



Homeostasis and Response

Inheritance, Variation and Evolution

Ecology

Key Ideas

## Ecology and the Environment

Communities  
Abiotic Factor  
Biotic Factor  
Adaptations  
Carbon Cycle  
Waste Cycle  
Climate Change  
Biodiversity  
Waste Management  
Land Use  
Deforestation  
Global Warming  
Food Chain  
Pyramids  
Food Production



**Organismal**

**Individual Species**



**Population**

**Groups of similar organisms living in the same area.**



**Community**

**Groups of population living in a defined area**



**Ecosystem**

**Groups of communities with its living and non living factors**



**Biosphere**

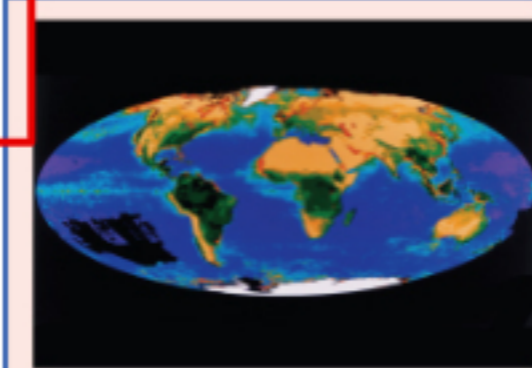
**Groups of different Ecosystem**



**Organisms, Populations, and Communities:** In a forest, each pine tree is an organism. Together, all the pine trees make up a population. All the plant and animal species in the forest comprise a community.



**Ecosystems:** This coastal ecosystem in the southeastern United States includes living organisms and the environment in which they live.



**The Biosphere:** Encompasses all the ecosystems on Earth.

# ECOSYSTEM

Ecosystem is the group of communities interacting with the biotic and the abiotic factors.

## BIOTIC FACTORS

Pathogens  
Parasites  
Predators  
Prey  
Mutualism  
Competition

## ABIOTIC FACTOR

Light  
Soil pH  
Temperature  
Water  
Wind  
Air  
Minerals



Most of the abiotic factors affects photosynthesis which affects the producers which inturn affect the complete food chain.

**Light**

Less light limits the photosynthesis and affect the entire food chain.

Plant in low light have broader leaves to increase surface area for absorption

**Water**

Water is required for growth. Less water limits the photosynthesis and affect the entire food chain.

**pH**

The low pH makes the soil acidic and limits the growth of plants and affect the entire food chain.

**Temperature**

Temperature also limits the rate of photosynthesis wich affects the food chain

**Oxygen**

The oxygen is required for the growth of the plant. In low levels of oxygen the organisms cannot survive.

**Carbon Dioxide**

Carbondioxide is required for growth. Less water limits the photosynthesis and affect the entire food chain.

**Wind**

Plants growing in high wind adapt different shapes.

Wind also affects the rate of transpiration.



**BIOTIC FACTORS**

**PARASITES**

**FOOD**

Food availability helps the species to grow and reproduce.

**PATHOGENS**

A pathogen can cause infectious disease and affect the growth of the population and can also wipe the whole population

Parasites can limit the growth of the host and affect the population of the community.

**COMPETITION**

Increasing competition can affect the growth of the population and can outcompete the individual of a population.

**PREDATORS**

Increase in predation can decrease the population of the prey.

## INTERDEPENDENCE



Pollination

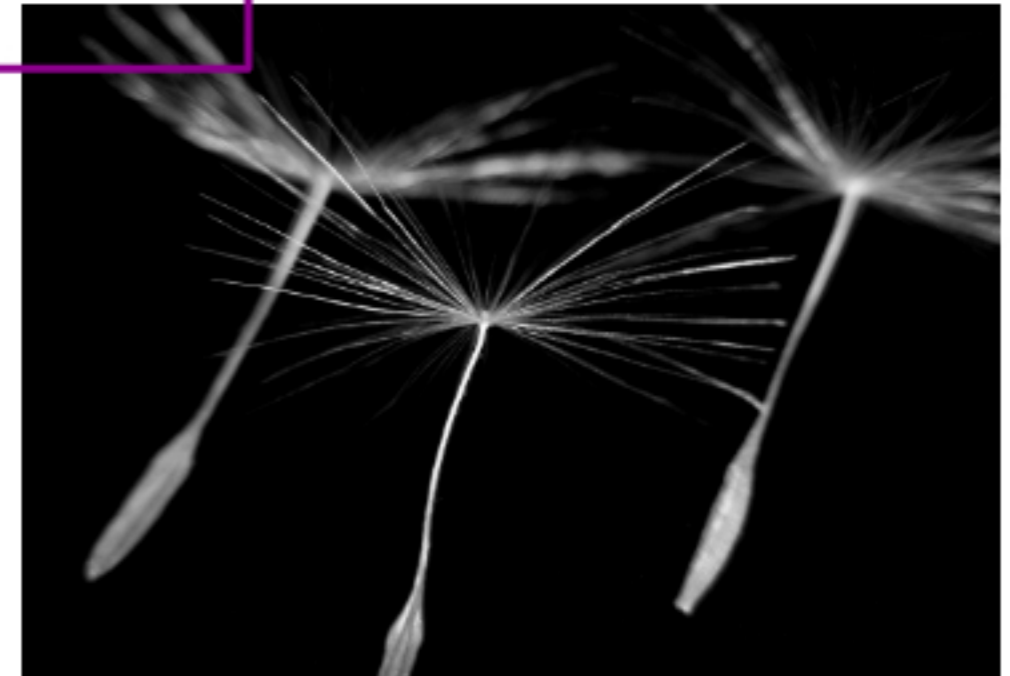
One species is dependent on other.

Like plants are dependent on insects for seed dispersal and pollination.

Herbivores are dependent on plants for food.

If one species is removed it affect the other species.

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Seed Dispersal

Source: Wikipedia

# COMPETITION IN PLANTS and ANIMALS

## INTERSPECIFIC COMPETITION

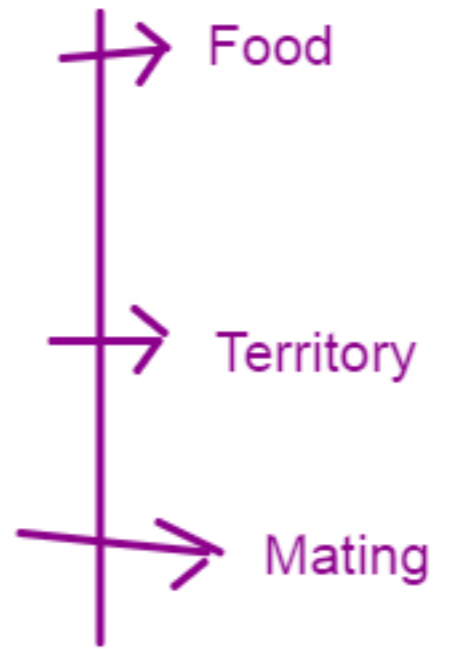
It is the competition between the members of different species.



It leads to the movement of species to a new place, adaptation or extinction

## INTRASPECIFIC COMPETITION

It is the competition between the members of the same species.



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Special Features that give the organisms the survival advantage and helps the organism to survive in the extreme conditions.

## PLANT REQUIRMENTS

Water, space, minerals, carbon dioxide for photosynthesis

Oxygen for respiration.

Major adaptations they have make them successful in getting these components from the environment

## ANIMAL REQUIREMENTS

Food to survive

Oxygen for respiration

Mate to reproduce.

Adaptations can be structural, behavioural and functional adaptations.

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# PLANT ADAPTIONS

PLANT CHALLENGES	PLANT ADAPTATIONS	EXAMPLE
Water loss and dry conditions in desert	Small leaves, Leaves reduced to spines to decreases the surface area for water loss. Extensive root system to absorb maximum water and succulent stems to store water. Plants are also covered with waxy cuticle to limit water loss.	Cactus where leaves are reduced to spines. Marram grass which has curled leaves and sunken stomata to trap moist air to limit water loss.
Lots of rain and water with less light in rainforest	Leaves are broad to trap maximum sunlight. They have thin cuticle.	Epiphytes like Lianas
Plant growing in low nitrogen soils.	The plants trap insect and digest them to fulfil their nitrogen and mineral requirments	Carnivores plant like Venus Flytrap
Plants prone to insect attack .	These plants secrete chemicals like alkaloids or tannins to repel insect.	Tobacco produced Nicotine.
Aquatic Plants growing in excess water and less light	Flexible stem to withstand water current. Broad leaves to absorb maximum light. They have hair spaces in leaves	Water Lillies

**ANIMAL ADAPTATIONS**

	DESERT ANIMALS Hot, dry conditions	ARCTIC ANIMALS Extreme cold
Structural	<p>They have large ears to give off maximum heat.</p> <p>They are small with large surface area to volume ratio.</p>	<p>They have small surface area to volume ratio to prevent heat loss.</p> <p>They have fur or thick fat deposit to provide insulation.</p> <p>White fur also comouflage with the ice.</p>
Behavioural	<p>They are more active during early morning and evening. When it is too hot or too cold they rest in burrows.</p>	<p>Polar bears form big dens and are strong swimmers and can swim through ice.</p>
Functional	<p>Produce very concentrated or no urine.</p>	<p>The fur or the coat change colours in summer and winters.</p>

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## EXTREMOPHILES

### EXTREME TEMPERATURE

They have enzymes that work at high temperature and do not get denatured.

### EXTREME SALT

They have salt glands expel excess salt  
They also have adaptations in the cytoplasm so that they cannot gain or lose water.

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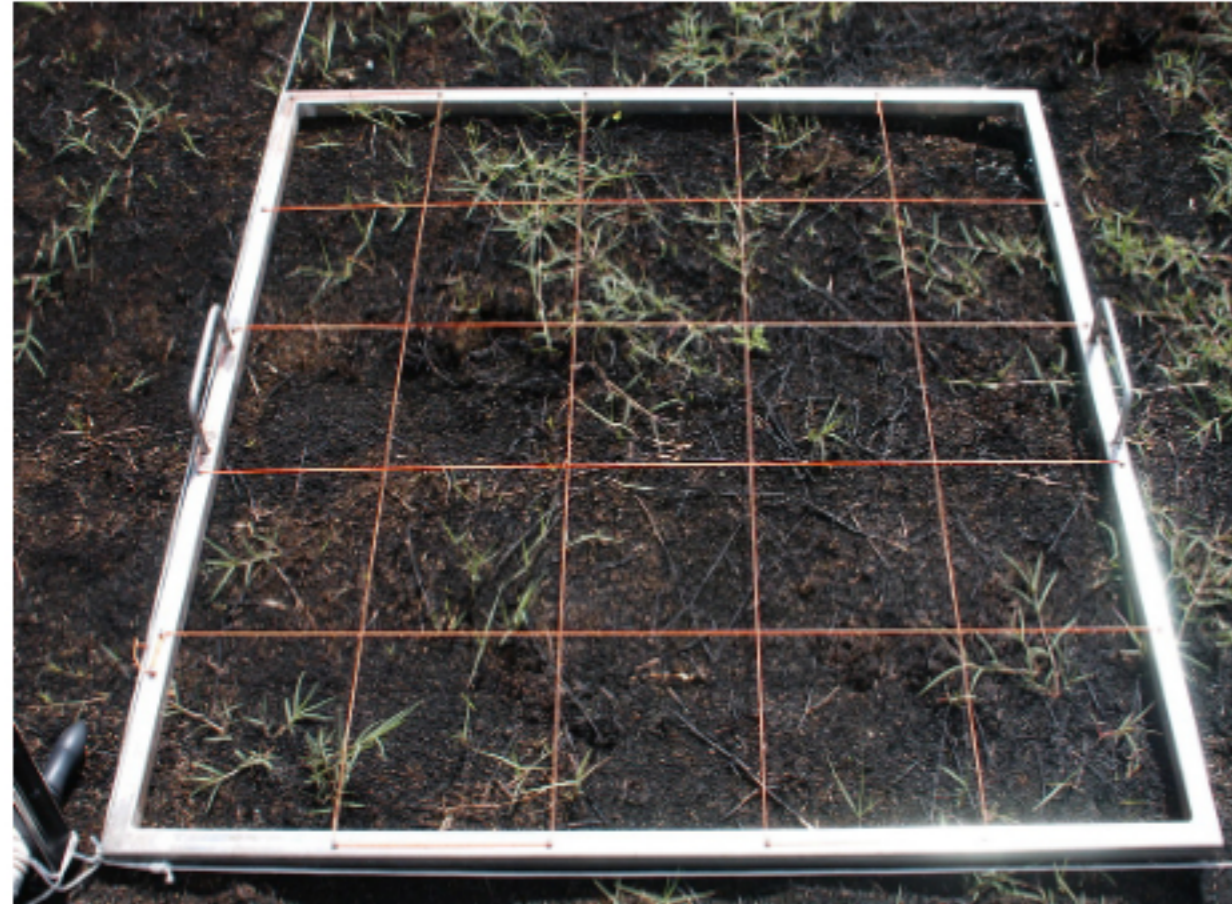
# STUDYING COMMUNITIES

## Quadrat Method

Random squares are placed at different point and the species within that squares are counted.

## Transect Method

A line is placed and the species that are within this line or few cm above or below this line are counted and recorded.



### Sample Size

The sample to be take for observation.

### Mean

It is the statistical value calculate by adding all the values divided by total number of values.

### Median

It is the middle value of the data.

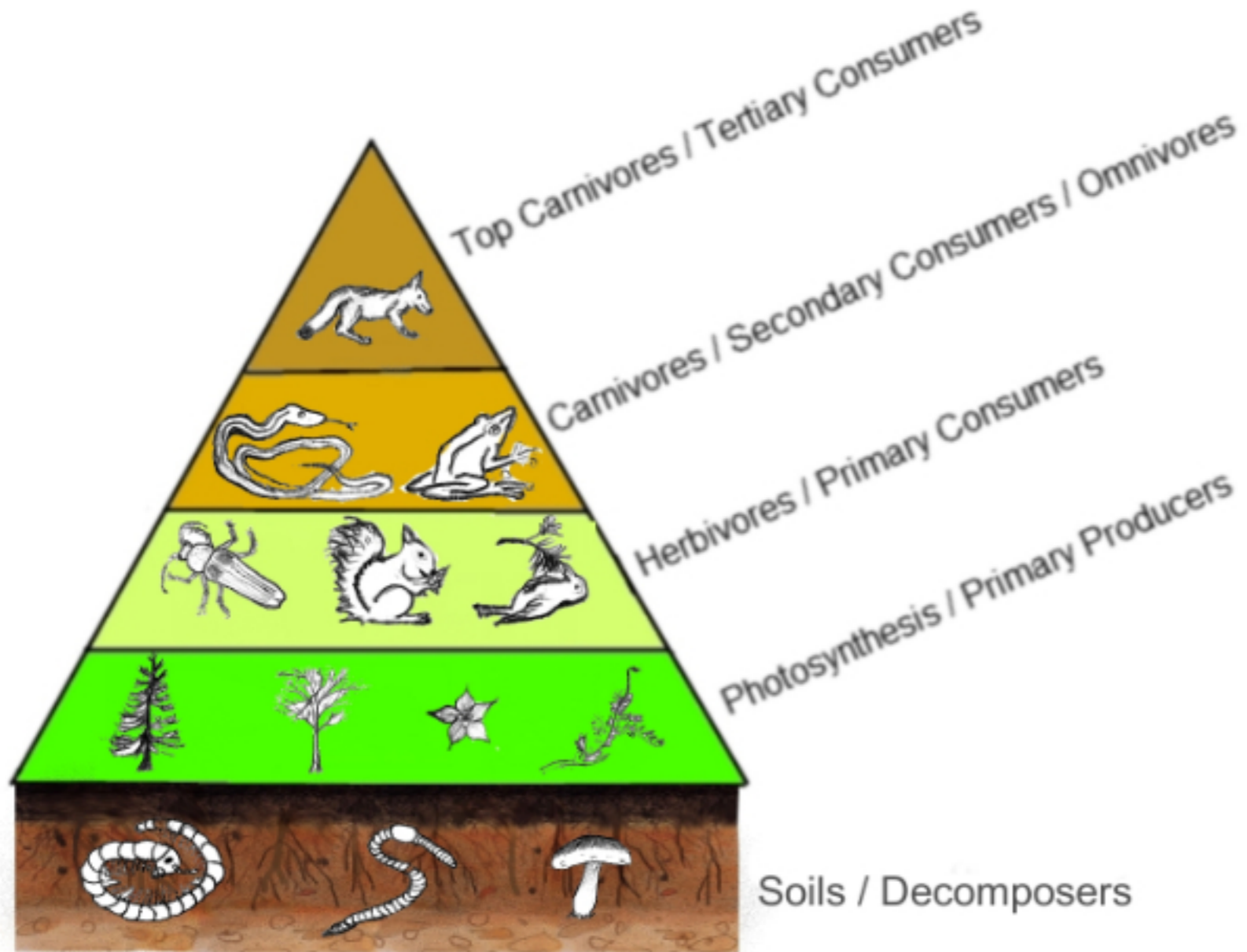
### Mode

The value that has the greatest frequency.

Range: It is the highest value take away the lowest value.



# TROPHIC LEVELS



Trophic Levels

**Producers:** They produce their own food as they can photosynthesize and convert Sun's energy to chemical energy.

**Primary Consumers**  
They are herbivores which feed on plants.

**Secondary Consumers**  
They are carnivores or omnivores which feed on herbivores.

**Tertiary Consumers**  
They are at the top of food chain

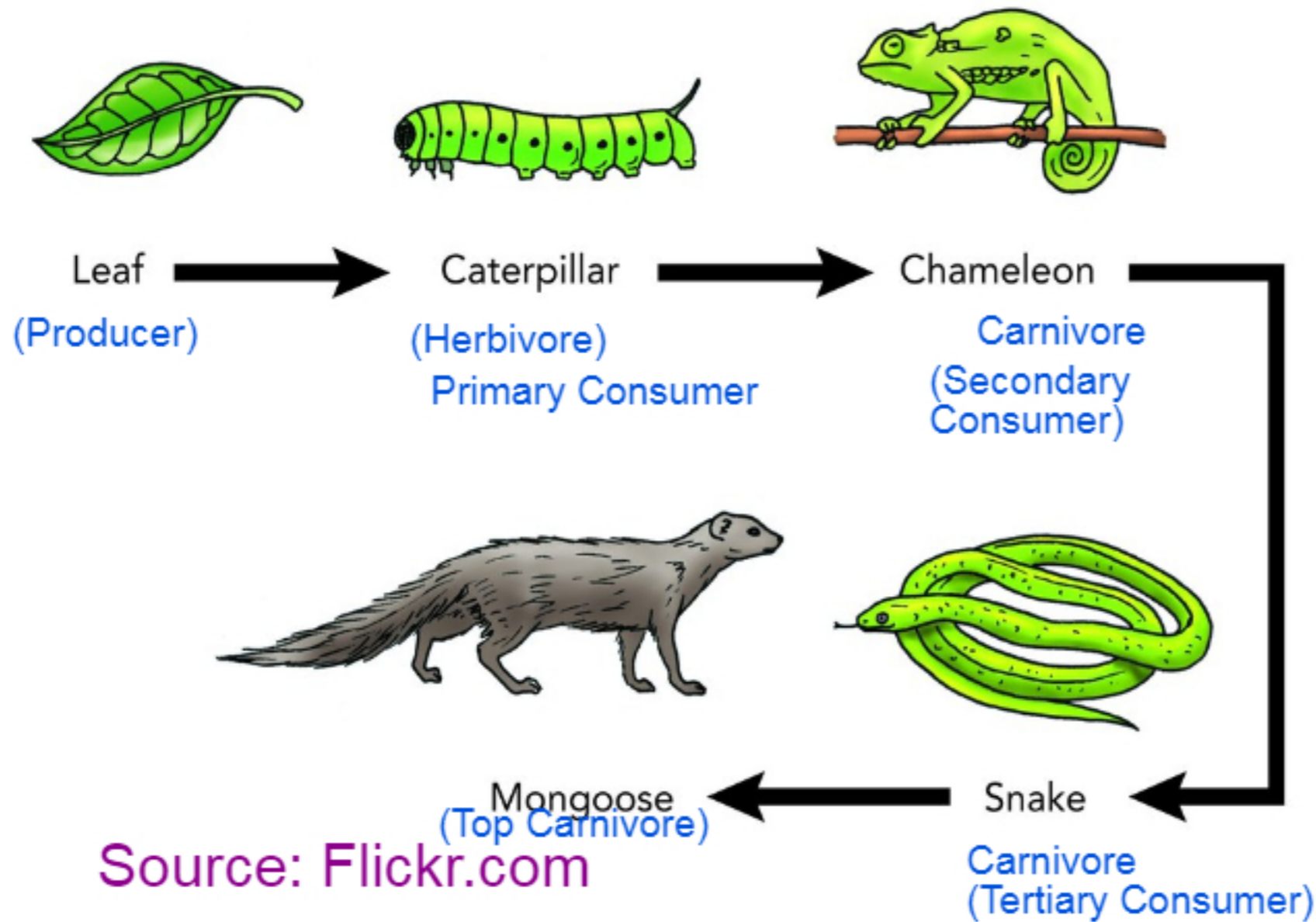
**Decomposers**  
Feed on dead and decay matter.

# FOOD CHAINS

It is the relationship of who eats whom.

At each level there is a loss of energy and only 10% is transferred to the next trophic level so the food chains are mostly restricted to 3-4 trophic levels.

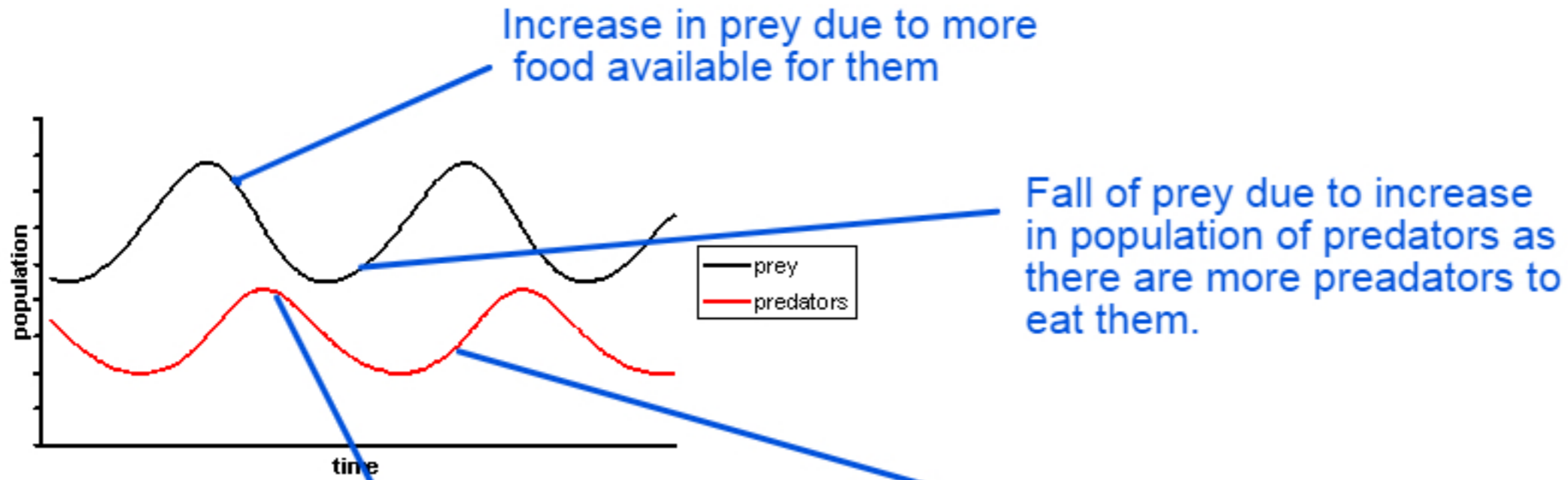
Sun is the principal source of energy driving the whole food chain.



Source: Flickr.com

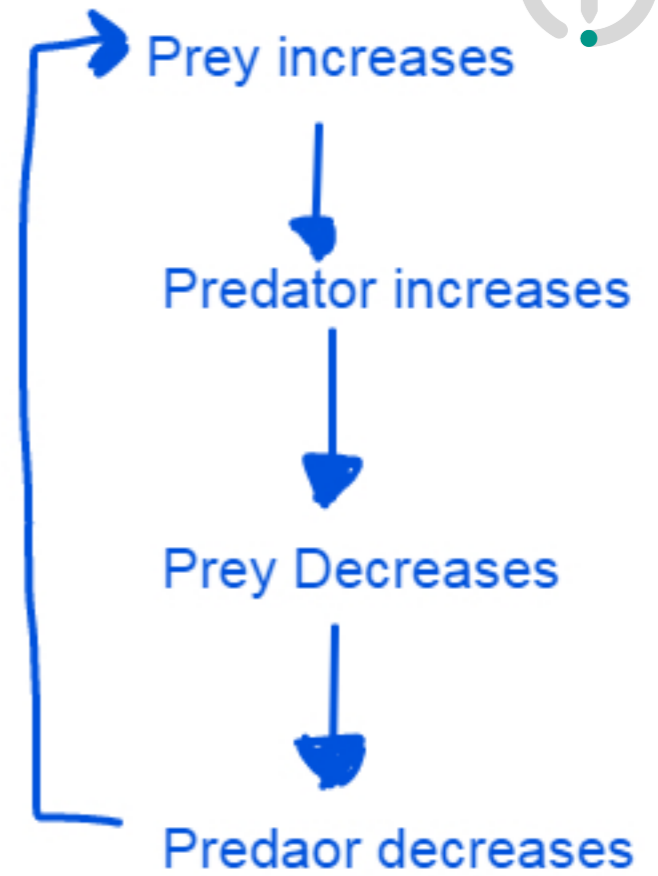
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PREDATOR- PREY RELATIONSHIP



Source: Wikimedia Commons

Increase prey population results in increase in predator population as more food is available for them.



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# PYRAMIDS OF BIOMASS



Aquatic  
Ecosystem

Source: Wikipedia

Biomass is the mass of the materials contained in the living organisms.



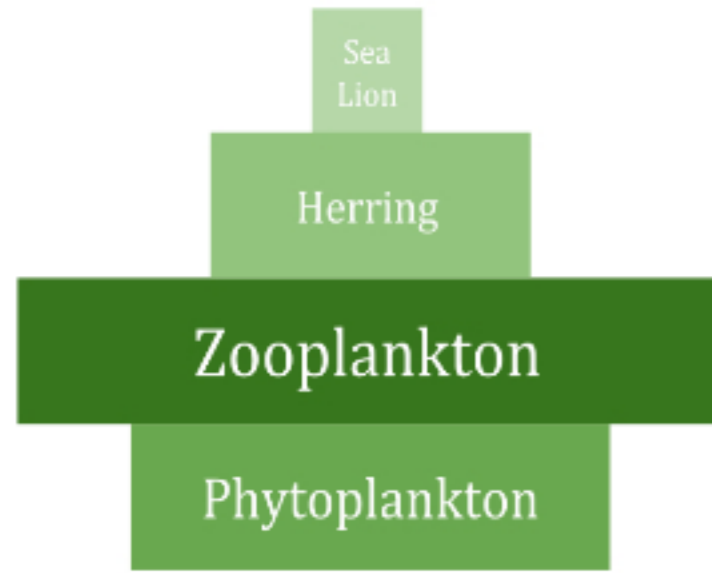
Terrestrial  
Ecosystem

Graphical representation of the mass of the living organism at each level.

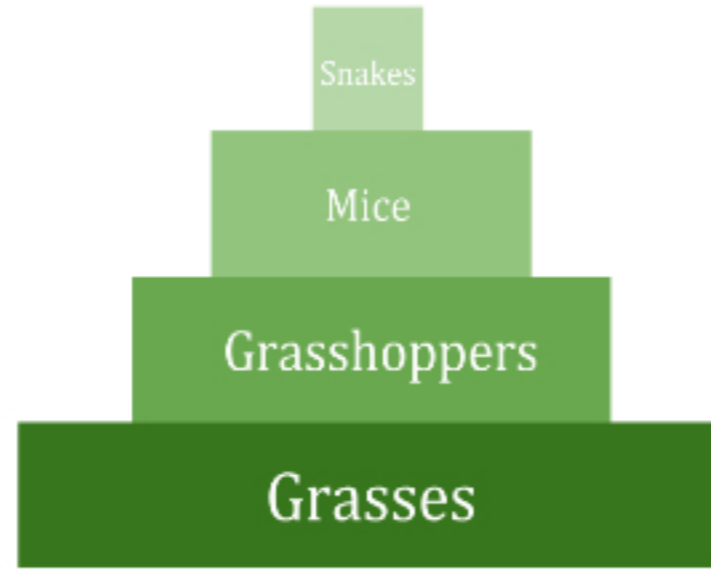
- It is upright as :-
- a) Not all the biomass is eaten by the next trophic level
  - b) Some of the biomass is lost as energy at each trophic level.
  - c) Some of the biomass is lost as waste product at the trophic level.



## PYRAMIDS OF NUMBERS



Aquatic  
Ecosystem



Terrestrial  
Ecosystem

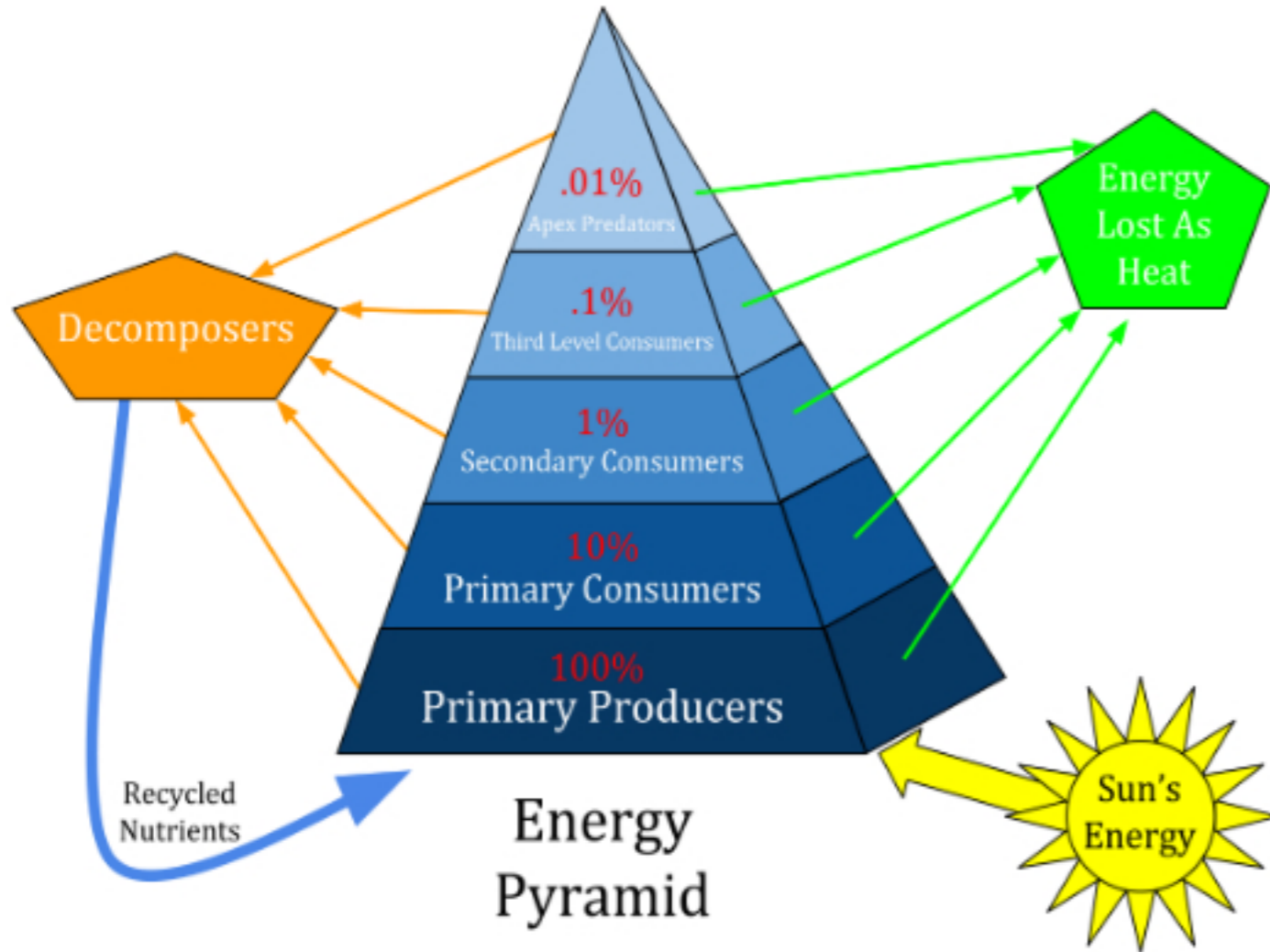
It is the graphical representation of the number of organisms at each trophic level.

It can be upright, inverted or upside down.

Source: Wikipedia Commons

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It is the graphical representation of energy at each trophic level.

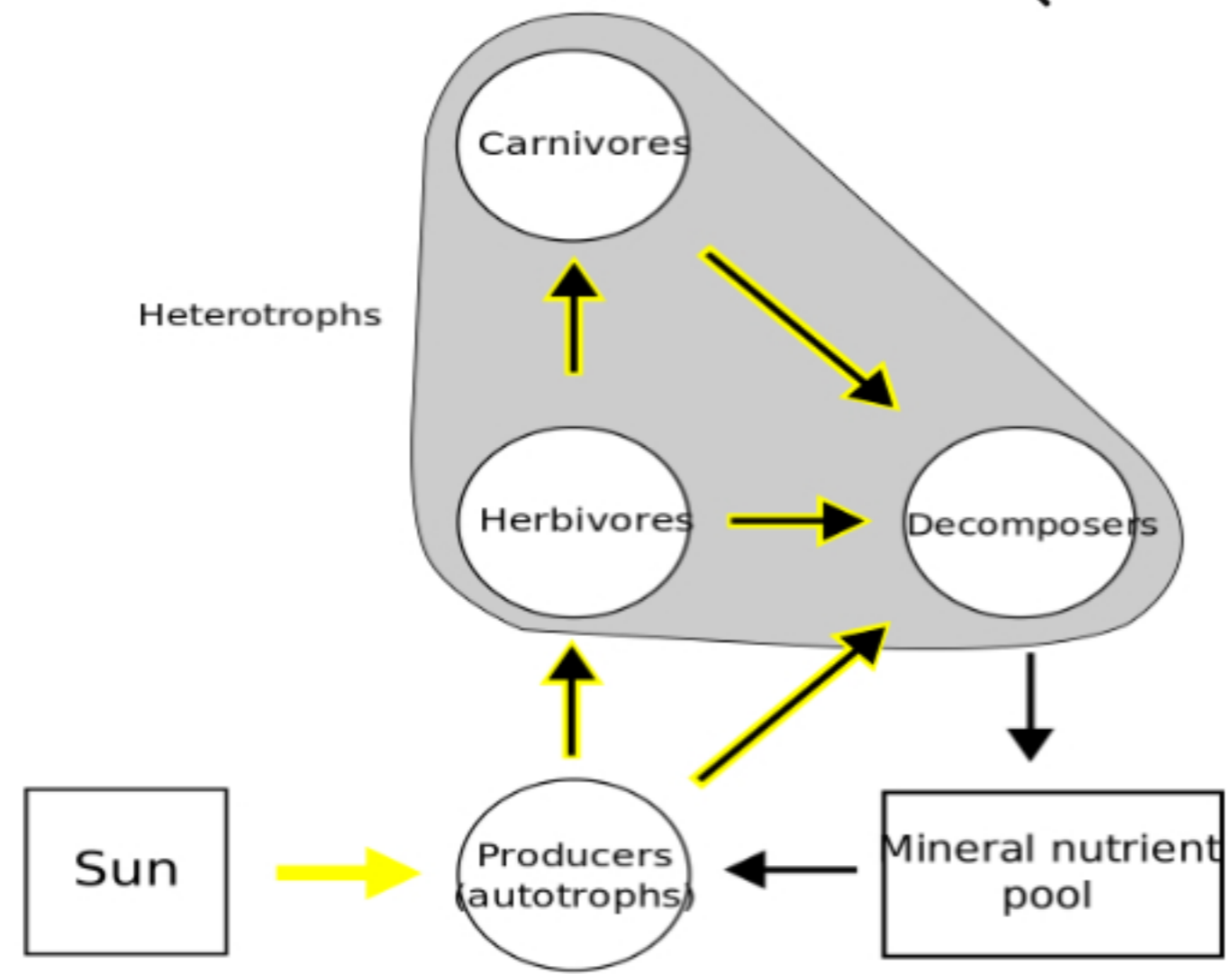


Source: Wikipedia Commons

## Energy Lost at Each trophic Levels

- a) Energy is required for movement, growth and repair
- b) Energy is lost in digestion
- c) Energy is lost in maintaining constant body temperature
- d) Energy is lost as heat during respiration.

# CYCLING OF MATERIALS



Decomposers Play an important role in material recycling

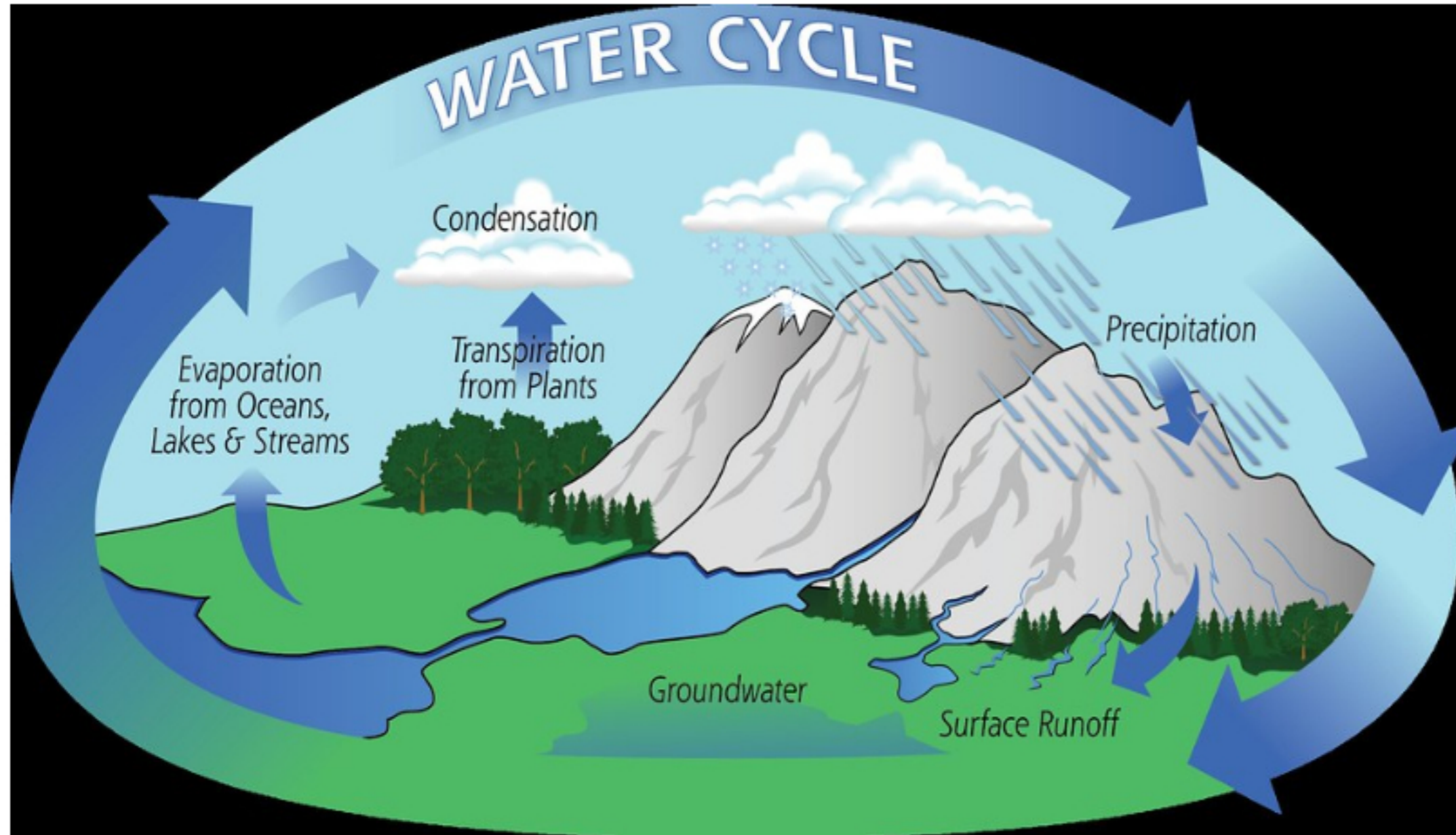
Decomposers feeds on dead and decay matter. They break the organic matter into simple components and return them to soil.

The products carbon dioxide into the atmosphere by the process of decomposition.

Bacteria and Fungi

Proteins in the dead and decay matter is converted into nitrates and returned to soil.

Source: Wikimedia Commons



### Evaporation

Water is evaporated from the water bodies like sea, lakes etc and form water vapours.

### Transpiration

The water vapours are also lost from the surface of the plants.

### Respiration

Respiration produced water vapour and it is lost in the form of water vapours

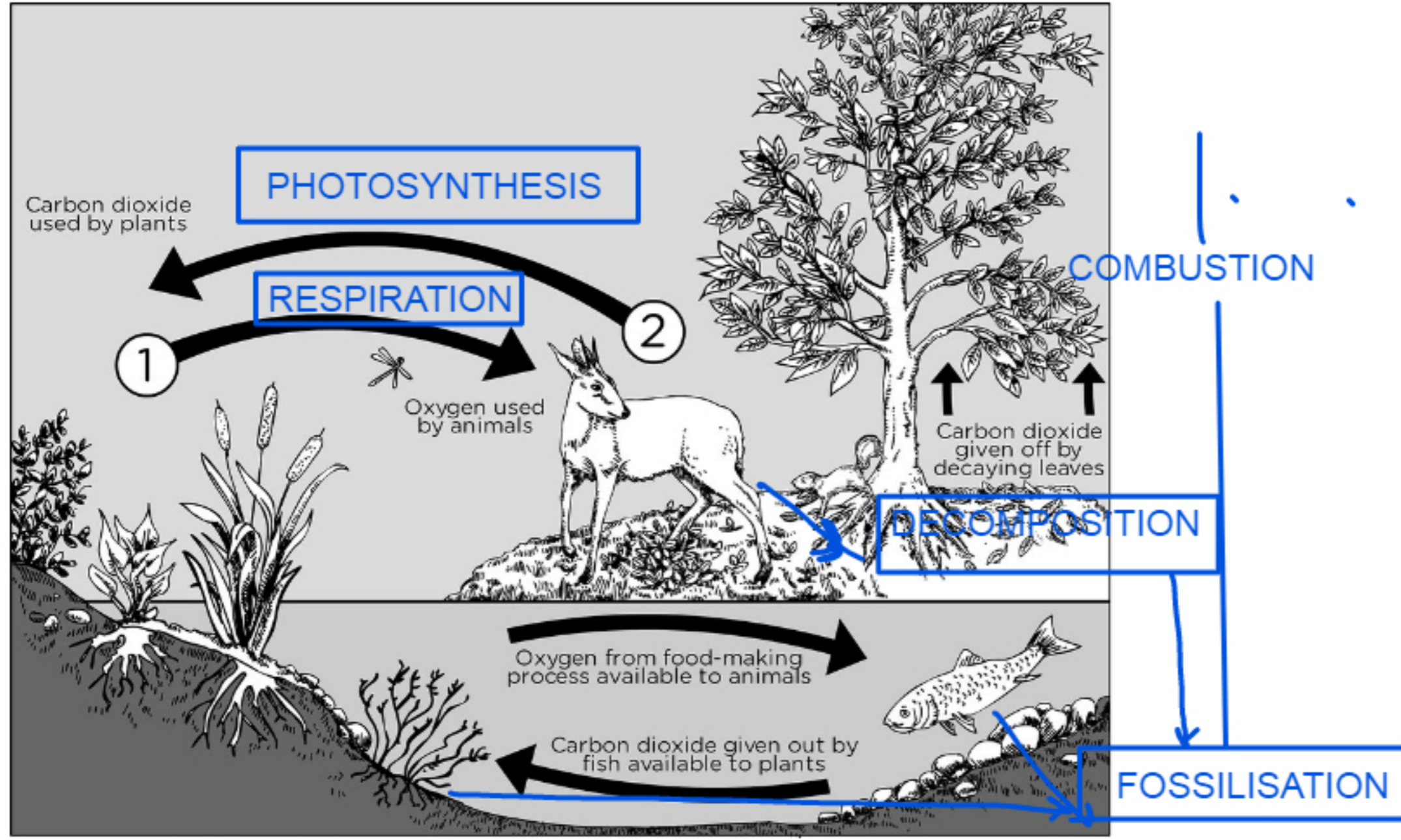
### Condensation

The water vapour from all the above source cools and condense to form clouds.

### Precipitation

When clouds get full the fall of as rain and the cycle continues.

# CARBON CYCLE



**Photosynthesis**  
It is the process by which green plants take in carbon dioxide from the atmosphere

**Respiration**  
The carbon dioxide is returned back to the atmosphere

**Combustion**  
The fuel burns releasing carbon dioxide into the atmosphere

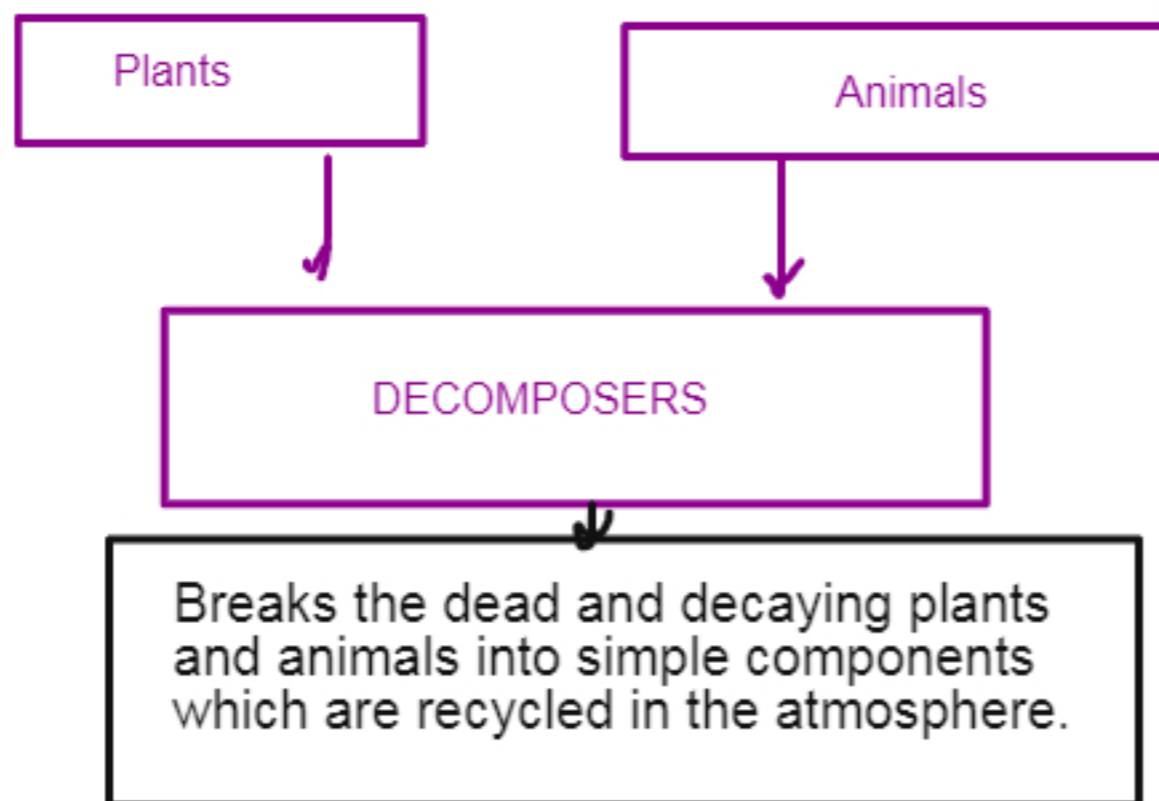
**Decomposition**  
It is the process by which decomposer decay dead material and release carbon dioxide into the atmosphere

**Fossilisation**  
Dead Plants and Animals form fossil fuels which burns to release carbon dioxide into the atmosphere.

SOURCE: FLICKR.COM

They are the microorganisms that breaks the dead and decay materials into simpler components.

They are very important as they return the nutrients and minerals back into the atmosphere.



## Condition required for decay

- a) Oxygen
- b) Warm Conditions
- c) Moist Conditions

Decay process forms methane which can be used as fuel.

Decay process also produce compost which can be used as a manure.

It is the measure of number of difference species in an area.

Greater the biodiveristy more stable is the ecosystem and less dependency on other organisms.

## Uses of Biodiversity

It is required to make the ecological balance as one species is dependent on the other.

It is required for medicine like medicinal plants.

It is required for agriculture and poultry.

It is required to maintain ecotourism.

Species are dependent on one another. So if one species is affected it can affect the entire population.

## Threats to Biodiversity: All factors are interconnectedf

**Deforestation :** Rapid population growth causing clearing of forests and making industries and home causing climate change and global warming.

**Population Growth**

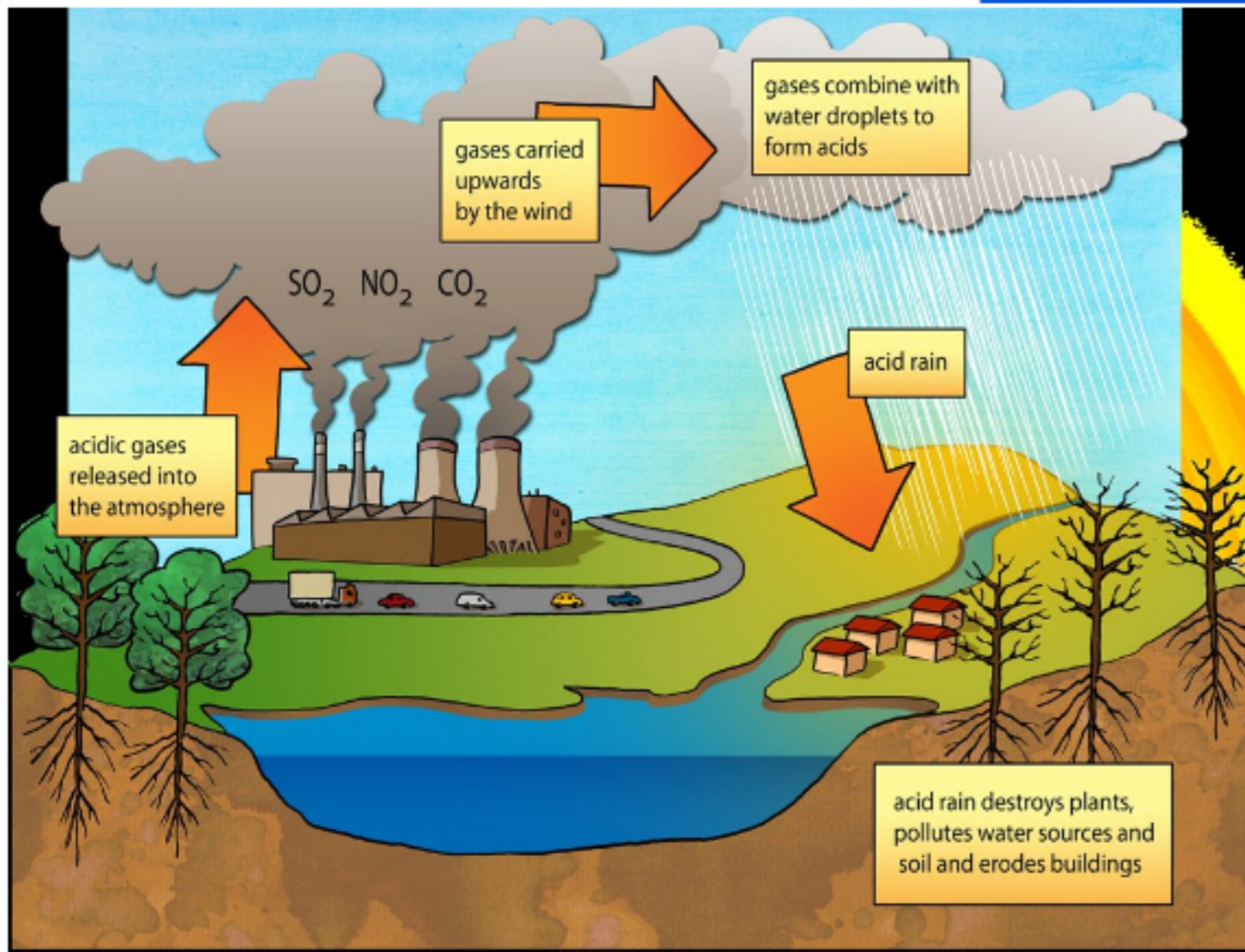
Leading to deforestation, monoculture

**Agriculture**

**Industrialization**



ACID RAIN



Formation

Sulphur and nitrogen present in fossil fuels forms carbon dioxide and sulphur dioxide by combustion.

Carbon dioxide and sulphur dioxide combine with rainwater forming nitric acid and sulphuric acid and falls as acid rain.

Effects

- a) Makes soil acidic
- b) Damage trees and aquatic life
- c) Corrossion of building
- d) Errodes building and rocks

Prevention

- a) Decrease in use of fossil fuels.
- b) Treat the waste to remove nitrogen and sulphur before evolving.
- c) Use alternative source of energy.





Source: Wikimedia Commons

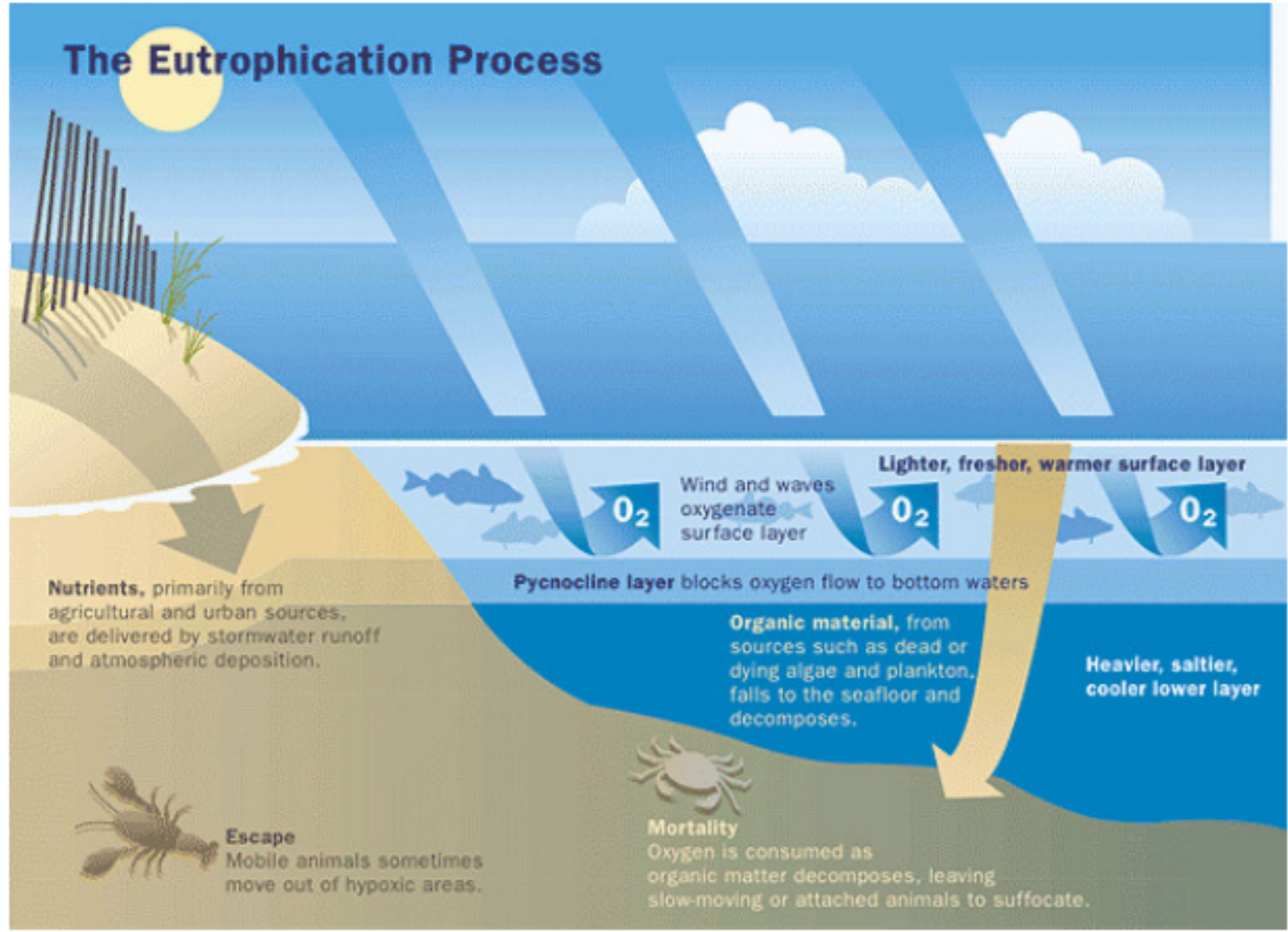
Mixture of nitrogen dioxide and sulphur dioxide particulates in the lower atmosphere.

Depletes ozone layer, cause dimming effect.

Lowers the Earth's temperature

If inhaled causes damage to lungs, respiratory problems and cardiovascular diseases.

# WATER POLLUTION



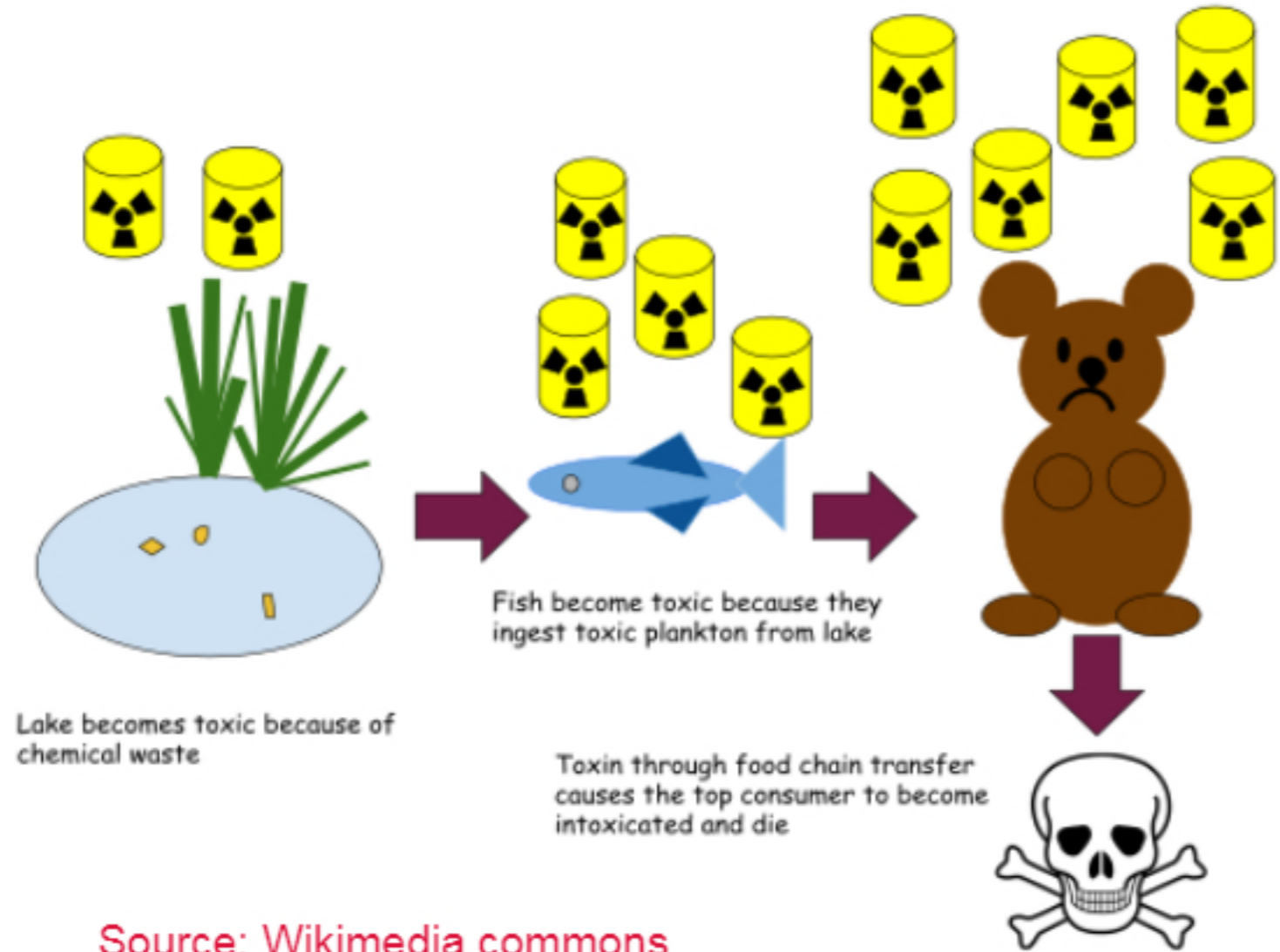
Fertilizers washed away

Increases the nutrient content of water causing algal bloom

## ALGAL BLOOM

Forms green layer, block sunlight

Death of plants, decreasing oxygen in water. Death of other species. Decomposers increasing further decreasing oxygen.



As the toxic products go along the food chain the concentration of the toxic chemicals increases

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Source: Wikimedia commons

## LAND POLLUTION



### Solid Waste

Plastic, metals and other man made chemicals fills the landfill sites

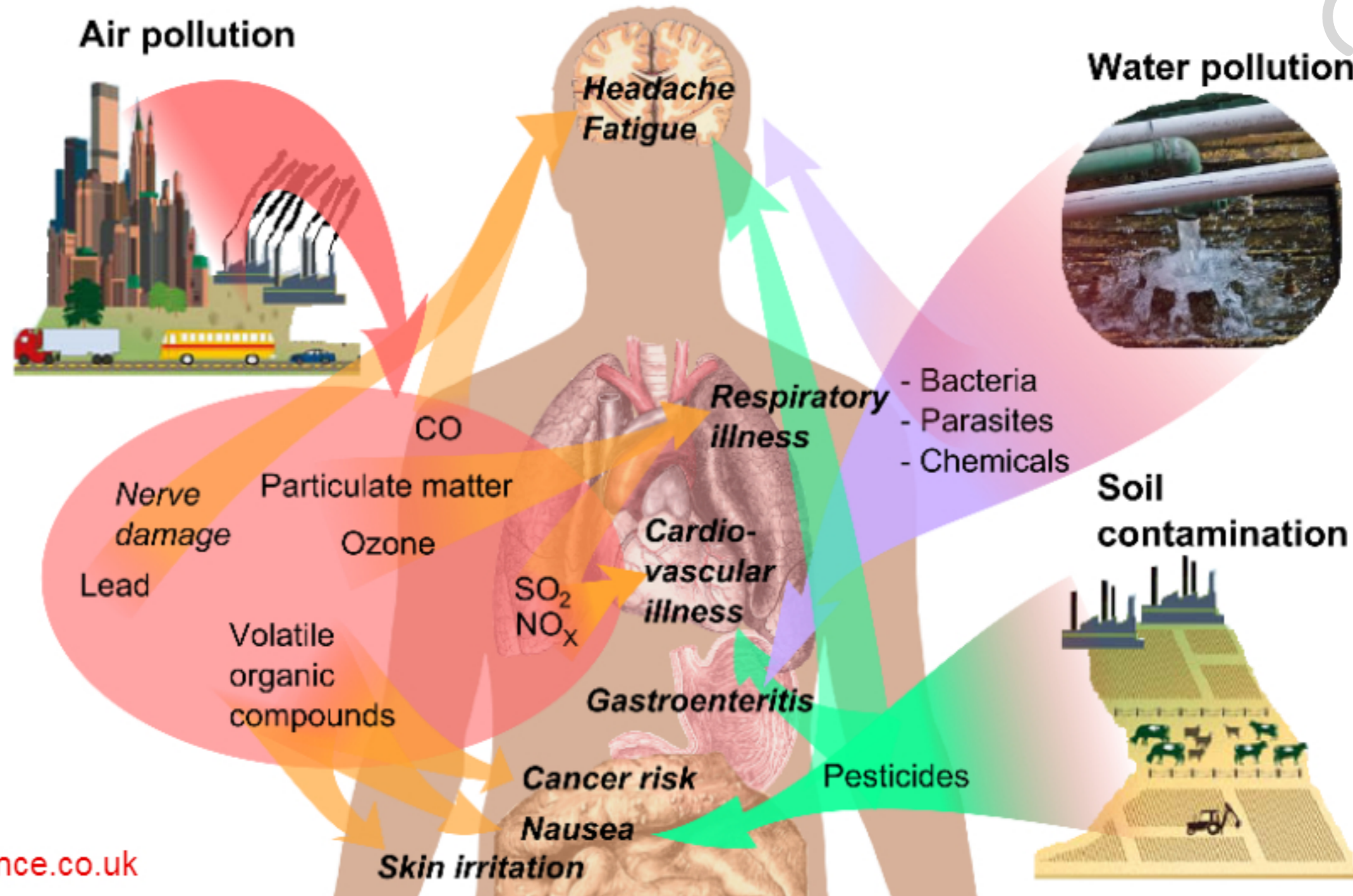
### Chemicals

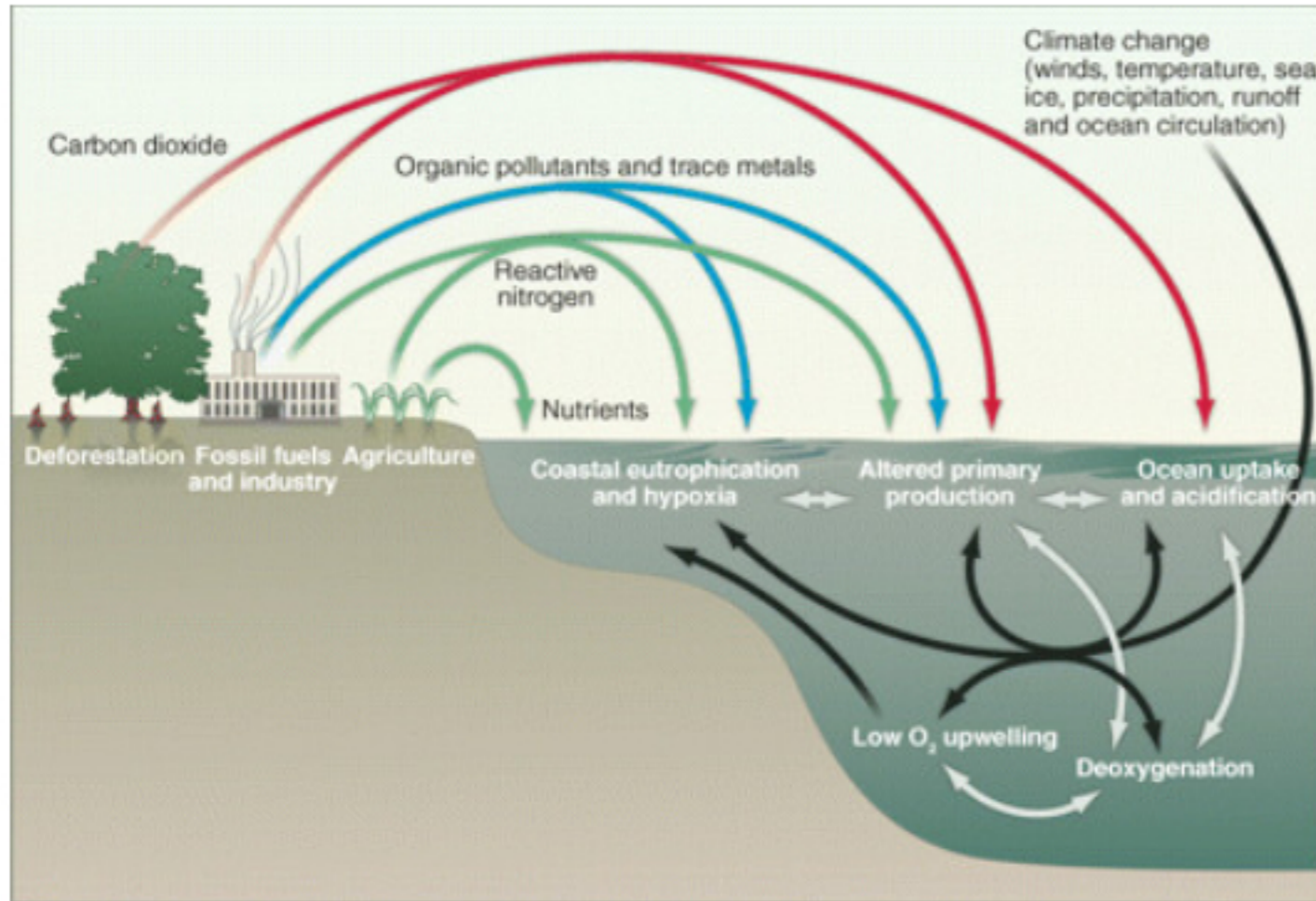
Toxic Chemicals come from industries and agricultures sites.

### Agriculture Waste

Spray of insecticides, pesticides and weedicide contributes to land pollution.

# Health effects of pollution





Source: Flickr.com

## Causes

Rapid industrialization, population growth and urbanization. Clearing of forests form making home and industries. Increase in agriculture to grow food and fuel crops.

## Effects

- Increase in carbon dioxide levels causing global warming and climate change.
- Loss of biodiversity by causing habitat destruction
- Causing extinction of species.

### What is Peat ?

It is a plant material that is not decayed due to acidic conditions.

Forms peatlands and peat bogs and are massive storehouse of carbon and host many organisms.

### Uses of Peat

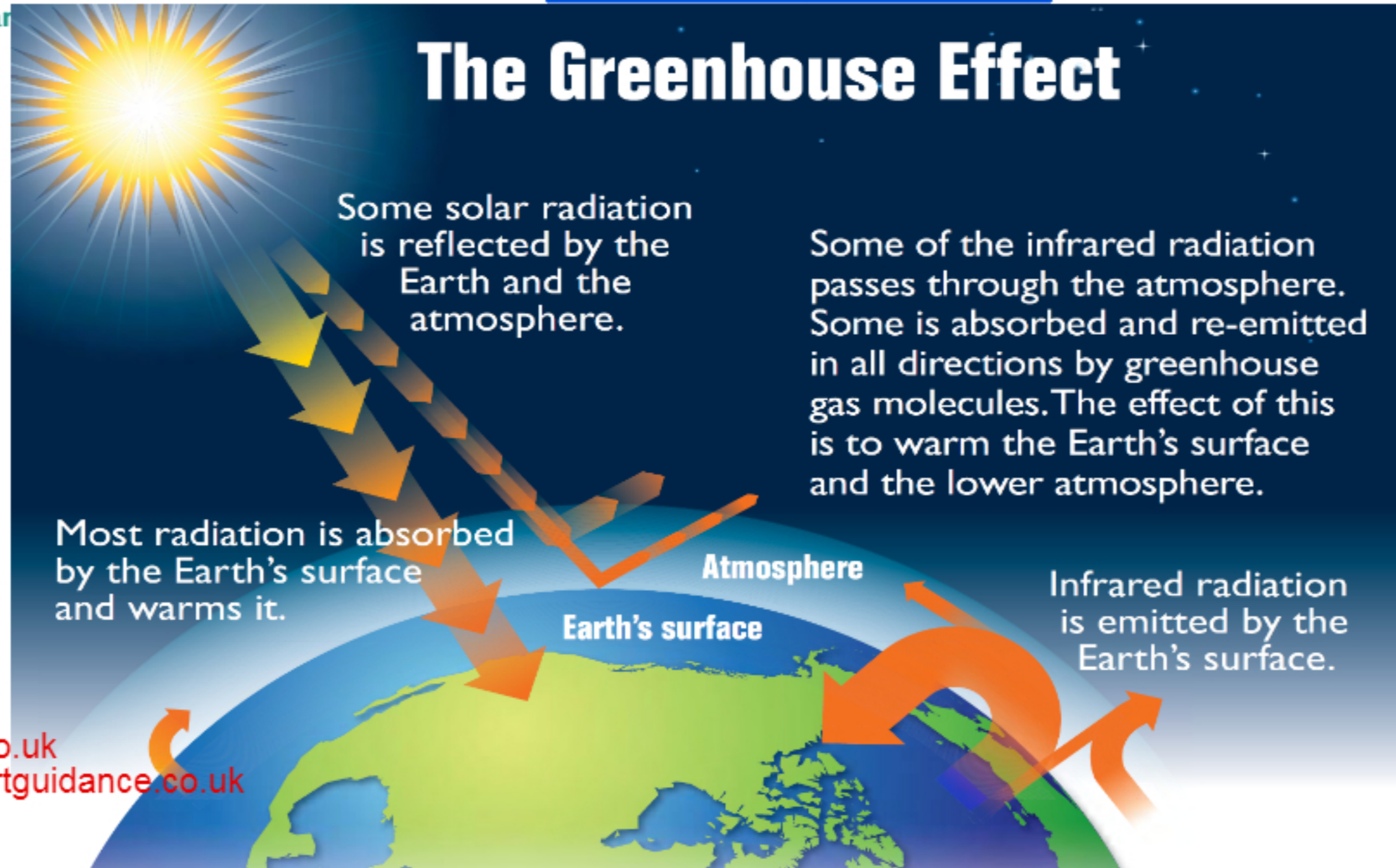
- a) Unique carbon store
- b) Habitat for many microorganism, plants and animals that can survive in acidic conditions.
- c) Used as fuel

### Effect of Peat Bog Reduction

Causes loss of biodiversity.

Takes millions of years to form.

# The Greenhouse Effect



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# GLOBAL WARMING

Climate Change

Habitat Loss

Floods

Change in Migration of Birds

Change in distribution of plants and animals

Change in seasonal pattern

Loss of Biodiversity causing extinction of species.

Source:  
The Wheezer  
Place

## Global warming: Causes and effects

Earth's temperature has risen about 1 degree Fahrenheit in the last century. The past 50 years of warming has been attributed to human activity.

Burning fuels such as coal, natural gas and oil produces greenhouse gases in excessive amounts.

Greenhouse gases are emissions that rise into the atmosphere and trap the sun's energy, keeping heat from escaping.

The United States was responsible for 20 percent of the global greenhouse gases emitted in 1997.

Most of the world's emissions are attributed to the United States' large-scale use of fuels in vehicles and factories.

During the past 100 years global sea levels have risen 4 to 8 inches.

Some predictions for local changes include increasingly hot summers and intense thunderstorms.

Damaging storms, droughts and related weather phenomena cause an increase in economic and health problems. Warmer weather provides breeding grounds for insects such as malaria-carrying mosquitoes.

Source: Environmental Protection Agency

NATE OWEN/STAFF

### In situ Conservation

It is the protection of endangered species in their own natural habitat like making national parks, wildlife sanctuary and making biosphere reserves.

Breeding programmes are also carried in these areas to increase the population of endangered species.

### Ex Situ Conservation

Preserving the biodiversity outside their natural habitat like Zoos, botanical garden, tissue culture, seed banks and gene bank.

### Preventing Deforestation and Combustion

Preventing deforestation and planting more trees can reduce the carbon emissions and can prevent global warming and climate change

### Recycling and using alternative sources of energy

Recycling and using alternative sources of energy can reduce the dependency on fossil fuels causing reducing the carbon emissions preventing global warming, climate change and its effects.

What is Food Security ?

Growing sufficient healthy food to feed the population and accessibility of the population to grow or buy the healthy food.

Factors Affecting Food Security

- a) Population Growth
- b) Inclination toward unhealthy and easy to cook foods
- c) Spread of Disease
- d) Pest and Insect attack to the crop.
- e) Climate Change
- f) Acid Rain and Pollution
- g) Water Pollution
- h) Increase in cost of agricultural supplies
- i) Food versus Fuel Issue



## Increasing more plant based products

When plant based products are used they have the highest biomass and maximum energy as they are at the initial level of food chain.

Plant based product reduces the dependency on animal products.

## Reducing the level of food chain

At each trophic level, there is energy loss.

So if the food chain levels are reduced maximum energy and biomass can be obtained.

## Intensive Farming

In intensive farming the animals are grown to limit energy loss and produce maximum biomass by

### a) Restricting Movement

By restricting movement energy loss in movement is prevented.

### b) Rearing them at constant temperature

Energy loss in maintaining body temperature is prevented.

### c) Giving them easy to digest food

It reduced energy loss in digestion.

### d) Giving them protein rich diet.

It helps to grow more biomass





# SUSTAINABLE FOOD PRODUCTION

a) Use of genetic engineering to increase the yield of the crops and making more disease resistant and high yield variety.

b) Use of microorganisms for food production

✓ Mycoprotein are the proteins source from fungi. It is excellent food source and is sustainable grown in fermenter.

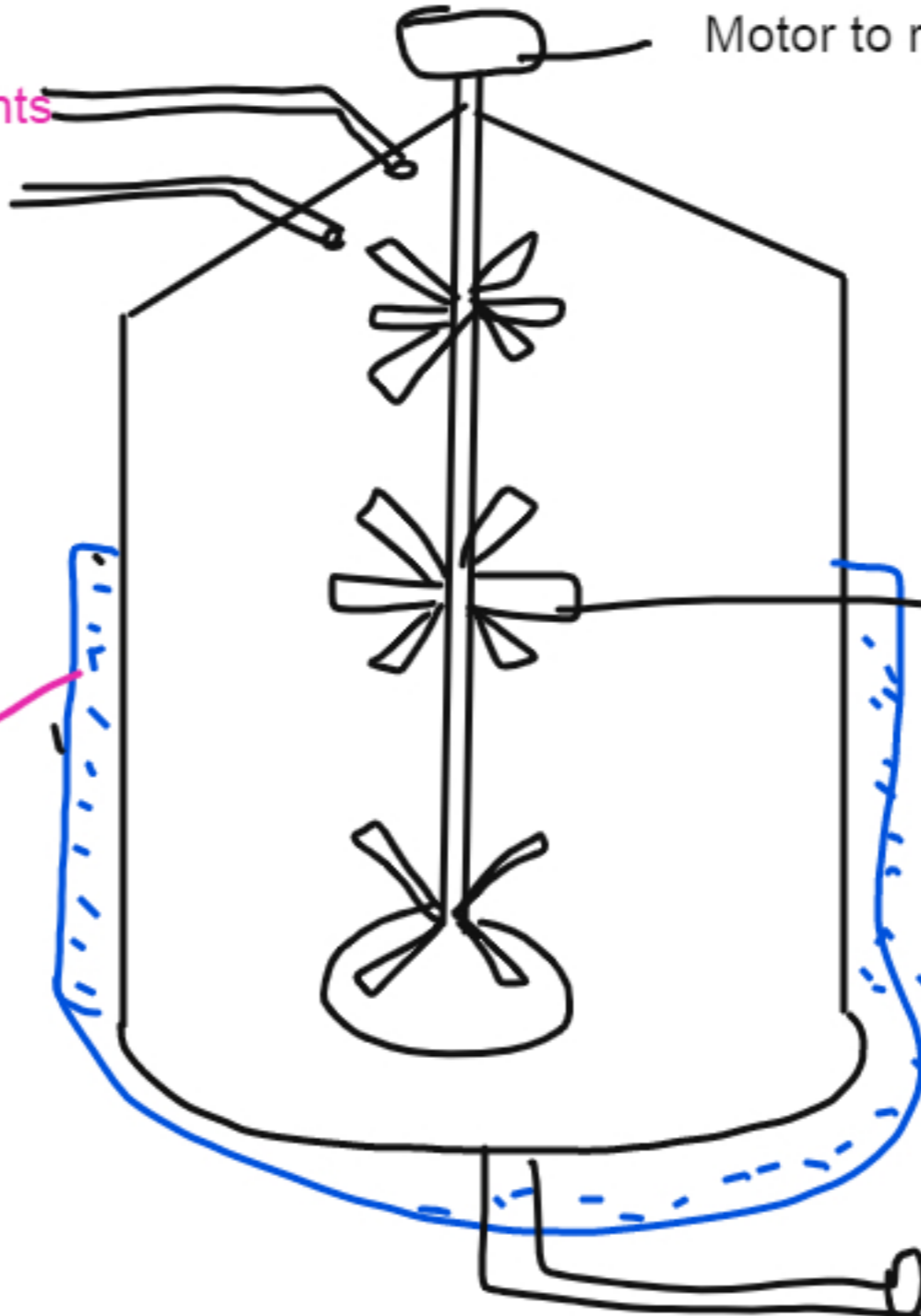
Inlet for nutrients

In let for Oxygen

Motor to rotate the pedal

Water Jacket to maintain the optimum temperature

Stirrer or paddle to mix the microorganisms, nutrients make the temperature even and prevent microorganisms from settling down.



KEY TERMS

- a) Communities
- b) Ecosystem
- c) Interdependence
- d) Stable Communities
- e) Abiotic Factor
- f) Biotic Factor
- g) Predator
- h) Prey
- i) Pathogen
- j) Parasite
- k) Competition
- l) Abundance
- m) Distribution
- n) Quadrat
- o) Sample Size
- p) Mean
- q) Quantitative Sampling
- r) Range
- s) Median
- t) Mode
- u) Transect
- v) Adaptation
- w) Biomass
- x) Producers
- y) Consumers
- z) Water Cycle

- a) Precipitation
- b) Condensation
- c) Evaporation
- d) Transpiration
- e) Photosynthesis
- f) Respiration
- g) Combustion
- h) Decomposition
- i) Decay Cycle
- j) Biodiversity
- k) Acid Rain
- l) Smog
- m) Eutrophication
- n) Biomagnification
- o) Global Warming
- p) Greenhouse Effect
- q) Trophic Level
- r) Pyramids of Biomass
- s) Pyramids of Number
- t) Food Security
- u) Fermenter
- v) Biotechnology
- w) Mycoprotein

NEXT STEP



CHECK SPECIFICATION



EXAM QUESTION ON THIS TOPIC

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