

Unit 6: Ecosystems

Module 15: Ecological Principles

NC Essential Standard:

- 2.1 Analyze the interdependence of living organisms within their environments



Did you know...

The water you poop in today is the water you drink "tomorrow"!

It's true! Matter cannot be created or destroyed...there is no "new" water for us to drink! However, matter can change form and be recycled. This is true of water AND other elements in nature (such as carbon and nitrogen). You have learned about the parts of the water cycle in nature, but in your life...

- Water is taken from a natural source (ie. Mountain Island Lake)
- It goes through the process of municipal water treatment to clean it up so you can drink it safely.
- It is piped into your home where it is used.
- When used water goes down the drain, it goes to a sewage treatment facility to clean it up enough to put it back into a natural source....and the cycle starts again!

- I. What is the biosphere and how is it organized?
 - A. **Biosphere** – Area of the earth _____; extends from oceans depths to a few kilometers above land.
 - B. **Biomes** – An extensive area of _____; there are six terrestrial biomes and three aquatic biomes.
 - C. **Ecosystem**
 1. A physically distinct, self supporting unit of _____
_____; Ex. Forest or pond
 2. Four important processes:
 - a. Production of _____ (usually from sunlight)
 - b. Energy _____
 - c. _____
 - d. _____ of nutrients
 3. Includes biotic and abiotic factors.
 - a. **Biotic** – _____ things
 - b. **Abiotic** – _____ things
Ex. Temperature, light, nutrients

Simple picture of an ecosystem (label a biotic and abiotic factor):

D. Communities and Populations

Simple picture of a community:

1. **Communities** – all the ecosystem’s _____
_____.
2. Communities may be broken down into smaller units called _____.
 - a. **Populations** – A group of individuals that belong to the _____ and occupy the same area and share common resources.
 - i. Each population has a specific **niche**, which means _____.
 - ii. The niche includes _____, place in food web, competition, _____, and _____ (temperature, water)
 - b. A community may have 1000’s of populations (tropical rainforest) or relatively few (tundra)

Simple picture of a population:

Check Yourself!

1. List the levels of organization of the biosphere from highest level (biosphere) to the most specific level (niche).
2. What is the difference between an ecosystem and a community?
3. What four essential processes would be found in an ecosystem?
 - a.
 - b.
 - c.
 - d.



II. How is energy transferred in an ecosystem?

A. Trophic Levels

1. Organisms in a community survive by either _____
_____ food.

Answer using the food web:

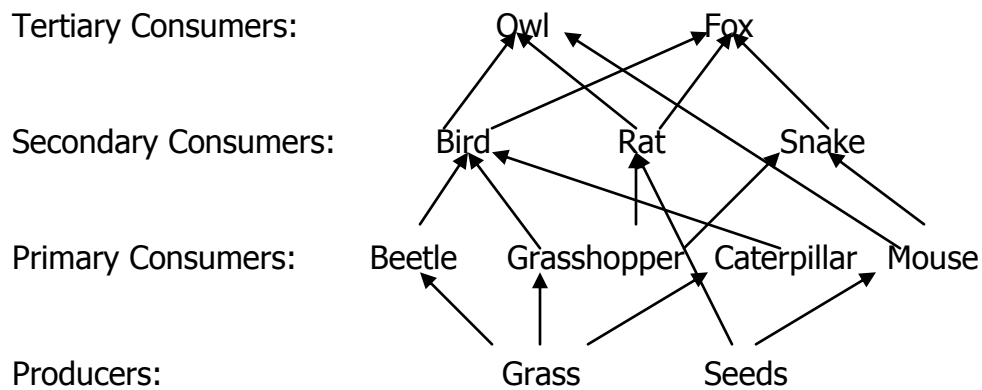
1. **Organisms that eat grass.**
2. **Food sources for the fox.**
3. **An "omnivore".**
4. **An "herbivore".**
5. **A "carnivore".**

2. **Trophic levels** – _____ in a community
 - a. **Producers** – _____ for themselves (ex. plants).
Other organisms may eat producers.
 - b. Consumers – must _____ (ex. fungi)
 - i. **Primary Consumers** – also called **herbivores** (ex. _____)
 - ii. **Secondary and Tertiary Consumers** – may be **carnivores** (ex. _____) or **omnivores** (ex. _____)
 - iii. **Decomposers** – break down wastes and dead organisms and _____.

B. Food Webs

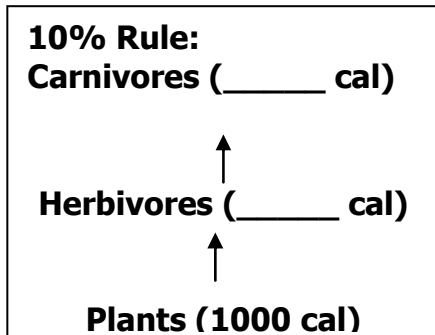
1. Made up of _____.
2. Shows feeding connections; arrows illustrate _____

3. Ex.



C. Ecological Efficiency

1. Producers have _____ available energy (sun).
2. _____ as it moves up through the food web; **10% rule** – only 10% of the available energy is passed to the next trophic level.
3. The "lost" energy is used to _____.



Check Yourself!

1. What is a trophic level?
2. What is the difference between an omnivore and a carnivore?
3. From the food web above, write out a food chain that includes the rat.
4. Which level in a food web has the most energy?



III. How is matter reused in an ecosystem?

A. Role of Decomposers

1. **Decomposers** break down _____
2. Decomposition allows nutrients to be _____ and atmosphere; this allows nutrients to be reused.
3. Decomposers include _____.



B. **Biogeochemical Cycles** – the pathway through which a substance is _____.

Diagram of water cycle:

1. **Water Cycle**

- a. _____ by **precipitation**; may **infiltrate** the soil (be absorbed) or **run-off** into surface water.
- b. _____ by **evaporation** or **transpiration** (the loss of water by plants)

2. **Carbon Cycle**

- a. Powered by two main processes
 - i. **Photosynthesis** – plants and algae _____ and change it into sugars (which have carbon)
 - ii. **Respiration** – all living things _____ for energy, which _____



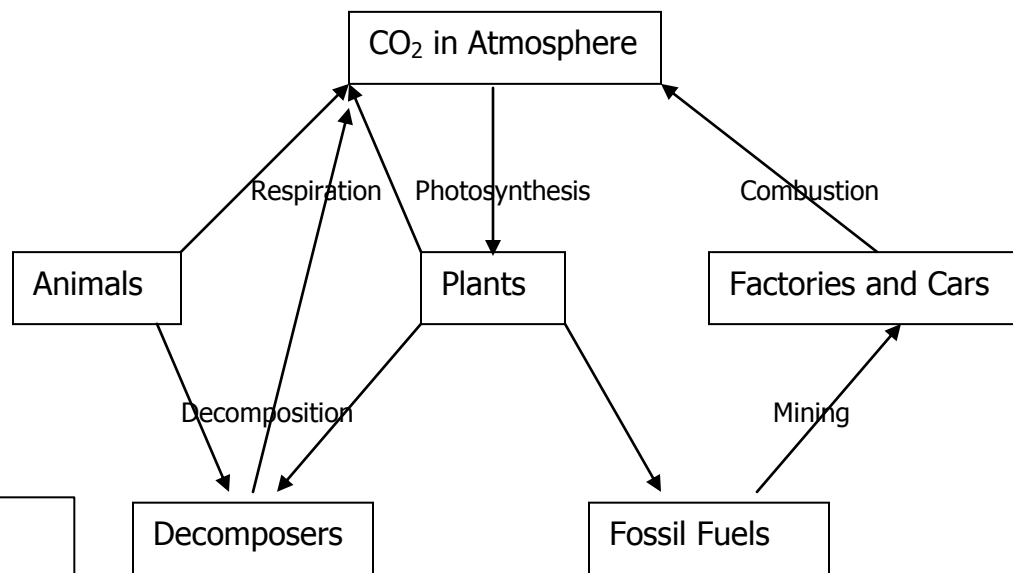
Factors that ADD carbon to atmosphere:

Factors that REMOVE carbon from atmosphere:

b. Other factors in the carbon cycle:

- i. _____ returns carbon to the soil and atmosphere.
- ii. Humans _____ which adds CO₂ to the atmosphere and contributes to climate change.
- iii. _____ removes trees which normally photosynthesize and remove CO₂ from atmosphere.

Diagram of Carbon Cycle



Watch It!



3. Nitrogen Cycle

- a. Nitrogen is essential for living organisms so that they can build _____; nitrogen is plentiful in the atmosphere, but is _____.
- b. **Nitrogen fixation** – _____ living in the root nodules of bean plants (legumes) _____ from the air into a more usable form.
- c. Nitrogen fixation is the _____ that involves bacteria and changing the form of nitrogen.

Check Yourself!

1. How do decomposers help with the recycling of nutrients?
2. How do plants return water to the atmosphere?
3. What two processes drive the carbon cycle?
4. What organisms are essential for the conversion of nitrogen?



IV. How do living things interact in a community?

A. **Competition** – a _____ among organisms.

Ex. nesting space for birds

B. **Predation**

1. **Predators** are organisms that _____.

Ex. Zebra eating grass

2. **Prey** are the organisms that _____.

Ex. Earthworm being eaten by bird

C. **Symbiosis** – two organisms of different species living together in a _____

1. **Mutualism** – the two organisms _____ each other

Ex. Termite and protozoan

Ex. Lichen – an alga and a fungus

2. **Parasitism** – one organism _____; the other is _____

Ex. Tapeworm and human

Ex. Mistletoe and tree

3. **Commensalism** – one organism _____; the other is _____

Ex. Epiphytes growing on trees

Ex. Barnacles and whales

Picture of competition:

Fill in the correct type of symbiosis for the following symbols:

+, + _____

+, - _____

+, 0 _____

Check Yourself!

1. Which biotic relationship is defined as a "struggle for resources"?
2. In your backyard, you observe a snake entering your bird feeder.
Who is the predator and who is the prey?
2. What is symbiosis?

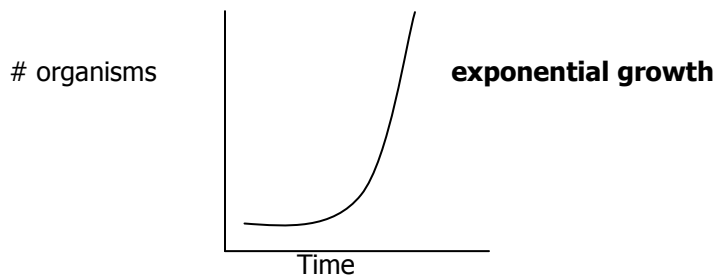


V. How do communities change over time?

A. Population growth

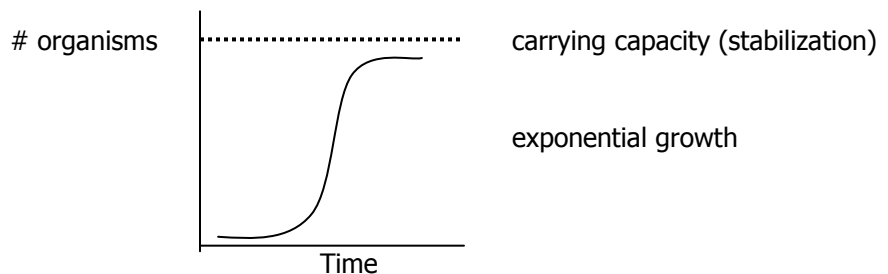
1. Populations will grow until they reach their **biotic potential**, _____ by factors in the environment; this type of growth is known as a **J-curve**

Define "exponential growth":



2. **Limiting factors**, such as availability of food, water, and space establish a _____ for populations; this type of growth is known as an **S-curve**;

List limiting factors for a population of dandelions:



3. **Carrying capacity** is defined as the _____. Limiting factors in the environment help to maintain ecosystem stability by allowing populations to _____ around the carrying capacity. This is called **dynamic equilibrium**.

- a. **Density dependent factors** have a greater effect on a population when there is a higher population density (the number of individuals in a given space). For example, _____, predation, and the spread of _____ are density-dependent factors.
- b. **Density independent factors** influence the size of a population regardless of its density. For example, _____ such as forest fires are density independent factors.

B. **Succession** is the idea that _____
_____ in a predictable, orderly way; this happens because every community alters the physical factors of the environment.
Ex. As trees grow, they produce shade

Check Yourself!

- 1. What kind of curve illustrates exponential growth?
- 2. What determines the carrying capacity of the environment?
- 3. List 3 examples of limiting factors.



_____ in a
community

Exist

Between living
organisms

Word Bank:

+ +

2 types

Balanced and Healthy

Biotic Relationships

Tick on you

Food

Predator

Resources

Symbiosis

Competition

Between two
organisms for

Such as

Space
Mates

Predator and Prey
Relationships

One who consumes

One who is consumed

Prey

Help to keep the
populations

Hawk killing and
eating a mouse

Close relationship
between two organisms

Parasitism

+ -

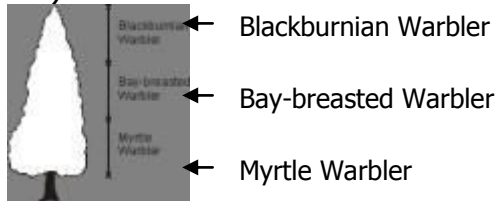
Mutualism

Antelope and
zebra watching
for predators

Unit 6 / Module 15 Problem-Solving Set

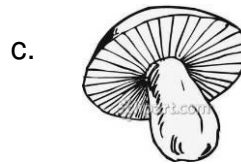
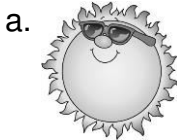
1. Put the following terms in order from smallest to largest:
Biome Ecosystem Population Biosphere Community

2. Using the following picture, explain how the “niches” of various warblers (a type of bird) are different.

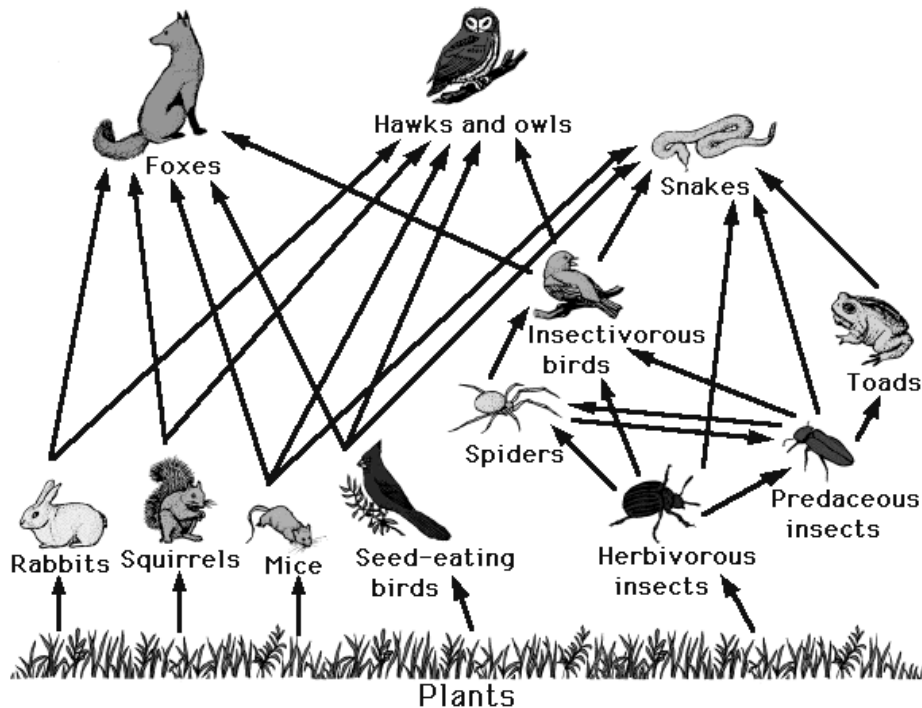


Explanation:

3. For each of the following, identify as a biotic or abiotic factor:

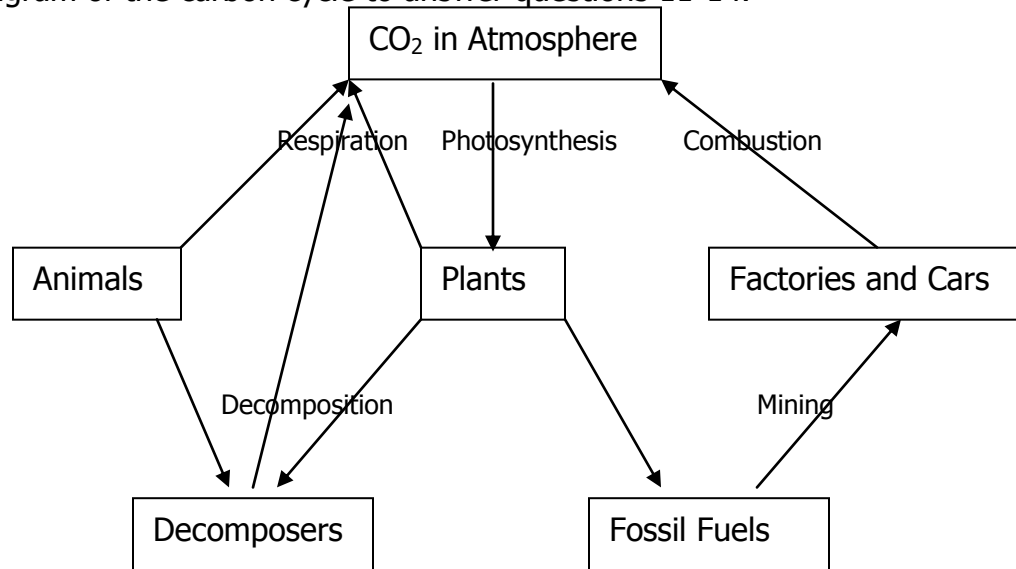


Use the food web below to answer questions 4-10.



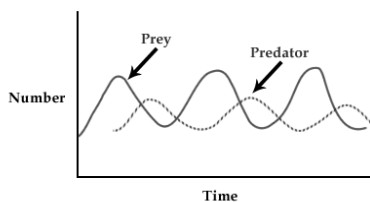
4. How many primary consumers/herbivores are there? _____
5. The fox can be a _____ or _____ consumer.
6. How many sources of food does the snake have? _____
7. The mice may be eaten by: _____, _____, or _____
8. The arrows show the direction of _____ flow.
9. In the food web, most of the energy is in the _____.
10. If there are 100 calories in a plant, _____ calories will be transferred to the rabbit and _____ calories will be transferred to the fox.

Use the diagram of the carbon cycle to answer questions 11-14.



11. What organisms take up carbon from the atmosphere? _____
12. These organisms use the process of _____ to convert carbon dioxide into sugars.
13. Name the 3 processes that can add carbon back to the atmosphere:
 _____/ _____/ _____
14. Humans are adding excessive amounts of carbon dioxide to the atmosphere because of our overuse of _____.

15. Using the graph below, explain the relationship between predator and prey in a community:

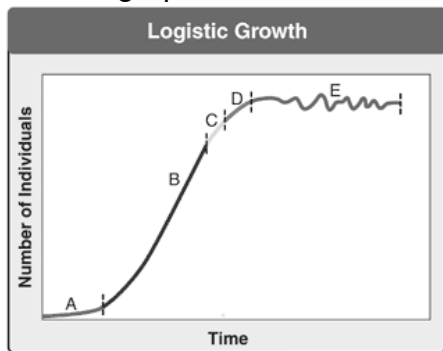


Explanation:

Fill in the chart below with the appropriate type of symbiosis:

Description	Type of Symbiosis
16. While bees gather nectar from flowers for food, they, in turn, pollinate other flowers.	
17. A vine winds up a tree in your yard so it can get closer to the sunlight. It does not block sunlight from reaching the tree.	
18. A tick attaches to your dog and sucks his blood.	
19. Remoras swim alongside sharks and eat the scraps of food the shark leaves behind.	
20. Oxpeckers ride on the backs of rhinos and pick insects and parasites off of the rhinos skin.	
21. A tapeworm enters a human as he eats undercooked meat, and attaches to the intestinal wall.	

Use the graph below to answer the following questions:



22. What type of population growth is shown in section "B"? _____
23. In section "E", stabilization has occurred because the _____
_____ has been reached.
24. This type of graph is also known as a(n) _____ - curve.
25. Assume that the graph above shows the population growth of bullfrogs in a local pond. List 3 limiting factors for the frog population. Be specific for frogs.

_____/ _____/ _____

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