

**WETLANDS EDUCATION AND AWARENESS
MATERIALS FOR PRIMARY SCHOOLS**

UNIT 1: OUR WETLANDS IN THE NILE BASIN REGION

1.0 INTRODUCTION

This is the first unit on wetlands. It will help you understand the meaning, forms and types of wetlands. You will read about how wetlands are formed and give examples of wetlands in the Nile basin region. This unit will also prepare you to some activities in a nearby wetland. We shall therefore cover the following topics:

- What wetlands are
- How wetlands are formed
- Wetlands and their surroundings
- Location of wetlands in the Nile Basin
- Types of wetlands in the Nile Basin

Learning outcomes

By the end of this Unit, you should be able to:

- **Say what wetlands are**
- **Explain how wetlands are formed**
- **Give characteristics of wetlands**
- **Give examples of wetlands in the Nile basin region**

1.1 WHAT ARE WETLANDS?

Study the picture below and describe what you are able to see.

Illustration: (3/4 page)

Typical wetlands showing:

Flooded land, wetlands plants and some animals and the surrounding area

- Discuss with your classmate what you see in this picture.
- Name a place which looks like this near your school.
- Do you know how long the water stays in the places you have named?

The place you have named and one shown here is called a wetland.

They are areas of land that may be flooded either permanently or seasonally. The land holds (retains) water for long enough for such plants and animals to live there.

All the things in the water and the surrounding areas and how they relate with each other is therefore what is known as a wetland ecosystem



Did you know that?

- In wetland we can have surface or water within the soil.
- Water in wetland is shallow less than 6 metres.
- Wetlands have unique soil conditions.
- There are specially adapted plants and animals in wetlands.
- In wetlands dead plants do not rot easily because of the soil and water conditions.

These are what make wetlands different from other lands. They are called features of wetlands.

Exercise 1

1. Can you now say what wetland is?
2. What is a wetland?

Now check if your answer is like:

“Wetlands are areas of land that are wet, flooded either permanently or seasonally, and where the land holds (retains) water for long enough to allow the development of characteristic soils, plants and animals.”

1.2 HOW WETLANDS ARE FORMED

We get water from rain and dew. In an area rain may fall frequently or occasionally. Here is an exercise for you to do on an occasion when rain has first fallen heavily.

Exercise 2

Observe the rain run-off water and make notes on:

1. In which direction the water runs.
2. The colour of the run-off water
3. What is carried in run-off water?
4. Where the run-off stops.
5. Run-offs from other direction which stop at this place.
6. What happens to the soil where the water collects?

The map below shows an example of run-offs from different directions. They all gather in a valley.

Illustration:

A map showing run-offs from different directions which form a wetland.

The valley retains water for long. The soil becomes water logged. The plants begin to adapt to this soil condition. Even animals which live have become used to these conditions. The area with these plants, animals and water logged soil of this condition is known as **Wetland**. The area may become larger as it gathers more water. The run-offs carry soil particles. More particles may be stopped by plants. This is called silting, silting enables the area of wetland to become larger.

In your Social studies or Geography lessons you have learnt about rivers. Some rivers are said to be fast moving. But other rivers are slow and water is delayed. This causes conditions of wetland. The soil become water logged (saturated with water). Plants and animals adapt to the conditions. The river may deposit more soil causing silting on longer area. This widens the wetlands area.

- We have seen that wetlands are formed from rain water-run offs. This gathers in a flat low lying area.
- Wetlands are also formed at a point where a stream or river is slowed.
- Wetlands can also become large as the condition spreads out.

Exercise 3

1. Discuss with your teacher.
 - (a) Other ways in which wetlands are formed.
 - (b) How wetlands in your country were formed.
2. Draw a similar map to the one shown above which shows how water run-offs in your area have formed a wetland near your home or school.
3. Revise your lessons on rivers in your country.

1.3 WETLANDS AND THE SURROUNDING AREAS

Wetlands are formed where water is retained or delayed within the catchments. This may be in a depression or basin. Therefore, important things for the formation of wetlands are:

- Water from a catchment
- Place for water to collect
- The soil beneath to become filled with water or water logged.

Your teacher will organize a field tour in the area surrounding the wetland near your school. Try to record:

1. Nature and patterns of rain; find out how frequently it falls in the area.
2. Drainage path of the wetlands.
3. Land forms in the area.

4. Peoples' activities in the area.

Each of these will affect the formation, nature and size of the wetland and the animals and plants in it.

- The nature and patterns of rainfall will provide the amount of water
- The drainage systems of the land around will direct the flow of water.
- Land forms will influence the spread of rain water-run offs
- People's activities in the catchments are will influence what materials the rain run-offs will carry.

1.4 LOCATION OF WETLANDS IN NILE BASIN

Revise the names and location of wetlands of your country. The factors we have discussed are important in wetlands. We first discussed factors that affect the occurrence of wetlands. These may be affecting the distribution of wetlands in your country.

Let us look at wetlands in the Nile Basin region. This includes your country.

Illustration:

Map showing Nile Basin countries and major wetlands.

Read your Geography or Social studies books and find information to complete the following table.

County	Area covered with wetlands	% of the total land area
Burundi		
DR of Congo		
Egypt		
Ethiopia		
Kenya		
Rwanda		
Sudan		
Tanzania		
Uganda		

From the above table we are able to see which country has most of its land covered with wetlands.

We can also find out the names of major wetlands in each country. Prepare a table that shows names of wetlands. Show their sizes and make a table as indicated below.

Country	Names of wetlands	Large of land covered by wetland

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Most of the wetlands in Nile basin are found at shores of lakes. Some are found along river banks, while others are found in the low lying basins of rivers, for example, at Bahr-el-Ghazel on White Nile in the Sudan. Some wetlands are at the points where rivers or streams enter major water bodies. There are also many wetlands that are formed at the point where two rivers or streams meet.

Types of wetlands in the Nile Basin

- We have just studied the distribution of wetlands. Some are found around lakes and others around rivers.
- Wetlands associated with lakes are called **lacustrine** wetlands.
- Wetlands associated with rivers are called **riverine** wetlands. From our atlas we can find examples of lacustrine and riverine wetlands. The table below is a summary of lacustrine wetlands in the Nile Basin.

Name of country	Wetlands associated with lakes (lacustrine)
Burundi	
DR of Congo	
Ethiopia	
Kenya	
Rwanda	
Sudan	
Tanzanian	
Uganda	

Are there any other examples you can give from your country?

Examples of Riverine wetlands in Nile Basin

Exercise 4

1. Revise your lessons in Geography or Social studies on rivers.

- (a) Name the rivers in your country.
 - (b) Name the rivers within the Nile Basin. Which ones are in more than one country?
2. Study the map of the Nile Basin in your Atlas. Read about Riverine Wetlands in the Nile Basin. Use the information to complete the table on Riverine Wetlands.

Table of Riverine wetlands in the Nile Basin

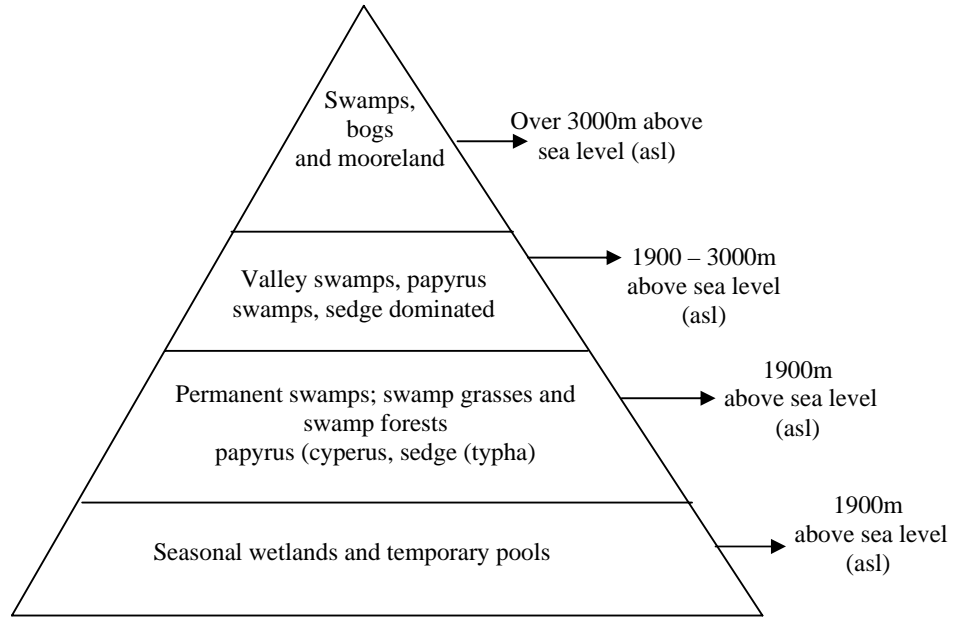
Name of country	Wetlands associated with lakes (lacustrine)
Burundi	
DR of Congo	
Egypt	
Ethiopia	
Kenya	
Rwanda	
Sudan	
Tanzanian	
Uganda	

- Compare your table with that of your classmates.
- Show your work to your teacher.

Wetlands according to height above sea level (altitudes)

Did you know that wetlands can be classified on the basis of height at which they are found (differences in altitude)?

The diagram below shows different vegetations found in wetlands at different heights.



Exercise 5

1. Copy this diagram in your exercise book.
2. Give examples of wetlands at different levels in your country.
3. Name the mountain or highlands where the wetlands are found.
4. Find out from your Geography or Social studies teacher about the names of highlands and wetlands in each of them.

There are three ways of grouping or classifying wetlands. The wetlands associated with lakes are called **lacustrine** wetlands. The wetlands associated with rivers are called **riverine** wetlands. Wetlands can also be grouped based on altitude. Each type of wetland gives us a variety of plants and animals. The soil type and condition will also vary. Therefore, each type of wetlands will be able to give us different **resources**. Sometimes wetlands are classified on the basis of whether or not they are constructed or made by man or that they occur naturally.

1.5 UNIT SUMMARY

Congratulations, you have just completed Unit 1 of the five units that will help you to understand wetlands better. You have dealt with:

- What wetlands are
- How wetlands are formed
- The different types of wetlands, and
- Where they are found

1.6 FURTHER READING

Wetland Inspection Division (WID). 2004. *Wetlands Resource Book*. Ministry of Lands, Water and Environment, Uganda. Kampala: MOWLE Publications.

United Nations Development Programme (UNDP). 2005. *State of World Environment Report*. Nairobi: UNDP Publications.

UNIT 2: BENEFITS FROM OUR WETLANDS

2.0 INTRODUCTION

We have just completed Unit 1 of our resource book. In this Unit, we shall examine the benefits from wetlands and the roles they play as well as the services that they offer. We shall therefore cover the following topics:

- Products of wetlands
- Wetlands services
- Wetlands roles

Learning outcomes

By the end of this Unit, you should be able to:

- Give examples of wetlands products and their uses
- Give examples of wetlands services in your locality or country
- Explain the role of wetland in making water clean, storing it and releasing it
- Carry out a project in your community to make the people ware of the importance of wetlands to them

2.1 WETLANDS PRODUCTS

We have either harvested or seen members of the community harvesting wetlands **products** and get wetland **services**. Products from wetlands include water, the plants and animal resources. Some of the products from wetlands are shown in the (diagram) pictures below.

Illustration:

Showing different products in use.

Exercise 1

1. Name the products shown in the picture.
2. What other products are got from wetlands in your country that are not shown here?
3. Write down what can go wrong when we over harvest the wetlands products.

The products people get from wetlands either occur naturally or are cultivated by the people living near the wetlands. People get products especially in the seasonally flooded areas of our wetlands.

The majority of wetlands products are plants and animal products. In some wetlands we get mineral products. We now look at the different wetlands products.

1. Water

Water is an important product from wetlands. Without water, the place we call a wetland would not be called so. Wetlands work like sponges and retain rainfall water for long periods.

Wetland plants and soil help to filter the water. The water supplied from a wetland is generally clean and can be used for animals, domestic and industrial purposes. The water supply can be seasonal or all the time free of cost.

Exercise 2

1. Name the wetland from which your community gets its water.
2. Find out the wetlands from which other communities get water.
3. What would happen to the water if the wetland dried-up?

2. Wetland plant resources

We harvest plant resources directly from wetlands. The plant resources can be used for: fuel wood, timber, building materials, food and herbal medicines. In Chapter 3, we shall look at other plant resources like reeds, grasses and papyrus that are commonly used for thatching, mulching and craft work. A large proportion of these resources are used directly by harvesters. Some are sold and provide financial benefits to local people. In Chapter 3, we shall look at names of different plants from wetlands and their uses.

The picture below shows some plant materials being used.

Illustration:

Picture of plant materials for crafts, medicine, and mulching.

Exercise 3

1. Name some plant resources found in wetlands in your local area.
2. What are the different plant materials or resources used for?
3. Which of the plant resources are used directly by harvesters?
4. Which ones of the plant resources are sold for money?

3. Wetlands animals resources

Wetlands are homes or habitats for many different plants and animals. Wetlands animal resources can be grouped as follows:

- Fisheries, and
- Wild life

(a) Fisheries

Picture: Of people in a wetland fishing while others are holding out fish for sale.

Wetlands provide different types of fish. Some are small and others are larger. Examples of fish we get from wetlands include;

- Catfish (*Clarias*)
- Lungfish (*Protopterus*)
- Nile perch (*Lates niloticus*)
- Tilapia (*Oreochromis*)

Wetlands are useful as breeding grounds for most fish. This means that when we destroy wetlands, we destroy the breeding grounds for fish which will then fail to breed.

Did you know that the large tilapia and Nile perch too breed in Wetlands?

The fish caught in wetlands are eaten by the local people. Some are sold in the market for money. Fish from wetlands provide the proteins and financial benefits. Can you name any other benefits of fish from our wetlands?

When wetlands are drained or polluted the available fish stock is interfered with. We need to care for the wetlands in order to benefit from the fish in it.

Exercise 4

1. Name other fish found in your local wetlands.
2. Find out from the fisherman what their monthly incomes are from fish.
3. Write an article to your school magazine on how to preserve wetlands for fisheries resources.

(b) Wildlife resources from wetlands

Illustration:

Wildlife species like:
Sitatunga, water bucks, hippopotami, crane birds, otters and amphibians. These should be shown in their natural habitats.

Exercise 5

1. The picture above shows a variety of wildlife. Name the animals.
2. What other animals are found in your local wetlands?
3. Give three ways we benefit from these animals.

Wetlands wildlife resources include animals and plants. We have already looked at plant resources. The animals found in wetlands include; Sitatunga, water bucks, hippopotami, otters, amphibians and birds. The bird species vary from location to location. Some of the birds such as storks and sea gulls migrate with seasons. It is therefore important to ensure that these birds are protected wherever they go. Agreements between countries are sometimes signed in order to ensure the protection of migratory species.

The animals and birds are usually hunted for their meat, skins, horns and feathers. Other animal products include; honey from bees, eggs and feathers from birds.

These resources are used directly by the local people. Others are sold for money. Wildlife in wetlands also attracts tourists who bring in money into our countries and cause people to be employed.

All wildlife animals depend on one form of wetland or another even in dry areas since wetlands offer the only places where wildlife can get water. There are oases or dry season refugees for wildlife and livestock in arid or very dry areas areas.

Exercise 6

1. Name such oasis or wetlands in your county.
2. Find out from your atlas the names of water point and oasis in other countries of the Nile Basin.
3. In or near which Wildlife Parks are such oasis found?

4. Wetlands for Grazing and Forage resources

Grazing is the consumption of grasses and soft vegetation by animals feeding at the ground level. Forage is material which animals get from **woody** plants (trees, bushes and shrubs). These are usually well above the ground.

The pictures below show (a) Animals grazing (b) Animals browsing from forage

(a) Grazing



(b) Browsing forage



Wetlands are usually communal grazing grounds. In all the Nile Basin countries domestic animals are grazed in seasonal wetlands especially during dry season.

Exercise 7

1. Name the common grazing areas of your country.
2. Which animals feed on forage?
3. What are the advantages of grazing animals in wetlands?
4. How is overgrazing dangerous to the wetlands?

Grazing has both positive and negative results on wetlands. It can increase grass production. It helps to fertilize the soils.

On the other hand it can:

- Lead to soil erosion due to overgrazing and over **trampling**
- Lead to removal or replacement of palatable grass.
- Well defined and deep trails and gullies
- Loss of water from the wetlands that results in drying of the wetland.
- Lead to wetlands conversion to dry land.

5. Agricultural resources in wetlands

Wetlands in the Nile Basin are some of the most important agricultural areas, for example, the Nile Delta, Gezira basin, Bar-el-Ghazel areas and around lakes such as Victoria, Tanganyika, Rudolf, George and Kyoga.

Wetland margins and especially margins of seasonal wetlands are useful for growing crops. They are useful in times of droughts or hardship.

Wetlands and wetland margins are popular for the growing of such crops as: rice, yams and sugarcane which are tolerant of waterlogged conditions. Cotton especially in the Gezira region, dates and mangrove trees and other tree species are some of other plants grown in wetlands. Seasonal wetlands in the highlands of Ethiopia are important for wheat growing.

All these crops can grow well in wetlands without a need for significant drainage. However, cultivation in wetlands destroys the natural vegetation. The entire wetland need not be used for the growing of these crops in order to avoid the wetland being destroyed. The wise use of wetlands should also involve constant assessment of the crop harvest.

It is dangerous to cultivate especially food crops in polluted wetlands. Why do you think that this is the case? Discuss this point with your teacher.

Exercise 8

1. Name crops which are grown in wetlands in your country.
2. Find out what size or proportion of each wetland is used for growing the various crops.
3. Find from farmers of each wetland the progress of their harvest in the last five years.

4. Write an essay on the use of wetland margins in your community.

2.2 WETLAND SERVICES

The services wetlands give us are all indirect benefits we get from it. They are not readily recognized not until it fails. The services of wetlands include;

- Water control e.g. flood reduction and constant water supply
- Drought limitation.
- Ground water recharged and discharge.
- Water supply
- Water quality
- Sediment retention
- Waste water treatment
- Chemical recycling
- Climate modification
- Wildlife habitats centres of living things (biological diversity)
- Transport and communication
- Recreation and eco-tourism
- Cultural attachments

1. Water control

Wetlands reduce floods by:

- Slowing down the speed of run-off from rain.
- Spreading out water and this reduces the force of storm-water.
- Wetlands vegetation offer resistance to water flow.

Characteristics which enable wetlands to reduce floods are:

- The size of the wetland – the more area is available for flood water storage and reduction of spread of water flow the better.
- The location within the drainage basin – the most effective is the foot of hills and upper regions of the main valley of the wetland system.
- The type and thickness of vegetation in the wetland.

Although a single wetland is able to reduce floods in an area, effective flood control is usually the result of the interrelationship of series of wetlands within a catchment.

2. Drought limitation

Water is retained within the wetland when the flow is slowed down. There is much more water retention (kept back) in the man-made reservoirs.

- Wetlands work like dams that leak. They release water slowly and evenly especially when in perfect state. They release water often well into the dry season.
- Wetlands hold water like it is in storage.
- The water is released, redistributed in time to sustain the flow even during drought season.
- Water from wetlands is redistributed to streams, wells, and boreholes.
- Wetlands help to maintain the base flow of rivers throughout the year.
- Wetlands provide coding effect during the hot drought season.

3. Ground water recharge and discharge

Water from the wetland infiltrate or percolate into the ground. In this way surface water bodies connect to ground water systems and keeps feeding into it. This is called **replenishing** or **recharging**. This process is usually slow and goes on throughout the year.

Wetlands allow water to leave into the ground to join ground water and it also allows water to join adjoining water body. This process is known as **discharging**. Wetlands recharge the ground water and adjoining water bodies through the process of water **discharging**.

Water discharge is important in maintaining ground water table and water levels in water bodies.

For good recharge and discharge the wetland must have the following qualities:

- Water permanence
- Presence of permeable soils (soil which can all water to pass)
- Presence of vegetation cover.

4. Water supply

Water from wetlands is important for;

- Domestic supply
- Agriculture irrigation
- Livestock watering
- Industrial purposes
- Wildlife watering points.

Wetland water is often clean and more free of pollutants as compared to other natural surface water sources.

Wetlands also help to distribute water widely through the region. Even in drier parts of the region the seasonal wetlands usually provide the needed water.

5. Water quality

We have seen that wetlands act as sponge. They lease or discharge water steadily. Wetlands also act as filters. They are able to remove pollutants and sediments from water that passes through them. The quality of water passing through a wetland is able to change because:

- As the water enters the wetland, the rate at which it moves is reduced. This causes particles to settle to the bottom of the wetland.
- When surface water is spread out over a wide area in wetland, this gives opportunity for chemical changes to take place between the water and the soil.
- There are many chemical processes taking place in wetland water and soil. This helps to remove pollutants e.g. nitrates are converted to nitrogen gas.
- Organic substances (solids or liquid) are slowly decomposed by the micro-organisms in wetlands.
- Some pollutants are taken up by plants or animals, for example, phosphorus and nitrates are taken up by growing wetland plants.
- The oxygen produced during plant photosynthesis oxidizes some chemicals and takes them out of solutions.
- The abundance of organic debris (small particles) in wetland sediments provides suitable surfaces for the attachment and trapping of some pollutants such as heavy metals.
- Other pollutants become strongly attached to clay particles in the bottom sediment thereby rendering them harmless.

When all these happen to the water passing through wetland the water that obtained as a result is of improved quality.

Exercise 8: Water monitoring

Your teacher will give you water testing instruments. Use them to test water from two different points about 1km from each other along a river; one upstream and the other downstream. Record your observations at the two different points and share your findings with your classmates.

6. Sediment retention

The process by which water quality is cleaned up is important soil particles carried from surrounding catchment area are removed. Particles are trapped by wetland vegetation and settle to the bottom. This filtration, settlement of particle is known as sedimentation process. Constant sedimentation leads to accumulation silt or cumulated soil particles.

Silt deposits result into the creation of fertile arable land. The River Nile in Egypt is a good example of such fertile land.

Silt retention has further benefits down stream. Activities like water storage dams and irrigation schemes are protected from in filling. The reclamation of over 400 hectares of the Rice scheme in Doho on River Manafa in Uganda benefits from such process.

7. Wastewater treatment

Wetland carries water from the catchment area. Such water is affected by the human activities in the catchment area. The water can be polluted by industrial wastes, agro-chemicals and domestic wastes. The water carrying such wastes is referred to as waste-water.

The waste-water treatment in a wetland process is similar to the process by which we get water quality improved.

Such process depends on four wetland features:

- (a) The rate at which wetland plants do remove the nutrients like phosphorus and nitrogen.
- (b) The high rate of settlement of suspended solids and their settlement in wetland bottom as sediments along with any pollutants.
- (c) The oxygen free (anaerobic) conditions in the bottom sediments which allows the conversion of **soluble** forms of heavy metals to **insoluble** form. This together with elimination nitrogen as a gas lost into the atmosphere.
- (d) The availability of protozoa, bacteria and fungi (decomposers) to convert some pollutants to less harmful forms.

Waste-water let into wetland may contain-nutrients, toxic substances and pathogens.

(i) Nutrients

- Nitrogen and phosphorus in water when simplified and are removed from water by plant up take turn out to be nutrients.
- Wetlands function with varying degrees of efficiency as nutrient traps.

(ii) Toxic substances

- Heavy metals, pesticides, herbicides and pharmaceutical wastes are all examples of toxic substances.
- Through complex chemical and biological processes many of these substances can either be changed to a harmless non-poisonous (toxic) or rendered harmless by being buried in the bottom sediments of the wetland.

(iii) Pathogens

- Pathogens are organisms which are harmful and can cause death. They may come from human waste, livestock and wildlife wastes. They get into the wetland system through sewage effluent.
- When water is retained in wetland for a long time, it allows for effective elimination of such organisms. They die-off and sediment.

- Wetlands help us to eliminate waterborne pathogens like cholera, dysentery, typhoid, polio, intestinal worms and diseases.

8. Chemical recycling

Conditions in wetlands do not allow the presence of adequate oxygen in the soils. This is known as **anaerobic** condition. Without oxygen, rotting or decomposition of organic matter does not occur. This leads to accumulation carbon (that is in organic matter). Peat may be formed and due to over weight and compression on these materials, coal may be formed.

This process reduces the speed at which carbon dioxide is released. Too much carbon dioxide in the air causes global warming.

When wetlands are drained, or peat deposits are mined and burnt, carbon is released into the air. This tends to cause global warming.

When wetlands are drained, or peat deposits are mined and burnt, carbon is released into the air. This trend causes global warming.

9. Climate modification

Apart from retaining carbon dioxide and reducing global warming, wetlands also act as local **air conditioners**. When water from wetlands evaporates into the air, temperature is reduced. The water vapour increases humidity, reduced dust and improves the quality of air.

The presence of wetland causes rainfall in the area. The rainfall may be local or from far. Presence of wetlands increases the local water supply.

10. Wildlife habitats and centre for living things

We have already seen that wetlands are homes of many animals and plants. These plants and animals adapt to the conditions of water logged soils and others.

Some animals completely depend on wetlands for food, protection, resting area, reproduction sites, moulting grounds and for hiding away from predators.

Other animals only live in wetland part of their lives, while others only stay in wetland during a particular period.

11. Other benefits of wetlands

Some wetlands are important for communication. Permanent wetlands are useful for transporting people and produce from one place to another.

The rich plant and animals lives in wetlands make them attractive for tourism. Wetlands can also be developed for recreation purposes.

Generally, we can benefit a lot from our wetlands. We get resources from wetlands; we use wetlands in many ways and wet direct and indirect services from wetlands.

We need to care for and protect the wetlands in order to get all these benefits.

Exercise 9

- 1. Visit a nearby wetland and look at plants that grow in it. List the different plant types that grow in it. Why doesn't the water run fast in the wetland?**
- 2. Can you explain how wetlands store water, improve its quality or purity and control flooding?**

2.3 UNIT SUMMARY

We can benefit from wetlands in many different ways, especially when we harvest products which we can either directly use or sell. We also get priceless benefits from wetlands, which are referred to as attributes. Wetlands also stop flooding, store and release water and purify it. All measurable and non-measurable benefits from wetlands can last as long as we take care of them. If we do not do so then, the functions, products and services of wetlands will be badly affected.

In this Unit, we have learnt that;

- Wetlands provide us with a number of products and services
- Wetlands help in water storage that keeps the surrounding soil moist for plant growth even in dry seasons
- Wetlands reduce floods and purify water by filtering out toxins and pathogens thus improving on water quality.

2.4 FURTHER READING

Wetland Inspection Division (WID). 2004. *Wetlands Resource Book*. Ministry of Lands, Water and Environment, Uganda. Kampala: MOWLE Publications.

United Nations Development Programme (UNDP). 2005. *State of World Environment Report*. Nairobi: UNDP Publications.

UNIT 3: PLANTS, ANIMALS AND OTHER LIVING THINGS IN THE WETLANDS

3.0 INTRODUCTION

We have already learnt about what wetlands are, the products that we get from them and what they do in water storage, release and purification. In this unit we are going to learn about living things in the wetlands.

Learning Outcomes

By the end of this Unit, you should be able to:

- List examples of living things in wetlands;
- Explain how living things are adapted to wetland conditions;
- Explain the roles of living things in wetlands;
- Describe how of living things in wetlands are dependent on one another (inter-dependence).

Exercise 1

- Look around the school compound
- List all things you see
- Which of them are living things?
- Which of them are non living things?

Exercise 2

- Look at things in the classroom
- How are they different from those outside the classroom?
- Which of them are living things?
- Give reasons why you think they are living things.

Exercise 3

Study the picture on Unit 1 about a wetland.

- List all the living things you can see
- Which of them are plants?
- Which of them are animals?
- Which of them do you find in a wetland near your village?

Wetlands commonly known as swamps are different in characteristics. They vary depending on the period of flooding, depth of water, height above sea level (altitude) and fertility of the surrounding soil. They however have distinctive plants and animals which are adapted to flooding.

3.1 WETLAND ANIMALS

Picture / illustration

Showing wetland animals like frogs, toads, mudfish, tilapia fish, wading birds like heron bird, fish eagle.

Wetlands provide varied homes (habitats) for a wide range of animals. Wild life species including Sitatunga, water buck hippopotamus and birds are common in swamps and oasis of the Nile basin.

- In most 149 species of Reptiles in Uganda, 103 species are species of snakes and 17 of these species are wetland snakes. Most of these have been carried from Lake Kyoga to the lower swampy areas of Sudan up the wide delta.
- Crocodiles are other wetland reptiles that may live both in fresh water and swampy areas.
- Amphibians are other class of animals that live in wetlands. About 100 species of amphibians are known to occur in Uganda and about 48% of them live in wetlands common examples of these are of order Anura Salientia (frogs and toads) and order candata urodela (Salamanders).
- Birds are also common class of animals that live in wetlands. Over 1000 species of birds are reported to exist in East Africa and over 243 of these a wetland species. They improve on eco-balance in food webs and food chains to make the ecosystem survive.
- First is another group of animals' species that live in wetlands. Mud fish and lung fish are common species of fish that live most of their lives in wetlands.

Picture / photograph

- People/fishermen harvesting mud fish in the swampy Lake Kyoga.
- Or/picture of people selling mud fish pierced on long sticks in a market.
- Mammals are other animal species that live in wetlands. There are about 338 species of mammals in East Africa and 18 of which are documented as wetland mammals. Examples, of these are Pelomysi – issali and pelomy hopkinsi which are common in North Uganda and South Sudan wetlands. The large Hippopotamus prefers living in fresh waters but can live happily in wetlands in the absence of fresh water in its surrounding.
- Lower animals especially micro-organisms are aquatic and the majority of these live in wetlands, except for corals, sea wasps and jellies that are marine in fresh water and seas. Molluscs are also common wetland animals particularly the large water snails and octopus.

3.2 WET LAND PLANTS

Picture / illustration

Showing a swampy area-seem are papyrus plants and other water weeds / mangroves and rainforests and reeds.

Besides the common papyrus reeds, lower plants are common living things that grow in the wetlands. Lower plants are commonly characterized by their lack of vascular tissues which is the transport system for water and nutrients in higher plants. Under these are the bryophytes, lichens and algae as wetland plants. Source of these species can be used as food for both man and animals and some have medicinal value.

The water Hyacinth (*Eichornia crassipes*) is another water weed that survives in fresh water and wetland. This has been firmly established in Lake Victoria, Lake Kyoga in Uganda and all along the river Nile basin. The weed is distributed in two distinct forms: as stationary plants along the shoreline and as mobile mats, but the good news is that the Hippo grass (*Vussia cuspidate*) has generally displaced the weed. Countries that tried to spray the weed like Sudan, had a lot of damage on other plants especially trees.

Preparing inventory of plants and animals of local wetland

Activity

- Visit a nearby wetland
- List all plants and animals you can see
- Write them in your local language
- Compare your answers with those of your friends

Project

- Prepare a small pond at school
- Grow papyrus / or any other wetland plant. 1st term / frogs + fish / tadpoles
- Observe their distinct / roots, leaves and pseudo-stems
- Compare their leaves with those of upland plants
- Make records on their breathing roots i.e. their growth and tropisms.
- Record their way of reproduction in toads and fish comparison with those of upland animals.

Record chart on growth of tadpoles

- From your graph/chart, how long do eggs of a frog take to hatch.
- Observe changes in growth of the tadpoles.

How long do the tadpoles take to:

- (i) Use the gills for breathing
- (ii) Lose their legs
- (iii) Lose their tails
- (iv) Become mature frogs
- (v) Start moving out from water to the land and vice-versa.

What differences do you note on the following	
<ul style="list-style-type: none">▪ Roots▪ Stems▪ Leaves▪ General plant growth	<ul style="list-style-type: none">▪ Eggs for toads / fish with those of upland snakes.▪ Hatching time for the spawn▪ Feeding habits of tadpoles.▪ Breathing habits of tadpoles.

Record your findings and use them to classify wetland plant-according to their structure of roots, stems, and leaves. (Make a chart record for tadpole growth)

Draw a graph like the sketch given above and present your records in a graphic form

3.3 HOW PLANTS AND ANIMALS ADAPT TO WETLAND CONDITIONS?

Plant adaptations

- The wetland plants have reduced roots or even absent if present they are unbranched and do not have root hairs. Papyrus has breathing roots that come out of water to breathe fresh air.
- Their stems are reduced and some of them may be modified into Rhizomes.
- Their leaves are usually thin, narrow with long petiole in some cases the leaves are large and are without wax.
- Mechanical tissues that keep the plants upright and vascular bundles (Phloem and Xylem) are generally lacking.
- The stomata are usually absent on the upper surface of the leaf.

Animal adaptations

- The common wetland animals like frogs and toads have webbed feet that enables them to swim easily in water. The frog breathes through its skin in water and lungs while on land. The young of the amphibian species; the tadpoles breathe through the gills by diffusion.
- Insects like tsetse flies do not lay eggs because they would not hatch. They instead give birth to larvae that hatch to pupa within a short period.
- Fish and many lower animals carry out gaseous exchange by diffusion.
- The presence of water current system especially the flagella beat to create water flow through the sponge of lower animals.
- The tadpoles and fish are adapted to feeding on water weeds and prey in water.
- Presence of fins as modified limbs in fish and tadpoles help them to swim in wetland water.
- Wading birds have long talons and spoon shaped beaks in swimming birds help to live in wetlands.

Activity

- List wetland plants and animals you know.
- Suggest characteristic of each living creature you have listed.
- How is each of them adapted to living in wetlands?
- Compare your answers with the rest of the class.

3.4 LIVING THINGS IN WETLANDS AND THEIR ROLES

- **Nutrient and toxic retention** – wetland vegetation will strip out nutrients from the inflow water. This protects the quality of water down stream. They also have ability to strip toxic silt and sewage from flowing water.
- **Vegetation also acts as sediment traps** – eroded materials from the surrounding catchments by rivers is sedimented out when the flow is slowed down up on reaching the vegetation. This prevents down stream sitting up of dams, farmland and lakes. It creates good usable water to animals.
- **The vegetation** – increases carbon dioxide retention
- **Climate modification** – when wetland plants absorb carbon dioxide from the atmosphere for photosynthesis, its concentration decreases. But plants also lose water into the atmosphere by transpiration, and this causes cooling of the atmosphere, and reduction in temperature.

Wetland plants can lose up to seven times more water than is evaporated from open water. The water that comes out from wetland plants surfaces is not lost because it forms rain which will fall within the area. The evaporation process reduces air temperature and increases humidity. The water vapour in the atmosphere reduces dust and air quality improves. The water that evaporates from wetlands surface and plants increases humidity thus increasing rainfall in an area. Some pollutants are also consumed by plants e.g. phosphorous and nitrates are taken up by growing wetland plants.

- Animals also play a big role as living things in the wetlands.
- They participate in eco-balance. They facilitate energy flow in food chain and food webs.
- The biological functions of micro-organisms as primary, secondary and tertiary consumers are conceived as essential to the continual survival of both themselves and higher forms of living things.
- Fish and most amphibians eat larvae of mosquitoes thus reducing spread of disease parasites to people.
- Large population of decomposers especially bacteria and fungi assist in the conversion of pollutants to less harmful forms.

Exercise 4

- Find out from your teacher why rainfall distribution is more even in wetland areas than in highland areas.
- Write brief notes on the wetland contribution to rain formation in an area.

3.5 RESOURCES FROM WETLANDS

Exercise 5

- Do you know the water plant from which your town or rural area is supplied with water with?
- What is the name of the wetland from which the water is located?
- What is the importance of water as a resource from wetlands?

Exercise 6

- In groups of four, list plants and animal products from wetlands
- List different mineral resources from wetlands.
- Compare your list with that of another group
- Which of the resources are renewable and which are non-renewable?

Wetland plants are directly harvested and provide resources for a number of purposes such as wood fuel timber, bark, building, and medicinal herbs. In most cases a large proportion of these resources are used directly by the harvesters while some enter the market places, where the market price serves as a measure of economic value. Such marketing demonstrates that wetlands are not actually wastelands but wealth lands since they provide financial benefits to local people and communities.

Exercise 7

1. With the help of your teacher or any other older person give local names of the edible wetland plants to complete the following table below.

Plant	Local name	Edible part
Anzima tetrantha.		fruit
Commelina Berghalensis		Leaves / shoot
Ficus natalensis		Fruit
Typha domigensis		Roots
Nymphaea caenilea		Rhizome

2. Find out more edible plant products and their local names.
3. Find out what other countries call them
4. Make a list of wetland plants which are used for craft materials.

Pix / illustration / photo?
 A craft shop / or craft display at school: seen are baskets (variety) mats, pottery.

5. Name the crafts you see in the picture.
6. Give the name of the wetland resource from which the craft is made.

3.6 FUNCTIONS AND SUMMARY OF VALUES OF WETLAND RESOURCES

Wetland resource	Value to human
Source of water	Domestic industrial, live stock consumption,
Bio-diversity, conservation of flora and fauna	Recreation and wildlife, tourism development, habitat for rare species like crested crane and sitatinoga
Habitat for spawning and refuge for young fish	Fish as food
Nutrient retention	Biofilters (Nutrient strippers)
source of raw materials	Handicrafts, e.g. mats from papyrus, Raphica phoenix and calamus.
agricultural buffer zones	Food production for local consumption.

Case of Sudan and Egypt

The Gezira irrigation scheme situated between Blue Nile and White Nile North of Sennar dam and South of Khartoum is a wetland managed by Gezira board – but owned by Sudan Government. The scheme is comprises of three areas, Gezira

Scheme, Managil scheme and Kenana Scheme. Crops like cotton, beans, Sorghum, finger millet and maize are grown. The swampy wetland has been affected by sitting that has encouraged flooding in the area, and pollution from developed industries. However, food resources have been harvested for a long period of time. The crops have played a big role in trapping silt thus controlling floods that used to be a menace in the Upper Egypt eases – Nile valley and delta. This has encouraged the river projects in Egypt.

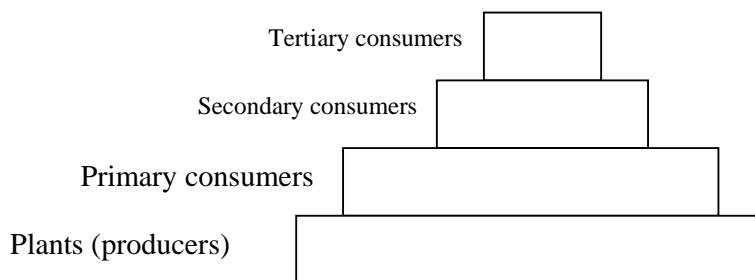
Exercise 8

- Make a survey of wetland in your country and make a list of crops grown in different wetlands.
- Does growing such crops interfere with the water quality and general functions of the wetland? Discuss with your teacher.

Interdependence of living things in wetlands

All energy utilized by living organisms comes from the sun of this only less than 1% is used by plants for photosynthesis. Plants have the wonderful ability to turn sunlight into food. The pigment or colour chlorophyll that makes wetland plants green also captures the sun's energy. The green leaves put together water and a gas called carbon dioxide from air to make glucose a kind of sugar. This is the food that gives plants energy to grow. This energy feeds wetland and other animals like toads and frogs. Living things get energy from plants which are producers to consumers (animals). Consumers can be primary as in herbivores and some omnivores and secondary consumers which are usually carnivores. In this way energy can flow from plants to carnivore's which do not eat grass. This is called **a food chain** and it helps the living things to interdependent on each other so that the ecosystem can survive.

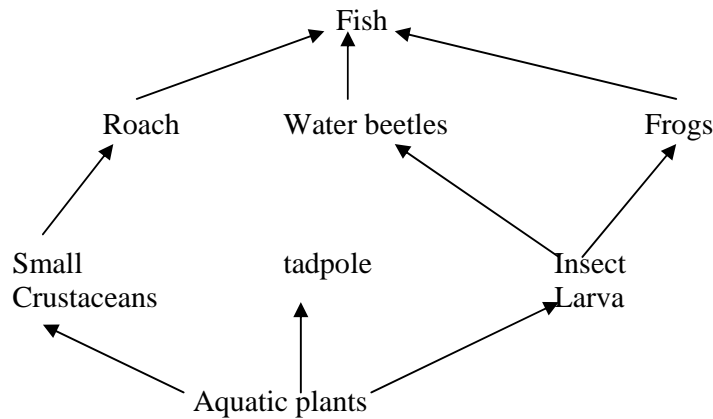
Ecosystem is more or less self sufficient community comprised of population of organisms in equilibrium with each other and with their environment. Energy and matter are exchanged between ecosystems and their surroundings. The activities of the community cause energy to flow through the ecosystem. The energy transferred to the next organism in a food chain keeps on reducing. e.g.



Example of a food chain in a wetland



A food web is a combination of many food chains. An example of a food web in wetland living things is shown below:



Exercise 9

Discuss in your groups, and:

- List ways how plants in the wetlands depend on animals for survival.
- In what ways do plants in the wetlands depend on other plants for growth?
- How do animals in wetlands depend on plants for survival?
- How do animals in wetlands depend on other animals for survival?

Compare your findings with those of other groups. Make one list and put your answers in the nature corner.

Exercise 10

- List different wetlands you know in the Nile basin.
- Your teacher will help you.
- List different plants and animals that live in those wetlands.
- What resources do people get from those wetlands (group them under animal resources, plant resources and other resources).

3.7 UNIT SUMMARY

In this Unit, we have learnt that:

- Biodiversity includes a variety of things in the environmental living.
- It is important to maintain diversity because of the different roles played by different things in wetlands
- Wetland animals and wetland plants are interacting together with the non living part of the wetland to form a “Wetland ecosystem.” They interact through feeding and in many other ways.

3.8 FURTHER READING

Wetland Inspection Division (WID). 2004. *Wetlands Resource Book*. Ministry of Lands, Water and Environment, Uganda. Kampala: MOWLE Publications.

United Nations Development Programme (UNDP). 2005. *State of World Environment Report*. Nairobi: UNDP Publications.

UNIT 4: HUMAN ACTIONS AND NATURAL OCCURRENCES THAT DAMAGE OUR WETLANDS

4.0 INTRODUCTION

We have already learnt about uses, roles and values of wetlands in maintaining water quality. In this unit we are going to discuss human actions and natural occurrences that damage our wetlands.

Learning Outcomes

By the end of this Unit, you should be able to:

- Tell the different ways in which humans abuse wetlands
- Explain the impact of floods on wetlands
- Using examples, explain the effect of natural catastrophes on wetlands
- Acquire skills of wetland restoration after abuse.

4.1 ACTIONS THAT DAMAGE OUR WETLANDS

- **Human actions that destroy wetlands**

Look at the pictures

/picture/. Wetland sea – plants, animals – frogs, toads, crocodile etc.

/picture/. Many houses (flats) – small town built on a wetland – seen as evidence of part of wetland not occupied but definitely damaged (abused).

/picture/. Case of Gezira scheme – cotton, other plants seen with stagnant water – evidence of stoppage of water movement.

/picture/. Heaps of rubbish / polythene papers, with silt seen near river terminals – entrance to a wetland, people grazing cattle on the heaps others fetching water / fishing from the abused land / water hyacinth in papyrus, canoes seen.

/picture/. People harvesting dry vegetation from the wetlands probably for firewood – seen heaps of wood fuel.

/picture/. Brick baking, kilns seen, many other bricks not yet dry partly covered with grass.

Exercise 1

- What human activities do you see on already abused wetland?
- What advice would you give to restore the wetlands?

Wetlands damaged by different human and natural actions

- List wetlands near your home
- What activities do people do in any of the wetlands you have named?

Did your answers include the following:

- Grazing animals
 - Growing crops
 - Throwing rubbish and other wastes
 - Digging for sand
 - Harvesting fish or papyrus or clay or sand
 - Brick making.
-
- **Wetland drainage for agriculture**

Study the picture below and answer the questions that study the picture below and answer the questions that follow.

Illustration /picture / photograph

- Showing of agricultural activities like – cutting down of vegetation, drainage channels expanded and water seen to flow the wrong way.
- Clearly shown are open water channels
- Soil degradation on surrounding areas like upstream as evidence.
- People planting rice / yams.

Exercise 2

1. What activity is shown in the picture?
2. What crop is grown?
3. Which crops do people grow in the wetlands near your home / school?
4. What damages on land can you see in this area?

Examples of wetlands drained for agriculture are spread all along the Nile valley / delta, and all over the Nile basin region. Activities meant to grow crops like cotton, sugar cane, yams, rice, vegetables are widely spread in the region. In Uganda, the Olweny rice scheme in Butaleja district, the Doho Rice Scheme and Tilda Rice Schemes show evidence of wetlands being drained for agricultural activities.

In Sudan, the Gezira irrigation scheme is not an exception to the drainage activities for agriculture. Other countries where large areas of wetlands have been drained for agriculture include; in Egypt and in Kenya.

Picture / illustration / photos

- Showing heads of cattle being grazed in the wetland
- Seen are people cutting pygmies – other harvesting fish in baskets.

Exercise 3

1. What activities do you see in the picture?
2. In what other ways do people in your area wetlands for agriculture?
3. Discuss your answers with those of the classmates.

- **Wetland drainage for industrial development**

A part from wetlands being drained for agriculture, many places around major towns of countries in the Nile basin are drained and in filled for purposes of developing industries.

Exercise/Activity 4

Your teacher of SST or Geography will help you.

- Name the industries near the major towns in your country
- Identify and name wetlands that have been destroyed for industrial development.
- Suggest suitable sites where such industries could have been located.
- How do we ensure that wetlands are not destroyed and yet industrial and other development activities are set up?
- In groups of four, write out ways you think such wetland damage can be controlled.
- Discuss your answers with the teacher.

- **Wetland pollution**

Exercise 5

1. What is pollution? (relate to what you study in science)
2. What is wetland pollution?
3. Discuss your answers with those of your classmates.

(i) **Pollution resulting from dumping**

Many towns in the Nile basin countries have real challenges in managing organic and inorganic wastes-garneted as a result of human economic activities. Such wastes are usually dumped especially in wetlands such as those close to Lake Victoria in East Africa. Other dumping practices are done by Town Council authorities who dump household rubbish food wastes and crop residues in wetlands that would have otherwise been recycled. Such dumping sites are usually polluted.

Look at Picture / photograph

- Photograph of Kitezi dumping ground in Gayaza near Kampala, Uganda.

(ii) Wetland pollution by factory effluents

Wetlands in the Nile basin did generally in many other African countries are heavily affected by factory effluents which are emptied in the streams leading to the wetlands or directly into the wetlands.

Picture / illustration / Photo

- Factory effluents emptying into wetlands seen are large pipes – evident of efficient emptying into wetland.
- Plants seen around the factory have changed colour look weak – (contrast)
- Visible is the colour of water – turned brownish.
- Suggest what a factory owner should have done to prevent the above from happening.

In Kampala City in Uganda, industries such as Mukwano industries, the Breweries at Port Bell and Jinja, Leather tanning industry, foam in mattress at Ntinda and Nakasero soap works all empty their industrial wastes into water bodies which flow into wetlands or bigger water bodies. People also pollute wetlands and water bodies when they wash vehicles in or near the wetlands. Others pour waste or dig up land close to the river / wetland.

Picture / Photograph

- People washing cars near / in wetland – evidence of vegetation in water.
- Rubbish heaps seen near / in the wetland – polythene papers.
- People digging around the wetland – crops seen.

Sometimes silted streams and rivers carry rubbish into the wetland. People throw rubbish in the streams which are taken to

Illustration / Picture

Case of Nakivubo channel – stream leads into the wetland in Luzira. Show water flowing carrying silt, polythene papers, small animals probably goats seen.

How do wastes affect aquatic life in wetlands?

Activity

- In groups of fours, list things or wastes people who live near wetlands throw in streams into the wetlands.
- Explain the meaning of the word silt.
- Mention common things that form silt.
- List ways of removing silt from streams or rivers.

- **Brick making/Clay mining**

We have learnt how wetland gets damaged by agriculture activities and deposition of wastes into the wetlands. Now let us look at other ways how wetland can be damaged by human activities.

Picture/Photograph

- People making bricks – wet / dry bricks seen
- Pools of water, heaps of clay evidence of a wetland shown, kiln seen, baking bricks in process, many still under the sun to dry.

Exercise 6

From the picture above

- What things do you see?
- Do you see holes of water?
- What dangers can result from what you see!
- How can this situation be made better to avoid the dangers?
- Name places near your home/school where this kind of activity is done.
- Suggest ways people can do to harvest clay and carry out brick making without damaging wetlands.
- Discuss with your classmates.

From the picture you could have seen the following:

- Holes full of water
- Clay prepared for brick making
- Bricks ready for baking
- People still working on bricks.

When clay soil has been harvested for brick making, the holes should be re-filled. This is because pools of stagnant water may become place for mosquitoes and a habitat for other disease sectors.

Making bricks from wetlands interrupts with the smooth flow of water and this interferes with the ecosystem of the area.

- **Sand Mining**

Have you ever used or seen people use sand at home, school or community? What is sand commonly used for?

- Where do these people harvest such sand from?

Picture / Photograph

Typical sand mining area – swampy area seen are

- deep pits some full of water
- interrupted water flow
- flooded up streams
- Crater water mass seen.

The sand we use at home (school and community) for building, is got from sand mines most of which are in wetlands. Such wetlands are located at the entrance of streams into bigger water bodies. Desert sand is dusty and not good as building – material.

Mining sand creates holes called crates which hold water and interrupts the otherwise constant flow of water joining the main water body. Sand in wetland helps to filter the water before it jams the main water body.

When sand is removed, the systems of wetland are damaged. All water pollutants are left to join the main water body and become polluted.

Activity

- What are the dangers of having stagnant pools of water in holes?
- Discuss your answers with those of your classmates.

Exercise 7

1. Name the sites of sand mining found in your area.
2. What dangers may such sand mining cause in a community?
3. Write a short story as a message to people who mine sand in the wetlands.

Picture showing

- Bush burning / vegetation burning and over harvesting of wetland vegetation.

People usually harvest wetland plants to make crafts.

Activity

- List some of crafts people make from papyrus
- Name the types of wetland grass vegetation people harvest for thatching hours.
- What do you think is the effect of removing grass vegetation from wetlands?

Discuss your answers with the teacher.

Activity

- Suggest other ways people damage wetlands in your area
- Compare your answers with those of your classmates.

Exercise 8**Read the poem below and answer questions that follow**

I am dead.
I am dead.
Man you have done it.
Done it to me.
Why? What wrong did I do to you?
You have dumped wastes,
Not spared rubbish on to me,
You have learnt vegetation.
My only blanket you have taken away,
I can no longer hold water,
Evaporation! Evaporation!
What a mess you have done to me.
No cover,
I am dead.
Fish has died
Frogs have run away
Toads have done the same,
Where will they go?
Please answer one,
I am deal. I am dead.
Sweet drams of rain formation
I can no longer
Habitat for aquatic life
I can no longer
Now I am no longer
Please help,
Restore me
I am dead
Bye, bye.

1. Who is telling the story?
2. Why is the story teller saying that “I am dead”?
3. Write a short story to explain what has happened to the story teller?

4.3 NATURAL OCCURRENCES THAT DAMAGE WETLANDS

We have learnt about human activities that damage wetlands. There are also natural activities that can damage wetlands.

Picture

Newspaper cut out on impacts e.g. floods, - in Eastern Uganda, - Western Sudan, Not yet – Egypt.

(Cap 1) floods – carrying things – seen is a flooded swampy area. Only tops of papyrus seen. Probably bride seen broken.

(Cap 2) land slides – seen are areas near water marsh / silt falls in the swampy area.

(Cap 3) drought – only dry shrub trees seen in a dry wetland – papyrus for dry soil bare seen is dead fish.

(Cap 4) volcanic eruption – magma settles in the nearby swamp – fish dead – seen.

4.4 SIGNS OF DEGRADED WETLANDS

When wetland is destroyed we say that it has been degraded. There are many human activities and Natural occurrences that cause wetland degradation.

When wetland has been damaged, the ecosystem is badly affected.

The effects of the damage may show in the following ways;

- Flooding upstream and the surrounding areas
- Water purifying capacity is weakened
- Excessive quantities of nitrogen and phosphorus
- Change in the quality of water (also by colour) in the main water body and the areas surrounding the affected wetland.
- Changes in water regime of wetlands like Raised water table.
- Changes in the eco-system mainly as a result of death of the original fauna and flora, or accumulation of heavy chemicals that upset the chemical composition of the nutrients.

Picture

Showing dead fish, toads, frogs by the affected area

- Case of drought (or floods)
- Withering of aquatic vegetation / dead trees.

Exercise 9

- What do you see in the picture
- Suggest the causes of what you can see in the picture.
- What do you think can be done to change this kind of situation?

4.5 MONITORING GENERAL QUALITY OF WETLANDS

We can carefully make regular records of our observations in a particular or a number of wetlands in our area. This is called monitoring. When we have accumulated what is observed as changes and we record possible causes of the changes we refer to this as assessment. We can have activities to do as individuals groups or even as a class or a club.

In order to do this we need to:

- The particular wetland we want to observe
- Specify what we want to observe in the wetland
- Prepare an advance of how to record our observation
- Decide on the period and duration within which to carry out the observation
- Prepare how to share our results with others we have decided to do so.

Activity: Class activity

- Select one wetland near your school or home and carry out a monitoring exercise.
- Make your assessment record and share the information with your classmates.
- What conservation activity can be done to improve the wetland you have monitored?
- What human activities were going on in the surrounding of the wetland
- How did such an activity affect the wetland?

- Teacher will help you to start on environment club in which you are a member.

- Write stories about wetland management and share them within the environment club.
- Display your work in the club's corner.

The club may have a school made wetland. Rear frogs toads and fish in the wetland. Grow water plants / weds in the wetland. List ways of how you would maintain the wetland without degradation.

The school club may formulate a prayer, a poem or a story to promote wetlands in the locality. Read the prayer below:

Wetland prayer

Though shall NOT:

- Drain it
- Reclaim it or fill in
- Build on it
- Demolish anything in it
- Dump harmful wastes / silt in it
- Disturb it in anywhere
- Add any foreign species

Except with permission of National Environment Management Authority (MEMA). AMEN.

4.6 UNIT SUMMARY

Human activities impact on wetlands functions and at many times have resulted into wetland loss. Natural occurrences have also contributed a certain percentage to the loss of wetlands.

When such actions change (convert) wetlands to a non-wetland area, we refer this as wetland loss. Wetland degradation is the weakening of wetland functions as a result of human activities.

Such human activities include;

- Wetland drainage for Agriculture and construction
- Pollution from agricultural activities, domestic and industrial waste.
- Brick making, sand mining and over harvesting of wetland products.
- Burning of wetland vegetation
- Diversion of stream water and rivers

All these activities affect wetland ecosystem, its capacity to function normally and subsequently the water and soil quantities.

4.7 FOLLOW-UP UNIT ACTIVITIES

1. Make a list of names of wetlands in your area.
2. Write down human activities going on in each of them.
3. List all possible natural occurrences that can affect wetlands.
4. List possible dangers each of the activities may have on the wetland.
5. Suggest ways of how to put right these dangers.
6. Compare your work with other members of your class.
7. Display your work in environment club's corner.

4.8 FURTHER READING

Wetland Inspection Division (WID). 2004. *Wetlands Resource Book*. Ministry of Lands, Water and Environment, Uganda. Kampala: MOWLE Publications.

United Nations Development Programme (UNDP). 2005. *State of World Environment Report*. Nairobi: UNDP Publications.

UNIT 5: PROPER CARE AND USE OF WETLANDS

5.0 INTRODUCTION

We now know what wetlands are and their benefits to us. We have also studied the living things in wetlands and the actions which can damage our wetlands.

This unit will help us learn more on:

- What we can do to care for our wetlands
- Why we need to care for wetlands
- How we should care and use our wetlands
- What care we should take of areas surrounding wetlands
- Institutions and organisations in Nile Basin concerned with wetlands.

Learning Outcomes

By the end of this Unit, you should be able to:

- Explain why it is necessary to wisely use and care for our wetlands.
- Describe the role played by various actors in the care of wetlands.
- Name the institutions and organizations that care for the wetlands and ensure their wise use
- What conservation activity can be done to improve the wetland you have monitored?
- What human activities were going on in the surrounding of the wetland
- How did such an activity affect the wetland?

5.1 What we can do to care for our wetlands

- Whatever we do that avoids the actions that damage wetlands will help us to care for them.
- Whatever we do that promotes wise use of wetlands products will help us to care for the wetlands.
- Whatever we do that does not interfere with wetlands roles and functions will help us to care for the wetlands.

The first exercise therefore shall remind us of:

- (a) Wetlands benefits to use and entire environment.
- (b) Actions we do and natural ones that damage our net lands.

Exercise 1

1. Make a list of wetland resources you get from your local wetlands.
2. Write do any ten wetlands services given to us and our environment.
3. Which action done by people can damage wetlands?
4. What natural actions can interfere with natural services we get from wetlands?
5. Do you know of the actions we can do to core for our wetlands?

The following table shows actions that affect the wetlands and what can be done to care for them

No.	Actions affecting wetlands	Examples of affected wetland	Correcting action
1	Drainage		Wetland can be left to regenerate and refill the channels with soil.
2	Encroachment		<ul style="list-style-type: none"> - Control hunting or stop settlement or other human activities. Allow for regeneration. - Follow laws and policies on wetland use.
3	Over-harvesting		- Selective harvesting. Harvest only mature products.
4	Burning		Avoid this completely.
5	Brick making		<ul style="list-style-type: none"> - Re-fill holes from which clay has been got. - Avoid excessive use.
6	Sand and other mineral mining		<ul style="list-style-type: none"> - Use correct methods - Avoid excessive mining
7	Pollution		<ul style="list-style-type: none"> - Treat whatever is drained into wetland. - Avoid or remove pollutants from wetlands.
8	Siltation		- Avoid actions which encourage soil erosion in catchment.

All human actions that affect wetlands should be avoided. This is because correcting action may never help the wetland to fully recover its natural functions and status.

5.2 WHY WE NEED TO CARE FOR OUR WETLANDS

The following table shows wetlands services and our actions that can promote wetlands to provide these services. Make suggestions of actions which promote these services.

	Wetland services	Actions which promote the services	Case studies
1	Water control – flood reduction and constant water supply.		
2	Drought limitation		
3	Ground water recharge and discharge		
4	Water quality		

5	Sediment retention		
6	Waste water treatment		
7	Chemical recycling		
8	Climate modification		
9	Wildlife habitat centre		
10	Transport and communication		
11	Recreation and eco-tourism		
12	Cultural values and attachments		

We care for wetlands so that we continue to get its services. Wetlands are sources of resources like water, timber, reeds, fish and animals whose meat we eat. If do not care for wetlands we shall not be able to get such resources.

Exercise 2

1. Organize a debate on the topic: “Wetlands are more important than farmlands”
2. Write down the points brought on: (a) Wetlands (b) Farmland
3. Use the points brought for wetland to write an article in your schools newsletters.
4. Use the points from the debate to talk to community on the important of wetlands.
5. How should we take care and yet use our wetlands?

5.3 HOW WE SHOULD TAKE CARE AND YET USE OUR WETLANDS

Wetlands are very important to us and we should continue to use them. But we need to take proper care of them so that we and the people in future can continue to benefit from them. There are many ways in which we can take care of our wetlands.

- The first thing that we need for us to do this well is to gather as much information as possible regarding the characteristics of the wetland. Such information may include its size, what it contains, what role it plays, who benefits from it and whether or not it is seasonal. This can be done from time to time and it is known as *monitoring*.
- We should also avoid *draining* the wetland too much when we are growing crops or trees on our wetlands as this will affect the amount, purity and flow of water to and fro the wetland. You will recall that earlier, we noted that wetlands play an important role in controlling the release and uptake of water.
- We should also avoid dumping or throwing rubbish and other harmful things such as used oil from garages, plastic containers and other products

into wetlands as these will prevent the wetlands from performing their role and providing us with the products or services that we need.

- We should also avoid infilling the wetland with soil in order to build factories or houses on wetlands.
- We should avoid over harvesting of wetland products such as papyrus reeds, grass or building poles as this does not allow them to recover quickly enough in order to continue providing these materials. In addition, we should not encourage over mining of sand or stones and minerals from wetlands.
- We can also report activities which harm our wetlands to the people concerned so that the laws which have been put in place to ensure their proper care and wise use can be put into action.
- As students we can also go to the communities and educate them about the importance of wetlands, and what they can do to take proper care while using the wetlands. We must remember that proper care of wetlands that are shared by the different administrative units or countries (Trans-boundary wetlands) is difficult because the people from either side of the wetland must agree to share information as well as to find ways of solving the problems being faced by people

Exercise 3

1. Organize yourselves into groups and carry out a study of the wetland you're your school. You should note its location, size, human activities in the surrounding areas, the flow of water, its colour and the amount upstream and downstream. You can also note the creatures that are found in the wetland plus many other interesting things that your teacher will ask you to do. Collect your information and then write a report with the help of your teacher.
2. With the help of your teacher, organize a visit to a community that is neighbours a wetland in order to make them aware of proper care and wise use of the wetland.
3. Look at the poster below. What messages does it give to the reader? How can we prepare and use such a poster to provide communities with the message of proper care and wise use of our wetlands?

A poster on wise use and proper care of our wetlands

The following is an example of a study carried out by primary school children in a school in Uganda. Read their report and together with your teacher, organize a similar study in neighbouring wetland.

Nile Watch

A CASE STUDY OF NILE RIVER NILE BANK: STATUS OF THE ENVIRONMENT AT KITAMBUZA VILLAGE KANGULUMIRA – KAYUNGA DISTRICT



The study report was compiled by the three colour groups participated

YELLOW	BLUE	GREEN
Kitenda Ronald P.6	Nafuna Lydia P.6	Mukiwondo Andrew P.6
Namatiti Nicholas P.5	Nansamba Mariam P.6	Kalusi Kuzairu P.6
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**KIGAYAZA C/U PRIMARY SCHOOL
KAYUNGA DISTRICT
SEPTEMBER 2004**

Kangulumira Coordinating Centre

Shimoni Core Primary Teachers College

Introduction

The River Nile flows through from south to north from Lake Victoria. The river Nile was called Kiira before the Europeans named it river Nile. The reason why it was called Kiira was that it used to produce a boiling sound (okutokota in Luganda). The people who live near the village and around the Nile are mainly peasants and fishermen. They grow crops like pineapples, maize, cabbage, tomatoes, potatoes, matooke, oranges, pawpaws, jackfruits as part of fruits. They also grow coffee as a cash crop. These people comprise the following ethnic groups, Bagishu, Basoga, Baganda, Japadhola, Bagwere, Iteso and few Sudanese.

LOCATION OF KITAMBUZA VILLAGE

Kitambuza village is found along the river Nile in the east of Kangulumira sub-county, Kayunga district. It is 1½km away from the school. It marks the boundary between Kangulumira and Kamuli district.

sketch map showing kitambuza village along the banks of the river Nile TO BE DRAWN

Purpose

The purpose of the study was to record information regarding the status of the riverbank, effect of human activities on it and to develop strategies to save it.

Objectives

- To sensitize the community about the benefits of the river bank.
- To collect information on the river bank.
- To promote sustainable use of the river and its banks.

Scope:

The study will be carried out on the river bank between Namiyagi and Kabelenge landing sites. The target will be people living along the river banks and people carrying out different activities on the river.

Significance:

It is hoped that the findings of the study will be useful to the following:

- Environmental activities
- Local ecosystem committee

- Local leaders, whose role it is to advise the community
- Researchers who will use the information for the good of the people

Methods of the study

Observation

Questionnaire

Interviewing members of the community

Drawing sketches and photography

Demonstration

FINDINGS

INFORMATION FOUND IN THE NILE

*The Nile has rocks called cataracts that

make water to fall in a high

- Speed producing a threatening sound.
- The Nile water sometimes reduces during dry seasons.
- The vegetation is green although it was affected by the charcoal burners.
- The Nile water is light greenish in colour and soft water.
- The Nile is used by people for performing traditional rituals.
- The Nile sometimes becomes dangerous and makes a bubbling sound incase it has not received any sacrifice thus kills any person coming close it.
- The Nile River is used by fishermen for fishing and ferrying people to Busoga using canoes.
- Sand is excavated and sold to Jinja, Buwenge and the nearby Kayunga and Busoga areas.
- The fish caught in the Nile is sold to people and markets when still fresh and for home consumption.
- The Nile water is used for domestic use and for irrigation during dry seasons. The water is carried using jerricans and watering cans for near areas and bicycles with Lorries for further areas.
- The houses around the Nile are scattered structures which are semi-permanent and unplanned for.
- The homesteads do not have latrines for urination and disposing their waste products.
- Some of the animals kept and make use of the Nile valley are cows, bulls, goats, sheep called as livestock.

FISHING

Types of fish caught in the Nile

Type of fish		Most common	Reason	Status	Method	Method of Preservation
Tilapia		Tilapia	Rate of	Threatened	Hooks,nets	Smoking

			reproduction is high			
Nile Perch		Moderately	Reproduction rate is slow	Threatened	Hooks, nets	Smoking
Mud fish		Moderately	Reproduction rate is slow	Threatened	Hooks, baskets	Smoking
Snout fish		Moderately	Lives in rocks	Threatened	Hooks, baskets	Smoking
Yellow fish		Moderately	Inadequate planktons	Threatened	Hooks, baskets	Smoking
Lung fish		Scarcely	Live in dark places/papyrus	Threatened	Hooks	Smoking

CHALLENGES

Problems facing fishermen

Solution to the above problem

Lack of enough fishing methods Lack of fishing methods can be solves by educating fishermen on various methods of fishing

Poor transport means

Proper boats should be supplied to fishermen

The size of nets catches evensnakes in water and young fish they are of 3.5 - 2.5 inches

Problem of snakes catching can be solved by use of large sized nets

Deforestation and agriculture is close to water as a result no harbour areas for fish
Provision of strong lined nets

The use of small canoes and baskets which cause accidents during windy seasons

Peasants and the community should be advised to leave some metres away from the source and avoid deforestation

The presence of water weeds e.g. water hyacinth kills fish and block the water

Death rate of fishermen can be solved by use of boats for fishing and ferries for transport

Problem of water weeds can be solved by collecting them and burning them on land or used as fertilizers

Practices of fishermen and the community around the Nile

- The area lacks latrines; thus people dispose the waste products in water
- The people bathe and swim in water of the Nile
- The people wash clothes in the Nile water
- The people are disciplined but a few steal clothes, hooks, baskets, fish, nets of other people

- No respect for one another's property
- Some people push others in water so that they can drown
- People like making sacrifices and cleansing in the Nile water, that this is done by the local doctors
- People like dumping broken bottles and garbage in water

Types of Animals found in the Nile

Animals	Local Name	Status	Home
Frogs & Toads		plenty	Land and water
Lizards		Threatened	Land
Snakes		scarce	Land and water
Crocodile		scarce	Water
Monitor Lizard		scarce	Land

Insect	Local Name	Status
Geese		Threatened plenty
Egrets		Threatened scarce
Mosquitoes		Plenty
Tsetse flies		Plenty
Caterpillars		Threatened plenty
Grasshoppers		Plenty

Other human activities done in the River Nile

- Swimming and rafting by Europeans and Africans
- Grazing of domestic animals
- Sand collection
- Fishing
- Touring
- Transportation of people
- Herbs collection
- Rocks collection
- Lumbering

Problems facing people living around the Nile shores and their solutions

Problem	Solution
Plenty of mosquitoes which spread malaria	Problem of mosquitoes can be solved by use of mosquito nets, mosquito coils and spreading with doom chemical
Plenty of tsetse flies which spread sleeping sickness and nagana to animals	Problem of tsetse flies can be solved by spraying with chemicals and use of tsetse fly traps
Poor sanitation and settlement permanent houses	Construction of proper latrines and

Shortage of clean water
dig bore holes

People should be advised to contribute and

Too much cold conditions during night and wet seasons

People should buy blankets
and construct permanent houses

River bank soil erosion and land

Practice proper methods of farming and
afforestation

General Solutions and suggestions against Nile conservation

- The people should be totally educated and sensitized about the importance of the river Nile as a wetland
- The community leaders should be involved in the policy making about the conservation of the Nile
- The community should be educated to get alternate jobs to earn a living other than the Nile
- The government should put a clear demarcation of the Nile and set up proper laws governing the utilization of the Nile

Benefits

The community around the Nile valley benefit directly from the Nile and the table below shows some of the plants and water-weeds plus their uses and danger to both the aquatic life and the people.

English Name and Uses

Water hyacinth

- Food for animals
- Fertiliser in garden - Kills fish
- Covers water
causing a swamp

Spirogyra

- For study purposes
- Food for fish - Makes transport difficult
- Sticks on peoples throats when
drinking water

Water reeds

- For fencing
- For making trumpets for building
- Habitat for dangerous animals, like snakes

Papyrus

- For making mats
- For making doors

- For building
- For making ceiling boards
- For making mariachi sofa (chairs) - Habitat for dangerous animals like snakes, monkeys, crocodiles

Black jack

- For curing wounds,
- act as tea leaves

Water cabbage

- For cooling water
- Food for fish
- For treatment of ulcers

Lantana camara

- Local toothbrush
- Making granaries

Important points to note about the Nile watch

- Cattle keeping practice promotes soil erosion leading to sedimentation of the river
- Swimming in the Nile causes death as the water is speedy and full of cataracts
- Destruction of the Nile as a wetland affects the environment and the aquatic life
- The communities use the Nile for domestic use traditional ceremonial sacrifices
- Nile water is contaminated with cowdung and cattle urine as well as the community yet some people use the same water for drinking and cooking
- Agricultural practices involving pesticides, insecticides kills aquatic life when it rains and increases the growth of water weeds like the hyacinth and water cabbage
- The Nile provides sand and stones for construction
- The Nile provides water for irrigation

Further Investigation

There is need for studying:

- How a community should control soil erosion around the river banks
- How the community members should be advised
- Conservation of flora and fauna
- Water behaviour during and heavy rainfall seasons
- Conservation of the Nile
- Deforestation reasons and Nile rocks
- Better life around the Nile

Follow up

Present our report to our LCV Chairman, Kayunga district M.P's and many other people. Fellow Ugandans the Environmental Management Education Club of Kigayaza Primary School appeals to everybody to guard and respect the wetlands for now and future survival.

5.4 CATCHMENTS OR AREAS SURROUNDING WETLANDS

Often our wetlands are affected by human actions away from the wetlands themselves. This is known as **off-site impacts**.

Off-site impacts

What entering a wetland comes from the surrounding area or **catchment**. Some water enters the wetland directly from rainfall over the wetland. Other wetlands receive water from rainfall that may have fallen distance away. Such water may be brought in through larger water bodies such as rivers, and lakes.

The quality of water in a wetland and the nature of the wetlands are influenced by the activities surrounding the catchment. These influences are experienced even when the activities occur at a great distance from the wetland itself.

These influences affect the quality, quantity and timing of the water received into the wetland. In turn this affects the functioning and benefits of the wetland.

Exercise 4

1. State five activities done in your community that can affect the water received into a wet land.
2. Write in few sentences how the activity can affect the wetland.
3. Visit a community living within a catchment for nearby wetland.
 - (a) Make a list of community activities
 - (b) Indicate which activities directly affect the wetland.
 - (c) Design message you can communicate to your community to address your findings.

Did your findings include examples such as:

- Sewage disposal from urban centres.
- Agricultural effluent run off from livestock rearing, abattoirs, coffee or sugar factories, and agro-chemicals from spray.
- Oils from nearby garages.
- Car and truck washing near the wetland.
- Mining and brick making activities.
- Soil erosion caused by activities like road construction, overgrazing deforestation.

All these above activities affect the **quality** of run off into wetlands.

Other activities affect the flow of water and water system. The water system of an area is known as **hydrology**. Activities which affect water system (hydrology) influence the quantity and timing of water flows into the wetlands.

Examples of these activities include;

- Building of claim and re-directing (diversion) of water. This is usually done when water is needed for
 - Irrigation
 - Industrial use
 - Generation of hydro power

These activities cause considerable reduction in water quantity through evaporation.

- Planting **Eucalyptus** and other trees which are high water demanding
- Deforestation affects the flow of water into the wetland. It increases the volume available at an increased speed. Water delivery is very fast but short lived.

Animals grazing on the vegetation of wetland margins may destroy the environment surround wetlands. This in turn affects the wetland. Grazing in wetlands and at its margins need to be done carefully. We should avoid overgrazing and actions which can destroy wetlands.

5.4 INSTITUTIONS AND ORGANIZATIONS CONCERNED WITH WETLAND CARE

Throughout the Nile Basin region, there are a number of institutions and organizations concerned with making sure that there is proper care and wise use of wetlands. Such organizations include:

- Ministries in charge of land, water and environment generally
- Organizations such as the National Environment Management Authorities such as NEMA in Uganda and Kenya
- Wetlands organizations
- Non Governmental Organizations (NGOs)
- Local administrative authorities in the different countries
- The Nile Basin Initiative (NBI)

Exercise 5

1. Name the organizations and institutions that are overseeing the proper care and wise use of wetlands in your locality and country
2. Explain how they oversee the proper care and wise use of wetlands
3. What problems do they face when trying to carry out proper care of wetlands
4. What things can you as a school do to help them do their work

Your teacher should be able to guide you in making a list of these organizations and institutions, and may even be able to invite people from these organizations or institutions to come and talk to you about their work.

5.5 UNIT SUMMARY

To end our Unit, we need to state what we have dealt with. We have been able to name/explain

- What we can do to care for our wetlands
- Why we need to care for wetlands
- How we should care and use our wetlands
- What care we should take of areas surrounding wetlands
- Institutions and organisations in Nile Basin concerned with wetlands
- Carry out different activities that will ensure proper care and wise use of our wetlands.

5.5 FURTHER READING

Wetland Inspection Division (WID). 2004. *Wetlands Resource Book*. Ministry of Lands, Water and Environment, Uganda. Kampala: MOWLE Publications.

United Nations Development Programme (UNDP). 2005. *State of World Environment Report*. Nairobi: UNDP Publications.

GLOSSARY OF COMMON TERMS

Wetland encroachment

The act or process of changing a wetland to some other use that may destroy its proper functioning, especially with out permission from the environment or wetland officer in a given area. E.g. building a house/industry or gardening.

Wetland Abuse

Any action that leads to loss destruction or degradation of a wetland.

Wetland degradation

A process by which the important uses, services, products or functions of a wetland are reduced or completely destroyed.

Biodiversity

The variety of living organisms (plants and animals) in a given ecosystem or habitat e.g. wetlands.

Ecosystem

A community of living organisms interacting with one another and with their environment.

Habitat

The specific area or environment in which a particular type of plant or animal lives.

An

Organism's habitat must provide all the basic requirements for survival.

Dissolved oxygen

Oxygen that is dissolved in water.

Effluent

The outflow of water, with or without pollutants, usually from a pipe.

Sewage

Wastewater containing liquid or solid wastes from a community, home an industry or an institution like a school.

Water surface runoff

The part of rain water that moves over the earth's surface (land surface) and normally washes away materials or substances into streams, wetlands or other receiving water bodies.

Greenhouse effect

The increase in the earth's temperatures that results from the presence of carbon dioxide and other gases that trap heat in the atmosphere.

Heavy Metals

A group of elements that is present in the environment from natural sources and human activities (e.g. mining) and can produce harmful effects to a variety of living organisms including man. This group includes mercury, copper, cadmium, zinc, and arsenic.

Pathogen

Any organism, but particularly bacteria and viruses, that causes disease. Many pathogens are found in contaminated water causing diseases such as cholera, Diarrhoea, Typhoid e.t.c.

Suspended Solids

Solid particles of different substances that are suspended in and carried by the water. They include; sand, mud, clay particles, human and animal wastes e.t.c.

Wastewater

Water that is contaminated (or polluted) as a result of human activities (e.g. during washing) and is not used for any other purpose, but discharged (or poured away) as a waste.

Toxic

Poisonous, or otherwise directly harmful to life. (E.g. sewage, heavy metals, e.t.c)

Ground water

Water beneath the earth's surface, often between the soil air spaces and rocks. This water supplies wells and springs from which millions of people depend especially in rural areas.

Water table

The level beneath the earth's surface below which the soil or rock spaces are permanently filled with underground water. When you dig a hole below the water table, water normally comes out and slowly collects in the hole. A good example of underground water is the borehole water. The water table in wetlands is almost at the land surface and changes with the dry and rainy seasons.

Water cycle (Hydrological cycle)

The cycle of processes or stages through by which water moves from the atmosphere to the earth and returns to back to the atmosphere. These processes or stages include; evaporation, and transpiration, condensation, Precipitation, surface runoff, e.t.c

Precipitation

This occurs in form of rain, snow, or hails, all of which are formed by condensation of moisture in the atmosphere and fall to the ground/earth's surface.

Water pollution

Addition of excess harmful substances (e.g. sewage, fertilizers, chemicals from industries e.t.c.) to water that changes its general quality or normal characteristics. This destroys the intended uses of water; for example, drinking, cooking swimming, the consumption of fish, and the health of water/aquatic organisms.

Waterborne diseases

Diseases caused by harmful [microorganisms](#) which are directly transmitted when contaminated [drinking water](#) is consumed. Contaminated drinking water, used in the preparation of food, can be the source of [foodborne diseases](#) through consumption of the same microorganisms. A waterborne disease can be caused by [protozoa](#), [viruses](#),

[bacteria](#), and [intestinal parasites](#). (Examples of waterborne diseases include; Diarrhoea, Dysentery, Cholera, Trachoma, Typhoid e.t.c)