Grazing food chain

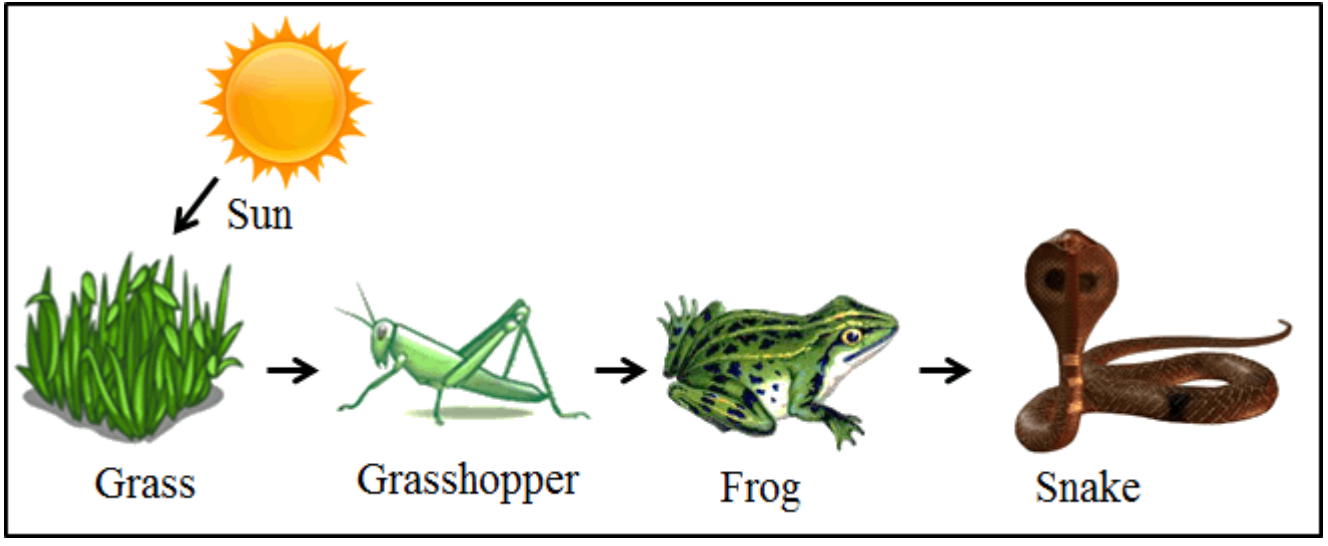
It starts with the conversion of solar energy into chemical energy.

This is directly dependent on the flow of solar energy.

Macroscopic organism constitute a major part of it.

Predator chain: Direct consumption of one species by other.

Parasitic chain: Parasitic dependence of one species on other.



Detritus food chain

It starts with the consumption of dead species by a microorganism.

This type of food chain acquires energy from detritus, utilizing the detritus to its fullest, with minimum wastage.

Detritus food chain helps in fixing inorganic nutrients.

Universal energy flow model

I = Input or ingested energy

NU = Energy not used

A = Assimilated energy

P = Production

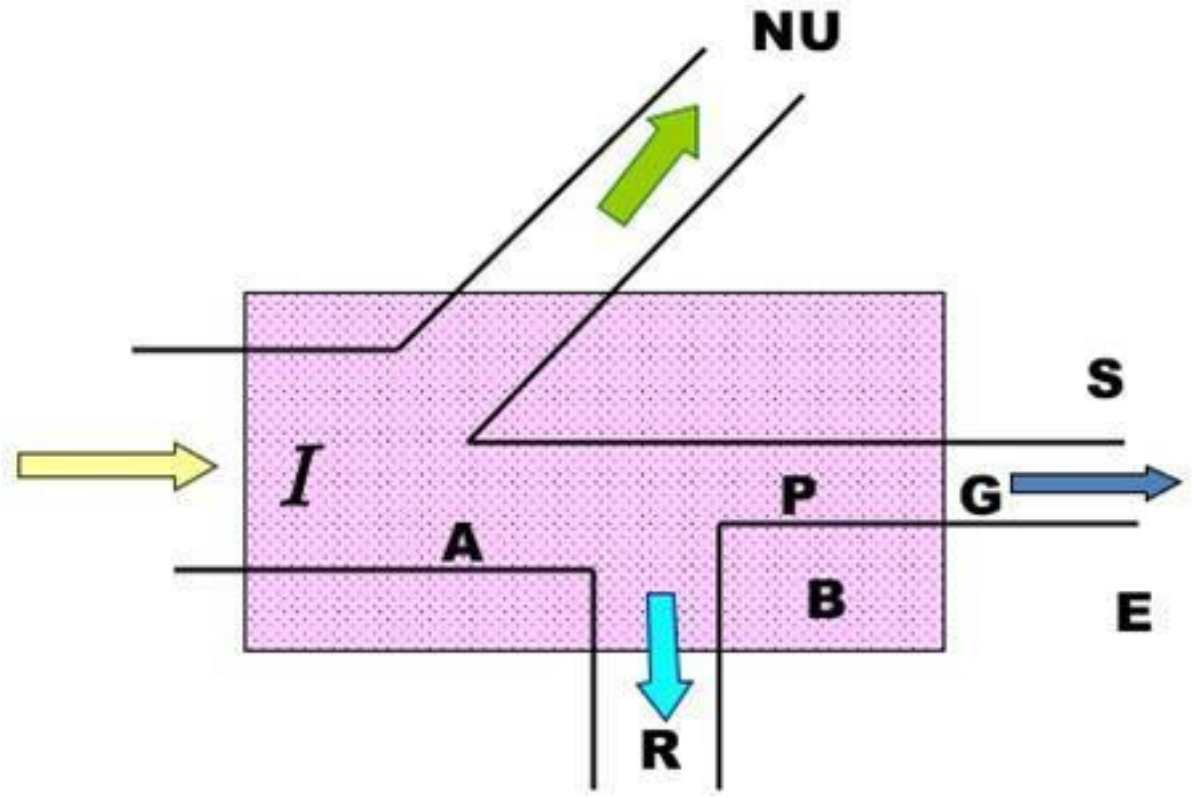
R = Respiration

B = Biomass

S = Stored energy

G = Growth

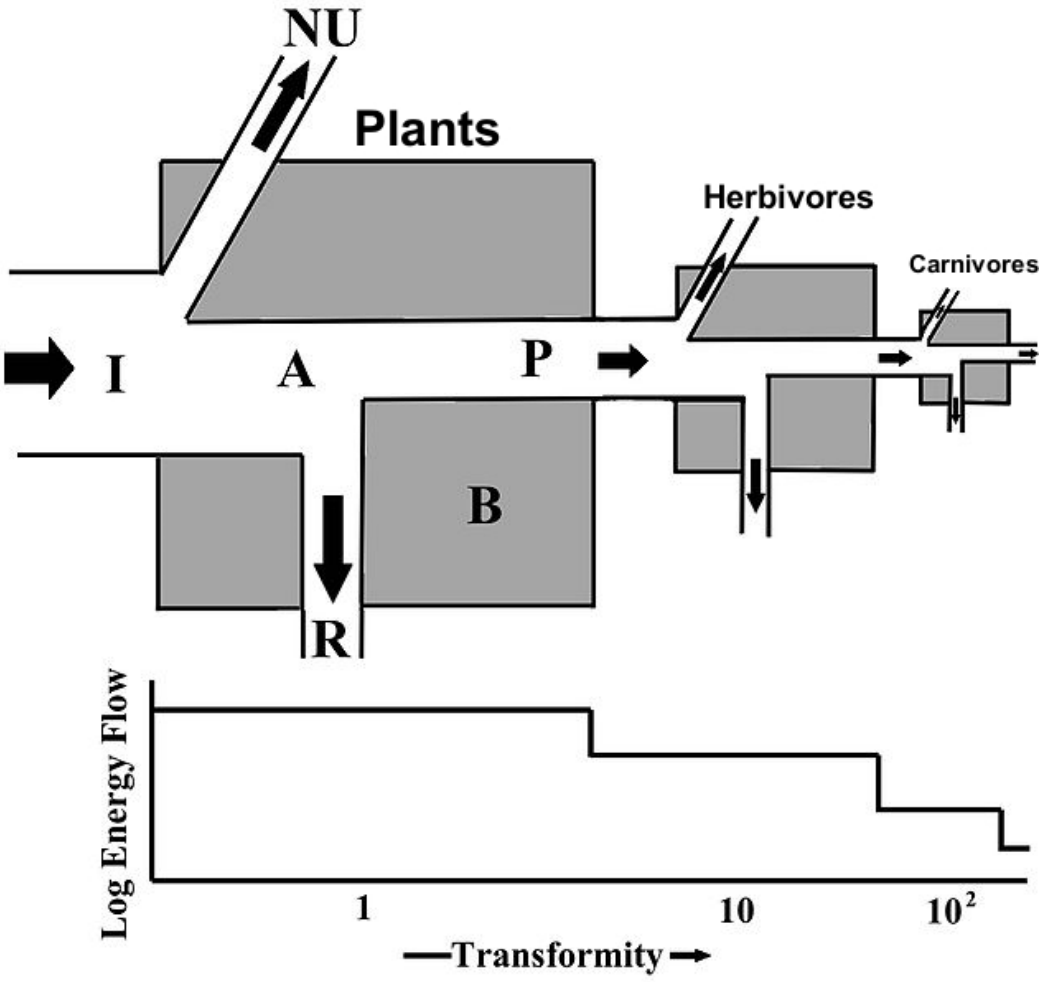
E = Excreted energy



Single channel energy flow model

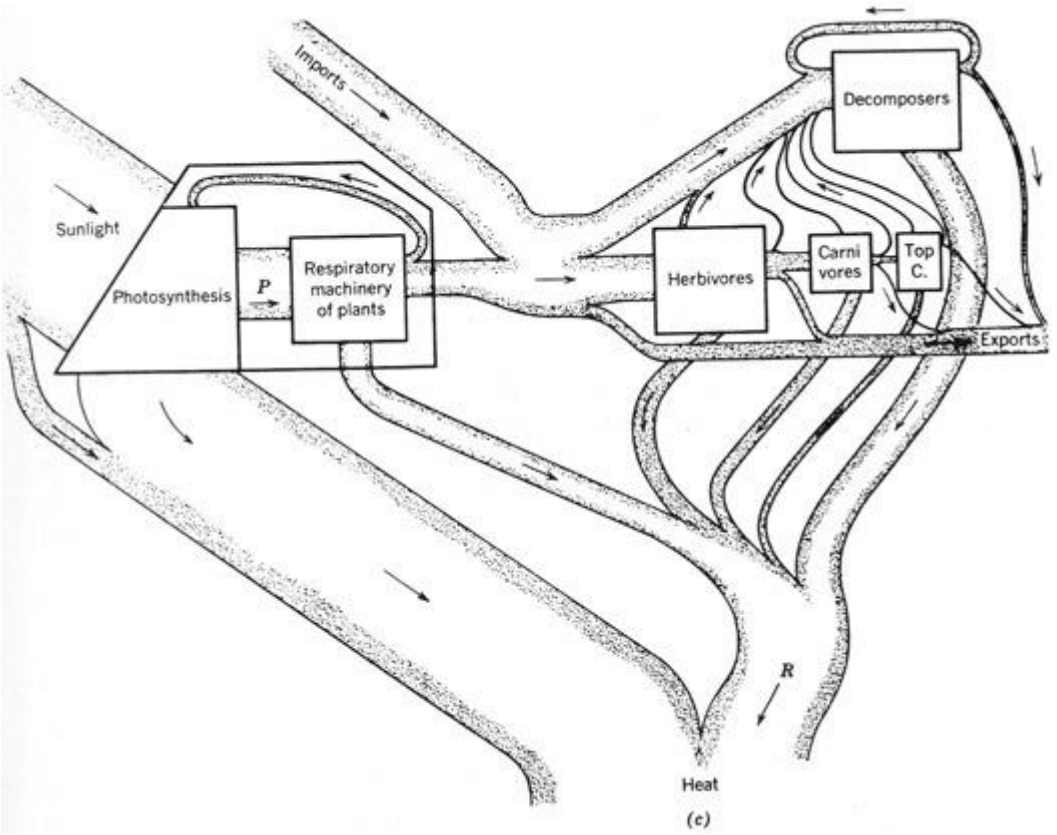
Single channel model describes the unidirectional flow of energy.

This also can be used to illustrate the gradual decline of energy at each trophic level.



Double channel or Y-shaped enegry flow model

This model describes the flow of energy in an ecosystem, where both grazing food chain and detritus food chains work simultaneously.



Nutrient cycling

Nutrients are chemical elements that all plants and animals require for growth.

The nutrient cycle describes how nutrients move from the physical environment into living organisms, and subsequently are recycled back to the physical environment.

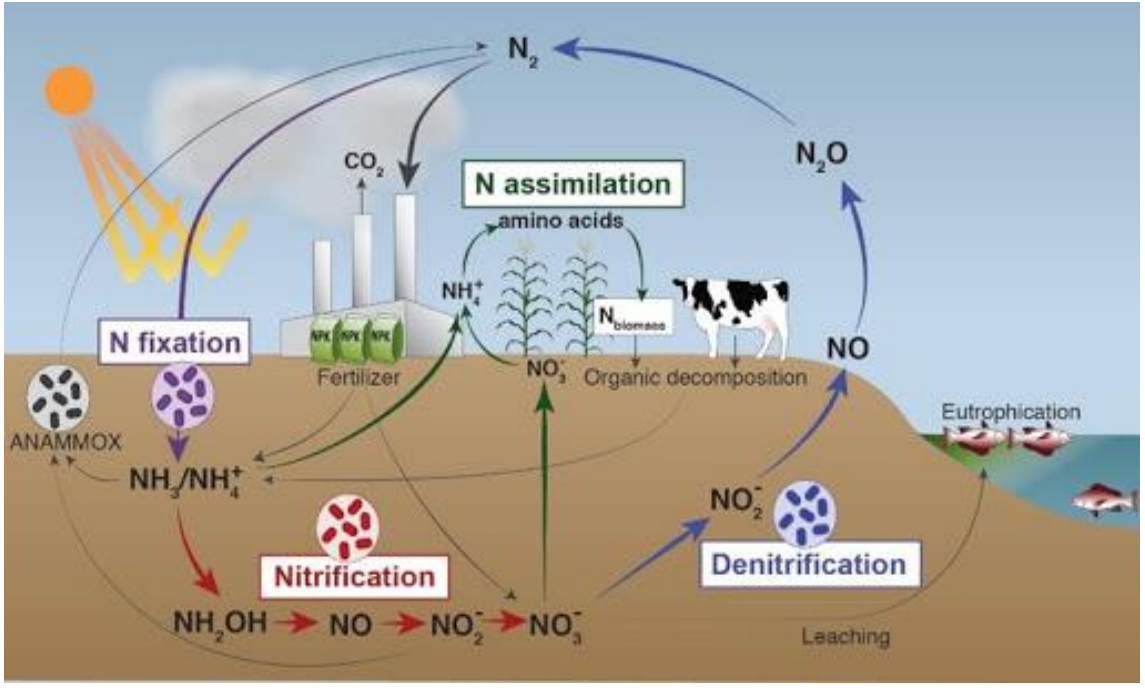
The pathway comprises cells, organisms, community and ecosystem.

Nitrogen cycle

By the process of nitrogen fixation, nitrogen-fixing bacteria fix the atmospheric nitrogen to ammonia and nitrifying bacteria converts ammonia to nitrate. It is then taken up by the plants

Atmospheric nitrogen is converted to nitrate lightning and assimilated by plants.

Decomposers break down the amino acids of dead and decaying organic matters.

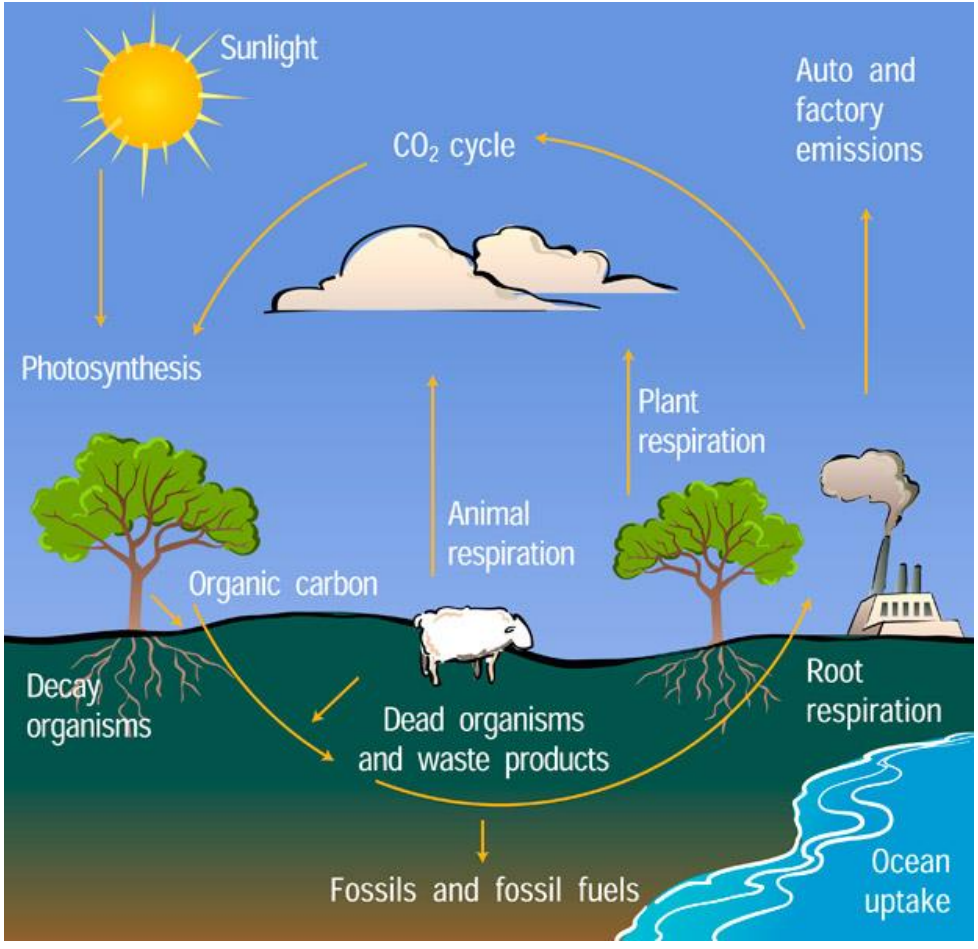


Carbon cycle

Carbon is mainly present as carbon dioxide or methane.

Exchange of carbon is continuous via the process of respiration.

Atmospheric carbon dioxide is fixed by the plants through photosynthesis.

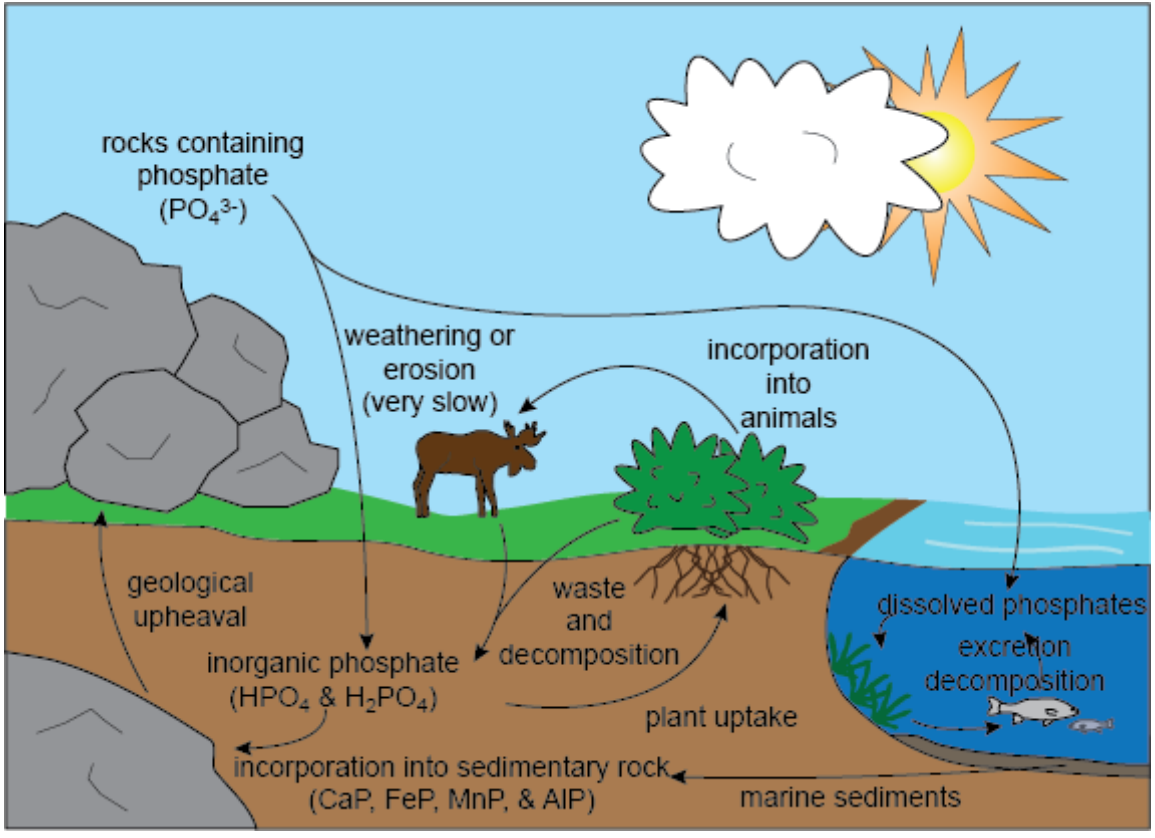


Phosphorus cycle

Phosphorus does not exist as gas in the atmosphere.

Largest reservoir of the phosphorus are sediment rocks.

Generally nitrogen cycle begins with rain water washing away the sediment phosphorus, and distributing them in soil and water.



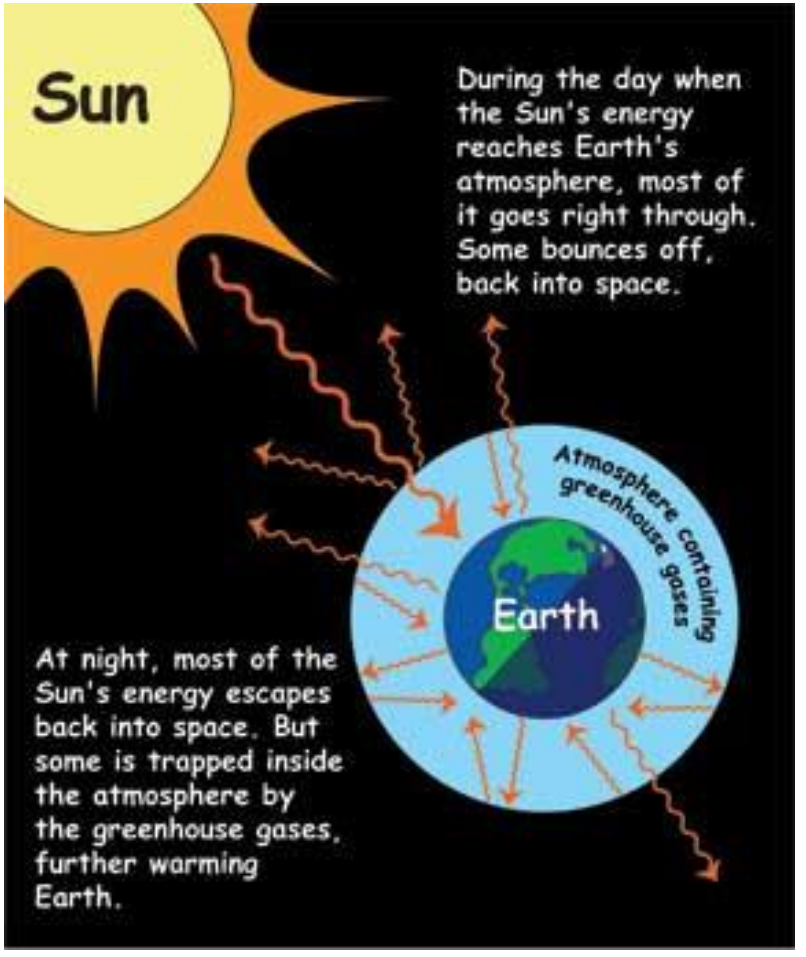
Effect of human activities on nutrient cycle

CO_2

Gases like carbon dioxide are important for keeping the earth warm.

These gases trap the heat from solar radiation. This phenomena is known as green house effect.

Without the presence of such gases temperature of earth will be too cold to sustain the life.



Effect of human activities on nutrient cycle

CO_2

Combustion of fossil fuels: Burring of the petroleum products e.g., petrol, diesel or natural gas etc., leads to increase in the atmospheric CO_2

Deforestation: Cutting down large areas of trees lead to reduction of photosynthesis, resulting in the higher amount of CO_2 in the atmosphere.

Ocean pollution: Polluting the water bodies, results in poor growth of aquatic autotrophs. Thus, resulting in the reduction of photosynthetic activity in aquatic ecosystems.

Effect of human activities on nutrient cycle

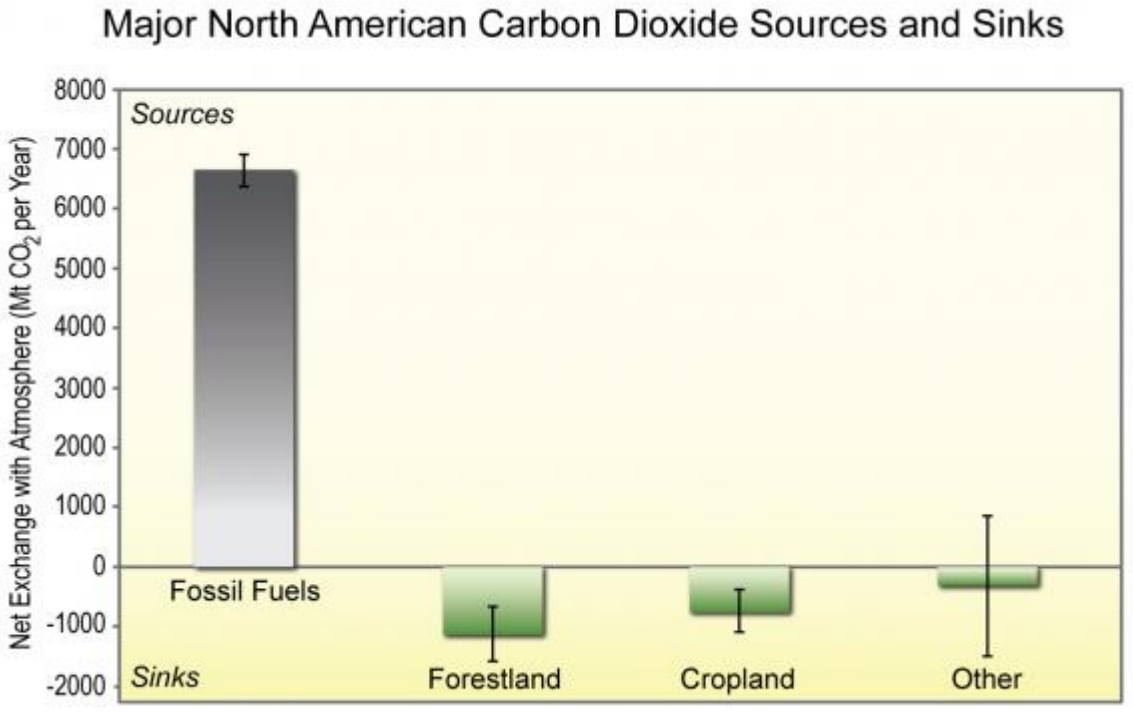
CO_2

Too much of CO_2 in atmosphere can cause a steep rise in earth's temperature.

Even few degree rise in earths temperature will adverse effects on earth's climate and ecosystem.

Effect of human activities on nutrient cycle

CO_2



Effect of human activities on nutrient cycle

Cycle of the other nutrients is also effected by the human activity.

Nitrogen cycle or phosphorus cycle is influenced by excessive use of fertilizers.

Burring of petroleum product also releases the sulfur and nitrogen compounds in atmospheres.

In aquatic environment, excess of nitrogen leads to the growth of ages. This reduces the dissolved oxygen level in the water. This situation is not favorable for the survival of other aquatic species.

Effect of human activities on nutrient cycle

Phosphorus, Nitrogen or Sulfur compounds in air may react with the atmospheric water to form acid rain.

Acid rain damages the soil, roots and leaves of trees.

It may cause the change of pH in water bodies, negatively impacting the growth of aquatic life.

It also damages the other important structures, like building

Productivity of the ecosystem

In ecology productivity refers to the rate of production of biomass in the ecosystem.

Ecological productivity can be classified into two:

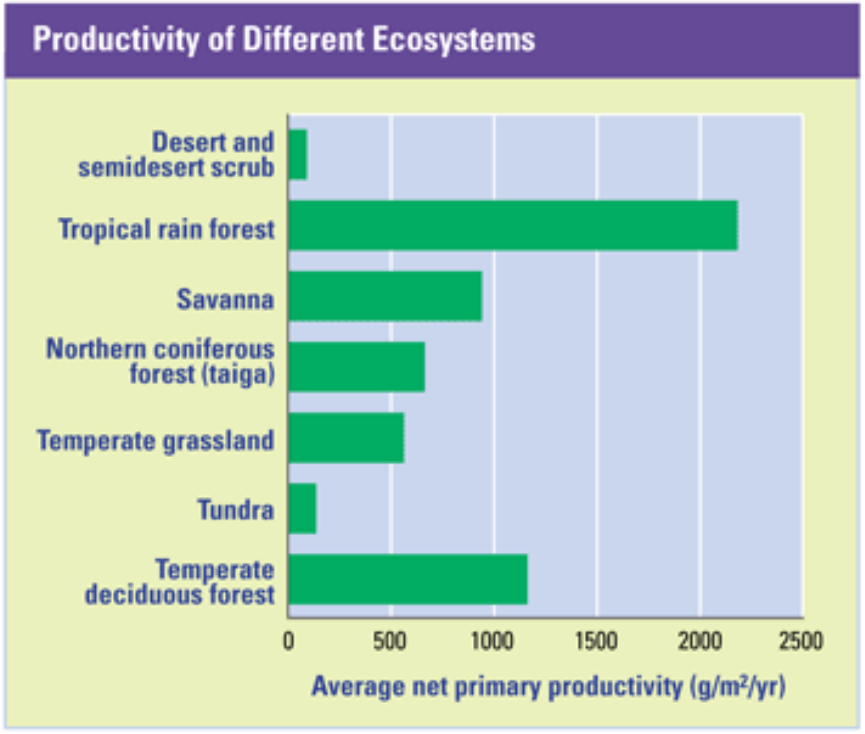
Primary productivity: This mainly refers to the biomass from autotrophs or via photosynthesis.

Gross primary productivity (GPP): Total solar energy trapped by the photosynthetic species

Net primary productivity (NPP): It is the net energy stored in the plants in the form of biomass

$$NPP = GPP - R$$

Productivity of the ecosystem



Secondary productivity: This refers to the accumulation of energy at consumer level. This is driven by the transfer of organic material between trophic levels, and represents the quantity of new tissue created through the use of assimilated food.

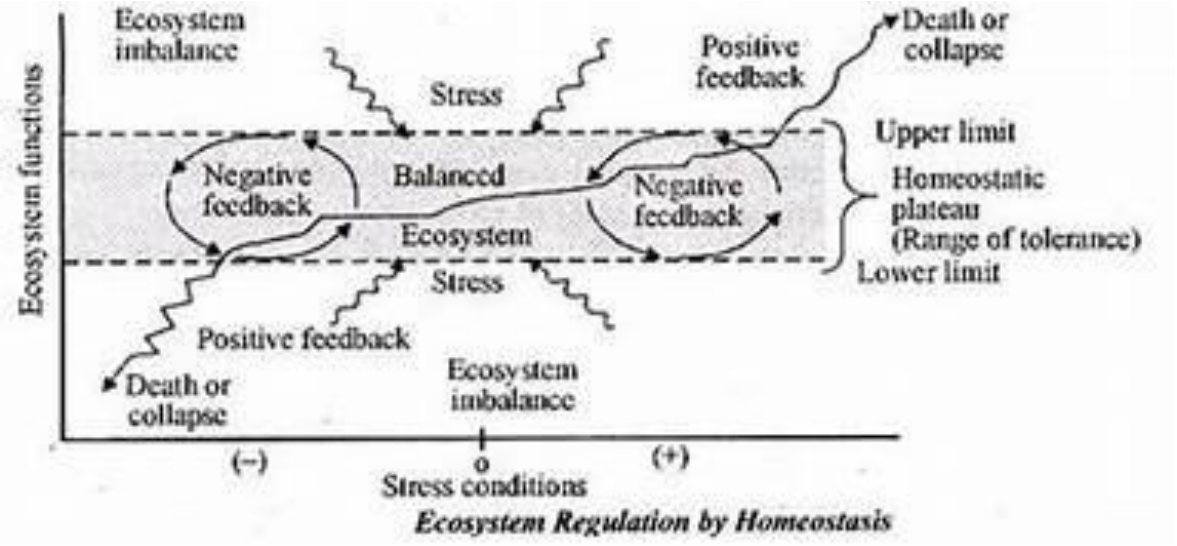
Ecosystem regulations

All the ecosystems function under certain set of environmental conditions.

Homeostasis: Ecosystem tries to resist any change in the equilibrium conditions.

Negative feedback: Reduces the stress on system.

Positive feedback: Increases the stress on system.



Ecosystem Regulation by Homeostasis

Ecology

It is the study of relationship between living species and enviornment. This includes both biotic and abiotic factors.

Global ecology: It deals with interactions among earth's ecosystems, land, atmosphere, and oceans. It helps to understand the large-scale interactions and their influence on the planet.

Landscape ecology: It is the study of the pattern and interaction between ecosystems within a region of interest, and the way the interactions affect ecological processes, especially the unique effects of spatial heterogeneity on these interactions.

Ecosystem ecology: It deals with the entire ecosystem, including the study of living and non-living components and their relationship with the environment. This science research how ecosystems work, their interactions, etc.

Ecology

Community Ecology: It deals with how community structure is modified by interactions among living organisms. Ecology community is made up of two or more populations of different species living in a particular geographic area.

Population Ecology: It deals with factors that alter and impact the genetic composition and the size of the population of organisms. Ecologists are interested in fluctuations in the size of a population, the growth of a population and any other interactions with the population.

Organismal Ecology : It is the study of an individual organism's behaviour, morphology, physiology, etc. in response to environmental challenges. It looks at how individual organisms interact with biotic and abiotic components.

Molecular Ecology: The study of ecology focuses on the production of proteins and how these proteins affect the organisms and their environment. This happens at the molecular level.

Ecological succession

Ecological succession is the process of change in community structure and function with time.

This is generally mediated via the modification of the physical environment.

Aim of the ecological succession is to reach an equilibrium with the environment.

Primary succession is the series of community changes which occur on an entirely new habitat which has never been colonized before. For example, a newly quarried rock face or sand dunes.

Secondary succession is the series of community changes which take place on a previously colonized, but disturbed or damaged habitat. For example, after felling trees in a woodland, land clearance or a fire.

Ecological succession

Pioneer community is the group of species that undergo the primary ecological succession.

Seral community is the intermediate stage of the ecological succession towards the climax community.

Climax community is the steady, stable, and self sustaining community in the ecological succession. Climax community is in equilibrium with the physical environment.

Depending upon starting point, ecological succession can be defined as:

(a) **Hydrarch** or **hydrosere** (pond, swamp), (b) **Mesarch** (adequate mostiure area), (c) **Xerarch** or **Xerosere** (Dry area) [Lithosere: Bare rock] [Psammosere: Sand] [Halosere: Saline soil]

Process of ecological succession

Ecological succession is completed through a series of sequential steps

1) **Nudation**: It is a process of developing a bare area without any form of life for the arrival of new species. The causes of nudation may be: (a) Topographic: soil erosion, land slide, or volcanic activity etc., (b) Climatic: storm, fire, frost, or drought etc., and (c) Biotic: destruction of forest, destruction of grass land or diseases induced by bacteria and virus.

2) **Invasion**: The successful establishment of a species in a bare area is called as invasion. This process of establishment is completed in three successive steps (a) Migration (dispersal), (b) Ecesis (Establishment, germination and growth), and (c) Aggregation.

Process of ecological succession

3) **Competition and Coaction**: Mainly for space and nutrition due to aggregation of the species in a limited space. Life process of one individual is affected by the surrounding species in various ways which is known as coaction.

4) **Reaction**: The species present in an environment constantly interact with it there by causing its modification. The mechanism of the modification of the environment through the influence of living organisms on it, is known as reaction.

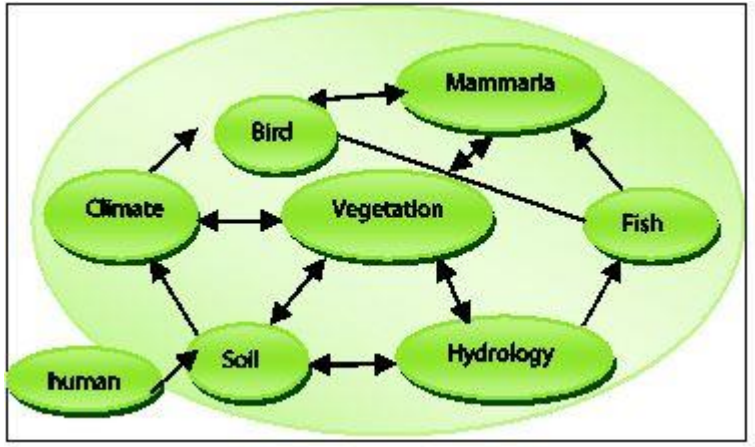
5) **Stabilization (Climax)**: At last a final or terminal community is established. Which is stabilized for a longer period of time and which can maintain an equilibrium with the environment of that area. This community is known as climax community and the stage is as climax stage.

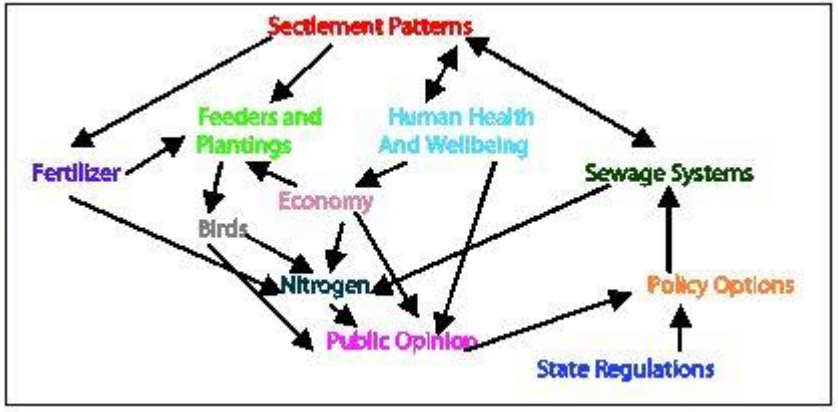
Ecological succession

Urban ecology

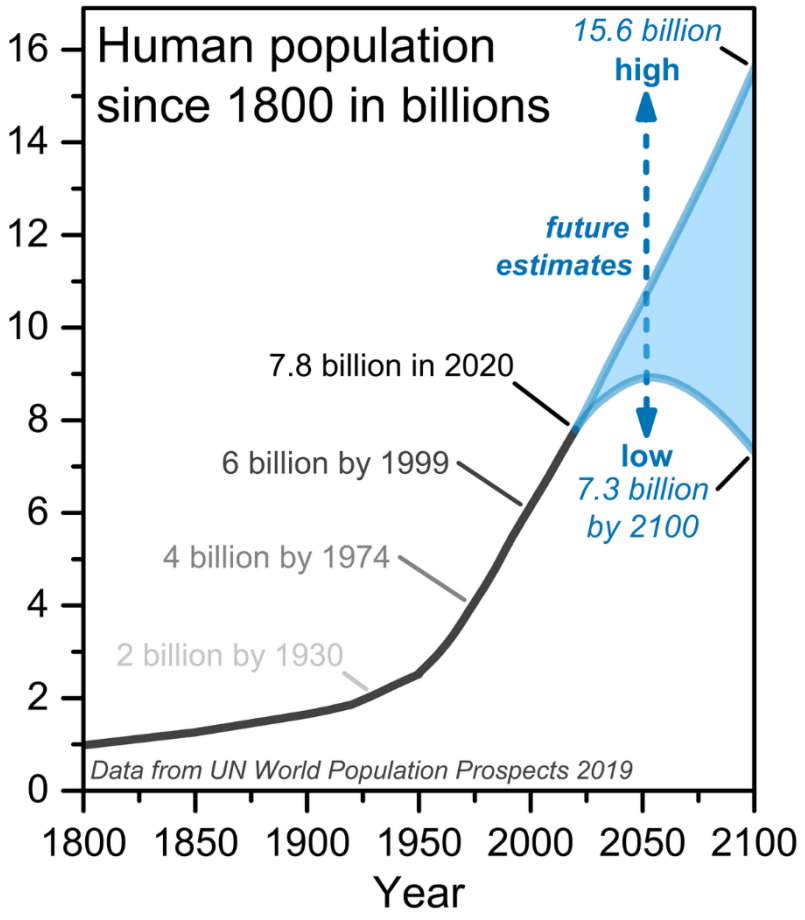
Urban ecology is the study of complex interactions between humans and their surrounding, such as construction, production, housing, transport etc.

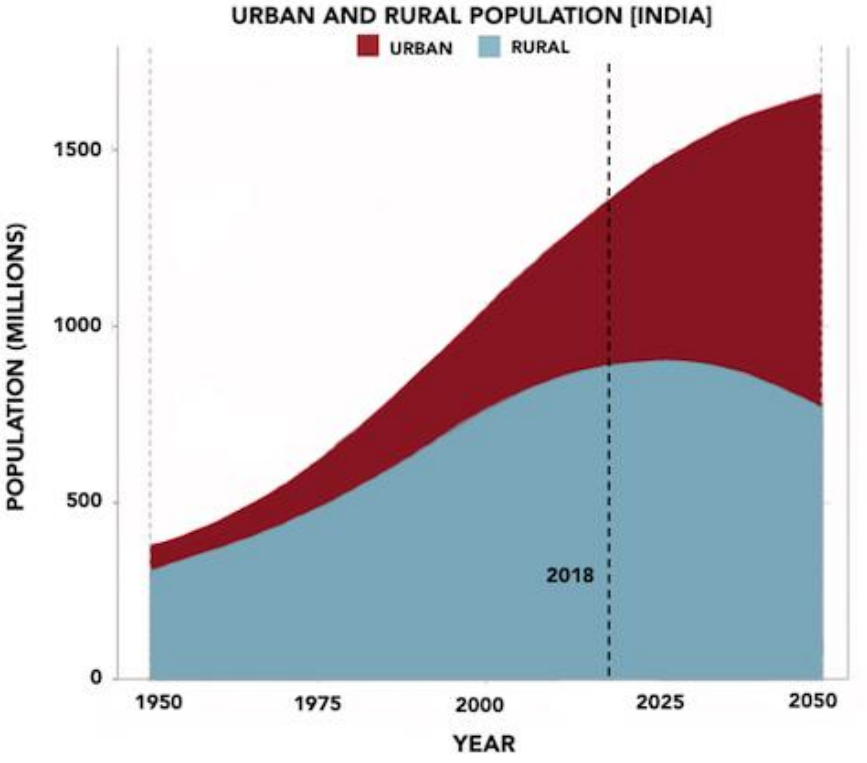
According to United Nations, in forty years' time, two-third of the world's population will be living in growing urban centers.





Urban ecology





Urban ecology

Urban ecology can be viewed from three points:

(1) Ecology and evolution of living organisms residing in city boundaries

(2) Biological, political, economic, and cultural ecology of humans in urban landscape

(3) Cities resultant of the coupled relations of humans and natural processes.

Urban ecosystem: In urban environments, it could be difficult to distinguish different forms of ecosystems. In fact, one can define the whole city as a single ecosystem.