EMT 302: ENVIRONMENT, ECOSYSTEM AND MAN (2 UNITS)

LECTURE NOTE

PREPARED BY

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ECOLOGY

Ecology is the study of living organisms in relation to each other and their environment.

The study of ecology could be in terms of plant ecology or animal ecology

Ecology can be divided into Autecology and Synecology.

Autecology is the study of one single organism in relation to its environment while synecology is the study of the community in relation to its environment.

It is the aim of plant ecology to discover the balance between plant and their environment so as to manipulate it for the achievement of desired result.

There are three levels of biological organization

- Organism (individual)
- Population
- Community

Population is the group of organism of the same type capable of inter-breeding.

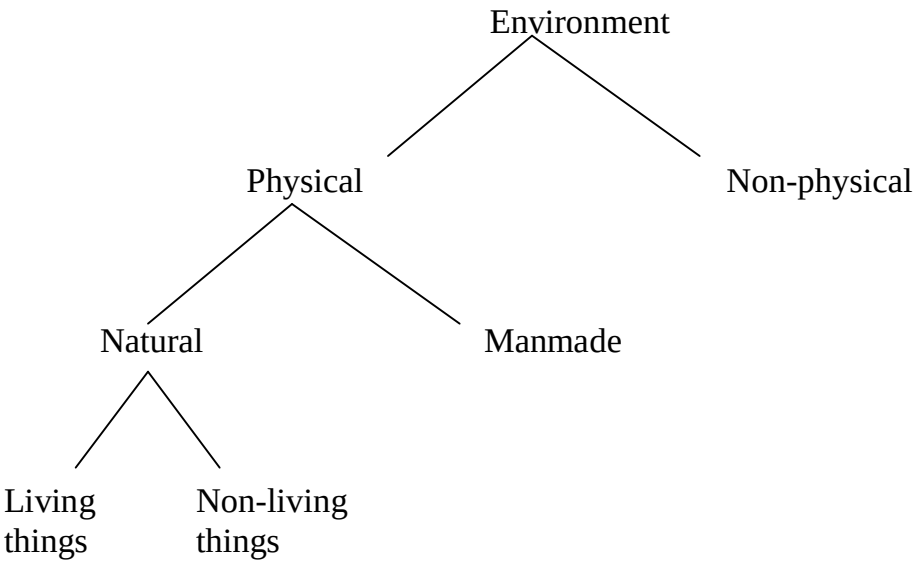
Community composes of all the population within a given habitat usually thought as inter-dependent. Community thus consists of different individual organism.

It may also contain property of similar or different organism. Attribute becomes less complex and less variable as we go from small to the large unit. For example the rate of photosynthesis of a forest community is less variable than that of individual leaves or trees within the community and understanding of the working at a level may provide an insight into the working of another level (especially a higher level but may not completely explain the working at the next level).

ENVIRONMENT

Environment embraces everything external to the organism which influence its life. It include non-livings such as climate, soil, rock and other living things present within the surrounding of the organism which influence its life.

Component of the Environment



1. **Physical components**

(a) Natural Non-living things

*Land (lithosphere)

*Water (Hydrosphere)

*Air (Atmosphere)

(b) Natural living things

* Plant

*Higher animals e.g. human beings, insects, birds and fish and also

microorganism.

2. **Non-physical component**

They include social, economic, educational, religion of individual leaves or trees within the community because if one component of the environment slows down, another may speed it up in compensation manner.

Biosphere

This is the portion of the universe in which living organism occupy. It is the largest and most self sustaining biological system.

Biosphere has been referred to as that part of the earth in which life is permanently possible and which contain all living organism. The biosphere can be divided into 4

a. Hydrosphere – ocean, sea, lakes, water bodies

b. Lithosphere – solid earth

c. Atmosphere- gaseous envelope, around the earth

d. Biota- is the sum total of all life on the earth. It is only some portion of the hydrosphere, lithosphere and atmosphere that are in direct contact with the biota that constitute the biosphere. This implies that not all aspect of the first 3 that are biosphere but the life supporting portion of these.

ECOSYSTEM

A system is simply a collection of a part that interact with one another to form a single whole. Ecosystem consist of the living community and non- living factors of the environment. It is therefore the totality of the system in which life proceed. Ecosystem is equal to living community plus non-living factors of the environment.

Ecosystem describe the interaction between the inanimate non-living environment and the community of plants and animals including the micro organism.

There is just an interplay both among the various population themselves and with the physical and non-physical component of the earth.

The functional system that results from this interplay is known as an ecosystem.

Ecosystem refers to the smallest unit of the biosphere that has all the characteristics to sustain life. It can also be described as an assemblage of populations grouped into communities and interacting with each other and their local environment.

Ecosystem varies greatly with respect to size location, weather pattern and types of animal and plant that live there.

Common to all ecosystems is a set of processes. There are 2 important characteristics of ecosystem concept:

1. It can be applied at any scale e.g a drop of water inhabited by protozoa or mosquito or a forest estate. Ecosystem vary strictly with respect to size, location, weather pattern and types. The boundary of an ecosystem is not absolute because animals may wander from one region to another; seeds are blown by mind from one place to another.
2. There is reciprocity between living component of the ecosystem. The environment affects the organism as much as the organism affects the environment.

Components of the ecosystem

There are 2 basic elements in a given ecosystem

1. Living or biotic element
2. Non-living or abiotic element

Biotic component

Living parts of ecosystem can be Sub-divided into

(a)Autotrophs: - are the green plants which are the primary producers because they are able to convert the atmospheric sunlight through photosynthesis to manufacture their own food.

(b) Heterotrophs: - they cannot synthesize their own food from sunlight and then depend on the primary producers (green plants). They are thus consumers. There are 3 levels of consumers:-

1. Primary consumers: - are the herbivores that feed directly on the primary producers. E.g Sheep, Goat.
2. Secondary consumers: - feed on the primary consumers. They are the carnivores e.g Dog, Cat.
3. Tertiary consumers:- are various carnivores that feeds on other carnivores e.g Hyena,

   Decomposers: - These break down the producers and the consumers to micro part for reservation back into the systems e.g Microorganisms.

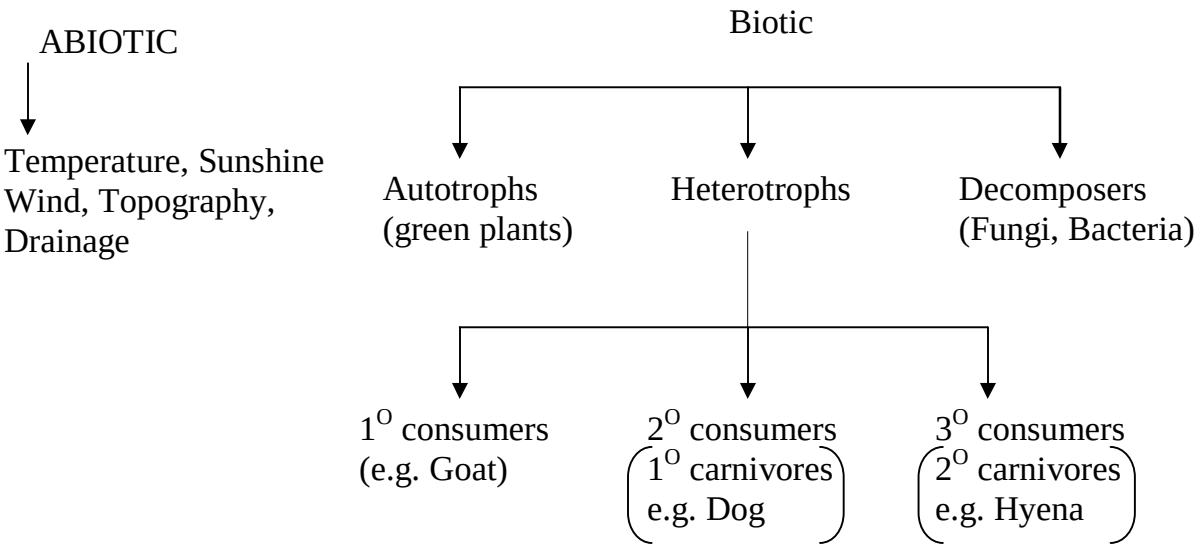
Abiotic component

Comprises the non-living, in -animate parts called physical environment.

This include

- Climate (Temperature, Humidity, Rainfall, Sunshine, Wind and Evapotranspiration)
- Geology
- Topography
- Drainage System.

Structure of Ecosystem



Environmental factors

Environmental factors can be classified into macro and micro environment.

1. Macro environment is influenced by general climate as measured by temperature, rainfall, light, topography, altitude e.t.c.
2. Micro environment is the environment close enough to the surface of the organism e.g Soil.

Macro environments can further be grouped into physical and biological factors:-

(1) Physical factors include moisture (precipitation, rainfall), Temperature, Solar radiation and soil.

a. Moisture:- The distribution in time is as important to plant growth as the total amount e.g while places in the equatorial and tropical climate may have the same annual rainfall, the former receives an equal share of the total each month while there is pronounced dry season in the latter. In effects, the 2 locations support different plants species. The same comparison can be made of Ibadan and Kaduna. The 2 places receive nearly equal annual rainfall but the extended distribution throughout the year around Ibadan makes it conducive for growth of trees than linted period of raining season as experienced in Kaduna.

b. Temperature:- influences moisture availability. At very low temperature, water is unavailable to plants and hence limits growth. At high temperature, evaporation removes a lot of soil moisture before it is absorbed by plants. Also, transpiration is increased.

c. Solar Radiation: May be absorbed, scattered or reflected back. The energy radiated back to space is called Terrestrial Radiation.

   Therefore, Net Radiation = Solar Radiation + Terrestrial Radiation.

   During the day, solar radiation is greater than terrestrial radiation hence positive net radiation. The reverse is the case during the night i.e solar radiation is less than terrestrial radiation giving negative net radiation.

   Net radiation may be –ve or +ve depending on location and time.

   Net radiation can be measured by using net Radiometer.

   Solar radiation provides 99.97 % of the energy used for various purposes in the atmosphere. Every minute the sum radiates, about 56 x 10 calories of energy of which the earth intercepts 2.55 x 10 calories. This energy is the driving force behind atmospheric and oceanic circulation. It is the energy that is used for evaporation and transpiration. It is also for warming the air and the soil, this energy is also vital for photosynthesis and hence plants productivity.

   Apart from providing a direct source of energy that man can use for various purposes, solar radiation is the ultimate source of the

conventional sources of energy now in use namely: fossil fuel, hydro electric power and wind power.

d. Light: - light energy is converted into sugar fro plants growth through the chlorophyll. Light intensity in the forest floor may range from 1-5 % of the full sunlight. Leaves developed under shade exhibit different morphological and physiological characteristics from those which develop under full light. The death of the large trees leads to the exposure of the under growth trees to light intensity.

e. Soil: - This is the part of the earth crust that has been changed by contact with living and non-living parts of the environment. Plants influences soil development by moving ions through the soil and absorbing them through the roots. Those ions accumulate in the leaves and return to the soil later. Nitrogen is also added to the soil through roots and shoots decay.

   Erosion and water loss are also prevented or reduced by plants canopy which serves as shelter. Soil development is also influences by the physical environment.

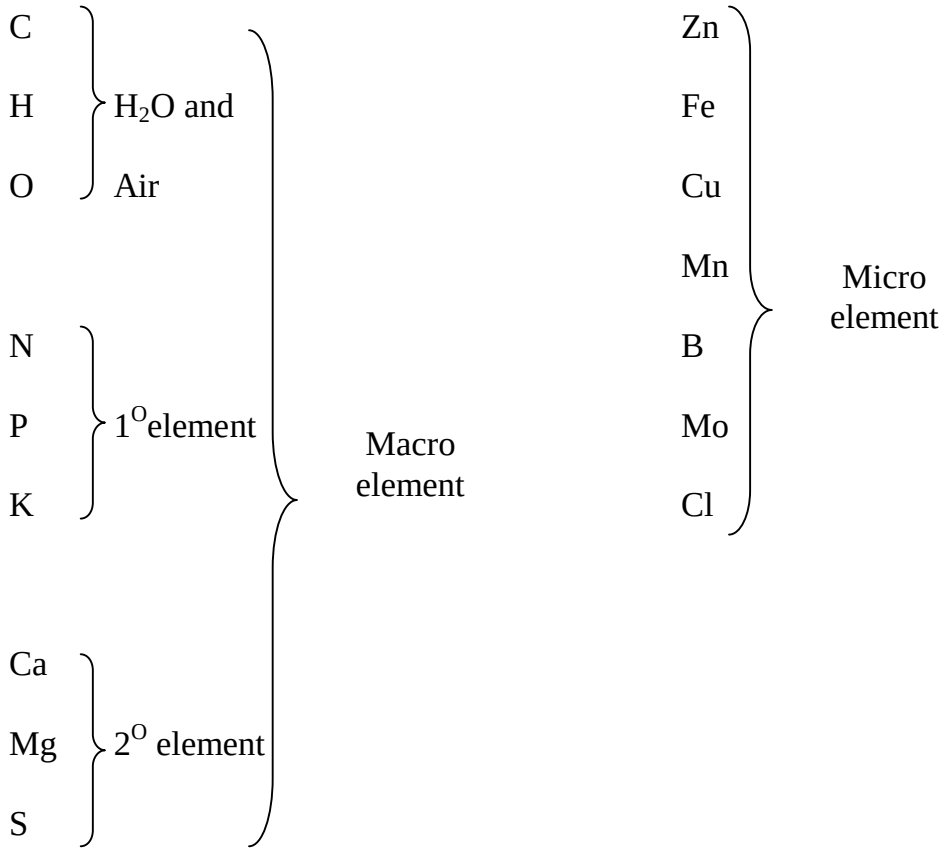
BIOCHEMICAL SALTS

Biochemical salts are essential nutrients that are very vital to the growth of living organisms. They are grouped into macro and micro Nutrients.

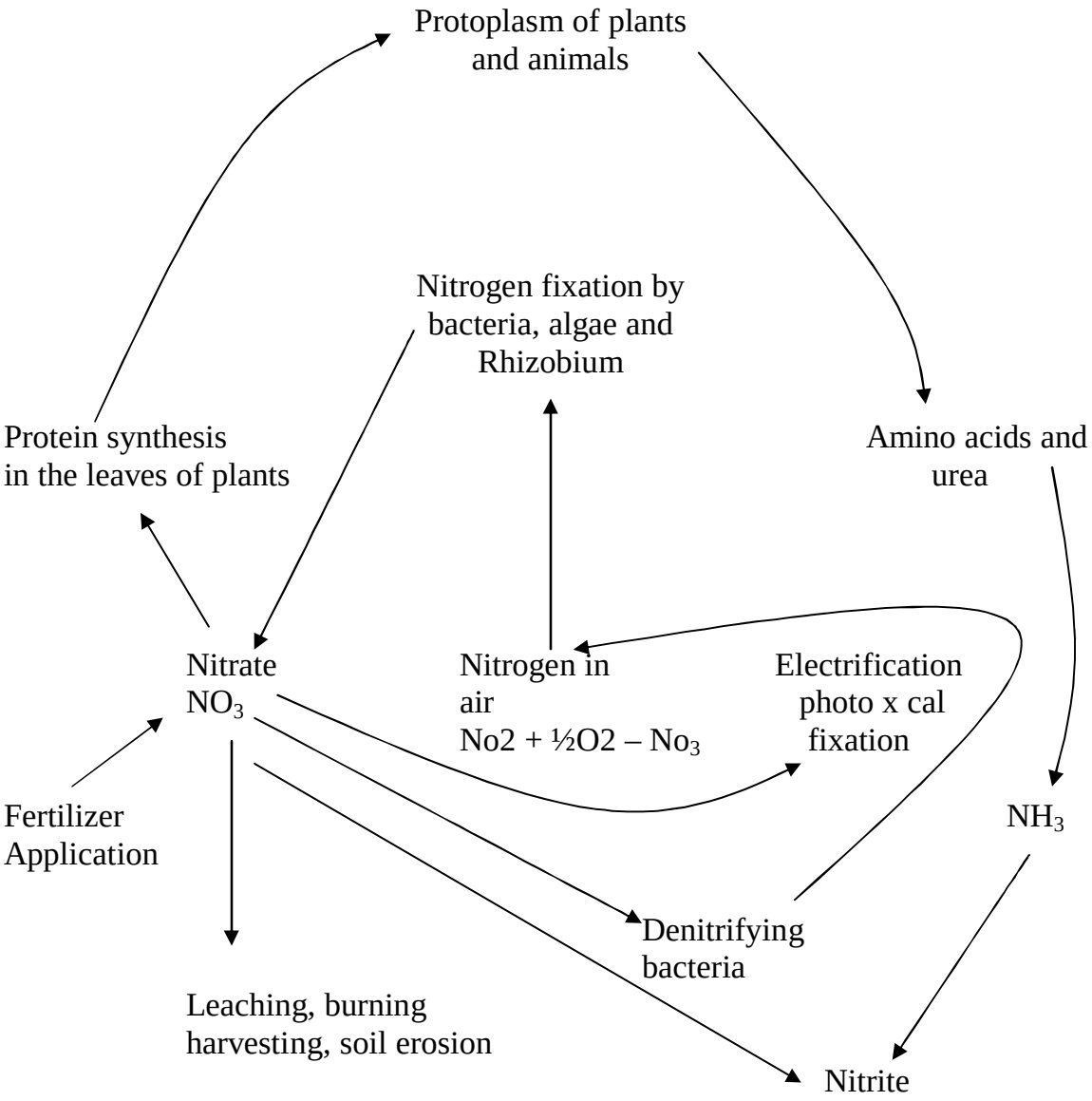
Macronutrients are essential elements required by plants in large quantity. They are the main nutrients required for plants growth. These are N, P, K, Ca, Mg and S without macro nutrients, the plants will not survive.

The micronutrients are required in very minute quantities and these are Zn, Fe, Cu, Mn, B, Mo and Cl

Note: Na, Si, Co and Se are also required in small amount to improve the yield and quantity of crops.

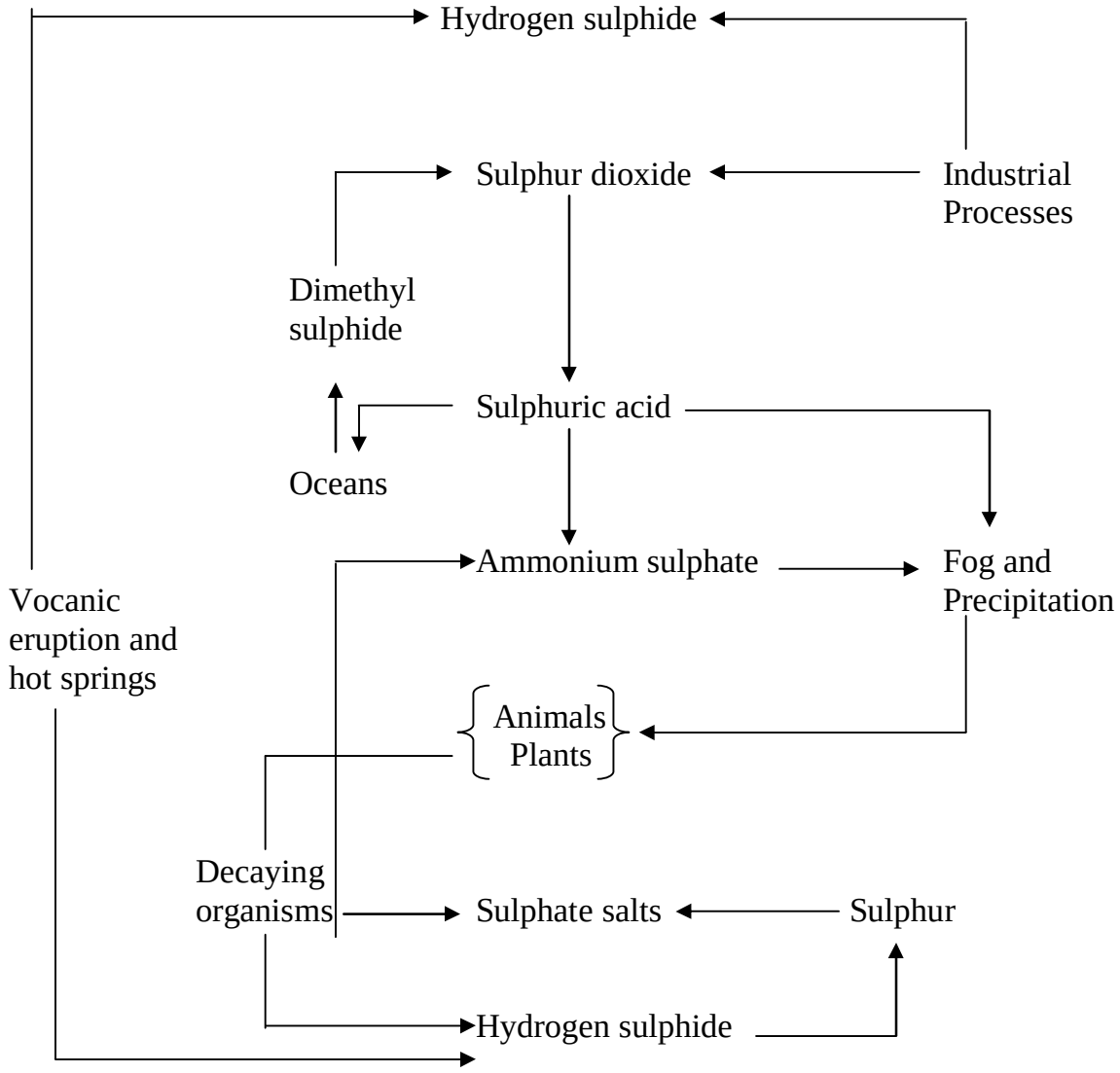


NITROGEN CYCLE



The form of nitrogen in the atmosphere is molecular nitrogen (N_2) which is very inert chemically and can be utilized by only few organisms. Nitrogen enters the system through the root of autotrophic vascular plants and through the cell wall of non-vascular plants. It is taken up in form of nitrate No_3.

SULPHUR CYCLE



Sulphur is one of the components that make up proteins and vitamins. Sulphur is important for the functioning of proteins and enzymes in plants and in animals that depends upon plants for sulphur.

Plants absorb sulphur when it is dissolved in water. Animal consume these plants, so that they take up enough sulphur to maintain their health. Most of the earth's sulphur is tied up in rocks and salts or buried deep in the ocean in oceanic sediments.

Sulphur can also be found in the atmosphere. It enters through both natural and human sources. Natural sources can be through volcanic eruption, bacteria processes, evaporation from water, or decaying organisms.

When SO_2 enters the atmosphere, it will react with O_2 to produce so SO_3 or with other chemicals in the atmosphere to produce sulphur salts. SO_2 may also react with H_2O to produce sulphuric acid (H_2So_4). H_2So_4 may also be produced from demethylsulphide, which is emitted to the atmosphere by plankton species. All these particles will settle back onto earth or react with rain and fall back into earth as acid deposition. The particles will then be absorbed by plant, decayed and are released back into the atmosphere so that the sulphur cycle can start over again.

Interaction within ecosystem

Living organism have influence on the changes and regulation of each others population density. This interactions can be interspecific or intraspecific.

A. Interspecific interaction: Interaction between different species. This include:

(1) Ammensalism and commensalism

(2) Competition

(3) Protocoperation

(4) Mutualism

(5) Parasitism and predation

(6) Defence

B. Intraspecific interaction: Interaction within specie. These include:

1. Competition
2. Territoriality
3. Social Dominance
4. Parasitism and Predation

Ammensalism

This is a non obligatory relationship where the action of one organism purposely harms or inhibits other specie. For example lactobacillus bacteria secreting lactic acid to inhibit the growth of other microbes.

Commensalisms

Is a relationship between 2 living organism where one benefits and the other in not significantly harmed or helped. For example Epiphytes sub tropical orchids use trees or branches of trees for support without harm or benefit from the tree, epiphytes obtain more light and air in this manner.

Protocoperation

Is when 2 population benefits from each other's interaction but their interaction is not essential to each others survival. E.g. fish, certain fish perform the task of cleaning other fishes by removing ectoparasites, cleaning wounded flesh and getting rid of dead flesh.

The fishes that do the cleaning are often concentrated around specific site where the other fishes come to for cleaning. These are known as cleaning stations.

Mutualism

The two organisms benefit from each other and their interaction is essential for one another's survival. This is the relationship most people think of when they use the word symbiosis. E.g. legumes and nitrogen fixing bacteria.

Competition

Interaction where 2 or more individuals compete for limited amount of resources. It also means struggling for the same thing. This becomes an important ecological factor where the population of an organism is high in relation to the available resources. E.g. competition among plant may lead to nutrient depletion. Apart from the effect on the parties, it may also lead to the extinction of the resources competed for. Where 2 or more species are in direct conflict with one another for the same resource, the one that is more efficient in obtaining the resources and translate into more effective reproduction will survive and the other will die. Competition is very important in determining plant distribution. Sometimes introduced species may become widely spread and replace native specie because they are better competitor than the native specie. For example *Chromolaena odorata*. Competition can be interspecific between different species and also it can be intra within specie.

Competition and co-existence

Interspecific competition is very important where 2 or more closely related specie are adapted to the same or similar niche. During competition, any of the following may occur

1. One of the specie may be eliminated completely,
2. One of the specie may be forced to abandon the niche for the other.
3. The 2 species may be forced to live together at reduced density by sharing the available resources.

Closely related species can also co-exist despite crowding and competition for limited resources if they differ in one or more of the following:

(1) Nutritional requirement e.g. legumes and non-legumes.

(2) Causes of mortality due to sensitivity to toxin or grazing.

(3) Sensitivity to controlling factors such as water and light.

Species that cannot normally live together in a restricted environment can adapt to co-exist by shift their niches to reduce competition pressure through physiological and behavioural changes.

Summary

(1) Closely related organisms do not often occur in the same place where they do use different energy sources or may be active at different time of the day or they occupy different niche.

(2) There is decrease in niche width when related species occupy the same region.

(3) Related species may replace one another.

Predation

This is a form of biological interaction in which an organism feeds on another. Predation plays an important part in plant distribution.

Effects of predation on the prey can lead to any of the following possibilities:

a. The predator imposing such a limiting condition on the prey that the population of the prey is reduced to extinction or neat extinction.

b. The effect of the predator may be a regulatory on the prey so that the population of the prey is kept in check i.e. not out run its resources.

c. The predator may be neither strongly limiting nor regulating.

The effectiveness of prey-predator interaction depends on

a. How vulnerable the prey is to the predator.

b. The population of each in relation to other.

c. How much energy the predator need before capturing the prey.

d. How successful the prey can avoid the predator.

Man is the greatest predator to the extent that it often kills its competitors (for the same prey). Generally speaking, predators are not beneficial to the individual prey but may be beneficial to the population as a whole.

Positive Interactions

There are generally three types of positive interactions: commensalism, protocooperation and mutualism

ECOLOGICAL NICHE

The type of organism found in a particular environment depends both on local prevailing condition and also on the geographical location. As a result, different organisms are found in different location or are adapted to a range of locations. E.g. kangaroos are found only in Australia and reptiles are common in the tropics. The ability of an organism to adapt to a particular environment for its survival is called Adaptive Radiation.

Ecological niche refers to the role the organism play in the ecosystem or the proportion of the environment occupied or utilized by each species. Niche can be regarded as resource space in which the species or organism can survive. As a result of inability of all species to respond to resource need the same way, those that cannot, do not. This situation enhances the evolution to divide the resource space to a set of niches. This is the basis for the concept of ECOLOGICAL EQUIVALENCE in which different communities in different places characterized by similar environment are often similar in their structure. The population occupying the similar adaptive condition may even be un-related. Thus cow, kangaroo, bison though taxonomically unidentical occupy the same niche in a grassland ecosystem. Within an ecosystem, different animals may occupy different niche as a result of their feeding habit.

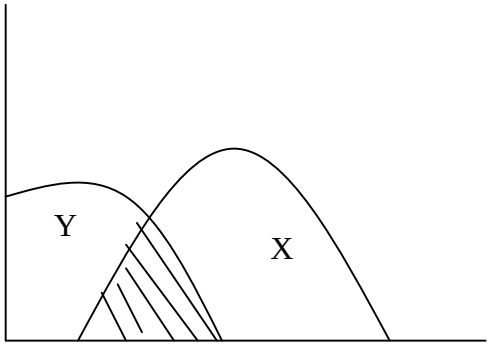
Ecological niche can be classified into:

i. Fundamental niche: This is a set of conditions within which each organism can operate.

ii. Realised niche: This is a set of conditions which organism operate.

Niche Overlap

In a particular community, the study of resources need of the different species gives an indication of the resources utilization. It is possible that 2 or more species feed on the same type of plant species, but not necessary the same part of the plant. The response of 2 population to resources gradient can be shown diagramatically



X – shoot

Y - leaves

\\\ - Niche Overlap

ECOLOGICAL TERMS

(1) **Standing crop:** The biomass existing in the system at any given time. Whereas, real biomas include both death, ill and living. Standing crop includes only the living ones.

(2) **Crop:** The total weight of organic materials removed from a given area over a period to the course of the normal harvesting practice.

(3) **Density:** Population size in relation to a unit space.

(4) **Yield:** The crop expressed as a rate (t/ha).

(5) **Birthrate or natality**: This is the rate at which new individuals are added to the population by reproduction.

(6) **Death rate or mortality:** The rate at which individuals are lost by death.

(7) **Population growth rate:** This is the net result of natality and mortality.

(8) **Dispersal:** The rate at which individuals migrate into the population or emigrate out of it.

Dispersion: The way in which individual are distributed in space.

a. **Random distribution:** In which the probability of a species occupying any one spot is the same as probably occupying another spot.

b. **Uniform distribution:** The components of the population occur more regularly.

c. **Clustered distribution:** The individuals occur more regularly than random.

d. **Frequency:** Simply refers to the number of occurrence.

BIOLOGICAL DIVERSITY

Biodiversity is the totality of genes, species and ecosystem in a region. It is simply the variation in plants, animals and microorganisms in form, structure, behaviour and distribution. Biodiversity also refers to the variety and variability among living organisms and the ecological living complexes in which they occur. A diversity can be defined as the number of different items and their relative frequency.

3-levels of Biodiversity

1. Genetic diversity
2. Species diversity
3. Ecosystem diversity

Genetic diversity is the variation between individuals within the same species due to difference in chromosomes e. g. Acalypha, Croton

Specie diversity is the variation in kind of species of plants and animals.

Ecosystem diversity is the variation in environmental condition between places. This is due to climatic factors e.g. Terrestrial (land), Ocean, Marine, Freshwater and Estuary ecosystem. Each ecosystem is different in structure and composition and there is variation between each ecosystem.

There are 3 levels of diversities. These are

1. **Alpha (α) Diversity:** This is within site diversity.
2. **Beta (β) Diversity:** This is between site diversity.
3. **Gamma Diversity:** This is the entire landscape diversity.

Richness measures the number of species in a community while evenness or heterogeneity refers to distribution of individual among species.

MEASUREMENT OF DIVERSITY

An important feature of natural biological environment is that they contain comparatively large number of species that are rare at any given point in time and space. Common species and rare species or endangered species are very important because they increase the diversity of the community.

Diversity Indices

- Simpson index (D)
- Shannon index (H)
- Berger-Parker index (d)
- Hill's N1
- Q-statistics

Each of these indexes has strength and weaknesses. Biologists often use the combination of several indices to take advantages of the strength each and develop a more complete understanding of community structure.

Simpson's Diversity (D) and Equitability (E_D)

A diversity index is a mathematical measure of species diversity in a community.

Diversity index provides more information about community composition than simply species richness (i.e. the number of species present). They also take the relative abundance of different species into account.

Consider 2 communities of 100 individuals each and composed of 10 different species. One community has 10 individuals of each species; the other has one individual of each of nine species and 91 individuals of the 10^{th} species. Which community is more diverse? The first community is more diverse but both communities have the same species richness. By taking relative abundances into account a diversity index depends not only on species richness but also on the evenness or equitability with which individuals are distributed among the different species.

Importance

Diversity indices provide important information about rarity and commonness of species in a community. The ability to quantify diversity this way is an important tool for biologists trying to understand community structure.

Specie	+	Specie	+
1	10	1	1
2	10	2	1
3	10	3	1
4	10	4	1
5	10	5	1
6	10	6	1
7	10	7	1
8	10	8	1
9	10	9	1
10	10	10	99
	100		**100**

Variables

D - Simpson's Diversity Index

S - Total number of species in the community (richness)

Pi - Proportion of S made up of that ith species

ED - Equitability (Eveness)

$$D = \frac{1}{\sum Pi}$$

$$ED = \frac{D}{Dmax} = \frac{1}{\sum Pi^2} \times \frac{1}{S}$$

NOTE: Equitability takes a value between 0 and 1, with 1 being complete evenness. Less than 0.5 means that it is not evenly distributed and above 0.5 means even distribution.

Shannon Diversity Index (H)

Is commonly used to characterize species diversity in a community. Like Simpson Index, Shannon Index account for both abundance and evenness of the species present.

$H = - \sum Pi \ln Pi$

$E_H = \frac{H}{Hmax}$ where $Hmax = \ln S$

$E_H = \frac{H}{\ln S}$

H = Shannon's diversity index

S = Total number of species in the community (richness)

Pi = Proportion of S made up of the ith species

E_H = Equitability (Evenness)

NOTE: Equitability assumes a value between 0 and 1 with 1 being complete evenness.

Ecosystem

Terrestrial Ecosystem has variations in their properties due to physical environmental factors such as climate, soil, topography etc. These variations lead to diversity in the communities and the ecosystem unlike the aquatic ecosystem where water dictates the tune of the habitat. Terrestrial ecosystem is a 3-phase system.

a. **Atmosphere:** It provides the oxygen for animal, and CO_2 for plant, both of which circulate well and seldomly limits plants and animal growth.

b. **Climate:** This is more variable in the terrestrial ecosystem than the aquatic ecosystem. For instance, rainfall is not predictable and so water availability.

Temperature is also more variable than in aquatic ecosystem. Temperature is controlled by absorption of heat by soil, rock and vegetation.

c. **Soil:** Soil performs two functions

a. Supporting living organisms

b. Source of essential nutrients for the plants.

It is also a site for detritus food chain and it is central to biogeochemical cycling of nutrients.

In the terrestrial ecosystem, soil varies both in physical and chemical properties from place to place.

Types of Terrestrial Ecosystem

There are many varieties but there is hardly any clear cut boundary from one type to the other. However, some species are adapted to the same habitat based on similarities in their

1. Composition
2. Structure

and thus can be classified as types of ecosystem. The basic ecosystem types are called BIOMES. Each biome tends to be distributed in areas of similar geographical characteristics. These characteristics are significant in identifying the differences and similarities between communities.

Biomes have been classified based on different criteria. The basic unit of classification is plant Association.

Plant Association is an assemblage of plant with definite composition and uniform appearance growing under uniform habitat condition.

Terrestrial ecosystem type can be grouped to

- Tropical
- Temperate
- Tundra (cold region)
- Desert

Plant Assemblage

- Forest
- Savannah
- Grassland
- Desert

Terrestrial Ecosystem Types

(1) Tropical rainforest

(2) Sub-tropical rainforest

(3) Tropical seasonal forest

(4) Tropical savannah

(5) Temperate rainforest

(6) Temperate deciduous forest

(7) Boreal conifer forest

(8) Temperate Evergreen Woodland

(9) Thorn Woodland and Scrubland

(10) Temperate Grassland

(11) Desert

(12) Tundra

Tropical Rainforest

Occurrence

General characteristics

This is the most complex and diverse forest on earth. It is also the most luxuriant and productive in terms of gross organic matter. It is found between $23^{O}30^{1}$ N and S Latitude and below 100 m altitude.

There are 3 important regions of tropical rainforest.

(1) American tropical rainforest located in South America especially the Amazon in Brazil and Mexico.

(2) Malaysian rainforest found in the South East Asia, Borneo, Malaya, Sumatra, Phillipines and South West India and Eastern Coast of Australia.

(3) African rainforest found along the Atlantic coast, Congo Basin, Malagasy and Pockets of it in East Africa.

General Characteristics

(1) The plants are luxuriant and productive.

(2) Animals are abundance and diverse.

Although, the number of large mammals may be small, there are definitely more species of vertebrates especially birds and insects in this biome.

(3) The mean daily temperature seldomly exceeds $13^{O}C$ and its more or less constant throughout the year.

(4) Precipitation is usually high about 2000 mm. Precipitation exceeds evapotranspiration so that shortage of soil moisture does not seasonally inhibit plant growth.

Aquatic Ecosystem

Aquatic ecosystem is a one-phase ecosystem in which water dominates the entire habitat as medium of all nutrients for aquatic life. Water is also a medium for organic and inorganic waste. The amount of energy reaching any aquatic community depends on how much light can be absorbed by the water.

In addition, the heat property of the water controls the circulations pattern within the ecosystem.

Generally, aquatic ecosystem classification is based on the salinity or the amount of the materials dissolved in the water.

Aquatic Ecosystem Types

1. Marine ecosystem
2. Fresh water ecosystem
3. Estuary
4. Hyper salinity

Element in Aquatic Ecosystem

In sea water, there are about 92 naturally occurring elements. In fresh water, there are fewer elements. Important elements are Na, Mg, K, Ca, Cl, e. t. c.

Cl has the greatest concentration followed by Na. In determining the salinity of water, the concentration of chlorine is used.

Sources of the above named elements in the seas include

(1) Rock weathering

(2) Decay of organic matter

(3) Atmosphere

Marine Ecosystem

There are more ecological zones in marine ecosystem than freshwater.

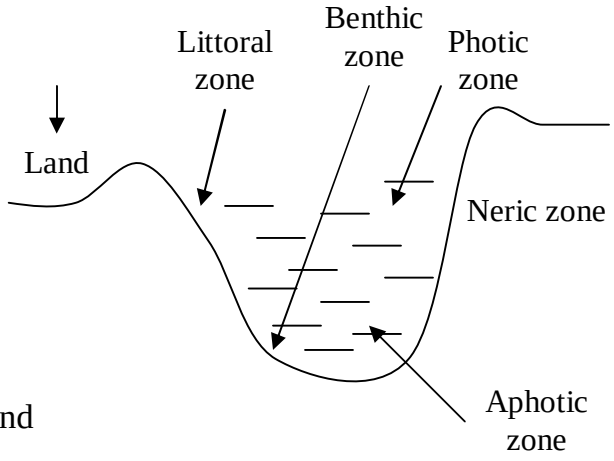
Marine ecosystem has about 35 % salinity e.g. The Ocean. This comprises more than 99 % of the earth's surface water.

Zone of ecological activities

1. - Neric Zone
   - Littoral zone
   - Benthic zone
   - Aphotic zone
   - Photic zone

   The Neric zone is near the land

LATERAL DIVISION



2. Pelagic zone (open water)
3. Inter tidal zone (near the beach)
4. Sub-littoral zone (where aquatic plants are found)
5. Continental shelf (shallow part where fishing activities concentrate)

Vertical Division

1. Epipelagic (near the surface)
2. Mesopelagic (middle)
3. Bathpelagic (near the bottom)
4. Abyssopelagic (the bottom of the ocean)

Fresh Water Ecosystem

Constitutes about 1/5 % of the aquatic ecosystem and it consist of lake, rivers and streams. It can be divided into:

1. Littoral zone: This is near the bank where aquatic plants are found e.g. water lily.
2. Photic zone: This zone receives enough light penetration to enhance photosynthetic activities. The depth of photic zone is determined by the turbidity of that zone Narrow photic zone affects the rate of photosynthesis, hence low number of aquatic plants and animal leading to little organic productivity.
3. Aphotic zone: There is virtually no light penetration.
4. Benthic zone

Fresh water ecosystem can be classified according to temperature into

1. Epibinmon Epilimnion
2. Thermoline Thermolimnion
3. Hypolumnion Hypolmnion

Epibinion is about 30 ^{O}C with a depth of up to 10 cm. Generally, temperature decreases with time. Thermoline is a region of variable temperature. Hypolimnion is the zone below the thermoline.

Estuary is the transition between marine and fresh water ecosystem e.g. Greeks.

Hypersalinity: There is increased amount of saline salinity is greater than that of the ocean e.g. salt lakes in the arid region (Dead sea).

ECODEVELOPMENT

Ecodevelopment is used to describe a form of planned growth that uses locally available resources within the constraints or limit of the local environment.

Strategies of Ecodevelopment

(1) In each region, effort must be made to exploit the specific resources so as to meet the basic needs of the population (food, clothing, shelter).

(2) Ecodevelopment must contribute to the improvement of the human life since man is regarded as the most precious resource.

(3) Identification, utilisation and management of natural resources must be done to take cognizance of the future generation.

(4) Minimization of or reduction in the negative impact of human activities on the environment.

(5) Ecodevelopment depends on the natural ability of a region to convert the solar energy to photosynthesis (food).

(6) Ecodevelopment implies innovative, technological style.

(7) Institutional frame work of ecodevelopment must take advantage(s) of potentialities of poor masses of developing countries by providing necessary impetus consistent with economics and ecological peculiarities of the situation.

Alteration of Environment for Development Purpose

As human beings affect their environment through their various activities, the environment also affects them. These effect may be +ve or –ve. The effect of development project on the environment can be categorised into 2

1. Those with direct impact on the environment e.g. Building and construction work.
2. Those with direct effect on natural resources vis-à-vis the environment e.g. Exploitation, processing and utilization of natural resources.

There is need to promote the +ve effect of our action on the environment so as to ensure sustainable utilization of the resources

Case Study

Effect of forest loss

The effect of the removal of vegetation cover can lead to the following:

1. Changes in regional climate
2. Changes in biological productivity
3. Accelerated soil erosion
4. Destruction of water shed stability
5. Increased emission of green house gases
6. Loss of biological diversity.