UNIT 4: ASESSMENT AND MONITORING OF WETLAND STATUS

INTRODUCTION:

It is now widely accepted that wetland ecosystems are under threat worldwide. Many communities are now trying to establish wetland rehabilitation programs, but the situation is made worse by a lack of objective information on wetland conditions or their importance.

In the previous units, we have looked at the importance of our wetlands and hence a need for their wise use and protection. One of the key aspects of conservation or wise use is keeping a close watch on them and taking note of the human activities and other conservation concerns. This is what we mean by assessment and monitoring. In this Unit therefore, we shall review the activities that **degrade** or destroy the quality of our wetlands, impacts and indicators of degradation, water assessment criteria or parameters and techniques. A set of activities have been suggested for you to try out in each sub-section. The specific learning out comes will be:

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

- **Identify degraded wetlands and give their symptoms**
- **Discuss the impacts of wetland degradation on the ecology, hydrology and socio-economic aspects of life of the people living in adjacent areas**
- **Give indicators that can be used to assess and monitor wetland condition or status**
- **Explain how wetlands can be assessed and monitored using various techniques**
- **Design ways of solving the problem of wetland degradation in the locality**

What then is meant by wetland assessment and monitoring?

- In assessment, we make a survey of the wetland status in terms of biodiversity and general functions, services and uses. Any impacts on these aspects are also recorded and evaluated for monitoring purposes.
- Wetland monitoring is the process of maintaining regular checks to assess the status and make a report on them.

During assessment and monitoring the focus, is on finding out if our wetlands can perform vital roles (functions), services and produce goods of local, regional, national or international importance. This prevents wetland abuse and degradation especially through human activities. You must remember that wetlands are very fragile ecosystems which mean that they are easily affected by our activities.

ACTIVITIES THAT DEGRADE WETLANDS

The following are some of the major activities that degrade or negatively affect the quality of our wetlands:

- Drainage: This is an activity that denies water access for or residence in a wetland. Water drainage can be in form of
    - Diversion of water to prevent it from entering the wetland
    - Water removal by digging drainage channels
    - Excess removal of water for industrial, agricultural or other use.
    - Damming of upstream water sources
    - In filling with municipal industrial solid waste in a landfill situation or with earth, murram or rocks in a land-making process.
    - Planting trees or other plants with high water demand with the aim of lowering the water table e.g. Eucalyptus and sugarcane.

Figure 1: Picture of the drainage channels in a wetland used for cultivation

ACTIVITY

- In groups of 5-6, discuss the likely impacts of drainage of wetlands to communities living in adjacent areas. Write them down

- Draw a programme detailing how you would sensitize the communities about the dangers of excessive drainage of wetlands. Your programme should include practical solutions or alternatives for the people.

- Encroachment: This means taking part of the wetland and utilizing it for a specific purpose. This changes the natural state and the functions of the wetland. Encroachment may be in form of activities such as large scale agriculture, live stock grazing and watering, fishing (including aquaculture), in-filling for industrial and residential developments, mining for minerals and materials e.g. sand and clay, and road and railway construction.

- Over exploitation of resources (over-harvesting):

  This involves large scale harvesting of wetland products which is not sustainable i.e. an act which comprises the wise-use concept for now and future generations e.g. over harvesting papyrus and rattans for crafts, etc.

- Some activities are off-site / away from the wetland but within the surrounding (catchment). The impacts of these activities affect the quality, quantity and timing of water entering the wetland.
- Some activities that pollute water lead to the decline of quality e.g. sewage discharge, effluents from septic tanks of oil, etc.
- Land use activities also affect the quantity of water flowing into the wetland.

IMPACTS AND INDICATORS OF WETLANDS DEGRADATION

Despite the usefulness of wetlands, pressure has been exerted on them in both rural and urban areas. Many wetlands have been converted to land for industrial or agricultural use, residential areas, waste disposal points etc.

The main impacts and indicators of wetlands degradation include;

- Increased flooding
- Outbreak of water borne diseases e.g. cholera
- Pollution of surface and under ground water
- Loss of biodiversity (especially plants and animal resources due to over harvesting).
- Hydrological effects such as increased water flow due to drainage channels, decreased water retention time, water quality deterioration, etc.

Activity 2: Rapid assessment of land use activities

Visit a nearby wetland and use the sheet below to make a rapid land use assessment.

Land use	Potential effects on wetland	Estimated % of wetland catchment/watershed
Industrial/Commercial/Residential Development		
Agricultural cropland		
Agricultural grazing		
Grassed recreation arrears/parks		
Highway or roads		
Others (specify)		

WETLANDS ASSESSMENT CRITERIA AND TECHNIQUES

For proper wetland management, we have to know where they are, what is in them, how they are being used and the actual and possible changes that might take place because of the changes in the surrounding area. This is what we refer to as their hydrological, ecological and socio-economic environment. We also need to know where, how and at what rate the wetland characteristics (status) are changing. This helps us to know the management interventions/options required and how effective they should be. We need to

make estimates about resources (especially finances and human resource) required to properly manage and monitor important wetlands at the local, national and regional level

There are four levels of wetland assessment, and these include;

- The overall assessment of the wetland value and what they contain (stock)
- The detailed assessment of wetland functions and use
- The permanent monitoring of changes in wetland ecology and other characteristics (status)
- Assessment of a cross-section of wetlands that have a common service, function or use of interest.

Approaches used in wetland assessment include;

- Wetland mapping based on satellite imagery. This activity is carried out by GIS experts. It is highly technical and requires specialized people with the ability to interpret satellite images according to colours to produce land use/land cover maps. This approach cannot however give some essential information such as wetland type, ecological features, present land use, threats, values and functions of the wetland.
- Local wetland descriptions based on physical observation of the wetlands in a given administrative area such as a division, district, province or region. In this approach Wetlands officers make physical observations in the field. Sections of a wetland are observed and general characteristics including vegetation, soils, land use, other human activities and water quality are recorded using a wetland characteristics observation sheet. This information is essential for monitoring interventions and cannot be generated by the satellite imagery approach.
- Wetlands inventory report based on analysis of the wetland descriptions showing the sate of wetlands in a given area. Each wetland is given a unique code, indicating its relative position in the drainage basin and to other wetlands. This inventory data base can easily be updated with additional data, maps, changes in wetland characteristics, human activities/land use, etc

WATER QUALITY ASSESSMENT IN WETLANDS

Wetlands are essential systems that effectively purify water to the purest natural state possible. This is why assessment of water quality is one of the most important things to consider while monitoring wetlands.

The quality of water entirely depends on the intended use such as drinking, cooking, washing, laboratory work etc. Different uses demand a certain level of quality levels beyond or below which the water is regarded pure or impure. Take an example of distilled water required for laboratory experiments. This water is normally de-ionized i.e. ions such as Mg^{2+}, Ca^{2+}, Na^{+} and Cl^{-} are removed. Since these ions are important nutrients for bone and teeth development, distilled water is therefore not good for drinking. Some of the ions we need in our drinking water interfere with laboratory chemical experimental results; this means that water for laboratory use is simply ***not good*** for human consumption!

WATER QUALITY PARAMETERS

The quality of water for any intended use is determined by both physical and chemical parameters (characteristics). The physical parameters that determine water quality include colour, temperature, smell and turbidity (determined by the number of suspended particles) or TSS (total suspended solids).

Some of the essential chemical parameters include; the pH, conductivity, alkalinity, dissolved oxygen (DO) and percentage oxygen saturation, Biological oxygen demand (BOD),Chemical oxygen demand (COD), Total nitrogen including; Nitrates, Nitrites ,and Ammonium ions, Total phosphorus and Total hardness etc. Selected commonly used water quality parameters in wetlands assessment and monitoring are discussed below:

Temperature

Temperature of water is a very important factor for aquatic life. It controls the rate of metabolic and reproductive activities, and determines which organisms or particular

species can survive in a given part of an aquatic system like a wetland. Temperature also affects the concentration of dissolved oxygen and can influence the activity of bacteria and toxic chemicals in water. Temperature is measured using a thermometer, and is recorded in either degrees Celsius (^{o} C) or degrees Fahrenheit (^{o} F).

PH

PH represents the effective concentration (activity) of hydrogen ions (H^{+}) in water. The pH of water can be measured with a pH meter, which is an electronic device with a probe which is dipped into water. pH can also be measured with pH paper or by adding a reagent (universal indicator solution) to the water sample and recording the change in colour. Sometimes gases such as CO_2, SO_2, H_2S get into the water forming acids.

Carbon dioxide (CO_2) enters a water body from a variety of sources, including the atmosphere, runoff from land, release from bacteria in the water, and respiration by aquatic organisms. This dissolved CO_2 forms a weak acid. Natural, unpolluted rainwater can be as acidic as pH 5.6, because it absorbs CO_2 as it falls through the air. Because plants take in CO_2 during the day and release it during the night, pH levels in water can change from daytime to night. For an example of how pH typically varies over a daily cycle.

Other factors that affect pH of water in a wetland include; *geology* and s*oils* of the watershed, increasing alkalinity of the water which raises the pH, drainage water from forests and marshes is often slightly acidic, due to the presence of organic acids produced by decaying vegetation, gaseous pollutants (e.g. nitrogen oxides (NO_2, NO_3) and sulfur dioxide (SO_2)) which can react in the atmosphere to form nitric acid (HNO_3) and sulfuric acid (H_2SO_4). These acids can affect the pH of streams and wetlands by combining with moisture in the air and falling to the wetland ecosystem as acid rain.

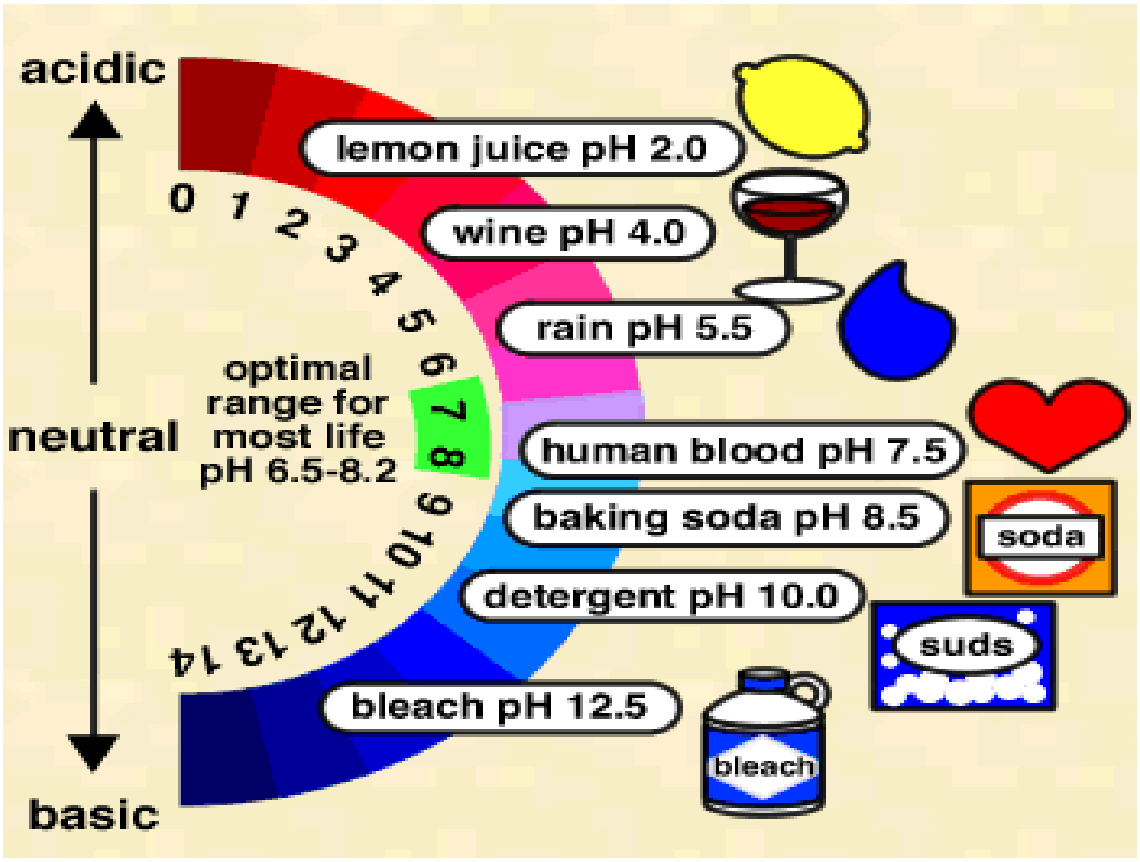


Figure 2: An illustration of the Ph ranges of some common substances

Dissolved Oxygen (DO)

Dissolved Oxygen (DO) is found in microscopic bubbles of oxygen that are mixed in the water and occur between water molecules. DO is a very important indicator of a water body's ability to support aquatic life. Oxygen enters the water by absorption directly from the atmosphere or through the photosynthetic processes of aquatic plants and algae. Oxygen is removed from the water by respiration and decomposition of organic matter.

Dissolved Oxygen can be measured with an electrode and meter or with field test kits. The amount of oxygen dissolved in water is expressed as a concentration, in milligrams per liter (mg/l) of water. Dissolved oxygen levels are also often reported in percent saturation. Temperature affects DO concentrations, and therefore "saturation level" is the

maximum concentration of dissolved oxygen that would be present in water at a specific temperature, in the absence of other factors.

Some factors that affect DO include;

- ***Velocity and volume of water:*** In fast-moving streams, rushing water is aerated by bubbles as it churns over rocks and falls down hundreds of tiny waterfalls.
- ***Climate/Season:*** During dry seasons, water levels decrease and the flow rate of a river/steam slows down. As the water moves slower, it mixes less with the air, and the DO concentration decreases. During rainy seasons, oxygen concentrations tend to be higher because the rain interacts with oxygen in the air as it falls.
- ***The type and number of organisms in the water*** body: During photosynthesis, plants release oxygen into the water. During respiration, plants remove oxygen from the water. Bacteria and fungi use oxygen as they decompose dead organic matter in the stream.
- ***Dissolved* or *suspended solids:*** Oxygen is more easily dissolved into water with low levels of dissolved or suspended solids
- ***Amount of nutrients in the water:*** Nutrients are food for algae, and water with high amounts of nutrients can produce algae in large quantities. When these algae die, bacteria decompose them, and use up oxygen, this process is called **eutrophication**),
- ***Organic Wastes:*** Organic waste is decomposed by bacteria; these bacteria remove dissolved oxygen from the water when they breathe

Alkalinity

Alkalinity is a measure of the buffering capacity of water, or the capacity of bases to neutralize acids. Measuring alkalinity is important in determining a wetland's/stream's ability to neutralize acidic pollution from rainfall or wastewater. Alkalinity does not refer to pH, but instead refers to the ability of water to resist change in pH. Buffering materials such as bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) ions help neutralize acids as they are added to the water.

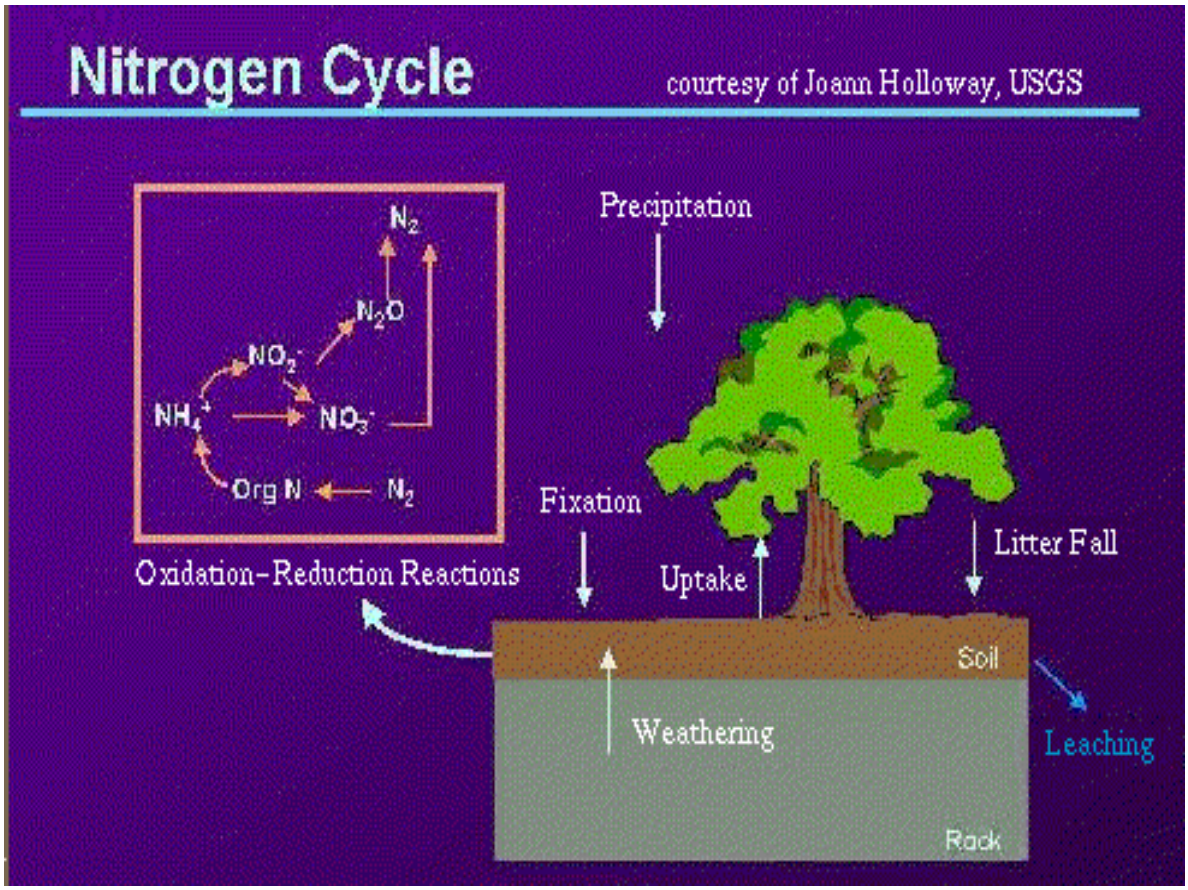
Waters with low alkalinity are likely to be affected by changes in pH. Waters with high alkalinity are able to resist major changes in pH. As increasing amounts of acid are added to a water body, the pH of the water decreases, and the buffering capacity of the water is reduced. Alkalinity not only helps regulate the pH of a water body, but also the metal content. Bicarbonate and carbonate ions in water can remove toxic metals (such as lead, arsenic, and cadmium) by precipitating the metals out of solution.

Alkalinity is measured by titration. An acid of known strength (the titrant) is added to a volume of a treated sample of water. The volume of acid required to bring the sample to a specific pH level reflects the alkalinity of the sample. The pH end point is indicated by a colour change. Alkalinity is expressed in units of milligrams per liter (mg/l) of $CaCO_3$ (calcium carbonate).

Nitrogen

Nitrogen is required by all organisms for the basic processes of life to make proteins, to grow, and to reproduce. Nitrogen is very common and found in many forms in the environment including wetlands. Inorganic forms include nitrate (NO_3), nitrite (NO_2), ammonia (NH_3), and nitrogen gas (N_2). Organic nitrogen is found in the cells of all living things and is a component of proteins, peptides, and amino acids. Nitrogen is most abundant in earth's environment as N_2 gas, which makes up about 78 percent of the air

we breathe. Nitrogen is recycled continually by plants and animals. This recycling of nitrogen through the environment is called the "nitrogen cycle (See the figure below).



ACTIVITY

- Using the diagram above and in groups of 5-6, discuss the various processes by which nitrogen is converted into the various inorganic and organic forms in the nitrogen cycle. Write these processes down.
- Compare your answer with an essay that was written by Master Abed in Sudan. What points did you miss in your group?

Master Abed's essay of the main processes that take place during the Nitrogen cycle

Most organisms (including humans) can't use nitrogen in the gaseous form N_2 for their nutrition, so they are depend on other organisms to change nitrogen gas to nitrate, ammonia, or amino acids. "Fixation" is the conversion of gaseous nitrogen to ammonia or nitrate. The most common kind of fixation is "biological fixation" which is carried out by a variety of organisms, including blue-green algae, the soil bacteria *Azobacter*, and the association of legume plants and the bacteria *Rhizobium*. Additionally, nitrogen can be fixed by some inorganic processes. For example, "high-energy fixation" occurs in the atmosphere as a result of lightning, cosmic radiation, and meteorite trails. Atmospheric nitrogen and oxygen combine to form nitrous oxides (NO_x), which fall to the earth as nitrate.

When plants and animals die, proteins (which contain organic nitrogen) are broken down by bacteria to form ammonia (NH_3). This process is called "ammonification." Ammonia is then broken down by other bacteria (*Nitrosomonas*) to form nitrite (NO_2), which is then broken down by another type of bacteria (*Nitrobacter*) to form nitrate (NO_3). This conversion of ammonia to nitrate and nitrite is called "nitrification." Nitrates can then be used by plants in order to grow.
To complete the nitrogen cycle, nitrates are reduced to gaseous nitrogen by the process of "denitrification." This process is performed by organisms such as fungi and the bacteria *Pseudomonas*. These organisms break down nitrates to obtain oxygen.

Common Forms of Nitrogen in Water

- *Nitrates*
- *Nitrites*
- *Ammonia*

Measurement of Nitrogen Forms

- Total nitrogen can be determined by adding chemicals to convert all of the nitrogen forms in a sample to nitrate, and then measuring nitrate concentration. Nitrate and nitrite can be measured together or separately. Nitrate and nitrite are most often measured using a **colorimetric method**, which your teacher will explain to you.

- Total ammonia (ammonium ion (NH_4^+) plus unionized ammonia gas (NH_3)) is often measured in a laboratory by **titration.** Again your teacher should be able to explain to you how this can be done.

Factors Affecting Nitrate Nitrite Concentrations

- *Wastewater and Septic System Effluents*

Human waste is significant contributor of nitrogen to water. Ammonia, nitrite, and nitrate are decomposition products from urea and protein, which are in human waste. Ammonia is an ingredient in many household cleaning products and is sometimes used to remove carbonate from hard water. Therefore in these forms, the nitrogen goes down the drains in our houses and businesses, and can enter streams from wastewater treatment plant effluent, illegal sanitary sewer connections, and poorly functioning septic systems.

- *Fertilizer Runoff*

Commercial nitrogen fertilizers are applied either as ammonia or nitrate, but ammonia is rapidly converted to nitrate in the soil. Animal manure is also used as a nitrogen fertilizer in some areas. Organic nitrogen and urea in the manure are converted to ammonia and, ultimately, to nitrate in the soil. Nitrate that is not used by plants washes from farmlands and residential and commercial places into storm drains and nearby streams, or seeps into groundwater.

- *Animal Waste*

A significant amount of nitrogen is released in the wastes produced by animals. This can be a serious problem in waters near cattle feedlots, piggeries and dairies.

- *Industrial Discharge*

Many industries use nitrogen during processing. Nitrite is sometimes used as a corrosion inhibitor in industrial process water. Ammonia is used in the production of nitric acid, urea and other nitrogen compounds, and in the production of ice and in refrigerating plants. Ammonia is also used in cleaning supplies and to remove carbonate from hard water. Water from industries is usually discharged to a wastewater treatment plant

(WWTP), and may end up in a downstream wetland or water body if not completely removed in the WWTP.

Phosphorus

Phosphorus is a nutrient required by all organisms for the basic processes of life. Phosphorus is a natural element found in rocks, soils and organic material. Phosphorus clings tightly to soil particles and is used by plants, so its concentration in clean waters is generally very low. However, phosphorus is used extensively in fertilizers and other chemicals, so it can be found in higher concentrations in areas of human activity.

Phosphorus in natural waters is usually found in the form of phosphates (PO_4^{-3}). If excessive amounts of phosphorus and nitrogen are added to the water, algae and aquatic plants can be produced in large quantities. When these algae die, bacteria decompose them, and use up oxygen in a process called eutrophication. Dissolved oxygen concentrations can drop too low for fish to breathe, leading to death of fish. The loss of oxygen in the bottom waters can free phosphorus previously trapped in the sediments, further increasing the available phosphorus.

There are several forms of phosphorus which can be measured such as in dissolved or particulate form using **a colorimetric method.** Your teacher will explain how this can be done.

> Eutrophication is a process that results from accumulation of nutrients in lakes or other water bodies. Eutrophication is a natural process, but can be greatly accelerated by human activities that increase the rate at which nutrients enter the water. Algae growth is limited by the available supply of phosphorus or nitrogen, so if excessive amounts of these nutrients are added to the water, algae and aquatic plants can grow in large quantities. When these algae die, they are decomposed by bacteria, which use dissolved oxygen. This process is called "eutrophication."

ACTIVITY

- Using a named example in your country, discuss the role of wetlands in prevention of Eutrophication of large water bodies in Africa. Write these processes down.

Water hardness

Hardness is measure of cations in water. Hardness generally represents the concentration of calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions, because these are the most common cations. Waters with high hardness values are referred to as "hard," while those with low hardness values are "soft".

Hardness affects the amount of soap that is needed to produce foam or lather. Hard water requires more soap, because the calcium and magnesium ions form complexes with soap, preventing the soap from sudsing. Hard water can also leave a film on hair, fabrics, and glassware. Hardness is generally measured by titration and is generally expressed in units of milligrams per liter (mg/l) or parts per million (ppm) of $CaCO_3$ (calcium carbonate).

Turbidity

Turbidity is a measure of the cloudiness of water; the cloudier the water, the greater the turbidity. Turbidity in water is caused by suspended matter such as clay, silt, and organic matter and by plankton and other microscopic organisms that interfere with the passage of light through the water. Turbidity is closely related to total suspended solids (TSS), but also includes plankton and other organisms.

Turbidity itself is not a major health concern, but high turbidity can interfere with disinfection and provide a medium for microbial growth. It also may indicate the presence of microbes. Turbidity is a measure of how much of the light traveling through water is scattered by suspended particles. The scattering of light increases with increasing suspended solid and plankton content. Turbidity in slow moving, deep waters can be measured using a device called a Secchi disk.

The depth at which the disk disappears is called the Secchi depth, and is recorded in meters. A Secchi disk does not work in shallow, fast-moving streams. In these waters, a

turbidimeter (sometimes called a nephelometer) is used. A less expensive method of measuring turbidity is to evaluate the fuzziness of a mark at the bottom of a clear tube when a water sample is poured in the tube. Units are reported in Jackson Turbidity Units (JTUs). This method can only be used in highly turbid waters.

Total Suspended Solids (TSS)

Total Suspended Solids (TSS) are solids in water that can be trapped by a filter. TSS can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for stream health and aquatic life.

High TSS can block light from reaching submerged vegetation. As the amount of light passing through the water is reduced, photosynthesis slows down. Reduced rates of photosynthesis causes less dissolved oxygen to be released into the water by plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. As the plants are decomposed, bacteria will use up even more oxygen from the water. High TSS can also cause an increase in surface water temperature, because the suspended particles absorb heat from sunlight. This can cause dissolved oxygen levels to fall even further (because warmer waters can hold less DO), and can harm aquatic life in many other ways.

To measure TSS, the water sample is filtered through a pre-weighed filter. The residue retained on the filter is dried in an oven at 103 to 105º C until the weight of the filter no longer changes. The increase in weight of the filter represents the total suspended solids.TSS can also be measured by analyzing for total solids and subtracting total dissolved solids.

Total and Fecal Coliform Bacteria

Fecal coliform bacteria, which belong to several genera of bacteria belonging to the family *enterobacteriaceae*, are present in large numbers in the feces and intestinal tracts of humans and other animals, and can enter water bodies from human and animal waste. If a large number of fecal coliform bacteria (over 200 colonies/100 milliliters (ml) of

water sample) are found in water, it is possible that pathogenic (disease- or illness-causing) organisms are also present in the water. Fecal coliform by themselves are **usually** not pathogenic; they are indicator organisms, which means they may indicate the presence of other pathogenic bacteria. Pathogens are typically present in such small amounts it is impractical monitor them directly.

Swimming, drinking or bathing in waters with high levels of fecal coliform bacteria increases the chance of developing illness from pathogens entering the body through the mouth, nose, ears, or cuts in the skin. Diseases and illnesses that can be contracted in water with high fecal coliform counts include typhoid fever, hepatitis, gastroenteritis and dysentery. Fecal coliform, like other bacteria, can usually be killed by boiling water or by treating it with chlorine. Washing thoroughly with soap after contact with contaminated water can also help prevent infections.

Measurement of Fecal Coliform

Bacteria are single-celled organisms that can only be seen with the aid of a very powerful microscope. However, coliform bacteria form colonies as they multiply, which may grow large enough to be seen. By growing and counting colonies of coliform bacteria from a sample of water, it is possible to determine approximately how many bacteria were originally present.

There are several ways coliform bacteria are grown and measured. Methods commonly used include the **most probable number** (MPN) method and the **membrane filter** (MF) method. Your teacher may explain to you how these methods work.

WETLAND ASSESSMENT GUIDELINES

In this sub-section we have a series of activities for you to carry out. Using the guidelines provided, assess and monitor the wetlands in your locality.

Activity: Assessing the impact of development on the functions of a wetland.

Make a survey on the major developments with in or around a wetland near your school or home area and carry out a simple assessment on their potential impacts using the data sheet below.

Type of development (specify) ----------

Ownership of development/project ----------

Impact of development on the functions of the wetland	Yes	No	Other Comments
Increase flood effect			
Reduce the capacity to store water			
Pollute the wetland at the site or downstream			
Lead to loss of plants (flora) and animals (fauna)			
Lead to loss of rare or endangered species			
Loss of access to wetland products and services			
Elimination of wetland resources			
Lead to conflict among different users			
Any other impact(s); (specify)			

Activity: Assessment and monitoring of hydrology, ecology and socio-economic aspects of your local wetland.

Use the guidelines summarized in the table below to carry out a simple fieldwork on wetland monitoring and assessment.

Name/Location of wetland ----------

Activities with in and around the wetland (With potential wetland hydrology, Ecology and socio-economic impacts)

Hydrology

Potential impacts of activities in wetland.	**YES**	**NO**	**Any other comment(s)**
Water Pollution (wastewater/sewage discharge, solid wastes disposal e.t.c)			
Changes in water Quantity (Drying of wells, decrease in water level/water table, water abstraction, Diversion of water e.t.c)			
Reduction in capacity to purify and treat water (Change in vegetation cover, sedimentation e.t.c)			
Reduction in capacity of wetland to store water(Increased water runoff, flooding, destruction of property e.t.c)			

Ecology

Potential impacts of activities in wetland.	**YES**	**NO**	**Any other comment(s)**
Loss of rare species if any.			
Loss of biodiversity (key wetland plants and			

animals in your locality)			
Soil erosion.			
Loss or change/modification of wetland habitats(destruction of animal movements, homes breeding/mating places e.t.c)			

Socio-Economic

Potential impacts of activities in wetland.	**YES**	**NO**	**Any other comment(s)**
Access to wetland resources by potential users of the wetland (any conflicts?)			
Wetland resources abundance and diversity (Any critical loss or massive clearance?)			
Does the activity contravene any wetland law or regulation in your area or country?			

Activity: Field study

- Make a checklist of wetland degradation activities within the catchment area to be surveyed and outline their potential impacts on quantity, quality of water entering the wetland
- Proceed to the wetland site and outline on-site activities that degrade the wetland
- With the guidance of your teacher try to reach to the people that live or interact with in or around the wetland in a friendly manner. Find out if they
    - Benefit from the wetland and how
    - Are aware of the impacts of the various activities that you have found in the wetland.
- Make recommendations with your teacher that can be of importance to wetland conservation.

Questions

1. Discuss the importance of water quality assessment in wetland monitoring.
2. Write a simple news paper article to create awareness of your local community about the importance of wetland assessment, monitoring and conservation.
3. Why is wetland assessment and monitoring important in the development of your country?

UNIT SUMMARY

In this Unit, you looked at:

- The meaning of the terms wetlands assessment and monitoring
- The symptoms of a degraded wetland
- The impact of wetland degradation to your community and other people outside your community
- Key parameters that are used in assessment and monitoring of wetland status
- Examples of the various techniques to assess and manage wetlands and how to apply them
- How water quality can be assessed using various parameters and tools
- How to carry out various wetland assessment and monitoring activities in your locality

FURTHER READING

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8. World Resources (2000-2001): People and ecosystems: The fraying web of life
9. http://www.eoearth.org/article/Eastern_Africa_and_freshwater_resources

UNIT 5: CONSERVATIONAND MANAGEMENT OF WETLANDS

INTRODUCTION:

This is a very important and exciting unit because at the end of it, you are going to be involved in helping to conserve this wonderful nature's treasure. But first, you are going to be guided on the concept of wise use, which is associated with suitable utilization, and review why it is important to manage wetlands effectively. You will learn that conservation though sometimes used interchangeably with management are different terms and that one leads to another. Case studies will be cited to help you understand on the rational of wetland management. You will meet the partners in wetland management and how they co-ordinate to sustain wetland use and there after learn about management of wetlands at international level. Watch out for the World Wetland Day, and mark it on your calendar incase you want to create awareness of the importance of wetlands to your community on that day. You might want to pay more attention to the Ramsar convention and its guiding principles surrounding wetland management because what Ramsar spells, the managers do. You will meet the world's heroes of wetland management some of them, are school children like you. Finally, you are urged to take individual action after learning so much here. Activities on how you can participate are given at the end of the unit.

At the end of each sub-topic, key words are highlighted for you to take note. You might find the glossary useful to define some of those. Okay, now let us look at the learning outcomes!

Learning Outcomes

At the end of this unit, you should be able to:

- Explain the term conservation or wise use
- Explain why it is important to ensure proper care and protection of our wetlands
- Distinguish between wetland management and wetland conservation

- Discuss approaches that can be used to manage wetlands well
- Identify an activity you can do towards conservation of wetlands.

Activity 5.1

Because wetlands can be found all over the Nile Basin, there is a good chance that there are wetlands near your school. Take a field trip to the wetland to make your observations of what a wetland looks like and how it's many parts function together. Note any human activities around the wetland and discuss how they are affecting the wetland. Identify wetlands that need conservation and suggest why and how this can be done. Also, carry out an interview with some members of the local community to find out how they value the wetlands and whether they are taking any steps towards their conservation.

CONCEPT OF CONSERVATION OR WISE USE

The 'wise use of wetlands' is a term borrowed from Ramsar convention and states: "their sustainable utilization for the benefit of humankind in a manner that will ensure the maintenance of the natural properties of the wetland ecosystem." This definition introduces terms that need clarification. Sustainable utilization is defined by Ramsar as human use of a wetland so that it may yield the greatest continuous benefit to people of the present generation while maintaining its potential to meet the needs and aspirations of future generations. Natural properties of the wetland ecosystem, is defined by Ramsar as those physical, chemical and biological components, such as water, soil, plants, animals and nutrients and the interactions between them.

MANAGEMENT OF WETLANDS

Management of wetlands requires participation of many people and organizations as we shall see briefly. In most of the countries of the world, there are some examples of effective wetland management in which sustainable use is encouraged while benefiting local communities. Although the terms conservation and management are used interchangeably, they have different meanings. Conservation as we have seen may be defined as the wise use of wetland resources, while management is the regulation of all

human activities which have a significant impact on the wetlands ecosystem. The goal of wetland management is to ensure that there is optimum use of wetland resources in order to satisfy human needs now and in the future, to conserve and where possible to add . But before we go any further, one may ask, why manage a wetland?

Why Manage a Wetland?

Wetlands serve a variety of uses and the preservation of these threatened ecosystems is very important. Wetlands are breeding grounds for wonderful plants and animals, some of which are endangered, themselves.

Wetlands are also generous to us, storing and purifying water, controlling soil erosion, regulating floodwaters and streams, and recharging the groundwater. In other words, they protect us from natural threats and offer drinking water. They also offer a variety of recreational activities, from fishing to boat riding and more.

Therefore, it is important that we learn to balance our own needs with the ever-increasing need for wetland conservation. Education and research of these complex ecosystems is vital. There is need to persistently learn more about these natural environments, and learn how we can coexist peacefully and fruitfully with them. That is why the following activity is important.

Activity 5.2

Identify an animal or a plant species in the local wetlands that is becoming endangered. See if you can help to protect the identified animal and plant. Visiting a wild life resource centre may enrich your knowledge on research findings on endangered wetland species and you may give suggestions on the steps to curb this.

Key words: Ecosystem, local community, wise use and wetland degradation

PRINCIPLES FOR MANAGING WETLANDS

Wetland management is based on aims and guiding principles, which are normally drawn from the broad aims and broad and objectives of this undertaking.

The overall aim for promoting the conservation of wetlands is to sustain their ecological and socio – economic functions for the present and future well being of the people. In support of this aim, governments in the region strives to achieve the following goals;

- Establish principles by which wetland resources can be optimally used, and ensure that their productivity is maintained,
- End existing unsustainable exploitative practices,
- Maintain a biological diversity either in the natural community of plants and animals or in the diverse agricultural activities.
- Promote the integration of wetland functions in economic development programs such as forestry, agriculture, fisheries, wildlife and aim at sound environment management

To achieve the above goals, three guiding principles are advised to individual governments:

a) The conservation of wetlands must consider the overall development strategies and activities.
b) Wetland conservation must adopt a coordinated and cooperative approach involving all the concerned people and organizations in the country, including the local communities.
c) The present attitudes and perceptions of the people in the Nile Basin regarding wetland needs to change.

Key words: Optimal use, integration, coordinated and co – operative approach

MANAGEMENT APPROACHES

A brief overview on the common wetland management approaches are outlined below.

1. **Drainage of wetlands**

   In instances where drainage has occurred on a large scale due to pumping, excavation of water channels and perhaps combined with excessive growing of trees and or building dams upstream of a wetland, such modifications should be avoided. Government requires that some wetlands which have already been drained should be allowed to regenerate.

2. **Environmental sound management**.

   Sometimes, the management of a natural resource may be debatable in line with whether its use causes adverse effects on the environment or not. A typical example is the production of bricks from clay soils. This may lead to deforestation around the brick – making kilns (areas) since they may cut the trees to burn the brick. However, the smoking of fish using papyrus (which could sustainably be harvested) may be environmentally sound and can reduce the exploitation of fuel wood supplies in the area. In such scenarios, since most users of wetland resources do not take into account other aspects of the environment, only those uses that have been proved to be non – destructive to wetlands and their surroundings are encouraged. These include water supply, fisheries, wetland edge gardens and grazing.

3. **Sustainable use of wetlands.**

   Sustainable use of wetland is understood as utilization which ensures that the products or services derived from that use are available at some foreseeable future. For example, yields from fishing or harvesting of papyrus, should be set at a level that can be maintained for the foreseeable future. To achieve that, wetlands need to be utilized in such a way that they do not lose traditional benefits and one's decision to use wetlands must consider the requirements of all other users in the community.

4. **Conservation of wetlands**

Wetlands are important habitats for a variety of biological resources, some of which depend entirely on wetlands for their survival. Their conservation would preserve indigenous species of plants and an animal is essential for the future biodiversity. Many attributes of wetlands remain to be discovered earning them ecological importance. For many of the Nile basin countries, internationally recognized wetlands have been established. Other important wetlands outside those that are internationally recognized also need to be protected. For that to happen, fully "protected wet land areas" of important biological diversity, should be established. Also, some wetlands may be for partially exploited and used for research. Protected wetlands should be left in their natural state without any disturbance from humans.

5. **Water supply and effluent treatment**

Any wetland serving as a source of water supply or receiving effluent as part of a designated service to any human settlement should be declared a fully protected wetland from encroachment, drainage or modification.

6. **Tenure and use**

Many wetlands in the Nile basin region belong to the public but contrary to what might be expected from this ownership status, some of them have been leased. Government consequently loses control of any protective or conservatory requirements. All wetlands therefore should be taken as public resources and should not be leased to individuals or organization except under certain circumstances.

Communal use should be permitted only once the environmental conservation and sustainable principles and strategies are adhered to. The communal use may be terminated by the government if it is found that the laws governing the use of wetlands are violated.

All future land tenure documents including maps and layouts should indicate whether the area contains a wetland and accordingly exclude these wetlands from tenure. The layout should be advertised in the local authority where land is to be given out for a specified period.

7. Environmental impact assessment (EIA) and monitoring

Development activities in general tend to impact upon natural resources and environment in various ways. Assessment and evaluation of such impacts helps to minimize the economic and social costs preventing damage before occurrence as compared to restoring a degraded wetland. In view of this, all planned new wetland development will be subjected to an EIA process to determine the required environmental controls and be monitored regularly there after to asses their impact.

8. Developing public awareness

Very often wetlands are degraded because the public is does not appreciate the diversity of values and functions of wetlands. Public awareness is therefore essential in creating a commitment and positive attitude towards conservation and sustainable utilization of wetland resources. Public awareness campaigns on wetlands resources in co – operation with other natural resources sectors should be carried out at local and national levels. Such media as leaflets, posters, radio, and television could be employed and all should give guidelines for wetlands developers.

See how you can actively create public awareness on wetlands by attempting the following activity.

Activity 5.3

Design a poster/s to sensitize your school or local community on the values and functions of wetlands. Or write a poem on a particular aspect of wetlands that you want your community to learn and read it at assembly or have it published in the school journal.

Activity 5.4

Read through the report of secondary school students in Uganda regarding the impact of flower growing on the environment. In groups of 5-6 people, discuss their major findings and recommendations. Design a similar study in your own country of the impacts of selected activities on wetlands.

Victoria watch

ENVIRONMENTAL IMPACT OF THE FLOWER GROWING INDUSTRY: A case study of Victoria Flowers Limited

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ENTEBBE SENIOR SECONDARY SCHOOL

Victoria Flowers Limited, Entebbe

Introduction

Floriculture is becoming a major economic activity around the shores of Lake Victoria. Some of the flower growing companies located along Kampala-Entebbe road are: Expression, Rosebud, Victoria Flowers Uganda Limited, Wagagai. All the farms are constructed near wetlands. Entebbe Secondary School Environment Club has carried out a case study at one of the flower farms in Entebbe that is Victoria Flowers Uganda Limited. The focus of the study was on the emrging impact of the flower farm on the other components of the environment in the locality.

Background

Victoria Flowers Uganda Limited is situated in Entebbe – Busambaga Zone 1½km off Entebbe-Kampala road. It was started by a Ugandan Businessman Mr. Gordon Wavamuno and his French Counterpart Mr. Rene Bartoli in 1995. It started with 2½ hectares but presently it convers 8 hectares and so far has 15 green houses. Further expansion is still going on. The farm employs approximately 200 workers both skilled and unskilled of whom 80% are women and 20% are men. Some of the rose species grown on the farm: Red calypso, Lambadda, Vanilla, Sun beam and Eskimo.

Objectives of the study

- investigate if there is pollution taking place
- find out the impact of flower growing on subsistence farming
- find out the effect of flower growing on Lake Victoria
- identify the effect of flower growing on the environment
- find out the different methods being used to grow flowers

Limitation/problems

- Language Barrier:

Some of the workers did not know English and some of the students did not know Luganda and so communication was difficult.

- False Information:

Some workers gave false information about pollution caused by the chemicals. Some said that there was an effect and others said there was no effect yet the waste chemicals are being poured into Lake Victoria.

- We had limited time for interviewing the workers.
- Some workers were impolite and rude and so they could not give us all the necessary information.
- Some workers could shy away and so we found it difficult to get information from them.

Talking to workers doing packaging

- Some students who interviewed some workers from the rooms where chemicals are mixed complained of an irritating smell.

Methods of study

- Questionnaire
- Interviews
- Field visits
- Observations
- Sampling
- Documentation

Four visits in all have been made with 3 of them in Victoria Flowers Limited and one to Rosebud. Both students and teachers participated in the formulation of the questions, administering the questionnaires and making evaluation.

Observing the packaging process

Two types of questions were administered. One was to the workers mainly to find out the effect of flower growing on subsistence farming and the occupational hazard of the worker (see questionnaire 1).

A student interviewing some workers outside the greenhouse.

FINDINGS

A

The findings of the visits to Victoria Flowers are summarized so far as below:

TABLE 1: WORKERS AT VICTORIA FLOWER FARM

Number of People interviewed	: 32
Gender	: Female 53% : Male: 47%
Age Range	: 20 – 50years
Working hours	: 10- 11 hours per working day
Meals given to workers	: Break : Porridge : Lunch : Posho and Beans
Previous employment before joining the farm	: Unemployed, former students, waitress, drivers, statisticians
Other jobs they do after their work	: Baking bread, housewives, further studies, kiosk business
Training for their job	: On job training and some trained before joining the farm

B

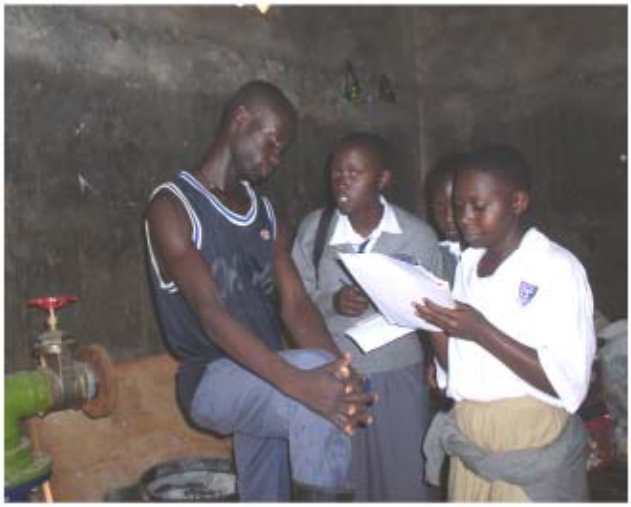
Method of Rose Growing: Budding

Advantages

- Grow faster
- Reduced costs
- Easy to carry out
- Many buds can be established on one stem

Disadvantages

- Time consuming
- Wilting
- Persons are exposed to thorn pricks
- Needs skilled labour



Occupational hazards

The workers reported:

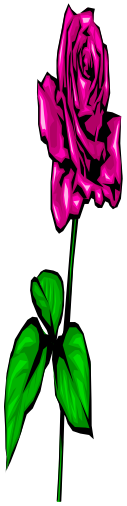
- Irritating smell of chemicals used for spraying
- Skin rash
- Chest pain
- Back pain

Extremes of temperature both hot and cold (in the cold room and green houses respectively)

Interviewing a worker

- Exposure to chemical irritants (sometimes workers are forced to undress in green houses when it is hot).

- Blindness: A worker is reported to have become blind when chemically treated soil particles entered his eye.
- Lung damage: A worker is reported to have developed holes in his lungs and he was retired
- Headaches probably due to too much sun shine or exhaustion
- Finger nail pricked by thorns infected because of pesticides



C

WATER POLLUTION

Cut flowers require a lot of water (60,000 litres/hectare per day). See impact of flower industry in Uganda by P. Asea and D. Kaija). Victoria Flowers pumps water from the lake which later finds its way back to the lake. Mitigation measures against pollution include using a soak pit with a stone medium and charcoal. Some samples of water have been taken for laboratory test by S.6 science students. When asked about pollution, 30 people said yes and 2 said there was no pollution.

FERTILISERS USED IN THE FARM

Fertiliser and chemical used	**Use**	**Effect to the Environment**
Sulphur dust	To kill invading insects such as bees, caterpillars, butterflies etc.	- Causes air pollution - Irritating smell - Reduces/kills biodiversity
Ammonia nitrates	To lower soil Ph from 7.5 to 6.8	It does not favour survival of extreme pH needing micro organisms in the soil
Poly feed	To increase root hair growth	
Manganese	Serves as a micro nutrient element	
Urea	To provide nitrogen to the soil	
Mono potassium phosphate		
Potassium nitrate	Provide potassium ions and nitrates	
Calcium nitrate	To provide nitrogen	
Magnesium sulphate	To provide for sulphur and magnesium	
Iodine	For micro nutrient	
Zinc nitrate	To provide nitrogen	

D

DISPLACEMENT OF PEOPLE

Most of the local people around Victoria Flowers are Kibanja holders (squatters). They lost their land rights when the land-owners sold out to Victoria flowers. Some had lived here for as long as 35 years. They have not been resettled and they complain of terms of resettlement. They are expected to vacate anytime.

NEGATIVE IMPACT ON THE LOCALITY

SUBSISTENCE FARMING

-Fruit trees (jack fruit, mangoes, avocadoes), banana plants, empafu, are no longer yielding as they used to.

- At least 12 goats miscarried in 2003 at New Life Education Centre which is close to the farm. Another goat this year had premature delivery.
- The free-range chickens which stray into the farm end up dying.
- They were hardly any flying insects in homesteads in the vicinity of the farm. A very distinct smell of chemicals can be smelt outside the fence around the flower garden.

- All the above is said to be due to the close proximity of homestead around the flower farm.

Test on water effluents from the farm

Test	Observation
PH	
Colour	Pale green
Ca^{2+}	Yet to be done
Mg^{2+}	Yet to be done
Suspended particles	Many
Smell	

F

Wetland encroachment and degradation:

Victoria flowers and Rosebud II (formerly Equator Flowers) are located at the edge of a wetland;

- Crocodiles, hippos and monkeys used to frequent this wetland, but are no longer there.
- We fear that the wetland might be reclaimed at Lutembe Bay (Rosebud).

Recommendations:

- Encourage resettlement of people to other areas; away from the farm.
- Flower farms should be established in areas with scarce settlement.
- Improve on the treatment of waste water.
- Improve on the use of protective gear for persons working on the farm.
- Proper incinerators should be used in burning waste.
- Put in place waste treatment measures

Key words: Impact, campaigns, media, Regenerate, debate, traditional benefits, Indigenous species, protected wetland, future biodiversity, natural state, lease

ROLE OF VARIOUS STAKE HOLDERS

Recently, partnerships to manage wetlands have developed among the central government, the district, local administrative leaders, the community, extension staff and NGO'S. The goal of these partnerships is to put into practice broad watershed protection approaches. A watershed approach recognizes the inter- connectedness of water, land, and wetlands resources and results in more complete solutions that address more of the factors causing wetland degradation. Let us now look briefly at the role played by each partner.

Wetlands conservation and management is a shared responsibility for all citizens, however, the Government has a leading role to play. The central government formulates policies on wetlands which are passed by the parliament into laws. These laws empower technical staff to handle wetland related issues. Central government identifies its resources, allocates annual budgets to the wetland sector and enters into agreement with donors. The Government provides legal framework for wetland management by establishing a monitoring and evaluation mechanism used to verify policy implementation local by authorities.

The physical management of wetlands is the mandate of either the central or local governments. Political support at this level is crucial to ensure that the administrative units carry out the wetland policy correctly. The administrative units play an important role in formulating and passing legislation that relates to the wetlands in their area. The administrative unit also protects and promotes wetland services and attitudes. They also encourage NGO's to take up active roles in promoting and building the capacity of those institutions. The local government finances activities related to wetland management. The local governments also look for donors interested in wetland management.

In the case of Uganda, according to local government statute, it is considered of great importance that management of wetlands is further devolved to local councils. The local authorities have the mandate to formulate bye – laws that are even more specific to there area than the district bye – laws and because sub – counties are small administrative units

it is easier to monitor the enforcement of the laws. Wetland activities are incorporated into the main sub – county development plan. The local authorities also encourage NGO's to take up active role in promoting and building capacity of institutions at this level. The local authorities have an important role in the financing of activities related to wetland management. Like the districts, sub – counties also write proposals and present them to potential donors interested in wetland conservation and management.

Technical staff carryout the wetland policies and management functions decided nationally and locally. The roles of technical staff include: carryout wetland inventories, draw up wetland management plans, assist the district environment officers to carryout environmental impact assessment, conduct sensitization activities on wetland to the communities to enrich their knowledge on the importance of wetlands, build capacity of members of the local community through training on proper use their wetlands, establish community – based wetland management structures and monitor and evaluate wetland related activities

For their part, the local community adequately promotes wise practices in all wetland activities. They ensure that what is being enjoyed today is left for future generations to enjoy. For this reason, the community: maps the wetland boundaries, provides information about the size, characteristics and inherent features and guides on prioritizing of wetland activities. The local community helps in identifying wetlands that require urgent attention with in their locations, Observes and identifies wet lands that are threatened by both human and natural activity and report to local authority.

Community associations organize and limit the community on how well to use and share wetlands for water, animal grazing and fishing and ensure participatory and transparent management of wetland resources. Can influence local governments to formulate bye – laws and supports or participate in enacting the laws at local level while promoting equitable participation.

The NGOs contributing towards wetland sustainability must clearly have defined their role and limit themselves to supporting the communities, avoiding taking up leading roles. The assistance should be transitory in nature, seeking to transfer their knowledge to the communities and enable them to become independent from external assistance and take up all functions in wetland management. Their role is therefore summarized in the following: draw up management plans of wetlands, financing reputable organizations and firms to carryout wetland conservation and management activities, raise awareness and train the local communities, provide wetland management materials for the communities, support the establishment of wetland management structures, monitor and evaluate projects on sustainable use and management of wetlands.

***Key words: Central government, district, local authority, legislation, annual budget NGO's, donors, local government, bye-laws, statute, technical staff, sensitization, proposal,* management structure.**

Study Questions

1. *How does the management of wetland sites and use of resources acknowledge local needs?*
2. *How do formal and informal institutional dynamics influence the management of wetlands in your area?*
3. *What are 'environmental entitlements' and how are they established and negotiated?*

Activity 5.4

Find five or six people in your class and discuss the following questions

- *What are the sources from which people derive their environmental awareness?*
- *How do variations in access to environmental knowledge affect understandings across time?*
- *How do people establish and negotiate their 'environmental entitlement'?*

MANAGEMENT OF TRANS-BOUNDARY WETLANDS

Individual action by States may be insufficient for the conservation and management of wetlands because many wetlands and watercourses cross national boundaries; many wetland species are migratory; coherent management of wetlands often requires collaboration and exchange of experiences between countries; and development assistance is often required for wetland conservation actions in developing countries.

Many protected areas share national or provincial boundaries and adjoin other protected areas across the boundary. It is obvious that poor planning can result in incompatible activities in areas on either side of the boundary. For example, the zoning of a wilderness area on one side of a boundary could be compromised by infrastructure development on the other. Coordinated planning can reduce this risk, and ensure that the partners develop an appreciation of their relative biophysical, political, social and economic contexts. Therefore, co-operation between neighbouring administrations in such situations is crucial.

Coordinated planning

This is essential if the purposes of the protected areas involved are to be translated into effective programs for management and development. Integrated planning ensures that all interests in neighbouring countries or provinces should be involved and that the consequences of decisions for sectoral programs are fully evaluated. The process of planning, if handled in a participatory manner, can promote commitment and empowerment among stakeholders on both sides of the boundary, as well as capacity building where there would otherwise be unequal experience or skill.

Examples of international cooperation over shared wetlands and water systems

Recent examples of international cooperation over shared wetlands and water systems in relation to Ramsar sites and the Ramsar Convention include:

The creation of the Prespa Lakes Trans-boundary Park by Albania, Greece, and The Former Yugoslav Republic of Macedonia, inaugurated on World Wetlands Day, 2 February 2000.

1. The momentum towards collaboration in the management of the Polesie wetlands shared by Belarus, Poland, and Ukraine, begun in May 2002.

2. The efforts of the member States of both the Lake Chad Basin Commission (LCBC) and the Niger Basin Authority (NBA), with assistance from WWF International and financial support from the Global Environment Facility, to designate each of their parts of these large catchments as Wetlands of International Importance and work toward their collaborative management, especially in the framework of memoranda of cooperation signed between the Ramsar Secretariat and both the LCBC and the NBA in November 2002.

3. The "Trilateral Ramsar Platform" for the Morava-Dyje Floodplains, signed by Austria, the Czech Republic, and Slovakia in August 2001 – for their assistance in this project, the NGOs Daphne in Slovakia, Distelvere in in Austria, and Veronica in the Czech Republic jointly received the Ramsar Wetland Conservation Award in 2002.

Activity 5.5

Plan to celebrate the World Wetlands Day in your school. Choose a theme for the day and plan the activities you and other members would do to create awareness on the wetlands. These are some activities you might find interesting to try: Form a wetland club for your school/community, conduct a nature walk in the wetlands, make an inventory of rare plants and animals, go swimming in a local stream/river, collect favourite flowers, plants from the wetlands and press them under newspapers to use later in your wetland journal. Make some crafts like basket from reeds and pots from clay etc.

Key words: migratory species, boundary, coordinated planning, integrated planning, World Wetland Day, Ramsar, wetlands of international importance

WHO MANAGES WETLANDS INSTITUTIONS AT INTERNATIONAL, REGIONAL AND NATIONAL LEVELS?

The Nile is the longest river in the world, combining the Blue Nile that rises in the highlands of Ethiopia, and the White Nile, which rises in the Equatorial Great Lakes region of East and Central Africa. The 3.2 million sq kilometers of the river basin contains all or part of the territory of ten countries - Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda, totaling at least 140 million people. Countries upstream are well watered while many of those downstream remain arid and heavily dependent on the Nile, a situation which has led to conflict over centuries. Accords signed by Britain and Italy in 1929 and 1959, respectively, awarded control of the Nile Waters to Egypt alone, creating conflict with countries which insist on being involved in the management of the waters of the Nile. In 1992, the Council of Ministers from the Nile Basin countries began an initiative to promote co-operation and development.

The **Nile Basin Initiative** was established in February 1999 to bring together governments of the ten riparian states in order to prepare coordinated development projects to benefit the poor, involving water, energy and agriculture. IUCN, WWF and World Bank hosted a workshop to investigate the establishment of an International Discourse on the Nile, held at the IUCN Headquarters in Gland, Switzerland. The idea was to involve civil society in planning and development in order to ensure that the developments coincide with the wishes of the Nile Basin peoples. Subsequent meetings underscored the need for the international discourse to continue for several years.

International Discourse on the Nile River Basin is designed to promote broad based dialogue, and sharing of views on development in the Nile River Basin. This occurs mainly through the Nile Basin Initiative with a wide ranged of national, regional and international levels. The discourse covers a broad range of themes including poverty alleviation, conflict resolution, the environment and development.

Key words: Nile Basin initiative, international discourse

RAMSAR CONVENTION

The Convention on Wetlands of International Importance especially as Waterfowl Habitat was adopted at Ramsar, a city on the Iranian shores of the Caspian in 1971. The Convention was astonishingly far-sighted for its time, recognizing several important principles which are now widely accepted: the interdependence of Man and his environment; the fundamental ecological functions of wetlands as regulators of water regimes; and the value of wetlands in economic, cultural, scientific, and recreational terms. This concern with the functioning of wetlands, and how it affects mankind and his cultural and economic well-being, has become more and more relevant over the first 25 years of Ramsar and will undoubtedly be a major issue for the 21st century, when water supply will become even more crucial.

Although the Convention's original focus was on wetlands as a habitat for waterfowl, Ramsar has developed into an international instrument dealing with wetlands from a broader point of view. Ramsar remains the only international convention that concentrates on a particular type of ecosystem - wetlands - rather than on species or other issues. Such an approach is natural, given the widely held view that wetlands and forests are two of the most threatened ecosystems in world terms.

Ramsar establishes, for the first time in an international convention, two basic concepts:

The first concept is the *List of Wetlands of International Importance* which is a list of important sites proposed by member governments, who formally accept an obligation to maintain the ecological character of these sites. The second concept is the principle of *wise use* of all the wetlands in the territory of a Contracting Party. Wise use of wetlands is considered as synonymous with sustainable use, a term which has recently gained general currency.

Like any other convention, Ramsar is a living, evolving instrument. The emphasis in the early years was on listed sites, the flagship concept which attracted immediate attention and publicity.

Key words: Ramsar, ecosystem, forests, threat wise use

RAMSAR AND WETLANDS OF INTERNATIONAL IMPORTANCE

In recent years, the broader concept of wise use has become increasingly important, with the growing realization that listed sites cannot be conserved in a vacuum but are affected by decisions taken outside their boundaries; the crucial need is to integrate conservation and wise use of wetlands into national land use and water management strategies. While the Ramsar text sets out basic concepts, guidance is needed on how to put them into practice and how to adapt them to changing world perceptions. In its first 25 years, Ramsar member states have, at their Conference of the Parties (normally held every three years), approved numerous interpretations of the text and mechanisms to make sure that the basic concepts of the Convention are effectively applied.

Ramsar definition of wetlands: An important feature of Ramsar is its approach to the once unfamiliar term 'wetlands'. The definition of wetlands in the first article of the Convention has been widely accepted: 'Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.' This definition encompasses coastal and shallow marine areas (including coral reefs), as well as river courses and temporary lakes or depressions in semi-arid zones.

Ramsar's outline on benefits and values of wetlands: The Ramsar 'Guidelines on wise use' provide a concise account, for both decision-makers and the general public, of the benefits and values of wetlands which may be felt within the wetland itself or some way away from it (for example in the case of wetlands which absorb floods). The Guidelines summarize the benefits as follows: sediment and erosion control; flood control; maintenance of water quality and abatement of pollution; maintenance of surface and underground water supply; support for fisheries, grazing and agriculture; outdoor recreation and education for human society; provision of habitat for wildlife, especially waterfowl; Contribution to climatic stability.

Key words: Ramsar conference, Ramsar definition of wetland, Ramsar guideline

Activity 5.6

Design a game to play with your friends to summarize the Ramsar guidelines on wetland management.

INTERNATIONAL AND REGIONAL POLICES AND LAWS ON WETLANDS

Overview of the Policies

It is the policy of the governments in the Nile basin region should be to promote the conservation, sustainable management and wise use of wetlands by all stakeholders for the benefit of present and future generations. Adoption of the Wetlands Policy means that the governments, in their decision-making will give explicit consideration to the biophysical requirements of wetlands with the goal of ensuring their sustainable management.

Goal of the Policies

Policies should assist in the protection of wetlands in good condition, rehabilitate degraded wetlands where feasible, and support appreciation of wetlands by:

- protecting wetland biodiversity, functions and services;
- protecting social and economic benefits of wetlands;
- providing flow regimes that mimic natural conditions, where possible;
- providing wetlands with water of appropriate volume and quality;
- limiting further fragmentation and reconnecting wetland systems;
- preventing or limiting catchment activities that impact upon wetlands;
- protecting the cultural heritage and spiritual significance of wetlands;
- rewarding wetland managers who improve the condition of wetlands; and
- promoting the importance of wetlands to the community.

Principles governing the Policies

The governments should achieve these goals by adopting the following principles:

- Wetlands are valued as significant parts of landscapes - their conservation and management are most appropriately considered at the catchment scale.
- Appropriate water regimes and water quality needed to maintain or restore the ecological sustainability of wetlands will be provided through the implementation of water management plans.
- Wetlands of international, national, state and regional significance will be identified and conserved.
- Land use and management practices will maintain or rehabilitate wetland habitats, processes and cultural values.
- Degraded wetlands and their habitats will be rehabilitated and their ecological processes restored as far as is practicable.
- The potential impacts of climate change will be considered in long term strategies for water resources and land use.
- Continued research into wetland ecology will be encouraged to better support water and land use planning and management.
- Natural wetlands should not be destroyed or degraded. When social or economic imperatives in the public interest result in a wetland being degraded or destroyed, the rehabilitation or construction of a compensatory wetland that supports similar biodiversity and ecological functions will be required.
- Purpose-built wetlands will not be constructed on the site of viable natural wetlands.
- Cooperation and incentives among land managers, government authorities, catchment management authorities, non-government organizations and the general community is essential for effective wetland management, and will be encouraged.

Study Questions

- *What are the sources from which people derive their environmental awareness?*
- *How do variations in access to environmental knowledge affect understandings across time?*
- *How do people establish and negotiate their 'environmental entitlement'?*

Key words: policy, principles

Activity 5.7

In group, discuss

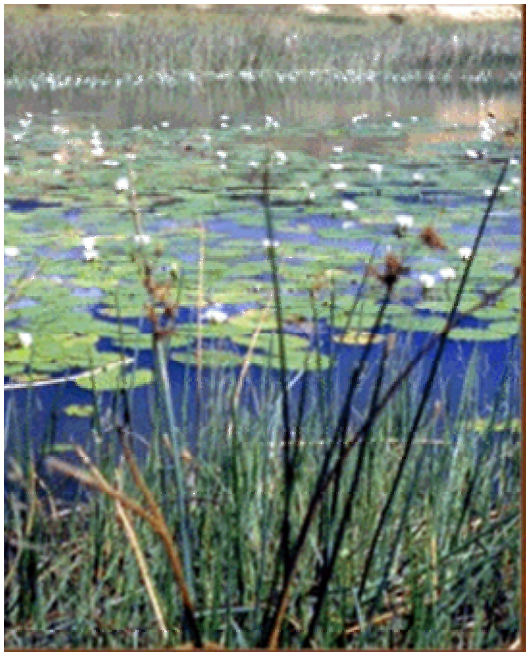
- *How does the management of wetland sites and use of resources acknowledge local needs?*
- *How do formal and informal institutional dynamics influence wetlands management?*
- *Study the policies governing wetlands management in your country and discuss them with your teacher. What needs to be done to ensure better management of wetlands?*

EARTHKEEPER HERO: WORLDWIDE WETLAND CONSERVATION

Below are three stories of heroes recognized internationally for working to preserve and protect wetlands

South Africa: A Schoolgirl Takes on Water Conservation

Claire Reid, a student from Johannesburg, South Africa, captured the attention of the scientific community with her unique ideas on water conservation and agricultural development.



Wetlands in South Africa

The Ministry of Water Affairs and Forestry hosted a competition for schoolchildren to create "an awareness of the importance of water and promote water conservation," and Reid's project was selected. Honored in Sweden for her idea, her "real gardening" concept requires less water than normal gardening and helps people grow vegetables even in dry and dusty arid lands.

Claire Reid conducted trials for her 'real gardening' concept with the help of the Diepsloot community

"I came up with the idea to help people, especially in less advantaged communities, grow their own food while at the same time saving water and saving money on fertilizers," Reid said.

Her idea could revolutionize agriculture for the arid regions of her home nation, and of the world. She sealed pre-fertilized seeds into long, narrow strips of newspaper. The newspaper allowed the seeds to stay moist, therefore utilizing less water in their planting process. "My method means that the seeds need less water, while the fertiliser and carbon from the paper make sure the seeds grow faster," Reid added. The seed strips are placed into the ground, covered with soil and watered. The strips make gardening nearly flawless even for the most amateur of gardeners, as each seed is at the appropriate distance from one another, and the strips ensure they are planted at the appropriate depth.

Reid's project is being implemented by local charities in needy parts of the country. Claire Reid's work is living proof that water conservation and environmental protection - as well as the consideration of, and assistance for, needier communities - is very feasible, regardless of age, clout or stature.

Western Asia

White-naped cranes in the wetlands of China

Comprised of the Middle East and Central Asia, the area considered Western Asia contains much of the world's main arid zones. Many types of fragile ecosystems including deserts, semi-arid lands, and mountains can be found there, but despite the prominent droughts of this often arid region, wetlands are also present. In fact, all but 3 of the 31 natural wetland types recognized by the Ramsar Convention (the main international resource on wetland protection and conservation) can be found in Western Asia, including mangroves, and coral reefs.

Of key importance, then, is the management of these areas to balance human consumption with environmental protection. The products of the wetlands support its local peoples economically, as well as the nation that hosts them. So while supporting economic development, wetlands simultaneously protect the country's environmental well-being and the health of its peoples.

Louisiana, The United States

Journeying into the expansive, but rapidly diminishing wetlands of Louisiana, The Jason Expedition's 2005 team of student and teacher Argonauts and host researchers are paving the way for further research, exposing classrooms around the world to the wonders of wetlands and to the need for preserving them. They are learning and sharing invaluable lessons of science in action.

JASON puts science in context for students; science is not just one more isolated subject in school. The curriculum is very good at relating real-world problems to the research designed to answer questions about that problem and how it might be solved. For students in the classroom it connects them with a learning community via technology.

An aerial view of the Louisiana wetlands
Credit Tom Abello, The Nature Conservancy

There are a couple of important things that JASON illustrates for kids:
1) Science is something that people do, science is a verb. And it is done by all types of people not just white men with beards and glasses in lab coats.
2) Science isn't an isolated topic. It is interwoven through every facet of life since every day you must make decisions and ideally those decisions are based on collected information. That's the basic premise behind scientific inquiry. About 10,000 students learning about wetlands and their importance!!

WHAT YOU CAN DO

While regulation, economic incentives and acquisition programs are important, they alone cannot protect the majority of our remaining wetlands. Education of the public and efforts in conjunction with local governments, and private citizens are helping to protect wetlands and to increase appreciation of the functions and values of wetlands. As wetlands are lost, the remaining wetlands become even more valuable. We must now take positive steps to protect wetlands to ensure that the functions and related values they provide will be preserved for the present and future generations. You can play a part in protecting these national treasures and below are some suggestions of how you can be involved.

- *Find out where the wetlands are in your community. Learn more about wetlands by contacting your local parks department, state wildlife or natural resource agency. Become a member if there is an opening.*
- *Visit a local wetland and take part in a bird watch, nature hike, canoe trip, or other activity.*
- *Volunteer with a local group (or start a wetland and conservation club if none exist in your area) to protect, restore, and monitor a local wetland.*
- *Plant native vegetation in your school yard or garden at home and limit use of fertilizers and pesticides.*
- *Encourage neighbours, developers, and state and local governments to protect the function and value of wetlands in your watershed.*
- *Familiarize yourself with the principles for the sustainable management of wetlands given.*

- *Use water wisely so that more will be available for wetlands.*

- *Avoid pouring down cooking oil or paint the drain to protect the water quality of your wetland.*

- *Throw your rubbish in the bin or recycle it move away from throwing it into your local wetland.*

- *Purchase government stamps that have wetland animals and plants from your local post office to support wetland acquisition.*
- *In future, select upland rather than wetlands sites for development projects and avoid wetland alteration or degradation during project construction.*

CREATING WILD WORDS

Naturalists study nature, especially plants, animals and their habitats. They record what they see by writing about it, drawing or sketching it, or sometimes they write creatively--poems, prose and essays. You too can be a wetland naturalist! You just have to enjoy being in a wetland, quietly watching birds, animals, insects and plants. Besides a love of the outdoors you need a journal to record your observations, poetry, ideas and to draw sketches. You can create your own journal on the wetlands!

For your wetland journal, you'll need: A small notebook crayons, pens, markers (to take into the field), and natural inspiration. A wetland is a quiet natural place to sit back and gather inspiration. Close your eyes and hear the wind in the trees. Feel sunlight on your face, and the cool ground under you. Open your eyes, but don't focus on any object in particular. Try to see the whole scene. Write about what you see, what you feel, what you smell. Sketch trees, grasses and animals, too. If you have your identification books along, try to identify what you're seeing and drawing. If you can, visit the same place through the year and see how its different inhabitants change.

If you'd like, you can also press flowers and put those into your journal, too. Falling leaves are also good to press. Fallen, dry leaves, though, aren't good for journals. They turn into dust. Try picking some colorful leaves that are still attached to a live tree and are flexible, not brittle. These will press well and be flat for your journal.

You can share your journal on the wetlands on a science day at school or have bits of it published in the school year book, or share with local wildlife or natural resource agency.

UNIT SUMMARY

In this Unit, you have been able to:

- Define the term conservation or wise use
- Give the rationale for conserving and managing wetlands properly
- Identify the actors in the management of wetlands
- Explain why it is important to have policies that govern wetlands management and give examples of such policies in your country
- Critically examine ways of strengthening wetlands management in your country
- Relate what has been achieved by individuals on wetlands management elsewhere in the world to our own situation in the Nile basin region.

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GLOSSARY OF COMMON TERMS

Adaptation- Evolutionary process by which an *organism* becomes better suited to live in a particular environment. How a species changes over time to better live in a particular environment.

Anoxic- Without oxygen.

Aquifer - an underground layer of rock and sand that contains water

Bog- A wetland ecosystem that is highly acidic and has an accumulation of decomposed plants known as peat.

Buffer zone- The area of land next to a body of water, where activities such as, construction are restricted in order to protect the water.

Buttress- Broadened bottom of a tree trunk that helps to stabilize a tree growing in wet soil or water.

Carnivore - any organism that eats other consumers (sometimes referred to as "meat eaters")

Consumer - any organism that cannot produce its own food and must, therefore, get its energy by eating, or consuming, other organisms

Decomposer - organisms such as fungi and bacteria that feed on dead material causing the chemical breakdown of the material

Detritus - Decaying organic matter found in the top layer of soil or mixed with wetland waters; a food source for many small wetland organisms.

Detritivore - any organism that consumes detritus

Dormant- Period when a plant is not actively growing, but is still alive. For most wetland plants this happens in the winter

Endangered species- Any species of plant or animal that is having trouble surviving and reproducing. This is often caused by loss of habitat, not enough food, or *pollution*. Endangered species are protected by the government sin an effort to keep them from becoming extinct.

Ecosystem- A network of plants and animals that live together and depend on each other for survival.

Emergent- Soft stemmed plants that grow above the water level.

Endemic – native only to a particular area.

Erosion- Process in which land is worn away by external forces, such as wind, water, or human activity.

Estuary - an environment where terrestrial, freshwater, and seawater (saline) habitats overlap

Evergreen- Any plant that keeps its leaves throughout the year.

Freshwater- Water without salt in it such as like ponds and streams.

Global warming- an increase of the earth's temperature by a few degrees resulting in an increase in the volume of water which contributes to sea-level rise

Habitat- The environment in which an organism lives.

Hydric soil- Soil that is wet long enough for anoxic (oxygenless) conditions to develop. The water in the soil forces air out. This soil is found in wetlands.

Hygrophyte- A plant that can, and often must live in water.

Mangrove forest- Wetland in tropical areas, such as the coasts of Africa, Mexico, Australia, that has mangrove trees and either fresh or salt water.

Marsh - an environment where terrestrial and aquatic habitats overlap; a wetland dominated by grasses

Nonpoint source pollution - indirect or scattered sources of pollution that enter a water system such as drainage or runoff from agricultural fields, airborne pollution from crop-dusting, runoff from urban areas (construction sites, etc.)

Omnivore - any organism that eats both plants and animals

Organic material- Anything that is living or was living; in soil it is usually made up of nuts, leaves, twigs, bark, etc.

Organism- A living thing.

Peat- Organic material (leaves, bark, nuts) that has decayed partially. It is dark brown with identifiable plant parts, and can be found in peat lands and bogs.

Persistent emergent plant- Species of plants whose stems show above the water and do not deteriorate when the plant goes dormant (e.g. cattails).

Pollution- Waste, often made by humans, that damages the water, the air, and the soil.

Precipitation- Rain, sleet, hail, snow.

Predator - an animal that lives by capturing other animals for food

Prey - an animal that is killed and eaten by another animal

Producer - any organism that is capable of producing its own food, usually through photosynthesis

Rhizome- A special underground part of the stem of a plant form which may grow new plants.

Riparian forest- A *swamp* that is narrow in width and runs along the shore of a river or stream.

Runoff- Rainwater that flows over the land and into streams and lakes; it often picks up soil particles along the way and brings them into the streams and lakes.

Salinity- The amount of salt in water.

Salt marsh- Flat land that is flooded by salt water brought in by tides; it is found along rivers, bays, and oceans.

Saltwater- Water with salt in it, such as in oceans.

Saltwater intrusion - the invasion of freshwater bodies by denser salt water

Saturation- the condition in which soil has as much water in it as it can hold.

Scavenger - an animal that eats the dead remains and wastes of other animals and plants

Silt- One of three main parts of soil (sand, silt, and clay); silt is small rock particles that are between .05 mm and .002 mm in diameter.

Submerged aquatic vegetation- Plants that live entirely under water.

Subsidence - a gradual sinking of land with respect to its previous level

Swamp- A wetland that has trees and shrubs.

Top soil- The top layer of soil; it is full of organic material and good for growing crops.

Water table- The highest level of soil that is saturated by water.

Watershed - All the water from *precipitation* (snow, rain, etc.) that drains into a particular body of water (stream, pond, river, bay, etc.).

Wetland- Land that is saturated with water and which contains plants and animals that are adapted to living on, near, or in water. Wetlands have special hydric soils and are usually located between a body of water and land.

Ground water

Water beneath the earth's surface, often between saturated soil and rocks. This water supplies wells and springs from which millions of people depend especially in rural areas. Ground water also refers to water that occurs below the surface of the Earth, where it occupies spaces in soils or rock layers.

Water table

Surface of a body of underground water below which the soil or rocks are permanently saturated with water.

The water table fluctuates both with the seasons and from year to year because it is affected by climatic variations and by the amount of water used by vegetation, evaporation from land, water and plant surface. It also is affected by withdrawing excessive amounts of water from wells, streams and springs.

Hydrology

The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydrological cycle

Hydrological cycle is the succession of water movement from the atmosphere to the earth and return to the atmosphere through various stages such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration

Precipitation

Rain, snow, or hails, all of which are formed by condensation of moisture in the atmosphere and fall to the ground/earth’s surface.

Watershed

It describes an area of land that drains down slope to the lowest point. In a watershed water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways include streams and rivers, which become progressively larger as the water moves downstream.

Wetland Catchment area

The entire geographical area drained by a wetland and its streams or river system; an area characterized by all surface water runoff being conveyed to the wetland system.

Water pollution

A change in the chemical, physical and biological quality or characteristics of water that is harmful to its existing, intended, or potential uses. (For example, drinking, cooking swimming, the consumption of fish, and the health of aquatic organisms)

The term “water pollution” generally refers to human-induced changes to water quality. Thus, the discharge of potentially toxic wastes and chemicals or the release of wastewater into a nearby water body is considered as water pollution.

Sewage

Water-carried wastes, in either solution or suspension, that flows away from a community, home, industry or any other institution. Also known as, wastewater characterized by distinct physical condition, chemical constituents, and bacteriological organisms. Depending on its origin, wastewater can be classified as sanitary, commercial, industrial, or surface runoff.

Pathogens

Microorganisms (e.g., bacteria, viruses, or parasites) that can cause disease in humans, animals and plants.Also refered to as a disease causing organism or an infectious agent that causes illness to its host

Waterborne diseases

Diseases caused by pathogenic 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 disease through consumption of the same microorganisms.A waterborne disease can be caused by protozoa, viruses, bacteria,

and intestinal parasites. (Examples include; Diarrhoea, Dysentry, Cholera,Trachoma,Typhoid e.t.c)

Ecological succession

The gradual and orderly process of change in an ecosystem brought about by the progressive replacement of one community by another until a stable climax is established. It is also referred to as the gradual process incurred by the change in the number of individuals of each species of a community and by establishment of new species populations that may gradually replace the original inhabitants.

Wetland degradation

A process by which the vital and valuable functions of a wetland are reduced or completely destroyed.

Wetland encroachment

The act or process of converting or changing a wetland to some other use e.g. building a house/industry or gardening. During the encroachment process, a small area of the wetland is taken and then increased little by little.

Wetland Abuse

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

Environmental Impact Assessment (EIA)

A systematic examination conducted or procedure followed to determine whether or not a given project / development activity/land use in a wetland will have any adverse impact on the environment.

Biodiversity - The number of different species in a defined ecosystem. **Ecosystems** - An ecological community together with its environment, functioning as a unit.

Conservation - Preservation or restoration from loss, damage, or neglect.

Management - The act, manner, or practice of managing; handling, supervision, or control.

Authority - The power to enforce laws, exact obedience, command, determine, or judge.

Coordinated Approach - Successful coordination and collaboration by the Service means focusing multiple stakeholder resources on priority natural resource issues that benefits listed species, migratory birds, and biological integrity, diversity, and environmental health within Ecosystems.

Goals - Broad statements of direction; end results or positions to be achieved.

Government - The office, function, or authority of a governing individual or body.

Bye-law - A law or rule governing the internal affairs of an organization.

Sustainable use **- Use of resources at a rate which will meet the needs of the present without impairing the ability of future generations to meet their needs.**

Natural resources - **are naturally occurring substances that are considered valuable in their relatively unmodified natural form.**

Policy - A plan or course of action, or business, intended to influence and determine decisions, actions, and other matters.

The Ramsar convention **- The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.**

Watershed - The drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a water body.