ENGLISH FOR ECOLOGISTS

Навчальний посібник для студентів спеціальності «Екологія».

Укладачі: Куліш І.М., Зінченко А.В.

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЧЕРКАСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
ІМЕНІ БОГДАНА ХМЕЛЬНИЦЬКОГО

ENGLISH

FOR ECOLOGISTS

Черкаси - 2025

УДК 811. 111 (075.8)
ББК 81. 2Ан – 91
К 90

Рецензенти:

***С.Р. Бабушко**, доктор педагогічних наук, професор, завідувач кафедри іноземних мов Національного університету фізичного виховання і спорту України, м. Київ*

***І.В. Некоз** – кандидат педагогічних наук, доцент кафедри іноземних мов Черкаського національного університету ім. Б. Хмельницького*

English for Ecologists: Навчальний посібник для студентів спеціальності «Екологія». Укладачі: Куліш І.М., Зінченко А.В. – Черкаси, 2025. – 61 с.

Навчальний посібник сформований у відповідності до програми з іноземної мови за професійним спрямуванням для студентів 1 курсу спеціальності «Екологія».

Навчальний матеріал розташовано за тематичним принципом (за розділами) та має комплексний характер. Два розділи охоплюють автентичний навчальний та ілюстративний матеріал з іноземної мови професійного спрямування, а саме, вступ до екології, сфери вивчення екології, взаємозв'язок в природі, проблеми популяцій, екологічні спільноти, біорізноманітність, тощо.

Робота за темою в межах одного розділу організовується на базі тексту професійного спрямування, лексичних вправ та завдань комунікативного характеру професійного спрямування, текстів для додаткового читання. Посібник вміщує завдання для самостійної роботи студентів та вправи для контролю умінь та навичок студентів, а також термінологічні словники до кожного розділу.

Затверджено до друку на засіданні вченої ради
Черкаського Національного університету
імені Богдана Хмельницького
протокол № 3 від 24.10.2024

ПЕРЕДМОВА

Навчальний посібник призначається для студентів спеціальності «Екологія». Мета посібника – формувати у студентів навички читання та розуміння літератури фахової професійної тематики на основі активізації знань загальновживаної лексики та основ граматики. Поряд з цим у посібнику реалізується мета комплексного оволодіння студентами всіма видами мовленнєвої діяльності на основі комунікативного підходу до вивчення іноземної мови. Посібник базується на різноманітному автентичному матеріалі, який підібрано з урахуванням комунікативного підходу у вивченні англійської мови та спрямовано на розвиток позитивної мотивації до вивчення іноземної мови.

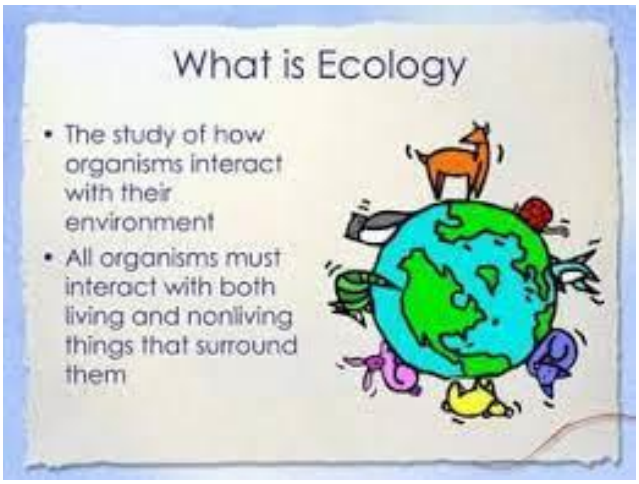
Навчальний матеріал професійного спрямування посібника розподілено на два тематичних розділи “Ecology as a Science” та “Ecological Communities”, текстовий матеріал яких згруповано за такими темами професійного інтересу студентів, як вступ до екології, сфери вивчення екології, взаємозв’язок в природі, проблеми популяцій, екологічні спільноти, біорізноманітність та інші. Кожний розділ, в свою чергу, вміщує декілька текстів професійного спрямування, які з різних сторін висвітлюють тему, та текстів, які несуть додаткову інформацію за певною тематикою. Комунікативні вправи мають різноплановий вплив на навчальний процес та стимулюють пізнавальний інтерес особистості студента.

Навчальний посібник включає термінологічні словники, побудовані на матеріалі кожного розділу, та які мають на меті удосконалення оволодіння іноземною мовою фахового спрямування, а саме, оволодіння термінами та фразами, необхідними в ситуаціях професійного спілкування.

Unit 1
Ecology as a Science

Lesson 1
Introduction to Ecology

(From Omerod S.J. Pienkowski M.W. & Watkinson A.R. 1999. Communicating the value of ecology. Journal of Applied Ecology 36, 847–855)



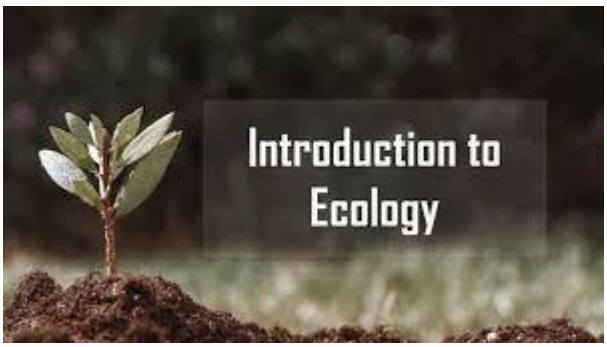
Ecology is the branch or aspect of biology that studies the biota (living things), the environment, and their interactions. It comes from the Greek oikos = house; logos = study.

Ecology is the study of ecosystems. Ecosystems describe the web or network of relations among organisms at different scales of organization. Since ecology refers to any form of biodiversity, ecologists research everything from tiny bacteria in nutrient recycling to the effects of tropical rain forests on the Earth's atmosphere. Scientists who study these interactions are called ecologists.

Terrestrial ecoregion and climate change research are two areas where ecologists now focus.

There are many practical applications of ecology in conservation biology, wetland management, natural resource management (agriculture, forestry, fisheries), city planning (urban ecology), community health, economics, and applied science. It provides a framework for understanding and researching human social interaction.

1. Find the English equivalents in the text:



Галузь біології, біота, навколишнє середовище, взаємодія, описувати, мережа звя’зків, на різних рівнях, стосуватися форми, біорізноманіття, еколог, досліджувати, переробка поживних речовин, вивчати взаємодію, наземні екорегіони, зосереджуватися, практичне застосування, природоохоронна біологія, управління водно-болотними угіддями, управління природними ресурсами, сільське господарство, лісове

господарство, рибальство, міське планування, міська екологія, охорона здоров'я, прикладна наука, забезпечувати основу, соціальна взаємодія людей.

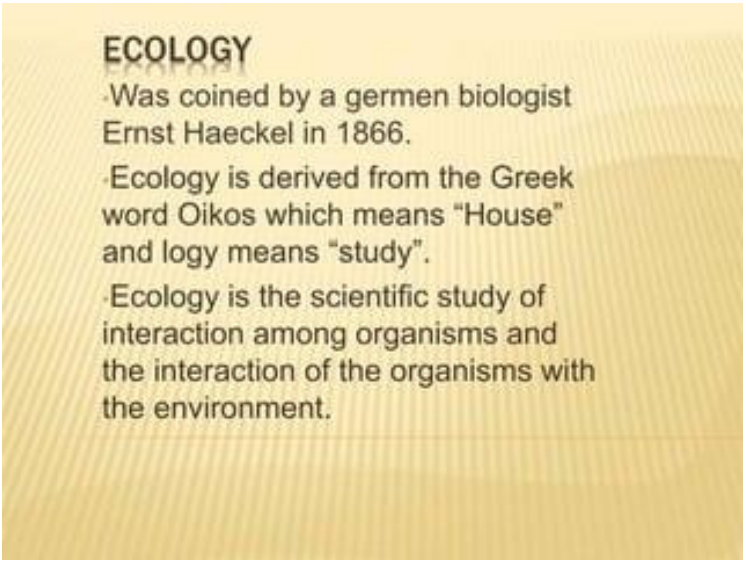
2. Translate the following terms and phrases:

Biota, environment, biodiversity, ecologist, bacteria, nutrient recycling, tropical rain forests, the Earth's atmosphere, terrestrial ecoregion, climate change, conservation biology, wetland management, natural resource management, agriculture, forestry, fisheries, city planning, urban ecology, community health, economics, applied science, human social interaction.

3. Match the terms and their definitions:

1	biology	the study of the environment	
2	ecology	the animal and plant life of a particular region	
3	biota	all the living things (plants, animals and organisms) in a given area, interacting with each other, and with their non-living environments (weather, earth, sun, soil, climate, atmosphere)	
4	biodiversity	the diversity or variety of living forms	
5	ecosystem	a natural science discipline that studies living things	

4. Find the verbs (a) with similar meaning (b):



(a) to study
to come from
to refer to
to focus
to provide

(b) to derive from
to relate to
to ensure
to pay attention
to research

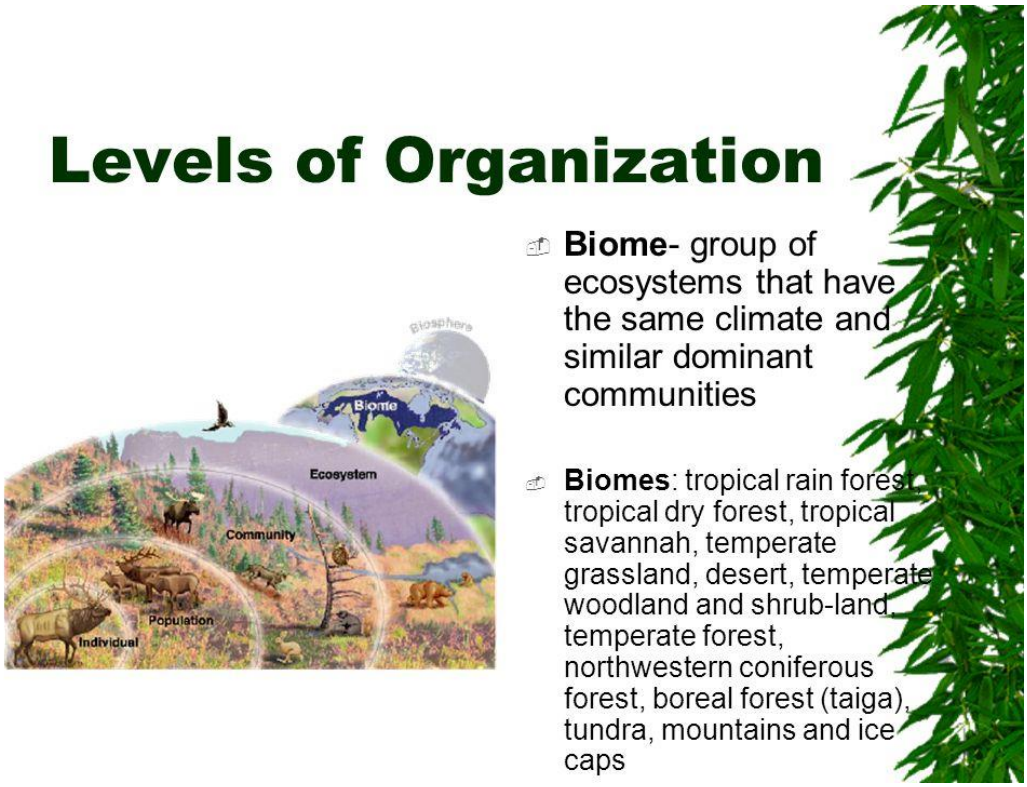
5. Complete the following sentences using the words from exercise 4 in the correct form:

1) What language does this word _____?
2) He _____ to the fact that the reason for this is global warming.
3) His article _____on the ecological problems.
4) The store _____ its customers with excellent service.
5) Next term we will _____ plants and how they grow.

6. Agree or disagree with the statements:

1) Ecology is the branch of geology.
2) Ecology studies the living things and their interactions.
3) Ecosystem involves all the living things (plants, animals and organisms) in a given area, interacting with each other, and with their non-living environments (weather, earth, sun, soil, climate, atmosphere).
4) Ecologists focus on the problems of terrestrial ecoregion and climate change research now.
5) There are many practical applications of ecology.

7. Look at the slide and answer the following questions:



1) What is biome?
2) What are the examples of biomes?

8. Answer the questions for summary:

1) What branch is ecology?
2) What does the word ecology come from?
3) What does ecology study?
4) What do ecosystems describe?
5) What do ecologists study?
6) What are the practical applications of ecology?
7) What is ecosystem?
8) What is biota?
9) What is biodiversity?

Lesson 2
Areas of Study

(From encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/environment)

Ecology is necessarily the union of many areas of study because its definition is all-encompassing. There are many kinds of relationships between organisms and their environment. Environment is the complex of physical, chemical, and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival.

Organisms are single individuals, groups of individuals, all the members of one species, the sum of many species, or the total mass of species (biomass) in an ecosystem. And the term environment includes not only physical and chemical features but also the biological environment, which involves yet more organisms.

In practice, ecology is composed of broadly overlapping approaches and further divided by the groups of species to be studied. There are many, for example, who specialize in the field of “bird behavioral ecology.” The main approaches fall into the following classes:

- evolutionary ecology,
- physiological ecology,
- behavioural ecology,
- population ecology,
- biogeography,
- community ecology,
- conservation biology,
- ecosystem ecology.

1. Find the English equivalents in the text:

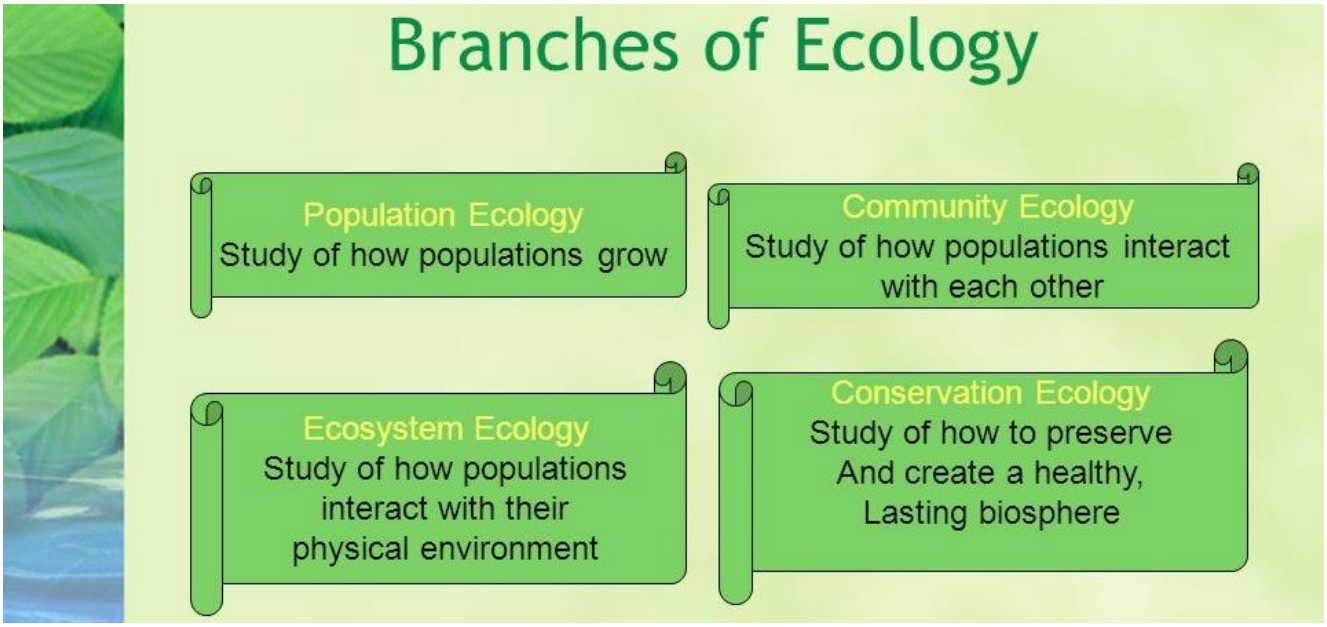
Об’єднання областей (сфер), всеохоплююче визначення, взаємовідносини, діяти на організм, визначати форму, хімічні властивості, біологічне середовище, охоплювати, складатися з, підходи (що перетинаються), розділятися на групи, поділятися на класи, біологія збереження.

2. Translate the following terms and phrases:

Biotic factor, ecological community, species, biological environment, bird behavioral ecology, physiological ecology, population ecology, conservation biology.

3. Look at the slide and answer the questions:

1) ***What is population ecology?***
2) ***What is community ecology?***
3) ***What is ecosystem ecology?***
4) ***What is conservation ecology?***



4. Look at the slide and name the aspects of ecological study.

Aspects of Ecological Study

- **Biosphere**

Portion of earth that supports life

- **Abiotic Factors**

Non-living parts of an organism's environment

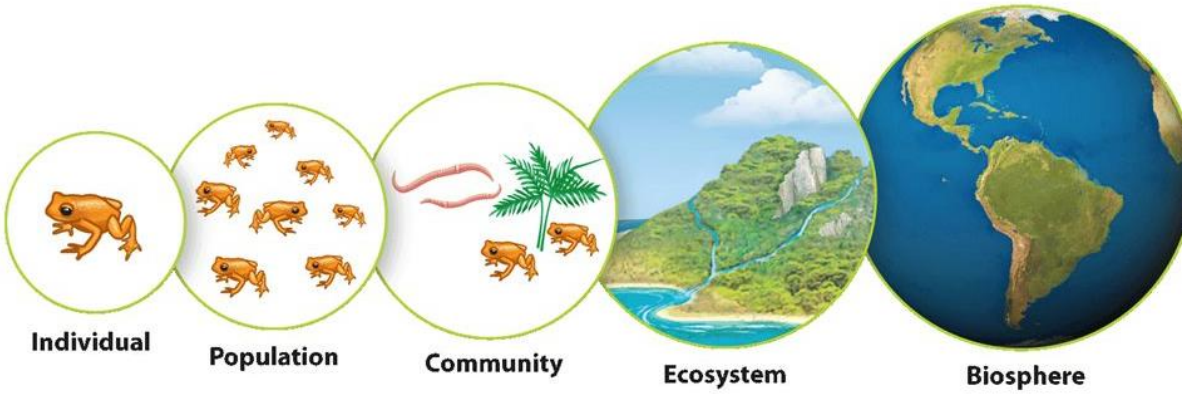
- **Biotic Factors**

All the living organisms that inhabit an environment.

5. **Look at the slide and answer the questions:**
   1) ***What definition of ecology does this slide give?***
   2) ***What levels do scientists study ecology at?***

Levels of Ecological Organization

- The study of how organisms interact with each other and with their environments
- Scientists study ecology at various levels of organization.



6. **Match the notions and their definitions:**

1	physiological ecology	deals with the relations between organisms in a certain habitat	
2	behavioural ecology	the branch of ecology that works to understand the patterns and processes of change over time or space for populations of a single species	
3	population ecology	studies how adaptations arise from selective pressures under different ecological environments, including new selective environments that are generated by animal behaviour	
4	community ecology	the study of how ecological factors cause changes in an organism throughout its history	
5	evolutionary ecology	the study of how physiological processes function with respect to environment, or are generated by interactions with the environment	

7. Complete the sentences using the following words and phrases:

single individuals
diversity of life
biological environment
approaches
biotic factors

1) Environment is the complex of physical, chemical, and _____.
2) Organisms are _____, groups of individuals, all the members of one species, the sum of many species, or the total mass of species (biomass) in an ecosystem.
3) The term environment includes physical and chemical features and the _____.
4) Ecology is composed of broadly overlapping _____.
5) Conservation biology is a science that focuses on how to protect and restore biodiversity, or the _____on Earth.

8. Agree or disagree with the statements:

1) Ecology is the union of many areas of study.
2) The definition of the term ecology is all-encompassing.

Environment determines the form and survival of ecological community.

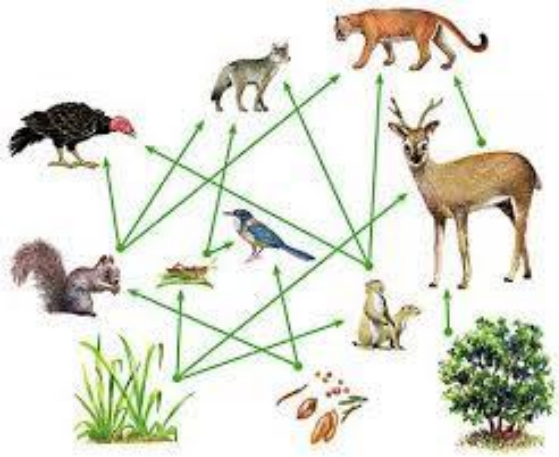
3) An ecological community is defined as a group of species that are commonly found together.
4) Physiological ecology deals with the relations between organisms in a certain habitat.
5) Population ecology is the study of how physiological processes function with respect to environment.

9. Answer the questions for summary:

1) Is ecology the union of many areas of study?
2) What is environment?
3) What does environment act upon?
4) What are organisms?
5) What is ecology composed of in practice?
6) What levels do scientists study ecology at?
7) What is population ecology?
8) What is community ecology?
9) What is ecosystem ecology?
10) What is conservation ecology?

Lesson 3
Interdependence in Nature

(From encyclopedia Britannica. Retrieved from: http://britannica.com/students/article/ecology/274117)



Ecology emphasizes the dependence of every form of life on other living things and on the natural resources in its environment, such as air, soil, and water. The English biologist Charles Darwin noted this interdependence. His observations of the relationship between organisms and their environment formed a key element in his theory of natural selection.

The term environment in ecology refers to both the physical and biological factors affecting organisms. The physical environment consists of abiotic, or nonliving, factors. These include resources such as light, carbon dioxide, oxygen, and soil; physical characteristics such as atmospheric pressure, temperature, and rainfall; and disturbances such as fire or tsunamis.

The biological environment is made up of biotic, or living, factors—anything that is living or was living, as well as things that are immediately related to life. For example, the biotic factors in a forest include all of the organisms living in it—plants, animals, fungi, and microbes—as well as animal droppings, leaf litter, and rotting logs.

1. Find the English equivalents in the text:

Підкреслювати залежність, відзначати взаємозалежність, спостереження, взаємозв'язок, ключовий елемент, стосуватися факторів, складатися з факторів, порушення, бути безпосередньо пов'язаним з життям, послід тварин, листовий опад, гнилі колоди.

2. Translate the following terms and phrases:

Living thing, natural resources, air, soil, water, theory of natural selection, physical factor, biological factor, abiotic factor, light, carbon dioxide, oxygen, soil, atmospheric pressure, temperature, rainfall, fire, tsunami, biotic factor, forest, plant, animal, fungi, microbe, animal droppings, leaf litter, rotting log.

3. Match the notions and their definitions:

1	biotic factor	a plant-like organism that does not make chlorophyll	
2	abiotic factor	the force exerted on a surface by the air above it as gravity pulls it to Earth	
3	atmospheric pressure	nonliving physical and chemical aspects of an environment	
4	fungi	an organism of microscopic size, which may exist in its single-celled form or as a colony of cells	
5	microbe	a living organism that shapes its environment	

4. Complete the sentences with the following words and phrases:

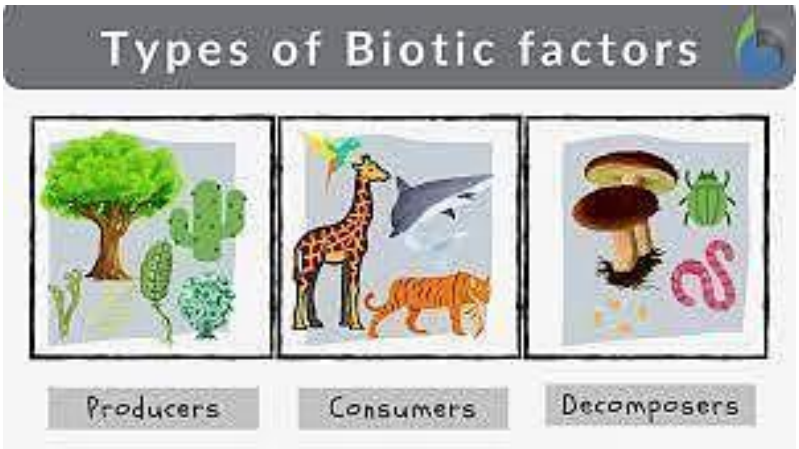
abiotic factors
microbes
atmospheric pressure
biotic factor
fungi

1) The normal _____is 76 cm of Hg.
2) In a freshwater ecosystem, examples of _____might include aquatic plants, fish, amphibians, and algae.
3) Mushrooms and molds are _____.
4) Some _____make us sick, but others are important for our health.
5) _____involving sunlight levels, soil chemistry, and climate —shape healthy ecosystems.

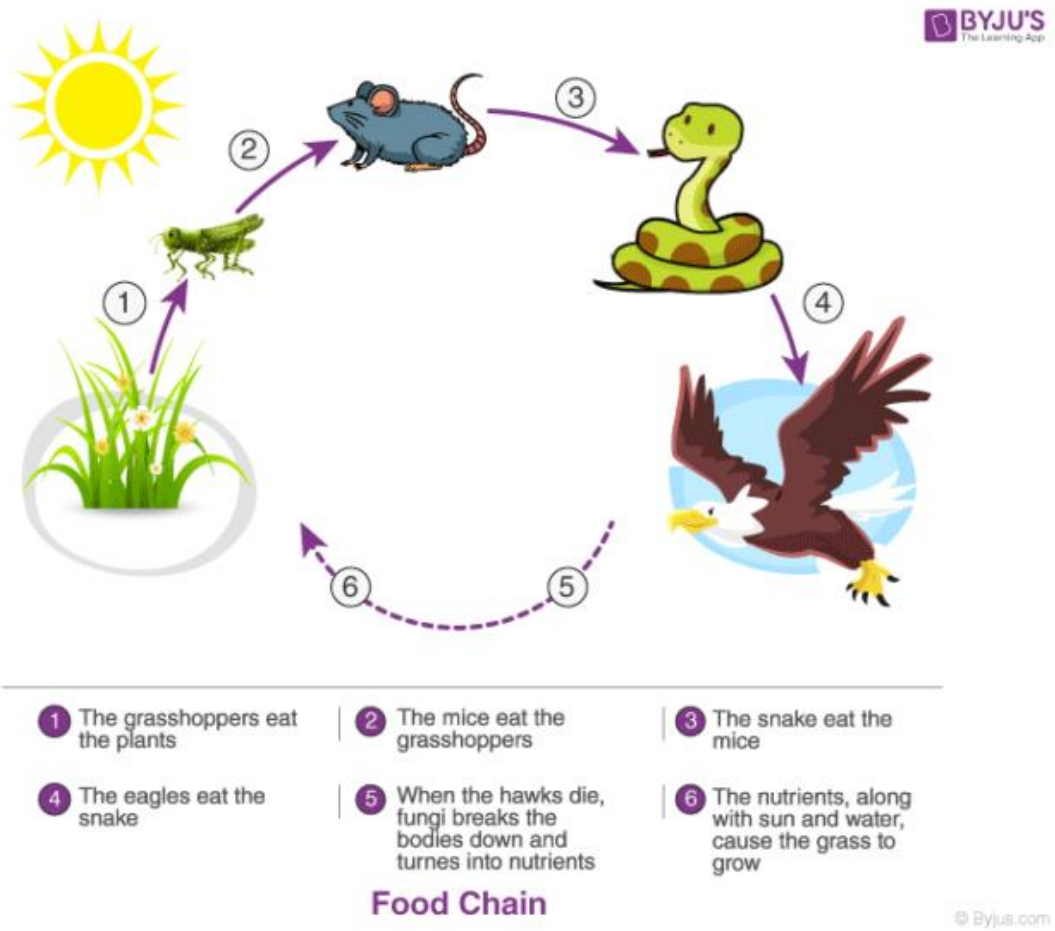
5. Agree or disagree with the statements:

1) Environment formed a key element in the theory of natural selection.
2) The term environment in ecology refers to biological factors affecting organisms.
3) The physical environment consists of biotic, or living, factors.
4) The physical environment includes resources and physical characteristics.
5) The biological environment involves abiotic, or nonliving, factors.
6) The biotic factors in a forest include all of the organisms living in it.

6. Look at the slide and give the examples of biotic factors:



7. Look at the slide and describe the interdependence of plants and animals:

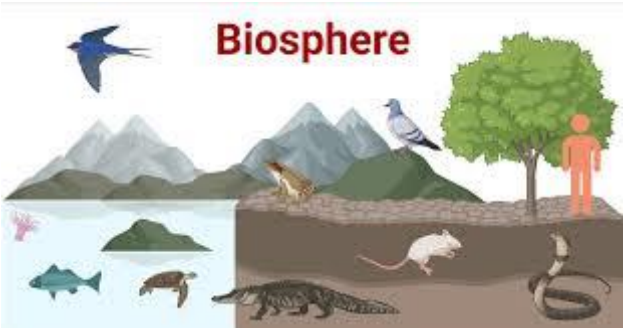


8. Answer the following questions for summary:

1) What dependence does ecology emphasize?
2) Who noted the independence of every form of life on other living things and on the natural resources in its environment?
3) What is a key element in Ch. Darwin's theory of natural selection?
4) What factors does the term environment in ecology refer to?
5) What does physical environment include?
6) What does physical characteristics involve?
7) What is the biological environment made up?
8) What does the biotic factors in a forest include?

9. Read the text, put 3questions to it for group discussion:

Interactions at different scales



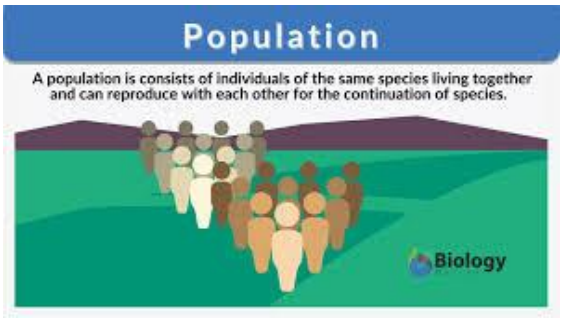
The interactions between living things and their environment occur at different scales. The most basic of these is the interaction between an individual organism and its environment.

The largest scale is the biosphere, which consists of the relatively thin layers of Earth's air, soil, and water that are capable of supporting life together with all organisms that live there. The biosphere extends from roughly 6 miles (10 kilometers) above Earth's surface to the deep-sea vents of the ocean. The biosphere is divided into large regions called biomes (or major life zones) that are distinguished by climate and vegetation patterns.

Most studies in ecology focus on interactions taking place at scales that fall in between the extremes of individuals and the biosphere: populations, communities, and ecosystems.

Lesson 4
Population

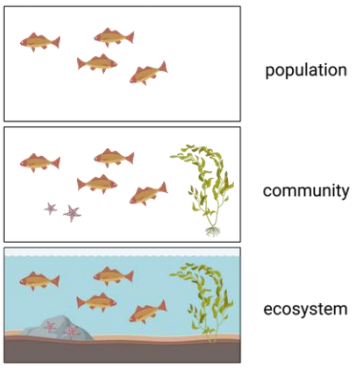
(From Encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/population-ecology)



A population consists of all of the individuals of the same species living within a given area. The area can be as small as a city park or as large as an ocean. Ecologists who study populations are interested in how the population members interact with each other and with their environment. Many factors, from the size of the population to its spatial arrangement, play a role in these relationships.

Populations are characterized by several attributes. Among these are size, density, distribution, and life-history strategies.

The size of a population is defined simply as the number of individuals in that population at a given time. Population size is determined by four factors: the number of births, the number of deaths, the amount of immigration (the movement of individuals into one population from another), and the amount of emigration (the movement of individuals out of a population) experienced by the population. Most ecologists study these factors as rates—the number of events per unit time. For example, birth rate is generally expressed as the number of births per year.



1. Find the English equivalents in the text:

Складатися, один і той же вид, певна територія, взаємодіяти один з одним, просторове розміщення, кілька ознак, розмір, щільність, розподіл, стратегії життя, бути визначеним (визначатися), кількість народжених, кількість смертей, обсяг імміграції, кількість еміграції, вивчати фактори як показники, народжуваність.

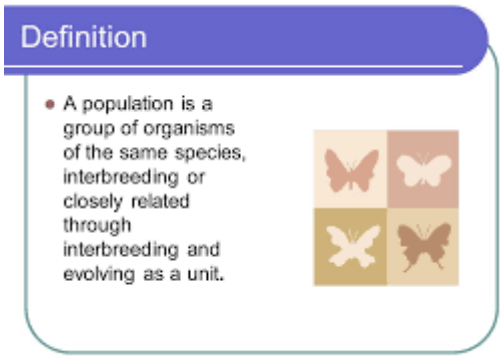
2. Translate the following terms and phrases:

Population, species, environment, spatial arrangement, size, density, distribution, life-history strategies, the number of births, the number of deaths, the amount of immigration, the amount of emigration, birth rate.

3. Match the terms and their definitions:

1	population	to movement of an organism from an area	
2	species	to movement of an organism to an area	
3	density	the manner in which a biological taxon is spatially arranged	
4	distribution	the number of individuals of a given species that occurs within a given sample unit or study area	
5	immigration	a group of organisms that can reproduce with one another in nature and produce fertile offspring	
6	emigration	a community of animals, plants, or humans among whose members interbreeding occurs	

4. Complete the sentences using the following terms:



emigrate
species
distribution
species
density
immigrate

1) A bird may _____to a new island from another island.
2) It is important to note that if you were to describe this differently - an organism moving from an area, then the term _____would apply.
3) Some examples of _____names include: Homo sapiens (humans) Felis catus (domestic cats) Vulpes vulpes (red fox)
4) The geographic limits of a particular taxon's _____is its range, often represented as shaded areas on a map.
5) The organisms belonging to the same_____, can interbreed and produce more of their kinds.
6) Plant _____is simply the number of individuals per unit ground area.

5. Read the paragraph and put 2questions to it for group discussion:

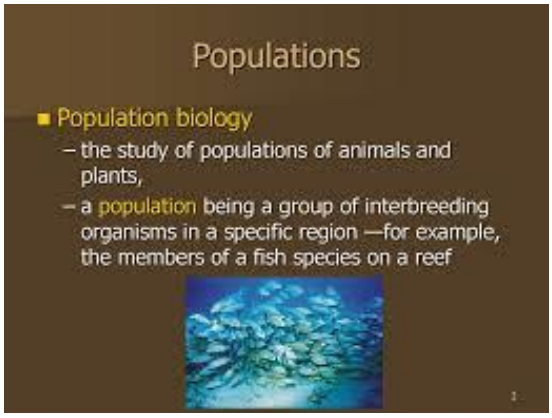
Births and immigration increase population size, while deaths and emigration lower it. When all of these factors are balanced, population size is at equilibrium. However, most populations in nature are dynamic—that is, they are

always increasing or decreasing in size. Changes in population size are connected to many factors, from the availability of resources in the environment to certain innate species characteristics such as life-history strategies.

6. Agree or disagree with the statements:

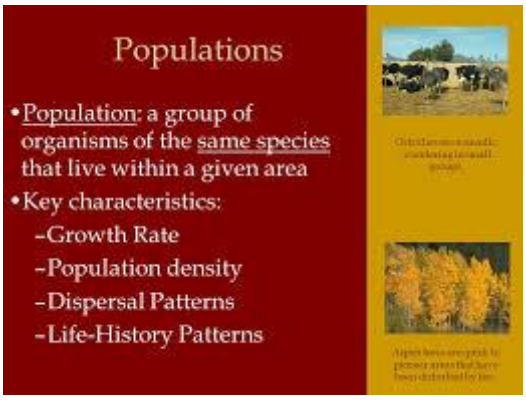
1) A population consists of all of the individuals of the different species living within a given area.
2) Populations are characterized by size and density.
3) The size of a population is defined simply as the number of individuals in that population at a given time.
4) Birth rate is generally expressed as the number of births per year.
5) Births and immigration decrease population size.
6) Deaths and emigration increase population size.
7) Most populations in nature are dynamic; they are always increasing or decreasing in size.

7. Look at the slide and answer the question:



1) What does population biology study?
2) What is a population?
3) What is an example of population?

8. Answer the following questions for summary:



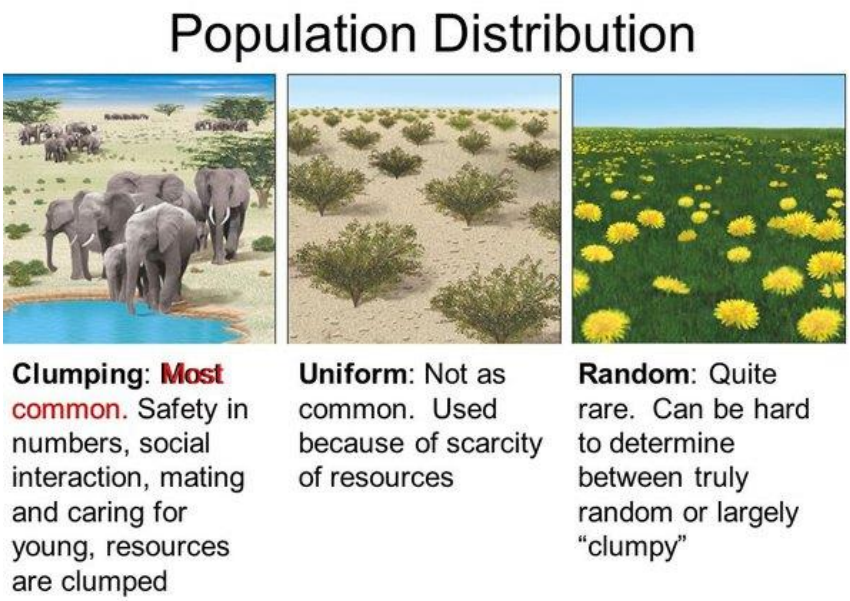
1) What does a population consist of?
2) How large may the given area of a population be?
3) What factors play a role in the relationships of population members and their environment?
4) What attributes are populations characterized by?
5) What factors is population size determined by?
6) Does immigration and emigration mean the same movement?
7) How is birth rate generally expressed?
8) What factor can increase population size?
9) What factor can decrease population size?

10) When is population size at equilibrium?

Lesson 5

Population density and distribution

(From Encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/population-ecology)



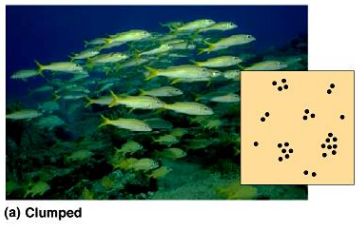
Population density is a measure of the number of individuals within a given area. Assuming that the population remains within the same area, the density then increases or decreases as the population size grows or falls, respectively. Some organisms, such as bees, are adapted to living in high-density populations. Others, such as brown bears and stray cats, live in low-density populations. The latter is characteristic of animals that display marked territoriality.

The spatial arrangement of population members reveals much about how they live and interact with their environment. Ecologists have described three distinct distribution patterns based on how key resources are distributed. In a random distribution, individuals are scattered randomly across a landscape without any particular pattern. Random distributions result when resources are distributed evenly or sporadically (not regularly). They are very uncommon in nature; some examples include tropical fig trees, which are distributed sporadically most likely because their seeds are dispersed by fig-eating bats. Dandelions, which are wind-dispersed, also display a random distribution.

1. **Find the English equivalents in the text:**

Щільність популяції, збільшуватися, зменшуватися, зростати, падати, бути пристосованим до, популяція з високою щільністю, бродячі коти, популяція з низькою щільністю, демонструвати виражену територіальність, просторове розміщення, взаємодіяти з навколишнім середовищем, чіткий розподіл, випадковий розподіл, бути розкиданим по ландшафту, насіння, поширюватися кажанами, кульбаба, розсіюватися вітром.

2. Translate the following words and phrases:



(a) Clumped

(c) Random

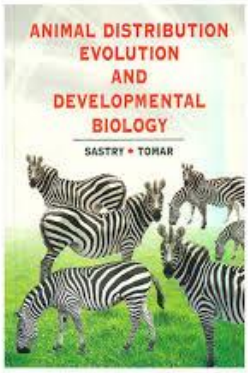
(b) Uniform

Population density, bees, high-density population, brown bear, stray cat, low-density populations, marked territoriality, spatial arrangement, distinct distribution, random distribution, sporadically, tropical fig tree, seed, to be dispersed, fig-eating bat, dandelion, to be wind-dispersed.

3. Match the notions and their definitions:

1	population density	individuals are spaced at unpredictable distances from each other	
2	population distribution	the population is evenly spaced	
3	random distribution	the population is distributed in clusters	
4	uniform (even distribution)	the natural geographic range of an organism	
5	clumped distribution	the average number of individuals in a population per unit of area or volume	

4. Complete the sentences with the following words and phrases:



population distribution
random dispersion
uniform distribution
population density
clumped distribution

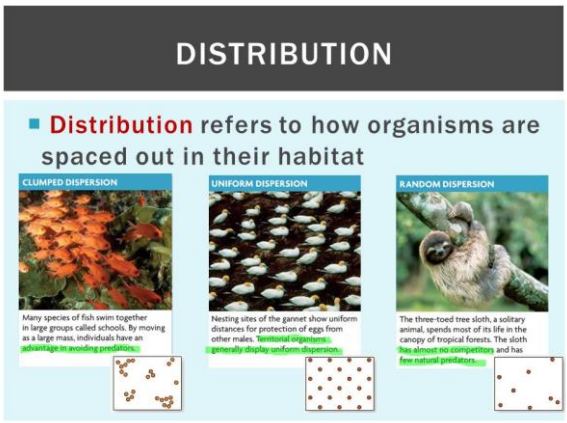
1) Desert shrubs and redwood trees grow in a_____—shrubs compete for water, while redwoods compete for light.
2) An example of _____comes from dandelions and other plants that have wind-dispersed seeds.
3) Animals, such as elephants, that travel in groups exhibit _____.
4) _____is a term that refers to how is the population spread across a given area changes.
5) _____is the number of people, or members of a particular plant or animal species, living in a specified unit of area.

5. Read the text, write down new terms and phrases, put 3 questions to the text to discuss them in the group:

Uniform, or even, distribution patterns are common where there is strong competition for a limited resource. The scarcity of water drives the uniform spacing of desert shrubs, while competition for light produces the uniform spacing of redwood trees. Animals that display strong territorial behaviour, such as stray cats, also tend to be distributed uniformly.

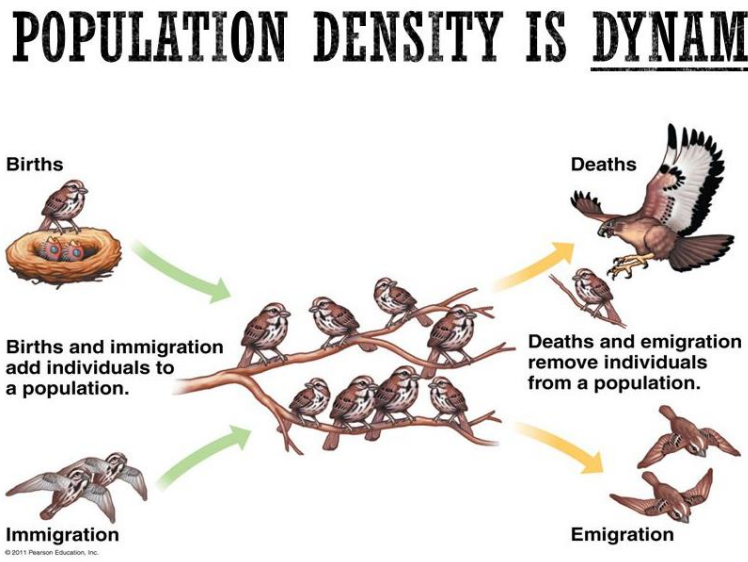
Clumped distributions are observed when resources are patchy or because of social structures. For example, the sporadic distribution of watering holes in the African savanna influences the clumped distribution of elephants. The strong social bonds of elephants, bees, and gorillas require a clumped distribution.

6. Agree or disagree with the statements:

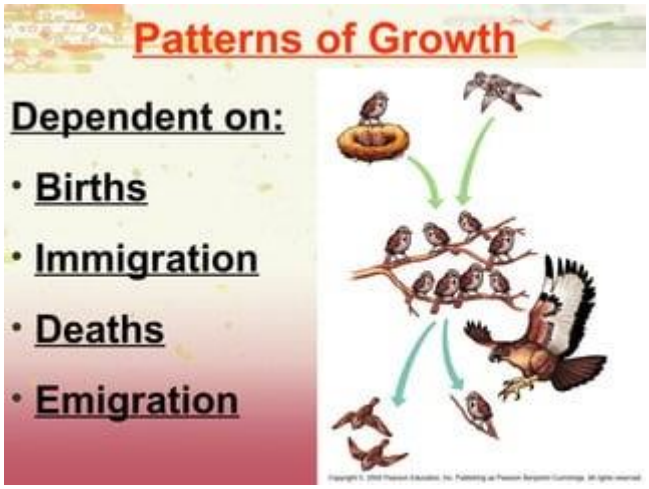


1) Population density is a measure of the number of individuals within a given area.
2) The population density increases as the population size falls.
3) Bees are adapted to living in low-density populations.
4) Brown bears live in high-density populations.
5) In a random distribution, individuals are scattered evenly across a landscape with a particular pattern.
6) Animals that display strong territorial behaviour, such as stray cats, also tend to be distributed uniformly.
7) The strong social bonds of elephants, bees, and gorillas require a clumped distribution.

7. Look at the slide and explain why population is dynamic:



8. Answer the following questions for summary:



1) What is population density?
2) When does population density increase?
3) What is an example of high-density population?
4) What is an example of low-density population?
5) What is population distribution?
6) What are three patterns of population distribution?
7) In what distribution pattern individuals are scattered randomly across a landscape without any particular pattern?
8) Where are uniform distribution patterns common?
9) What animals tend to be distributed uniformly?
10) When are clumped distributions observed?

GLOSSARY I

- abiotic factor — абіотичний фактор
- agriculture — сільське господарство
- air — повітря
- animal — тварина
- animal droppings — послід тварин
- applied science — прикладна наука
- atmospheric pressure — атмосферний тиск
- bacteria — бактерії
- bee — бджола
- biodiversity — біорізноманіття
- biological environment — біологічне середовище
- biological factor — біологічний фактор
- biota — біота
- biotic factor — біотичний фактор
- bird behavioral ecology — екологія поведінки тварин
- birth rate — народжуваність
- brown bear — бурий ведмідь
- carbon dioxide — вуглекислий газ
- city planning — містобудування
- climate change — зміна клімату
- community health — здоров’я громади
- conservation biology — біологія збереження
- dandelion — кульбаба
- density — густина
- distinct distribution — чіткий розподіл
- distribution — розподіл
- Earth's atmosphere — атмосфера Землі
- ecological community — екологічна спільнота
- ecologist — еколог

- economics — економіка
- environment — навколишнє середовище
- fig-eating bat — кажан-фігоїд
- fire — вогонь
- fisheries — рибальство
- forest — ліс
- forestry — лісове господарство
- fungi — гриби
- high-density population — висока густота населення
- human social interaction — соціальна взаємодія людини
- leaf litter — опале листя
- life-history strategies — стратегії життєвої історії
- light — світло
- living thing — жива річ
- low-density populations — низька густота населення
- marked territoriality — позначена територіальність
- microbe — мікроб
- natural resource management — управління природними ресурсами
- natural resources — природні ресурси
- nutrient recycling — переробка поживних речовин
- oxygen — кисень
- physical factor — фізичний фактор
- physiological ecology — фізіологічна екологія
- plant — рослина
- population — населення
- population density — густота населення
- population ecology — популяційна екологія
- rainfall — кількість опадів
- random distribution — випадковий розподіл
- rotting log — гниюча колода
- seed — насіння
- size — розмір
- soil — ґрунт
- spatial arrangement — просторове розташування
- species — види
- sporadically — періодично
- stray cat — бродяча кішка
- temperature — температура
- terrestrial ecoregion — наземний екорегіон
- the amount of emigration — кількість еміграції

- the amount of immigration — кількість імміграції
- the number of births — кількість народжень
- the number of deaths — кількість смертей
- theory of natural selection — теорія природного відбору
- to be dispersed — бути розсіяним
- to be wind-dispersed — бути розсіяним вітром
- tropical fig tree — тропічне фігове дерево
- tropical rain forest — дощовий тропічний ліс
- tsunami — цунамі
- urban ecology — міська екологія
- water — вода
- wetland management — управління водно-болотними угіддями

Unit II
Ecological Communities

Lesson 1
Characteristics of Community

(From Encyclopedia of Ecology. Reference Work. Second Edition. 2019. Retrieved from: https://www.sciencedirect.com/referencework/9780444641304/encyclopedia-of-ecology)

A community is made up of interacting groups of species living in a common location. The members of the community are connected through a network of interactions in which a direct interaction between two species may indirectly affect the community as a whole.

Certain types of plants and animals live together in similar communities regardless of their location on Earth. Antelope and other grazing mammals inhabit dry grasslands; songbirds migrate seasonally from northern temperate woodlands of oak and maple to southern tropical forests; marine tide pools contain algae, crustaceans, and mollusks. Some communities are populated by species unique to that area: American bison (buffalo) and prairie dogs are unique to the grasslands of North America, while platypuses are found only in the waterways of Australia.

1. Find the English equivalents in the text:

Складатися, взаємодіючі групи, спільне місце, бути пов’язаним, пряма взаємодія, опосередковано впливати, незалежно від розташування, пасовищні ссавці, сухі луки, співочі птахи, північний помірний ліс, південний ліс, морські припливні водойми, водорості, ракоподібні, молюски, лугові собачки, качкодзьоби.

2. Translate the following terms and phrases:

Community, species, plant, animal, antelope, grazing mammal, grassland, songbird, temperate woodland, oak, maple, tropical forest, marine tide pool, American bison, buffalo, prairie dog, platypus, waterway.

3. Match the notions and their definitions:

1	Grazing	any of various widespread arthropods of the class Crustacea that live mostly in water and have a hard shell, a segmented body, and jointed appendages.	
2	Temperate woodland	forested landscape in tropical regions	
3	Tropical forest	a simple, non-flowering, and typically aquatic plant of a large group that includes the seaweeds and many single-celled forms	
4	Algae	structurally simple forest with widely-spaced trees and a ground layer of grasses with scattered shrubs	
5	Crustaceans	a method of feeding in which a herbivore feeds on low-growing plants such as grasses or other multicellular organisms, such as algae	
6	Platypus	a semiaquatic egg-laying mammal which frequents lakes and streams in eastern Australia	

4. Complete the sentences with the following words and phrases:

tropical rainforests
crustaceans
temperate woodlands
platypus
algae
grazed

1) The cattle _____on grass in the field.
2) _____are the most biologically diverse terrestrial ecosystems in the world.
3) _____include crabs, lobsters, shrimp, barnacles, and copepods.

4) _____are globally distributed in temperate climates with warm-season droughts.
5) _____is a Greek word which means “broad, flat feet”.
6) _____is a type of plant with no stems or leaves that grows in water or on damp surfaces.

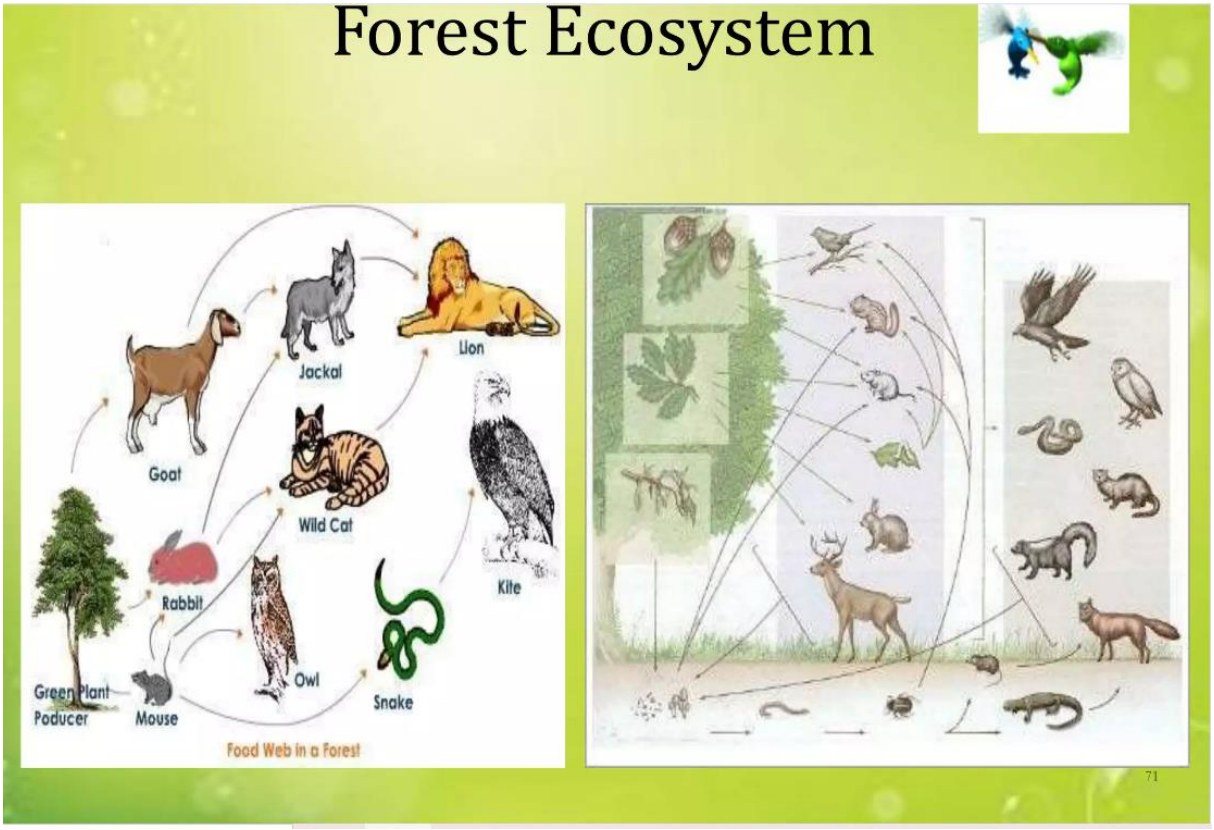
5. Read the paragraph, write down new words, put 2 questions for the group discussion:

Like populations, communities and the way they function are affected by the presence and interplay of several factors. These include the diversity of the species in the community, the functional roles that the species play, and the presence of dominant species and those that have a disproportionately large impact on the community.

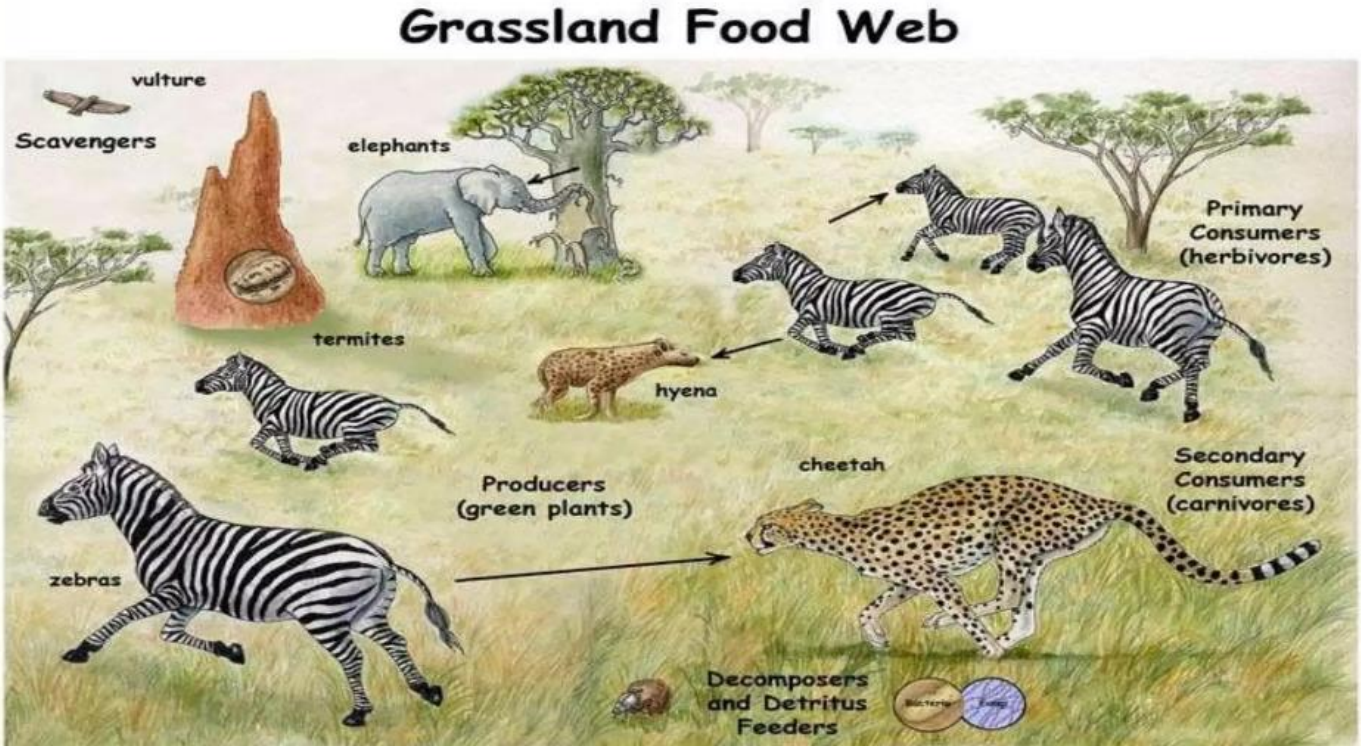
6. Agree or disagree with the statements:

1) A community involves interacting groups of species living in different locations.
2) The members of the community are connected through a network of interactions.
3) Certain types of plants and animals live together in similar communities regardless of their location on Earth.
4) Grazing mammals migrate seasonally from northern temperate woodlands of oak and maple to southern tropical forests.
5) Songbirds inhabit dry grasslands.
6) American bison (buffalo) and prairie dogs are found only in the waterways of Australia.
7) Platypuses are unique to the grasslands of North America.

7. Look at the picture and name the species of grassland and forest ecosystems:



8. Answer the following questions for summary:



1) What does community make up of?
2) What are the members of the community connected through?

3) May two species indirectly affect the community as a whole?
4) What animals inhabit dry grasslands?
5) What birds migrate seasonally from northern temperate woodlands to southern tropical forests?
6) Are some communities populated by species unique to that area?
7) What animals are unique to the grasslands of North America?
   What animals are found only in the waterways of Australia?
8) What factors are communities affected by?

Lesson 2
Biodiversity

(From World Wildlife Fund. Retrieved from: https://www.worldwildlife.org/pages/what-is-biodiversity)

Biodiversity is all the different kinds of life in one area—the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world. Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life.

A high level of biodiversity, or biological diversity, is generally the sign of a healthy well-functioning natural community. Biodiversity is often measured as the number of species within a given area. Some habitats have a modest amount of biodiversity; others, such as rainforests and coral reefs, are extremely rich in species.

Long-term studies have shown that species-rich communities recover faster from disturbances than communities with low diversity. In the midwestern United States, grasslands with higher biodiversity were more drought-resistant compared to species-poor grasslands. Likewise, grasslands in the Serengeti region of eastern Africa that had greater species richness were able to recover better after grazing by animals than grasslands with fewer species.

1. Find the English equivalents in the text:

Різноманітність тварин, заплутана мережа, утримувати баланс, підтримувати життя, ознака, природне співтовариство, оселище (середовище проживання), скромна кількість, бути надзвичайно багатим видами, відновлюватися після порушень, луки, бути стійким до посухи, випас тварин.

2. Translate the following terms and phrases:

Biodiversity, animal, plant, fungi, microorganism, bacteria, ecosystem, natural community, habitat, rainforest, coral reef, disturbance, grassland, grazing.

3. Match the terms and their definitions:

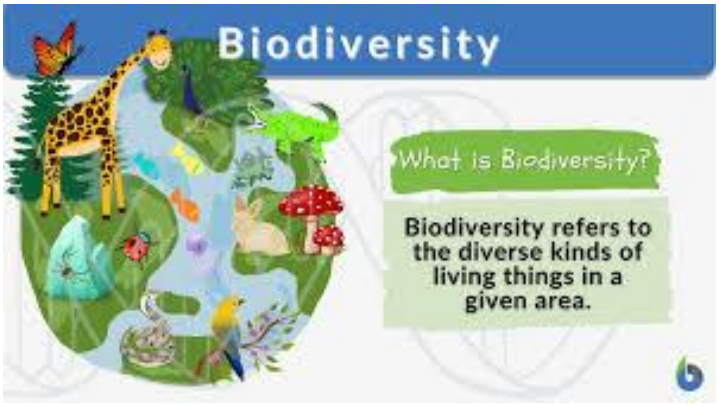
1	organism	a group of organisms that can reproduce naturally with one another and create fertile offspring	
2	species	the natural home or environment of a plant, animal, or other organism	
3	ecosystem	an assemblage of plants and animals that repeats across the landscape wherever similar environmental conditions occur	
4	habitat	a system that environments and their organisms form through their interaction	
5	natural community	an individual living thing that carries on the activities of life by means of organs which have separate functions but are dependent on each other	

4. Complete the sentences with the following terms:

habitat
organism
ecosystem
natural communities
species

1) Two organisms are the same _____if they can have offspring and those offspring can also breed and produce offspring.
2) A _____provides the organisms that live there with food, water, shelter and space to survive.
3) An _____would, therefore, be any animal, plant, fungus, protist, bacterium, or archaeon on Earth.
4) Freshwater wetland, estuarine, and upland _____are classified according to their dominant vegetation and their physical setting.
5) An _____ includes all the living things (plants, animals and organisms) in a given area, interacting with each other, and with their non-living environments (weather, earth, sun, soil, climate, atmosphere)

5. Read the text, write down new words, put 2 questions to the text for group discussion:



Low biodiversity is a characteristic of artificial "communities," such as croplands and wide expanses of lawn. Natural communities that have become polluted often exhibit low species diversity. For example, a lake polluted with industrial and agricultural wastes such as sewage, detergents, and fertilizers may undergo eutrophication, which is an increase in concentrations of phosphorous, nitrogen, and other plant nutrients.

The excessive amount of nutrients allows certain species of microscopic organisms or algae to grow on the lake's surface in much greater numbers. "Blooms" of some microbes may release toxins into the water. In addition, the mat of surface organisms blocks out much of the sunlight that would normally penetrate the water and also eventually causes the water to become deficient in oxygen. Species of fish and other underwater organisms may then die.

6. Agree or disagree with the statements:

1) Species and organisms work independently and separately in ecosystems.
2) Biodiversity is often measured as the number of species within a given area.
3) All habitats have a similar amount of biodiversity.
4) Species-rich communities recover slower from disturbances than communities with low diversity.
5) Rainforests and coral reefs are extremely rich in species.
6) Low biodiversity is a characteristic of artificial "communities".

7. Look at the slide and answer the following questions:

1) What is biodiversity?
2) Why is biodiversity important?
3) What is biodiversity threatened by?
4) What is needed to protect biodiversity?

WHAT IS BIODIVERSITY?

Biodiversity refers to the variety of living organisms on Earth and the interactions between them. This includes the diversity of species, ecosystems, and genetic variations within a species.

Biodiversity is important because it provides numerous benefits to humans, such as food, medicine, and ecosystem services like pollination and water filtration. It also plays a crucial role in maintaining the balance and resilience of ecosystems, which in turn supports the sustainability of human life.

However, biodiversity is currently threatened by various human activities, including habitat destruction, pollution, and climate change. Conservation efforts are needed to protect and restore biodiversity and ensure the continued provision of its benefits to both humans and the planet as a whole.

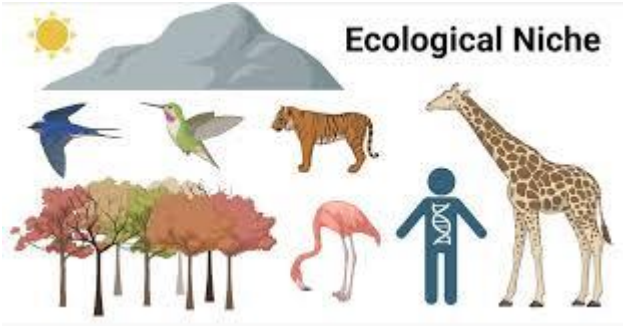
8. Answer the questions for summary:

1) What is biodiversity?
2) How do species and organisms work to maintain balance and support life?
3) What is the sign of a healthy well-functioning natural community?
4) What is biodiversity often measured as?
5) What communities recover faster from disturbances?
6) What grasslands are more drought-resistant?
7) What is a characteristic of artificial “communities”?
8) What species diversity do the polluted natural communities exhibit?

Lesson 3

Niche

(From National Geographic. Retrieved from: https://education.nationalgeographic.org/resource/niche/)



In ecology, a niche is the functional role played by a species in the community it inhabits: where it lives, what it eats and recycles, and what preys on it. A community may have millions of different niches, all of which are connected and all of which must be occupied for the community to function effectively. Only one species can occupy a niche. Two species trying to fill the same niche must compete for it, with one species eventually outcompeting the other.

When a species goes extinct, its niche becomes empty, and many species will compete to fill it. Many niches become available following mass extinction events and are rapidly filled by surviving species that have adaptations that allow them to take over the niche.

Just as all niches in a community must be filled, all species in a community must have a niche. If a niche becomes lost or changes because of a disturbance such as an earthquake or fire, the species that had occupied it must emigrate or try to adapt by occupying another niche (for which it has to outcompete the species occupying it). If this fails, the species will probably die out within the community.

1. Find the English equivalents in the text:

Населяти, переробляти, полювати, бути пов’язаним, ефективно функціонувати, займати нішу, конкурувати за нішу, випереджати, вимирати, ставати порожнім, масове вимирання, порушення, землетрус, пожежа, в межах спільноти.

2. Translate the following terms and phrases:

Functional role, community, species, to occupy a niche, empty niche, extinction, survive, adaptation, disturbance, earthquake, fire, emigrate, adapt, occupy a niche.

3. Match the notions and their definitions:

1	niche	a physiological, behavioural or morphological character of an organism that allows it to survive and reproduce in its natural environment	
2	extinction	the shaking of the surface of Earth resulting from a sudden release of energy in the lithosphere that creates seismic waves	
3	adaptation	a process in which substances combine chemically with oxygen from the air and typically give out bright light, heat, and smoke; combustion or burning	
4	earthquake	the role an organism plays in a community	
5	fire	the reduction of a species to such low abundance that, although it is still present in the community, it no longer interacts significantly with other species	

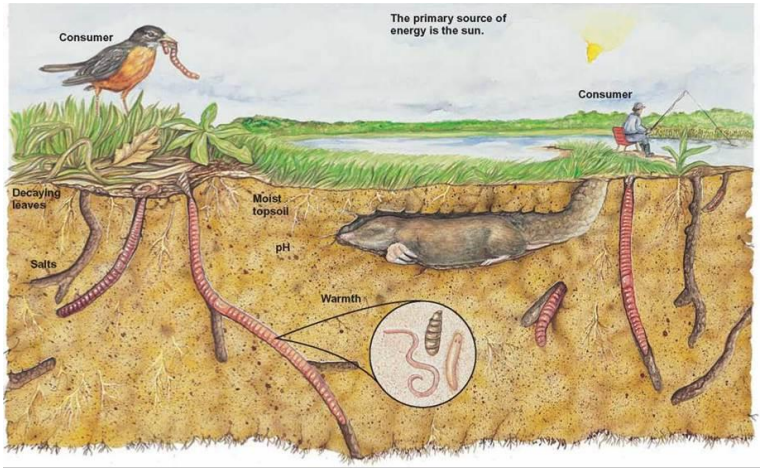
4. Complete the sentences using the following words and phrases:

Ecological extinction
A species' niche
Earthquake environmental effects
Fire ecology
Adaptations

1) _____allow the organisms to survive in their current ecological environment in which they are residing.
2) _____stands out because it is the interaction ecology of a species that is important for conservation work.
3) _____encompasses both the physical and environmental conditions it requires (like temperature or terrain) and the interactions it has with other species (like predation or competition).

4) _____is the study of fires and fire regimes in global forest, prairie, shrubland, chaparral, meadow, and savannah ecosystems.
5) _____are the effects caused by an earthquake, including surface faulting, tsunamis, soil liquefactions, ground resonance, landslides and ground failure, either directly linked to the earthquake source or provoked by the ground shaking.

5. Agree or disagree with the statements:

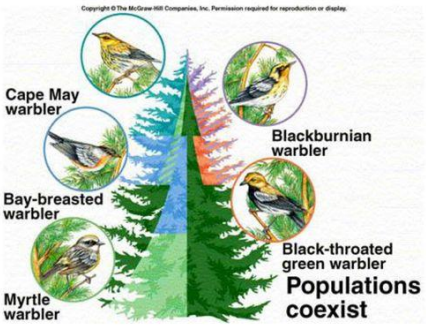


1) A niche in ecology is the functional role played by a species in the community it inhabits.
2) A community has several different niches.
3) All niches are connected in the community to function effectively.
4) Some species can occupy one and the same niche.
5) Many niches become available following mass extinction events.
6) All niches in a community must not be filled.
7) All species in a community must not have a niche.

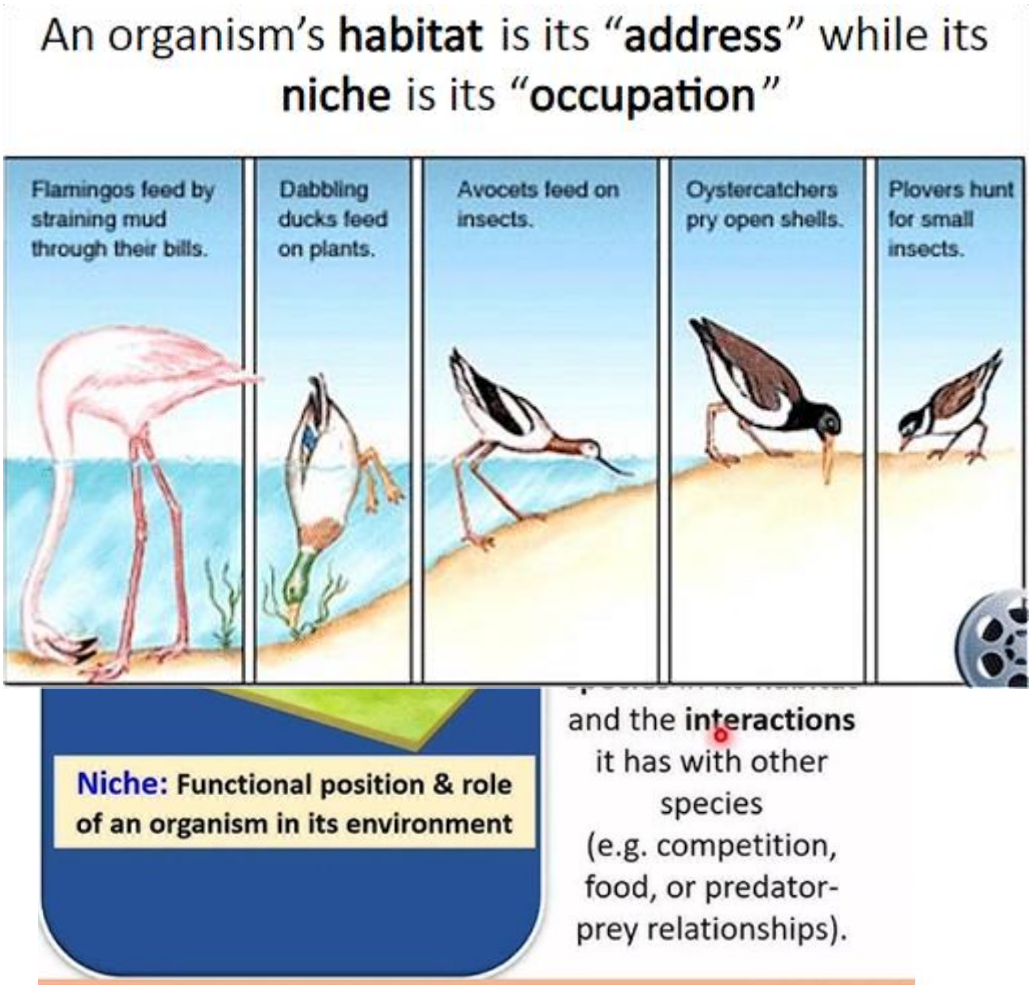
6. Look at the slide and find the features of an ecological niche:

Ecological Niche

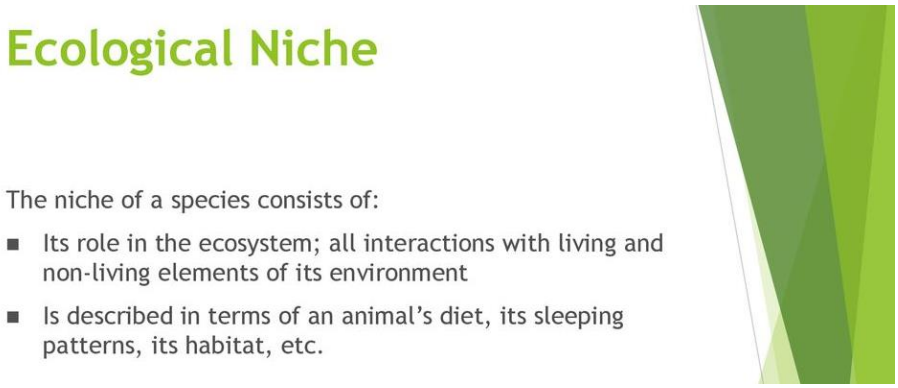
- Physical, chemical, and biological factors that a species needs to survive
- Includes food, abiotic conditions, and behavior
- How an organism lives
- How an organism 'makes a living'



7. Look at the slides and determine the differences between niche and habitat:



8. Answer the following questions for summary:

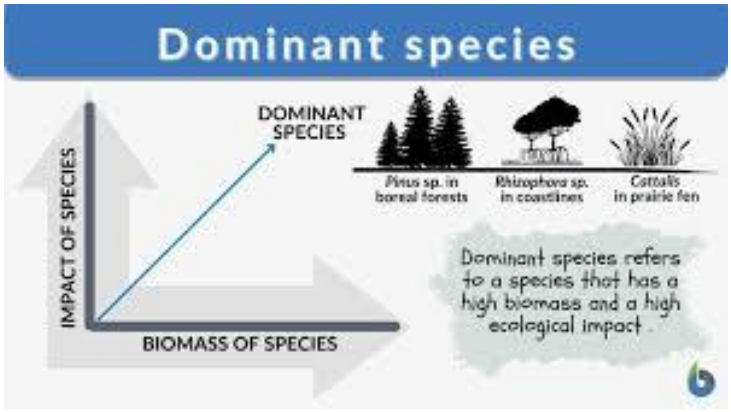


1) What is a niche in ecology?
2) How many niches may a community have?
3) How many niches can one species occupy?
4) What must two species do, trying to fill the same niche?
5) When do many niches become available?
6) Must all niches in a community be filled?
7) Must all species in a community have a niche?
8) Why must a species emigrate or try to adapt by occupying another niche?

Lesson 4

Dominance

(From Biology Online. Retrieved from: https://www.biologyonline.com/dictionary/dominant-species)



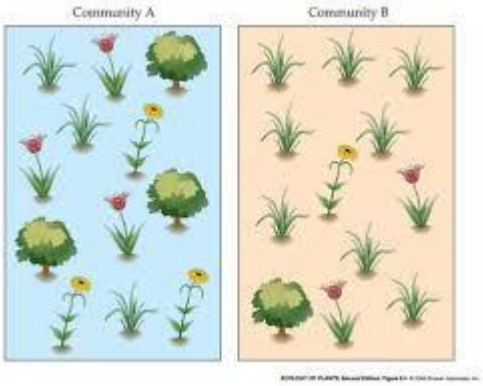
In most communities, the growth or behaviour of one or more species controls the activity and other characteristics of the community. Such species are called dominants. The dominant species in a forest may be a certain tree species whose growth may affect the amount of light available to other species. One of the dominant microbes in the human mouth is Streptococcus salivarius. Dominant species influence community diversity as well as stability.

The presence of a keystone species is crucial to maintaining the functioning and diversity of many communities. A keystone species is a species that has an unusually large effect on its neighbours. Through predation or competition, it may prevent the overgrowth of a population that would otherwise dominate the community. This is the case in the rocky intertidal pools found on the Pacific Northwest coast of North America in which the sea star Pisaster ochraceus is the keystone species. Pisaster preys on the mussel Mytilus californianus, keeping the mussel population from getting too large. When ecologists removed Pisaster experimentally, the Mytilus population grew so rapidly that it outcrowded every other species that normally inhabited the community.

1. Find the English equivalents in the text:

Ріст виду, поведінка виду, домінант, домінуючий вид, впливати на кількість світла, бути доступним іншим видам, впливати на різноманітність спільноти, ключовий вид, мати вирішальне значення, хижацтво, конкуренція, запобігти надмірному зростанню популяції, скелястий приливний басейн, морська зірка, полювати на мідій, видалити експериментально, населяти спільноту.

2. Translate the following terms and expressions:

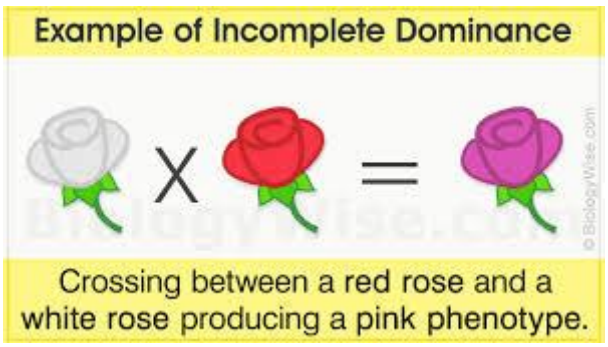


Community, growth, behaviour, species, dominant, dominant species, tree species, dominant microbe, Streptococcus salivarius, diversity, stability, diversity as well as stability, predation, competition, rocky intertidal pool, sea star, Pisaster ochraceus, mussel, Mytilus californianus, mussel population.

3. Match the notions and their definitions:

1	growth	the group of organisms (or species) that have the most significant influence or control over the other organisms in its ecological community	
2	dominant	the ability of an ecosystem to resist changes	
3	diversity	a subset of individuals of one species that occupies a particular geographic area and, in sexually reproducing species, interbreeds.	
4	stability	the variation in both terrestrial and aquatic ecosystems	
5	population	a change in the number of members of a certain plant or animal species in a particular location during a particular time period	

4. Complete the sentences using the following terms and phrases:



species diversity
dominant species
stable system
growth rate
population

1) The geographic boundaries of a _____are easy to establish for some species but more difficult for others.
2) The term _____is often used interchangeably with biodiversity, which also refers to both the genetic diversity within a species and the number of different species present in an ecosystem.

3) _____are species that have high abundance relative to other species in a community, and have proportionate effects on environmental conditions, community diversity and/or ecosystem function.
4) A _____is one having low variability (i.e., little deviation from its average state) despite shifting environmental conditions.
5) The rate, or speed, at which the number of organisms in a population increases, is called_____.

5. Agree or disagree with the statements:

1) The growth of one species cannot control the activity and other characteristics of the community.
2) The dominant species in a forest may be a certain tree species.
3) Dominant species do not influence community diversity.
4) A keystone species is a species that has an unusually large effect on its neighbours.
5) A keystone species may prevent the overgrowth of a population that would otherwise dominate the community.

6. Read the paragraph, write down 5 terms from it and put 2 questions to it for the group discussion:

CULTURAL KEYSTONE SPECIES

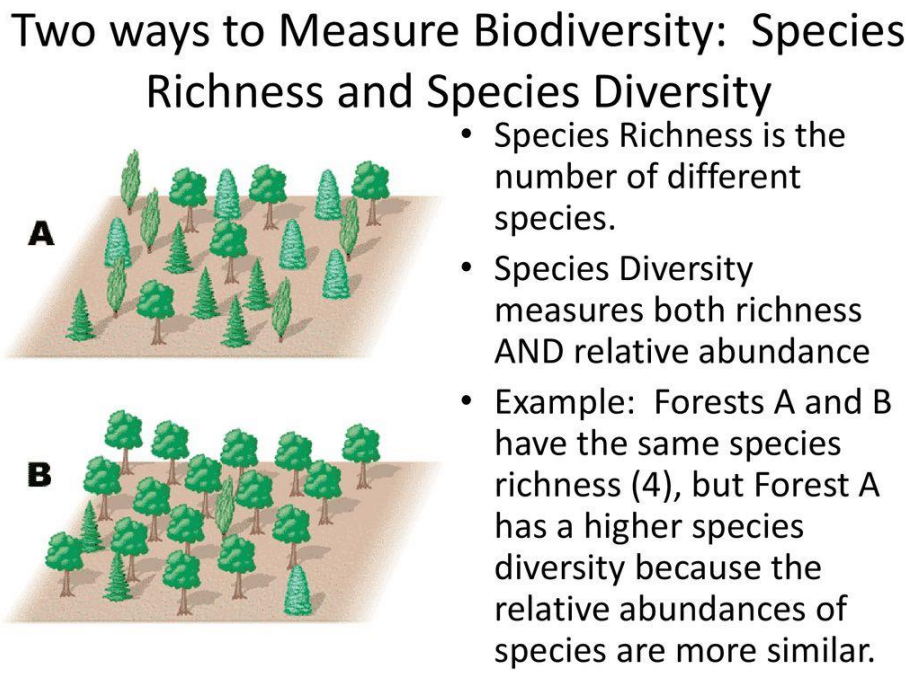
OLIVE TREE SALMON BISON BAOBAB TREE CEDARS

In some communities, the keystone species provides critical resources for other members of the community. Because they provide fruit year-round, fig trees (Ficus species) in the tropical rainforests of Central and South America provide fruit for many birds and other animals during periods in which other fruits are

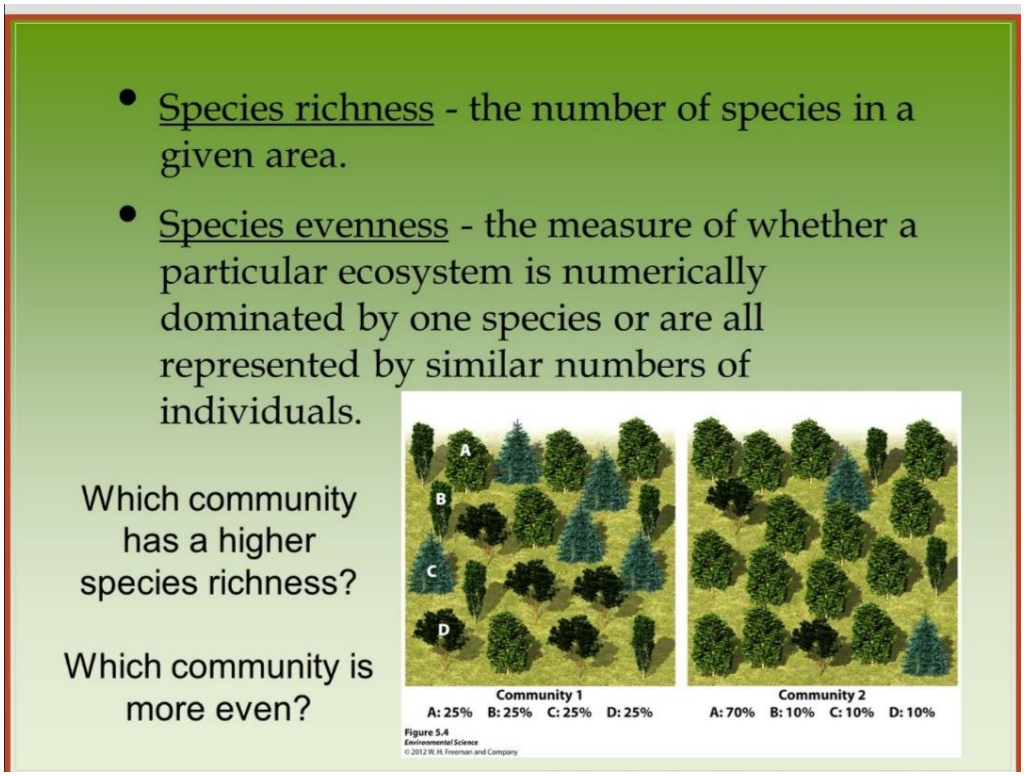
scarce. Without the fig trees, many animals in these communities would have to emigrate to other habitats, thereby decreasing community diversity.

7. **Look at the pictures (a, b), read the definitions (a, b) and answer the questions (b):**

(a)



(b)



8. Answer the following questions for summary:

1) What factor can control the activity and other characteristics of the community?
2) What species are called dominant?
3) What is one of the dominant microbes in the human mouth?
4) What can dominant species influence?
5) What is crucial to maintaining the functioning and diversity of many communities?
6) How may keystone species prevent the overgrowth of a population?
7) What is the keystone species in the rocky intertidal pools on the Pacific Northwest coast of North America?
8) What happened when ecologists removed Pisaster experimentally?

Lesson 5

Community Interactions

(From Encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/community-ecology/Effect-on-community-structure)

The organization and stability of a biological community result from the interactions between its member species. Each interaction between two species directly affects each of them. These effects may be beneficial or detrimental, depending on the species and the interaction. Some interactions have a distinct effect on one species but no effect on another.

In addition to their direct effects, some interactions between two species have indirect effects on other members of the community. The connection between all of the direct and indirect effects forms an interactive web that binds the community together.

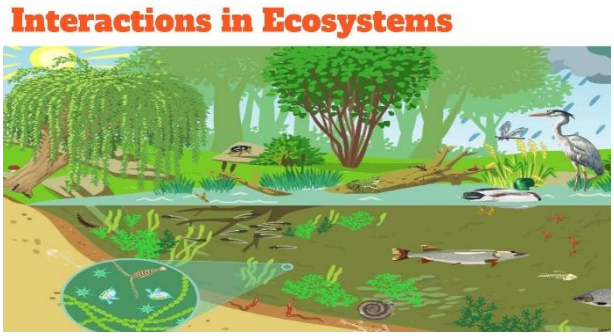
Community interactions refer to the inter- and intraspecific interactions that occur within ecological communities. There are three types of community interactions: competition, predation, and symbiosis. Three types of symbiosis are currently recognized – commensalism, mutualism, and parasitism.

Thus, interactions within an ecological community are essential since they promote biodiversity within an ecosystem. In addition, the interacting species are shaped as they evolve through ecological community interaction.

1. Find the English equivalents in the text:

Бути результатом взаємодії, безпосередньо впливати, корисний вплив (ефект), шкідливий вплив (ефект), залежати від виду, чіткий вплив, непрямий вплив, інтерактивна мережа, пов’язувати разом, міжвидова взаємодія, внутрішньовидова взаємодія, конкуренція, хижацтво, симбіоз, коменсалізм, мутуалізм, паразитизм, сприяти біорізноманіттю.

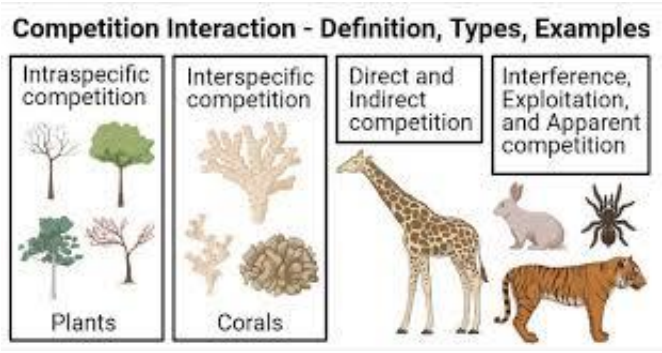
2. Translate the following terms and phrases:



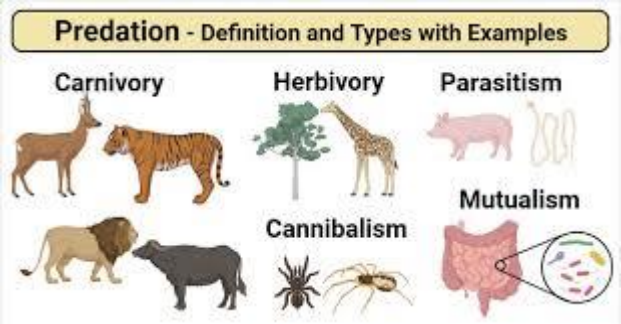
Biological community, interaction, beneficial effect, detrimental effect, distinct effect, direct effect, indirect effect, interactive web, interspecific interaction, intraspecific interaction, ecological community, competition, predation, symbiosis, commensalism, mutualism, parasitism.

3. Read the definitions of the terms with examples. Fill in the table with the definitions of the following terms:

1	competition		
2	predation		
3	symbiosis		
4	commensalism		
5	mutualism		
6	parasitism		

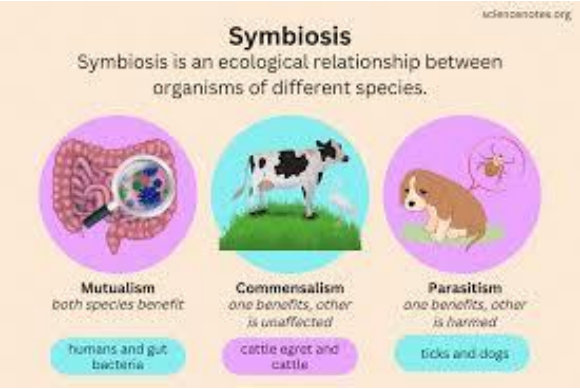


1) **Competition** is an interaction between organisms or species in which both require a resource that is in limited supply (such as food, water, or territory) (Begon et al. 1996). *Bumble bees and honey bees are an example of interspecific consumption competition, as they compete for the same floral resources.*

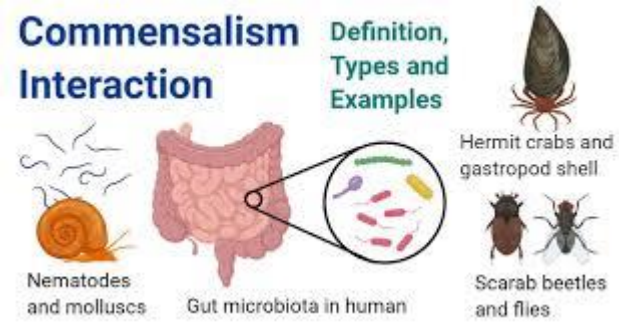


2) **Predation** is an interaction in which one organism, the predator, eats all or part of the body of another organism, the prey. *Herbivory* is a form of predation in which the prey organism is a plant. *Examples: A pride of lions attacking a larger*

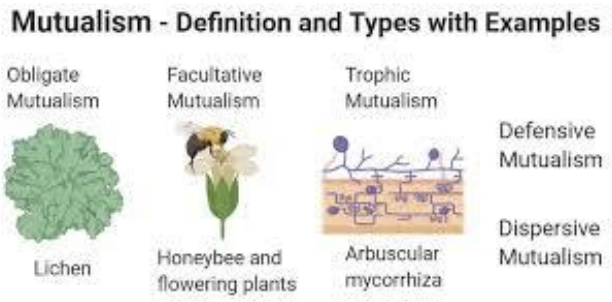
animal, such as an elephant or wildebeest. Dolphins chasing and eating fish.



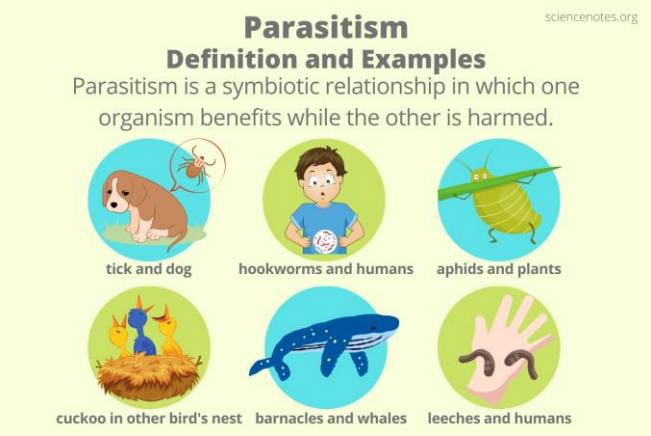
3) **Symbiosis** is defined as a close, prolonged association between two or more different biological species. *One example of symbiosis is the relationship between certain species of ants and acacia trees. The ants live in the hollow thorns of the acacia tree and help to protect the tree from herbivores by attacking any that try to eat the leaves or bark.*



4) **Commensalism** is a symbiotic relationship between different species of organisms where one (the commensal organism) benefits from the relationship while the other is unaffected and neither benefits nor is harmed. *For example, cattle and egret, barnacles on the back of a whale, sea anemone, and the clown fish.*

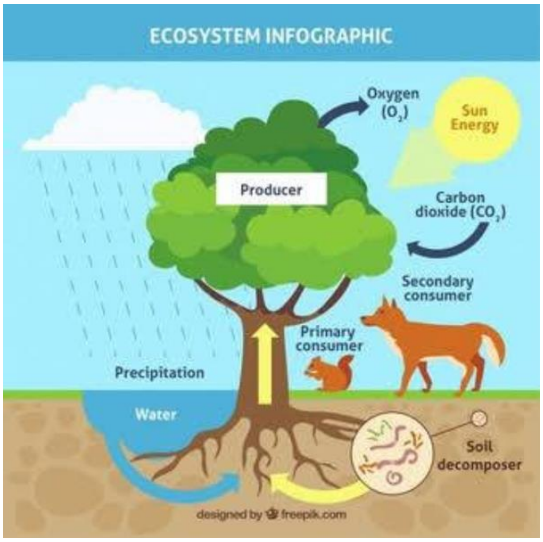


5) **Mutualism** describes the ecological interaction between two or more species where each species has a net benefit. Mutualism is a common type of ecological interaction. *For example, Ants live and feed on the nectar of acacia trees. Here ants are the mutualist and acacia tree is the host. The acacia tree provides home and food for the ants.*



6)**Parasitism** is relationship between two species of plants or animals in which one benefits at the expense of the other, sometimes without killing the host organism. *Example: Plant Parasites: Cuscuta, Dodder. Animal Parasites: Lice, Mosquitoes, Tick.*

4. Complete the sentences with the following terms:



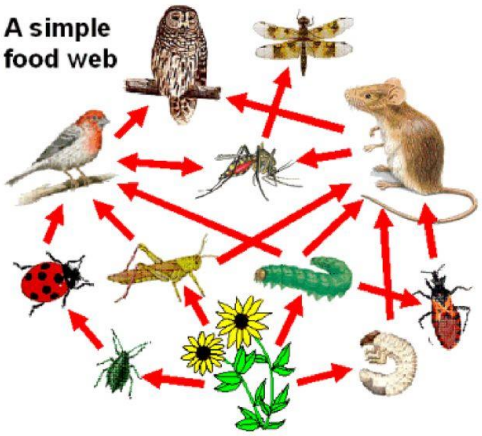
symbiosis
competition
predation
mutualism
commensalism
parasitism

1) Lice, Mosquitoes, Tick are an example of animal_____.
2) The relationship between certain species of ants and acacia trees is an example of_____.
3) Bumble bees and honey bees are an example of interspecific consumption_____.
4) Barnacles on the back of a whale is an example of_____.
5) A pride of lions attacking a larger animal is an example of_____.
6) Ants and acacia tree is an example of_____.

5. Agree or disagree with the statements:

Community Interactions

- **Community**: Many different species interacting in the same environment.
- Three types of interactions:
  - Competition
  - Predation
  - Symbiosis



1) The interactions between its member species have no effect on the organization and stability of a biological community.
2) Each interaction between two species directly affects each of them.
3) The connection between all of the direct and indirect effects forms an interactive web that binds the community together.
4) There are three types of community interactions: competition, predation, and symbiosis.
5) Interactions within an ecological community promote biodiversity within an ecosystem.
6) The interacting species are shaped as they evolve through ecological community interaction.

6. Look at the slide and answer the following question:

1) What is a biological interaction?
2) What is an example of biological interaction?
3) What are the types of community interaction?

Community Interactions

- A biological **community** is a collection of populations of different species living close enough to interact with one another

  For example, a pond = insects, fish, algae, animals, plants, frogs all live close enough to interact

- Three types of community interactions:

  –Competition

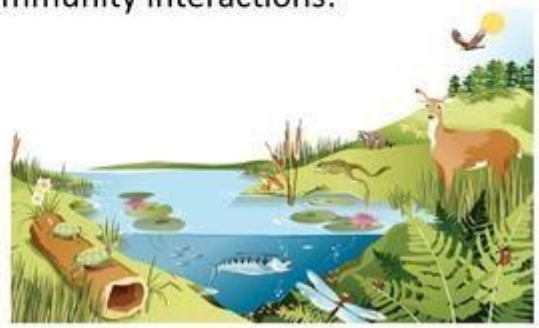
  –Predation

  –Symbiosis

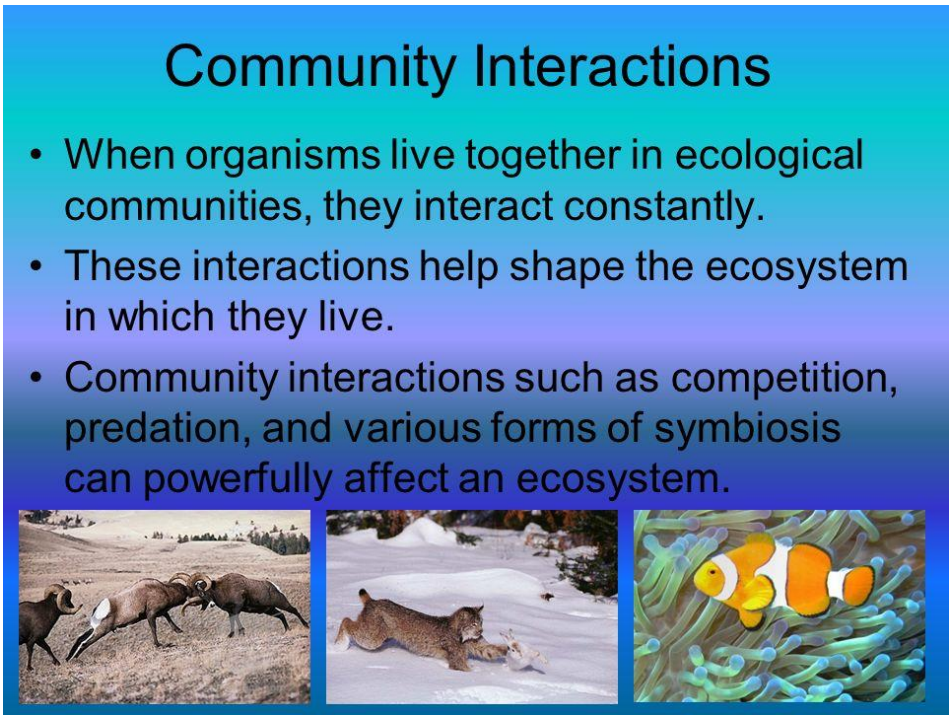
  mutualism

  commensalism

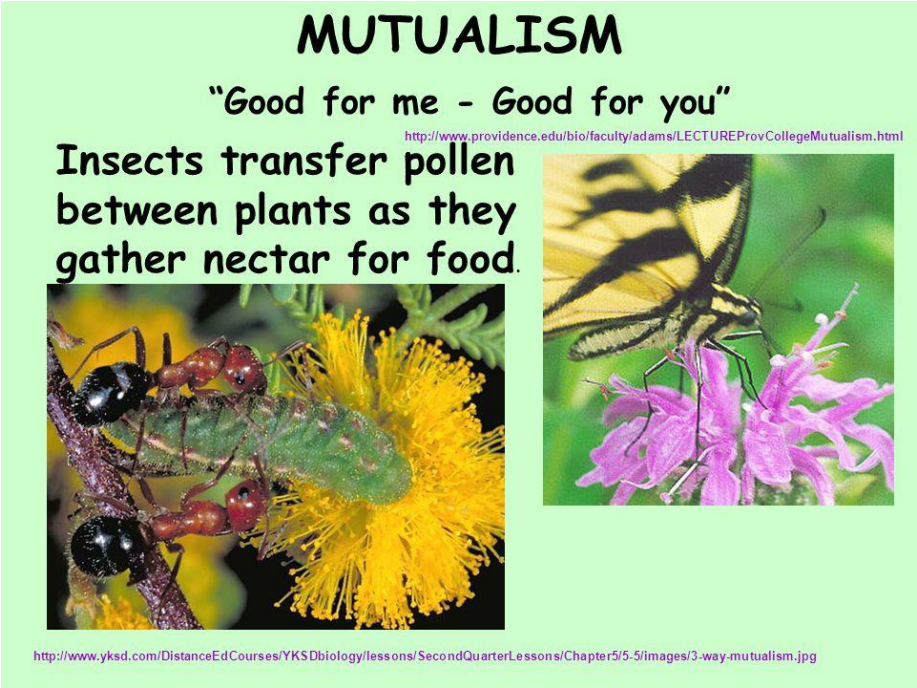
  parasitism



7. Look at the slide and put 3 questions to discuss in the group:

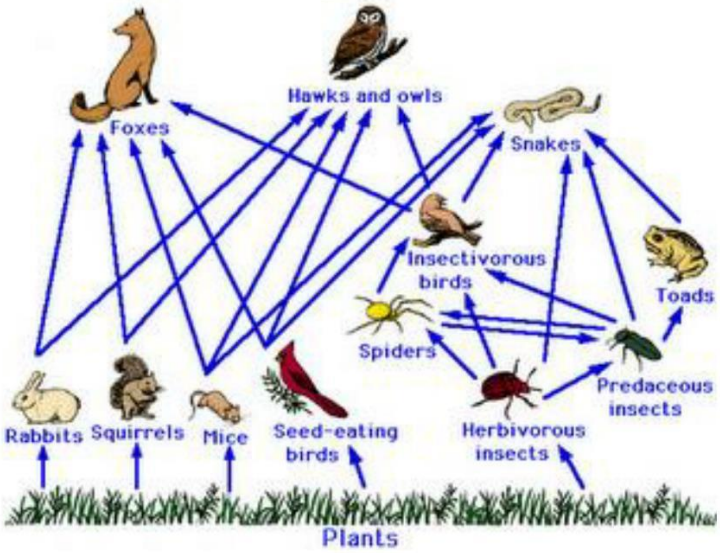


8. **Read the example of mutualism ad think of another example:**



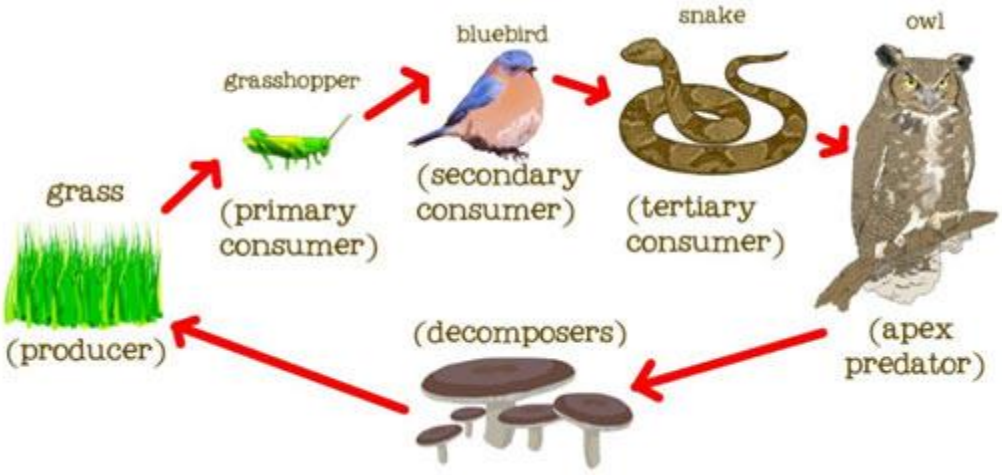
9. **Answer the questions for summary:**

Community Interactions



1) What do the organization and stability of a biological community result from?
2) What effects of interactions may be?
3) Do interactions have a distinct effect on all species?
4) What does the connection between all of the direct and indirect effects form?
5) What is the function of an interactive web?
6) What do community interactions refer to?
7) What are three types of community interactions?
8) What three types of symbiosis are recognized?
9) Why are interactions within an ecological community essential?
10) Are the interacting species shaped as they evolve through ecological community interaction?

GLOSSARY II



- Adapt — адаптуватися
- Adaptation — адаптація
- american bison — американський бізон
- animal — тварина
- antelope — антилопа
- bacteria — бактерії
- behaviour — поведінка
- beneficial effect — сприятливий вплив
- biodiversity — біорізноманіття
- biological community — біологічна спільнота
- buffalo — буйвол
- commensalism — коменсалізм
- community — спільнота
- competition — конкуренція
- coral reef — кораловий риф
- detrimental effect — згубний вплив
- direct effect — прямий вплив
- distinct effect — виражений вплив
- disturbance — порушення
- diversity — різноманітність
- dominant — домінантний
- dominant microbe — домінантний мікроб
- dominant species — домінантні види
- earthquake — землетрус
- ecological community — екологічна спільнота

- ecosystem — екосистема
- emigrate — емігрувати
- empty niche — порожня ніша
- extinction — вимирання
- fire — вогонь
- functional role — функціональна роль
- fungi — гриби
- grassland — пасовища
- grazing mammal — пасовищний ссавець
- grazing — випас
- growth — зростання
- habitat — середовище проживання
- indirect effect — непрямий вплив
- interaction — взаємодія
- interactive web — інтерактивна мережа
- interspecific interaction — міжвидова взаємодія
- maple — клен
- marine tide pool — морський припливний басейн
- microorganism — мікроорганізм
- mussel — мідія
- mussel population — населення мідій
- mutualism — мутуалізм
- mytilus californianus — митилус каліфорнійський
- natural community — природна спільнота
- oak — дуб
- to occupy a niche — займати нішу
- parasitism — паразитизм
- pisaster ochraceus — пісастер охрацеус
- plant — рослина
- platypus — качкодзьоб
- prairie dog — луговий пес
- predation — хижацтво
- rainforest — тропічний ліс
- rocky intertidal pool — скелястий приливний басейн
- sea star — морська зірка
- songbird — співоча пташка
- species — вид
- stability — стабільність
- streptococcus salivarius — слинний стрептокок
- survive — вижити

- symbiosis — симбіоз
- temperate woodland — помірна лісистість
- tree species — види дерев
- tropical forest — тропічний ліс
- waterway — водний шлях

REFERENCES

1. Omerod S.J. Pienkowski M.W. & Watkinson A.R. 1999. Communicating the value of ecology. Journal of Applied Ecology 36, 847–855.
2. Encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/environment
3. Encyclopedia Britannica. Retrieved from: http://britannica.com/students/article/ecology/274117
4. Encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/population-ecology
5. Encyclopedia of Ecology. Reference Work. Second Edition. 2019. Retrieved from: https://www.sciencedirect.com/referencework/9780444641304/encyclopedia-of-ecology
6. World Wildlife Fund. Retrieved from: https://www.worldwildlife.org/pages/what-is-biodiversity
7. National Geographic. Retrieved from: https://education.nationalgeographic.org/resource/niche/
8. Biology Online. Retrieved from: https://www.biologyonline.com/dictionary/dominant-species
9. Encyclopedia Britannica. Retrieved from: https://www.britannica.com/science/community-ecology/Effect-on-community-structure

CONTENTS

Навчальне видання

Укладачі:

Куліш І.М., Зінченко А.В.

English for Ecologists

Навчальний посібник для студентів спеціальності «Екологія»

Тираж 50 примірників
Ум.друк.арк. 4,1
Підписано до друку
Друк ФОП Нечитайло О.Ф.
Україна, м. Черкаси
вул. О. Дашкевича, 39
тел. (0472)366260
Свідоцтво про внесення додержавного реєстру
суб'єктів видавничої справи АВ № 488421 від 18.10.2013 р.