GRAMSOL

NEW CURRICULUM

Geography

Form 3

Approved by Ministry of Primary and Secondary Education
ZIMBABWE

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Geography

Form 3

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GRAMSOL

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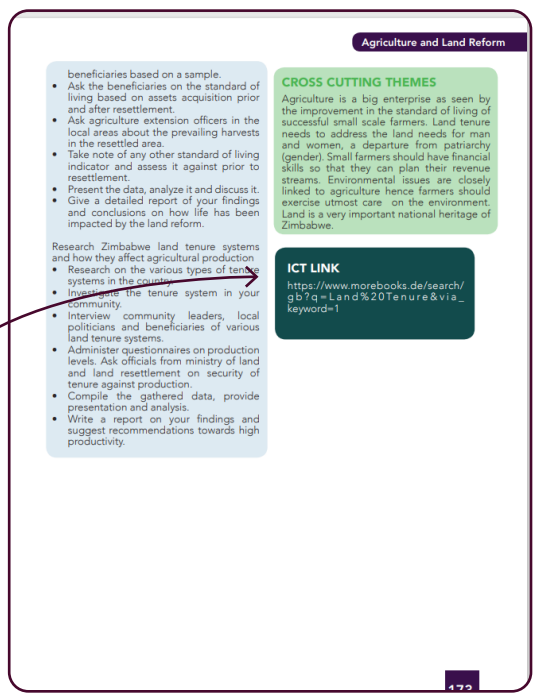

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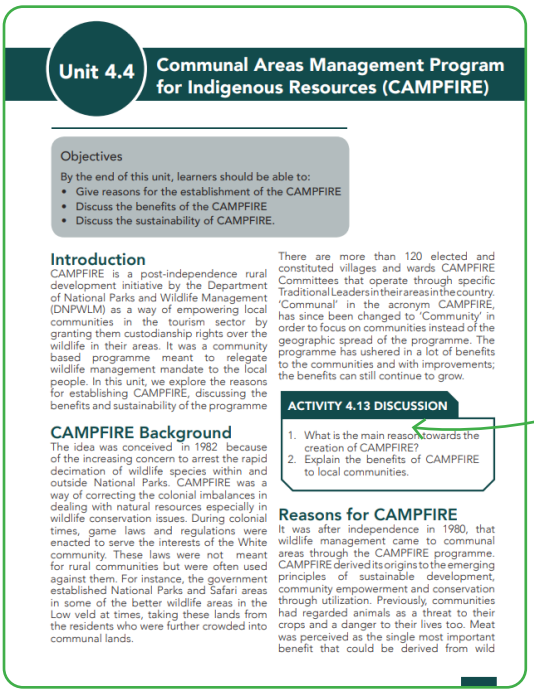


Unit 4.4 Communal Areas Management Program for Indigenous Resources (CAMPFIRE)

Objectives

By the end of this unit, learners should be able to:
- Give reasons for the establishment of the CAMPFIRE
- Discuss the benefits of the CAMPFIRE
- Discuss the sustainability of CAMPFIRE.

Introduction

CAMPFIRE is a post-independence rural development initiative by the Department of National Parks and Wildlife Management (DNPWLM) as a way of empowering local communities in the tourism sector by granting them custodianship rights over the wildlife in their areas. It was a community based programme meant to relegate wildlife management mandate to the local people. In this unit, we explore the reasons for establishing CAMPFIRE, discussing the benefits and sustainability of the programme

CAMPFIRE Background

The idea was conceived in 1982 because of the increasing concern to arrest the rapid decimation of wildlife species within and outside National Parks. CAMPFIRE was a way of correcting the colonial imbalances in dealing with natural resources especially in wildlife conservation issues. During colonial times, game laws and regulations were enacted to serve the interests of the White community. These laws were not meant for rural communities but were often used against them. For instance, the government established National Parks and Safari areas in some of the better wildlife areas in the Low veld at times, taking these lands from the residents who were further crowded into communal lands.

There are more than 120 elected and constituted villages and wards CAMPFIRE Committees that operate through specific Traditional Leaders in their areas in the country. 'Communal' in the acronym CAMPFIRE, has since been changed to 'Community' in order to focus on communities instead of the geographic spread of the programme. The programme has ushered in a lot of benefits to the communities and with improvements; the benefits can still continue to grow.

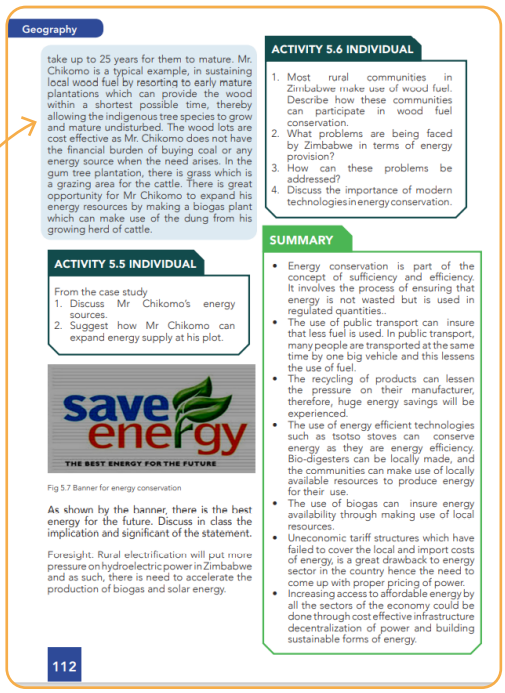
ACTIVITY 4.13 DISCUSSION

1. What is the main reason towards the creation of CAMPFIRE?
2. Explain the benefits of CAMPFIRE to local communities.

Reasons for CAMPFIRE

It was after independence in 1980, that wildlife management came to communal areas through the CAMPFIRE programme. CAMPFIRE derived its origins to the emerging principles of sustainable development, community empowerment and conservation through utilization. Previously, communities had regarded animals as a threat to their crops and a danger to their lives too. Meat was perceived as the single most important benefit that could be derived from wild

In-text activities keep learners busy.



Geography

take up to 25 years for them to mature. Mr. Chikomo is a typical example, in sustaining local wood fuel by resorting to early mature plantations which can provide the wood within a shortest possible time, thereby allowing the indigenous tree species to grow and mature undisturbed. The wood lots are cost effective as Mr. Chikomo does not have the financial burden of buying coal or any energy source when the need arises. In the gum tree plantation, there is grass which is a grazing area for the cattle. There is great opportunity for Mr Chikomo to expand his energy resources by making a biogas plant which can make use of the dung from his growing herd of cattle.

ACTIVITY 5.5 INDIVIDUAL

From the case study
1. Discuss Mr Chikomo's energy sources.
2. Suggest how Mr Chikomo can expand energy supply at his plot.

Fig 5.7 Banner for energy conservation

As shown by the banner, there is the best energy for the future. Discuss in class the implication and significant of the statement.

Foresight. Rural electrification will put more pressure on hydroelectric power in Zimbabwe and as such, there is need to accelerate the production of biogas and solar energy.

ACTIVITY 5.6 INDIVIDUAL

1. Most rural communities in Zimbabwe make use of wood fuel. Describe how these communities can participate in wood fuel conservation.
2. What problems are being faced by Zimbabwe in terms of energy provision?
3. How can these problems be addressed?
4. Discuss the importance of modern technologies in energy conservation.

SUMMARY

- Energy conservation is part of the concept of sufficiency and efficiency. It involves the process of ensuring that energy is not wasted but is used in regulated quantities.
- The use of public transport can insure that less fuel is used. In public transport, many people are transported at the same time by one big vehicle and this lessens the use of fuel.
- The recycling of products can lessen the pressure on their manufacturer, therefore, huge energy savings will be experienced.
- The use of energy efficient technologies such as tsotso stoves can conserve energy as they are energy efficiency. Bio-digesters can be locally made, and the communities can make use of locally available resources to produce energy for their use.
- The use of biogas can insure energy availability through making use of local resources.
- Uneconomic tariff structures which have failed to cover the local and import costs of energy, is a great drawback to energy sector in the country hence the need to come up with proper pricing of power.
- Increasing access to affordable energy by all the sectors of the economy could be done through cost effective infrastructure decentralization of power and building sustainable forms of energy.

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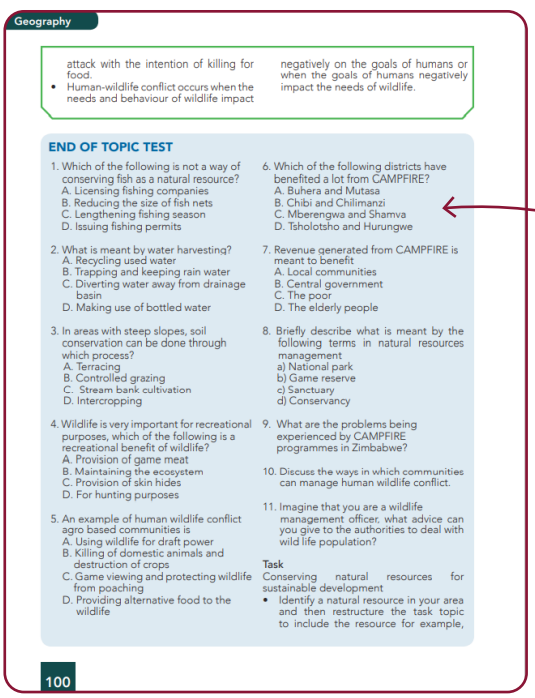
Each topic has a unique and relevant case study.



Geography

attack with the intention of killing for food.
- Human-wildlife conflict occurs when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife.

END OF TOPIC TEST

1. Which of the following is not a way of conserving fish as a natural resource?
   A. Licensing fishing companies
   B. Reducing the size of fish nets
   C. Lengthening fishing season
   D. Issuing fishing permits

2. What is meant by water harvesting?
   A. Recycling used water
   B. Trapping and keeping rain water
   C. Diverting water away from drainage basin
   D. Making use of bottled water

3. In areas with steep slopes, soil conservation can be done through which process?
   A. Terracing
   B. Controlled grazing
   C. Stream bank cultivation
   D. Intercropping

4. Wildlife is very important for recreational purposes, which of the following is a recreational benefit of wildlife?
   A. Provision of game meat
   B. Maintaining the ecosystem
   C. Provision of skin hides
   D. For hunting purposes

5. An example of human wildlife conflict agro based communities is
   A. Using wildlife for draft power
   B. Killing of domestic animals and destruction of crops
   C. Game viewing and protecting wildlife from poaching
   D. Providing alternative food to the wildlife

6. Which of the following districts have benefited a lot from CAMPFIRE?
   A. Buhera and Mutasa
   B. Chibi and Chilimanzi
   C. Mberengwa and Shamva
   D. Tsholotsho and Hurungwe

7. Revenue generated from CAMPFIRE is meant to benefit
   A. Local communities
   B. Central government
   C. The poor
   D. The elderly people

8. Briefly describe what is meant by the following terms in natural resources management
   a) National park
   b) Game reserve
   c) Sanctuary
   d) Conservancy

9. What are the problems being experienced by CAMPFIRE programmes in Zimbabwe?

10. Discuss the ways in which communities can manage human wildlife conflict.

11. Imagine that you are a wildlife management officer, what advice can you give to the authorities to deal with wild life population?

Task

Conserving natural resources for sustainable development
- Identify a natural resource in your area and then restructure the task topic to include the resource for example,

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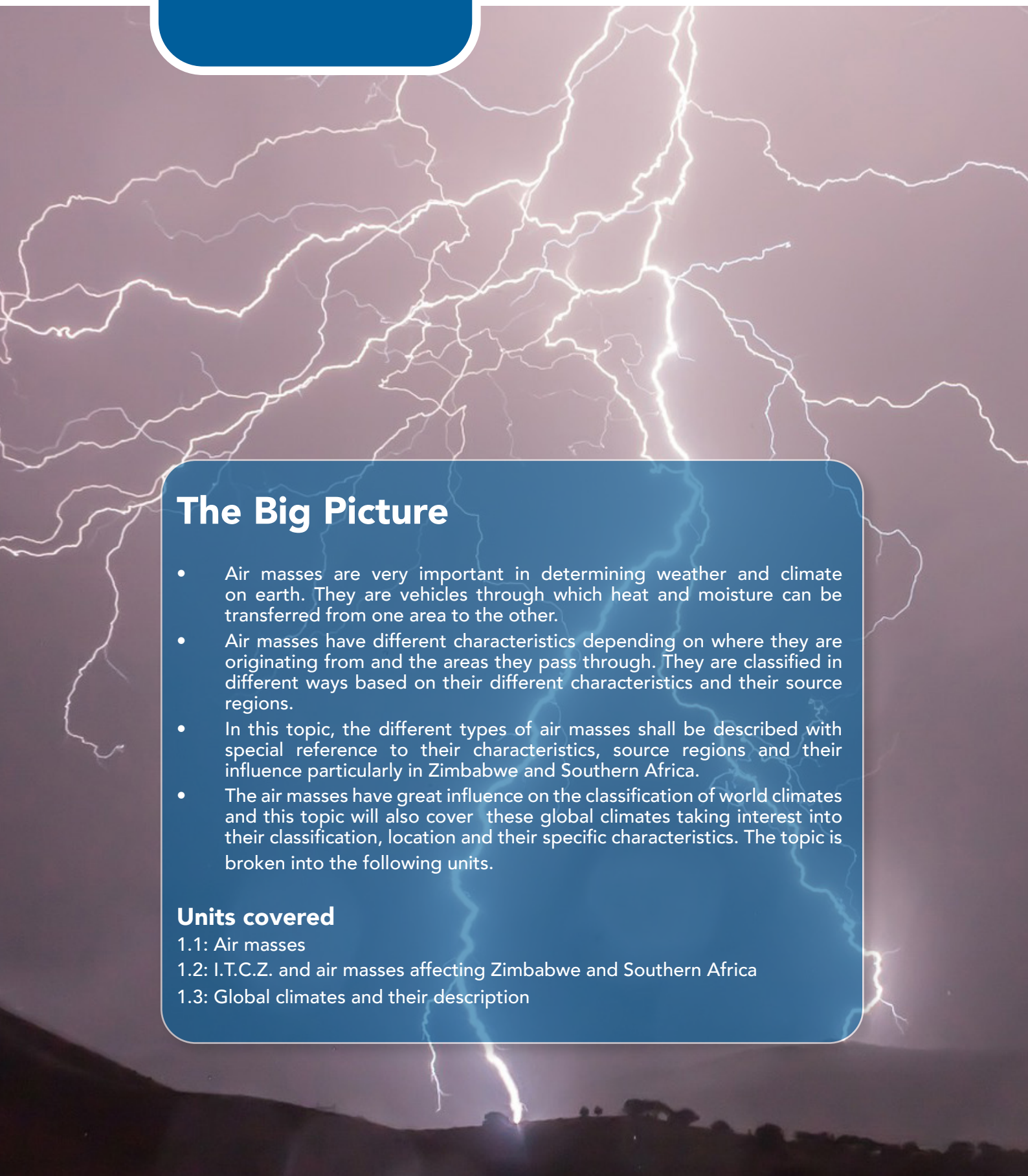
End of term revision tests help with assessment.

Contents

Topic 1 Weather and Climate



The Big Picture

- Air masses are very important in determining weather and climate on earth. They are vehicles through which heat and moisture can be transferred from one area to the other.
- Air masses have different characteristics depending on where they are originating from and the areas they pass through. They are classified in different ways based on their different characteristics and their source regions.
- In this topic, the different types of air masses shall be described with special reference to their characteristics, source regions and their influence particularly in Zimbabwe and Southern Africa.
- The air masses have great influence on the classification of world climates and this topic will also cover these global climates taking interest into their classification, location and their specific characteristics. The topic is broken into the following units.

Units covered

1.1: Air masses

1.2: I.T.C.Z. and air masses affecting Zimbabwe and Southern Africa

1.3: Global climates and their description

ACTIVITY 1.2 IN PAIRS

Describe the effect of rotating earth on wind systems.

Is there a difference between an air mass and wind?

Answer: A wind is not an air mass but an air mass is a wind. Lets explain further, when an air mass is in motion, it becomes a wind but when it is stationery, it cannot be a wind.

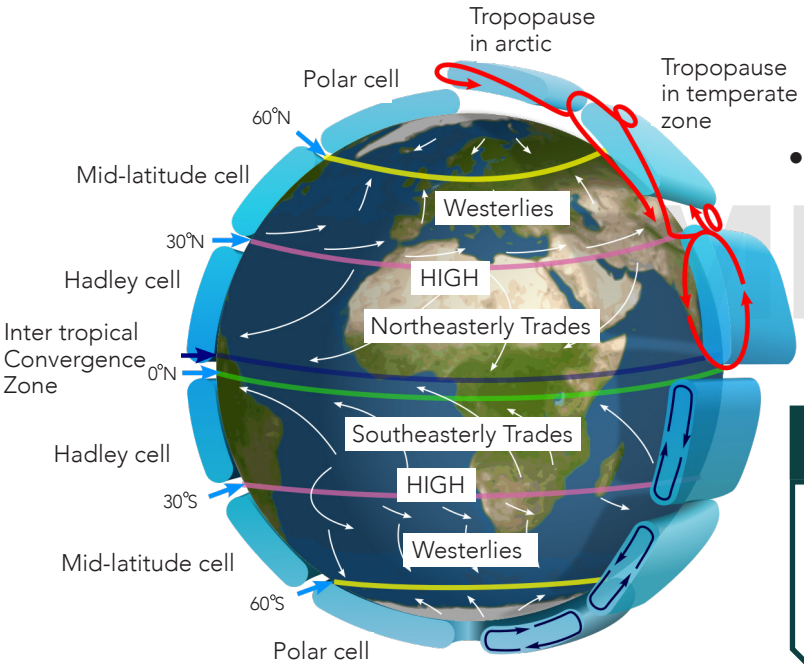


Fig 1.3 Planetary wind system

Look at the arrows in fig 1.3, discuss the direction where the air masses are coming from and where they are going.

Source regions of air masses

As previously mentioned, the area where air masses originate from are called source regions. These are specific geographic locations either over land or water surface. They have the following specific characteristics.

- Air masses originate from areas where air accumulates and remains stationary at its place of origin long enough to acquire specific characteristics.
- These are usually areas of high pressure (anticyclone regions) where the stability and any vertical movements help to distribute surface characteristics throughout the air mass.
- Air masses also originate from areas where air sinks or subsides and diverges at the surface with light movements that allow uniform characteristics to develop.
- There should be an extensive uniform area over which the air rests.
- The air is conditioned from the Earth's surface hence, properties of warmth or coldness, humidity or dryness become strikingly homogenous when the air rests over an extensive uniform area.
- As the air moves away from the source region, it is modified by other surface conditions; temperature increases if the surface temperatures are high and humidity increases if the air mass is forced to rise by high ground.

ACTIVITY 1.3 INDIVIDUAL WORK

1. Define the term air mass.
2. How do air masses develop?
3. Explain the main characteristics of the source regions of air masses.

Types of air masses and their characteristics

There are two types of air masses, the **maritime** and the **continental air masses**. The continental air mass is generally dry, and it originates from the land masses whilst the maritime air mass is wet, and it originates from the water bodies. These air masses are further split into different types as shown by the picture on fig 1.4 and table 1.1. This classification is based on where the air masses originate from and how they look like.

Unit 1.2 Air masses affecting Zimbabwe and Southern Africa

Objective

By the end of this unit, learners should be able to:

- Describe the inter-tropical convergence zone
- Describe weather associated with air masses affecting Zimbabwe and southern Africa
- Describe weather conditions associated with the inter-tropical convergence zone.

Introduction

Air masses have great influence on weather patterns as they are always in constant motion. They either converge at a front or diverge at specific high-pressure belts. In this unit, we walk through the intertropical convergence zone which can be termed as the tropical front and the weather associated with the front. Special attention will be focused on the influence of air masses over southern Africa.

Convergence and divergence of air masses

Air masses interact with one another at pressure belts or front. They move in relation to each other that is either moving away from each other (divergence) or moving towards each other (convergence.) This interactive movement creates zones of air masses convergence and zones of air masses divergence. The Inter-tropical convergence zone is a zone where air masses meet within the tropics thereby contributing greatly to the weather patterns on the African continent and other parts of the world which have tropical climate.

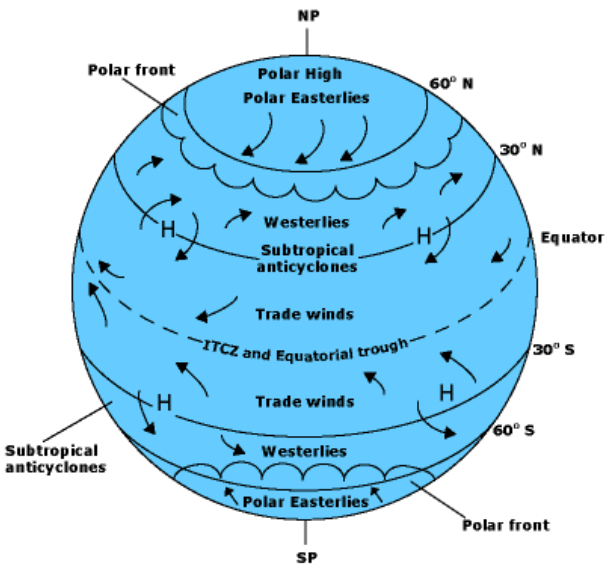


Fig 1.5 Air masses convergence and divergence

ACTIVITY 1.5 IN PAIRS

1. Take note of the position of the ITCZ on fig1.6, which air masses are converging?
2. Identify other zones of air masses which are convergence and divergence.

that continuously blows from one zone to another. The South East Trade wind brings drizzle (guti) and light showers mostly to the eastern parts of Zimbabwe with cloudy conditions in winter. The North East monsoon is a seasonal wind which blows in Southern Africa in summer bringing considerable moist conditions. Monsoon refers to a seasonal air mass, which brings moisture to an area it encroaches in.

The North East monsoon blows towards Southern Africa in summer and contributes to rain making in the northern parts of Zimbabwe during the months of December and January. The Congo air which is named as the North West Trade wind comes from the Atlantic Ocean. It comes into Zimbabwe via Angola and Democratic Republic of Congo. The air mass absorbs moisture in the Zaire basin and tropical rainforest and arrives in Zimbabwe after having attained moisture. The moist condition brings considerable heavy rainfall in the northern parts of Zimbabwe in December and January.

The North East monsoon, Congo air and South East Trade air masses meet at a front thereby bringing rainfall in summer when the Inter-tropical front is down in the southern hemisphere. As they meet along a low-pressure area, convection currents are created and vapor rises to form clouds and then rain falls. In winter, conditions become stable in southern Africa and low rainfall is received. However, Zimbabwe can continue to experience a relief type of rainfall as the South East Trade wind coming from the Indian Ocean is forced over the Eastern Highlands of Zimbabwe bringing rainfall, light showers which are called guti in Zimbabwe.

DID YOU KNOW?

ITCZ is like a marriage partner to the sun, where ever the sun is focused the ITCZ follows.

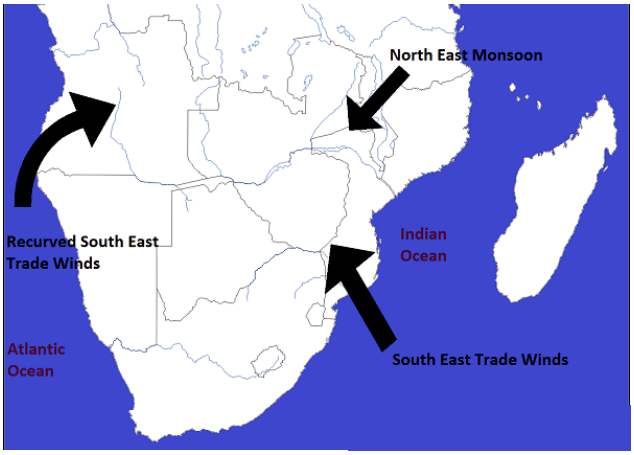


Fig 1.7 Air masses affecting Zimbabwe and Southern Africa

Rainfall in Southern Africa is influenced by the movement of ITCZ. The ITCZ changes position during the year, which is migrating between the Equator and the Tropics of Cancer and Capricorn. Southern Africa experiences the bulk of its rainfall from November through to March as the ITCZ moves southwards. The further the zone moves south, the more promising the rainy season becomes. The average positions of ITCZ in July and January in figure 1.8 illustrate this situation. In a normal Southern African rainy season, the ITCZ influence covers parts of Tanzania to southern parts of Zimbabwe and is associated with the wet summer season. The "Botswana High" pressure system pushes the ITCZ away, and this repels rainfall often resulting in periods of drought in large parts of Botswana and Namibia. This may partly explain the existence of the Kalahari and Namib deserts and the general dryness in some western parts of Zimbabwe.

ACTIVITY 1.7 INDIVIDUAL WORK

1. Name the air masses that have influence over Zimbabwe.
2. Describe the weather conditions associated with each air mass.
3. Differentiate between a trade wind and a monsoon.

SAMPLE

Warm temperate	Mediterranean for example, Western Cape, Maritime temperate or oceanic (wet). Continental temperate (dry) Humid subtropical (Eastern China).	Lies between 23 and 60 south and north of the equator, Moderate temperatures have clearly defined seasons.
Polar	Tundra (low thermal range) ice cap (permanently frozen) Antarctica.	Lies above 66 north and south of the equator, very close to the poles, presence of glaciers and cold temperature mostly covered by ice

Table 1.2 Characteristics of global climates

The mountain climates experience significant rainfall on the windward side of the mountains as the air masses are forced to rise over the mountain to form rainfall. On the leeward side, little rainfall is received as the air descends and then becomes dry.

ACTIVITY 1.8 GROUP WORK

1. Describe the classification of global climates.
2. Explain climate conditions of the tropical temperate and polar climates.

Description of global climates and data presentation

As we describe climates, we also need to appreciate how the climate data can be presented for easier and clearer understanding. On a map, climate data can be shown using isolines which represent lines that join places of similar climate variable. On rainfall, istherms are used, isohyets for temperature and isobars for pressure. There are more isolines to research on. In this topic, tables and graphs are important in showning rainfall and temperature as will be shown. Lets now go through the specific global climates.

The equatorial climate

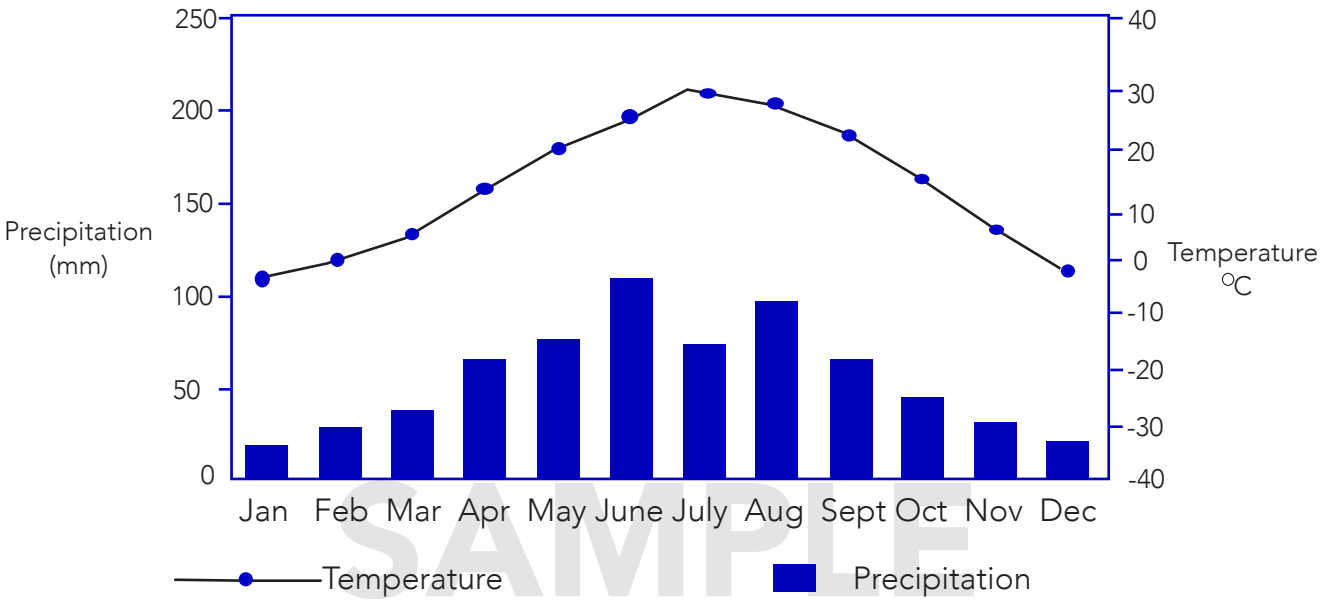
This is a type of climate which is located between 5° and 10° north and south of the equator. It is dominated by the major two basins that is the amazon and congo basins of South America and Central Africa respectively. The climate covers the major global forest which is the tropical rainforest hence sometimes it is refered to as the tropical rainforest climate.

- They experience high rainfall and high temperatures throughout the year with very small diurnal monthly and annual temperature ranges. The annual rainfall is more than 1500mm whilst average annual temperatures are between 24 to 28 There is an absence of clearly defined seasons in the equatorial climate.
- The rainfall received is very heavy and usually of convective type as it is caused by high rates of evapotranspiration.
- The climate is associated with high humidity with the double maxima associated with the changes in the position of the sun between the southern and northern hemisphere. The change happens on 21 March and 23 September every year when the positon of the sun will be directly over the equator.
- This climate is considered to be the most humid and hot climate in the world.

SAMPLE

Month	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rainfall	220	200	240	120	60	20	10	20	40	100	180	200
Temperature	28	28	28	27	25	24	24	26	27	28	28	27

Table 1.4 Rainfall and temperature for tropical continental in the Southern Hemisphere



SAMPLE

Fig 1.14 Tropical continental in the northern hemisphere

Month	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall	15	24	35	60	90	140	90	100	75	40	30	20
Temperature	-1	0	8	10	15	24	25	24	20	16	8	-1

Table 1.5 Rainfall and temperature for tropical continental in Northern Hemisphere

Interpretation of the data

The graphs and tables above, show the savannah climate data both in the southern and northern hemisphere. The main distinctive feature is that there are seasons which are characterized by variations in average temperatures and rainfall. In the southern hemisphere, temperature and rainfall are high during the summer season from September to March and they drop from May to August which is considered to be a dry and cold winter season. On the other hand, in the northern hemisphere, temperature and rainfall are high during the May to August seasons and becomes low during the September to April season a clear contrast to that of the southern hemisphere. The difference in the seasons are a result of variations in the position of the sun between the two hemispheres. From the two hemispheres, it is evident that annual temperature range is generally high more than 10°C and some months can receive rainfall which is less than 10mm.

This is the climate located between 30˚ and 40˚ north and south of the equator, mostly on the western sides of continents such as the Western Cape in South Africa as well as Central Chile in Southern America. The climate can be called the warm temperate western margin climate. The main characteristics of the Mediterranean climate are:

- There are warm and dry summers of 23˚C, and cold and wet winters of 15˚C temperature. The winters receive rainfall as they experience cyclonic conditions whilst the summers though dry experience anticyclone activities.
- There is relatively high temperature range and rainfall range between 400mm to 650 mm per year and it falls in winter.

Climate data presentation for the Mediterranean

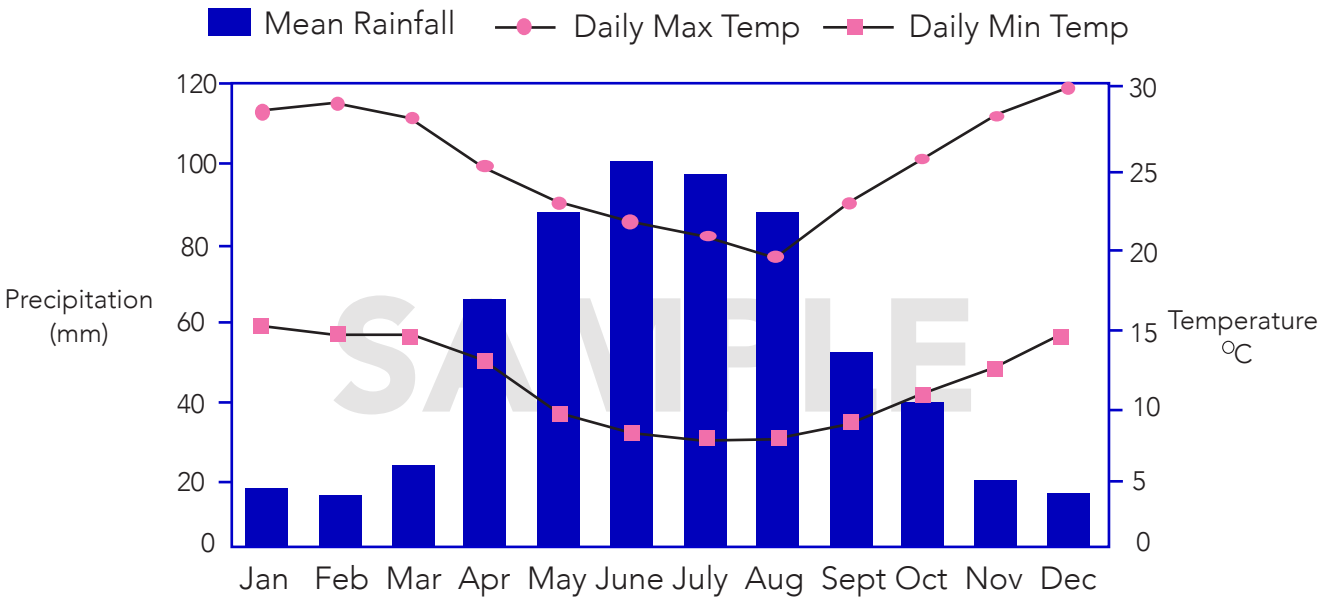


Fig 1.18 Mediterranean climate graph

Month	Jan	Feb	Mar	Apri	May	Jun	Jul	Ag	Sep	Oct	No	De
Rainfall	20	19	22	60	83	103	100	85	49	40	20	19
Temperature	23	22	21	18	17	15	16	16	18	20	21	23

Table 1.7 Rainfall and temperature table for Mediterranean climate.

Data interpretation

The mediteranean climate is a unique climate in which low temperature concide with the advent of rainy season whilst high tamperature are experienced during the dry season, a sharp contrast to the savanna climate. Significant rainfall is recieived from March to October when temperatures are below 20˚C. In October to March, temperatures are above 20˚C and this is characterised by a decline in monthly rainfall total. The climate therefore experiences warm dry summers and wet cold winters. Generally, the temperatures are on the lower side not exceeding 24˚C and total rainfall is not very high less than 700mm per year.

Climate data presentation for the temperate continental climate

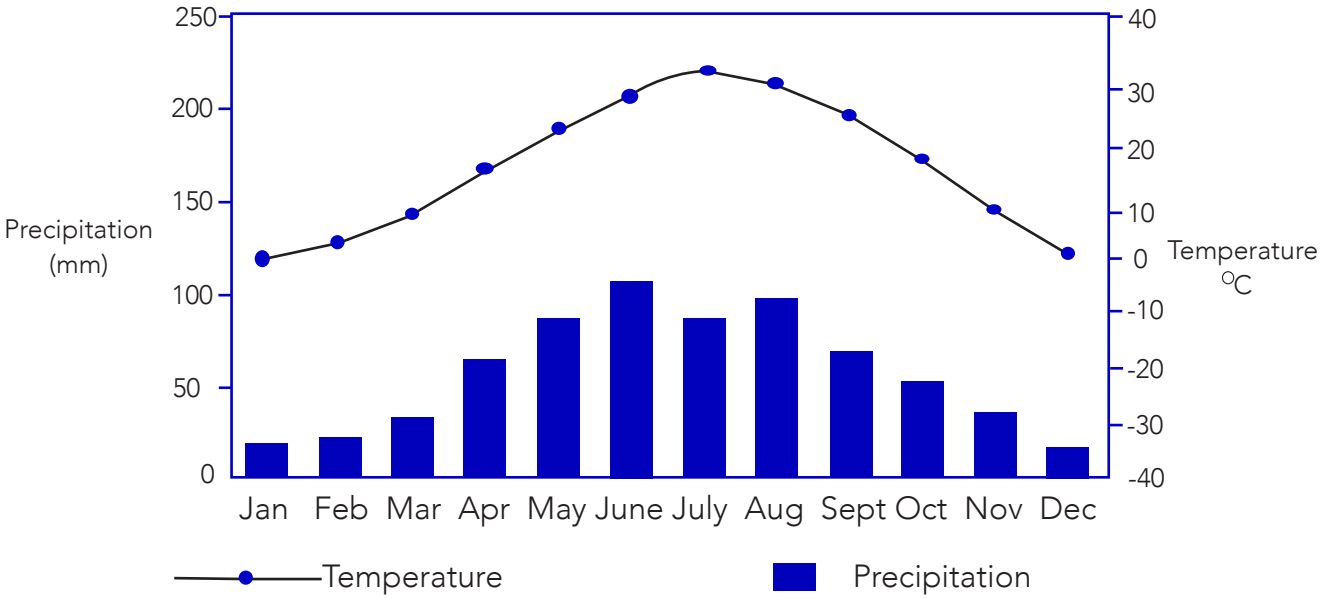


Fig 1.19 Temperate continental climate

SAMPLE

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug.	Sep	Oct	Nov	Dec
Temperature	-4	-2	0	8	16	20	24	23	18	12	4	-2
rainfall	20	25	35	65	80	110	80	100	65	35	25	20

Data interpretation

The climate is characterised by low rainfall of less than 700mm per year within the least monthly rainfall received when temperature is extremely low. The months of December to February have temperatures below 0˚C with monthly rainfall of below 30mm. Temperatures of below 0˚C shows that the climate experiences are for some periods of snow but from May to September, the conditions become warmer. Seasons are also clear the cold and dry season and the warmer wet season. Temperature range is high going to more than 20˚C as influenced by the fluctuating position of the sun between the northern hemisphere.

Polar climate

This is the climate which lies between 66˚and 90˚ south and north of the equator. The climate is extremely cold and usually covered by ice caps. The climate is positioned rather far away from the position of the sun hence temperature can go far much below 0˚C . Some areas in the climate belt may go up to six months with insignificant experience of sunshine. The climate is divided into the polar dry which is generally dry with temperature permanently remaining below 0˚C. There is also the polar wet which receives rainfall due to the influence of the polar maritime air masses. I In this climate zone, temperature can go up to above 0˚C and significant amount of rainfall can be received.

Use the table to answer number 6 and 7

Month	Jan	Feb	Mar	Apr	M	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Temperature(˚c)	24	25	26	25	27	24	25	26	27	25	25	26
Rainfall (mm)	120	176	157	167	176	124	134	159	173	147	130	126

6. Which type of climate is represented by the table?
   A. Warm temperate
   B. Tropical continental
   C. Tropical rainforest
   D. Tropical desert

7. One major characteristic of the climate shown by the table is
   A. High temperature range
   B. Low annual rainfall
   C. Cold throughout the year
   D. Hot throughout the year

8. Identify and explain the air masses that have great influence over Zimbabwe.

9. With the aid of diagrams, describe the position of Inter-Tropical Convergence Zone in Africa in July and January.

10. Discuss the climate characteristics of the following climates:
    a) Tropical climates
    b) Warm temperate climate
    c) Polar climate

Task

- You have been tasked to record the rainfall, temperature and wind direction from January to December with your colleagues in your community/ school.
- Design a record sheet for the annual recording of rainfall, temperature and wind direction.
- Design monthly weather reports for the year.
- Use weather samples to show the average monthly weather conditions.
- Draw a climate graph for the area assuming that what you recorded, represents the average weather conditions over thirty years.
- Which type of global climate zone does the area fall under?

Investigate the impact of climate change and forms of adaptation in the area of your choice

- Name the area.
- Locate the area on map.
- Collect the data on climate using personal observation, interview local people, weather officials, design and administer questionnaires to local people.
- Analyze the collected data.
- Present the data in terms of graphs, tables and any other method of your choice.
- Describe how animals and humans have adapted to the climate.

SAMPLE

CROSS CUTTING THEMES

Human beings have greatly contributed to climate change in global climates, for example, the Sahelian climate of Africa is linked to desertification as caused by pastoral farming. Disaster risk management should take into consideration the climate characteristics of an area. This is so as the world continues to experience increased weather and climate related hazards.

A deeper knowledge of weather and climate will make people determine safety and health precautions associated by leaving in particular climate; furthermore, weather and climate can also influence enterprises such as agricultural activities which are the most important sources of livelihood in rural communities of Zimbabwe.

ACTIVITY 2.1

1. From fig 2.2, describe the formation of the present-day continents according to the continetal drift theory.
2. What does the word jigsaw fit puzzle imply?

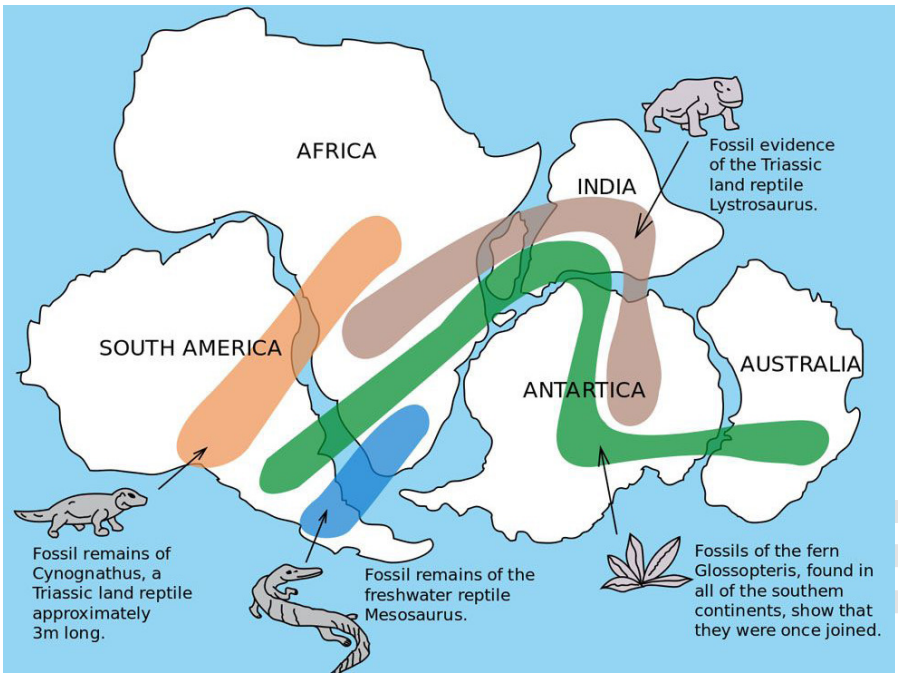


Fig 2.4 Biodiversity similarities

Biological evidence

Similarities in flora and fauna in continents which are separated by water suggest that they were once joined together and later drifted apart. An example is the fossils of Mesosaurus, a small freshwater reptile which is found both in South West Africa and Brazil.

Climatological evidence

The coal and oil reserves found in Antarctica suggest that this area drifted from one zone to the other. Glacial marks in Brazil and West Africa indicate that the area once experienced the same climate but later glided away. It is evident that some places could have drifted to the current climate belts they are in as they show a past dry or wetter pluvial climate. The theory of continental drift was heavily criticized for its failure to account for the forces which caused the movement and the conditions at the ocean floor. Research therefore, led to the development of the plate tectonic theory which embraced some ideas from continental drift thus bringing in more ideas.

ACTIVITY 2.2 IN PAIRS

1. What is meant by continental drift theory?
2. Explain the geological, climatological and biological evidence of continental drift.
3. Why was the continental drift theory heavily criticized?

DID YOU KNOW?

The theory of continental drift is very old. It was proposed by Abraham Ortelius in 1596 but fully developed by a geologist cum meteorologist Alfred Wegener in 1915.

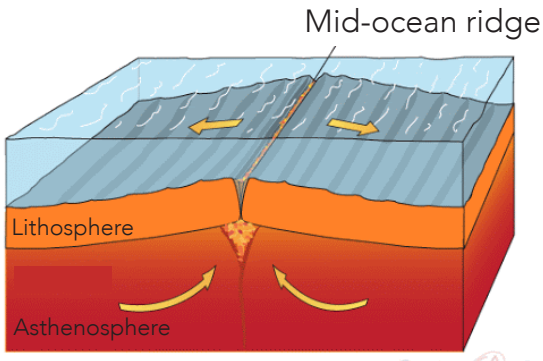


Fig 2.6 Diverging plates

Oceanic from oceanic

When oceanic plates move apart, molten rock called magma rises to the surface to fill the gap and then cools to form a new oceanic crust. This leads to the formation of mid-oceanic ridges and volcanoes on the ocean floor. The Mid-Atlantic ridge and the Pacific were formed from magma coming out as constructive margins. The formation of a new crust makes the margin constructive, and when tensional forces act in opposite direction, it is called divergence. The divergence of Eurasian plate and North American plate in the North and South America and Africa in the South has given rise to the Mid-Atlantic ridge with a lot of underwater volcanoes.

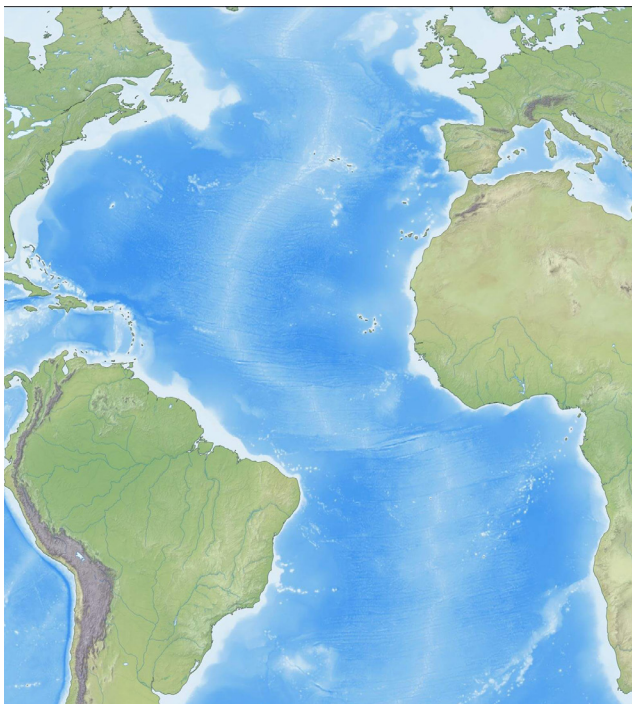


Fig 2.7 Mid- Atlantic oceanic ridge

Continental from continental

When two continental plates diverge, there is subsidence of the central block creating a rift valley between the fault lines. There will be a series of volcanoes within the rift valley such as those in the East African rift valley.

Fig 2.8 Continental moving away from another continental

SAMPLE

ACTIVITY 2.6 DISCUSSION

1. What is a constructive plate margin?
2. Identify the main features at a constructive plate margin.
3. Describe some plate margins where diverging is takes place.

DID YOU KNOW?

The North American plate is moving 4cm westwards per year whilst the pacific plate is also moving at the same rate northwards.

Destructive plate margin

The destructive margins occurs where two plates are converging, for example, an oceanic plate converging with a continental plate, an oceanic meeting another oceanic plate and when a continental plate meets another continental (collision). This is a destructive plate margin because crustal material is destroyed as the plate gets

Tectonic activities at the conservative plate margin

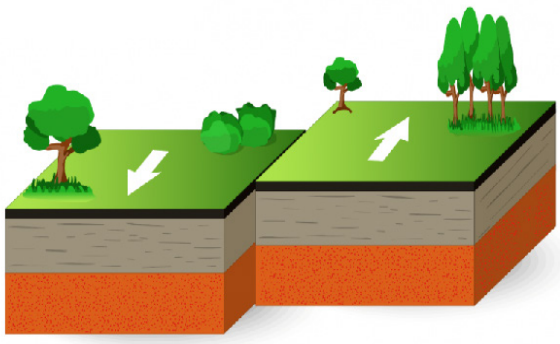


Fig 2.15 Activities at conservative plate margin

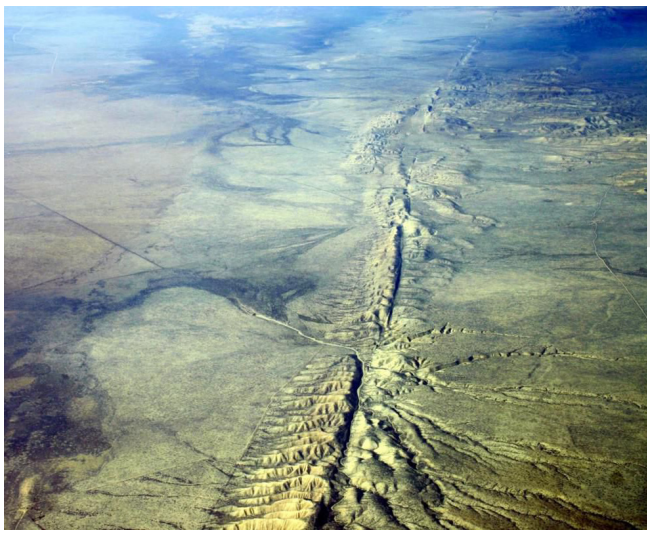


Fig 2.16 San Andréa's fault

ACTIVITY 2.8 INDIVIDUAL

1. Describe and explain the activities at a conservative plate margin.
2. Explain how the San Andrea fault could have been formed.

PLE

Young and old fold mountains

Fig 2.21 Himalaya young fold mountain

Fig 2.22 Urals old fold mountain

Young fold mountains	Old fold mountains
• Newest in the history of the earth, formed some 10 to 25 million years ago. Examples are the rockies, the andes and himalayas. • Higher elevation. • Steep conical peaks. • Rugged relief.	• Very old, formed over 200 million years ago. Examples include urals and appalachians. • Lower elevation. • Gentle rounded peaks. • Worn away by denudation processes into plains.

SAMPLE

Table 2.1 Young and old fold mountains

ACTIVITY 2.10 IN PAIRS

1. Describe the process of folding.
2. Identify and explain the various types of folds.
3. Discuss the formation of young fold mountains.
4. Distinguish between young fold mountain and old fold mountain.

How is rift valley by compression formed?

- A crust is subjected to compression forces.
- The crust develops a pair of reverse faults.
- Continued compression forces will push the two outside blocks upward towards each other.
- The central block sinks/subsides.
- This subsidence of central block creates the rift valley or Graben.
- The outside blocks will be up thrown.
- The up throws are known as the block mountains or the horst mountain.
- Overhangs from the up-thrown blocks will be destroyed by denudation enlarging the extent of the rift valley.

Map of East African rift valley

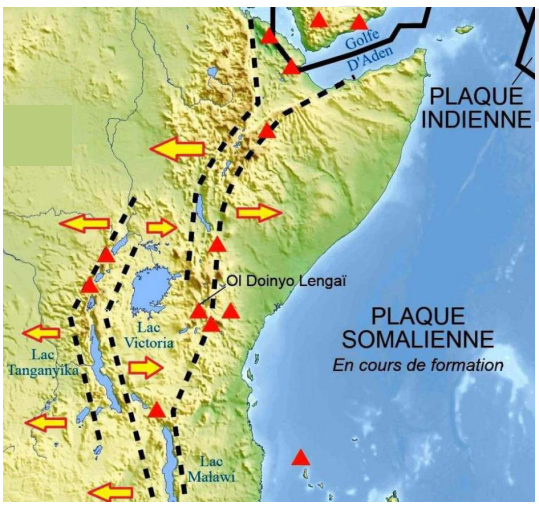


Fig 2.35 East African rift valley

East Africa rift valley

The Great East African rift valley is a result of tension forces caused by tectonic movements, the divergence of African and Arabian plates. As the plates are pulled apart, the central crustal block sank creating a down throw which is a rift valley. It stretches from Lebanon to Mozambique for approximately 6000km in length. In Africa, it can be viewed as starting from the Afar Triangle North of the horn of Africa to Mozambique. The rift valley is divided into the Western rift and the Eastern rift. This is viewed as the splitting of the African continent into different future tectonic plates. In the rift valley, there are several features such as volcanoes and lakes. Some of the great lakes are the Lake Malawi and Lake Tanganyika in Malawi and Tanzania respectively. Some mountains in the rift valley are Mount Elgon and the Ruwenzori range.

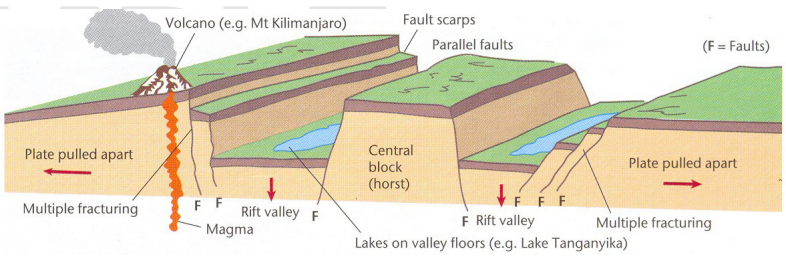


Fig 2.36 African rift valley

ACTIVITY 2.13 DISCUSSION

1. Identify the mountains which are found along the East African rift valley.
2. Identify the lakes which are found in the East African rift valley.
3. Differentiate between rift valley lakes and Lake Victoria (Basin Lake).

ACTIVITY 2.14 INDIVIDUAL

1. Describe the processes of faulting.
2. What are the main landform features of faulting?
3. Which parts of the world experience faulting? Explain your answer.
4. Describe and explain how a rift valley is formed due to tension and compression forces.

Sill is when a sheet of magma is ejected in the crust to lie along a bedding plane. They form ridge-like escarpments when exposed by erosion, for example, Chimanimani Dolerite sill.

Dyke is when a mass of magma cuts across bedding planes. Dykes may be vertical or inclined and they form ridges when exposed to the surface, for example, the Great Dyke.

Laccoliths are when magma within the crust of the earth solidifies to form a dome-like feature. It forms mountains when exposed, for example, Mt. Mulanje (Malawi). The magma pushes the upper end of the bedding plane to create a dome shaped feature.

Lopoliths forms when magma solidifies within the crust to form a saucer-like shaped feature. Zimbabwe's great dyke is a lopoliths though it is wrongly called a dyke.

Hot springs are formed when water is heated when in contact with hot crustal rocks under the surface such as Rupisa and Nyanyadzi are found in the Eastern Highlands in Zimbabwe. These are formed when hot water gushes out of the crust onto the surface.

Nature of volcanic eruptions

Nuée ardente can be referred as a glowing cloud or pyroclast flow. This is the flow of superheated ash and gases flowing at very fast speeds or cloud of red-hot gas, ash and pieces of lava which travels at over 100km/h.

Lahar or Mudflow is the mixture of ash with rain or melted ice which flows down the side of a volcano.

Lava flow is the molten rock (magma) flowing down the sides of a volcano. It creates a river of molten rock (hot basaltic lava which flows very fast) up to 1 200°C, which destroys everything in its path.

Dust and ash clouds (Ash fall) is ash thrown high into the atmosphere which shuts out the sun and causes gloomy days. On setting, layers of ash can completely bury roads, buildings and crops. Global climate ash is carried high into the atmosphere, reflects sunlight and makes the world climate cooler.

ACTIVITY 2.20 INDIVIDUAL

1. Distinguish between extrusive and intrusive volcanic features.
2. How does volcanic eruption influence climate change?

Negative effects of volcanoes

- Displacement of people triggering refugee problems.
- Destruction of property such as buildings, roads and many others.
- Pollution through the emission of gases, ash and dust.
- Floods and starvation as crops and animals are destroyed.
- Heat waves.
- Disruption of air transport like what happened in Western Europe due to Iceland eruption in 2012.
- Landslides and lava flows.
- Poisonous gases, for example, sulphide dioxide and carbonic acid.
- Fire which causes destruction of vegetation, animal and human life.
- Acid rain which can damage crops and buildings.

Benefits include

- Fertile soils through volcanic deposits.
- Thermal energy that is geothermal power generation.
- Tourism through the resultant features such as hot springs and volcanic mountains.
- Mining, minerals are usually deposited during volcanic eruption.
- Hot water through springs. The hot water from springs is believed to be medicinal.

Why do people continue to live in the areas surrounding volcanoes?

- Volcanic ash weathers to produce very fertile soils which are excellent for farming, for example, lower slopes of Mt

SAMPLE

ACTIVITY 2.24 IN GROUPS

1. What are the main reasons for earthquakes in Zimbabwe?
2. Why are earthquakes in Zimbabwe less destructive?
3. Which parts of Zimbabwe often experience earthquakes?
4. Explain the reasons why countries such as Tanzania experience more earthquakes than Zimbabwe.

Recording of earthquakes

- Earthquakes are recorded using very sensitive instruments called seismometers which record the earthquake shock waves.
- The vibrations they detect are drawn on a seismography.
- The strength of an earthquake is usually described using the Richter scale.
- The Richter scale uses a logarithmic scale of which each level is ten times more powerful than the previous one.
- The Richter scale measures the total amount of energy released in the earthquake.
- Earthquakes are also measured using the Mercalli Scale.
- The Mercalli Scale is a descriptive scale ranging from (1 rarely felt) to 12 (total devastation). In other words, the Mercalli scale measures the amount of damage caused by an earthquake.

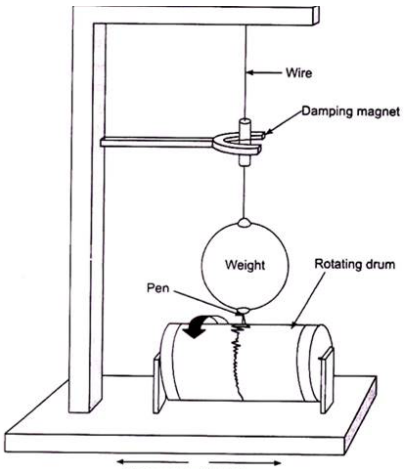


Fig 2.50 Seismometer

Richter scale

Richter Magnitude	Earthquake effects
0-2	Not felt by people
2-3	Felt little by people
3-4	Ceiling lights swing
4-5	Walls crack
5-6	Furniture moves
6-7	Some buildings collapse
7-8	Many buildings destroyed
8-Up	Total destruction of buildings, bridges and roads

Fig 2.51 Recording an earthquake on Richter scale

Impacts of an earthquake

- **Structural damage** poorly built structures are prone to earthquakes that may occur within a short time. Houses, office blocks and bridges are at risk, and people may be trapped or crushed inside.
- **Falling objects** injuries resulting from falling objects are common for example, falling glass from broken windows, and electricity cables are especially dangerous.
- **Fire** gas pipes that have broken during an earthquake may catch fire. Fires are difficult to extinguish hence property is damaged.
- **Tsunamis** an earthquake occurring at sea can result in 40 metres high waves, which travel at over 300mph. Settlements in coastal areas may be wiped out.
- **Disease** lack of clean water may result in the spread of diseases, for example, cholera and typhoid which may result in deaths.
- **Economy** earthquakes have a long-term negative economic impact on individuals, companies and governments as they have to spend money on rebuilding and buying medication.
- **Homelessness** people are made homeless due to property damage and fire outbreaks caused by earthquakes.

SAMPLE

Impacts of volcanoes and earthquakes on climate

Earthquakes and volcanoes increase gas emission in the atmosphere which triggers global warming, a critical factor of climate change. Gases produced like sulphur dioxide and nitrous oxide are greenhouse gases which can trap heat energy radiated from the surface thereby causing a general increase in the temperatures. A lot of heat is also released during an earthquake and a volcanic activity from the crustal friction thus increasing the atmospheric temperature. The increase in global temperature can give rise to melting ice unlocking more water for evaporation subsequently increasing chances of flooding. Climatic variables such as rainfall are likely to be affected due to increased heat. Glacier melting is attributed to climate change as caused by global warming. Volcanoes and fold mountains can also set the basis for the occurrence of relief rainfall as extensive volcanic mountain or huge fold mountains can force the air to rise leading to relief rainfall.

SAMPLE

SUMMARY

- The continental drift theory suggests that the world was one large continent which then split and drifted to form the present-day continents which are separated by oceans.
- The evidence of continental drift theory is derived from geomorphology, climatology and biology.
- The plate tectonic theory suggests that the world is divided into lithospheric slabs which are called plates.
- The tectonic plates move away, towards and past each other and they interact at boundaries which are called plate margins or plate boundaries.
- According to plate tectonic theory, there are three plate boundaries which are convergence, divergence and transform.
- At the convergence boundary, plates move towards each other and there is destruction of crust which is referred to as destructive plate boundary.
- At the divergence plate boundary, plates move away from each other creating a gap which will be filled up to form new crust called a constructive plate boundary.
- At the transform margin, plates move past each other creating faults and no crust is destroyed nor created and this iscalled a conservative plate margin.
- Features such as fold mountains, trenches and island arcs are formed at the destructive plate margins whilst mid oceanic ridges and volcanoes are formed at the constructive plate margins.
- Tectonic movements are associated with earthquakes, volcanoes, tsunamis, faulting and folding.
- Earthquakes, volcanoes and tsunamis are mostly experienced along plate margins.
- Earthquakes, volcanoes and tsunamis have displaced and destroyed infrastructure, human and animal life for examples in countries such as Japan, Philippines, Mexico and Haiti.
- Mitigating against tectonic hazards requires investment into rescue and evacuation operations, prediction and monitoring, education and awareness and disaster resilient infrastructure.

END OF TOPIC TEST

1. Which of the following represents the evidence of a continental drift theory?
   A. The mid-Atlantic and pacific ridges
   B. Similarities in flora and fauna in continents which are separated
   C. The occurrence of tsunamis in Japan and Philippines
   D. The increasing hazards of earthquakes and volcanoes

The chemical elements are not lost out from the ecosystem but rather they are recycled through the atmosphere, lithosphere, hydrosphere and biosphere. In some cycles, they may be locked up in reservoirs where there are accumulated or held for a long time. In the biogeochemical cycles, chemical elements and compounds are moved between the living and non-living environments.

Chemicals taken by living organisms as they feed, pass through the food chains and food webs and then, returned to the soil, air and water by processes such as respiration, excretion, and decomposition. As elements move through the cycles, they often convert into compounds due to metabolic processes that build up tissues in living organisms as well as natural reactions in the atmosphere, lithosphere and hydrosphere. Biogeochemical cycles involve the geological and biological processes that recycle chemicals which are vital to life. The cycles can either be gaseous or sedimentary. Gaseous cycles include the movement of nitrogen, oxygen, carbon and water which have chemical elements that are easily transformed into gas or vapour. In this type of a cycle, materials are moved through processes such as evaporation, absorption by plants and wind dispersal.
Sedimentary cycles include the precipitates of minerals and salts from the earth's crust and their subsequent settling as sediments or rock before the cycle repeats. Plants take in carbon dioxide and release oxygen and in the process, make the air suitable for breathing. Plants also absorb nutrients from the soil which are obtained by animals though feeding.

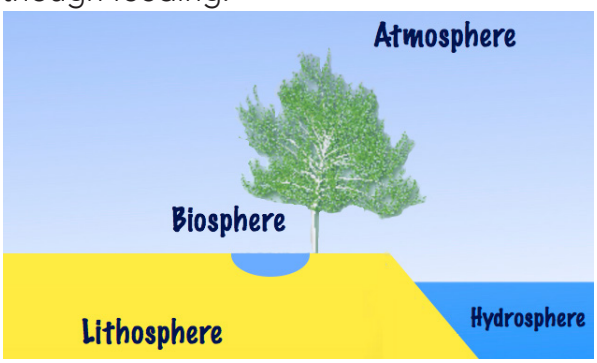


Fig 3.2 Matter cycling between the atmosphere, the lithosphere and the hydrosphere

Dead plants and animals return these nutrients to the soil through decaying. The cycle then repeats itself now and again to allow other living things to benefit as well. The ecosystem is kept in balance through these biogeochemical cycles which support life on earth. The chemicals which are recycled constitute critical elements of ecosystem sustenance. The simplest example of biogeochemical cycles is water cycle, in which water evaporates from surface water bodies. The vapour is then condensed to form the rain clouds that produce rain that falls on the surface, to start the cycle again.

ACTIVITY 3.1 INDIVIDUAL

1. Define biogeochemical cycles.
2. What is the importance of biogeochemical cycles to the ecosystem?

SAMPLE

Forms of biogeochemical cycles

Nitrogen cycle

The nitrogen cycle is the biogeochemical cycle in which nitrogen is converted into various chemical forms as it circulates among the atmosphere, terrestrial (land) and marine (water) ecosystems. The conversion processes in the nitrogen cycle are the nitrogen fixation, ammonification, nitrification, and denitrification. The majority of the earth's atmosphere (78%) is nitrogen which makes it its largest source. Despite being the most abundant element in the atmosphere, nitrogen is not directly accessed for biological use because of general scarcity in usable nitrogen in most ecosystems. The nitrogen cycle is of interest to ecologists because nitrogen affects the rate of key ecosystem processes such as primary production and decomposition, human activities such as the use of fossil fuel and the use of artificial nitrogen fertilizers.

The nitrogen cycle operates through nitrogen fixation, nitrification, ammonification and denitrification. During nitrogen fixation,

Unit 3.2 Wetlands

Objectives

By the end of this unit, learners should be able to:

- Explain the importance of wetlands
- Outline the benefits of wetlands.

Introduction

A wetland is a permanently or seasonally waterlogged area, which assumes a distinct ecological condition as compared to other surrounding areas. It has a unique vegetation, soils and animals making it a vibrant ecosystem on its own. Wetlands constitute reserves of water permanently or temporarily which are very important to living organisms including human beings, resulting in land use that supports aquatic or semi-aquatic plant life. It is generally accepted that water is life hence a wetland being a preserve of water, constitute a critical component of life on earth. In this unit, we will go through the description and explanation of the importance of wetlands.

Wetlands

In Zimbabwe, there are various types of wetland ecosystems such as Dambo (mapani), flood plains, artificial impoundments and water pans. These wetlands share a common factor of having abundant water kept or passing through for a long time to influence the soils, land use and other life forms that thrive within them. The country has many wetlands some of which are being threatened by human activities. Some types of wetlands are described in the following sections.

Flood plains

Fig 3.6 Flood plain

Flood plains develop along flat low-lying areas adjacent to major rivers. They are usually open to flooding as water spills from rivers. Zimbabwe is located on the plateau and has few flood plains which are found in the Zambezi Valley and around the major rivers such as Save and Runde. The flood plains are generally gentle because they can retain water for a long period of time. They draw water from the high veld and as such, they are mainly used for agriculture and tourism.

ACTIVITY 3.4 DISCUSSION

1. What is a flood plain?
2. Which human activities can be carried out near a flood plain?
3. What are the dangers of living near a flood plain?

CASE STUDY: THREATS TO WETLANDS: ZIMBABWEAN EXPERIENCE

Zimbabwe has a lot of wetlands dotted across the entire breadth of the nation. These wetlands have provided a lot of services particularly in agriculture where crops such as rice can be grown and where animals can graze during the dry periods. The wetlands are facing a lot of pressure as human activities continue to negatively affect them. In Chitungwiza, the construction industry has extended into wetlands some of which have already dried out. A very big church was constructed in Chitungwiza wetland and the authorities failed to stop that. Industrial effluent is being discharged in wetlands particularly those near rivers such as Mukuvisi. The construction of Long Chen plaza near the national sports stadium is also a clear example of destroying a wetland. Fertilisers and other agrochemicals are finding their way into wetlands causing massive pollution. The over use of wetlands particularly during dry periods has deteriorated the conditions of wetlands.

ACTIVITY 3.6 DISCUSSION

1. Explain the main characteristics of wetlands.
2. Visit a nearby wetland and describe its importance to ecosystem.
3. Describe how your community can develop an artificial wetland.
4. Discuss the benefits of a wetland that you know.

SAMPLE

Fig 3.13 Gulley filling by wood

Fig 3.14 Gully filling by stones

The adoption and subsequent rehabilitation of degraded ecosystems can bring big benefits as it restores ecological balance thereby insuring sustainable development of communities. The boosting of native species can improve species diversity and people can accrue great benefits from them for example, increased tree species provides firewood and timber whilst improved wildlife provides meat. Reclaimed lands can then be brought back into use thereby boosting agricultural production. Restoration also brings about the aesthetic value of ecosystem which can then attract investment into economic activities such as tourism. Problems such as soil erosion can be contained through effective methods of restoration such as reforestation as the movement of water on the surface is controlled.

Fig 3.15 Mine dump rehabilitation in progress

ACTIVITY 3.8 IN PAIRS

1. What is meant by ecosystem restoration?
2. Describe the methods used in ecosystem restoration in your community.
3. Discuss how communities can benefit from ecosystem restoration.

SAMPLE

Provisioning services

Ecosystems are essential to our well-being, as they provide us with food, clean air and fresh water. They are an exceptional source of outdoor recreational opportunity where people go out and enjoy themselves. Activities such as fishing, skiing and yachting are carried out within the confines of specific ecological setups. In rural ecosystems, people derive their source of livelihoods from local ecosystems. Water in rivers, firewood from nearby forests, irrigation from dams and even getting relish from nearby fields are some of the critical benefits of ecosystems.

Vegetation is also the source of oxygen which sustains human and animal lives. Leaves from trees decompose to provide humus which enriches the soils as well as protecting it from erosion. Herbal medicines can also be extracted from forests. There is also the habitat service which provides shelter to various forms of biodiversity.

Fig 3.17 Wild fruit picking

Regulatory services

One of the critical benefits of ecosystems is to regulate extremes within specific ecological setups. The excess gases in the atmosphere is controlled by vegetation within the ecosystem thus reducing air pollution. Water purification can be done through the works of wetlands. Other forms of environmental degradation are contained through intricate linkages of ecosystem components. Ecosystems such as wetlands provide water purification services through trapping sediments in water. Vegetation plays a protective role against natural hazards such as floods and it also contribute to the aesthetic value of the ecosystem. Pests and diseases are controlled through the existence of predators and parasites. Humans depend on different ecosystems together with their livestock. Insects such as bees and bumble bees are key actors in providing pollination services to maintain crop production. Vegetation in the ecosystems cleans the atmosphere through the uptake of excess carbon dioxide as well as providing fruits which are critical for human health.

Cultural services

Ecosystem can provide spiritual services such as the establishment of religious shrines and the performance of rainmaking ceremonies such as mukwerera which are usually done outside homesteads. Most churches in Zimbabwe have resorted to specific ecological setups such as mountain ecosystems for conducting their ceremonies. Marine ecosystems have provided the Christian communities with areas of baptizing their members. Ecosystems also provide opportunities to marvel at the national heritage sites for example Victoria Falls which ultimately provides benefits such as tourism and recreation. Some ecosystems have assumed prominent roles as havens of cultural heritage where people are reminded of the need to keep traditional ethos. Some water bodies and mountains are considered to be sheltering societal spirits for example Inya'nga mountain.

Supporting services

The supporting service is provided through the biogeochemical cycles that support life on earth. The hydrological cycle is spurred through evapotranspiration from trees. Soil biodiversity is a major factor in soil formation, which supports a range of provisioning services such as food, fibre and fuel. A diverse soil community helps prevent loss of crops due to soil-borne pest diseases. Well managed and protected areas can also provide vital ecosystem services, such as

SAMPLE

Unit 4.1 Conservation of resources

Objectives

By the end of this unit, learners should be able to:

- Describe resources conservation measures
- Identify ways of conserving resources.

SAMPLE

Introduction

Natural resources are an important aspect of human development hence there is a great need to conserve them. There are a lot of conservation measures which people can implement in their communities as a way of sustaining their local natural resources. Sustainable development mandates the current generation to take a stewardship role towards resources to avoid the overuse of them.

Conserving natural resources

The future generations should continue to enjoy the present resources and this calls for concerted effort to conserve the natural resources today. Natural resources are provided by nature, but humanity has an obligation to conserve them through a multiplicity of strategies bordering on acts of commission or omission. It should ensure that there is careful use of resources. In Zimbabwe, a lot of effort has been channelled both at community and national levels to conserve the available resources. Government has come up with legislation whilst communities have designed bylaws to safeguard natural resources.

Conserving fish

Fig 4.1 Banner for fish conservation

Fish is a very important natural resource which is a big source of protein. Fishing has also become a very exciting recreational activity and as such, the possibilities of overfishing are high. Zimbabwe has got several dams which are known for fishing and Kariba dam is one of the biggest fishing source. The population of fish in this habitat are depleting because the rate of fishing is outpacing the rate at which the fish are reproducing themselves.

The process of maintaining fish stokes is referred to as fisheries management and at its centre is the control of fish catch. The fish species should be protected by the laws of the country. Fishing companies must be licensed so that they can take responsibility in ensuring the conservation of the fish. At the catch level, the size of nets should be relatively big so as

ecological systems. The forests are banks for biodiversity as they constitute habitats for most wildlife. They clean excess carbon dioxide, provide oxygen and accelerate the hydrological cycle which is critical in rainfall formation. It is incumbent for people to manage forests as they also control runoff which can contribute to soil erosion.

The conservation of forests can be done through some of the following strategies

- Legislation against the indiscriminate cutting down of trees, fines should be charged on law-breakers.
- Encourage the use of alternative sources of energy such as hydro-electrical and solar power. Rural electrification can also minimize the cutting down of trees. In rural areas, Tsotso stoves can be used because of their energy efficiency.
- Afforestation is a proactive method used to improve forests. It is the planting of trees on bare ground which previously had no trees. This is done for either domestic or commercial use. Afforestation improves the provision of wood and wood products such as timber. It also prevents the overuse and destruction of natural forests. Communities have been urged to plant exotic woodlots such as gum trees and this has the impact of conserving our indigenous natural forests. In Zimbabwe, tobacco farmers are encouraged to have woodlots from which they can harvest firewood rather than relying on indigenous trees which take a long period to regrow.
- Reforestation is another method of sustaining forests by expanding them. It is a process of planting trees in a once forested area. It is the opposite of deforestation. Once trees are cut, reforestation should follow as a way of maintaining the forests.
- Selective logging is another way of conserving forests as it deals with the indiscriminate cutting of trees. It is the removal of old trees and leaving the immature ones to grow. Selective logging allows the recovery of forests to take place between and after the selective harvest cycles.
- Controlled bush burning can benefit a lot in the regeneration of forests. Once a forest is carefully burnt, undergrowth quickly colonizes the area and the germination of new trees is stimulated. In Zimbabwe, veldfires have had a negative impact towards the forests, hence there is need to control them.
- The creation of gene-banks, preserves forests and animals from human interference.
- Traditional prohibitions and indigenous knowledge can also be used to control the reckless cutting down of trees. In the case of Zimbabwe, some trees like Muonde/Umkhiwa are sacrilegious lest this can antagonize the local traditional spirits.

SAMPLE

ACTIVITY 4.4 IN GROUPS

1. What is meant by forest conservation?
2. Why are natural forests facing threats in your community and in Zimbabwe?
3. Outline ways of conserving forests in Zimbabwe.
4. Discuss how indigenous knowledge systems are important in conserving forests in Zimbabwe?