ECOLOGY

Ecology is defined as the study of relationships between living organisms towards one another and with their surrounding environment.

There are two types of ecological studies

(i) Autecology

(ii) Synecology

(i) Autecology

This is the study relationships between an organism and its environment eg studying a zebra.

(ii) Synecology

This is the study of the communities and their environment ie it involves the study of more than one species and their interaction in an area.

The study of ecology is significant in the following ways

- Applied in the field of agriculture, forestry and fisheries
- To predict incidences of pollution and how they can be prevented
- To understand the consequences to the environment of construction of dams, reclamation of swamps and wetlands, construction of infrastructure like roads, bridges and urban development
- In application of biological conservation methods.

ENVIRONMENT

This refers to all the conditions in which an organism lives such conditions include; temperature, water, light and other organisms.

Ecology can be broadly studied at various levels which include the following

a) species
b) community
c) population
d) ecosystem
e) biosphere
f) Biome
g) Habitat
h) Niche.

a Species
This refers to a group of organisms with similar characteristics which are capable of interbreeding to produce fertile offsprings

b Population
This refers to the number of organisms of the same species living in an area for a given period of time.

c Community.
Refers to the organisms of different species living together and interacting in a given area.

d Biosphere.
This includes all living organisms and the physical environment with in which they interact. It is the largest part of the planet which is occupied by living organisms. The biosphere is often divided into geographical regions known as Continents of the world. The geographical regions include Africa, Europe, North and south America.

e Biomes.
Refers to a region with in the biosphere with its unique set of conditions where specific types of animal species and plant species are adapted to live.
The biomes of the world include. Tropical rain forests. deserts, tropical savanna, deans etc.
The biomes are divided into smaller units called Zones eg tropical rain forests are divided into. The ground zone and canopy zone.
Habitats.
With in each biome are habitats.

f Habitat.
Is a specific locality with a particular set of climatic.
Conditions to which communities of organisms get adapted eg fresh water ponds, stream etc.
Habitat is further divided into; micro habitat each with its only particular condition.

Ecological Niche:

This is defined as an area where an organism lives and the entire way of life and roles played in the community.

A niche of an organism in the absence of predators is called fundamental niche. and its niche in the presence of the predator and other competitors is known as Realised niche.

Organism's environment; This refers to all the conditions in which organisms live and has two broad components namely:

- Biotic } components.
- Abiotic }

ABIOTIC COMPONENTS:

This is the physical and non-living component which contains matter and energy.

BIOTIC COMPONENTS:

Is the living component of the environment. Both abiotic and biotic components affect the distribution and abundancy of organisms in different ways in different habitats

Abiotic factors affecting distribution and abundancy of organisms

The main abiotic factors include the following.

Temperature, water, light, humidity, PH, mineral salts, topography / altitude and soil (Edaphic factors).

1. Temperature -

Is the measure of amount of heat in an environment.

It majorly affects the activities of enzymes when catalyses various physical activities both both photosynthesis, respiration, fruit and flowing in plant:

Optimum temp of 35° to 40°C favour increase in enzyme activities which double for every 10°C rise while extreme temperatures for below and above the optimum lower enzyme activities due to inactivation and denaturation of the enzymes respectively.

In aquatic system, high temp lower the concentration of dissolved O_2 while low or optimum temp increase the concentration of dissolved O_2.

Most organisms tend to be more abundant and having a big population size in habitats with relatively stable and optimum temps and less abundant in habitats with extreme temperature.

2. Water:

Water availability is essential for the process of growth and development of plants and animals.

Increased water content in the soil increases plant growth and population size and more food is available for the primary consumers. This will increase their population size. Most organisms are more abundant in areas with good water systems as then areas where water is scarce.

Significance of water to organisms

✓ Dispersal of seeds and fruits

✓ Habitat for aquatic plants and animals.

✓ For plant growth because essential mineral salts are carried to the plant when they are dissolved in water

✓ It is for seed germination.

✓ Regulate body temperatures in plants and animals.

✓ It is a raw material for photosynthesis

✓ It is a medium for most metabolic reactions

3 Light

The presence of light favours the growth of plant population through the process of photosynthesis. Most primary producers will highly support the survival of primary consumers and this will support the survival of many animals

Effect of light on the ecosystem.

The presence of l

Effect of light on the ecosystem.

* positive effects

✓ provide energy for photosynthesis, transpiration and for stomata opening

✓ It provides Vision / sight

✓ Regulate the Internal body temperature.

✓ Stimulate growth of leaves, Internode growth and synthesis of Chlorophyll.

✓ Stimulates flowering and fruiting

✓ Stimulates breaking of seed dormancy

✓ Stimulates the formation of vitamin D in animals.

* Negative effects

* Provides visibility which enables predation to occur

* Increased temperatures reduce the concentration of dissolved oxygen in aquatic environments thereby affecting the lives of aquatic animals.

* Excessive light bleaches chlorophyll molecules leading to in

* Radiations of less energy than red light are absorbed by water bodies leading to increased temp of water which causes some organisms to migrate.

* Ultraviolet light causes skin cancer.

4. Humidity

This is the amount of water vapour in the atmosphere

High humidity lowers the rate of evaporation of water from the surfaces of organisms. In plants, the rate of transpiration is reduced and this encourages water conservation.

Low humidity promotes high rate of evaporation and ensures H_2O loss.

5. PH

This is the acidity or alkalinity of a given medium.

It influences the distribution of plants in soil and fresh waters

Some plants thrive in acidic conditions eg Tobacco is distributed more in acidic soils while others are distributed more in alkaline soils.

6. Mineral salts.

These particularly affect the distribution of plants in the soil.

Sources of mineral salts in aquatic environment include the following.

- ✓ salts that dissolve in rain water are carried into the water bodies
- ✓ Minerals deposited into the waterbodies by run-off water washed down from neighbouring land masses.
- ✓ Dust particles carried into the water bodies
- ✓ From dissolved
- ✓ From dissolution of minerals from the underlying rocks in the waterbodies

✗ In the terrestrial environments the mineral salts can be obtained in the following ways

- ✓ weathering of the rocks
- ✓ Use of fertilizers on agricultural land

- From pesticides and insecticide sprays.
- Nitrification process and nitrogen fixation by nitrogen fixing bacteria.
- Decomposition of organic materials

7. Salinity

This refers to the salt content of a given aquatic environment. It influences the distribution of estuarine animals. These have special physiological or behavioral adaptations to withstand fluctuations in salinity

8. Topography / altitude.

This refers to the altitude of the slope of a place. Topography causes differences in illumination, moisture and temperature. These differences cause differences in the distribution of living organisms eg. the population size of organisms on the side well illuminated will be greater than on the side not well illuminated

This is because of better climatic conditions on the illuminated side.

At high altitudes, the population size of organisms and number of species of organisms is low. High altitudes have unfavourable climatic conditions and these include cold temperatures, low oxygen partial pressure and atmospheric pressure. This reduces plant growth and reduces plant population and providing little food for other organisms and the population size is low.

9. Background.

This is the over all colouration of the environment in which particular organisms live. Population size is high and organisms are well distributed where the organisms resemble the background because they can camouflage and survive selective predation.

one the other hand, population size is low and organisms are scantly distributed where: they do not resemble the environment such organisms cannot camouflage and are easily supported by predators and consumed at higher rates.

10. SOIL Factors.

This is a complete mature of inorganic, organic mater and decaying matter that occurs above the earth's crust The soil factors affecting plants and animal life are refered to as Edaphic factors.

Soil is an important factor for plants in the following ways eg

- provides water and mineral salts.
- Provide support / anchorage for plants.
- Habitats for some animals eg Anelids like earth worm, beetles, insects etc.

Edaphic factors affecting population size and distribution of plants and animals.

① Soil micro organisms; These include bacteria and fungi

* They affect the lives of organisms in the following ways.

✓ Cause rapid decomposition of organic matter in the soil releasing nutrients that promote plant growth

✓ Increase soil aeration since the process of decomposition releases gases and more room for air is created.

✓ Breaks seed dormancy promoting plant growth

✓ Promote nitrogen recycling by working as nitrogen fixing organisms.

② Soil matrix

③ Soil moisture

This can achieve the following;

- Dissolved mineral salts in the water so that they are rapidly absorbed and utilized by the plants.
- Activate the process of seed germination.
- High water content of the soil lowers rate of absorption of mineral salts, reduces aeration and decomposition of organic matter and some plants may dry up in conditions of water logging.

④ Soil texture

Is the proportion of sand and clay particles that affects drainage and water retention in soils determining survival of plants.

6. Soil temperature.

It influences physical chemical and biological process A physical process affected is soil formation, chemical process is decomposition while the biological process affected by temperature is Respiration, seed germination and activities of micro organisms.

At optimum temperatures of 35 - 40°C, the physical, chemical and biological process are increased while at temperature below or above the optimum are negatively affected.

Soil temperature also affects water content of the soil, the humus content and the vegetation cover of the soil.

7. Soil PH.

It affects the following

(i) Activities of nitrifying bacteria and other soil micro organisms

(ii) solubility of solutes such as Fe^{2+}, Fe^{3+} etc.

Rhomans 12 : 2

(iii) Vegetation distribution of some crops is some plant prefer acidic conditions while others alkaline.

8. Soil aeration.

(s the amount of air in the soil and its is determined by the following factors.

(i) Number of air spaces in soil.
(ii) Size of air spaces in soil.
(iii) Water content of the soil.
(iv) Humus content of the soil.

Importance of soil

- For seed germination.
- For respiration of soil microorganisms.
- Respiration of plant roots.
- Decomposition of organic matter.

9. Fire

This is another important factor that can affect the population size and distribution of plants and animals.

CAUSES OF FIRE.

Human intention; In tropics, pastoralists are known to start fire in order to clear the old unpalatable vegetation to pave way for the new young soft palatable vegetation.

Natural Causes; This is brought about by lightning, volcanic activity, extreme high temperatures in some cases. These conditions spark off fire naturally in many forests and grass land.

Aspects of fire as an ecological factors.

- It is a source of fire; Fire can be wild ie fire whose source is unknown or prescribed ie fire whose source is well known and often set by ecologists on some shedule.
- Season of burn; They can be clearly burnt ie fire whose source is unknown
- season of burn; They can be clearly burnt ie set at the beginining of the dry season season or late burn ie set at the end of the dry season.
- Fire intensity; This is the heat content of the fire and depends on the type of fuel, amount of fuel present, environment temperatures.
- Fire fireguency; Refers to the number of times per year an area is burnt. The seasons for burning the rotation of a suitable freguency include the following

Removing the top old vegetation paving way for fresh young and palatable vegetation.
To prevent accumulation of litter which could harbour pests.
It can be applied to enhance weeding.

Advantages of fire.
It improves soil fertility whereby the burnt plant materials add organic matter into the soil.
It destroys pests and parasites.
Improves visibility of animals in bushlands which is important for predation predator prey relationship.

Disadvantages
It leads to soil erosion as it removes the top vegetation on the soil surface leaving the land bare and prone or susceptible to agent of soil erosion.

- Destroy the soil micro organisms and slow moving animals like snails.
- Destroy crops which are food sources to many organisms thereby disrupting food chains and web.
- Destroys the habitats of living organisms.

BIOTIC ENVIRONMENTS.

This is the living component of the environment and it is made up of all the other organisms interacting together. These include the following.

(1). Predation: A predator is an organism which hunts, attacks and feeds on other animals. The animals which are feed on are called the prey. In this case, the ofest distribution and prey are related.

Predators are found where there are suitable prey eg. Cannibals only found in areas where there is suitable prey.

Predation is an interspecific relationship where only one organism benefits while the other loses out.

2. Competition

Is a relationship where two or more species of organisms try to struggle to obtain the same limited natural resources.

Organisms of different species frequently compete with one another for natural resources such as food, mates etc.

The relationship is harmful to the both species because they are unable to exploit the resources as fully as they would in absence of competition

Competition among organisms may cause starvation or death and migration to occupy other habitats. these reduce the population size in an area.

Competition is divided into two types namely Interspecific competition and intraspecific competition
i) Interspecific competion is one that exists between organisms of different species while Intraspecific competition is that existing between organisms of the same species

ECOLOGICAL SIGNIFICANCE OF COMPETION -
It leads to colonisation of wide range of habitats
A better quality and better adapted species of organisms develops since selection pressure tends to favour only better competitors over the weaker competitors.
It has unabled organisms of the same closely related species to evolve into different species of organisms in order to occupy different ecological niches.

3: Parasitism: This is the relationship between organisms of different species where one organism called the parasite live on or in another organism called the host where it obtains all its nutrients and shelter while the host organism does not benefit at all from ~~that's~~ this relationship and even may be harmed the parasite benefits from the relationship -

Ecological significance of host - parasite relationship -
✓ Leads to rapid production of the offsprings of the parasite since the immune defence responses of the hosts tend to destroy many of the parasites
✓ Development of resistant stages in a life cycle of a parasite to survive under harsh environmental conditions eg the eggs of round worms can stay in the soil for a period of two years.

✓ Many parasites occupy strategic locations in the host to ensure maximum utilization of available resources which increases their chances of survival eg the gut parasites are found in the Duodenum and ileum where soluble products of digestion are formed while liverflukes are found in the liver where end products of digestion are stored.

✓ It influences the distribution of parasites eg tsetse flies can be found in areas with grazers like cattle and buffaloes.

✓ Parasites can be used as biological control agents to eradicate harmful organisms.

4. Mutualism: Is the close association between organisms of different species where both organisms benefit from the association eg the lichen which is an association of algae and fungi. Algae are photosynthetic and provide food (carbohydrate) and oxygen for aerobic respiration to the fungi while the fungi offer shelter and protection to the algae. The fungi also absorbs water and mineral salts for the algae.

5. Commensalism: Is an interspecific association whereby one species of organisms benefit and the other species neither benefit nor loses or harmed eg Epiphytes and most plants, vectors and pathogens they carry, white egrets and buffaloes.

6. Camouflage: This is where some animals possess body colourations that resemble closely the colour pattern of their environment so that they are not easily sported by their predators and successfully hide or closely resemble parts of a plant.

This offers protection against predation. In such case the plant species concerned form the most important part of the insect bird's environment. Most organisms would prefer to stay in habitats with a background resembling the colour patterns of their bodies.

7. Mimicry: This is where some animals resemble other harmful or unpalatable animals to predators in order to escape predation. The unpalatable species generally possess markings or dest distructive colours. Predators learn to recorganise these signs and avoid attacking this particular species.

8. Human influence; This is the most powerful biotic factor in influencing the size and distribution of organisms in the environment. Human interaction with other species of organisms can affect their distribution and abundance with in certain habitats.

Man achieves this through his work of cultivation of crops, bush burning, reclamation of wetlands and swamps, industrialisation and urban development. Man can change habitats and create new ones.

9. Predator - Prey relationship

This is the interspecific association whereby the predator hunts, captures, kills and feeds on another organism called the prey.

The biological significance of predator prey relationship

- It determins the distribution and abundancy of prey and can be applied in the biological pest control.
- It may result in evolution of new species and may lead to dispersal of fruits and seeds since it involves movement of organisms from one place to another.

Advantages of predator prey relationship.

To the predators

- There is availability of food for the predators.
- It leads into existance of better adapted speaes of the predators.
- Intraspecific competition determinates the less adapted organisms.
- It leads to formation of new species with better adaptive features.

To prey

- It lowers the level of intraspecific competition.
- Decreases over crowdness among the prey species.
- Food resources, breeding sites and natural habitats become sufficient.
- Selection pressure exerted eliminates the less adapted and a better adapted species evolve.
- Colonisation of new ecological niches/localities occur.

ECOSYSTEM.

This is ecological system comprising the biotic assemblage of plants, animals and microbes, functioning together with their abiotic environment. An ecosystem differs from a community in that the latter embraces only a set of interacting organisms and concerns itself only with biotic relationship.

The development of an ecosystem concept is as a relationship result of the study by an ecologist who found out that the most important of the factors holding plant communities together was the physical habitat hence the ecosystem became the basic functional unit since it includes both organisms and the abiotic environments each influencing the properties of the other and both necessary

for maintainance of life therfore the ecosystem study concerns energy flow nutrient cycles.

All ecosystems are ecosystems ie there is necessary inflow and outflow of materials.

Examples of ecosystems include;

- Natural ecosystem
  - Terrestrial eg forest, grassland, desert
  - Aquatic
    - Freshwater
      - Moving water (Lotic) eg rivers, spring stream
      - Standing water (Lentic) eg lakes, pond
    - Marine eg oceans, seas,
- Artificial ecosystem (man made eg agroecosystems

They are diverse in types from small to large, terrestrial to aquatic fresh water to marine etc. Despite the unique combinations of particular abiotic and biotic components in any particular ecosystem, there are general structural (components) and functional (processes) attributed that are distinct.

THE STRUCTURE OF THE ECOSYSTEM

The trophic structure of an ecosystem is too layered and has.

(i) Autotrophic upper stratum. This is composed chlorophyll containing plants or plant parts able to fix light energy

and use of simple inorganic substances to build up complex organic substances.

ii) Heterotrophic lower stratum: This is composed of soils and sediments, chain partners etc. in which utilisation, re-arrangement and decomposition of complex materials pre dominate. From the biological point of view, the following components contribute to the ecosystem.

a. Inorganic substances (Nitrogen, O_2, C etc); These substances are cycled in material cycles and biochemical synthesis eg carbohydrates, lipids, proteins etc.
b. Organic substances; These are carbohydrates, proteins, lipids that form a link both biotic and abiotic factors.

c. Climatic factors eg. Temperature, rainfall, humidity etc.
d. Autotrophs (producers); These are mainly non plants and some some chemosynthetic bacteria that can synthesize organic compounds for the community.
e. Macro consumers; These are heterotrophic organisms mainly animals that ingest other organisms.
f. Micro consumers; These are commonly referred to as decomposers. They are a group of organisms which feed on dead and decaying materials from the other two groups i.e producers and consumers with the aid of decomposers all the organic materials taken into the bodies of consumers and producers are eventually broken down again and returned to producers for use thus all the available matter circulates through the system and there is no overall loss or gain.

In terrestrial ecosystems the primary producers are mainly ~~determine~~ dominated by large plants and trees, shrubs and grass. The primary consumers are the

herbivores which include insects, reptiles, birds and mammals.

The small animals are detrivores such as earth worm, wood lice, centipedes etc.

CHARACTERISTICS OF AN ECOSYSTEM

An ecosystem exhibits the following properties.

(i) Energy flow / energy transfer.
(ii) Feeding relationship
(iii) Cycling of materials.
(iv) succession
(v) productivity in an ecosystem.
(vi) Evolution
(vii) Diversity patterns in time and space.

Feeding relationship in an ecosystem.

This is abiotic factor which influences an ecosystem and includes such aspects as food chains, food webs and ecological pyramids.

(a) Food chains;

This is a linear sequence of series of organisms existing in an ecosystem through which chemical energy formed and stored by the green plants and other photosynthetic organisms is systematically transferred. Each organism in the serie feeds on and thus derives energy from the preceding one. It is also consumed by another organism following it and provides energy to that organism.

The energy in the food chain is passed along the hierarchy in a food chain. Ie From each feeding level in a food chain is called trophic level. Some energy is lost when it is passed from one level to another and this is why food chains are short.

TYPES OF FOOD CHAINS:

There are two types of food chains:

(i) Grazing food chain
Detritus food chain.

(i) Grazing food chain

It is the linear nutritional sequence of organisms in an ecosystem where the chemical energy is passed on in which the first trophic level is occupied by the green plant or green algae and the second trophic level is a grazing animal (herbivore) and the subsequent levels by the carnivores eg.

Grass ⟶ Grass hopper ⟶ Frog ⟶ snake ⟶ Eagle.
producer / Primary consumer / Secondary consumer / Tertiary consumer / Quaternary consumer

(ii) Detritus food chain:

Is a linear nutritional sequence of organisms in an ecosystem through which chemical energy is passed but in this case, the first trophic level is occupied by detritus second trophic level by detrivores and subsequent levels by carnivores eg leaf litter being feed on by earth worms that is consumed by a blackbird.

leaf litter ⟶ Earthworm ⟶ blackbird ⟶ Snake.

OR

Dead animal ⟶ fly maggots ⟶ Frogs ⟶ grass snake

Fragments of decomposing materials are called Detritus and many small animals feed on them contributing the decomposition process. These animals are called Detrivores and include the following

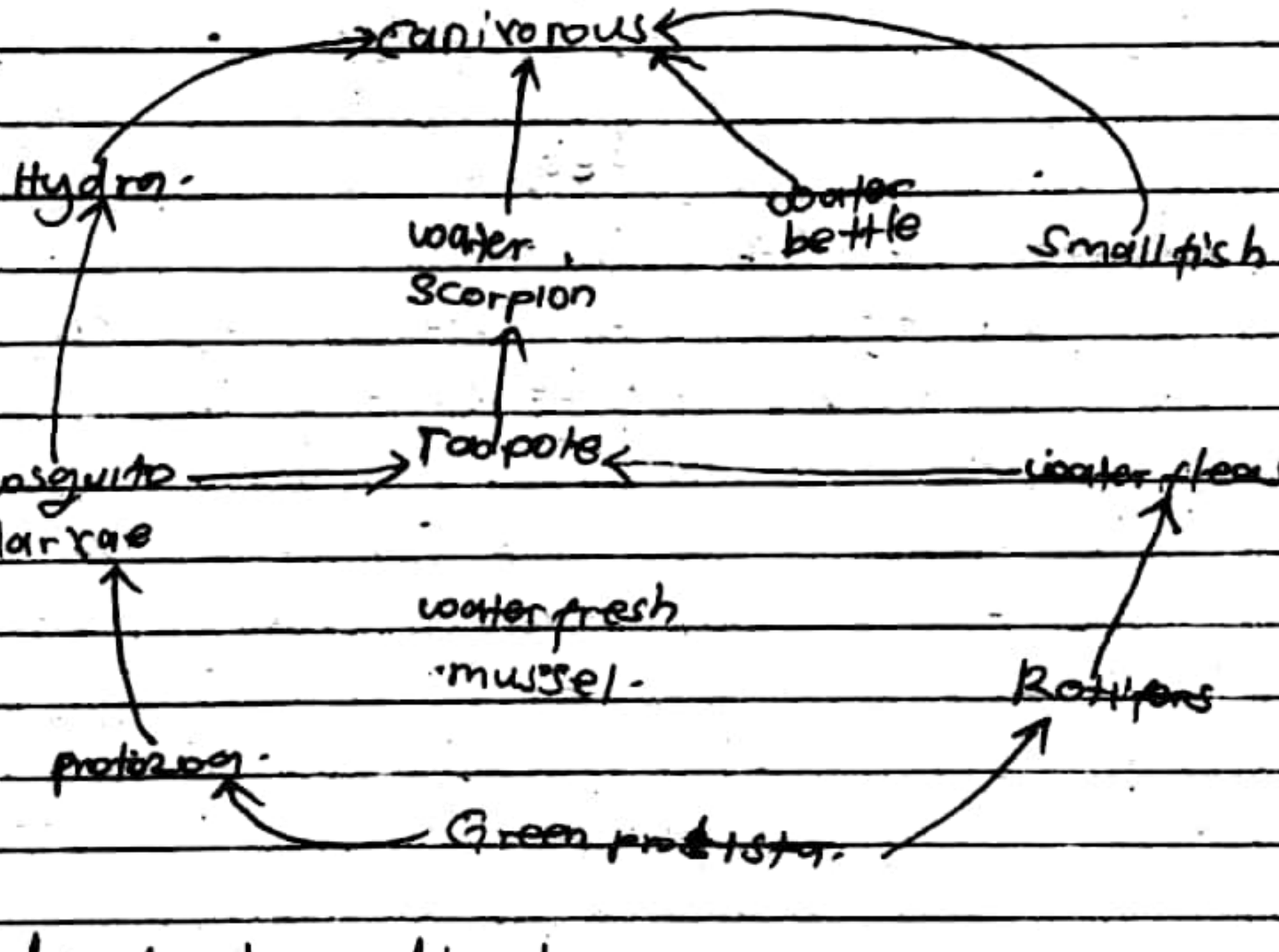
- Earth worm
- Woodlice

Dung beetles
- millipedes
- Termites etc.

FOOD WEBS

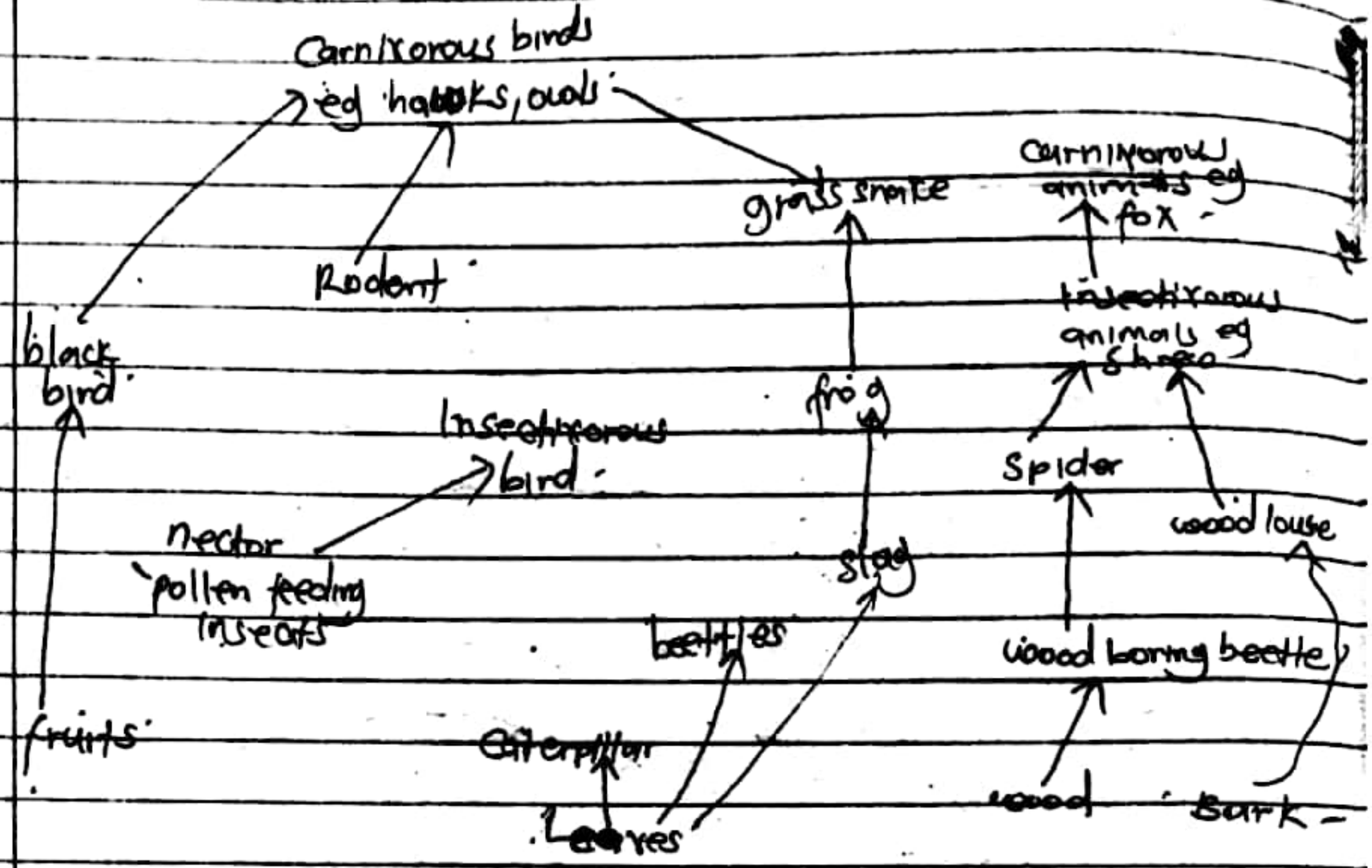
The food web is inter connected complex of food chains in which an animal or organism at one trophic level has several alternative animals that it can feed on at different trophic levels and also has many other animals that can feed on it at different trophic levels.

Example of a food web in a typical fresh water pond.



Food web in woodland.

Food web in woodland.



ECOLOGICAL PYRAMIDS -

Feeding relationships and energy transfer through the biotic components can be modified and shown diagramatically as ecological pyramids.

Ecological pyramids provide the basis for comparing different ecosystems; seasonal variations with in an ecosystem and changes in an ecosystem. There are three types of ecological pyramids which include.

- ✓ pyramid of numbers.
- ✓ pyramid of biomass.
- ✓ pyramid of energy.

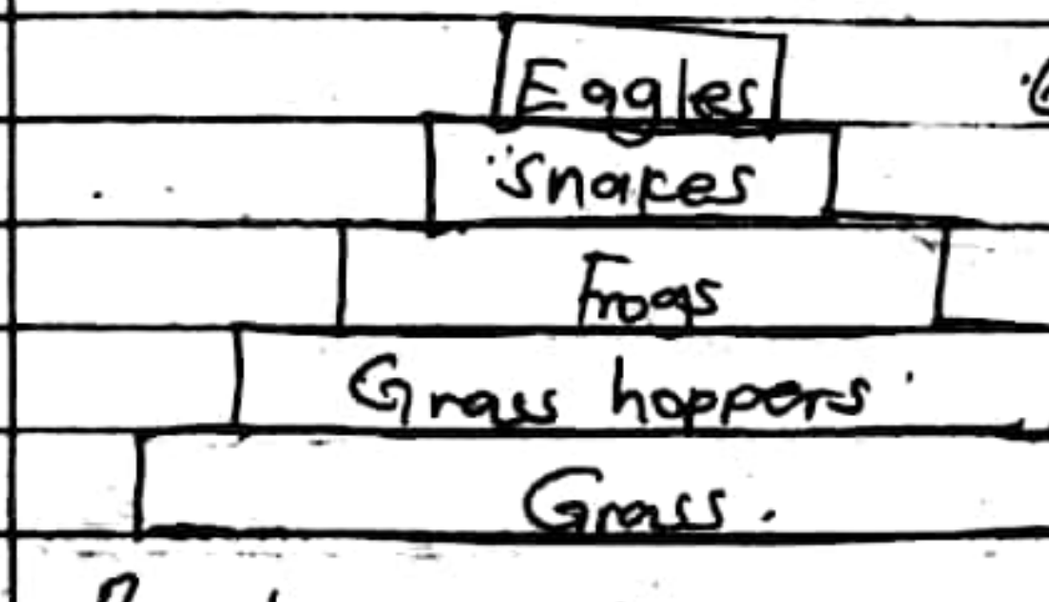
Short comings of ecological pyramids include the following.

It is quite not easy to identify the trophical levels of an organism as many organisms as many organisms feed of different trophic levels.

It only considers energy stored by green parts of the plants and consumed by herbivores yet some herbivores eat only the seeds, fruits or nector.

Pyramid of numbers

This is a bar diagram indicating the relative numbers of individuals at each trophic level in a food chain eg.



The length of each bar indicates the relative number of organisms at each trophic level. It can be notified from pyramid of numbers that there is a progressive decline in number of individuals at each trophic level. This is because, alot of energy is lost at each level each time it is passed from one trophic level to another in a food chain. This places a natural limit and this loss of energy causes the food chain to be shorter ie not more than six levels exist. Therefore to support individuals at one trophic level, more energy from the individuals at the level below it is required and this is achieved by having more individuals at the lower trophic levels

Advantages of pyramid of numbers

It is easy to carry out

It is relatively cheaper to conduct ie does not require many equipment to do measurement

Disadvantages:
It does not indicate the source of energy in an ecosystem.
All individuals are counted as one yet not all individuals have the same size eg an Oak tree is counted as one individual in the same way as the aphid.

Examples of un usual pyramids of numbers eg.

a) Fox — secondary consumer
Rabbits — Primary consumer
grass — Primary producer

b) Bird
Aphid
Oak

c) parasites
Caterpillar

d)

a) is a normal pyramid of numbers for comparison.
b. The producer is a single plant such as a single tree.
c The producer is a single plant infested with parasites (primary consumer) and the latter care also parasitised by other parasites.
d. A large number of producers eaten by a single primary consumer which is infested with parasites.

PYRAMID OF BIOMAS:
This is a bar diagram of proportionate length indicating dry masses of all organisms at each trophic level.
Biomass is the weight of the living material per unit volume or area.

Advantages of pyramids of Biomass.

✓ It provides relatively accurate measure of the amount of energy in each trophic level.

Disadvantages

✓ It is impossible to measure exactly the biomass of all individuals in a population. A sample is usually taken and measured and this sample may not be a representation representative of all organisms at a particular trophic level.

✓ It involves destroying or killing of living organisms in order to obtain the dry weight

✓ No source of energy is indicated

✓ It is very much time consuming because it involves many steps and produces.

3 PYRAMID OF ENERGY.

This is where the rate of energy flow and or productivity at successive trophic levels is shown.

Unlike the first two types of pyramids which may be inverted in some cases. This one must always take upright pyramid shape provided all sources of food and energy in an ecosystem is considered.

Advantages of pyramid of energy.

✓ It represents the amount of energy per unit area or volume passed from one trophic level to another so it is more accurate.

✓ It takes into account of energy from the sun which is the source of energy in an ecosystem.

✓ Both usual and inverted pyramids are not obtained.

Disadvantages

It is difficult to obtain data for pyramid of energy for pyramid of since it requires alot of

- It is expensive to carry out because it requires some sop.

BIOGEO CHEMICAL CYCLES:

The major feature of an ecosystem is the means by which essential nutrients in nature like nitrogen, carbon, hydrogen and H_2O are maintained at constant levels.

The biochemical cycles existing in an ecosystem include nitrogen cycle, carbon cycle, hydrological cycle, phosphorous cycle.

Nitrogen cycle-

Nitrogen comprises about 78% of all atmospheric gases. Atmosphere nitrogen is converted into nitrates by the following process.

1. Lightning: This combines Nitrogen and oxygen to form nitrates. The nitrates formed dissolve in rain water and fall down and enter the soil. The nitrates are absorbed by plant roots and converted into nitrogen compounds in plants such as amino acids and proteins.
2. Fixation of nitrogen: The aerobic nitrogen fixing bacteria such as Rhizobium and azotobacter leave in root nodules of leguminous plants like peas, beans. These aerobic nitrogen fixing bacteria in root nodules fix or convert atmospheric nitrogen into nitrates which are then built up into amino acids and proteins in plants. The plant materials are consumed by the herbivores and other animals. In this way, the nitrogen compounds become available to the herbivores. The herbivores are equally eaten by other animals called heterotrophs.

When the plants and animals become old, they die and then remains mix with soil. In the soil, saprophytic organisms like the fungi causes the

breakdown of proteins in dead decaying organisms to form ammonium compounds. Other ammonium compounds can be derived from any of the following sources

(i) Animals excrete urine containing high conc of nitrogenous wastes.

(ii) Industrial harber process produces ammonia that is released into the soil.

(iii) Human activity, which involves application of inorganic fertilizers like N.P.K, releasing nitrogen compounds and urea into the soil.

(iv) Sewage discharge on land; Sewage contains ammonia compounds. In the soil, ammonia is converted into ammonium compounds by chemical combinations. The ammonium compounds are converted into nitrites to nitrates by a process called nitrification which is the process by which ammonium compounds are converted to nitrites then to nitrates by activities of nitrifying bacteria. In this process, aerobic nitrifying bacteria like Nitrosomonas and nitrobacter further oxidise nitrites to nitrates. Some of the nitrates in the soil can be converted back into atmospheric nitrogen a process known as denitrification which is a process of converting nitrates in the soil into gaseous nitrogen which is given off into the atmosphere.

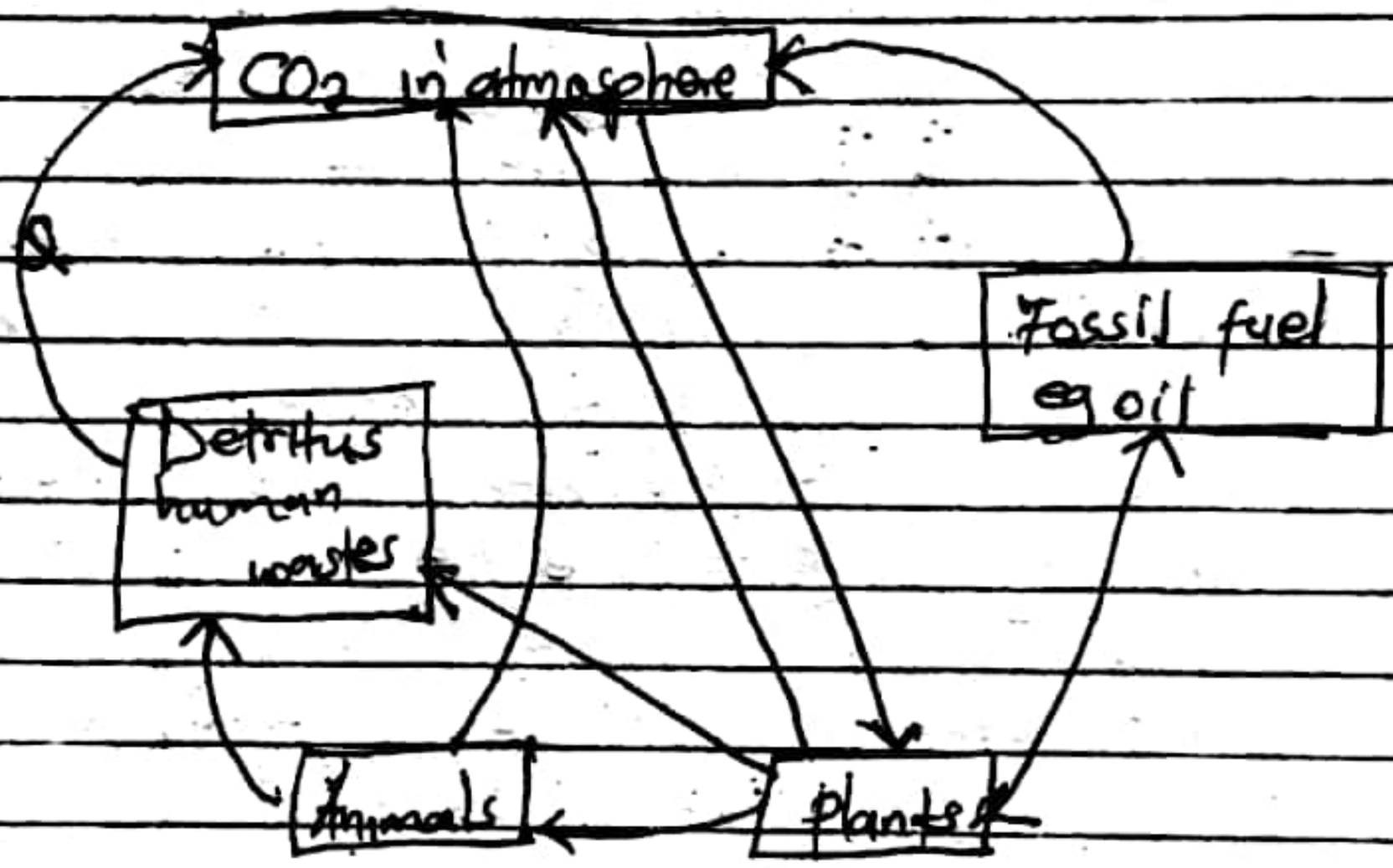
It is carried out by anaerobic bacteria like Pseudomonas and thiobacillus. They necessary anaerobic conditions are in water logged soils where the denitrifying thrive and by converting nitrates to atmospheric nitrogen, they reduce soil fertility. This is why farmers plough and dig up their land in order to improve drainage

and aeration so as to avoid anaerobic conditions but instead promote aerobic conditions but instead promote aerobic conditions

N:B
Nitrogen enters the food chain in the following ways

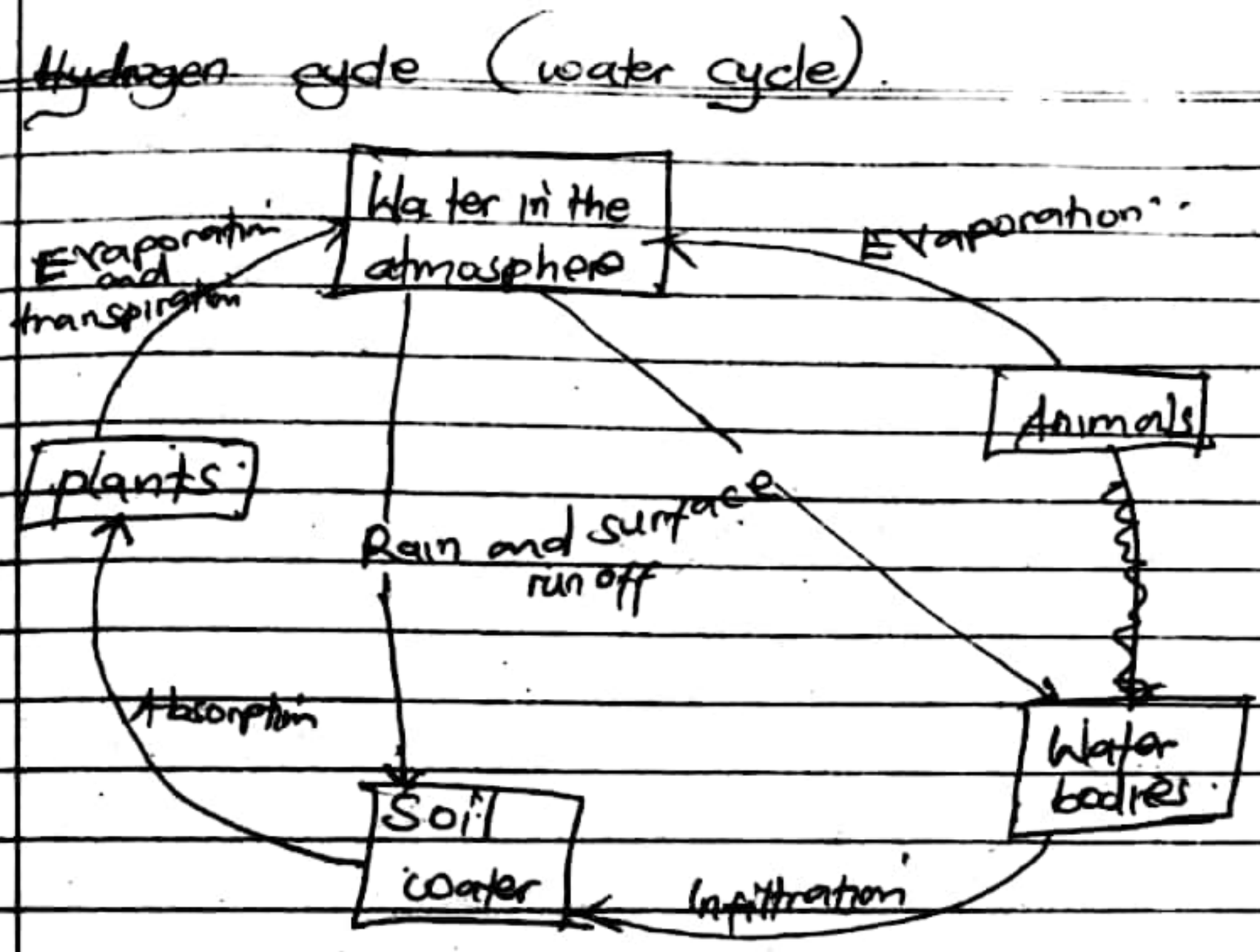
1. Use of inorganic fertilizers
2. Nitrogen fixation
3. Lightning
4. Nitrification process

CARBON CYCLE



R combustion
D Decomposition
U Respiration
T Photosynthesis
P Death
S Respiration

Hydrogen cycle (water cycle)



SPECIES DISPERSION.

It refers to the way in which individuals in a population are distributed in space and this is important in the structure of eco-system as it has considerable bearing on sampling procedure.

Broadly there are 3 patterns of distribution, These include;

(i) Random distribution.

This occurs where the the environment is uniform and there is not tendency to aggregate.
The individuals probability of occuring at any one spot is the same as any where else.

(ii) Uniform distribution.

This occurs where competition between individuals is severe. The distribution is more regular than random.

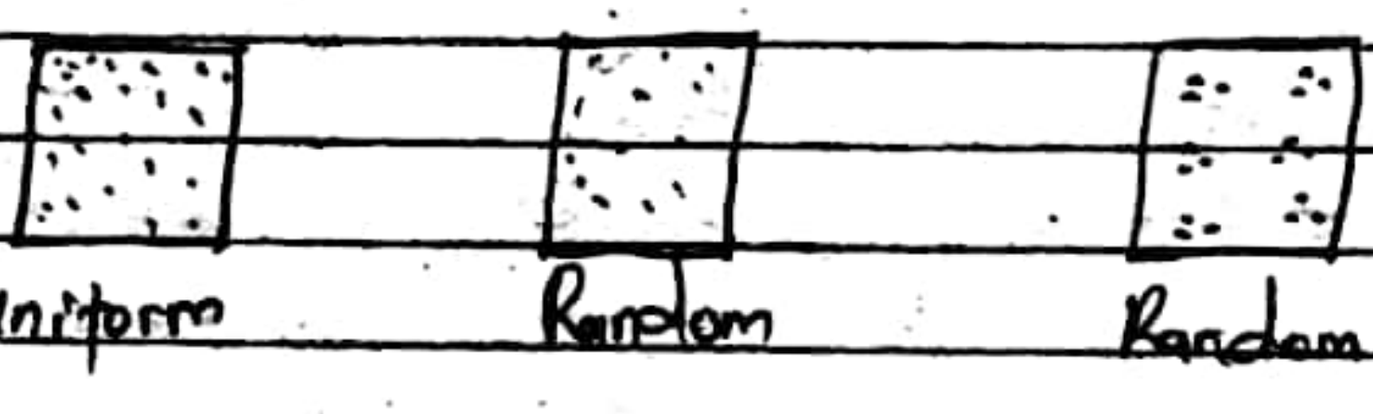
(iii) Clumped.

This type of distribution is irregular, non random and aggregated clumping of varying degrees represents by far the most common pattern when individuals are considered.

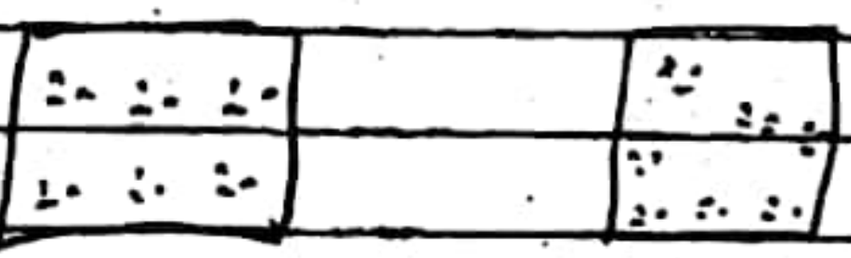
The groups could be of the same size or varying size and they can be randomly distributed / uniformly distributed or clumped with large spaces unoccupied As a consequency of these, there are 5 types of distribution

Uniform
Random
Random clumped.
Uniform clumped
Aggregated clumped.

Illustration.



Uniform Random Random clumped.



Uniform clumped Aggregate clumped.

These patterns may be influenced by many factors eg Soil conditions, physical factors such as moisture gradient, behaviour etc.

ENERGY FLOW IN AN ECO-SYSTEM.

The energy flow in an ECO-system is basically non-cyclic (Energy flows in one direction).

It is dispersed along a feeding hierachy in chains called food chains.

Each feeding stage or level in a food chain constitute a trophic level.

The source of energy in an eco-system is the sun and it is received inform of Electro magnetic radiations.

About 40% of the suns radiation is reflected and part of the sun's radiation is trapped by green plants which are the primary predators (autotrophic organisms) and later converted into chemical energy in the process of photosynthesis.

The rate at which this chemical energy is formed and trapped by primary producers per unit area time is known as Gross primary productivity.

Some of this chemical energy is utilised by green plants and in the process lost as heat in respiration and photorespiration.

The remaining energy is stored inform of carbohydrates per unit area per unit time.

The net primary productivity becomes available to the primary consumers which are the herbivores at the next trophic level.

The herbivores feed on primary producers to aquire this chemical energy.

Some energy is lost by primary consumers as heat through respirations Excretion prepaire uneaten plant parts et

The remaining energy is passed into the secondary and Tertiary consumer in the next next trophic level which they feed on the herbivores.

In this process energy is lost or heat through the same process.

Decomposers which include bacteria and fungi withdraw energy from every trophic level when the organism in each stage of the feeding relationship die and beg in to decompose.

POPULATION ECOLOGY:

Population is a group of organisms of the species occupying a particular particular place at a given given period of time.

A population is usually isolated to some Extent from other similar groups by geographical barriers such as mountain desert etc.

A population size is the number of individuals of the some species living in an area at a given time while population density is the number of individuals per unit area.

Characteristics of a population.

1 Mortality:

This is the number of individuals which die with in a population in a given area at a given period of time.

a. Natality

Is the number of individuals born with in a population in a given area.

3. Fecundity

This is the reproductive capacity of individuals female species. In mammals, the birth rate is used to measure fecundity. There is the size of a population is regulated by

4 - Balance between its fecundity and its mortality.

5 - Migration rate and this include; Immigration; where Individuals join / enter into population from neighbouring areas and Emmigration where individuals depart or leave a population.

6 - Age distribution/Age structure.

This refers to the proportional distribution of individuals of various ages in a given area.

It gives information about the future of population growth. More young individuals than old ones, indicate a growing population while less ~~fe~~ young individuals than the old ones indicate declining population.

7. Biotic potential

This is a maximum rate at which members of the species can reproduce with unlimited resources and under ideal environmental conditions.

8. Growth form;

This refers to the ~~ver~~ variation of population size with time.

Dispersion.

This is the distribution of individuals with in a given area.

Carrying Capacity.

Is the maximum number of individuals that can be supported/sustained by available natural resources in an environment.

Population growth is a measure of change in a population. The change can either be postive when the number of organisms increase and Negative change when ~~Th~~ the number of organisms decrease.

There is no change in population growth when the number of organisms remains constant.

Many environmental factors determine the size of population by affecting any of the variables which include;

- Birth rate
- Death rate
- Immigration
- Emmigration

The factors that affect the size of the population in an eco-system and divdual into 2 broad categories

1. Density dependent
2. Density independant.

Density Dependant Factors

These are factors whose effectiveness in controlling the size of the population depends on the number of individuals per unit area. These factors are usually include the following;

1. Availability of food.

Plenty of food favours reproduction in the population size. And

The lack of it leads to reproductive failures and death. This causes decline in the size of the population.

2. Accumulation of toxic wastes.

Toxic wastes can cause death of some organisms and reduce their population size.

3. Diseases;

Where there is a large number of individuals crowded together disease spreads rapidly and causes death reducing the population

4. Predation

Predators feed on other organisms refered to as prey. Where the no of predators are few or when individuals have the ability to avoid predators, the population size increases.

5. Availability of space.

This includes breeding sites and it determines protection of organisms from hostile environmental conditions.

Plenty of suitable space increase population size while lack of it or inadequate space decreases the population size.

6. Psychological factors

6. Psychological factors
These include factors arising from over crowding and it leads to abnormal behaviours such as cannibalism, stress, induced abortion leading to reproductive failures thereby decreasing the population's size.

7 Territories
It occurs among a wide range of animals such as reptiles, birds and social insects where a male or both male and female demarcate an area where they live and defend against members of the same species. This limits the size of the population.

Density independent factors.
These are factors whose effectiveness in controlling the size of a population does not depend on the number of individuals or organisms per unit area and these factors are usually abiotic. They include;
Availability of light
Sufficient light intensity provides energy for photosynthesis and favour the growth of plant population.
This causes increase in the population size of plants. The animals feed on these plants and their population increase after reproduction
Availability of Oxygen.
This is utilised by aerobic organisms for respiration. The presence of O_2 in sufficient amount of amounts favour growth of aerobic organisms and hence increase in their population.
Climatic condition
These include temp, relative humidity and when favourable leads to growth of plants and survival of animals.

Catastrophy.

These include fires, floods, that may lead to sudden death of organisms reducing their population.

Topography

This influences local climate and soil factors. The main topographic factor is altitude

Higher altitudes are associated with lower average temperatures, lower atmospheric pressure, increased wind speed, all of which lower growth rate and supports small sizes of population than lower altitude.

Environmental distance

This refers to both biotic and abiotic factors that together prevent the maximum reproductive potential to be achieved and as such limit growth of populations. They include;

- External factors such as shortage of food, water, Oxygen presence of predators and parasites, intra specific competition, lack of light
- Lack of light etc

The balance between biotic potential and environmental resistance determines the carrying capacity of a particular environment for a particular population

Environmental indicators for a population that has exceeded its carrying capacity include;

- Accumulation of wastes
- Destruction of vegetation leading to rapid environmental degradation.
- Death rates exceeding birth rates.
- Extinction of some species of organisms.

POPULATION GROWTH CURVES.

These are graphs which show trends of population growth over a period of time.

There are two types of growth curves;

U-shaped growth curve

S-shaped (sig-moid growth curve.

S-shaped growth curve.

It describes a situation where organisms better adapt in the initial lag phase when the population size increases rapidly during the exponential phase that exceeds the carrying capacity than without establishing a stationary phase, the population growth suddenly stops and declines.

Such a decline is described as crash.

The population that show this type of growth curves are to be referred to as boom and bust population

The population that show this type of growth curves are regulated by density independent factors

Over population can damage the environmental

Over population can damage the environment leading to a new lower carrying capacity

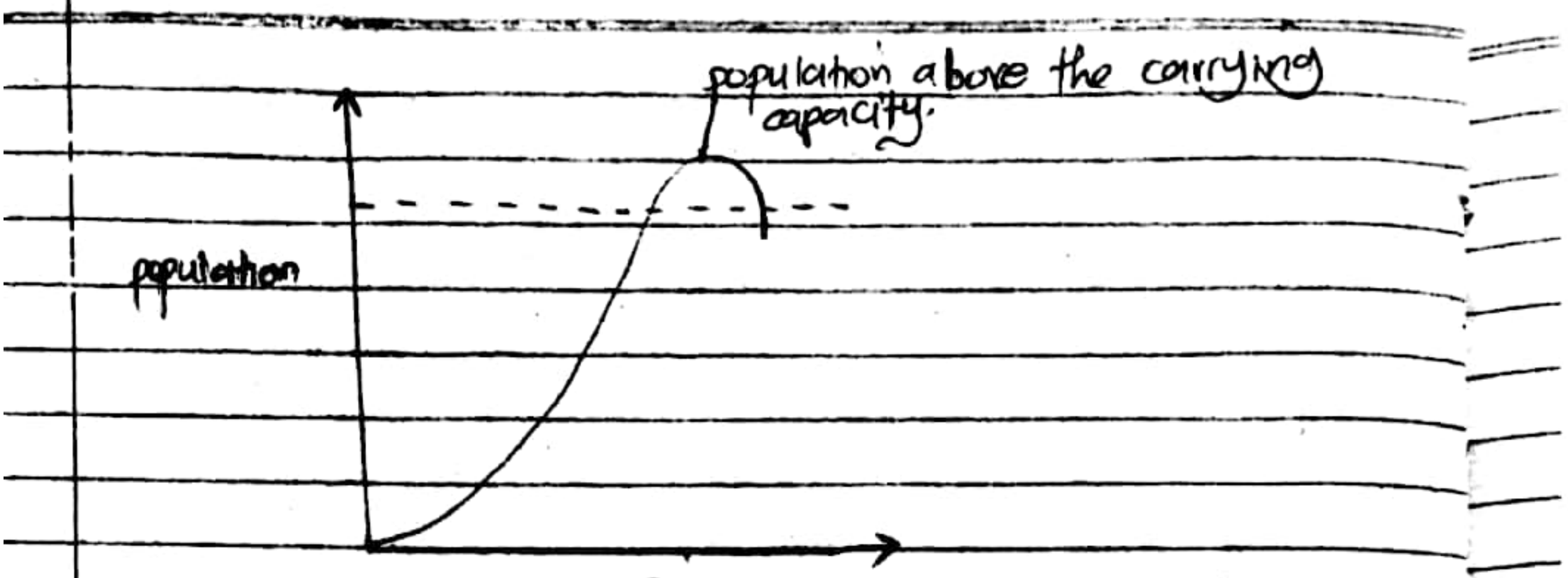
After the crush, the population fluctuates around the new carrying capacity

Causes of population crush.

Application of pesticides or insecticides to control an insect pest

Too much harsh environmental conditions.

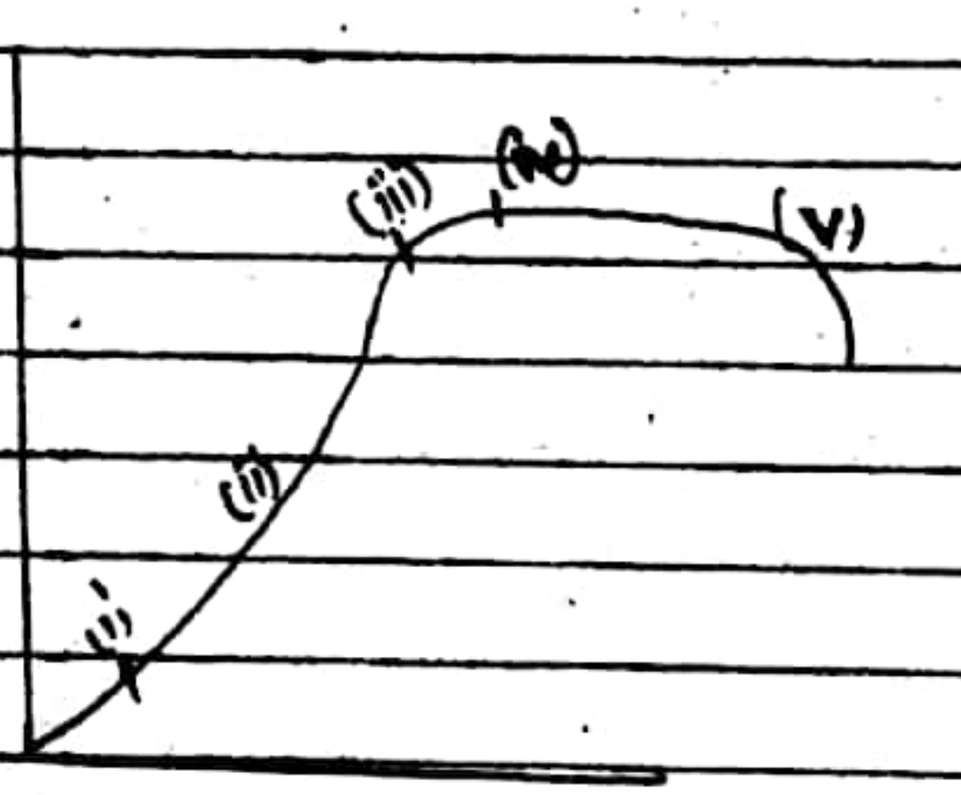
End of a particular stage in the life cycle of some organisms.



S-shaped / sigmoid growth curve.

The type of population that exhibits the sigmoid growth curve has its population growth controlled by density dependent factors.

It is associated with the population's living in an area with limited resources.



(i) log phase

(ii) Exponential phase.

(iii) Decelerating phase

(iv) constant / stationary phase

(v) Decline phase.

Describe the shape of the graphs'

Initially, the number of individuals in a population increases gradually and then increase becomes rapid but as it is approaching the carrying capacity, the number of

individuals in a population begin to increase slowly until it reaches maximum, after which it remains constant for a while and later gradually declines.

Explanation of the graph s

lag phase;

The population increases slowly because there are few reproducing individuals which are widely dispersed.

In some cases the organisms are not fully adapted to the environmental conditions and only a few will start to reproduce.

Exponential phase;

Population increases drastically / very rapid / steeply.

This is because there are more individuals reproducing and minimum environmental resistance ie food and space are sufficient, there is minimum competition for available resources such as oxygen ; water etc and the biotic potential is higher and hence natality exceeds mortality.

In some cases the organisms are adapted to the environmental conditions which are more favourable to the organisms.

Decelerating phase;

The population increases until it ~~reduces~~ reaches maximum. This is because the environmental resistance sets in, resulting in increased competition, mortality exceeds natality.

Constant phase;

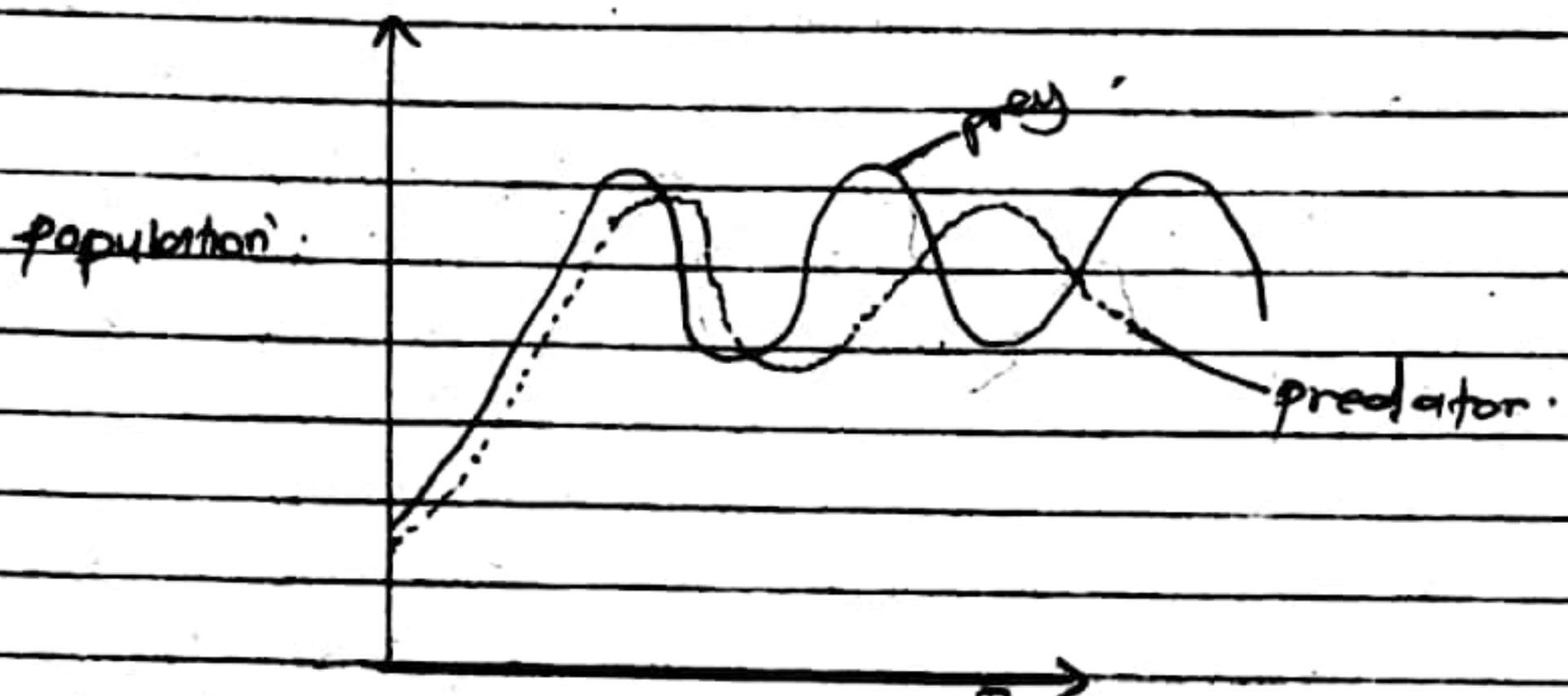
The population of the individuals remains constant. In this case the population has reached its carrying capacity.

Natality and mortality balances each other.

X Decline phase;

The population rapidly declines. There is intense overcrowding, more competion for food, space, O_2 etc.
The reproductive potential rapidly declines and mortality exceeds Natality.

CYCLIC CURVES IN PREY PREDATOR RELATIONSHIPS.



Explanation of the prey-predator curves
Description:
Initially, the population of the prey increases more rapid than that of the predator until it reaches the maximum. Then it declines rapidly as the population of the predator increases rapidly until the population of the predator reaches the peak. Thereafter the population of the prey and predator fall rapidly and then fluctuates.
Explanation:
Predators feed on the prey and reduce their numbers. When the population of the prey is higher, predators are provided with enough food and there is minimum competition. This increases their reproductive potential and their numbers rapidly increase until it reaches the maximum. At this stage more prey are fed on and their numbers decline rapidly, then the predators begin to complete with each other for the scarce food available.

Some predators face acute competition and die of starvation. The predator population therefore declines and this reduction in their number results in fewer prey being eaten and so allows the number of prey to increase again.

This increase in turn leads to an increase in the predator population.

Predator prey population regulate each other that keeps the population balance that the environment can support

Determining the population Size.

The methods or techniques for estimating size of a population in an eco-system

The factors to consider include;

The size of the area.

The size of organisms to be counted

Behaviour of the organisms

Nature of the habitat whether Terrestrial / aquatic

Resources available eg apparatus, money etc.

These methods include;

Total count method.

This involves physical counting of all the organisms in an area under study.

In this method, a whole area is searched, all organisms are counted and should give absolute numbers in the whole area. These methods include the following.

a. Direct observation.

b. Aerial photographs

a. Direct observation.

This involves direct counting of all animals in the whole area of study, the total no of animals observed is counted and recorded.

It is applied to slow moving animals and also it is applied to many large mobile organisms that do not live in hidding / concealed areas such as lions.
Direct observation methods are further divided into;
Direct and
Dirive and counts.

Here the animals are given by a no of people to a particular spot and they are counted
Advantages of Drive, and count method.
- It reduces the chances of having the some animal counted more than once
- It is fairly quick and easy to carry out.

Disadvantages
It involves disturbance of animals which may make them aggressive.
Stripped Transcas.
Stripped census.
In this method animals are counted along path while walking or in a vehicle.
Population density is determined as no of individuals per unit area on the strip.
This method is applied to large animals that live in non concerted areas.

Advantages
It is fairly quicker
It is comparatively cheaper.
Disadvantages.
The animals may be scared by passing vehicles or even by presence of human beings
Some animals avoid path and therefore may not be counted
Some of the animals are too mobile and they are likely to be counted twice.

✓ Direct counting using a low flying aircraft.

This method involves physical counting of animals and it is applied to large animals that live in non concealed habitats eg lions buffalo, elephants etc.

In this method, the study area with in the path is studied using a low flying aircraft which is flown along a transect and animals along that transect are counted.

The aircraft then flies back along another transect, several such countings are carried out and an average is determined.

The product of an arerage count and the total per unit area of study gives estimated size of the population of organisms.

✓ Advantages:

Its a very guide method of counting population.

* It can be applied in some aggressive animals like lions since it has minimum risks of being attacked.

It reduces the chances of counting the same animal more than once since it is more organised

✓ Disadvantages

Very expensive since it involves expensive equipments.

The aircraft may scare away the animals which may go into hidding and end up not being counted.

It can not be applied in very small animals since they may not be seen from the distance.

Its operation can be operated by bad weather or poor climatic conditions eg when the weather is misty.

• AERIAL PHOTOGRAPHY.

This method is applied to large animals that live in non concealed habitats.

After the period of time, the traps are set up randomly in an ared and animals brea and animals are captured from the second time and the number is recorded and labelled N2.

At the same time the no of animals captured and bear the mark (recaptured animals) are labelled N3.

Assumptions of the

organisms mix randomly with in the population

Sufficient time must elapse btn capture 3 recapture to allow mixing.

It is only applicable to populations whose movement is restricted geographically.

Organisms disperse evenly within the geographical area of the population.

Changes in the population size as a result of Immigration, Emmigration, birth and death are negligible -

Marking does not hinder the mast of the organism or make them conspicious to predators or death of the organisms.

Every animal captured, marked and released must have the same or equal problem of being recaptured.

Precautions.

The marks should not be harmful to the animals

Sufficient time should be given btn the 1st, 3, 2nd recapture.

The mark or tag should not be conspicious to predators.

QUADRAT METHOD -

A quadrat is a metal or wooden flame with ten sides.

It endures

It endoses an area of $1m^2$ however large quadrats can be marked on grounds by either ropes or suitable material may also be used.

A it is a random sampling method and suitable for estimating population size of plant species and very slow moving organisms

In this method, survey the area under study and establish its size in square meters.

Then a quadrat of known square meters ie $1m^2$ is thrown at random on an area understudy and established its size in square metres, and the number of enclosed organism are counted, so many of these throws are carried out several times an average of this counts is taken and the popln size is estimated by determining the product of average count taken and the total square meters of the area under study is

Size of population = Average of number of animals per metre squared x Total no of square meters of area understudy.

Eg If 5 quadrats of $1m^2$ show no of certain plant species as;

1st = 3, 2nd = 7, 3rd = 2, 4th = 4, 5th = 4 and the total area under study is equivalent to $500m^2$.

$$\frac{3+2+7+4+4}{5} = 4.$$

$1m^2 = 4$.

$500 \rightarrow \frac{4}{1} \times 500$.

= 2000 species.

The quadrant method provides means of studying and aspects of species.

- species density.

This is the no of individuals of a given species in a given area. It is obtained by counting the no of organisms randomly.

- species frequency

This is a measure of the problem of finding a given species with in any one throw of a quadrant in a given area. It is obtained by counting the number of organisms randomly.

- species frequency;

This is a measure of the problem of finding a given species with in any one throw of a quadrat in a given area. This is obtained by recording the presence or absence of a species in a randomly-thrown quadrant.

- species cover

Is the proportion of the ground occupied by the species. It gives the esthmate of the percentage of the area covered by the species.

Its obtained by observing of species covering the ground and the number of random points.

ADVANTAGES OF A QUADRAT

It is cheap to be carried out since it does not require expensive equipment to use.

The aspect of species density makes this method accurate and enabling different areas and different species to be compared.

Species density provides absolute measure of abundance of species in an area.

* The aspect of species frequency is easy and quick to conduct.

Can be applied on large eco-system such as woodland.

Disadvantage

It can only be efficiently applied in estimating population size of plant species and very slow moving animals.

It is time consuming in like in determination of species density.

In determining the species frequency, the quadrat size, plant size and the distribution of the organisms may affect the results

LINE TRANSECT/ BELT TRANSECT.

This consists of a record of plants occuring along a line taken by stretching a string in the study area.

Survey the area under study to Establish in size in square meters then a string are counted and are counted and recorded. This method is useful to study changes in plant species in an area.

To establish the size of population of plant species using this method, several counts are made and an average of such counts is taken where population size is the product of average count and the actual size is the product of average count and the actual size of the area under study in square m^2.

BELT TRANSECT.

This is where parallele strings are tied across a habitat The area btn the strings is the belt.

Organisms within the belt are recorded and this method can be applied for both animals and plants in larger areas of study. Over a short distance, a line transect is used and over a longer distance a belt transect is suitable.

COMMUNITY ECOLOGY-

A community is a group of organisms of different species living together in a particular area in a particular time and interacting with one another.

A community is dynamic involving energy flow cycling of matter and interactions bto community members which include the following:

1. competition
2. Predator-Prey relationship.
3. Mutualism
4. Parasitism
5. Commensalism

ECOLOGICAL SUCCESSION.

Communities may undergo changes in their animal and plant species.

competition over time in a process called ecological succession

Succession is a sequence of change from the initial colonisation of the new area to establishing a relatively stable community.

The main features of ecological succession are that,

- It occurs gradually and in stages as several stages where there is a pioneer community at the beginning which is gradually replaced by other communities until a relatively stable community which is in equilibrium with its environment is re.

Ecosystems are dynamic is constantly changing in response both physical factors such as climate and biological factors resulting from the activities of the organisms with in the community.

TYPES OF ECOLOGICAL SUCCESSION.

1: Primary succession in Terrestrial Eco-system -

This is the sequence of change from the initial colonisation of a new area which has never been inhibited before by living organisms such as the bare rock.

To Establish a relatively stable community/climax community, It occurs in 3 stages.

(i) pioneer stage

(ii) pruce stage

(iii) Climax stage.

The process proceeds slowly and begins when the propagation structures like seeds, buds, risomes, bulbs are not readily available.

PIONEER STAGE.

During this stage, bare rocks break down physically and chemically during the process of weathering.

* The acid rains dissolve more minerals which further integration of the rocks

The existing conditions do not favour growth of on moving plant syste species but Litchen which is an association btn algae and fungi are the

Algae are drought resistant and photosynthetic providing food for the fungus.

The hyphae of the fungus penetrate tiny cracks absorbing minerals and also provide support.

Some hyphae of the fungus penetrate tiny cracks, absorbing minerals and also provide support

After the activity of the Litchen, enlarge the cracks in the rocks in addition to the decomposing dead Litchen.

The conditions with in the rock become favourable for the growth of drought resistant Mosses as coell as insects that feed on them.

The masses form a dense mark like network which traps tiny particles of soops, some organic matter and H_2O and some soil'd hair begin to form and eventually Lichens are replaced by the Mosses and liverworts.

SPRUCE STAGE.

Death and decay of the most plants add nutrients to the rock particles and the thickness of the soil increases favouring the growth of herbs like ferns, grasses and other Angiosperms.

Animals like amphibians, reptiles add birds also come in.

Some herbs die off leading to accumulation of organic matter which increases the thickness of the soil layer enough to support other plants of even greater size.

CLIMAX COMMUNITY.

Soon large woody shrubs begin to grow in the newly formed soil. The masses and Lichens may be covered by decaying leaves and other vegetation.

Eventually as a thicker layer of soil develops, trees are able to take their roots in deeper rock crevices and shrubs disappear.

Larger animals may also come in and after a very long period of time, a mature forest community growth and this is the climax community which is relatively stable overtime.

Climax community is the relatively stable community which is in equilibrium with the environment.

PRIMARY SUCCESSION IN AQUATIC ECO-SYSTEM.

In ponds and lakes, organic matter builds up from dead remains of plants and animals brought by H_2O run off from the land. This causes the H_2O to become shallow and richer in nutrients allowing rooted plants to grow and to crowd along the shores of rivers and lakes. The growth of these plants extend further in into the pond, rivers and lakes and more sediment is trapped in the process and the H_2O becomes shallower

These H_2O bodies develop into swamps, which support good growth of many herbs and shrubs.

Given good climatic

Given good climatic and ecological conditions after a long time, a woodland develops and eventually large trees forming a climax community.

SECONDARY SUCCESSION.

Is a sequence of change from the initial colonisation of the area which has previously been inhabited by a particular community like a cleared forest, abandoned field, burnt area etc to establishing a relatively stable climax community

In secondary succession, the pioneer organisms are fast growing annual plants like black jack, commelina etc. These grow in an area which was previously inhabited by well established communities. The animals which became available at this stage include insects, earth worms and their predators

When some of the organisms die, they decompose and add organic matter into the soil. After a few years shrubs such as lantana camara begin to establish themselves in the area. After many years small trees such as acarcia inhibit the area. These other small trees gradually displace the herb community

and at this stage, birds come and due to the favourable ~~climatic~~ climatic conditions, created by the shrub community, a climax community comprising of large trees and large animals.

HUMAN ACTIVITIES AFFECTING ECO-SYSTEM.

Deforestation

Pollution.

Pesticide use to control pests

Over fishing

Industrialisation etc.

Urban development which include activities such as construction of houses, roads, recreation centres, reclamation of swamps and wetlands; urban development

Hunting and poaching

Use of fire to burn forests and grasslands.

ENVIRONMENTAL POLLUTION -

Pollution is defined as the release into the environment of substances or energy in such quantities and for such a duration that may cause harm to the people or other organisms of that environment.

Common pollutants.

A pollutant is a natural or artificial substance which enters the ecosystem in excess amounts and it becomes harmful to the ecosystem.

Those pollutants include the following;

i) Chemical pollutants, such as industrial waste products like Nitrogen oxide, hydrocarbons, mercury or any other heavy metal.

iv. Biological pollutants such as sewage.
Gaseous emmisions like CO, sulphurdioxide, CO_2 etc.
Physiological such as radioactive substances from nuclear power stations.
v. oil linkages
vi Agricultural drugs like pesticides and herbicides.

TYPES of POLLUTION.
Air pollution.
H_2O pollution.
Sound pollution.
Radioactive pollution
Thermal / heart pollution.

Air pollution.
All air pollutants are gases added to the mixture of air which support life. All air pollutants are as a result of burning fossil fuels either in the homes, industries or internal combustion engines.

Examples of air pollutants include the following.
i carbondioxide.
ii Sulphurdioxide
iii smoke / carbonmonoxide
iv lead
v Nitrogenmonoxide

Carbon monoxide;
This gas is released from air exhaust pipes and when inhaled, it combines irreversably with haemoglobin to form carboxy haemoglobin reducing the capacity of red blood cells to transport oxygen.

Sulphurdioxide

- Burning of fossils

Burning of fossil fuels from industries or at home emmits some amount of SO_2, it may combine with H_2O and ammonia to form harmful compounds especially when released in high or concentration. Some of the harmful effects of SO_2 include;

- It can damage the eyes by causing irritations of the eye.
- It kills the lichens on the surface of trees and on rocks and this reduces photosynthetic activities of the blue green algae reducing primary productivity. Sulphurdioxide dissolves in rain water and fall down as acid rain that enters lakes and oceans causing death of aquatic plants. Acid rains also cause great destruction of forests.

Carbondioxide.

CO_2 is formed through respiration by aerobic organisms, decomposition of organic matter, volcanic activities and burning of the fossil fuels. It is used by plants for photosynthesis to ensure that it does not accumulate. Deforestation and increased burning of fossil fuels has resulted in excess release of CO_2 into the atmosphere. This has caused unnecessary unnecessary rise and increase in the concentration of atmospheric CO_2 causing the occurance of three major problems;

(i) Ozone depletion
ii Green house effect
iii Global warming.

Carbondioxide and green house effect.

Solar energy reaches earth inform of short wave radiations when these radiations strike the surface. Much of their energy is converted into heat of long wave radiations.

CO_2 is present in the lower atmosphere, and is transparent to the Incoming short wave radiations from the sun.

CO_2, H_2O vapour and other gases present in the atmosphere allow short wave radiations from the sun to pass through them to reach the surface of the earth.

In this case these gases including CO_2 act like panes of glass in a green house letting light in but retaining some of the heat before it escapes into space hence the term green house effect.

The retention of heat by the green house effect is a natural process essential for the evolution of life on earth.

It maintains optimum average temperatures of the Earth otherwise without freezing temperatures can't exist on the earth.

Many species of organisms will die or be driven into extinction without this green house effect.

However the green house effect appears to be increased by the emission of certain industrial gas collectively called green house gases as most important of which are CO_2, methane, CO_2 contributes the largest percentage of this green house effect.

SMOKE.

Is tiny pane

Is tiny particles of soot suspended in air which are produced as a result of burning fuels such as oil/ smoke has a number of harmful effects which include the following.

When breathed in it can damage the alveoli it reduces light intensity at the ground level leading to overall lowering of rate of photosynthesis and hence productivity. Deposits of soot coat plant leaves blocking the stomata thus reducing rate of photosynthesis in green plants.

Some dirtened-clothes and building which are very castly to clean.

Water pollution

Clean water picks up ~~pollutes~~ additives as it loses through air as water flows to rivers. It picks up minerals, organic matter etc. Therefore pure water does not exist naturally. The main water pollutants include sewage toxic chemicals, fertilizers, oil, etc.

Sewage:

This is decaying matter that passes through pipes into H_2O bodies. It is mainly deposited in H_2O from homes and industries.

Domestic sewage is about 95% of organic matter. The organic matter in sewage are harmless but act as a source of food to saprophic organisms eg bacteria.

Sewage deposition in a water body brings about both physical and chemical changes in the H_2O body.

EUTROPHICATION:

This is nutrient enrichment of the water body. A nutrient rich waterbody is said to be Eutrophic

Eutrophication of Se

Eutrophicatum may arise as a result of;

i. Discharge of sewage in water.

ii Excessive use of fertilizers in farm land near a H_2O body

iii Weathering of the parent rock near the H_2O body.

The high mineral content stimulates growth of phytoplanktons especially algae leading to algal bloom. The algal bloom prevents penetration of light reducing photosynthesis of phytoplanktons in the lower parts of the waterbody.

These then die and the are decomposed further lowering the amount of Oxygen in the waterbody. This leads to the death of aquatic animals including fish and anaerobic conditions. May spread to the upper parts of the H_2O body. This also reduces species diversity in addition to increasing the turbidity of the H_2O body.

Thermal pollution

This is pollution of a waterbody by heat which may arise as a result of hydro electric generations.

Heat increases the metabolic rate of aquatic organisms raising the demand for dissolved oxygen

The increase in temperature also reduces the amount of dissolved O_2 and may lead to death of some aquatic organisms.

PRODUCTIVITY IN AN ECOSYSTEM.

Productivity is the total rate at which plants and other distotrophs synthesis organic material such as carbohydrates and it includes organic material used in respiration as well as new plant tissue.

This is also referred to as gross primary productivity
Primary productivity is the rate at which energy
is stored by producers inform of organic substances
that can be used as food materials.
Net primary productivity is the amount of energy
and biomass available per a unit time per unit
area after a loss of some energy from gross
primary productivity due to respiration and
photorespiration ie Net primary productivity
GPP - (Respiration + photorespiration).

Gross secondary Productivity
Is the rate at which certain amount of energy
of biomass is stored by primary consumers per
unit area.

The amount of energy of biomass that remains
in primary consumers per unit area time after
some energy has been lost due to excreation,
egistion and respiration is reffered to as
Net secondary productivity than herbivores because
of the following reasons.
The diet of carnisores is rich in proteins which
is easily digested and the soluble products
efficiently absorbed.
In this case, Very little energy is lost while
herbivore feed on diet rich in carbohydrates,
cellulose (plant material) which is not easily
digested on only partially digested and so a lot
of energy is lost undigested part and hence
herbivores have a looser Net secondary productivity.
Carnivores do not have symbiotic microbes to
consume part of the energy in their diet while
herbivores have cellulose secreting bacteria

in their diets and these bacteria utilise some of the energy from cellulose breakdown.

Some parts of the plant may not be edible by the herbivores and therefore energy remains locked to them while almost all parts of the carnivore food is consumed minimising energy loses

Pesticides;

These are chemicals that kill pests. They are normally named according to the pests they kill. A good pesticide should be

- Specific
- Biodegradable
- Able to kill the target species in low concentration.

Biological magnification.

This is a phenomenon through which certain pollutants accumulate the tissues in increasing concentrations along a foodchain eg DDT. This is because these pollutants are non biodegradable and therefore can not be metabolised or excreated. They accumulate in fat containing tissues of organisms once absorbed. The predation also feeds on many prey more of it.

Pest - resurgence

This is when the number of pests increase to more numbers than those before application of the pesticide that may kill the pest but also its natural predators so that when their numbers begin to rise, there is no control mechanism.