently or to improve my actions in future? If not, what do I need to find out and how?
- Who else could/should I involve to assist me?
- How would I deal with a similar situation in the future?

Steps to guide reflection

There are several techniques to help you with your reflection. When reflecting we suggest you use the following steps:

Step 1. Describe what happened

Step 2. Analyse the situation

Step 3. Ask yourself: What does it mean for my practice (way of doing)? How should I act upon it?

Let us look at an example to illustrate the steps you need to follow when reflecting.

Sarah working with the Mtombeni household

Sarah is a UNISA student, who works in a rural community in KZN. One of her households, the Mtombeni family, wants to make a homestead garden, to enhance their food security. Sarah is a very good student who takes her work seriouly, and she gets upset with Mr. Mtombeni, who she perceives as being very negative. The following is an account of a contact session they had.

Sarah: *I think we should plant the following vegetables in your homestead garden.* (Sarah shows the packets of seeds to the Mtombeni family).

Mr. Mtombeni: *We don't want to plant carrots. None of my children really like carrots.*

Sarah: *Oh, but you must! It is a rich source of Vitamin A. Listen to me, you clearly don't know how to plan a balanced diet!*

Mr. Mtombeni: *You don't ever listen to me, and you always think you know better. I think you should leave my house.*

When Sarah reflected on this incident, she wrote the following:

Step 1. Describe what happened
Mr. Mtombeni and I had a confrontation today. I wanted him to plant carrots in their homestead garden, and he refused, saying that I am pushy and always know better.

Step 2. Analyse the situation
Thinking back, I realised that I should have perhaps followed a different approach. Perhaps I should have started by asking the household what vegetables they like to plant. Perhaps I should talk less, and listen more.

Step 3. What does it mean for my practice? How should I act upon it?
I realise that I excluded the household from the decision making process. I should ensure that I act as facilitator, so that people in the households feel that they have a voice.

2. Now do the following on the evidence sheet in your portfolio file.
Reflect on any incident that caused you some discomfort or stress when you worked with households, using the three steps mentioned above.

You have to complete the evidence sheet for Portfolio Activity 4.5, which is in your portfolio file.

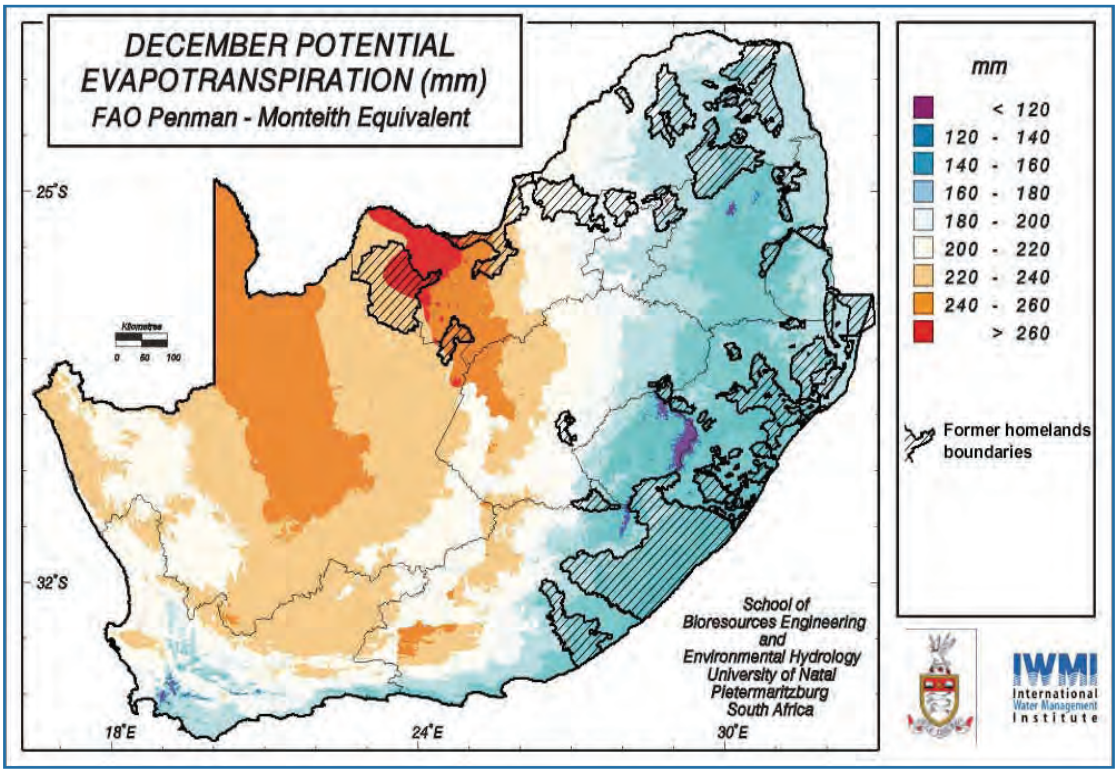


Figure 1.14 Map showing December evapotranspiration potential in South Africa
(See Annexure A)

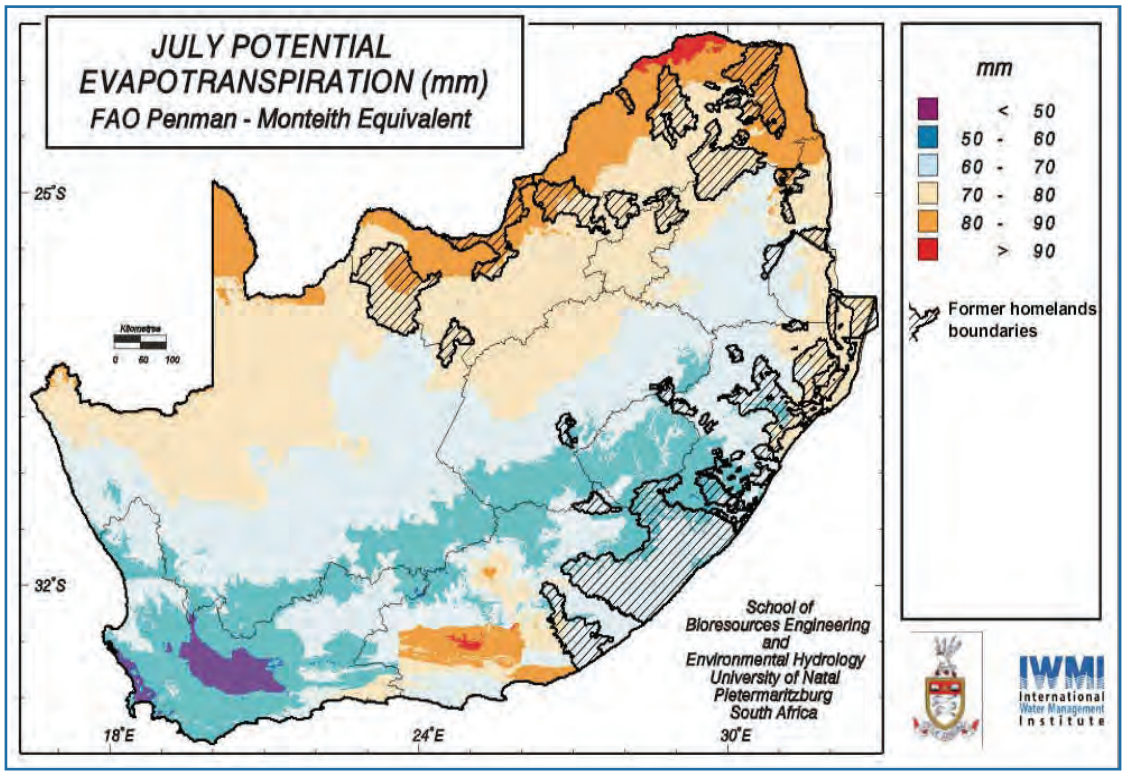


Figure 1.15 Map showing the July evapotranspiration potential in South Africa
(See Annexure A)

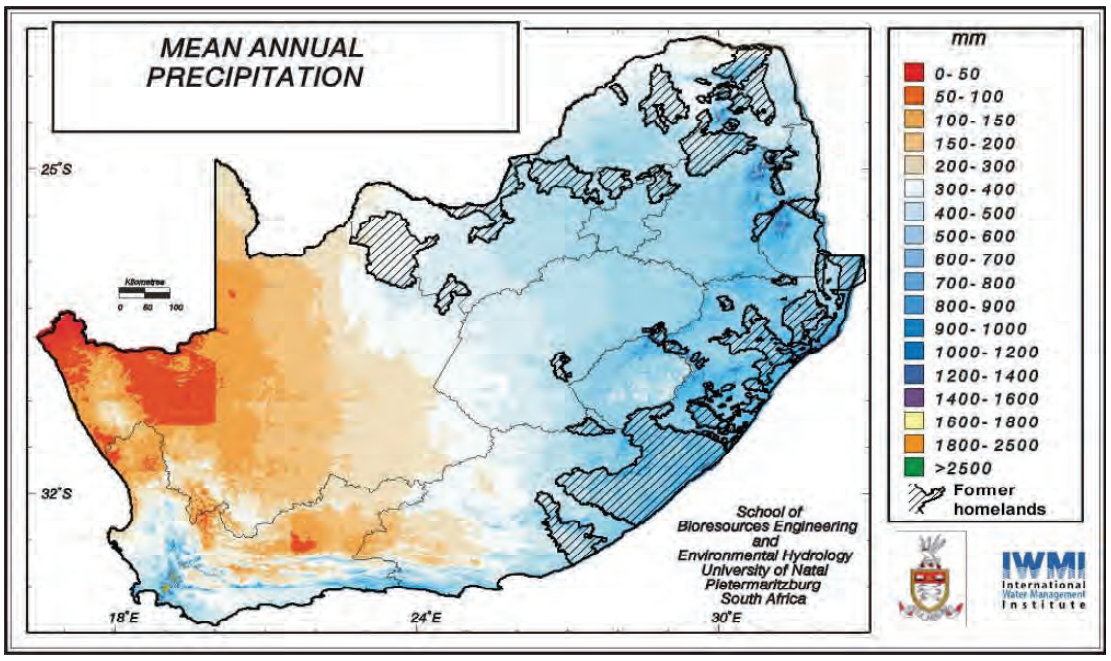


Figure 1.9 Average annual rainfall for South Africa (see Annexure A)

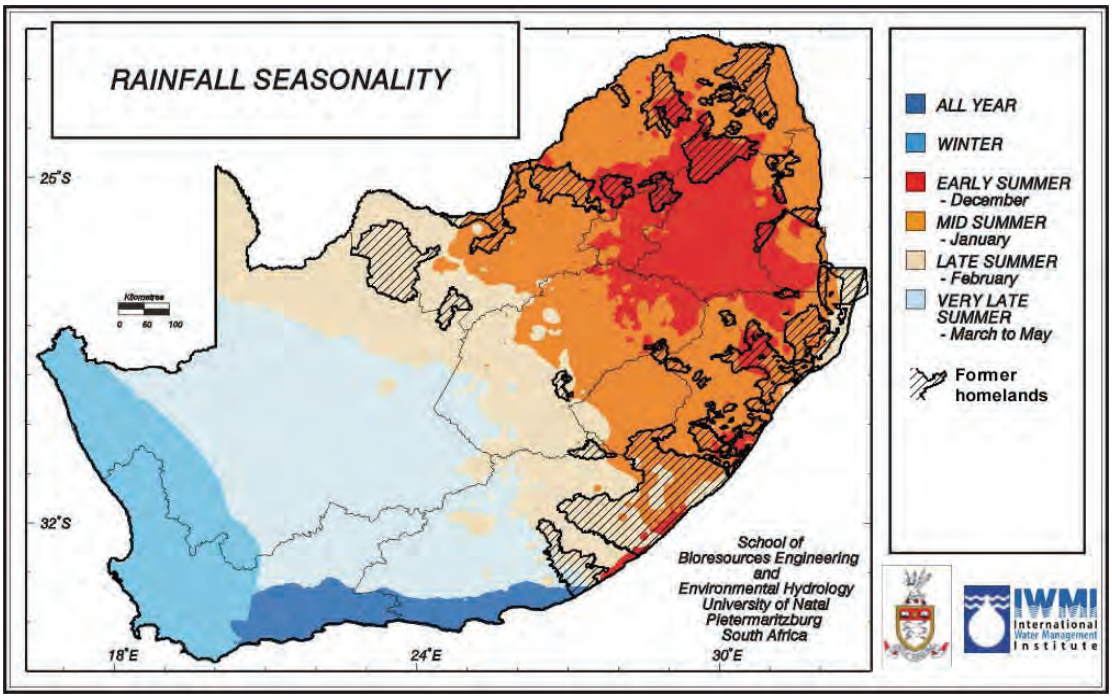


Figure 1.10 Seasonality of rainfall in South Africa (see Annexure A)

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Glossary

AIDS: Aquired immune deficiency syndrome, thought to be caused by the human immunodeficiency virus (HIV), which attacks the immune system, transmitted from one person to another by the exchange of body fluids.

Aquifers: Cracks or huge caves under the ground that are usually filled with water.

Bacteria: Are microorganisms that can be benefiacial or harmful. For example beneficial bacteria recycle waste or make beer and harmful bacteria cause diseases such as tuberculosis and cholera.

Biodiversity: The richness and diversity of all living things on Earth.

Blossoms: flowers

Carnivores: Meat eaters e.g lions and dogs.

Catchment: a structure for catching or collecting water

Coal: Is a solid fossil fuel found in the Earth and is a non-renewable source of energy.

Co-exists: to live or exist together at same time or in same place

Condensation: The water vapour in the air condenses back into water when it cools down there. Clouds are formed that consist of very small droplets of water.

Condone: to approve, forgive or overlook

Consensus: an opinion or position reached by a group as a whole

Consumers: Organisms that depend on plants (photosynthesisers) for a source of food e.g. animals.

Contours: Imaginary lines that are on the same level (at the same height or elevation), across a slope.

Compromised: weaken by accepting standards that are lower than is desirable

Crude oil: This oil is extracted from the crust of the Earth (underneath the surface of the Earth) and is used to make many products. The main products are related to energy – the production of fossil fuels such as petroleum and diesel.

Data: Results, often numerical, from scientific enquiry.

Dead organic matter in soil: The remains of plants (leaves, fruits or grass), and animals (manure

or dead organisms), which enriches the soil.

Decomposers: Organisms such as bacteria and fungi that feed on dead organic matter.

Deforestation: The destruction of forests for firewood, to make way for urban developments, by logging companies for financial benefit, for the sale of wood for furniture and other products, to make way for roads, tree plantations,farming and mining, by flooding from human-made dams.

Degraded: reduced in quality over a period of time

Depleted: use up the supply of; exhaust the abundance of

Desertification: Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including variations in climate and human activities.

Drainage: Drainage is to seep or move away and usually refers to water moving to a lower point. So, water drains out of a basin into a pipe and water drains into the soil, or from high lying mountains down to the sea.

Ecology: the study of the Earth, our home. We share the Earth with millions of other living organisms such as plants, insects, bacteria and mammals. Ecology is also the study of the relationships between living organisms.

Ecological Pyramid: A diagram that shows the relative amounts of energy or matter, or numbers of organisms within each trophic level in a food chain or food web.

Ecosystem: a group of interdependent organisms (plants, animals and microorganisms) in a particular area together with the environment (sun, water, soil and air) that they live in and depend on.

Effluent: liquid waste flowing out from a sewer or sewerage system

Element: A substance that cannot be broken down into simpler substances by chemical means.

Energy: The capacity to do work; comes in forms such as solar, chemical and electrical.

Evaporation: Heated by the sun, water evaporates into the atmosphere from the surfaces of any open body of water such as oceans, lakes, rivers and dams.

Evapotranspiration from a given piece of land = evaporation on the ground surface + transpiration by plants

Exotic plants/Alien plants: Plants, from other countries that were brought into an area by people. Examples are pines, bluegums and blackwattles. They grow in our natural areas, and use large amounts of water.

Food web: A food network showing the interconnections between one organism and all other organisms to which it relates.

Fossils: remains of plants or animals from millions of years ago that have been preserved inside a rock or other geological deposit, often as an impression or in a petrified state).

Fossil fuels: The non-renewable resources of coal, oil and natural gas.

Gender: Refers to whether a person is male (a man) or female (a woman).

Gender relations: Women's roles in relation to those of men (and vice versa), rather than women's or men's roles separately.

Gender roles: Refer to the socially constructed roles of, men and women. For example, in certain parts of the world women collect only non-wood products such as herbs, mushrooms and medicinal plants, while the men collect firewood.In other parts of the world men and women both harvest these products.

Global warming: Is the increase in the average temperature of the Earth's lower atmosphere. It is caused by certain gasses such as carbon dioxide and methane which is called 'greenhouse gases' If the increase in temperature continues it cause dramatic changes in climate.

Grey water: Used water that could be directed into a food garden or be used to water trees.

Groundwater: The water that infiltrates into the soil becomes groundwater.

Habitat: The natural condition or environment in which an organism lives.

Herbicides: Chemicals, which are bad for the environment and human health and which are used to kill harmful plants especially weeds

Herbivores: Plant eaters e.g elephants and donkeys.

Humus: Dead organic, decomposed material which enriches the soil and makes plants grow well.

Indigenous plants: Plants that grow naturally in an area. For example the Marula tree in Limpopo Province, Proteas in the Western Cape and cycads in the Eastern Cape.

Infectious disease: An abnormal and harmful condition affecting an organism, caused by another organism. E.g malaria caused by the malaria parasite.

Infinite: limitless or endless in space, extent, or size; impossible to measure or calculate

Infiltrates: The absorption and downward movement of water into the soil layer

Infiltration: Water falls on the land and infiltrates into the soil until all the pores/openings are filled and the soil is saturated.

Industrial processes: Industry is the large scale production or manufacture of a product, such as a car or petroleum.

Inorganic: Are considered to be of a mineral or chemical, not biological, origin.

Impermeable: not permitting fluids to pass through it

Leaching: A process to describe water moving through the soil, which dissolves and removes the salts to layers lower down.

Leguminous: a plant of the bean or pea family

Livelihood: Livelihood is a word that refers to ways and things that help people live and survive. A livelihood is sustainable when it can cope with and recover from stress and shocks (eg: unemployment, drought, floods), maintain or enhance its capabilities and assets and provide sustainable livelihood opportunities for the next generation.

Macrolevel: the most general level of a concept or process

Manufacturing: This is the process of producing or making a product using raw materials. It is the processing of certain materials to produce other materials or products, usually with monetary value and is the basis of modern business. Thus many materials or inputs are used to manufacture a car for example.

Mulch: A layer of leaves, grass, husks or other organic matter that is placed on the soil between plants.

Natural environment: Provides natural resources such as land, water, soil and biodiversity, which in turn will influence food production.

Nitrogen-fixing bacteria: certain bacteria that change nitrogen from the air into forms that can be used by plants and certain other organisms.

Non-renewable resources: A non-renewable resource is a natural resource that cannot be produced, re-grown, regenerated, or reused on a scale, which can sustain its consumption rate. These resources often exist in a fixed amount, or are consumed much faster than nature can recreate them. Fossil fuels (such as coal, petroleum and natural gas) and nuclear fuel are some examples. In contrast, resources such as timber (when harvested sustainably) or metals (which can be recycled) are considered renewable resources.

Open pollinated: plants that grow from seed and produce seedlings just like the parent plant

Organic: Is made up of biologic things, that are or were alive, as opposed to mineral, chemical or physical things.

Organisms: Living things e.g bacteria, protozoa, fungi, plants and animals.

Ownership of resources: A resource such as land can be owned by someone while another person uses it or decides about its use.

Pandemic: Major epidemics where many people over a very large area suffer from an infectious disease such as HIV/AIDS and cholera.

Permaculture: Short for permanent culture, is the design of our environment based on ecological principles.

Pest: any unwanted and destructive insect or other animal that attacks food, crops, food or livestock

Pesticides: Chemicals, which are bad for the environment and human health and which are used to kill harmful insects and other organisms.

Photosynthesis: The process by which green plants and some other organisms such as algae, use energy from sunlight to synthesise (make) food from carbon dioxide and water.

Physical resources: Resources that make up an environment that are visible. They can be distinguished from natural resources to an extent as physical resources are usually the structural parts of an environment. Examples may include buildings, roads, water taps and other infrastructure. Some physical resources are also natural resources, but are the more structural ones (see physical features below). Examples are mountains, rivers and so on.

Physical features: Features that make up an environment that are visible, such as mountains, plains, rivers, towns, buildings and so on.

Physiology: Studies the functions of the body parts of living things, e,g your body parts such as your heart and kidneys.

Plantations: Large natural areas, for example in Mpumalanga and the Southern Cape, where the indigenous trees are removed and then planted with one kind of exotic tree (mono-culture), such as pine trees and eucalyptus (bluegum) trees which are exotic (not from South Africa)

Pollution: Is the unwelcome concentration of unnatural, harmful or poisonous substances that are beyond the environment's capacity to handle. These substances are harmful to humans and other living things. For example exhaust gases from cars, or pesticides to kill harmful insects.

Potential: That can, but has not yet, come into being.

Potable water: drinkable water

Precipitation: Water falls from the clouds back to Earth through rain, hail, sleet and snow. Dew, frost and mist are formed when water vapour condenses directly onto the land without first forming clouds.

Proceeds: money received through a sale or a loan

Psychology: Studies the functions of the human mind especially those affecting behaviour.
Resource map: A drawing of an area, which can be used to show the physical features, natural resources, issues concerning resources as well as actions to improve the situation.

Rain-gauge: An instrument for catching, collecting and measuring the amount of rainfall

Recycle: Save or collect used or waste materials in order to reuse them.

Recycling: Means processing waste material and using the material to make new items, such as melting down old plastic and using the plastic to make new containers, or placing kitchen waste on a compost heap.

Renewable resources: A natural resource qualifies as a renewable resource if it is replenished by natural processes at a rate comparable or faster than its rate of consumption by humans or other users. Solar radiation, tides, winds and hydroelectricity are perpetual resources that are in no danger of long-term availability. Renewable resources may also mean commodities such as wood, paper, and leather.

Replenish: To fill up or become available again. In this way renewable resources are replenished in a cyclical nature; plants and animals grow for example.

Resource mapping, Transect walks, Ranking and Scoring: Participatory tools to find out about resources and the issues concerning the resources in an area.

Resources:

- Access to resources: Having the possibility to use the resource, for example land or production equipment.
- Control of resources: Someone decides how the resource can be used and by whom. It does not necessarly imply ownership
- Ownership of resources: A resource such as land can be owned by someone while another person uses it or decides about its use.

Ridges and valleys: Ridges are at the tops of hills or slopes. Valleys are at the bottom of hills or slopes.

Rill Erosion: the formation of many closely spaced small channels due to the uneven removal of surface soil by little streams of water

Riverine vegatation: Plants that grow along the banks of a river.

Route of transmission: How an infectious disease is spread from one person to the next or from one organism to the next.

Sanitation: This is the act of making or keeping something clean, for the sake of making it hygienic or healthy. This is especially important for reducing the spread of diseases and disease causing organisms.

Seasonality: According to the time of the year, spring, summer, fall, and winter or rainy or dry.

Sheet flow: a very slow acting form of erosion where a thin film of water transports soil particles away by rolling them along the ground

Simulate: to copy or replicate, to imitate the appearance or character of something

Sleet: a form of precipitation consisting of ice pellets, often mixed with rain or snow, similar to hail but usually smaller and more likely to occur in winter

Socio-cultural environment: Includes aspects of culture, economy, educational level and social organizations.

Soil erosion: The loss of soil and therefore of natural nutrients which impact negatively on plant growth

Soil Profile: A soil profile is a cross section through the soil which reveals its horizons (layers). Soil generally consists of visually and texturally distinct layers

Soil structure: Tells us how the soil particles are mixed or grouped together. It also tells us how well the smaller particles stick together in clusters. This influences how easily water and air (and plant roots) can move through the soil.

Solar energy: Energy from the sun and can be captured and turned into electricity with special solar panels.

Strategies: Strategies are plans, policies or tactics that are employed or acted upon to achieve a certain goal or end point. A strategy to reduce poverty for example could be to create employment for people.

Sustainability: Sustainability exists when a situation can sustain itself or keep on going or existing for a long period of time. For example, using renewable natural resources sustainably means using them no faster than they can be replenished.

Swales: Trenches that are dug to capture and manage water runoff, and increase rainwater infiltration into the soil.

System: A combination of elements that are related and organized to form a complex whole.
Natural resources: Natural resources are naturally occurring substances that are considered valuable in their relatively unmodified (natural) form (eg: minerals, energy, land, water, and living things).

Technological environment: Includes aspects such as food processing, storage, and distribution, which will influence food availability.

Terrarium: a closed container in which selected plants and sometimes small animals are kept and observed.

Threat: endanger or vulnerable to depletion, Threatened species are any species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future

Top dressing: a covering of fertilizer spread on soil without being ploughed under

Top and Subsoil: Topsoil is well decomposed organic matter, mixed with a smaller amount of minerals. Subsoil or mineral layers, the content of which varys according to the nature of the soil and its parent material.

Topography: Tells you about the shape of the land e.g slopes.

Transcribe: This means to copy or write. Here an image can be redrawn from one place to another. Information is transcribed from paper in handwritten form for example to computer in a digital form.

Transect walk: A participatory method for collecting information by walking through an area and paying attention to specific environmental features, resources and human activities, and issues such as water scarcity, soil erosion or any other problem. Transect walks are sometimes referred to as observational walks.

Transpiration. A process, by which plants lose part of the water in their bodies as vapour into the air, through pores (small holes) in the leaves.

Viruses: Are smaller than bacteria and can only reproduce when they are inside another living organism. They are therefore parasites which causes disease such as AIDS, other sexually transmitted diseases (STD's) and influenza (flu).

Waste: Refers to the 'leftovers' or unwanted products from industries and other human activities.

Water cycle: Water constantly circulates around our planet moving from the oceans to the skies to the land and back to the oceans again in a pattern called the water cycle. This cycle is driven by heat energy from the sun.

Water shed: a ridge of high land dividing 2 areas that are drained by different river systems

Water table: The upper boundary of the underground water.

Wilt: To become limp, wither, droop or weak from heat or lack of water.

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