TOPIC # 7

BIOCENOSIS AS A MULTI-SPECIES BIOLOGICAL SYSTEM

The motivational statement of the theme

The biocenosis includes interconnected living organisms living in a given area, i.e. it is an important structural component of the natural community. Each organism lives surrounded by many other organisms, entering into a variety of relationships with them with both negative and positive consequences for itself, and ultimately cannot exist without this living environment. The biocenosis includes interconnected living organisms living in a given area, i.e. it is an important structural component of the natural community.

For the first time the term "Biocenosis" was introduced by the German biologist Mobius and is currently one of the main concepts in the structure of ecological knowledge.

The objective: to form knowledge about the biocenosis as the most important component of the general ecology, to get acquainted with the main parameters and characteristics of the biocenosis, species, spatial, etc

Questions for oral questioning:

1. The concept of biocenosis/ Structures of biocenosis (species, spatial, ecological).
2. The biogeochemical cycle of substances (N_2, H_2O, C, S)
3. Relations of organisms in biocenoses (predator-prey, parasite-host relations, commensalism, neutralism, amensalism, competition).
4. Connections in biocenoses (trophic, topical, phoric, fabric).
5. Ecological niche. Cenotic strategies of species.

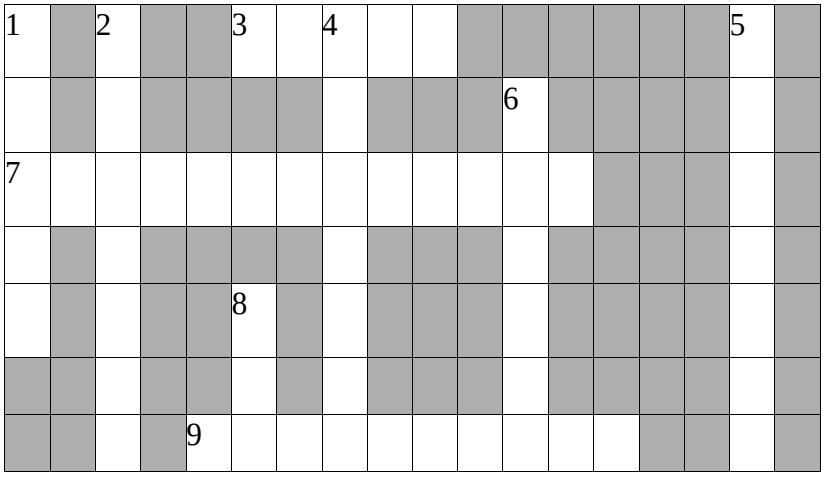
Students' classroom activities:

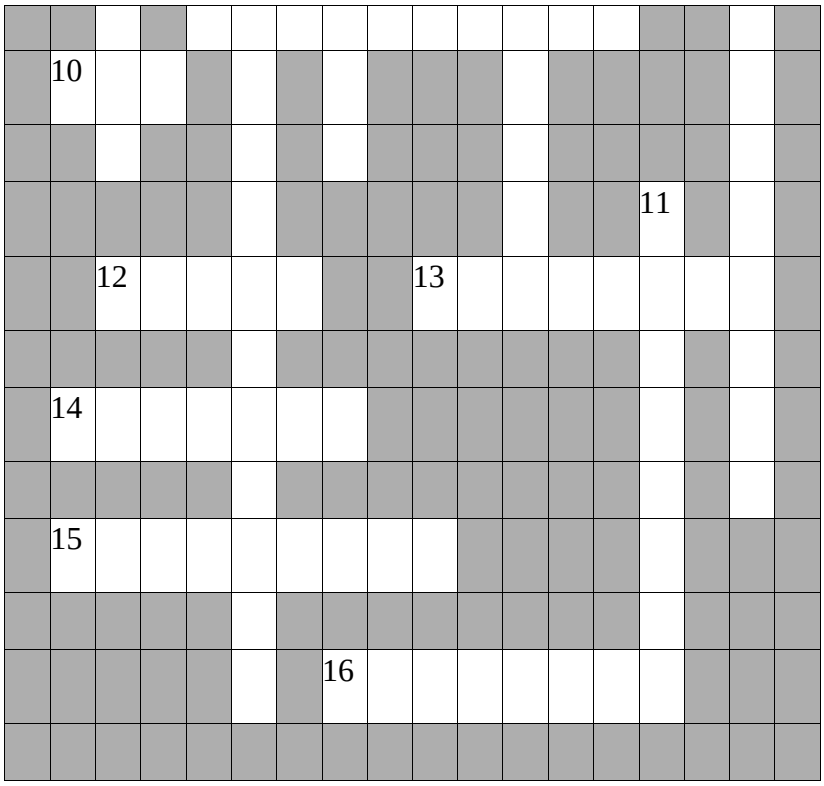
1. Solving situational problems.
2. Discussion report prepared by the students on an individual task of a teacher.

Plan of students' independent activities

" _____ " _____ 20___.

Task 1. Food Chains, Food Webs, Biomass Pyramids and Cycle Crossword Puzzle





Across

3. Reuse of water is known as the water____.[5]
7. Loss of water through leaves of plants.[13]
9. Scientific name for bacteria and fungi that break down dead matter and wastes.[10]
9. A network of food chains is a food_.[3]
12. Series of organisms showing feeding relationships is a food_____.[5]
13. Animal that eats both animal and plant matter.[8]
14. Total dry weight of organisms in each level of a food chain or biomass pyramid.[7]
15. Plant-eater.[9]
16. Plant that begins a food chain.[8]
11. Organism that obtains nutrients by eatinganother organism.[8]

Down

1. Important chemical that cycles or is reused.[5]
2. Animal that eats other animals that are already dead e.g. crab.[9]
4. Meat-eater.[9]
5. Plant process changing carbon dioxide and water into sugar and oxygen.[14]
6. Burning.[10]
8. Rain, snow and hail.[13]

Reference information

Term descriptions

Biocenoses arose on the basis of the biogenic cycle and provide it in specific natural conditions.

Biocenosis is a dynamic, self-regulating system, the components of which (producers, consumers, reducers) are interconnected.

This word is formed by the fusion of two Latin words: "bios" - life and "cenosis" - common. This term denotes the totality of microorganisms, fungi, plants and animals that live in one territory, interconnected and interacting among themselves.

Therefore, it can be said that biocenosis are the plants, animals and microorganisms that inhabit a territory known as a biotope. The components of the biocenosis are as follows:

- **Phytocenosis:** refers to all the vegetables that live in common.
- **Zoocenosis:** refers to the animals that live in the biotope.
- **microbiocenosis**: are microorganisms such as bacteria and viruses that live in the ecosystem.

Biocenosis has a structure that is derived according to the number of individuals that form it. Let's see what are the different structures that it can form:

- **Individuals:** refers to each of the living organisms that live in the biotope, be they plant, animal or microorganism.
- **Species**: it is a set of individuals who have both external and internal characteristics similar. These living things can reproduce with each other and will lead to fertile offspring.
- **Populations:** they are all individuals of the same species living at the same time in the same place. These living beings have to share natural resources and territory.
- **Community:** It is made up of all living beings of various species that inhabit the same place. These living things must also compete for natural resources.

All the various structural aspects of biocenosesare closely interrelated. As a rule, the more complex the spatial structure is organized, the richer and more diverse is its species representation. Over time, the structure of the biocenosis changes in insignificant limits. Such a state of relative stability that arises during the interaction of constituent elements is called homeostasis.

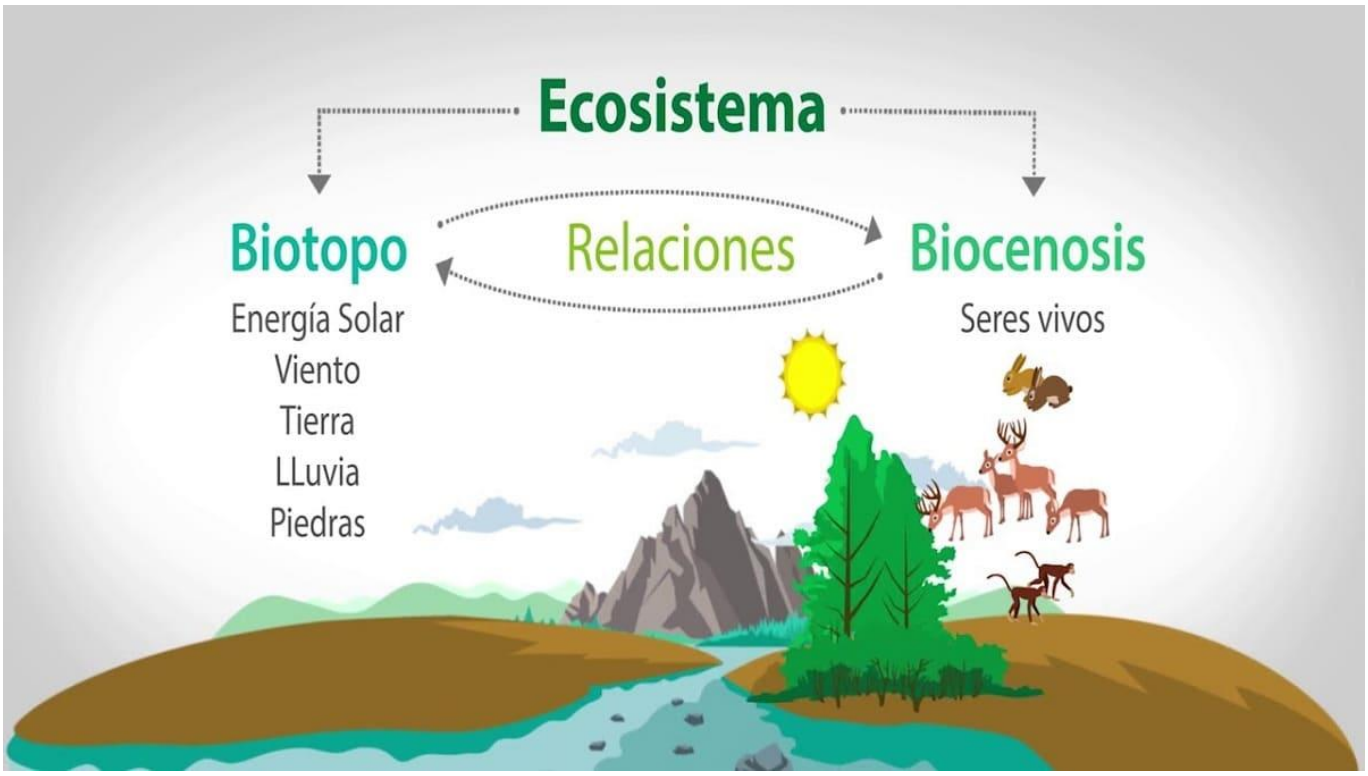
Spatial structure

Biocoenosis has its own structure in space, which can be both vertical and horizontal.

The vertical structure is formed as a result ofdistribution of different species of plants and animals at different altitude levels of the biosystem, which leads to the formation of longline. Such a system is largely determined by the stratification of the plant community, namely the horizons of the location of the most productive parts of plants, such as the root system and photosynthetic foliage. For phytocenosis is characteristic of both above-ground and underground stratum. The first is manifested in the possibility of joint growth of a variety of plant species that have a different need for sunlight. This is most pronounced in the forests of the temperate climatic belt, where there are tree and shrubby upper layers, slightly below the semi-shrubs and grasses, and directly above the surface of the earth is the above-ground layer, usually consisting of mosses or lichens.

Underground stratum in biological systemsallows the phytocenosis to make full use of soil moisture, due to the different depth of the root system of plants. Steppe regions are characterized by a three-level arrangement: the most deeply embedded core systems, then the roots of various cereal crops, and quite close to the surface - tubers, bulbs and root systems of annual plants.

Factors limiting the distribution of biocoenosis



Biocenosis is impaired by various barriers that interrupt the area of distribution. In a biological community, external living organisms do not interfere, and the external physical and chemical environment and its modifications are decisive. For example, **the amount of light that exists in the ecosystem and its intensity is a limitation of biocenosis**. Variations in temperature, humidity, wind regime, cloud cover and many more variables are limiting the area of distribution of the biocenosis.

We are going to analyze what are the factors that limit the biocenosis in its distribution:

- **Physical barriers**: we can point to the physical barrier as the earth itself. In the case of aquatic animals or vice versa, both land and water become a physical barrier. Aquatic animals can only live in an aquatic ecosystem and terrestrial animals in the terrestrial ecosystem.
- **Climatic barriers:** On those where climatic variables affect to a large extent. The most important variable is temperature. For example, there are animals that require a certain degree of temperature to live and cannot spread in all areas.
- **Biological barriers:** when there are enemies or predators, different diseases and lack of food are considered as biological barriers. This is because certain species can no longer change their range due to these barriers.

The transition zones that exist between the barriers that we have named are called ecotones. It can be a very narrow line under a large region and this transition line usually houses organisms that are mixed with both communities. Ecotones **they are normally good landscapes that are home to a lot of biodiversity.** The most representative examples of when barriers limit living things are the main biomes.

The main biomes are as follows: tundra, savanna, fall, forest, grassland, wasteland, desert, mangrove, and forest. These biomes cover the earth's surface and are characterized by a dominant **association** that characterizes the entire landscape as a whole.

All terrestrial biomes with all the organisms that inhabit them and the environment that live within nature is what makes up the biosphere. From this point of view, we can consider that the entire biosphere as a whole is a great biocenosis.

Fluctuations and changes

The biocenosis is not always stable and there are also some changes and characteristics that vary. The main changes usually include changes in the number of individuals or fluctuations of a species over time. Here you have to analyze the context of the space. For example, we analyze the variation in the number of individuals or the fluctuation of the species during a certain time in a specific habitat. Fluctuations in most cases are usually present in a regular cyclical manner today depending on some factors.

Let's analyze what are the main factors:

- **Environmental changes:** it may be that the presence of a season of drought or floods may vary the number of individuals over time. In many cases the populations can react by increasing by decreasing the number of individuals.
- **Migrations:** It is a totally extended biological process and it represents the movements of individuals due to a modification of the habitat.
- **Disproportion between company and predator**: if there are external impacts that reduce prey and predator populations, the rest of the animal populations will also be affected.

We must know that the existing link between living beings is very important and is what determines the development between the dominant species.

The most important quantitative indicators of biocenoses are biodiversity (the total number of species in it) and biomass (the total mass of all types of living organisms in a given biocenosis).

Types of biocenosis structures:

- species,
- spatial (vertical (tiered)
- and horizontal (mosaic) organization of the biocenosis) and trophic.

Biocenosis is the ratio of species that occupy certain ecological niches.

Types of biocenoses:

- Natural (river, lake, meadow, etc.)
- Artificial (pond, garden, etc.)

Natural biocenoses

Natural biocenoses are Unification of living beings, created by nature itself. Such communities are natural systems that develop, develop and function according to their own specific laws. German ecologist V. Tischler highlighted **the following features** that characterize such entities:

1. There are communities of ready-made elements, which can act as representatives of individual species, and whole complexes.

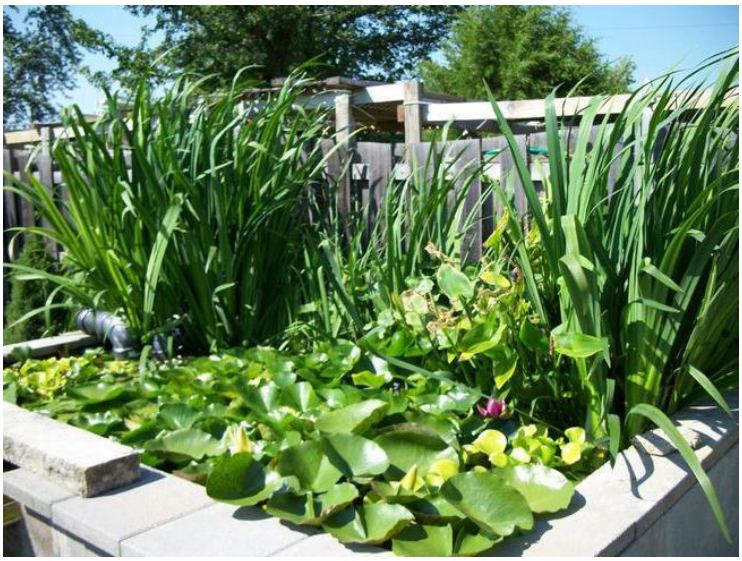
2. Individual parts of the community can be replaceable. Thus, one species can be superseded and completely replaced by another, having similar requirements to the conditions of existence, without negative consequences for the entire system.

3. Due to the fact that in the biocenosis the interests of different species are opposite, the entire superorganism system is based and exists due to the balancing of oppositely directed forces.

4. Each natural community is built on the quantitative regulation of one species by others.

5. The dimensions of any superorganismic systems depend on external factors.

Artificial biological systems



Biocoenosis artificial are created, supportedand are governed by man. Professor BG Johannzen introduced the concept of anthropocenosis into the ecology, that is, artificially created by people of the natural system, for example, a square, a terrarium or an aquarium. Among the artificial biocenoses are allocated agrobiocenoses (agrocenoses) - communities created by man for obtaining any products.

These include:

- reservoirs;
- channels;
- ponds;
- drained swamps;
- pastures;
- fields for growing various crops;
- forest shelter belts;
- artificially renewed plantations.
- agrophytocenosis as the basis of vital activity;
- lack of system self-regulation;
- low species diversity;
- domination of domestic animals or cultivated plants;
- obtaining additional support from a person (control of weeds and pests, fertilization, etc.);
- the impossibility of a long existence without human participation.

However, it should be noted that even the poorest in Species diversity of agrocenosis includes dozens of species of organisms belonging to different ecological and systematic groups. Any field, sown by man fodder or crops, is a biocenosis inhabited by different living organisms. Examples - this is the field of rye or wheat, where besides the main crop, weeds also live; and various insects (both pests and their antagonists); and many microorganisms and invertebrates.

Food Chain

A Food Chain is a series of organisms that are dependent on the next as a source of food. Organism feed on each other. These organisms take part at various biotic levels and form food chains. A trophic level is each step or level in the food chain. They show the direction of energy in an environment. The producers or **autotrophs** which produce food by the process of photosynthesis are at the first trophic level. Autotrophs or producers fix up the solar energy & make it available for consumers, which are also known as **Heterotrophs**.

The food chain is the straight chain of organisms that starts with the producer and then the energy is transferred from the producer to the carnivores and ends with the decomposer in the food web. The food chain explains the feeding relationship of organisms.

Those who produce their own food by changing the organic energy into chemical energy are known as autotrophs and in the process known as photosynthesis that organisms have chlorophyll for making food. Thus, they are called Producers or Autotrophs. Some organisms which are dependent on the producers as a source of food are termed, **consumers**. Consumers are also known as **herbivores**. Those who feed on the producers are known as primary consumers and place on the second trophic level and they

occupy the second trophic level. Those who feed on primary consumers are known as small carnivores or secondary consumers and secondary consumers occupy the third trophic level. Large carnivores which feed on secondary consumers or small carnivores are known as tertiary consumers and they form the fourth trophic level.

The food chain has four main components those are:

1. **Sun:** Plants use solar energy for the process of photosynthesis.
2. **Producer:** These are the organisms that produce food themselves through the process of photosynthesis. Producers are also known as **Autotrophs**. Solar energy is converted into chemical energy which transfers from one trophic level to the other as a source of energy. Producer Example-Algae, green plants, cyanobacteria, etc.
3. **Consumer:** These are the organisms that consume the food produced by the producers, also known as **heterotrophs**. Heterotrophs are those organisms that cannot make their own food and depends on other for food. The consumer can be **herbivores**, i.e., that organism that feeds upon green plants, or carnivores i.e., organisms that feed upon another organism. Consumers are the largest part of any food chain.
4. **Decomposers:** Organisms that break down complex organic substances into simple inorganic substances, which then go into the soil and they are an important part of maintaining the nutrients cycle in the environment.

The food we consume acts as fuel to our body and it provides energy and helps in maintaining homeostasis. Due to the interactions among the components of the environment energy flows from one component of the system to another component. Autotrophs absorb energy from sun rays and convert it into chemical energy. It is this energy that supports all the activities. The energy pass in a **unidirectional upward movement** from producer to decomposer. When one form of energy is converted into another form of energy, some amount of energy or a huge amount of energy is lost to the environment and can't be used again.

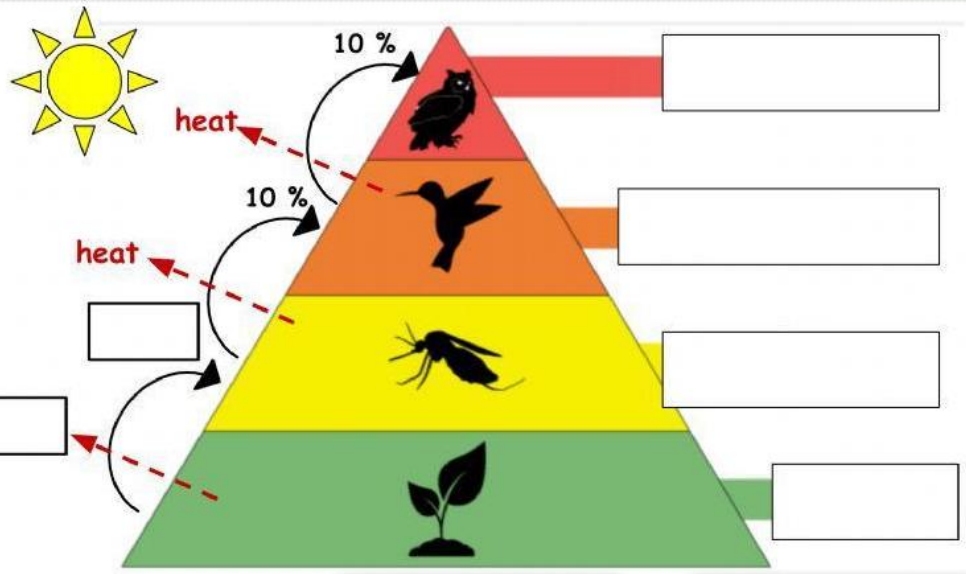
Another aspect of the food chain is that some chemicals enter our body through the food chain and start accumulating in the body this is known as **Biomagnification**. Humans use various chemicals and pesticides to protect crops from pests and other diseases. These chemicals reach soil or water bodies when they are washed off. On the one side, from the soil, these are absorbed by the plants along with water & minerals. On the other side, the water bodies, are taken up or consumed by aquatic plants & animals. In this way, chemicals enter the food chains. These chemicals are not degradable. So they go on accumulating at each trophic level. It's human beings who occupy the topmost level of the food chain. It can also be defined as a process in which the maximum concentration of chemicals gets accumulated in the body of organisms occupying the topmost trophic level. This is the reason wheat, rice, fruits, vegetables, and meat contains varying amount of chemicals.

Law of Leinweber

This is also known as the 10% rule.

- This law states that the energy passed from one trophic level to the next level will only the 10% of the previous tropic level.
- The flow of energy is unidirectional and always in the upward direction.
- There is a max. loss of energy as heat loss so for the next level they have less amount of energy to transfer.

Energy Pyramid



10 %

heat

Tertiary consumers

Primary consumers

Secondary consumers

Producers