

Ecosystem



- Ecology is the study of how organisms interact with each other and with their non living environment.
- In other words, Ecology is defined as the branch of science that studies how people or organisms relate to each other and their environment. An example of ecology is studying the ecosystem of a pond.



Five levels of ecological organization:

- Organism: The definition of an organism is a creature such as a plant, animal or a single-celled life form, or something that has interdependent parts and that is being compared to a living creature. Organisms are classified into groups such as multicellular animals, plants and fungi or unicellular microorganisms such as bacteria. Species refers to the organisms that resemble one another in terms of their appearance, behavior, chemistry and genetic makeup.
- Population is a group of interacting individuals of the same species living in a given area. **Example**: sunfish in a pond, white oak trees in a forest, people in a country.

- Community consists of all populations of different species of plants, animals, and microorganisms living and interacting in an area.
- Ecosystem is a community of different species interacting with one another and with their physical environment of matter and energy in a particular area.
- Biosphere is the sum of all ecosystems.

- Habitat is the place where a population (or an individual organism) normally lives. It may be large as an ocean or as small as the intestine of a termite.

Classification of Ecosystem

An ecosystem is formed by the interactions between all living and non-living components

- In terms of **origin** ecosystems can be
 - natural : Sahara desert, Sundarban forest, Atlantic ocean.
 - artificial (human created) : crop fields, farm ponds.

- In terms of their **location** ecosystems can be
- Terrestrial ecosystem : related to land
 - Forest
 - Mountain
 - Desert
 - Grassland
 - Urban ecosystem
- Aquatic ecosystem : related to water
 - Marine- Ocean

Freshwater- ponds, lakes, rivers etc.

■ Structure:

Two types of components make up the ecosystem:

Abiotic or nonliving components such as water, air, nutrients & solar energy. Also known as physico-chemical environment.

Biotic or living components such as plants, animals and microbes. Also known as ecological community.

- Processes:

- Ecosystems are controlled both by external and internal factors.
- External factors are
 - Climate
 - Parent material
 - Topography
 - Time
 - Biota

Internal factors are

- Decomposition
- Root competition
- Disturbance
- Succession

- Primary Production

Primary production is the production of organic matter from inorganic carbon sources. This mainly occurs through photosynthesis.

- Energy Flow

Energy and carbon enter ecosystems through photosynthesis, are incorporated into living tissue, transferred to other organisms that feed on the living and dead plant matter, and eventually released through respiration. The carbon and energy incorporated into plant tissues is either consumed by animals while the plant is alive, or it remains uneaten when the plant tissue dies .

- Dynamics:
- Ecosystems are dynamic entities. They are subject to periodic disturbances and are in the process of recovering from some past disturbance
- From one year to another, ecosystems experience variation in their biotic and abiotic environments. A drought, a colder than usual winter, and a pest outbreak all are short-term variability in environmental conditions. Animal populations vary from year to year.
- Disturbance also plays an important role in ecological processes. Disturbance is a relatively discrete event in time and space that alters the structure of populations, communities, and ecosystems and causes changes in resources availability or the physical environment.

Major Components of Ecosystem

- Any ecosystem includes two major components- the non living (abiotic) and living (biotic) components
- Some of the major non living components of ecosystem are
 - soil,
 - solar energy,
 - local atmosphere,
 - water
- Major living components include the plants, animals and microorganisms which can be classified as
 - producers,
 - consumers and
 - decomposers

Abiotic Components

- **Soils** contain a mixture of weathered rock fragments, minerals particles, organic matter and living organisms.
- Soils provide nutrients, water, air, a home and a structural growing medium for organisms.
- The **atmosphere** provides carbon dioxide for photosynthesis and oxygen for respiration for the organisms found in the ecosystem. Exchange of other essential gases also occur.
- The processes of evaporation, transpiration and precipitation are responsible for the cycling of water between the atmosphere and the earth's surface.
- **Solar radiation** is used in ecosystems to heat the atmosphere and to evaporate and transpire water into the atmosphere.
- Sunlight is also necessary for photosynthesis.
- Also regulates optimum temperature for favorable habitat.

- Most living tissue is composed of a very high percentage of **water**, up to and even exceeding 90%.
- Water is the medium by which mineral nutrients enter plants and are translocated in plants. It is also necessary for the maintenance.



Biotic Components of Ecosystem

- **Producers**- sometimes called autotrophs (self-feeders)- are organisms that can make their own food (the organic compounds they need as sources of energy and nutrients).
Most producers are green plants that can manufacture their food through the process of photosynthesis.
- **Consumers**- or heterotrophs (other-feeders) get their energy and nutrients by feeding directly or indirectly on producers and also other organisms.
 - Plant eating animals are known as **herbivores**.
 - Organism that feed on herbivores known as **carnivores**.
Carnivores can also consume other carnivores.
 - Consumers which feed on both plants and animals are called **omnivores**.

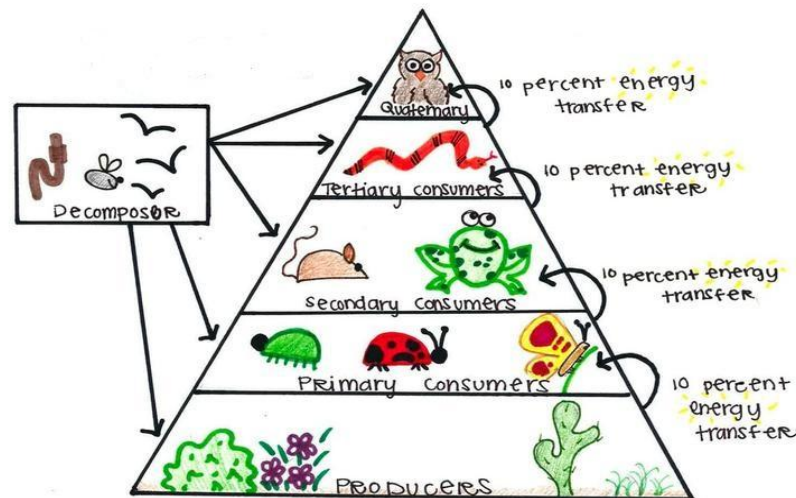
- **Decomposers** or **detritivores**, such as bacteria and fungi, decompose dead organisms. They break down organic materials into simpler inorganic compounds into soil and water where producers and other microorganisms can take them up as nutrients.

Food Chain and Food Web

- **Food chain:** simplistic representation of the feeding relationship among organisms.

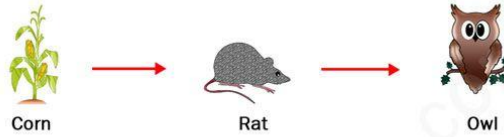
A linear sequence of organisms, each of which serves as a source of food for the next, is called a food chain.

It determines how energy and nutrients move from one organism to another through the ecosystem.

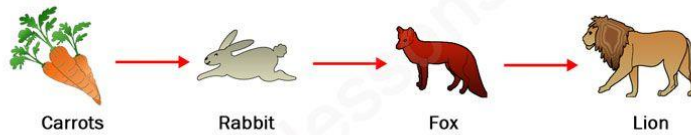


Example of a Food Chain

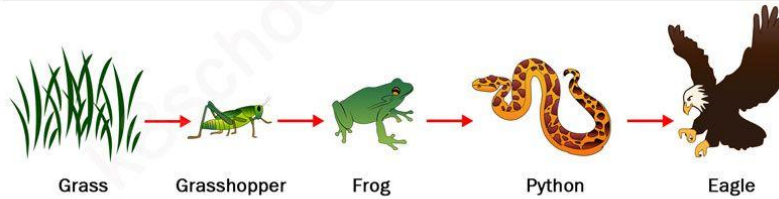
Food Chains



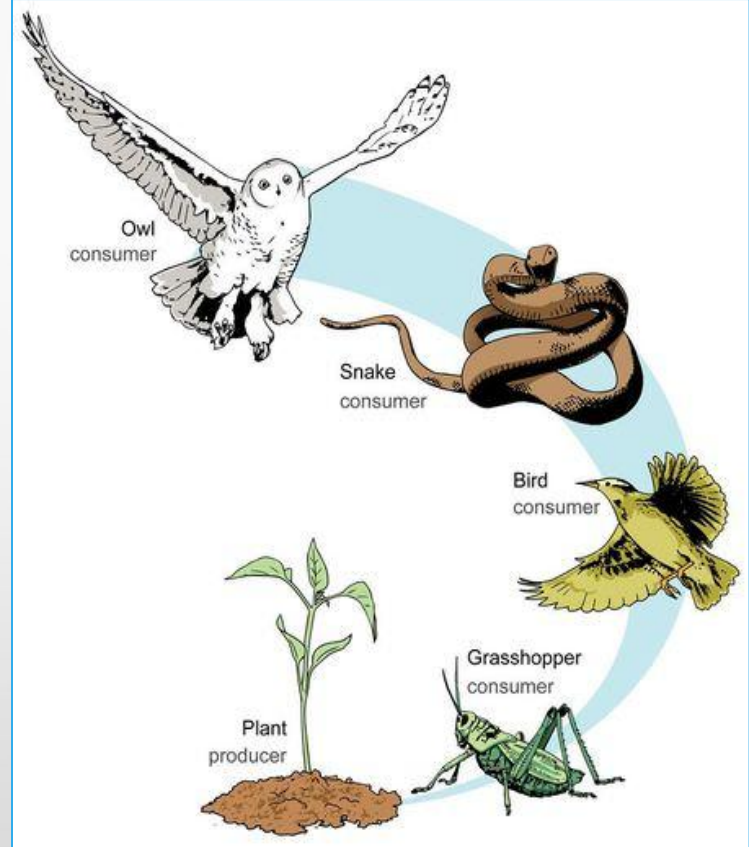
A three linked food chain

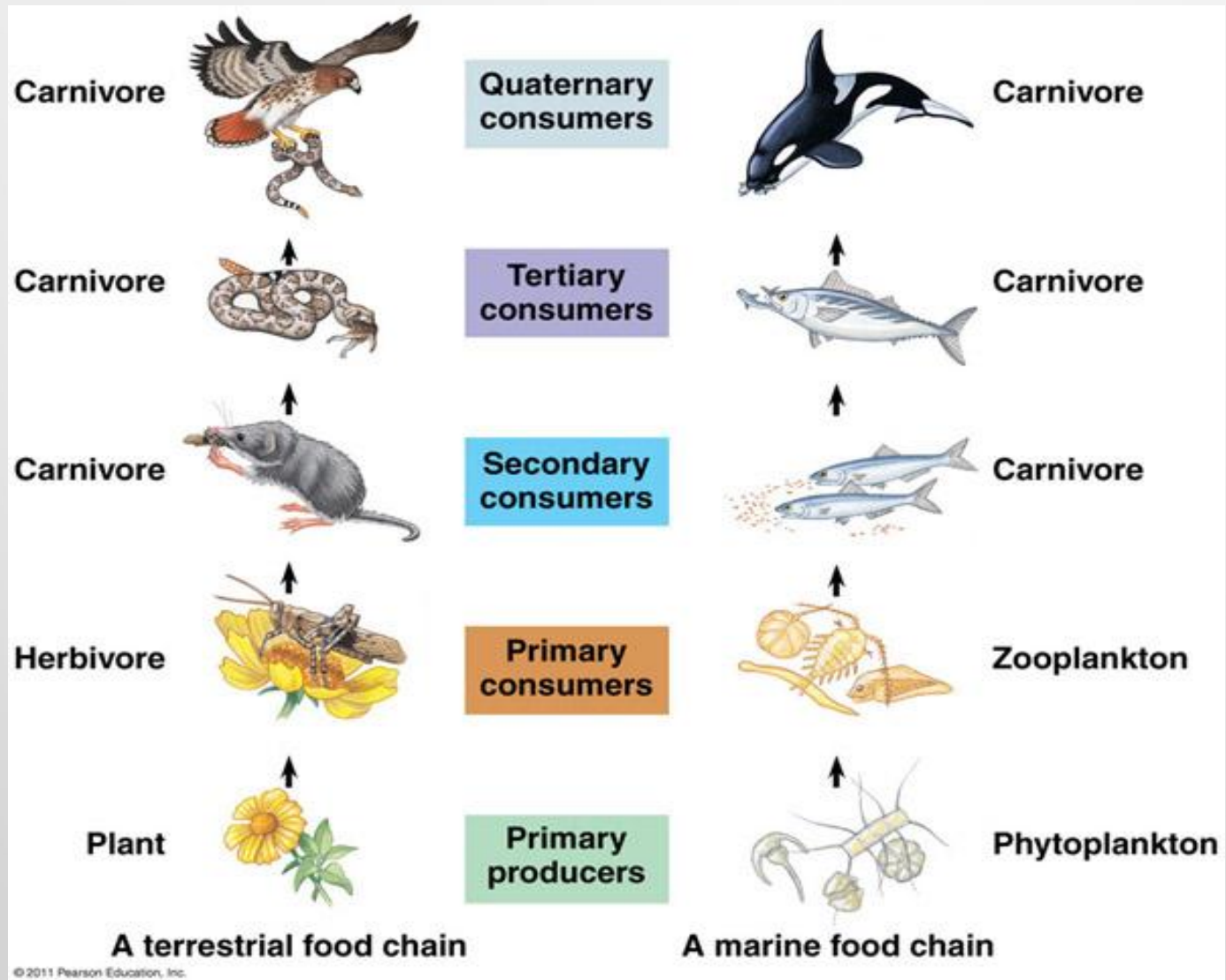


A four linked food chain



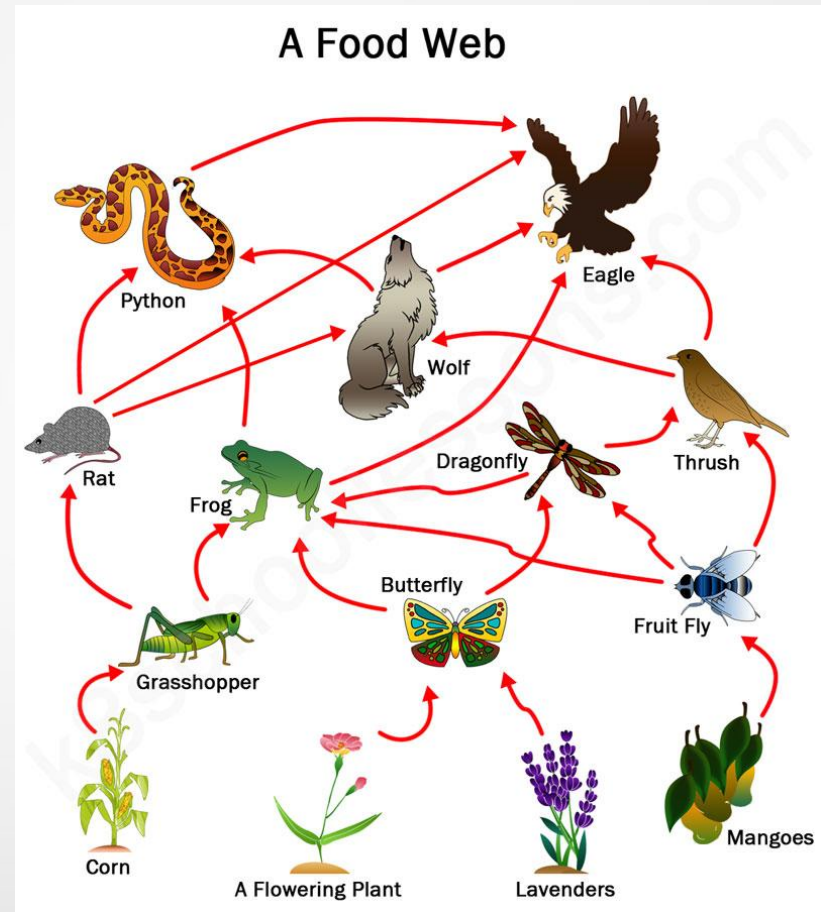
A five linked food chain





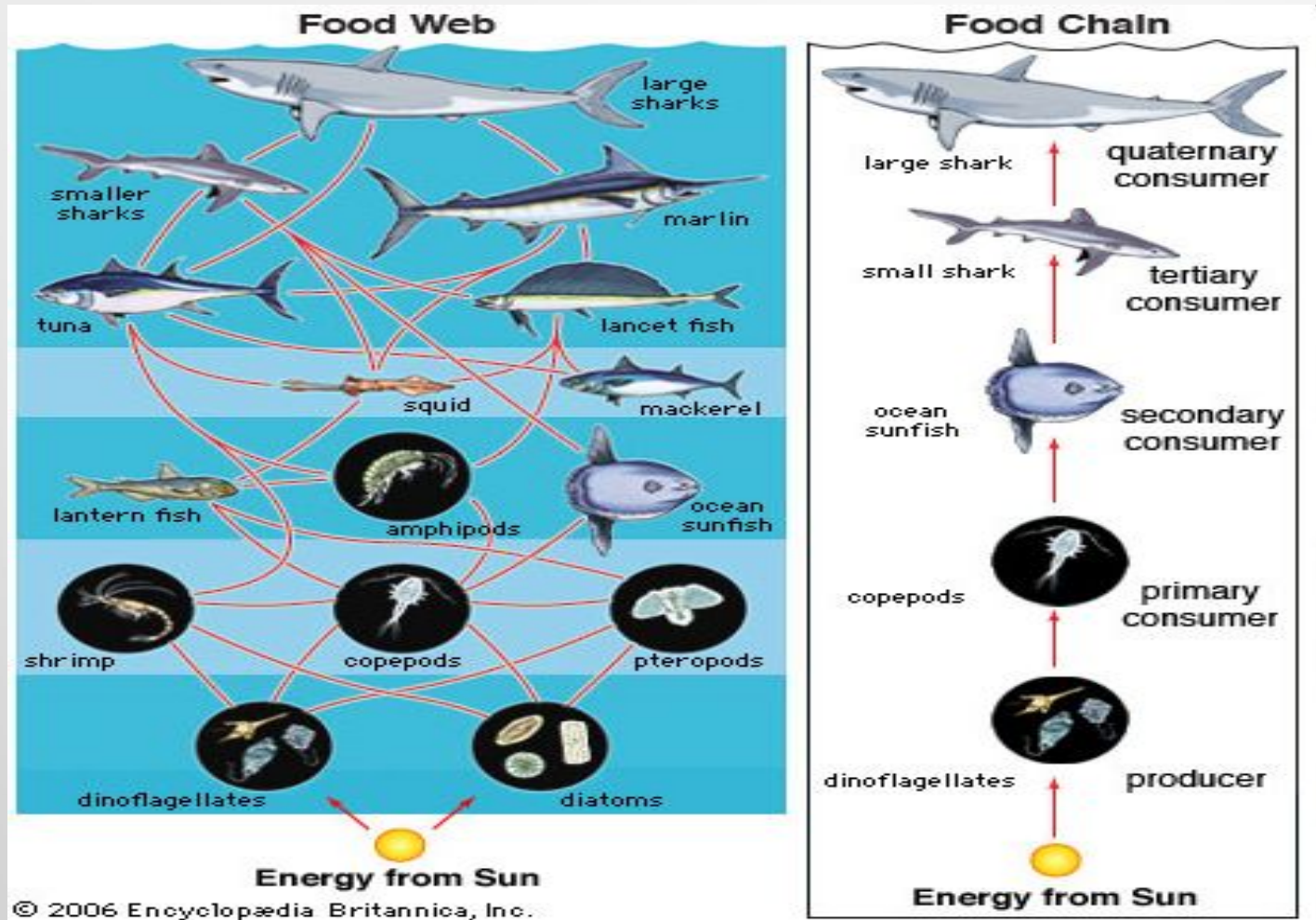
- **Food web:** Real ecosystems are more complex. Most consumers feed on more than one type of organism and most organisms are eaten by more than one type of consumer.

The realistic and complex network of many interconnected food chains in the ecosystem is called a food web.

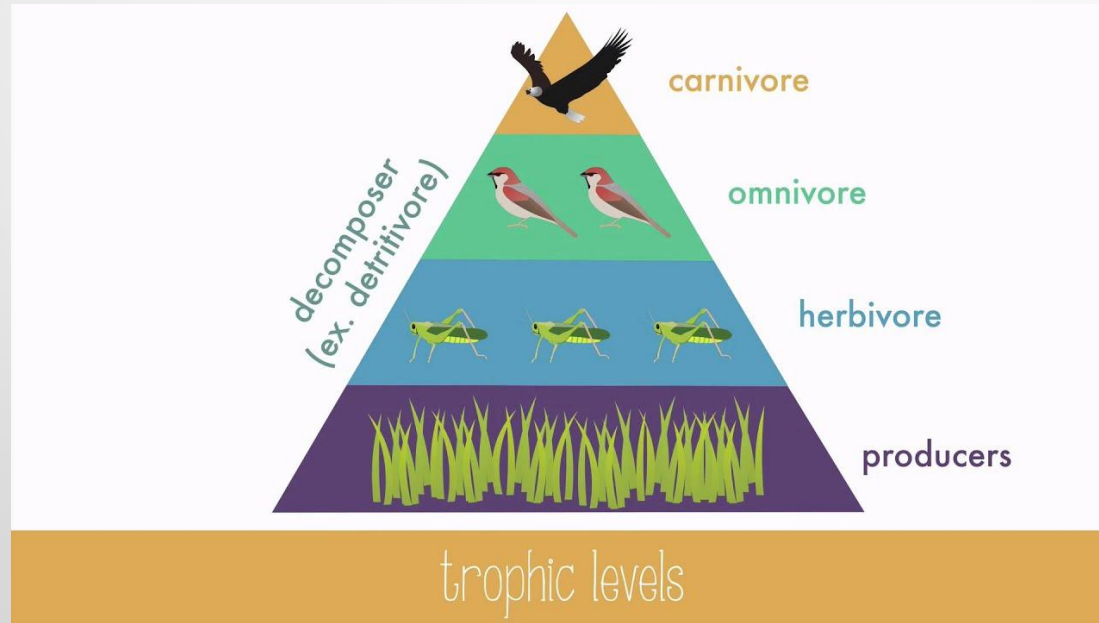


Terrestrial food web

Marine food web and food chain



- **Trophic level:** Also known as feeding level. Each organism in the ecosystem is assigned to a trophic level depending on whether it is a producer or a consumer. The trophic level of an organism is the position it occupies in a food chain.



Energy Pyramid

- Each trophic level in a food chain or web contains a certain amount of **biomass**. Biomass is the dry weight of all organic matter contained in its organisms. The chemical energy stored in biomass is transferred from one trophic level to another.
- There is a decrease in the amount of energy available from one trophic level to another in a food chain or web.
- The percentage of usable energy transferred as biomass from one trophic level to the next is called **ecological efficiency**. It ranges from 2-40% (that is a loss of 60-98%) depending on the types of species and ecosystem involved, but 10% is typical.
- Why energy is lost at each higher level of food chain-
 - Some of the food that organisms eat is undigested and does not provide usable energy.
 - Much of the energy that is absorbed is used in the daily processes of living or lost as heat when it is transformed from one form to another and thus isn't stored as biomass that can be eaten.

Pyramid of energy flow

