ESC 207 A Ecology, Evolution, and Environment

Weekly Lecture Plan

Week Number	Lecture Topic	COs Met	Assignment/Labs/Tutorial
Week 1	Organisms and their environment	CO1, CO2, CO3	A course project will be assigned. Groups of 4-6 students will work together on the project.
Week 2-5	Fundamentals of Evolution	CO1, CO2	
Week 6-9	Fundamentals of Ecology	CO1, CO2, CO3	
Week 10	Ecosystems	CO1, CO2, CO3	
Week 11	Fieldwork	CO1, CO2, CO3	
Week 12	Biodiversity Conservation	CO1, CO2, CO3	
Week 13	Current Environmental Challenges	CO1, CO2, CO3	

*Please insert more rows if required.

Resource Material

Type Title

Textbook

Reference 1. From Individuals to Ecosystems, Michael Begon, Colin R. Townsend and John L. Harper, 2006, Blackwell Publishing, 4th edition.

2. The Economy of Nature, R.E. Ricklefs, 2008, WH Freeman and Co. 6th edition. (ISBN 9780716738831)

3. Evolution, D.J. Futuyama, 2009, Sunderland, MA: Sinauer Associates, 2nd edition (ISBN-13: 978-0878932238)

4. The Ecology of the Changing Planet, Mark B. Bush, 2003, Prentice Hall, 2nd edition (ISBN 0130662577, 9780130662576)

5. Internet

6. Articles or Resource Material and Information on Topics, Research Papers, Wikipedia, Encyclopedia, My Own Experience and Research Work etc.

ESC 207 A Ecology, Evolution, and Environment

Marks Distribution

Assessment Plan

Type of Evaluation	% Contribution in Grade
Mid-sem	20
End-sem	30
Project	20
Assignments	15
Quiz	10
Class Participation and Attendance	5

Marks are very important

Students have to take care of their marks themselves.

Dead lines may be set and marks should be finalized within the dead line set, near the end of the semester.

Every thing has to be finished within dead line set, otherwise, the result cannot be prepared on time given by the Administration.

I may not be able to help after the dead lines as the result has to be declared on time.

Organisms and their Environment

Organism

Something having many related parts that function together as a whole : an individual living thing that carries on the activities of life by means of organs which have separate functions but are dependent on each other : a living person, plant, or animal., microorganism etc.

A form of life composed of mutually interdependent parts that maintain various vital processes. a form of life considered as an entity; an animal, plant, fungus, moulds etc. any organized body or system conceived of as analogous to a living being.

An organism refers to a living thing that has an organized structure, can react to stimuli, reproduce, grow, adapt, and maintain homeostasis.

An organism would, therefore, be any animal, plant, fungus, protist (algae, amoebas), bacterium, or archaeon (extremophiles) on Earth.

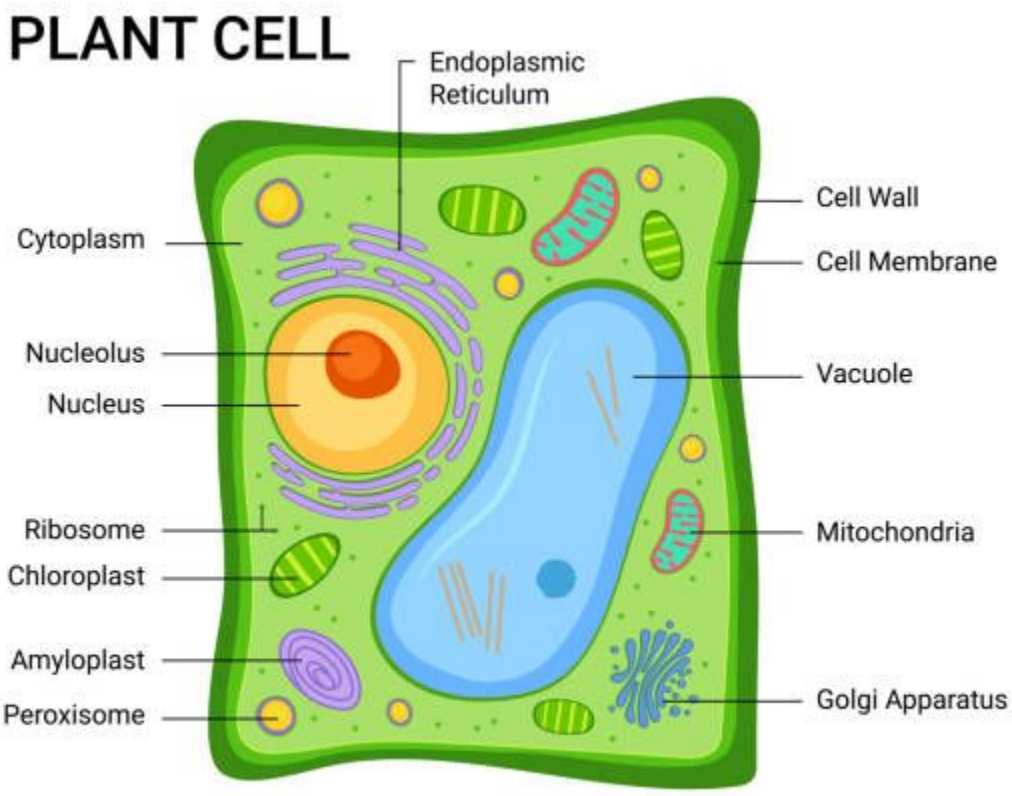
Fruit is an organism or not ?

Earth is an organism or not ?

Eukaryote, any cell or organism that possesses a clearly defined nucleus. The eukaryotic cell has a nuclear membrane that surrounds the nucleus, in which the well-defined chromosomes bodies containing the hereditary material) are located – e.g., man

Prokaryotes : Prokaryotes are organisms whose cells lack a nucleus and other organelles. Prokaryotes are divided into two distinct groups: the bacteria and the archaea, which scientists believe have unique evolutionary lineages. Most prokaryotes are small, single-celled organisms that have a relatively simple structure.

Humans are eukaryotes. They are multicellular organisms, the cells contain a membrane-bound nucleus and other organelles (mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum).


PLANT CELL
Endoplasmic Reticulum
Cytoplasm
Nucleolus
Nucleus
Ribosome
Chloroplast
Amyloplast
Peroxisome
Cell Wall
Cell Membrane
Vacuole
Mitochondria
Golgi Apparatus

Organisms surviving in ice cold and other extereme conditions :

Psychrophiles are microorganisms that can grow at 0 °C and below, have an optimum growth temperature close to 15 °C, and usually do not survive at temperatures above 20 °C. They are found in permanently cold environments such as the deep waters of the oceans.

Extremophiles – Thermophiles (Volcanic), psychrophiles, halophiles and acidophiles.

Five animals that can survive in extremely cold weather

1: Arctic Fox. With its stunning white winter coat the Arctic fox is extremely well equipped to handle freezing conditions. ...

2: Polar Bear. ...

3: Emperor Penguin. ...

4: Musk Ox. ...

5: Reindeer.

Anaerobic bacteria are germs that can survive and grow where there is no oxygen. For example, it can thrive in human tissue that is injured and does not have oxygen-rich blood flowing to it. Infections like tetanus and gangrene are caused by anaerobic bacteria.

Aerobic Bacteria Examples: Some examples of aerobic bacteria are *Nocardia sp. Pseudomonas aeruginosa, E. Coli, Citrobacter, Klebsiella, Proteus, Salmonella, Achromobacter Mycobacterium tuberculosis* etc.

Facultative Bacteria that can use dissolved oxygen (DO) or oxygen obtained from food materials such as sulfate or nitrate ions, or some can respire through glycolysis. The bacteria can live under aerobic, anoxic, or anaerobic conditions.

Chemoautotrophic bacteria Use CO2 instead of carbohydrates as their carbon substrates.- *Acidithiobacillus ferrooxodans*…

Bacteria

Bacteria are ubiquitous, mostly free-living organisms often consisting of one biological cell. They constitute a large domain of prokaryotic microorganisms.

Fungus

Fungi in the form of yeast, mold, or mildew are found just about everywhere, including in the air, in soil, on plants and trees and in water. Some types live on the human skin. Fungi thrive in cool moist areas like the basement and in between walls. Fungi grow by shedding tiny spores (think of plant seeds) in the air.

A virus is an infectious microbe consisting of a segment of nucleic acid (either DNA or RNA) surrounded by a protein coat. A virus cannot replicate alone; instead, it must infect cells and use components of the host cell to make copies of itself. Human Metapneumovirus (HMPVvirus – China – 2025).

Some common types of viruses that you might hear about include: Influenza viruses. Human herpesviruses. Coronavirus..
Viruses are not made out of cells, they can't keep themselves in a stable state, they don't grow, and they can't make their own energy. Even though they definitely replicate and adapt to their environment, viruses are more like androids than real living

Algae – Aquatic species – Coloured in lakes
Algae is an informal term for a large and diverse group of photosynthetic, eukaryotic organisms. It is a polyphyletic grouping that includes species from ...
Green algae · Red algae · Brown algae · Golden algae.
Microalgae and macroalgae
Sequestration of CO2
Production of O2.
Medicines
Proteins
Biodiesel
H2 etc. Etc.

Below are a few of the probiotics that are taken to treat or prevent disease, and how they are thought to work.

Lactobacillus. In the body, lactobacillus bacteria are normally found in the digestive, urinary, and genital systems. ...
Bifidobacteria. ...
Streptococcus thermophilus. ...
Saccharomyces boulardii.
(to be written in etalics).

Some beneficial uses are as follows:
Decay and decomposition. Soil bacteria are important to us because they cause decomposition of the organic matter. ...
Enhancing soil fertility. ...
Industrial production. ...
Bacteria in medicine. ...
Bacteria in genetic engineering and biotechnology.
Most bacteria are good for us

The bacteria in our bodies help degrade the food we eat, help make nutrients available to us and neutralize toxins, to name a few examples . Also, they play an essential role in the defense against infections by protecting colonized surfaces from invading pathogens.

Pathogenic bacteria are bacteria that can cause disease. These are the bacteria that are harmful to humans. Most species of bacteria are harmless and are often beneficial but others can cause infectious diseases. These are dangerous bacteria.

Pathogenic bacteria are bacteria that are capable of causing disease or death. Five pathogenic bacteria include Bacillus, Spirochetes, Rickettsia, Staphylococcus aureus, and Escherichia coli.

How many bacteria are in the human body?
Do our bodies contain far more bacteria than human cells ...
The researchers calculated the number of bacteria in the large intestine to be 3.9x10 raised to 13. All other organs of the human body contain at most another 10 raised to 12 bacteria. This means that in total, some 3.9x10 raised to 13 (39 trillion) bacteria frolic in and on the human body.

Common terms in ecology

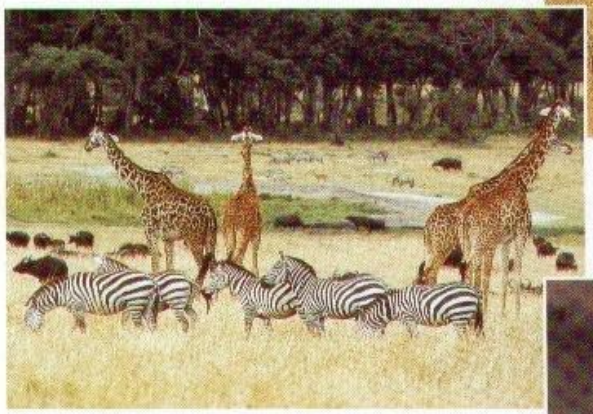
- Habitat: The place or environment where a specified organism lives
- Ecological niche: The role played by an organism in its habitat
- Predator: An animal that feeds on another animal
- Prey: An animal that is eaten by another animal
- Population: A group of individuals of the same species that live within the same area
- Community: Different populations of plants & animals living and interacting with a given habitat
- Ecosystem: An ecological system formed by the interaction between different populations as well as their interaction with the non-living environment within a given habitat

Video on Organisms, their growth and the environment

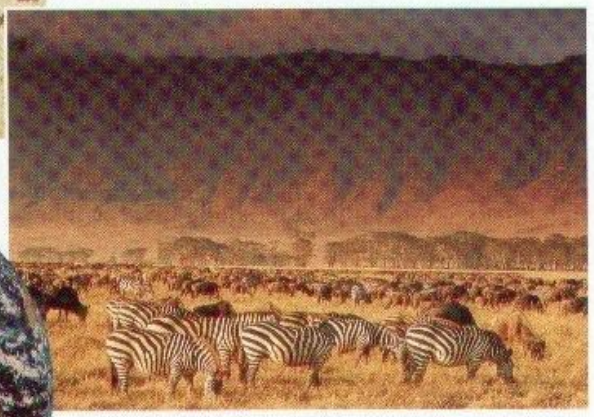
https://www.google.com/search?q=video+of+organism+and+their+environment&rlz=1C1YTUH_enIN1045IN1045&oq=video+of+organism+and+their+environment&gs_lcrp=EgZjaHJvbWUyBggAEEUYOTIJCAEQIRgKGKABMgcIAhAhGI8CMgcIAxAhGI8C0gEKMzc3NThqMGoxNagCCbACAQ&sourceid=chrome&ie=UTF-8#fpstate=ive&vld=cid:33d83897,vid:XEkafr12Wd8,st:0

Organism

Populations



Communities



Ecosystems

Biosphere

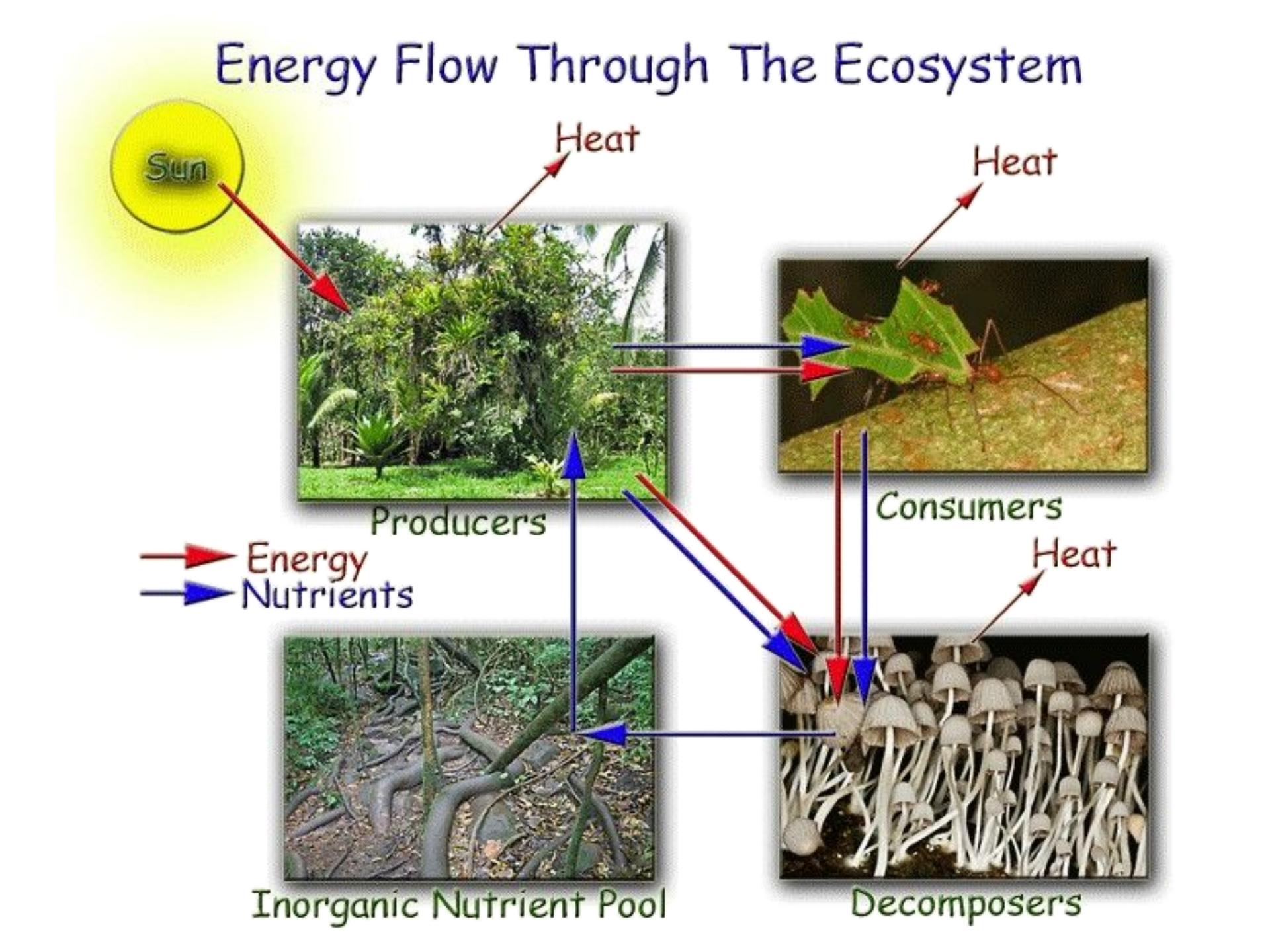
Figure 2.4
Ecology deals with several levels of biological organization, including organisms, populations, communities, ecosystems, biomes, and the biosphere.

Energy flow and chemical cycles

Two key processes which sustain ecosystems making up the biosphere are energy flow and chemical cycling.

1. The principal source of energy input into biological systems within an ecosystem is the Sun
2. Energy flows into the ecosystem primarily as light energy and is eventually released as heat energy
3. The light energy that enters the ecosystem is converted into chemical energy by plants during photosynthesis and is incorporated with elements such as carbon, hydrogen, oxygen and nitrogen into organic compounds such as carbohydrates, proteins and fat
4. The chemical elements can be recycled but the energy is released at different stages as heat energy and can not be recycled
5. Thus, energy flow within an ecosystem is non-cyclic and must be constantly supplied to the system.

Energy Flow Through The Ecosystem



Food chains and food web

Both energy flow and chemical recycling depend on the transfer of substances in the feeding relationships of an ecosystem.

The sequence of food transfer from one trophic level to another is called a food chain

Trophic levels: describe the position that an organism occupies in a food chain - what it eats, and what eats it.

1. Producers: at the base of all food chains – autotrophic organisms which produce their own organic matter from inorganic nutrients

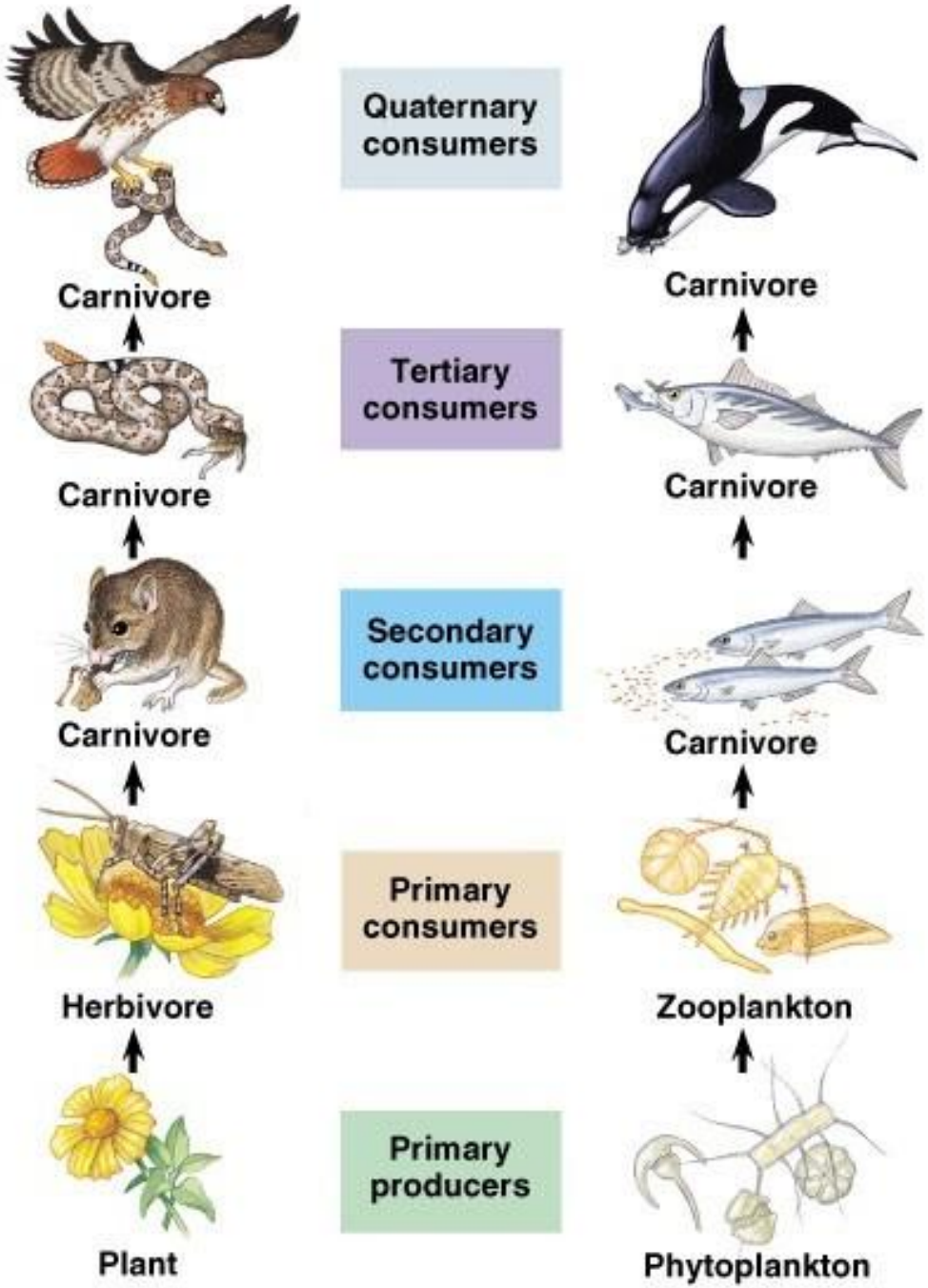
The main producers on land are the photosynthesising green plants

In aquatic ecosystems, producers could be water plants or phytoplankton, Azolla, which comprises photosynthetic one / single -celled organisms, including **algae** and **bacteria**

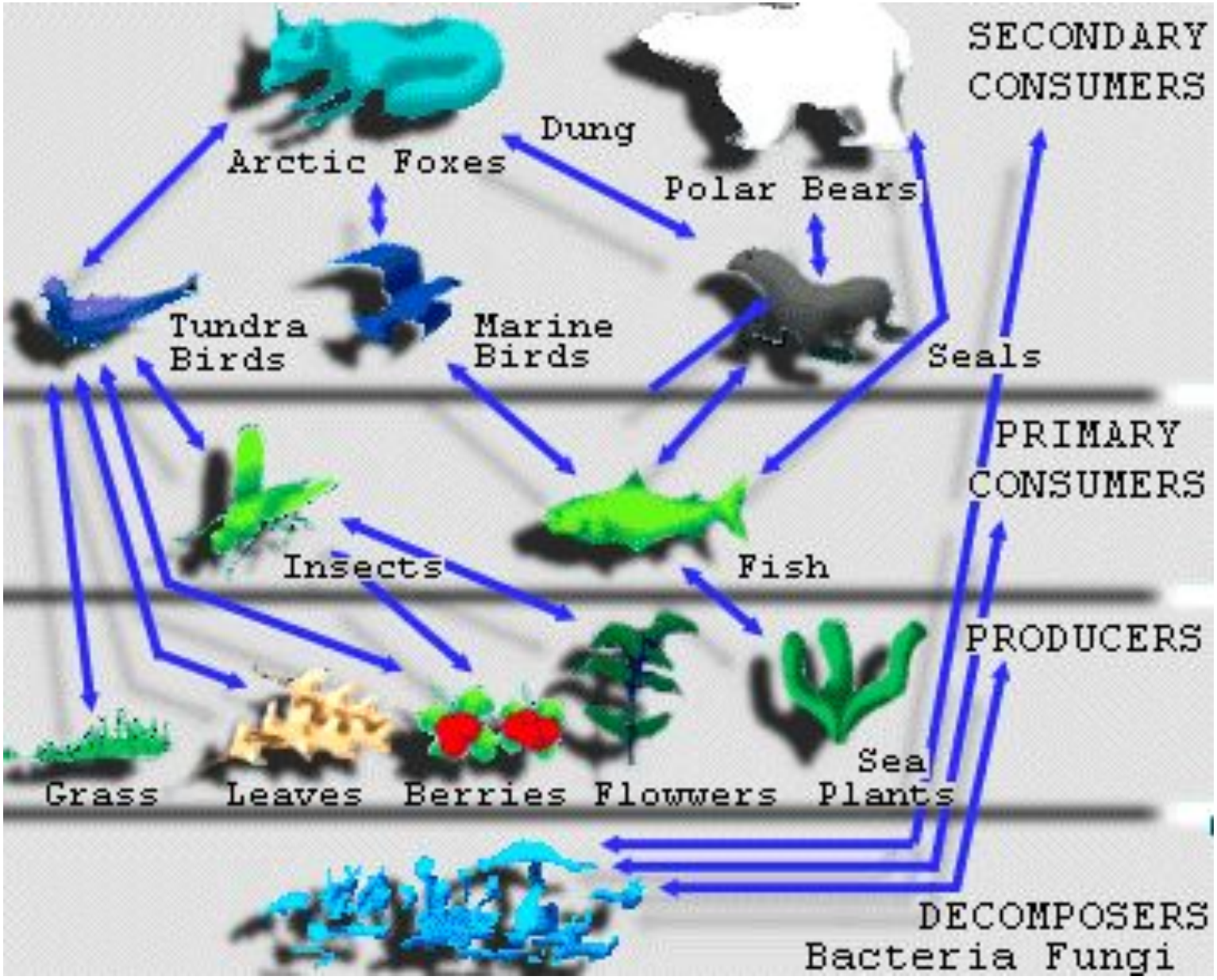
2. Consumers: All organisms in the tropic levels above the producers. Depend (directly or indirectly) on producers. Obtain energy by feeding on other organisms

- Herbivore – Primary consumers which feed directly on plants or algae. In aquatic ecosystems, primary consumers are zooplankton (microscopic organisms which preyed on phytoplankton)
- Carnivore – Consumers which feed on other consumers from the trophic level below it. Tertiary consumers feed on secondary consumers. Quartenary consumers feed on teritary consumers
- Omnivore: A consumer that feeds on both other consumers and producers

- **Detritivore/ Decomposers:** Critical trophic level of consume
  - Bacteria and fungi obtain their energy from *detritus* – the dead material left by all trophic levels as well as animal wastes and plant litter
  - feed on decaying matter, speed up the decaying process that releases mineral salts back into the food chain for absorption by plants as nutrients Chemical elements are recycled



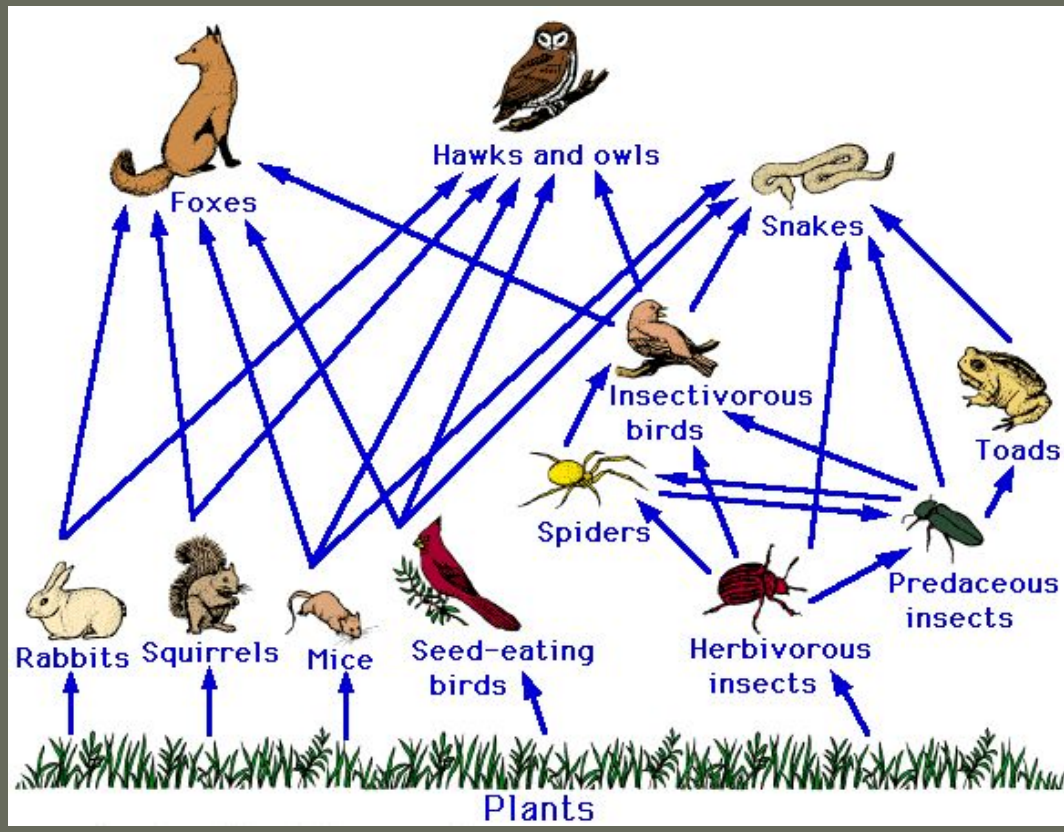
A terrestrial food chain **A marine food chain**


SECONDARY CONSUMERS
Arctic Foxes
Dung
Polar Bears
Tundra Birds
Marine Birds
Seals
PRIMARY CONSUMERS
Insects
Fish
PRODUCERS
Grass
Leaves
Berries
Flowwers
Sea Plants
DECOMPOSERS
Bacteria Fungi

Food web: Represent the inter-relationships between food chains

Food relationships are very complex because:

- Several types of primary consumers may feed on the same plant species
- One species of primary consumers may feed on different plants
- A secondary consumer may feed on several types of primary consumers which may also be eaten by other secondary consumers.
- Some consumers may feed on several trophic levels



Energy loss in a food chain:

The transfer of energy along a food chain is inefficient.

90% of the energy stored at a trophic level is lost in the transfer to the next level.

Reasons for the loss of energy:

- Used up for cellular respiration
- Converted to heat as a result of activities
- Not all the organic material can be consumed by the consumer, some of it may be inaccessible
- Lost as metabolic and biological wastes

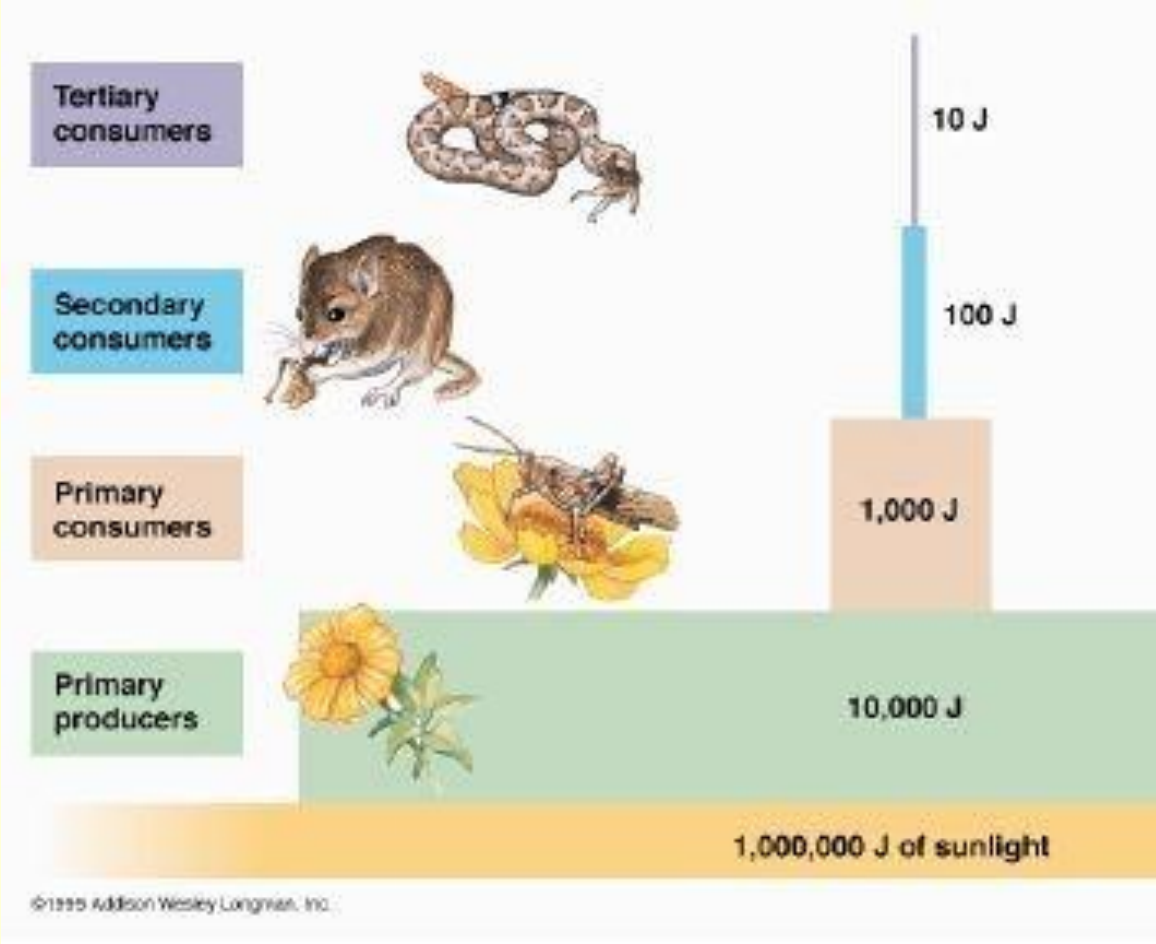
Less and less amount of energy is transferred to higher trophic levels

 Limit the length of the food chains (usually 2 or 3 trophic levels long, never exceeds 6)

Ecological pyramid

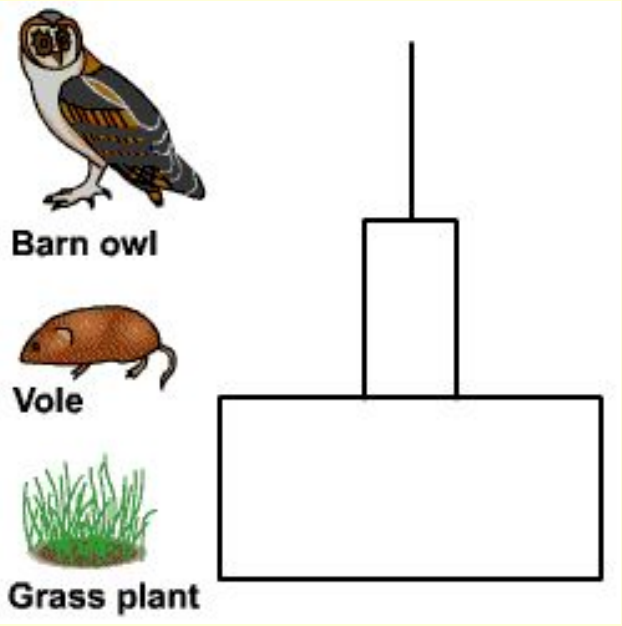
The pyramid of energy:

Represent the cumulative lo from a food chain

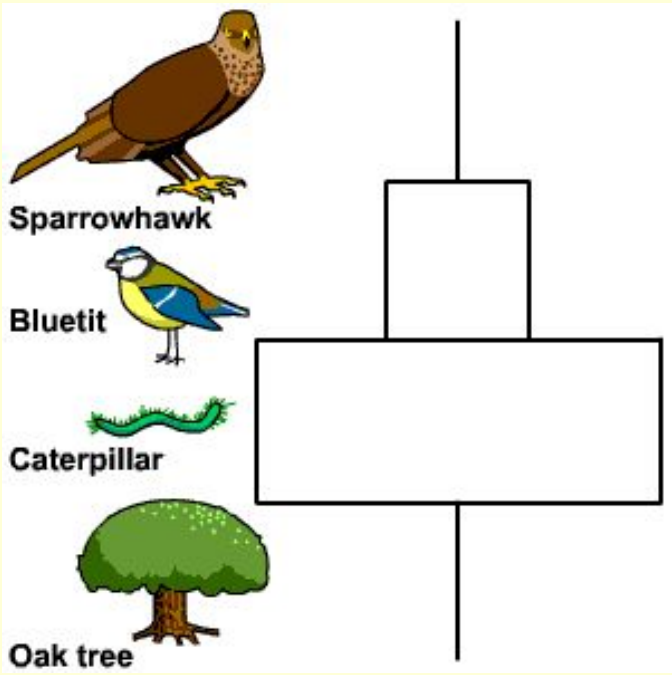


The pyramids of numbers:
Represent the number of organisms counted for each species at each trophic level in the same area at a particular time

Pyramids of numbers will often be pyramid-shaped like this
-but not always



If the producer is a large plant such as an oak tree, the second layer of the pyramid representing primary consumers will be much larger than the base. In this case it would make more sense to draw a pyramid of biomass



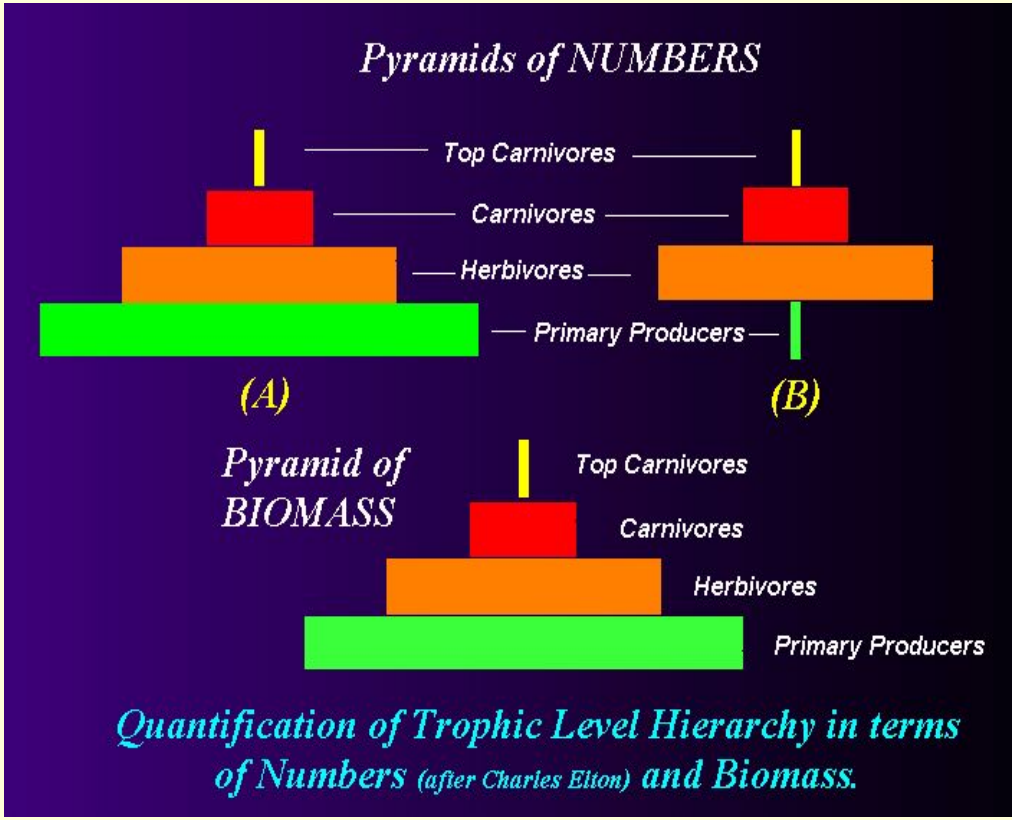
Disadvantages of pyramid of numbers:

- The pyramid may become inverted if producer is large
- The number of individuals in each species may vary widely, making it difficult to represent the entire community of the same scale

The pyramid of biomass

- Show the total biomass (the amount of biological material) of organisms of each species at each trophic level in the area at a particular time

- Average dry weight of individuals must be obtained, then total biomass is calculated by multiplying the average dry mass by the estimated number of individuals in the food chain



Disadvantages of pyramid of biomass:

- Determining the dry mass involves drying and hence killing samples which may affect the food chain
- The sample taken may not be representative of the population
- It represents the biomass at a particular time and not the productivity of a species, and hence results in an inverted pyramid (This usually happens in aquatic system, the population of phytoplankton though smaller in biomass at a particular time grows fast enough to support the larger but slower growing zooplankton population)

How did wolves change Yellowstone National Park?

The creation of the national park did not provide protection for wolves or other predators, and government predator control programs in the first decades of the 1900s essentially helped eliminate the gray wolf from Yellowstone. The last wolves were killed in Yellowstone in 1926.

From 1995 to 1997, 41 wild wolves from Canada and northwest Montana were released in Yellowstone.

Wolf reintroduction caused unanticipated change in Yellowstone. It rebalanced elk and deer populations, allowing the willows and aspen to return to the landscape.

The end to overgrazing stabilized riverbanks and rivers recovered and flowed in new directions. Songbirds returned as did beavers, eagles, foxes and badgers.

How reintroducing wolves saved this ecosystem – Yellowstone Park in USA

Video

https://www.youtube.com/watch?v=CFHmtVNu97E

The carbon cycle

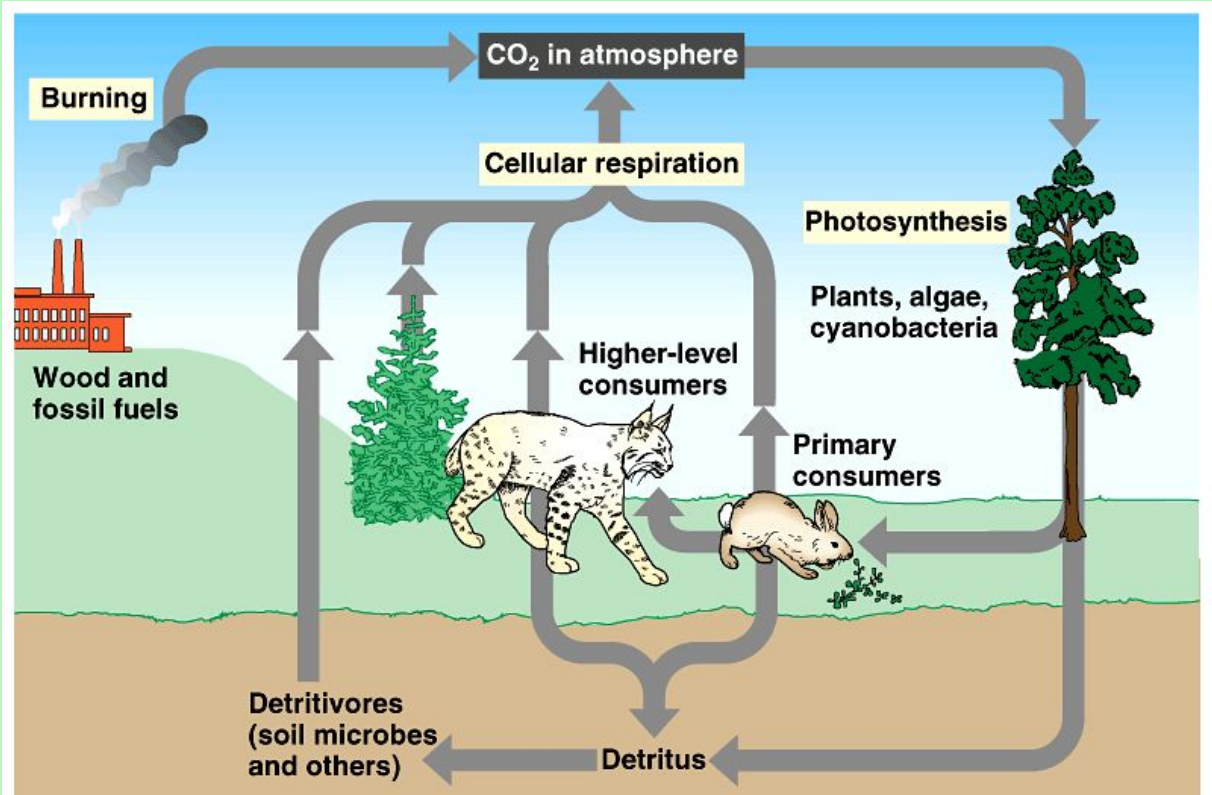
1) Photosynthesising organisms convert carbon from CO2 into sugars. **Photosynthesis** takes place only in the presence of light and remove CO2 from the atmosphere.

2) As organic molecules are oxidised in all cells to release energy, C are converted back to CO2 via **respiration**

3) Decomposition by fungi and bacteria returns some of carbon in dead tissues to the atmosphere as CO2

4) Some of the remains of dead organisms are locked up as carbon-based **fossil fuel** e.g. coal and oil

5) The **burning** of fossil fuels releases C stored in such fuels into the atmosphere as CO2



Pollution

Pollution: The release into the environment of substances which cause harm to living organisms. Pollution is a problem of international dimension

Factors contributing to the extent of the problem:

- The exponential increase in world population size over the last few centuries- 8 billion from 2.5 b in 1950.
- Developments in technology leading to widespread industrialisation.

Water pollutants:

1. Biological,
parasites, viruses, or bacteria which cause diseases *or*
could be of biological origin – animal wastes/ plant residues (which pollutes by removing O2 from water because of the bacteria they support)
2. Chemicals:
detergents, pesticides, salts, oil-based products and fertilisers cause health problems, disrupt the functioning of the ecosystem.

3. Thermal pollution:

releasing H_2O used us coolant in industrial process e.g. electric power plants, food processing factories…, directly into rivers and lakes.

As H_2O tends to be stable, aquatic organisms poorly adapted to rapid changes any small change in to temp. could be lethal.

Temperature increase solubility of O_2 lower affect - species requiring high O_2 levels

A stretch of H_2O with different temp. prevents migratory species from reaching or leaving spawning sites. Trout fish dies.

4. Sediment: carried by rivers to oceans.

Soil loss greatly hastened by recent human activities e.g. deforestation, construction and other sources of erosion.

Sediment makes lake & rivers less attractive and drinking water more costly to produce, also destroys habitats as it smothers aquatic life.

Effects of water pollution by sewage:

1. Major health problems:

- **in many 3rd world countries, sewage treatment does not exist, most of the population lives close to wastes they produce**
- **as excreta contains pathogenic organisms waterborne diseases e.g. typhoid, cholera, infectious hepatitis…Amoebic dysentary**
- **Malaria, yellow fever and filariasis transmitted by insects in aquatic life.**

Sewage/ Fertilisers contains large amounts of *nitrogenous and phosphates compounds*

encourage growth of plants/ algae in aquatic ecosystems

- **most of these producers die and decompose since there is no corresponding increase in no. of consumers**
- **reduce amount of soluble**
- **O2available- subsequent death of**
- **consumers- fish**
- **their decomposition removes even more O2**
- **The process is known as eutrophication, to render the streams and rivers unsustainable of aquatic life**

Effects of pollution on dissolved oxygen levels:

➢Upstream from the pollution source, oxygen levels support normal populations of clean-water organisms.

➢Immediately below the pollution source, O2 levels begin to fall as decomposers/ bacteria metabolise waste materials/ dead organic matters/ untreated sewage. Organisms feeding on detritus and can tolerate low O2 levels e.g. trash fish found here.

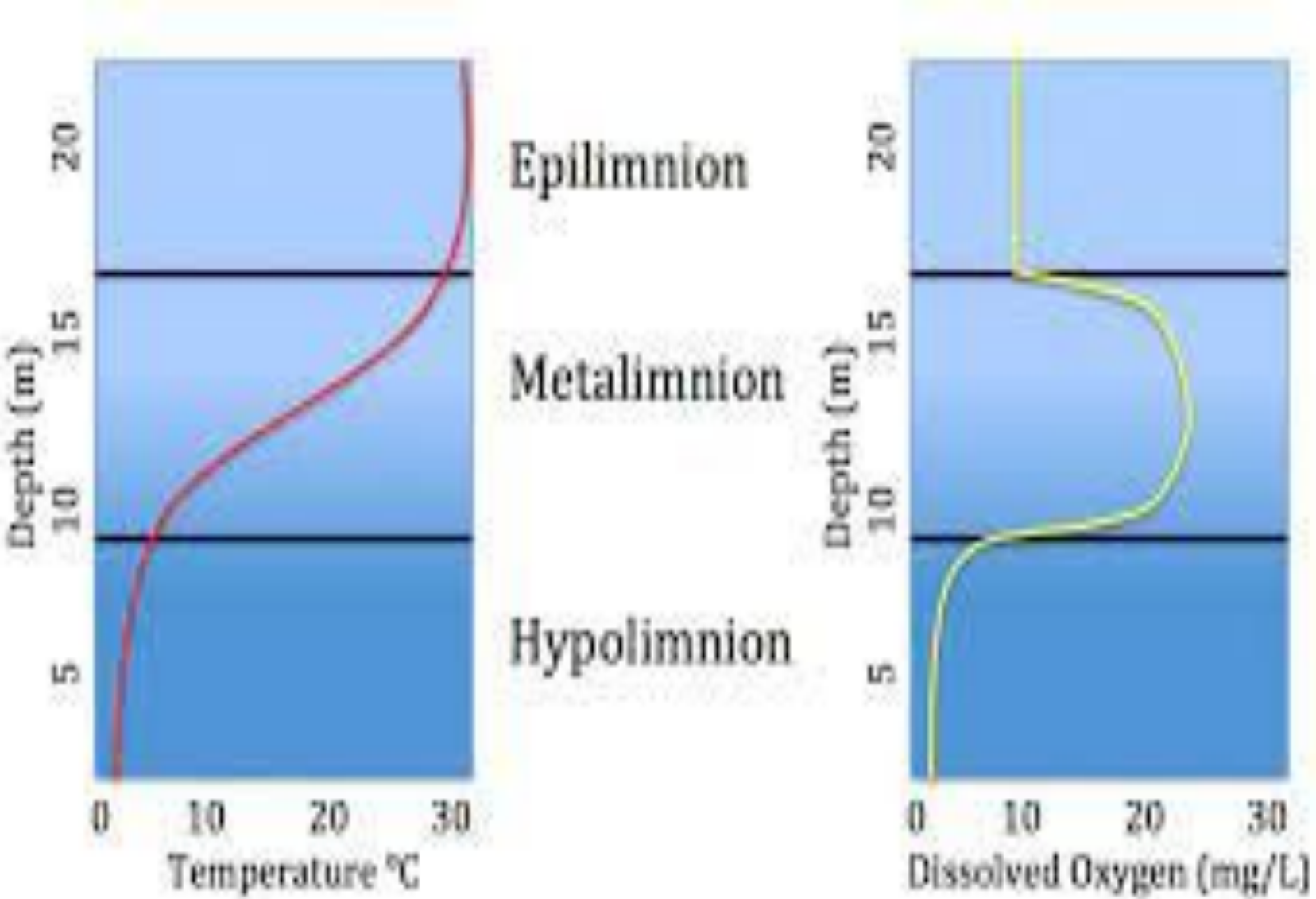
➢Further downstream, water becomes so anaerobic that only the most resistant micro- organisms & invertebrates survive.

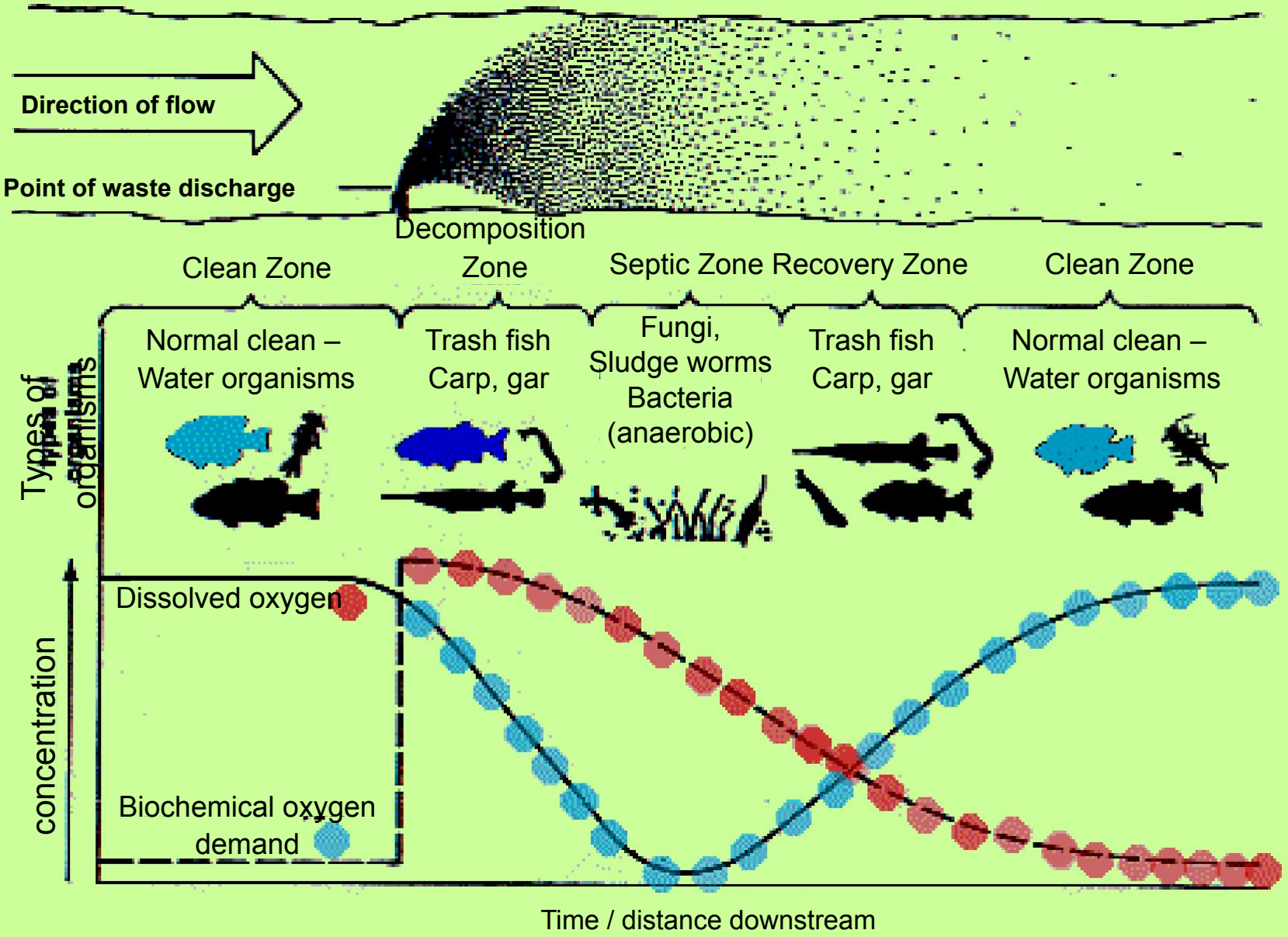
➢Eventually most nutrients used up, the decomposer population decreases water oxygenated enough to support clean-water organisms again

-When the water is turbulent and rapidly flowing, the ability to recover from effects of O2-demanding wastes is more rapid

-The activity of naturally occurring decomposers is sufficient enough to maintain sanitary conditions where population densities are low.

-Problems arise when *more* sewage produced than the natural process can cope with


Epilimnion
Metalimnion
Hypolimnion
Depth (m)
20
15
10
5
0
10
20
30
Temperature ℃
Depth (m)
20
15
10
5
0
10
20
30
Dissolved Oxygen (mg/L)


Direction of flow
Point of waste discharge
Decomposition Zone
Clean Zone
Septic Zone
Recovery Zone
Clean Zone
Normal clean – Water organisms
Trash fish Carp, gar
Fungi, Sludge worms Bacteria (anaerobic)
Trash fish Carp, gar
Normal clean – Water organisms
Types of organisms
Dissolved oxygen
Biochemical oxygen demand
concentration
Time / distance downstream

The use of environmental biotechnology in solving water pollution:

Sewage treatment plants employ the natural decomposition process of micro-organisms to address the problems

Products of sewage treatment:

- **Micro-free effluent – returned to waterways**
- **Nutrients-rich sludge – for use as fertiliser to improve soil structure and provide vital missing nutrients**
- **Methane gas produced during decomposition of sludge – to generate electricity.**
- **PFAS a in water, air, dust (elwectromagnetic wastes), Microplastics in sea, rivers etc.**

Roles of the microbes in sewage disposal

Secrete enzymes that digest solid organic wastes into harmless soluble substances & CO_2. Also feed on digested products.

Remove organic matter from water by ensuring decomposition takes place mainly at the treatment plants, O_2 levels of waterways into which effluent released less likely to be affected.

Remove water-soluble nitrates & phosphates from the effluent.

Both stimulates growth of producers. The process of enriching the environment with nutrients known as eutrophication which causes harmful effects as discussed Eliminate pathogenic micro-organisms from both the sludge and the effluent.

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) and Microplastics

They are ingredients in various everyday products. For example, PFAS are used to keep food from sticking to packaging or cookware, make clothes and carpets.

It is currently known that three treatment processes can be effective for PFAS removal: granular activated carbon, ion exchange resins, and high-pressure membrane system.

Most plastics in the ocean break up into very small particles. These small plastic bits are called "microplastics." Other plastics are intentionally designed to be small. They're called microbeads and are used in many health and beauty products. They pass unchanged through waterways into the ocean.

Nanopollution (NPs)

NPs being released into the air, water and soil pose a serious threat owing to their small size. They can float easily into the air and get transported through water into the soil, and then get accumulated from plants into humans through food chain, causing a deleterious effect on humans.

Human-made (anthropogenic) nanoparticles are emitted by large industrial processes, and in modern life it is particles from power stations and from jet aircraft and other vehicles (namely, those powered by internal-combustion engines; car tires are also a factor) that constitute the major fraction of nanoparticles. Nanofiltration, Adsorption etc. Prevention is better.

Wastewater Treatment – Sewage Treatment Plants

Primary wastewater treatment : Physical Treatments

Secondary wastewater Treatment- Activated Sludge and Trickling Filters – Biological Wastewater Treatment – Aerobic degradations by the sludge or rock based microbes.
Tertiary Wastewater Treatment : Adsorption, Reverse Osmosis, Disinfection – Ozonation, Chlorination etc.

India generates almost 73000 million liters of sewage per day , out of which almost 34-45 % is treated through Sewage Treatment Plants – According to CPCB, Ministry of Environment and Forests and Climate Change, Govt. of India.
Remaining flows into the drains and remains a polluted water.
Yamuna river
Clean Yamuna and Clean Ganga Missions

Effects of water pollution by inorganic wastes

1. Heavy metal poisoning:

E.g. Hg, Pb,Cd, Ni highly toxic, even present in miniscule amounts

***Mad hatter syndrome* – trembling, loss of co-ordination, slurred speech, loosening of teeth, memory loss… observed among the gold miners poisoned by Hg used to extract Au from soil.**

2. Non-metallic salts: e.g., NH4Cl

Percolating groundwater may bring poisonous non-metallic salts e.g. selenium and arsenic to the surface

E.g. in the USA, large amounts of salt used to melt road ice every winter leach into surface waters where it has a devastating effect on aquatic systems

3. Acids:

Released as by-products in industrial process, SO2 & NOx dissolve in moisture to form acid rain

Changes the pH of the soil or water body it lands in affects the functioning of organisms in them, killing the fish, trees slowly die

Causes toxic mineral e.g. Al & Hg leached out from soil, it can damage or kill

Pollution by insecticides

Advantages of insecticides: Insecticides like DDT have been used effectively in control and prevention of diseases like malaria, typhus, plague…

Disadvantages of insecticides:

1. The danger of increasing resistance:

Some insects possess a natural resistance that enables them to survive being sprayed with insecticides

The genes for resistance passed to their offspring the next generation contains higher % of individuals with resistant genes

Eventually the species immune to the insecticides

Nuclear radiation resistance in some insects.

2. Biological amplification:

Bioaccumulation: Cells can selectively absorb & store a wide variety of molecules

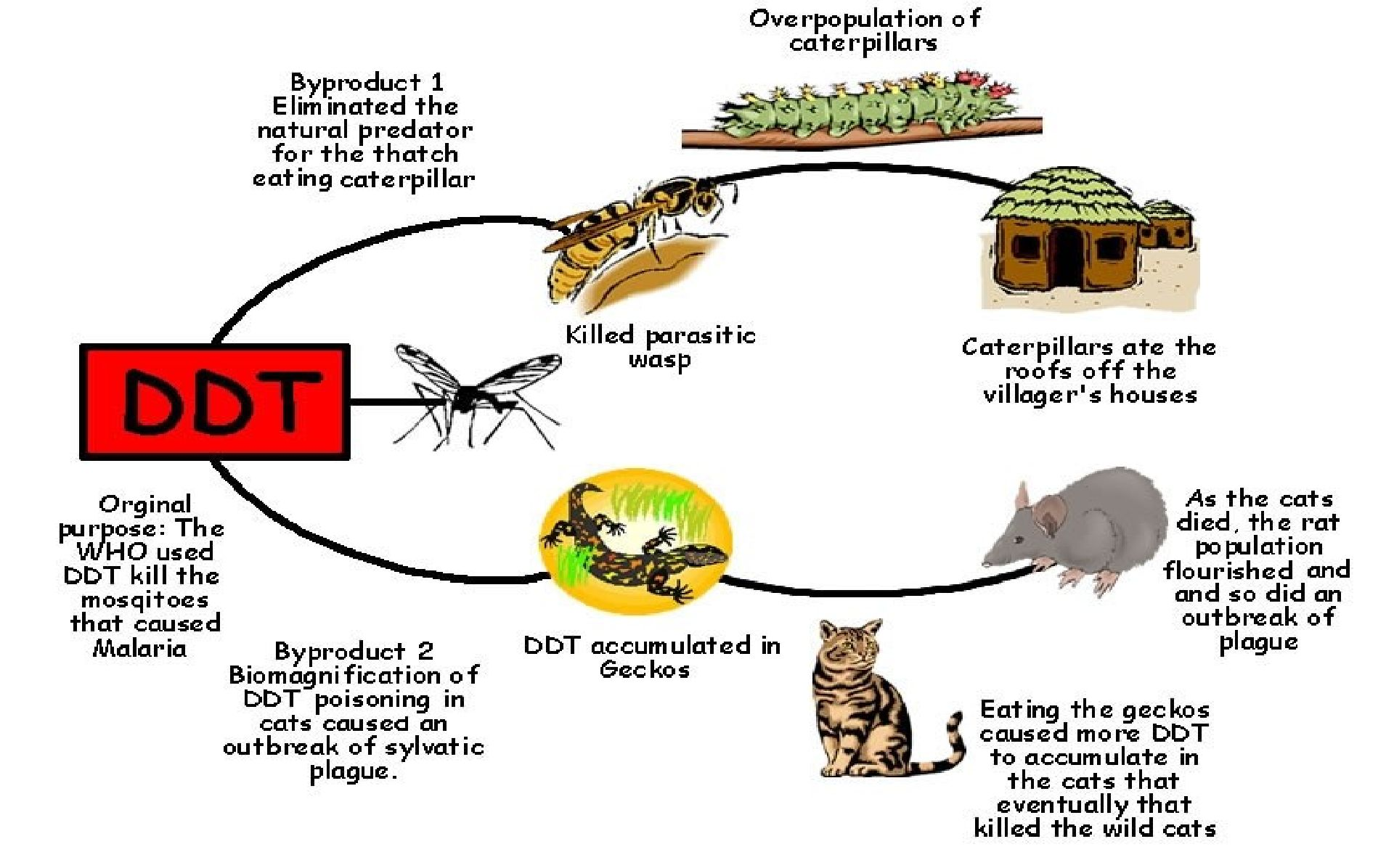
When these cells consumed, the substances they contain get accumulated and concentrated in the cells of organism in the next trophic level

The effect of biological amplification was seen in 1950s when the populations of the fish-eating birds at the top of the food chain plummeted (followed by ban on DDT)

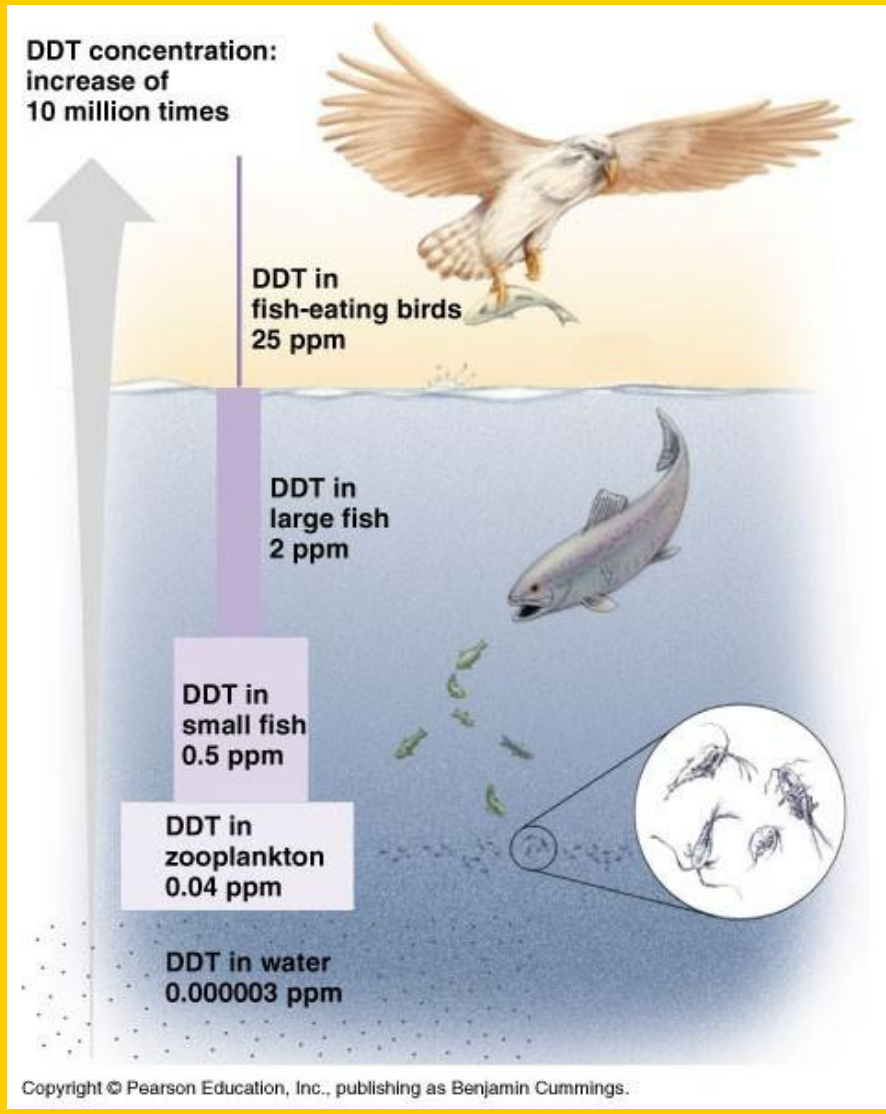
A lethal, non-persistent chemical cause less long-term effect than a sublethal but non- degradable chemical.

Effect of DDT Use in Borneo

In the early 1950's the people in Borneo, suffered from Malaria the World Health Organization had a solution, kill the mosquitoes with DDT. This is what happened.



If each phytoplankton organism retains only 1 unit of DDT from water, a small fish eating thousands of zooplankton store thousands units of DDT. A large fish that eats 10 of smaller fish store tens of thousands of units. The top predator which eats several large fish will thus ingest hundred thousands of units



Conservation

Conservation: The sensible use of the earth's natural resources in order to avoid excessive degradation and impoverishment of the environment

Maintenance of Biodiversity

1. Biodiversity refers to range of varieties of species present in a given ecosystem

2. Conservation ensures that biodiversity is maintained and plant & animal species are not forced into extinction. The extinction of one or more species will upset the natural balance of nature in the ecosystem

3. Biodiversity is important because of the large number of potential benefits that these organisms can afford Man.

4. Biodiversity ensures that food chains and food webs can be sustained to ensure stable and balanced ecosystems. When ecosystems are disrupted, there can be far reaching consequences such as global warming and Yellowstone Park type of problems.

5. Biodiversity ensures that a sufficiently large and varied gene pool is maintained, ensure that cross-breeding produces new genetic varieties better suited to survive in changing conditions or when faced with new diseases.

Current Conservation Practices in India

Kanha National Park

Grow more grass so that deer and other herbivore population increases otherwise leopards and tigers are eating dogs, cats or other animals from nearby areas.

Bharatpur Bird Sanctuary

Fish population is decreasing due to water shortage there.

Kingfisher population is dropping which feed on fish.

Authorities are planning to make some water available from dams for the fish population there.

Cheetahs in Kuno Park from Namibia and South Africa.

As part of the first-ever intercontinental translocation of the big cats, 20 cheetahs have been brought to the Kuno National Park in Madhya Pradesh so far — eight from Namibia in September 2022 and 12 from South Africa in February 2023.

Plant Conservation is a broad group of activities which aims to prevent plants from becoming extinct. It includes the direct conservation of wild populations, collections of plants with gardens, education programmes, invasive species control, recovery and restoration work, research programmes, training etc.

Why do we need to maintain biodiversity in different ecosystems?

1. *Tropical forests* contain 70% of the world's vascular plants & more species per m2 than a temperate forest.

-Chief source for pharmaceuticals e.g. quinine derived from the bark of Cinchona to treat malaria, morphine from the sap of poppy flower to relieve pain…

-Important sources of genetic stock for plant breeding e.g. a species of wild maize from Mexico found to be resistant to 5 of the world's 7 most important corn viruses important for corn-improvement programs

-Source of raw materials for different industries, e.g., latex from rubber plant, rattan used in the manufacture of furniture, cotton to make cloth

-Source of food; natural insecticides & pesticide – ChilePepper, Neem (*Azadirachta indica*)

2. *Water bodies* of the world with compounds in marine creatures which belong to chemical classes unknown amongst land animal

- **Research into defence mechanisms of marine animals and plants – toxins e.g. the cone snail kills prey much larger than itself with a venom-containing harpoon. The venom contains various toxic compounds, enough to kill a large fish almost immediately. The inland taipan is considered the most venomous snake.;**

antivenom injection. Chemicals extracted from marine invertebrates e.g. corals & sponges more effective than existing pharmaceuticals in treating as cancer

Importance of fisheries:

- Fish – important sources of food (protein) – potentially renewable resources but fish are being killed sustainable source of fish to be established

- Over-fishing can reduce fish populations to a point where they are unable to maintain their numbers

Problems with fishing:

Methods of fishing do not discriminate between the target fish species & other sea animals.

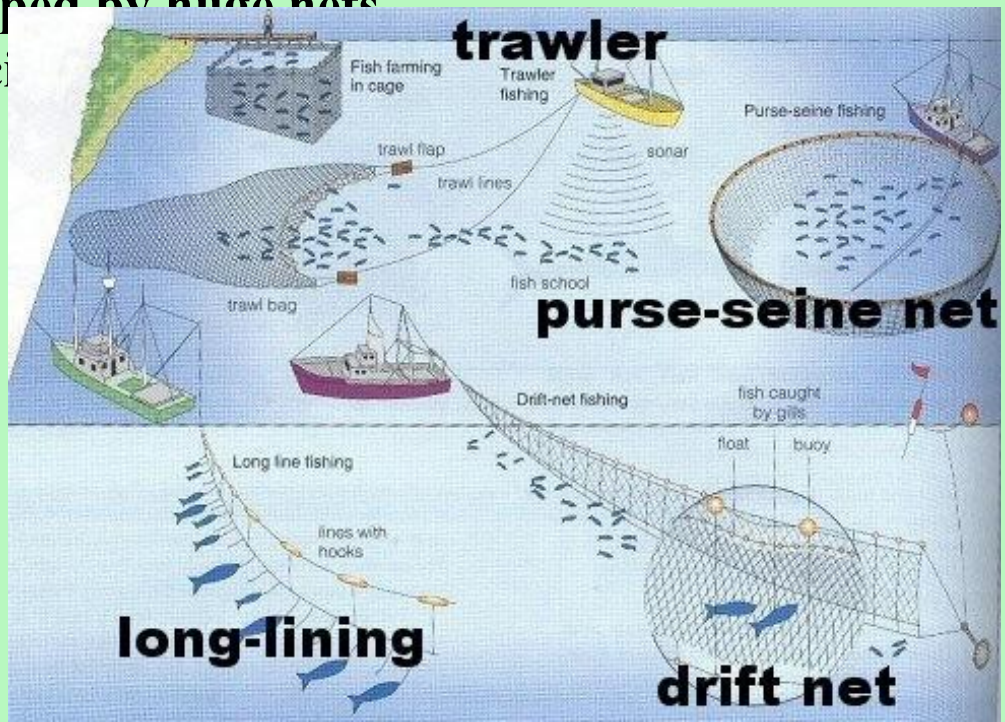
Huge number of marine creatures trapped by huge nets

Once on board the ship, the target speci

separated out of the rest, many of which may be dead, dumped overboard.

Trawl fishing: does more than catch fish. The heavy rollers used to weigh down the nets flatten everything in their path as they are dragged along the ocean floor

devastate habitats which is there for thousands of years.



Management of fisheries

1. **Fish farming:**

Supplies ¼ of all fish on the dinner table.

Cultivate marine organisms in a controlled environment. Food supplied so that organisms can grow fast and in high densities.

2. **Marine reserves:**

No-take zone: defined areas in marine waters where fishing is prohibited Provide fish populations a permanent refuge from fishing pressure

Ensure critical ecological relationships are protected ensure the survival of multiple species and not just the species being farmed

However, they are difficult to design and expensive to enforce

3. **Legislation and international cooperation:**

Have in place enforceable laws with procedures for determining & punishing violators

Prohibit destructive fishing practices e.g. dynamiting, poisoning and using drift nets Ban the harvesting of endangered species to prevent the extinction of the species and restock dwindling populations

Protect important fish habitats e.g. wetlands, mangroves and reef from destruction and pollution

Strictly regulate the period of fishing in fishing grounds so as not to deplete fish

Effects of deforestation

1. **Reduced biodiversity:**
As forests provide shelter for animals and form important habitats

2. **Global warming:**
They are major source of oxygen and acts as a *carbon sink* – through photosynthesis, CO_2 is removed, prevent a possible runaway greenhouse effect. The burning of forest plants to clear land releases tonnes of CO_2 which increases the impact of global warming- Fires in Hollywood - > 1000 houses burnt.

3. **Soil erosion:**
Forests help regulate the flow of fresh water through the ecosystem.
The lands they lie on act as giant sponges, soaking up water from rain, which recharges springs, streams and groundwater. The roots of the trees hold on to soil, helping to control soil erosion and reduce the amount of sediment washing into water bodies
Deforestation reduces soil cohesion, so that erosion, flooding and landslides often ensue

4. Climate change:

50-80% of the moisture in the air above tropical forests comes from transpiration & evaporation

With deforestation, average annual precipitation drops the region's climate becomes hotter and the soils, with nothing to hold them are easily washed away. In the extreme cases, desertification is the result

Instead of trapping precipitation, deforested areas become sources of surface water runoff. That quicker transport of surface water can translate into flash flooding.

Management of timber production

1. **Reforestation:**

Young trees and seed trees are not cut down

New seedlings are planted to replace the trees that were cut down

Major reforestation projects involve large plantations of single-species forests called monocultures

The trees are grown for a specific purpose e.g. *Eucalyptus* or Acacia for the pulp and paper industry. Profits from logging this kind of forest is high since machines can easily be used, saving time and money

2. **Establishing forest reserves:**

To ensure different varieties of trees survive

E.g. in the *Chipko* movement 1970s, when commercial loggers began large-scale tree felling in India to supply wood that would be used for making tennis rackets, the locals rushed into the forests ahead of the loggers, flung their arms around the trees and dared the loggers to let the axes fall on their back

. In 1974, Gaura Devi and 25 other women and then Amrita Devi Bishnoi. Medha Patkar, A. K. Banerjee and Sunder Lal Bahuguna involved in Chipko movement.

The result was a 15-year ban on commercial logging in the hills of the Indian State of Uttar Pradash in 1980s.

3. Legislation:

Instilling laws to ensure that trees are cut at a sustainable rate to ensure that the forests are still able to be maintained

Loss of tree cover by commercial logging aggravated by the rampant illegal logging (to meet the massive demand for cheap and plentiful tropical timber in consumer markets)

Many nations however, failed to take steps to eliminate illegal timber from the supply chain and are content to turn a blind eye

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aims to protect certain plants & animals by regulating and monitoring their international trade

The International Union for Conservation of Nature (IUCN) is a membership Union uniquely composed of both government and civil society organizations.
- Species are classified into one of nine Red List Categories: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern.

Video

https://www.google.com/search?q=video+of+organism+and+their+environment&sca_esv=5571eca2e3b5ace7&rlz=1C1YTUH_enIN1045IN1045&sxsrf=ADLYWILgwPMQMWv_RFzNXdRFsNF37wOHHQ:1735973883389&ei=-9t4Z9q7F8Kd4-EP_vjtkAI&start=10&sa=N&sstk=ATObxK7QrseD1NO1RL_CEGim3mRjpKKEdLQ2_E85hIAb2521my37PrS5Ak81NdI8imTPY-mgj_KYXnq-tOqvO32CMG0ENLwnv95lug&ved=2ahUKEwiapaLVvtuKAxXCzjgGHX58GyIQ8tMDegQICxAE&biw=1067&bih=449&dpr=1.5#fpstate=ive&vld=cid:712de2c6,vid:dKGNsye4HV8,st:0

Assignment 1

Main theories of evolution

No Plagiarism – Please check for the plagiarism as per the Institute rules.

6 - 8 Pages

Single space 12-14 Font size.

Tables, Figures and References are not to be included in the number of pages

Last date.