

Federal State-funded Institution of Higher Education
«Volgograd State Medical University»
Ministry for Public Health of the Russian Federation

Department of Hygiene and Ecology

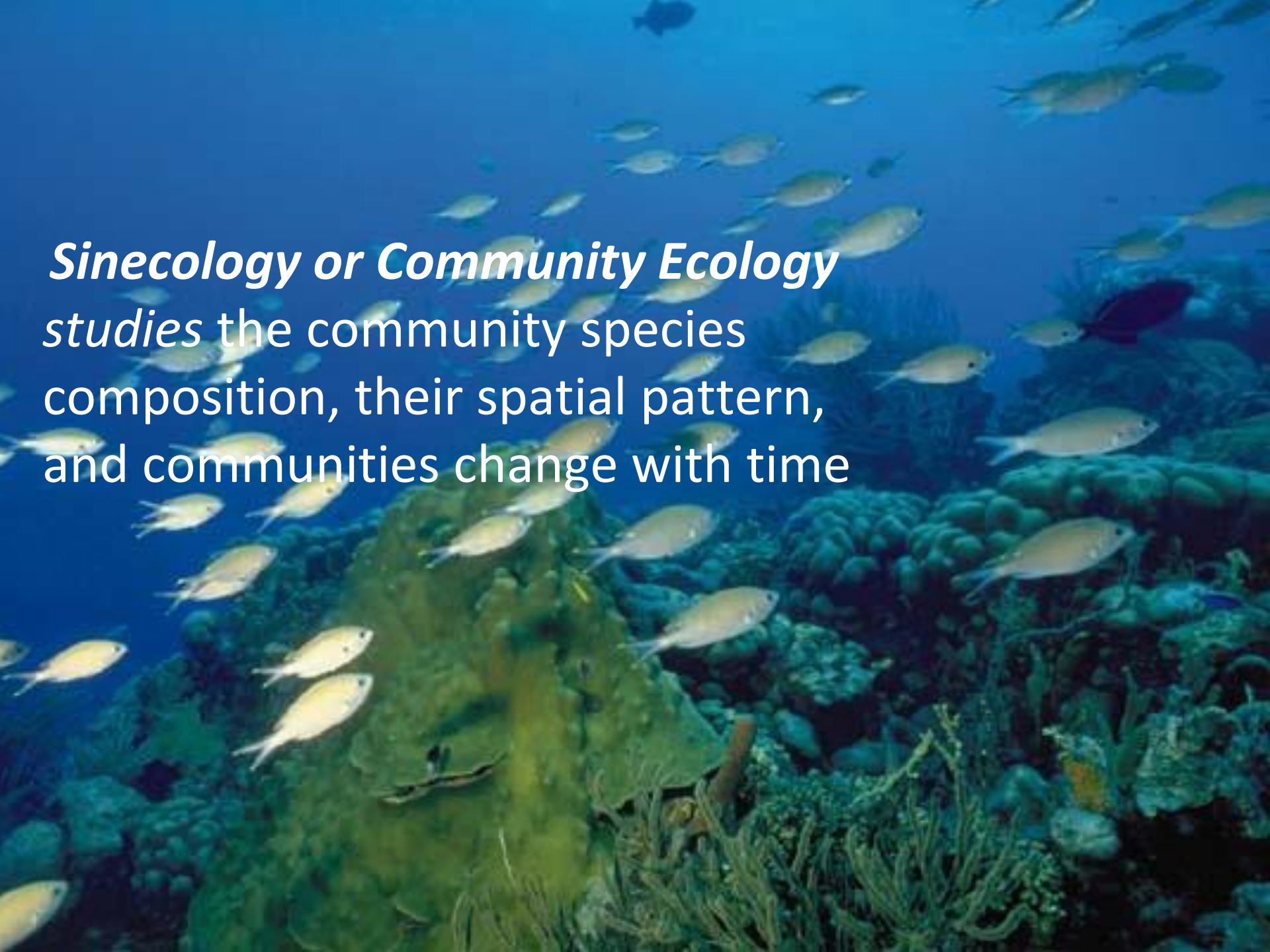
Lecture:

Biotic communities: concept. Species structure of biocenosis. Spatial structure of biocenosis. ecological niche. Interaction of organisms in the biocenosis

Volgograd, 2023

PLAN

- Biocenosis, biogeocoenosis and Concept of Ecosystem
- The State of the Species Under Various Forms of Relationship
- Trophic Structure of Biocenosis
- Food chain and trophic levels

An underwater photograph showing a large school of small, yellowish fish swimming in a clear blue ocean. Below them is a diverse coral reef with various types of coral and green algae. The text is overlaid on the left side of the image.

Sinecology or Community Ecology
studies the community species
composition, their spatial pattern,
and communities change with time

- **Biocenosis** is the *community* of populations of different species living and interacting in a given habitat (K. Mobius, 1877)

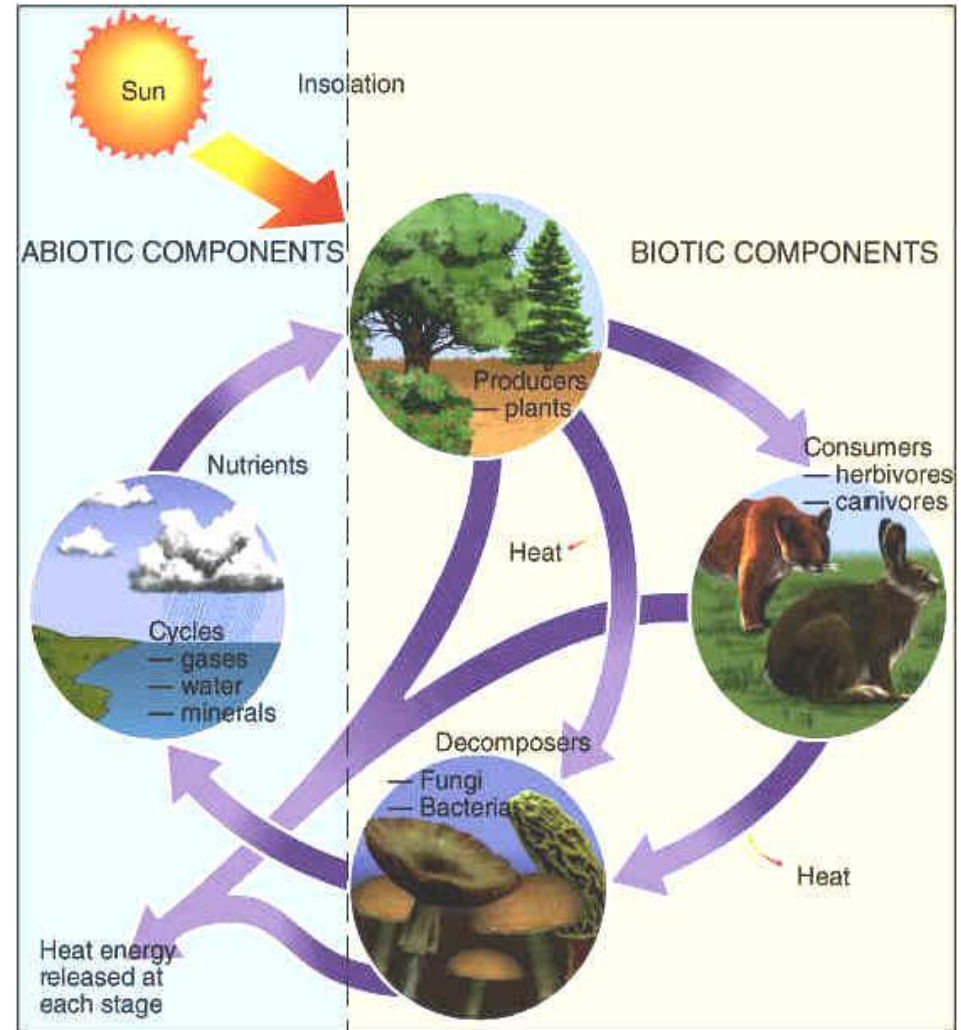
Ecosystem (ecological system) is the community of all populations of different species living on the common territory and interacting with their environment (A. Tensli, 1935)

Components of Ecosystem

ABIOTIC COMPONENTS	BIOTIC COMPONENTS
Sunlight	Primary producers
Temperature	Herbivores
Precipitation	Carnivores
Water or moisture	Omnivores
Soil or water chemistry (e.g., P, NH ₄ ⁺)	Detritivores
etc.	etc.

An ecosystem comprises of two basic components

- 1) Abiotic components and
- 2) Biotic components



- The state of the species (population) under various forms of relationship is indicated by conventional signs
- " – "an adverse effect, the body suffers harm,
- "+" - positive effect,
- "0" - no effect.



- All biotic links can be divided **into six groups**:

- 1) "++"- mutually beneficial, symbiotic relationships. In this group the following is isolated:
 - a) protooperation when cooperation is beneficial, but not necessarily (pollination of various meadow plants by bees);
 - b) symbiosis or inseparable links (lichens - fungi + algae, termites, and flagellate intestinal, which produce an saccharolytic enzyme);
 - c) mutualism when a partnership is mandatory (cembretum, feeding by cedar seeds and spreading them).

- 2)“+0”- useful and neutral, or commensalism (shark and sucker fish).The followings should be distinguished in his group:
- a) sponger when the host food remnants are used (lion and hyena),
- b) commensal,
- c) tenant (orchids, lichens, mosses live in trees)

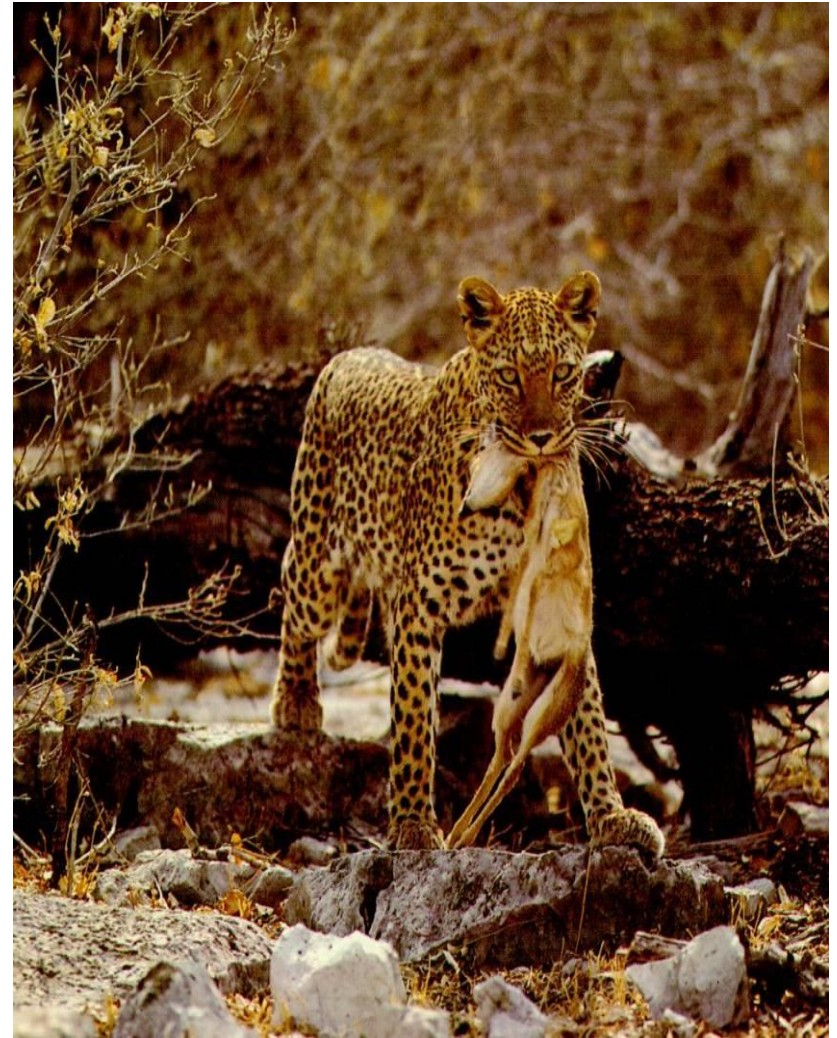


- 3) "-0" - negative-neutral, or amensalism
(grass under the trees are suffering from
severe shading).
- 4) "00 - neutral, or neutrality.



5) "+-"- useful and harmful;
in this group the following
may be distinguished:

- a) carnivorism,
- b) parasitism.



6)"--"- mutually harmful, when species that have identical ecological requirements enter into competition



Trophic Structure of Biocenosis

All living things can be classified according to the way they obtain food. These are the **trophic levels**



Trophic structure of biocenosis

- *Two major components: autotrophic and heterotrophic may be identified In biocoenosis or ecosystem.*
- **The autotrophic component** ("self feeding") consists of green plants, which, by using solar energy synthesize organic matter of their cells (biomass) from the mineral components of environmental and is a major supplier of organic matter and related to its energy in biocenoses and ecosystems. In ecology, these organisms are **called producers**, while organic material they created is called **primary production**.

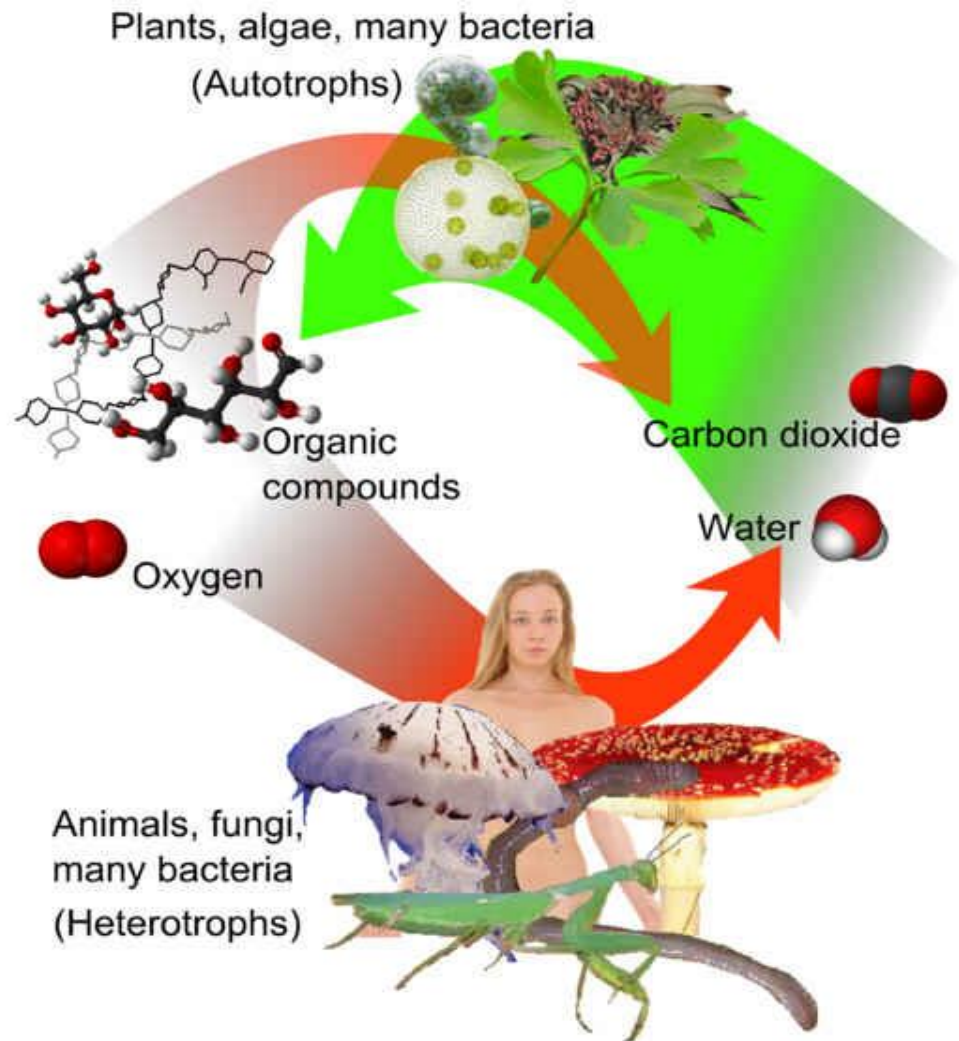
Make their own food organic matter by using carbon dioxide , water and mineral salts.

We call them autotrophic organism.

plants

algae

some
bacteria



Heterotrophic component

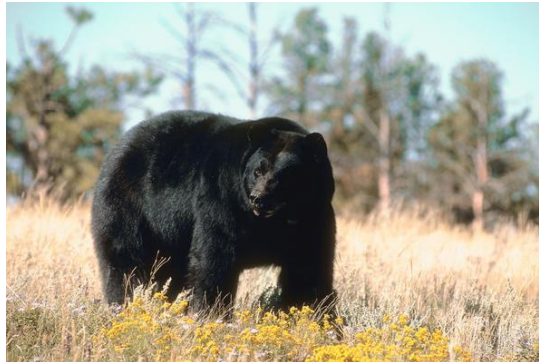
- **Heterotrophic component** ("eating others") consists of organisms that derive their energy from food resulted from destructed organic matter, originally created by producers. Heterotrophic organisms are divided into two major groups: **consumers** and **decomposers**.
- **Consumers** are organisms that consume the finished organic matter (all animals, parasitic and humans).

Consumers consume food provided by plants or other animals. They have heterotrophic nutrition.

Herbivores(primary)
They eat producers



Secondary consumers
-carnivores



Tertiary
They eat secondary and primary consumers also producers



- **Decomposers** are heterotrophic organisms (fungi and bacteria) that subsist on dead organic matter and during their vital activities decompose it to inorganic. Thanks to them, the most important nutrients contained in dead organisms go back into the biological cycle and are repeatedly used in the metabolism of living organisms.

They decomposed organic matter like dead animal and plants into inorganic matter. And then inorganic matters are used again by producers.

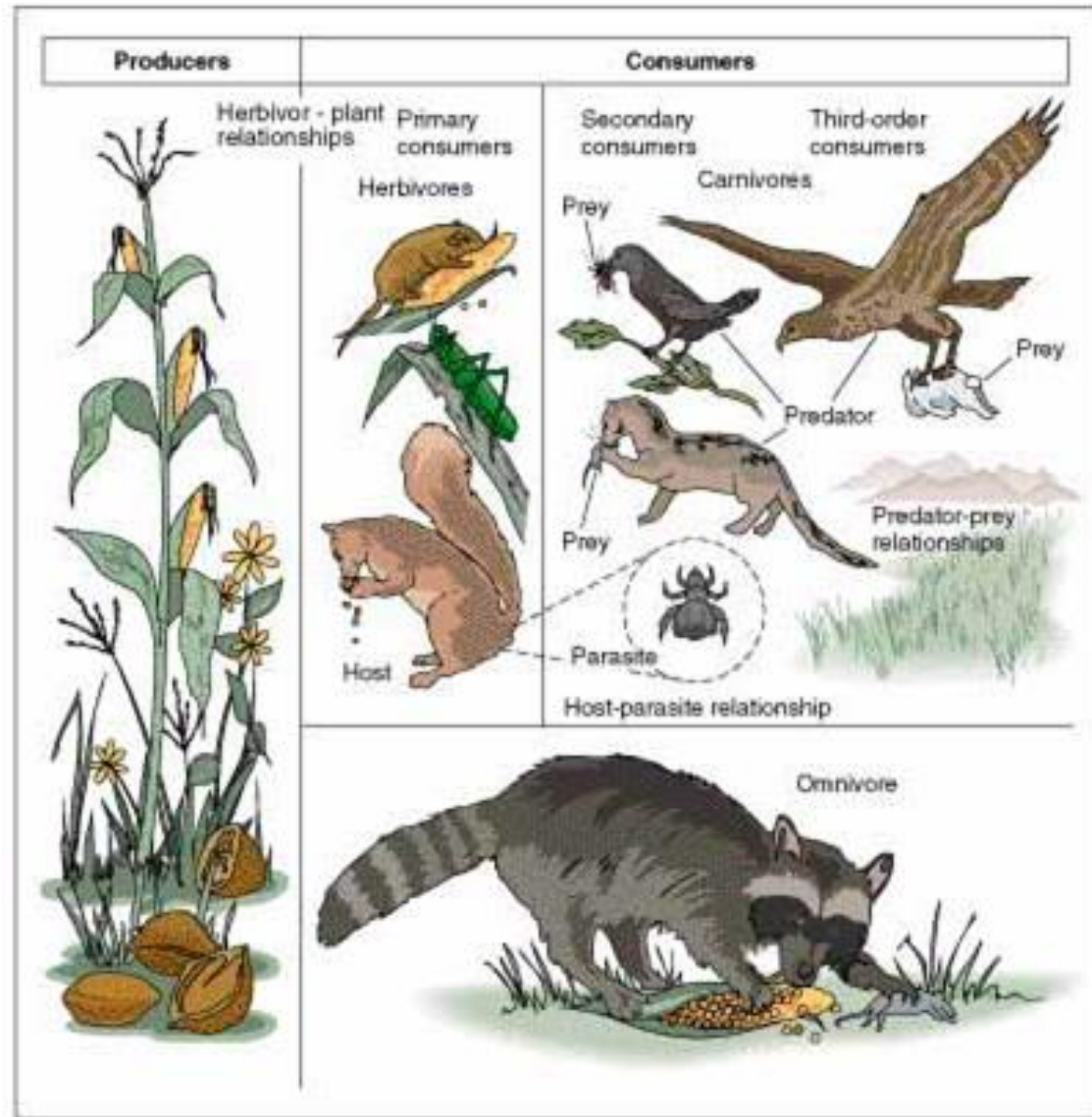
-Fungi



-Bacteria

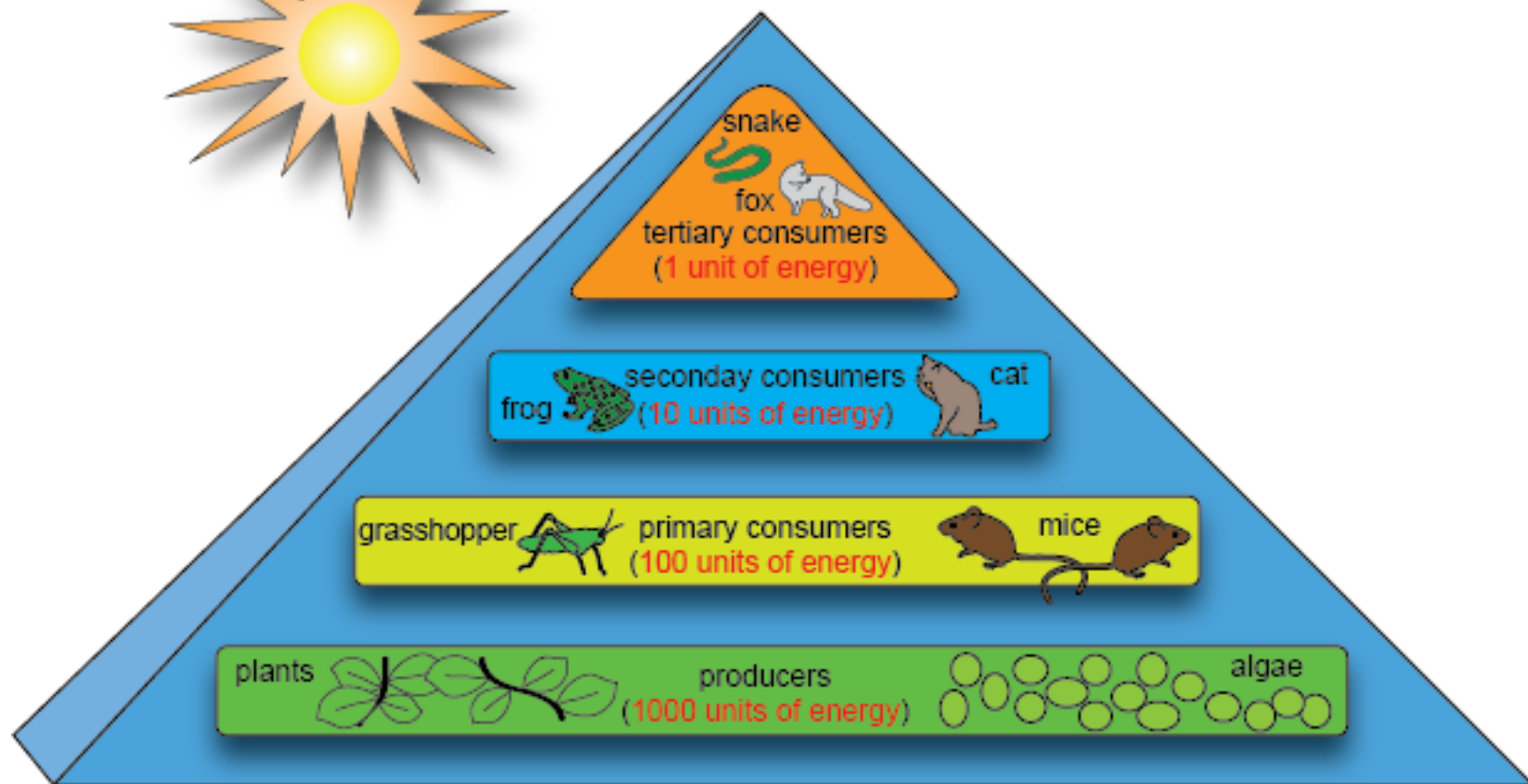


- Joint effect of these three groups of organisms maintains a relatively endless circle of matter in ecosystems and biogeocenoses.



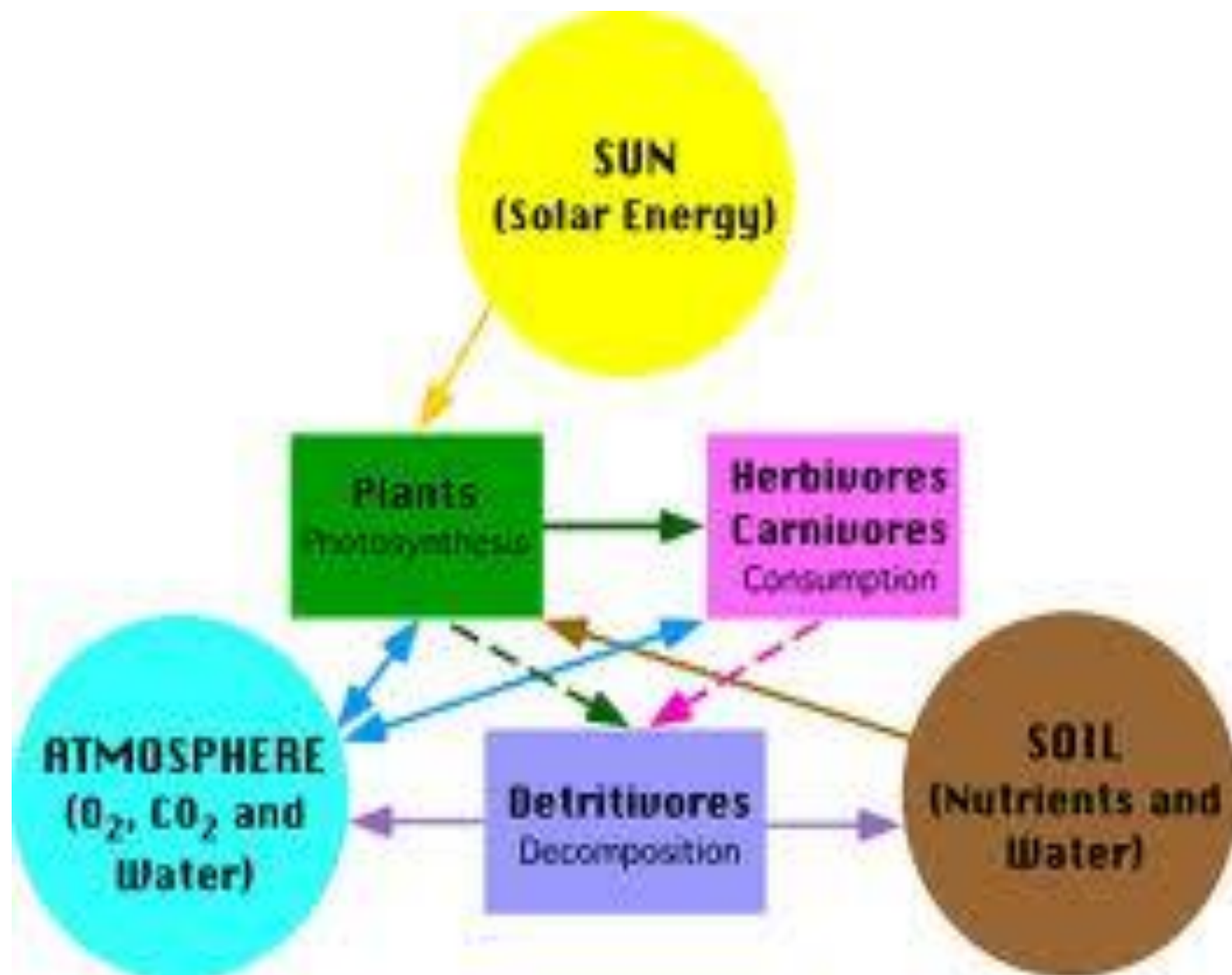
Food chains and trophic levels

- Matter and energy have been transferring through a series of organisms, and each previous organism supplies the subsequent one with raw material and energy in the form of food. Such chain of organisms is called a food chain, and each of its link - **a trophic level**



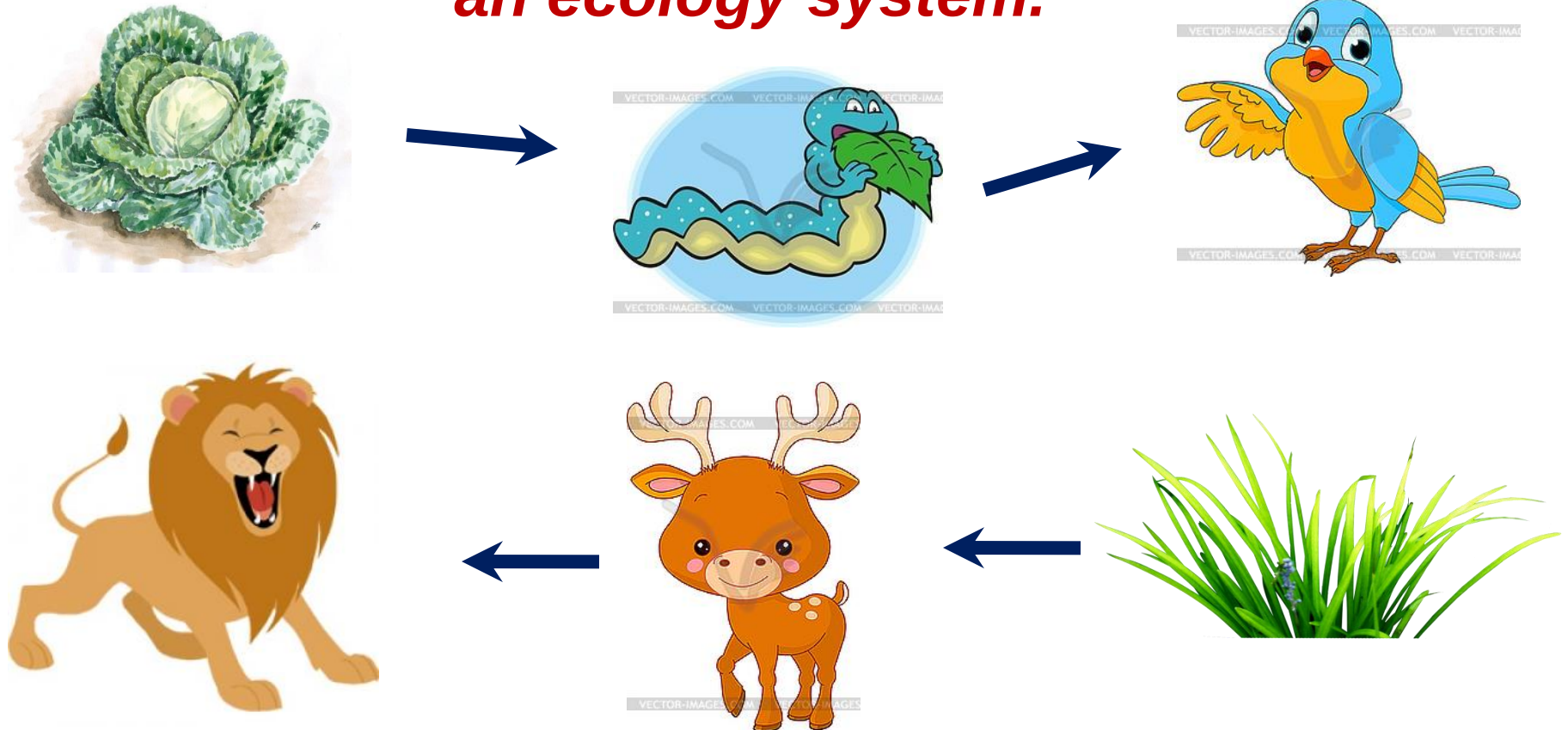
Energy flow and circulation of chemical elements in the ecosystem

- Any ecosystem consists *of biotic* and *abiotic* components, which closely interact with each other, exchanging matter and energy: living organisms consume matter and energy from the environment and give them back into the environment during the life-sustaining activity.



Food chains

A food chain shows which plants or animals eat or get eaten by others in an ecology system.



- All living organisms appear to be consumers of food, that is of matter and energy. In the process of respiration of energy from its rich substances obtained from food releases. In process of breathing energy appears to release from energy-rich matter received from food.

- Energy can be defined as an ability to do work. All living organisms can be considered as working "machines" that require a constant flow of energy from outside.

- Living organisms can only use two forms of energy: **photoenergy** and **chemical energy**. All organisms are divided into **phototrophic** and **chemotrophic** depending on the energy source.

- Organisms synthesizing all necessary organic matter by means of light energy (photosynthesis) belong to a **phototrophic** group, it includes all plants and cyanobacteria.

- **Chemotrophic** organisms synthesize organic matter through the energy of chemical bonds of various substances. This includes all animals and bacteria.

Succession

- Any ecosystem undergoes changes both in time and space, in addition, changes are seen in the biocenosis structure, ecosystem structure and its productivity. Continuity of biocenoses occurring on the same territory as a result of impact of natural factors or human activities, is called succession (Latin word: successio means succeed).

Conclusion

- Knowledge of the laws of ecosystem productivity has great practical importance, because the production of natural and artificial communities is the main source of food supply for humanity. Exact calculations of the energy flow and the extent of ecosystem productivity allow people to adjust them in the cycling of substances to achieve maximum production for human