Norfolk Public Schools
Science Learning in Place Plan: Biology Lessons

Week 7: April 27 – May 1, 2020 (Carry Capacities)

Monday	Tuesday	Wednesday	Thursday	Friday
Population Growth Assignments: • **Read** pages: 1-3 • Complete Reading Check # 1-3	**Population Growth** Assignments: • Reread pages 1-3 • Compete Reading Check # 4 • Complete Activity # 1 Use vocabulary terms to create a matching activity. Study terms then solve.	**Human Population Growth** Assignments: • Read pg. 4 • Complete Reading Check# 5 Census Opinion Question • Complete Activity # 2 Human Population Growth Graphing Activity	**Human Population Growth** Assignments: • Re-read pgs.# 1-5 • Complete Activity # 3 Mystery Logo and Slogan Activity	**Population Growth Review** Assignments: • Re-read pgs.# 1-5 • Activity # 4 Write a summary

Week 8: May 4 – 8, 2020 (Patterns & Cycles)

Monday	Tuesday	Wednesday	Thursday	Friday
Nutrition and Energy Flow Assignments: • Read pgs. #6-8 • Complete Reading check# 6-9 • Complete Activity # 5 : Energy Flow Table	**Organisms and Environment** Assignments: • Read pg.# 9 • Complete Reading Check# 10 • Complete Activity # 6: Pyramid • Complete Activity # 7: Matching	**Succession** Assignments: • Read pg. # 11 • Complete Reading Check # 11 • Complete Activity # 8 Vocabulary Review: Matching	**Cycles of Matter** Assignments: • Read pgs. # 13-14 • Complete Reading Check # 12 • Complete Activity # 9: Cycles-Important Facts	**Cycles of Matter** Assignments: • Re-read pgs.# 6-14 • Activity #10 List 10 important facts

Week 9: May 11 – 15, 2020 (Natural Events & Virginia Ecosystems)

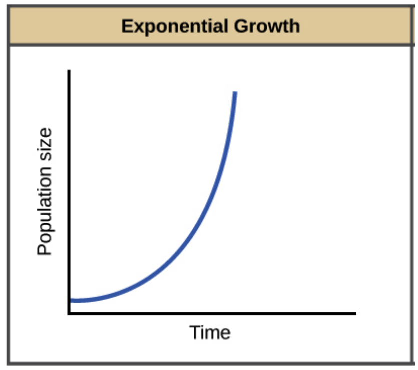
Monday	Tuesday	Wednesday	Thursday	Friday
Human Impact Assignments: • Read pg. #15 • Complete Reading Check # 13	**Human Impact** Assignments: • Re-read pg. # 15 • Read pg. # 16 • Complete Reading Check # 14-15	**Chesapeake Bay and Human Impact** Assignments: • Read pgs. #17-18 • Complete Reading Check # 16 • Complete Activity # 11 : Human Impact	**The Bay Today** Assignments: • Read pgs. # 19-20 • Complete Reading Check # 17 • Complete Activity # 12: Positive or Negative Impact	**Restoring the Bay** Assignments: • Read pg. #21 • Complete Reading Check # 18 • Complete Activity # 13: Letter

Population Growth

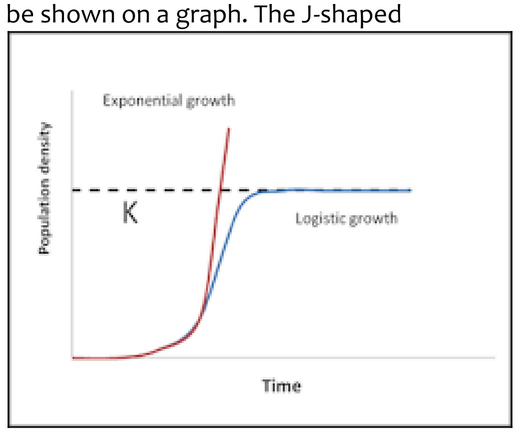
Principles of Population Growth

Every organism is a member of a population. A **population** is a group of organisms of the same species that live in a specific area. When individuals move into a population it is called **immigration**. You may have a population of grass in your backyard. There also may be a population of ants there. You may even have a population of bacteria on your bathroom door handle. Populations grow, die, increase, and decrease. Factors that affect the growth rate of populations include food, space, disease, and predators. Scientists have discovered that populations of organisms tend to grow in the same way. Populations start by growing slowly. In the beginning, there are just a few organisms that reproduce. Soon the rate of population growth increases because there are more organisms reproducing.

How do populations grow?

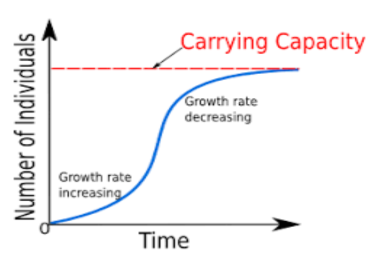


Scientists use graphs to show how populations grow. The graph of a growing population looks like a **J-shaped curve**. The flat part of the J shows slow growth. The part of the J that rises shows rapid growth. The J-shaped curve is a picture of exponential growth. **Exponential growth** means that as a population gets larger, it grows at a faster rate. For example, you may have one dandelion in your backyard. A few weeks later you may have twenty dandelions. A few weeks after that you may have hundreds of dandelions. The reason is exponential growth. One dandelion produces many seeds. Twenty dandelions produce hundreds of seeds. Can populations grow and never stop growing? No, there are factors that slow down or limit growth. These are called **limiting factors**. The effects of limiting factors also can be shown on a graph. The J-shaped curve begins to look like an **S-shaped curve** as population growth slows or levels off. When populations run out of food or space, growth starts to slow down. Population growth also slows when disease or predators attack populations. When individuals move out of a population it is called **emigration**. Later, you will read about other reasons why population growth slows.



What is an environment's carrying capacity?

The **carrying capacity** of an environment is the number of organisms of one species that can be supported for an unlimited amount of time. Until carrying capacity is reached, there are more births than deaths in the population. If a population grows larger than the carrying capacity of the environment, there will be more deaths than births. The number of organisms in a population is sometimes more than the environment can support and sometimes less than the environment can support.



Reading Check # 1

How does the number of organisms in an area affect population growth?

Population Growth

Density, or the number of organisms in a given area, affects population growth. Factors that are related to the density of the population are called **density-dependent factors**. They include disease, competition, predators, parasites, and food. These factors become more important as the population increases. For example, when members of a population live far apart, disease spreads slowly. When the members live close together, disease spreads quickly. This is true for both plants and animals. It is true for populations of people. Some scientists think that the presence of contagious diseases in populations is a limiting factor in the growth of those populations. **Density-independent factors** affect populations, no matter how large or small. Density-independent factors include volcanic eruptions, temperature, storms, floods, drought, chemical pesticides, and major habitat disruption. Imagine a pond containing a population of fish. If a drought caused the pond to dry up, then that population of fish would die. It would not matter if there were 10 or 100 fish in the pond. Drought is a density-independent factor. Human populations also can be affected by density independent factors. Rivers sometimes overflow their banks after a heavy rain. If a town is flooded, it does not matter how many people live in the town; everyone feels the effects of the flood.

Organism Interactions Limit Population Size

Populations also are limited by contact with other organisms in a community. The relationship between predator and prey is a good example. Scientists observe cycles of population increases and decreases. Some are quite regular and predictable. An example is the interaction of the snowshoe hare and the Canadian lynx. The lynx, a member of the cat family, eats the snowshoe hare. As you can see, predator populations affect the size of prey populations .Usually the lynx population catches the young, old, injured, or sick members of the hare population. This makes more resources available for the remaining healthy members of the hare population.

Reading Check # 2

Why did the brown tree snake population on Guam increase unchecked?

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Is there competition among members of the same population?

The lynx and hare are members of different populations, but members of the same population also interact with each other. Populations can increase so that members are competing for food, water, and territory. **Competition** is a density-dependent factor. When only a few individuals need the available resources, there is no problem. When the population becomes so large that demand for resources is greater than the supply of resources, the population size will decrease. Sometimes populations become crowded and organisms begin to show signs of stress. Individual animals may become aggressive. They may stop caring for their young or even lose their ability to bear young. Stress also makes animals more at risk for disease. All of these stress symptoms are limiting factors for growth. They keep populations below carrying capacity

Population Growth

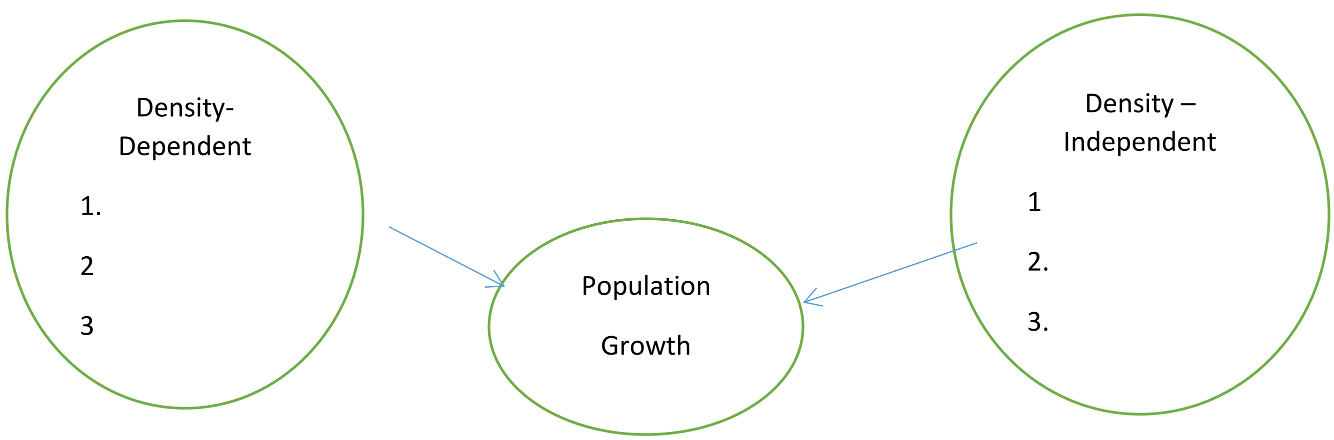
Reading Check # 3

Vocabulary Check:

Term	Definition	How am I going to Remember the Meaning

Reading Check # 4

The **web diagram** below identifies two factors that affect the growth of populations. Write three examples of each factor in the diagram



Activity # 1 Matching for Vocabulary Terms

Create a matching activity using the vocabulary terms above. Study terms then complete.

Human Population Growth

A census, which counts all the people who live in a country, is taken every ten years in the United States. It also collects information about where people live and their economic condition. The United Nations keeps similar information for each country in the world. The study of information about human populations is called **demography** (de MAH gra fee). Information about populations includes size, density, distribution, movement, birthrates, and death rates. Human population has grown at a rapid rate in recent years. Scientists estimate that it took from the time of the first humans to 1800 for the world human population to reach 1 billion. In 1930, there were 2 billion people. In 1999, there were 6 billion people. If this rate continues, scientists estimate that in 2050 there will be 9 billion people on Earth.

Reading Check #5

What is your opinion on 2020 census and the impact the corona virus will have on our economic conditions?

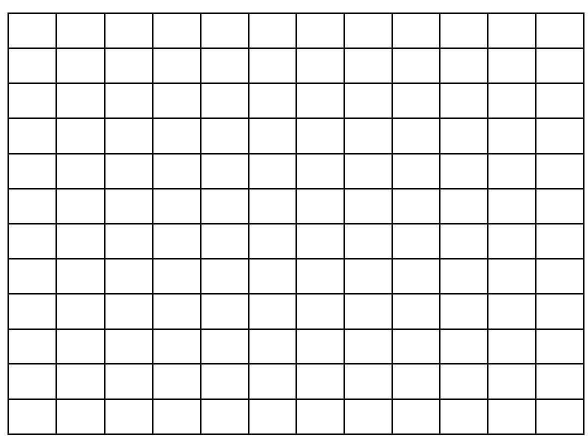
What factors affect the growth of human populations?

Remember that populations can keep growing as long as they have enough resources. Human populations are different from other populations because humans can consciously change their environment. Humans can grow their own resources by farming and raising farm animals. Humans can control limiting factors such as disease. Many illnesses that killed people in the past can now be treated with medicine. People live longer and they are able to produce more children. The children grow up and they produce more children, causing the population to grow.

Activity # 2 Human Population Growth and Carrying Capacity

Step 1- Create Human Population Growth Graph Directions: Use the following data to graph the human population starting in the year 1650. Scale the x-axis from years 1650 through 2050, and the y-axis from 0 to 8 billion people. Make sure that you 1) label your axis, 2) scale the axes so that it uses most of the graph, 3) plot the points, 4) draw a best-fit line; and 5) provide a title for your graph.

Year A.D	# of People(in billions)
1650	.50
1750	.70
1850	1.0
1925	2.0
1956	2.5
1970	3.6
1980	4.0
1991	5.5
2000	6.0
2004	6.4
2008	6.7
2011	6.9



Human Population Growth

Step 2- Answer Analysis Q's after creating the graph. It took 1,649 years for the world population to double from .25 billion people to .50 billion people.

1. How long did it take for the population to double a second time? ____________
2. According to this information, the human population has increased / decreased (circle one) at a decelerated / accelerated rate (circle one).
3. Based on your graph, in what year will the population reach 8 billion? _____________

Activity # 3 Chapter Mystery

A plague of rabbits

When an Australian farmer released 24 wild European rabbits on his farm, things got out of control.

Design a logo and slogan that warns people of dangers of introducing new species.

Activity # 4: Summary (5 sentences)

Write a summary on human population growth. Include limiting factors and predict the carry capacity if the population continues to grow at its current rate. Last include your opinion on the impact of Covid-19 on 2020 Census count of the population.

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Nutrition and Energy Flow

How Organisms Obtain Energy

Autotrophs The ultimate source of energy for all life is the sun. Plants use the sun's energy to make food. This process is called photosynthesis (foh toh SIN thuh suhs). This makes plants autotrophs. Autotrophs (AW tuh trohfs), or producers, are organisms that use light energy or energy stored in chemical compounds to make energy-rich compounds. Grass, trees, and other plants are the most familiar autotrophs, but some one -celled organisms, such as green algae, also make their own food.

Heterotrophs Some organisms cannot make their own food. They must eat other organisms to get their food and energy. These organisms are called consumers, or heterotrophs (HE tuh ruh trohfs). Some heterotrophs, such as rabbits, feed only on autotrophs. Other heterotrophs, such as lions, feed only on other heterotrophs. Still other heterotrophs, such as bears and humans, feed on both autotrophs and heterotrophs.

Decomposers There are other organisms called decomposers. They break down the complex compounds of dead and decaying plants and animals. They change these compounds into simpler forms that they can use for fuel. Some protozoans, many bacteria, and most fungi are decomposers.

Reading Check #6

Define autotrophs and heterotrophs in your own words.

Autotrophs: ____

Heterotrophs: ____

Decomposers: ____

Flow of Matter and Energy in Ecosystems

When you eat food, such as an apple, you consume matter. Matter, in the form of carbon, nitrogen, and other elements, flows through the levels of an ecosystem from producers to consumers. Scientists call this flow of matter cycling. The apple is more than matter, though. It also contains some energy from sunlight. This energy was trapped in the apple as a result of photosynthesis. As you cycle the matter in the apple by eating it, some trapped energy is transferred from one level of the ecosystem to the next. At each level, a certain amount of energy is also transferred to the environment as heat.

What are food chains?

Ecologists study feeding relationships and symbiotic relationships to learn how matter and energy flow in ecosystems. These scientists sometimes use a simple model called a food chain. Food chains show how matter and energy move through an ecosystem. In a food chain, nutrients and energy move from autotrophs to heterotrophs to, in the end, decomposers. A food chain is drawn using arrows. The arrows show the direction in which energy is transferred. An example of a simple food chain in a forest ecosystem is shown below. Most food chains are made up of two, three, or four transfers, or steps. Each organism in a food chain represents a feeding step, or trophic (TROH fihk) level, in the transfer of energy and matter. The amount of energy in the last transfer is only a small part of what was available at the first transfer. At each transfer, some of the energy is given off as heat.

Nutrition and Energy Flow

Activity # 5

Use the table below to help you review what you have read. For each of the organisms shown in the food chain, choose three facts from the list below the table that are true. Then write the facts in the table under the correct organism.

Grass → Rabbit → Wolf

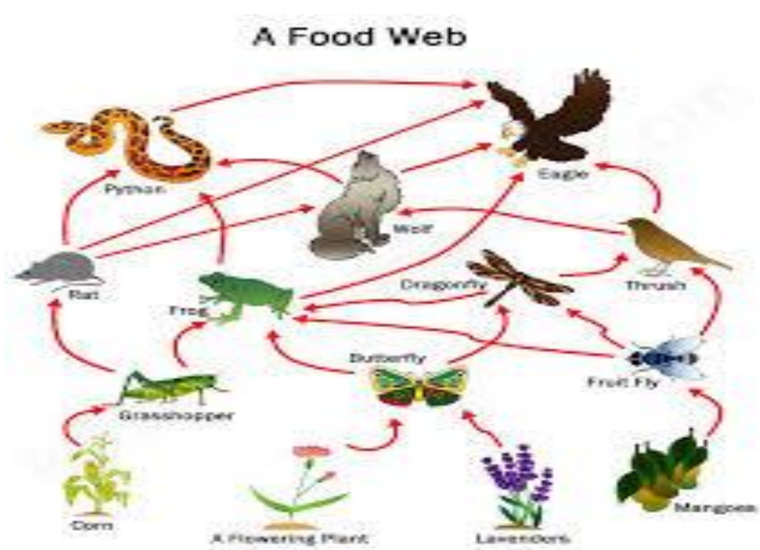
Performs photosynthesis
on second trophic level
eats autotrophs

Primary heterotroph
autotrophs
on third trophic level

Secondary heterotroph
eats other heterotrophs
on first trophic level

Reading check # 7 How does energy flow through an ecosystem?

What is a food web?



A food chain shows only one possible path for the transfer of matter and energy through an ecosystem. Many other paths may exist because many different species can be on each trophic level. The black bear, for instance, does not eat only mice. It also eats berries. There also are other animals in the forest that eat berries and mice. Food webs are models that show all possible feeding relationships at each trophic level in a community. A food web is a more realistic model than a food chain because most organisms depend on more than one type of organism for food.

Reading check # 8

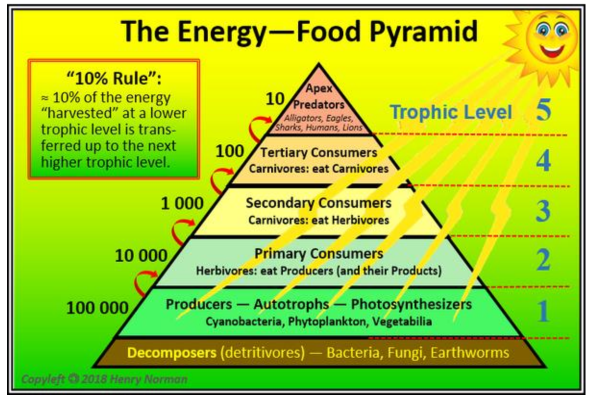
Compare food chains to food webs.

Similarities	Differences

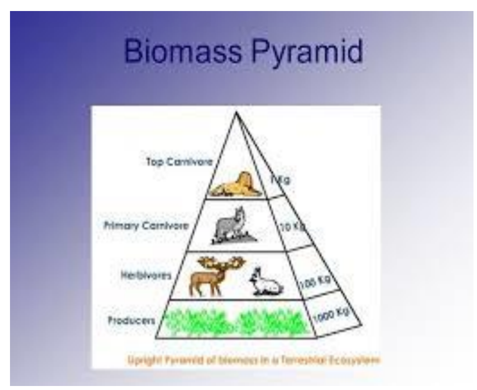
Nutrition and Energy Flow

Transfer of Energy

There are three broad categories of ecosystems based on their general environment: freshwater, marine, and terrestrial. Within these three categories are individual ecosystem types based on the environmental habitat and organisms present. Food chains and food webs deal with both matter and energy. When ecologists want to focus only on energy, they use another type of model—an ecological pyramid. An ecological pyramid shows how energy flows through an ecosystem. Energy flows through an ecosystem in one direction, from sun or inorganic compounds to autotrophs (producers) and then to various heterotrophs (consumers). There are different types of ecological pyramids. Each pyramid has the autotrophs, or first trophic layer, at the bottom. Higher trophic layers are then layered on top of one another. The pyramid of energy shows that the amount of available energy becomes less from one trophic level to the next. The total energy transfer from one trophic level to the next is only about ten percent because organisms do not use all the food energy in the trophic level below them. An organism uses energy to do all the things necessary for life. Organisms use energy to move, to interact with their environment, and to digest their food. They also use energy to build body tissue. Some of this energy is given off as heat. The law of conservation of energy states that energy is neither lost nor gained. Even though some of the energy transferred at each trophic level enters the environment as heat, it is still energy. It is just in a different form. A pyramid of numbers shows the number of organisms eaten by the level above it. In most cases, the number of organisms decreases at each higher trophic level.



Biomass is the total weight of living matter at each trophic level. A pyramid of biomass shows the total dry weight of living material at each trophic level. Cycles in Nature Matter, in the form of food, moves through every organism. In this way, matter is found at every trophic level. Matter is never made or destroyed. It just changes form as it cycles through the different trophic levels. There is the same amount of matter today as there was when life on Earth began.



Reading check # 9

What is each level on a pyramid called? ________________

What percent of energy is transferred from each level?

____

What are some life processes that require energy? ________________

Organisms and Their Environment

What is ecology?

The branch of biology that developed from natural history is known as ecology. Ecology is the study of relationships between organisms and their environment. Ecologists use both qualitative and quantitative research.

What place does a species have in its habitat?

Though several species may share a habitat, the food, shelter, and other needed items in that habitat are often used in different ways by each species. For example, if you turn over a log, you may find a community of millipedes, centipedes, insects, slugs, and earthworms. Each species has its own niche. A niche (neesh) is all strategies and adaptations a species uses in its environment. It is how the species meets its specific needs for food and shelter. It is how and where the species survives and reproduces. A species' niche includes all its interactions with the biotic and abiotic parts of its habitat. Two species cannot exist for long in the same community if they both have the same niche. There is too much competition. In the end, one species will gain control over the resources in the community. The other species will either die out in that area, move somewhere else, or change in some way to fill another niche.

Symbiosis

People once thought that animals in the same environment fought each other for survival. In reality, most species survive because of the relationships they have with other species. A relationship in which there is a close and permanent association between organisms of different species is called symbiosis (sihm bee OH sus). Symbiosis means living together. There are three major kinds of symbiosis—mutualism, commensalism, and parasitism. **Mutualism** (MYEW chuh wuh lih zum) is a relationship between two species that live together in which both species benefit. The relationship between ants and an acacia (uh KAY shuh) tree is a good example of mutualism. The ants protect the tree by attacking any animal that tries to feed on the tree. The tree provides nectar as a food for the ants. The tree also provides a home for the ants. In an experiment, ecologists removed the ants from some acacia trees. Results showed that the trees with ants grew faster and lived longer than the trees with no ants. **Commensalism** (kuh MEN suh lih zum) is a relationship in which only one species benefits and the other species is not harmed or helped. For example, mosses sometimes grow on the branches of trees. This does not help or hurt the trees, but the mosses get a good habitat. **Parasitism** (PER uh suh tih zum) is a relationship in which a member of one species benefits at the expense of another species. For instance, when a tick lives on a dog, it is good for the tick but bad for the dog. The tick gets food and a home, but the dog could get sick. The tick is a parasite. A parasite is the organism that benefits from the relationship. The dog is a host. The host is the organism that is harmed by the relationship.

Reading Check: # 10

1. What is the difference between biotic and abiotic factors? List 3 examples of each.

   ____

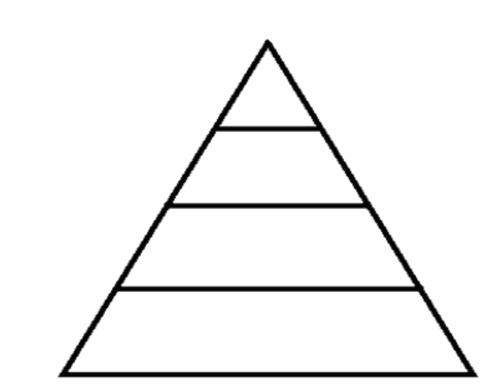
2. Complete the table below.

Symbiotic Relationships	Description	Examples
Mutualism		
Commensalism		
Parasitism		

Activity # 6

Use the pyramid diagram below to help you review what you have read. List the four levels that ecologists have organized the living world into. Start with the least complex level at the bottom and work your way up.

Community, ecosystem , species, population



Activity # 7

In Column 1 are some new concepts you learned about in this section. Column 2 gives one example of each concept. Use the line next to each concept to put the letter of the example that matches it

New Concept	Examples
_____1. Abiotic factor	a. an owl eating a mouse
______2. Habitat	b. rain forest
_____3. Predator-prey relationship	c. rain
______4. Biological community	d. a tick on a cat
______5. Parasitism	e. insects, earthworm, slugs under a log

Succession

Changes over Time Succession (suk SE shun) is the process of gradual, natural change and species replacement that takes place in the communities of an ecosystem over time. There are two types of succession— primary and secondary. The ability of living things to survive the changes in their environment is called **tolerance**. An organism reaches its limits of tolerance when it gets too much or too little of an environmental factor. For example, corn plants need warm, sunny weather and a regular supply of water. If these conditions do not exist over a long period of time, the plants may survive, but they will not produce a crop. The figure above shows the range of tolerance for organisms.

What is primary succession?

Primary succession takes place on land where there are no living organisms. For example, when lava flows from a volcano, it destroys everything around it. When it cools, land forms, but there are no living organisms in the new land. The first species to live in such an area is called a pioneer species. Decaying lichens, along with bits of sediment in cracks and crevices of rock, make up the first stage of soil development. Gradually, other life forms take hold. After some time, primary succession slows down and the community becomes stable. Pioneer species eventually die. Once little or no change occurs, the community is called a climax community. A climax community can last for hundreds of years.

What is secondary succession?

Secondary succession is the pattern of changes that takes place after an existing community is destroyed. The destruction can be caused by a forest fire or when a field is plowed over and not replanted. During secondary succession, as in primary succession, organisms come into the area and change gradually. But, because soil already exists, the species involved in secondary succession are different from those in primary succession. Secondary succession may take less time than primary succession to reach the stage of a **climax community**.

What is a limiting factor?

Anything that limits an organism's ability to live in a particular environment is known as a **limiting factor**. For example, in most mountain areas, there is a timberline. Trees cannot grow above the timberline. It is too high, too cold, too windy, and the soil is too thin. Something that limits one population in a community can have an indirect effect on another life form. A lack of water could cause grass to die in an area. If an animal group living in that area depends on grass for food, its population could decrease as a result.

Succession

Reading check: # 11

1. What is succession?

2. How does limiting factors affect succession?

3. What are pioneer species?

4. After a flood destroys everything growing on the land, which type of succession is most likely?

Activity # 8

Important vocabulary review:

a. climax community   b. limiting factors   c. pioneer species   d. secondary succession   e. tolerance

______the first organisms to grow on a new patch of cooled, hardened lava

______weeds and wildflowers beginning to grow in a field after a corn crop is harvested

______ability of mosquitoes to survive in very different conditions all over the world

______cold temperatures and high winds that prevent tree growth in mountain areas

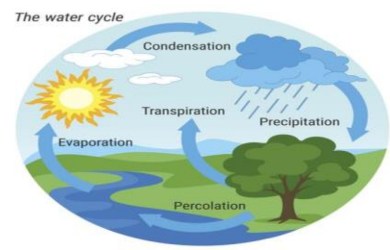
______an old forest that has not had any fire damage in over 200 years

Cycles in Nature Matter

In the form of food, moves through every organism. In this way, matter is found at every trophic level. Matter is never made or destroyed. It just changes form as it cycles through the different trophic levels. There is the same amount of matter today as there was when life on Earth began. Unlike the one way flow of energy, matter is recycled within and between ecosystems.

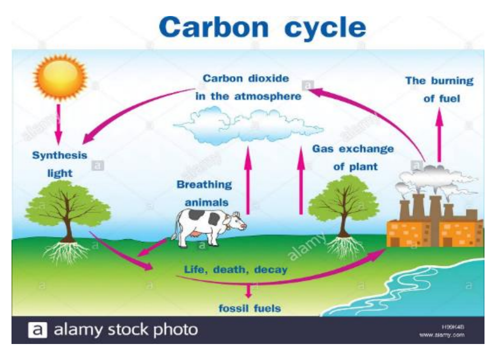
What is the water cycle?

Water also cycles through different stages. It is always moving between the atmosphere and Earth. For instance, when you leave a glass of water out for a few days, some of it seems to disappear. It has evaporated or changed into water vapor in the air. Similarly, water from lakes and oceans evaporates. At some point, this water vapor condenses, or comes together, and makes clouds. After even more condensation, drops of water form. This water then falls back to Earth as rain, ice, or snow.



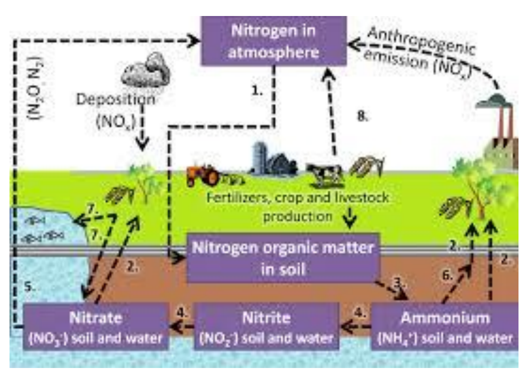
What is the carbon cycle?

Carbon has its own cycle. All life on Earth is based on carbon, and all living organisms need carbon. The carbon cycle starts with autotrophs. In photosynthesis, autotrophs use the sun's energy to change carbon dioxide gas into energy-rich forms of carbon. Autotrophs use this carbon for growth and energy. Heterotrophs then feed on autotrophs or feed on other animals that have already fed on autotrophs. The heterotrophs then use the carbon for growth and energy. As autotrophs and heterotrophs use this carbon, they release carbon dioxide into the air. The carbon cycle continues very slowly. How rapidly it cycles depends upon whether the carbon is found in soil, leaves, roots, in oil or coal, in animal fossils, or in calcium carbonate reserves.



What is the nitrogen cycle?

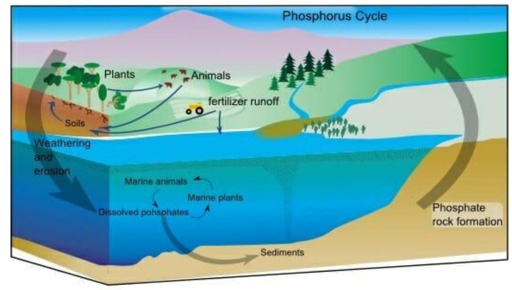
Nitrogen is another element important to living things. Although 78 percent of air is nitrogen, plants cannot use this form well. There are bacteria, though, that change the nitrogen from air to a form plants can better use. Bacteria transform nitrogen gas into ammonia in a process called nitrogen-fixation. This form is found in the soil. Plants use this nitrogen to make proteins. Animals eat the plants and change the plant proteins into animal proteins. These proteins are used in building muscle and blood cells. Urine is an animal waste that lets animals get rid of nitrogen they do not need. This urine returns nitrogen to the soil. When organisms die and decay, nitrogen returns to the soil. Plants then reuse this nitrogen. Soil bacteria also act on these dead organisms and put nitrogen back into the air. In this way, nitrogen is always cycling through the system.



Cycles of Matter

What is the phosphorous cycle?

Phosphorus also cycles through ecosystems. It is another element that all organisms need. It cycles in two ways. In the short-term cycle, plants get phosphorus from the soil. Animals get phosphorus from eating plants. When these animals die, their decaying bodies release phosphorus back into the soil to be used again. In the long-term cycle, materials containing phosphorus are washed into rivers and oceans. As millions of years pass, the phosphorus becomes locked in rocks. Millions of years later, as the environment changes, some of the rock is no longer covered. As this rock wears away, the phosphorus is released back into the atmosphere.



Reading check #12

1. What type of organisms change nitrogen in the air into a form plants can better use?
2. Where is most of the phosphorus stored in the biosphere?

Activity # 9

In the chart below summarize the benefits of each cycle on the ecosystem.

Cycles	Important Facts
Water Cycle	
Carbon Cycle	
Nitrogen Cycle	
Phosphorus Cycle	

Activity # 10: Write 10 Facts

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________

Natural Events & Virginia's ecosystems

Human Impact

As the human population increases, so does human impact on the environment. Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the environment, and intensive farming, have changed Earth's land, oceans, and atmosphere. Some of these changes have decreased the capacity of the environment to support some life form. Humans depend on other organisms. People rely on plants and animals for food. People also rely on plants for wood, cotton, and many types of medical drugs. These are just a few examples of how people depend on animals and plants. If biodiversity continues, people will always have a supply of living things. One day, drugs to cure cancer or HIV might even be found in some of these living things.

Loss of Biodiversity

Biodiversity can be lost when species become extinct. Extinction (ek STINGK shun) is the disappearance of a species when the last of its members dies. A certain amount of natural extinction goes on all the time. But now it seems that more than usual is occurring. This could be due to a difference between human needs and available resources. A species is considered to be an endangered species when its numbers become so low that extinction is possible. When a species is likely to become endangered, it is called a threatened species. African elephants are one example of a threatened species.

Threats to Biodiversity

The complex interactions among species make each ecosystem unique. Within each ecosystem every species is usually well adapted to its specific habitat (the place where a species lives). This means that changes to a species' habitat can threaten the species with extinction. In fact, habitat loss is one of the biggest reasons for decline in biodiversity. Habitat Loss one example of habitat loss is in the Amazonian rain forest. In the 1970s and 1980s, thousands of hectares of land were cleared for firewood and farming. Clearing the land destroyed many habitats. None of them can be built up again easily. Without these habitats, some plants and animals may become extinct.

Habitat Degradation

Habitat degradation is another threat to biodiversity. Habitat degradation is damage to a habitat caused by air, water, or land pollution. Air pollution can cause breathing problems. It can also irritate the eyes and nose. Acid precipitation—rain, snow, sleet, and fog with low pH values—has damaged some forests, lakes, statues, and buildings. Acid precipitation forms when pollutants in the air combine with water vapor in the air. When these acidic droplets hit Earth, the moisture takes nutrients out of the soil. Without the nutrients, many plants become sick and die. The Sun gives off waves, called ultraviolet waves, which can damage living things. Earth has an area in its atmosphere, between 15 km and 35 km altitude, called the ozone layer, which absorbs some of these ultraviolet waves before they reach Earth. Pollution has damaged the ozone layer. Today more ultraviolet waves reach the Earth than in the past. Over some parts of Antarctica, the amount of ozone overhead is reduced by as much as 60 percent during the Antarctic spring. This seasonal reduction of ozone is caused by chemicals such as chlorofluorocarbons (CFCs), which are produced by humans.

Reading Check # 13

1. How does pollution affect the environment? ____
2. Who is responsible for the seasonal reduction of the ozone layer? ______________________________
3. List some examples of ways various types of pollution that is threatening biodiversity.
   ____

Human Impact

Water Pollution

Water pollution degrades, or damages, habitats in streams, rivers, lakes, and oceans. Many different kinds of pollutants can harm the living things in these habitats. Examples include detergents, fertilizers, and industrial chemicals that end up in streams and rivers.

Land Pollution

Land pollution comes in many forms. One form is chemicals used to kill plant pests. Many years ago DDT was often sprayed on food crops to control insects. Birds that ate the insects, plants, or fish exposed to DDT had high levels of DDT in their bodies. The DDT passed from the birds to the predators that ate them. Some of the predators, such as the bald eagle, laid eggs with very thin shells because of the DDT in their bodies. The thin shells cracked easily and many of the eagle chicks died. The use of DDT was banned in the United States in 1972.

Reading Check # 14

1. Explain in your own words why bald eagles were once placed on the endangered species list? Can you infer why they are now a protected species? ____
   ____

Exotic Species

Sometimes people bring new plants or animals to an ecosystem where these organisms have not lived before. In other words, these species are not native to the area. Such species are called exotic species. When they begin to live in a new area, they can upset the biodiversity in that ecosystem. For example, many years ago, goats were taken to Catalina Island off the coast of California. There had never been goats on the island. As the goats multiplied, they ate more and more of the plants on the island. Eventually, 48 kinds of plants that used to be on the island were gone. They disappeared because the goats had eaten all of them. When exotic species are taken to a new area they can multiply quickly because they do not have natural predators in the area.

Reading check # 15

1. If remain unchecked what impact could exotic species have on an ecosystem?
   ____
   ____

Chesapeake Bay watershed and Human activities

The **Chesapeake Bay** serves humans, animals and plants alike. The estuarine ecosystem of the **Chesapeake Bay** is so rich in nutrients that over 3,600 species of plants and animals call it home. Plant life flourishes in this habitat because runoff from the land often carries essential, natural nutrients for plant growth. Forests are critical to the health of the **Chesapeake Bay**. Large stands of **trees** protect clean water and air, provide habitat to wildlife and support the region's economy. Conserving and expanding forest cover is a critical, cost-effective way to reduce pollution and restore the **Bay.**

The **Chesapeake Bay** is **best known for** its seafood production, especially blue crabs, clams, oysters and rockfish (a regional name for striped bass). The **Bay** is also home to more than 350 species of fish including the Atlantic menhaden and American eel. Unfortunately, the **Chesapeake Bay** faces serious problems due to **human** activities, including polluted storm water runoff, over-fertilization and pollution from animal wastes, deforestation, wetland destruction from agricultural, urban, and suburban development, and sea level rise caused by global climate change. A brown river of **sediment** flows into a storm drain, taking chemicals, oil, and other pollutants from streets and yards with it. There are three major contributors to the poor health of our streams, rivers, and the Chesapeake Bay—**nitrogen**, **phosphorus**, and **sediment**.

Reading Check # 16

1. What is the most cost effective way to reduce pollution to the Chesapeake Bay?
   ____

Human Impact

Nearly 17 million people live in the Chesapeake Bay watershed, and demographers estimate that the watershed's population is growing by about 157,000 residents per year. At this rate, the population will reach 20 million by 2030. A growing population creates issues that threaten the Bay ecosystem.

Land use changes

As people move to the area and development increases, land use in the watershed changes. New homes, businesses, and roads replace forests and fields. Lands that once absorbed rainfall have been transformed into impervious surfaces such as parking lots and roads that increase storm water runoff—often full of sediment, excess nutrients, and chemical contaminants—flowing into the Bay and its tributaries. More people also means more cars on the road, increasing traffic congestion as well as air pollution. Air pollution threatens the air we breathe and the land and water. Air and water pollution are intricately linked. Of particular concern to the Chesapeake region are airborne nitrogen and chemical contaminants such as mercury. These airborne pollutants come from large point sources like power plants and industrial facilities, vehicles, and agricultural sources. Airborne nitrogen increases the acidity of surface waters and soils, forms ground-level ozone, and contaminates drinking water. Chemical contaminants persist in the environment, moving through the food web in a process called bioaccumulation. This affects the growth and reproduction of both terrestrial and aquatic species.

Excessive nutrients

Nitrogen and chemical contaminants pose threats to the Chesapeake Bay when they enter the Bay either by falling directly into the water or by falling onto the land and being carried into the water by storm water runoff. Excess nutrients such as nitrogen and phosphorus—most of which come from agricultural sources such as fertilizer and manure—create algae blooms that prevent sunlight from reaching submerged aquatic vegetation, limiting growth of vital underwater Bay grasses. These excess nutrients also deplete dissolved oxygen, necessary for the survival of oysters, crabs, and other bottom-dwelling species in the Bay.

Human Impact

Sedimentation

Excess sediments also contribute to the Bay's poor health. More than 18.7 billion pounds (8.5 billion kg) of sediment enter the Bay each year. Sediments come from the erosion of land and stream banks (watershed sources) and shoreline and nearshore areas (tidal sources). Too much sediment makes the water cloudy, which keeps sunlight from reaching underwater grasses; smothers oysters and other bottom-dwelling species; degrades streams; clogs ports and channels; and binds with pollutants, which then spread throughout the Bay.

Overfishing

The fishing industry is essential to the Chesapeake Bay character and economy. The Bay provides rich grounds for both commercial and recreational fisheries of the Chesapeake's signature species, including blue crabs, oysters, American shad, Atlantic menhaden, and striped bass. Overfishing, along with pollution, diseases, and other stressors, has affected the populations of many fish and shellfish in the Bay and, in cases like the American shad, contributed to closures of commercial fisheries in the Bay.

Invasive species

Plants and animals currently living and reproducing in a habitat outside their historic native range are considered "exotic." Exotic species become "invasive" when they negatively impact an ecosystem or species by encroaching on habitat and food sources. Introduced through a variety of means (some intentional, some not), invasive plants, insects, and diseases threaten all the habitats of the watershed. Invasive plants often grow and reproduce faster than native species, lowering the quality of available food and shelter for native species and out-competing native plants for habitat and pollinators.

Activity # 11

Human Uses (Cause)	Impact (Effect)
Building New Homes etc.	
Overfishing	
Farming	
Invasive Species	

The Bay Today

Increasing temperatures

The Chesapeake region has begun to feel the effects of a changing climate, which has repercussions for the entire ecosystem. Over the last century, the average air temperature along the coastal margins of the Chesapeake Bay has warmed 1.4° F. Between 1950 and 2000 water temperatures rose about 2° F. These warmer air and water temperatures can change the plant and animal species in an area, contribute to expanding dead zones and algal blooms, and encourage the expansion of hardy invasive species such as nutria.

Precipitation

Much of the Chesapeake region is experiencing greater precipitation extremes and a 10 percent increase in average precipitation. The increasing precipitation and storm intensities will lead to greater volumes of runoff and associated toxic chemicals and nutrient pollution in Bay waters.

Precipitation is part of the water cycle, also known as the hydrologic cycle—the movement of water on, above, and below the surface of the Earth.

Sea-level rise

Water levels in the Bay have also risen, with nearly a foot of sea-level rise in some places. Many coastal marshes and small islands have already been lost to rising water, and more are at risk. These marshes provide important ecosystem functions by filtering pollution, protecting shorelines, and providing habitat. Sea-level rise will also affect salinity and distribution of freshwater in the estuary—and consequently the Bay's animals and plants.

Effects on waterfowl

Global warming poses a triple threat to waterfowl in the Chesapeake Bay. First, the summer breeding grounds of many of the Bay's migratory duck species are threatened. Many of these birds breed in the Prairie Pothole Region of south-central Canada and north-central United States, which has an abundance of small, shallow wetlands. With 50 percent of the nation's ducks coming from this area, it is the most important breeding ground for North America's migratory ducks. As the climate warms, these vital wetlands are expected to remain wet for shorter periods or dry up all together.

Second, as global temperatures increase, some migrating waterfowl have begun a phenomenon known as "shortstopping." Many of the birds that formerly spent the winter in the Chesapeake Bay watershed are stopping farther north along their routes as they find more ice-free areas as winters become warmer.

A third threat to the migrating waterfowl will affect those who do make it to their wintering grounds in the Chesapeake. They will likely face a loss of shallow-water habitat as sea levels rise. Higher water levels will inundate the coastal marshes and wetlands that provide vital food for these animals.

Effects on fish and shellfish

Researchers have linked the spread of new diseases and more frequent epidemics to global warming. In the Chesapeake, a new species of mycobacterium recently infected rockfish, and outbreaks are more common in other Bay fish as well. Diseases have decimated native oysters. Poor water quality, pollution, and habitat degradation are factors in these infections, but the stress of warmer water makes the species more vulnerable to disease.

Effects on submerged aquatic vegetation

Resource managers expect sea-level rise to have a direct effect on submerged aquatic vegetation in the Chesapeake Bay. As water depth increases, the sunlight available to the plants decreases, reducing their ability to photosynthesize. Higher water temperatures also affect underwater grasses. For example, higher water temperatures, in conjunction with turbidity and low-light conditions, have contributed to the decline of eelgrass in the last decade. Warmer water, in conjunction with turbidity and low-light conditions, kills the grasses. Some documentation indicates that grasses can recover when water conditions improve, but the trend towards further warming will have the opposite effect. Increased precipitation as a result of climate change alters the amount of water flowing into the Bay, which, in turn, can decrease salinity as more freshwater runoff pours into the Bay. This change in salinity can have a dramatic effect on available habitat for submerged aquatic vegetation. Additionally, species have different abilities to tolerate salinity, so the species that are present may change.

Activity # 11

Impact	Change	Negative or Positive
Increase in Temperature		
Precipitation		
Sea level rise		
Effect on Waterfowl		
Effect on fish and shell fish		
Effect on submerged vegetation		

Reading Check: # 11

1. Where any of the effects positive? ______________

Restoring the Bay

Today the Chesapeake Bay is in peril. We can see the results of human activities and natural events that affect the Bay's health and diversity. The Bay's ability to sustain life has diminished in visible and measurable ways. Key species have declined, threatening the sensitive ecosystem and the livelihoods of communities dependent on Bay harvests. Cutting forests to make way for development has destroyed natural protections for fragile shorelines, habitats, and water quality. The complex network of rivers and streams within the surrounding watershed carries pollution and heavy sediment loads downstream.

From historical accounts left by early explorers, we know how abundant the Chesapeake Bay once was. Through modern science, we know what actions are needed to restore it to health. Through concerted restoration efforts involving all levels of government and countless organizations and individuals, we can see progress. But restoring the Chesapeake Bay is a race against time. Population growth and other human activities are offsetting much of the recent restoration progress. The future health of the Bay depends on accelerating restoration efforts and involving every person who lives in or visits the watershed.

What you can do?

You may think you have little impact on the Chesapeake Bay, but collectively the nearly 18 million people living in the Chesapeake watershed play a very significant role in the health of the Bay and its many tributaries. It will take the actions of all of us to successfully restore the Chesapeake. **Simple everyday actions** make a big difference if we each do our part to save the Bay.

Reading Check # 18

1. What is affecting the restoration progress of the Chesapeake Bay?
   ____
   ____

Activity # 13

Write a letter to your local legislators expressing your concerns for the impact humans are having on the Chesapeake Bay. List at least 3 concerns and ways you suggest we make changes in your community.

Dear ________________________

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