

ecology

by

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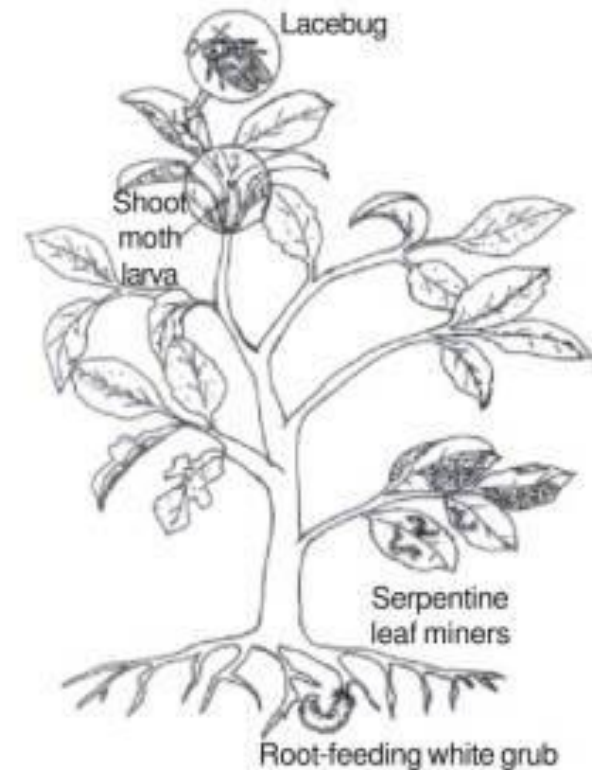
Birzeit university

Interactions among living things and abiotic factors

- Ecosystem: interaction of populations in a community and nonliving (physical) surroundings
- kinds of ecosystems
 - Terrestrial (land)
 - Aquatic
 - Fresh water,
 - Marine: 75% of the earth)

Organisms in Ecosystems

- Even though two species occupy the same habitat, they do not occupy the same niche because resources (food, shelter) are used in different ways
- It is an advantage for a species to occupy a different niche, unique strategies are important to reduce competition
- a **niche**: is the fit of a species living under specific environmental conditions.



Different species of insects feeding on different parts of the same plant

COMPONENTS OF THE ENVIRONMENT

- (A) Abiotic
 - Physical components : They are the various climatic characteristics such as light, temperature, humidity precipitation, pressure and soil profile. These factors sustain and control the growth of organisms in an ecosystem. Deficiency or excess of any one of these is harmful for their growth.
 - Chemical components
 - (a) Inorganic components : Substances such as carbon, carbon dioxide, nitrogen, oxygen, phosphorus sulphur, zinc, water and many other minerals are the inorganic nutrients required by all living beings. They may be classified into the micronutrients and macronutrients..
 - The essential inorganic elements such as carbon, hydrogen, nitrogen, phosphorus, calcium, potassium which are required in large quantities are called **macronutrients**.
 - The essential elements required in small amounts are the **micronutrients** e.g. zinc, boron and magnesium.
 - **Sources** of all nutrients for plants are **air, water and soil**. All these nutrients are converted into the living biomass by the plants.
 - (b) Organic components : The complex molecules such as **carbohydrates, proteins and lipids** (oil, fat) are the organic substances in an ecosystem. These substances when out side the organism make the abiotic component but in the living organism they make an important component of the biomass. They make a link between the biotic and abiotic components.

COMPONENTS OF THE ENVIRONMENT

- (B) Biotic Components (living)

The living organisms form the biotic component of the environment. All the living things **require energy** for their life processes and material for formation and maintenance of their body structure. Food meets both these requirements. The biotic components can be classified as producers, consumers and decomposers.

1. **Producers** : **Only plants are capable of capturing solar energy and transforming it into food energy for all the other living organisms.** Therefore, they are called as producers. These plants are also named as autotrophs since they make their own food.
2. **Consumers** : Animals depend upon the plants directly or indirectly for their food and are called consumers. Their mode of nutrition is called heterotrophic. Consumers can be herbivores, carnivorous, omnivorous, parasitic or scavengers as described later in this lesson.
3. **Decomposers** : They feed on dead and decaying animals and plants. They are small microscopic organisms and help in recycling of nutrients in the environment

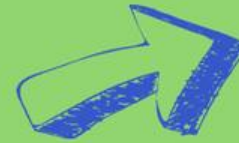
Producers, Consumers and Decomposers

Within an Ecosystem there are several categories these include Producers, Consumers and Decomposers



Producers

Producers are organisms that use the energy from the sun and the nutrients in the ground to create their own food.



Decomposers



Decomposers then receive energy from the producers. Decomposers break down the dead plants and animals which is then turned into organic matter which goes back into the soil.

The process then repeats

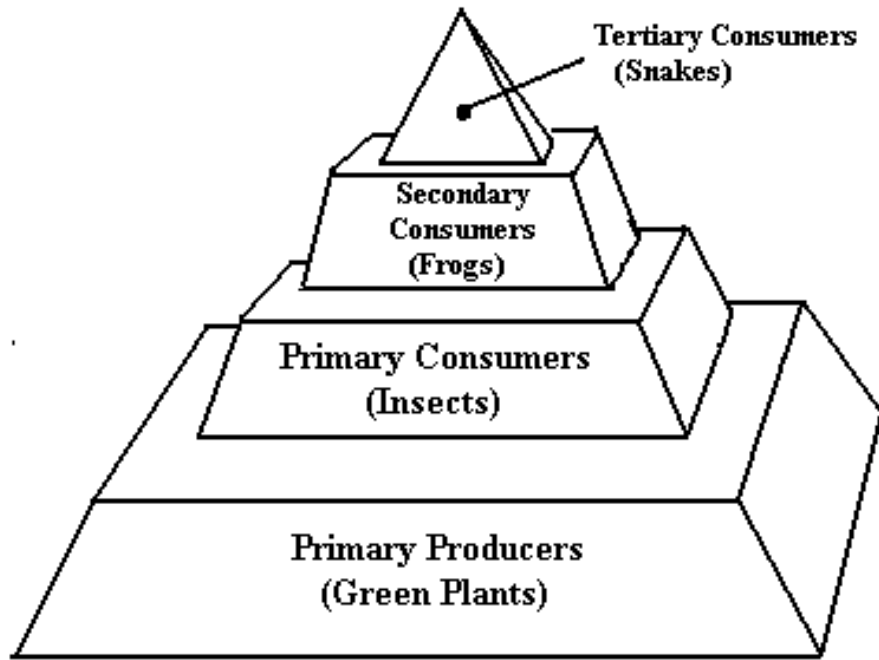
Consumers



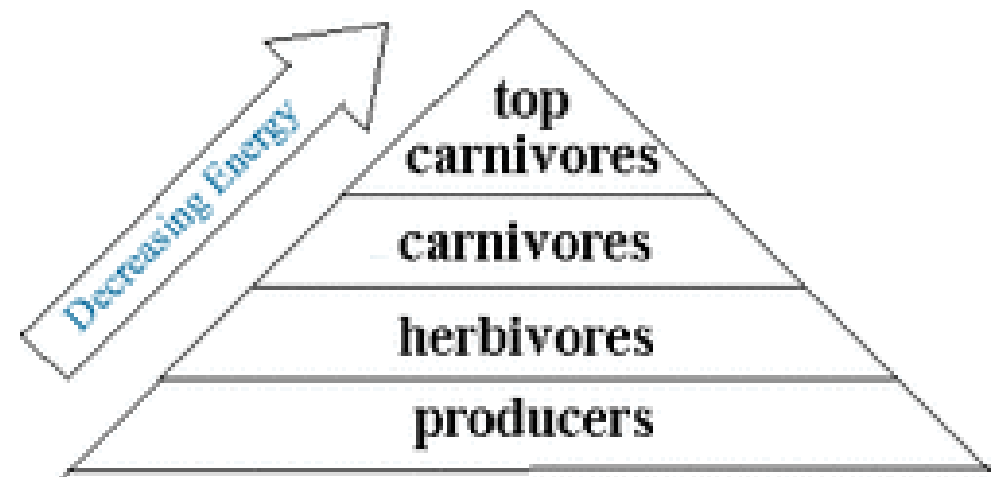
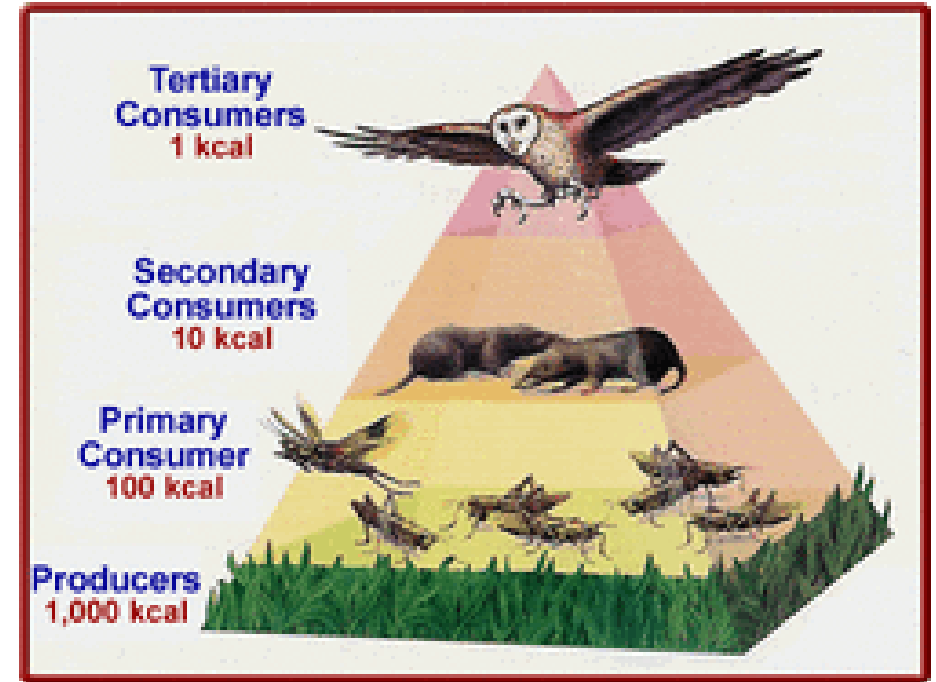
The consumers are the animals. They receive their energy from the producers. Some consumers like the lion will receive their energy from a zebra when it is eaten.



ecosystem

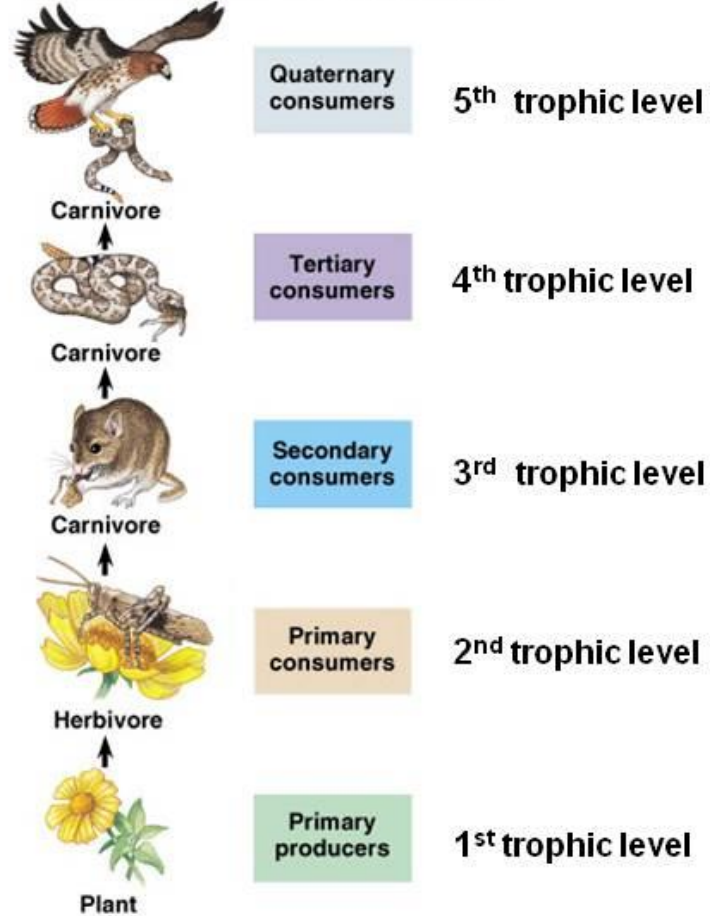


herbivores, carnivorous, omnivorous, parasitic or scavengers



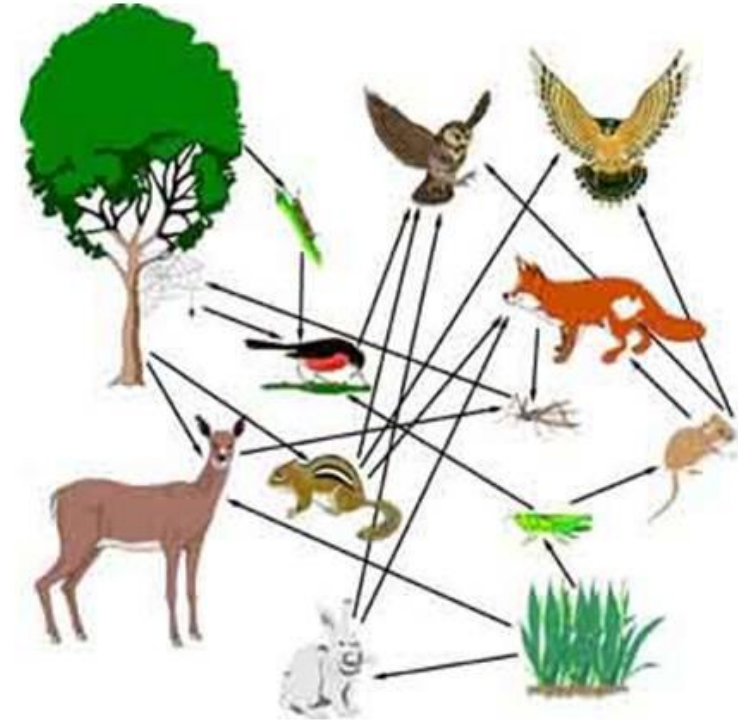
Food Chain

(just 1 path of energy)



Food Web

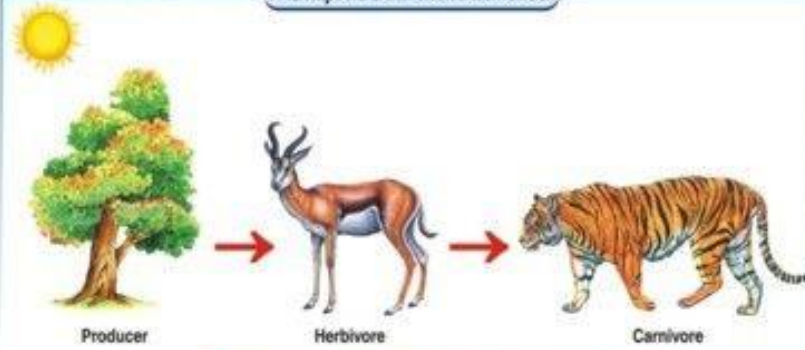
(all possible energy paths)



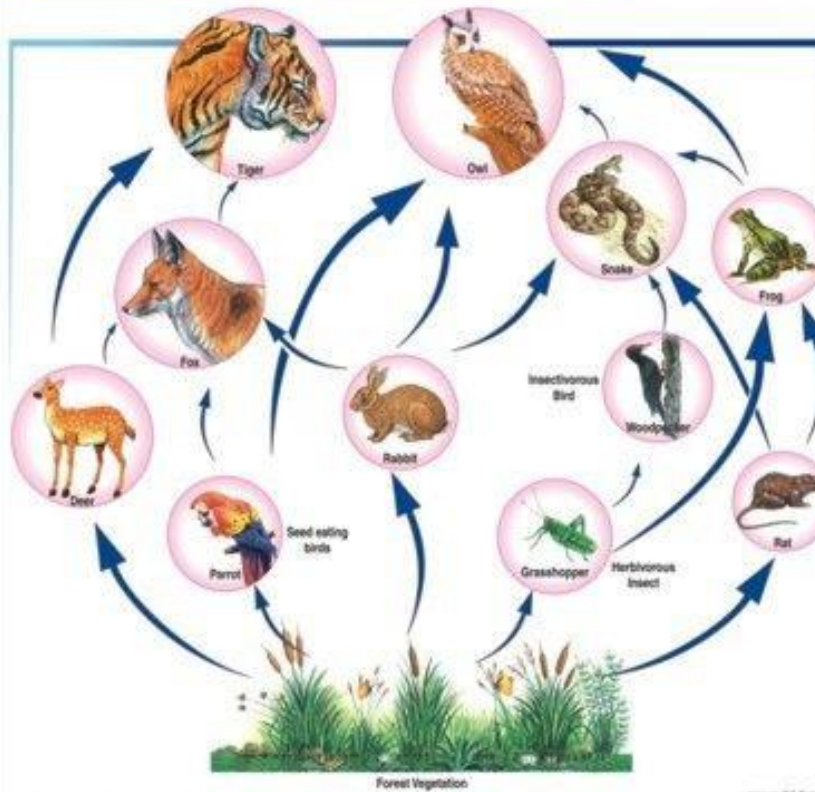
The *arrow* points to the eater and shows the transfer of energy.

Food Chain in Forest Ecosystem

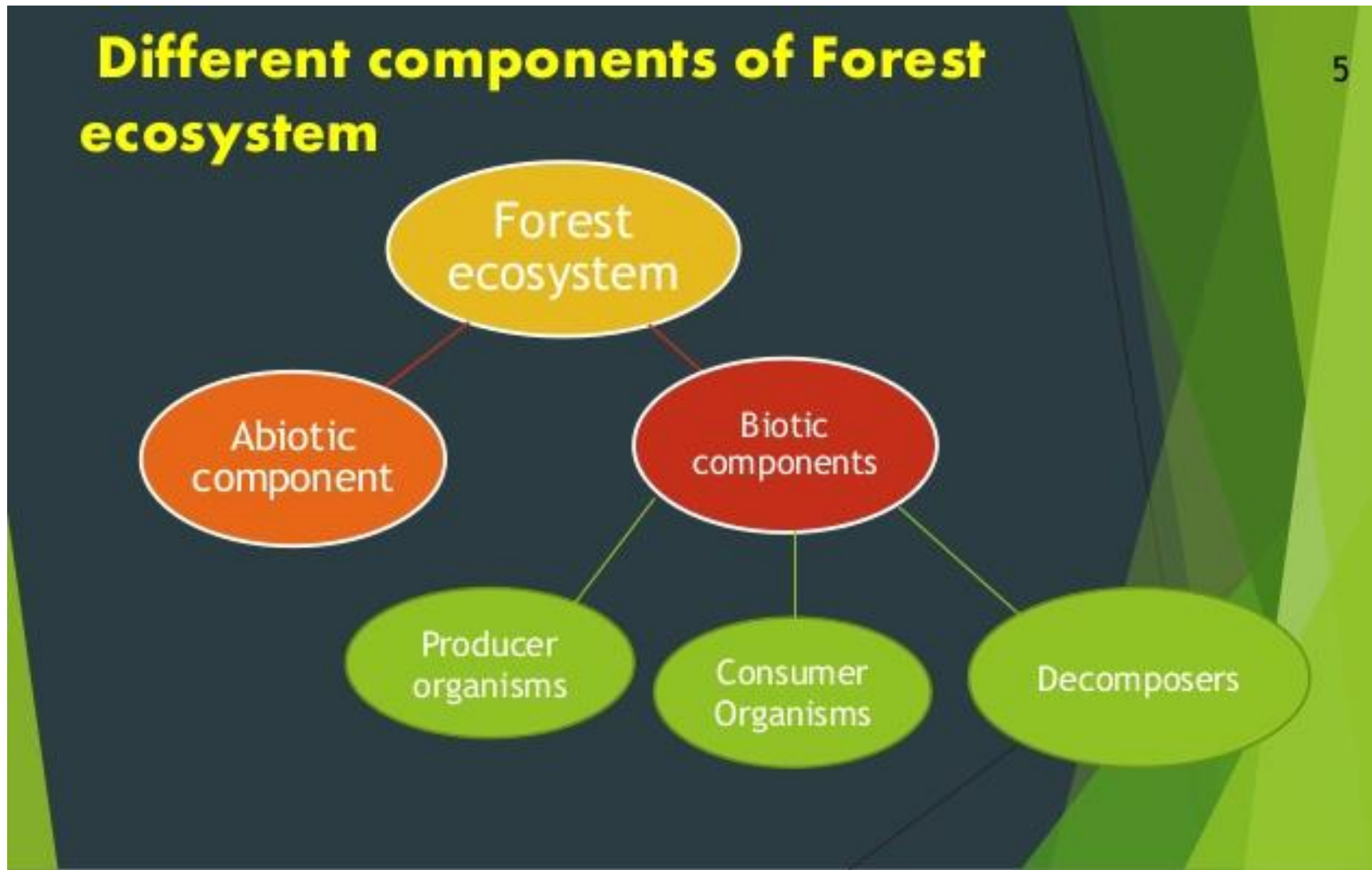
A Simple Food Chain in Forest



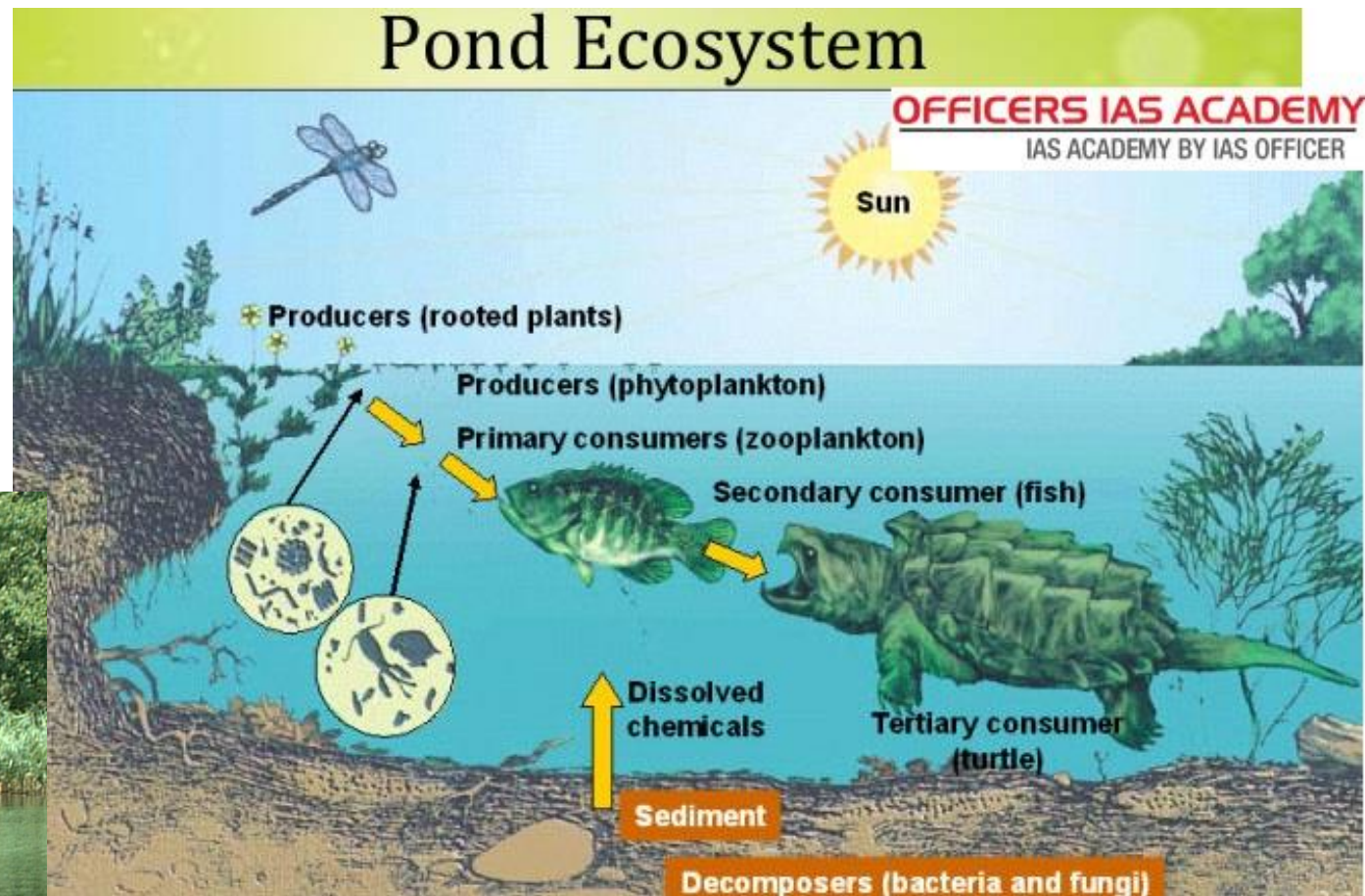
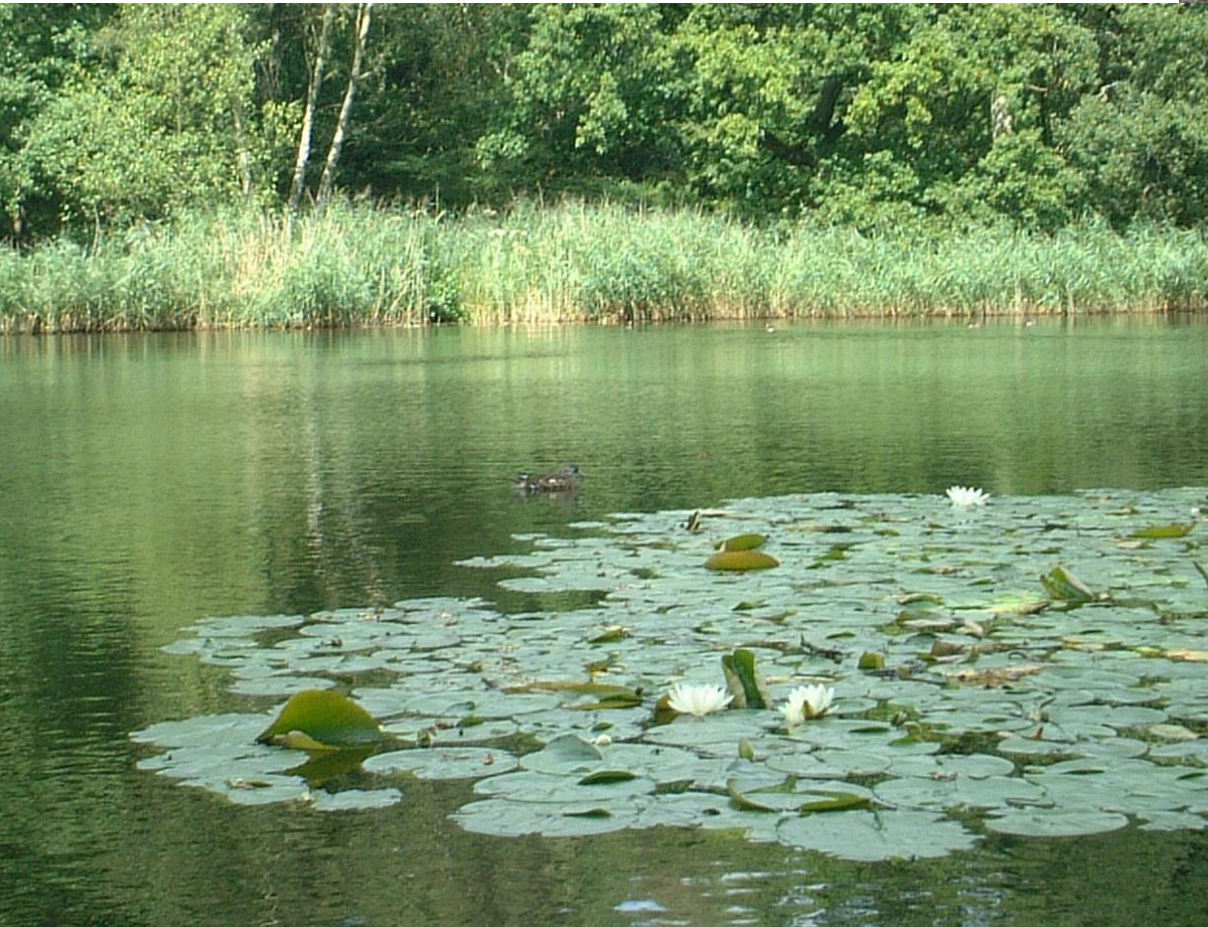
A Food Web in Forest



Forest ecosystem



Structure of pond ecosystem



Species Composition

- A community is an assemblage of many populations that are living together at the same place and time. For example **a tropical forest community** consists of trees, vines, herbs and shrubs along with large number of different species of animals.

This is known as species composition of tropical forest ecosystem.

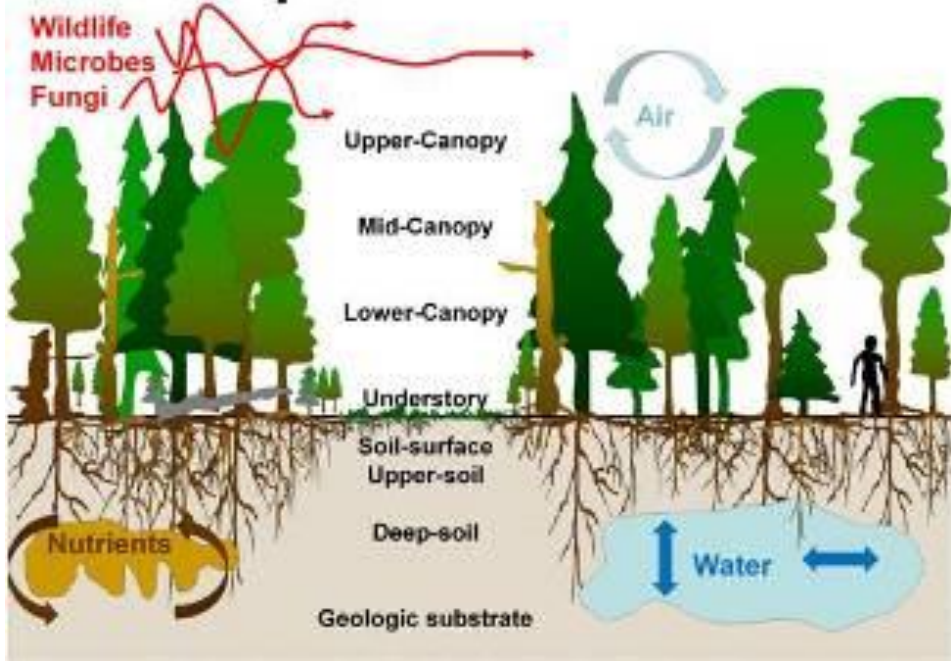
Each ecosystem has its own species composition depending upon the suitability of its habitat and climate.

If you compare animal and plant populations of a forest they are entirely different from that of a grass land. Not only the types of species are different in these two ecosystems even their total number and biomass varies.

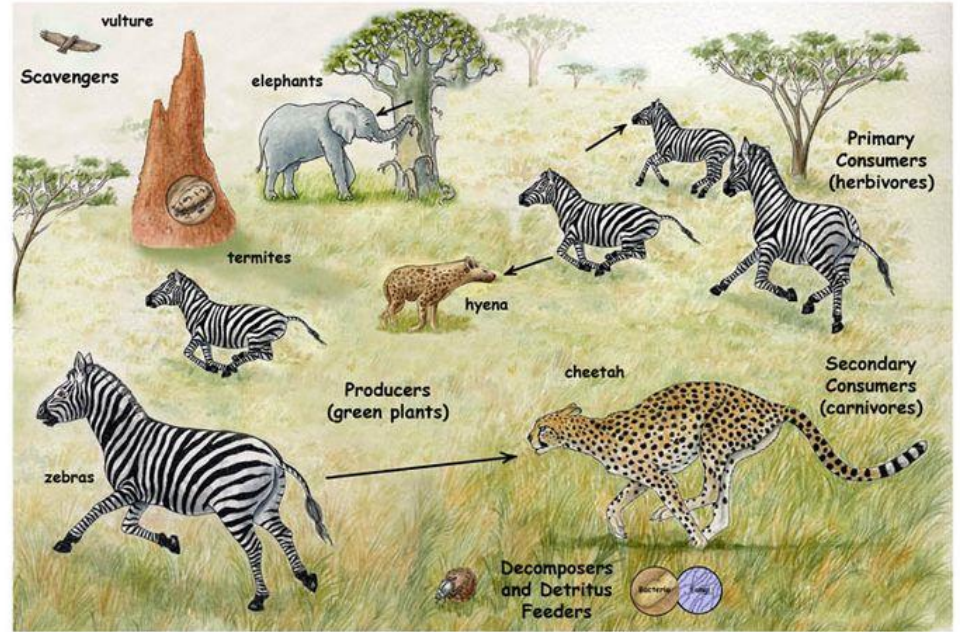
A forest ecosystem supports much larger number of species of plants and animals than a grassland. The total number and types of species in a community determine its stability and ecosystem balance (ecosystem equilibrium).



Components of a Forest



Grassland Food Web

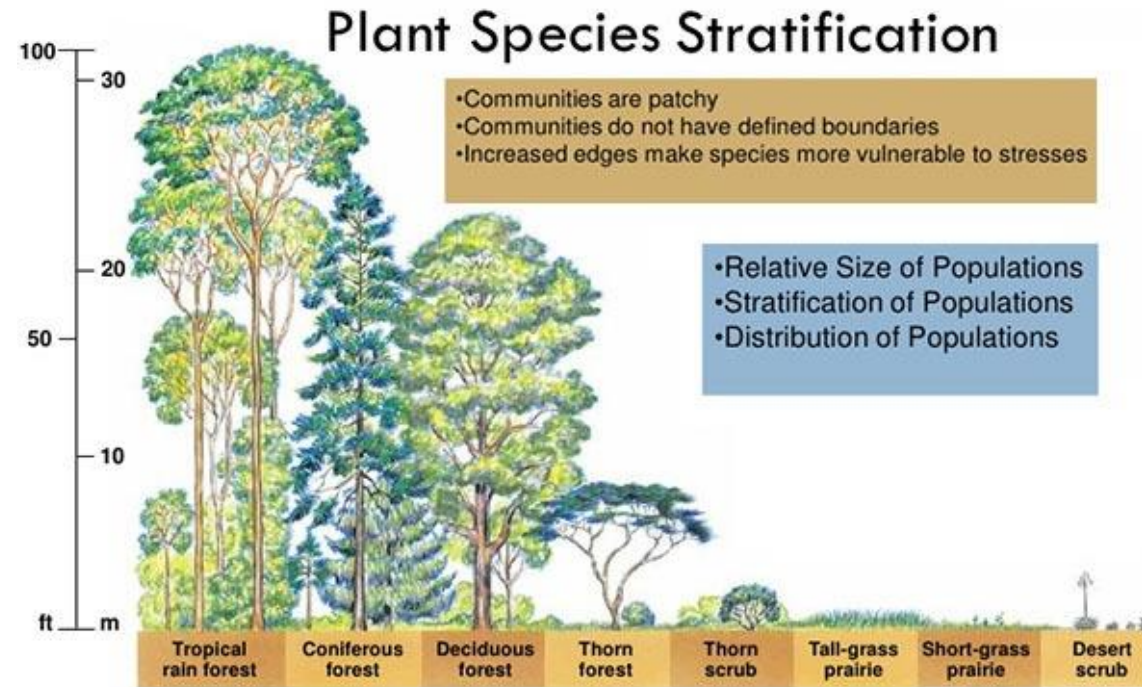


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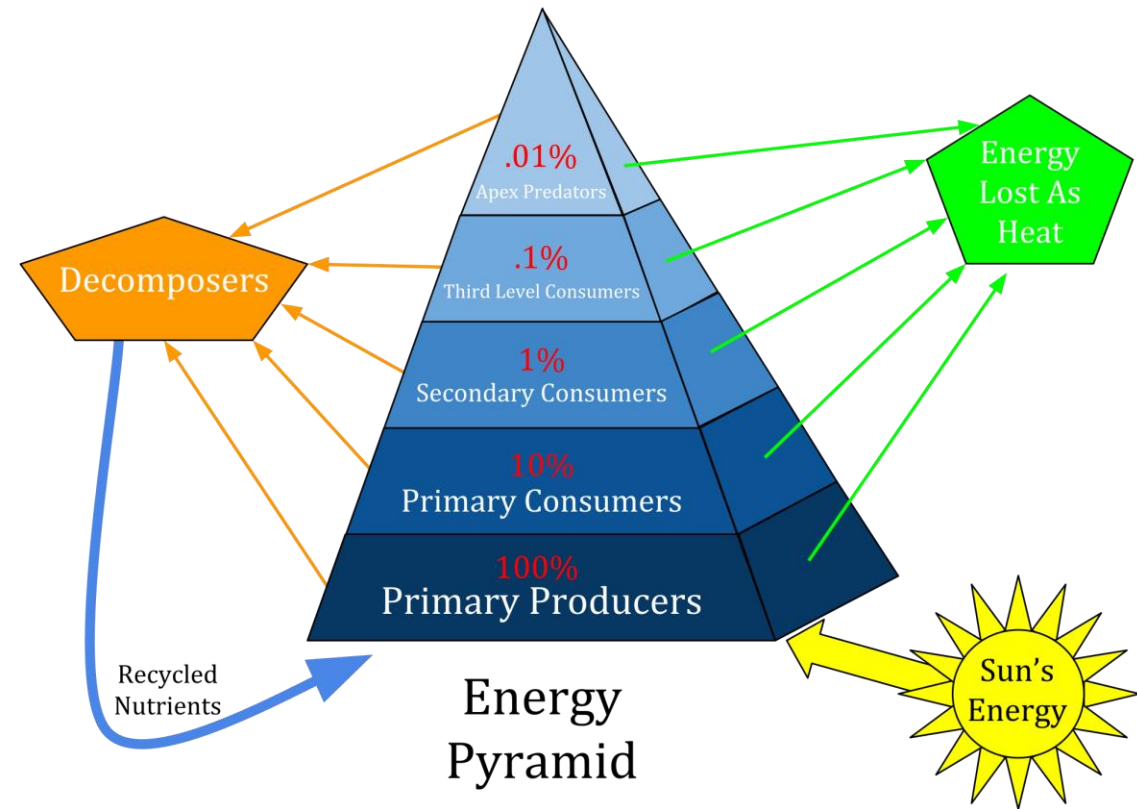
Stratification

- The vertical and horizontal distribution of plants in the ecosystem is called ecosystem stratification. You would have observed that the plants are of different heights in forests. Tallest trees make the top canopy. This is followed by short trees and shrubs and then the forest floor is covered with herbs and grasses. Some burrowing animals live underground in their tunnels or on the roots of the plants.
- Each layer from the tree top to the forest floor has its characteristic fauna and flora. This is termed as vertical stratification of forest ecosystem. On the other hand desert ecosystem shows low discontinuous layers of vegetation and animals with some bare patches of soil showing a type of horizontal stratification.



Flow of energy

- Energy flow through an ecosystem The energy enters into the ecosystem in the form of solar radiation and is converted into food (plant biomass) by the producers.
- Food stored by the plants and their biomass (matter) is the chemical form of energy.
- From the producers this chemical form of energy passes through various trophic levels in the food chain.
- This process of transfer of energy through various trophic levels of the food chain is known as **flow of energy**.



- All the functions of ecosystem depends on the flow of energy through it
- The quantity of energy flowing through the successive trophic levels decreases This is because all the energy entering at each trophic level is not used for production of biomass due to the following two reasons.
 - a part of the energy is lost (not utilized).
 - a part of it is used up by the organisms for their own metabolism through the process of respiration. If herbivores consumes 1000 kcal. of plant energy in the form of food, only 100 kcal. is converted into herbivore tissues, and 10 kcal. into first level carnivore and only 1 kcal into second level carnivore. This is known as 10% law (or ecological rule of thumb) where by only 10% of the energy is transferred to the next higher trophic level.

- The entire process of energy flow can be summarized in the following four steps:
 - The flow of energy in an ecosystem is always linear or one-way.
 - At every step in a food chain the energy received by the organism is also used for its own metabolism and maintenance. The left over is passed to next higher trophic level. Thus energy flow decreases with successive trophic levels.
 - It follows the ecological thumb rule of 10%.
 - The number of steps is limited to four or five in a food chain for the transfer of energy.