Aquatic Organisms – Where Do Organisms Live and How Do They Survive?

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Introduction

An ecosystem consists of the biological community that occurs in some locale, and the physical and chemical factors that make up its non-living or abiotic environment. There are many examples of ecosystems - a pond, forest, estuary, or grassland. The boundaries are not fixed in any objective way, although sometimes they seem obvious, as with the shoreline of a small pond. Usually the boundaries of an ecosystem are chosen for practical reasons having to do with the goals of the particular study. Studies of ***individuals*** are concerned mostly about physiology, reproduction, development or behavior, and studies of ***populations*** usually focus on the habitat and resource needs of individual species, their group behaviors, population growth, and what limits their abundance or causes extinction. Studies of ***communities*** examine how populations of many species interact with one another, such as predators and their prey, or competitors that share common needs or resources.

While studying ecosystems students will learn: What is an ecosystem, and how can we study one? Is the earth an open or closed system with respect to energy and elements? How do we define "biogeochemical cycles," and how are they important to ecosystems? What are the major controls on ecosystem function? What are the major factors responsible for the differences between ecosystems?

Demographics

I work in the Christina School District. Currently I teach in the city of Wilmington at Bancroft Elementary School. The student demographics are 82.3% African American, 8.7% Hispanic, 6.3% White, and the school is 80.3% low income according to Delaware standards. We are the largest elementary city school within the Christina School District. It is comprised of approximately 421 students. 33% of our students are classified as special education. This year I have all the fifth grade special education students in my classroom. I have a special education teacher in my class along with me. In the past, the unit my students have enjoyed the most was the ecosystems unit. I like to make science fun and interesting. During my lessons I joke a lot with my students all are involved and remain on task. My goal is to get students to fall in love with science, and hopefully they will want to pursue a career in the field. One of the many challenges urban schools often face is students are not exposed to field trip experiences and often times they do not learn or go to locations where they can have hands on experiences with the world in its natural setting. This unit, however, will allow educators to govern field experiences and open opportunities for urban students to learn about the natural environment. This premise is very easy to incorporate and students will love learning how organisms live and survive in a natural setting.

The intended audience for this unit is fifth grade. I would like to teach my students that ponds have a wide variety of microbial life. Students will learn most of Earth is covered by water, but very little of it is freshwater. Freshwater is an important natural resource that many living things need to survive. Students will learn about different bodies of freshwater, including rivers, streams, ponds, lakes, and wetlands. They will also explore how different plants and animals have special adaptations to survive in their freshwater habitats and how it is possible for all of these microbes to survive in various conditions. If something changes in temperature, amount of dissolved oxygen, or food resources, how can these organisms adapt to change?

Background

Many organisms live and survive in the ponds, lakes and streams. A pond is a body of freshwater smaller than a lake. Ponds are naturally formed by a depression in the ground filling and retaining water. Streams or spring water are usually fed into these bodies. They can also be man-made ponds which can be created by damming a stream, or digging a hole near a source of water. Ponds are usually land locked and have no outflow. Because of this, they are considered to be self-contained ecosystems. These ecosystems are often teeming with rich vegetation and diverse forms of life.

By using the idea of “Where do organisms live and how do they survive?” we will design a structured inquiry activity to teach students about pH ranges, temperature ranges, and dissolved oxygen requirements for various aquatic organisms in a local pond and stream setting. Students will use indicators, thermometers, water collection and observation tools, journals, and various pond/stream guides to collect and interpret information from both settings. Students will learn about pH and dissolved oxygen indicators. They will use critical thinking skills to make a list of variables that might have an effect on their data (i.e. seasons, pollutants, climate, etc). Students will be lead to discover the terms diversity and variables. Students may also identify organisms by observing characteristics and comparing them to charts and guides. They will learn to draw conclusions about the conditions in which these organisms live. They will also collaborate with other groups in the lab to compare findings.

Biomes are where several habitats intersect and are global in nature. Biomes are naturally occurring environments, although people can create controlled biomes. Within all biomes, habitats, and ecosystems is an **energy cycle**. This energy cycle determines which populations survive or die. Every living thing on Earth needs energy and ultimately the sun is the source of all energy within an ecosystem.

A **food chain** is how energy is passed, in the form of food, from one organism to another. See lesson 1.02 for a good definition of the organisms in the food chain. The organisms in the food chain are either, **producers, consumers**, or **decomposers**. Some organisms make their own food (producers), while others need to eat other organisms for food (decomposers and consumers). A food chain is the path of food given from the final consumer back to a producer. A food chain is one single path, but in the real world there is not a straight path, but rather a web of paths. This is because many animals do not consume only one type of plant or animal. A **food web** is made up of interlocking food chains.

Water and energy are vital to the survival of an ecosystem; **conservation** is needed. Most ecosystems conserve the resources naturally. An example would be the exchange of carbon dioxide (given off from animals) and oxygen (given off by plants). Another example is the waste of some species becomes the food of another. When there are limited resources, the conservation process is urgent and more visible. If the conservation efforts do not succeed, then species can become **endangered** or even **extinct**. When species become endangered when the available habitat can no longer support the members of a population. When a habitat disappears and all of the members of a population die, the species is considered extinct.

A ***functional group*** is a biological category composed of organisms that perform mostly the same kind of function in the system; for example, all the photosynthetic plants or primary producers form a functional group. Membership in the functional group does not depend very much on who the actual players (species) happen to be, only on what function they perform in the ecosystem.

Processes of Ecosystems

Ecosystems have energy flows and ***ecosystems cycle materials***.

These two processes are linked, but they are not quite the same. Energy enters the biological system as light energy, or photons, is transformed into chemical energy in organic molecules by cellular processes including photosynthesis and respiration, and ultimately is converted to heat energy. This energy is dissipated, meaning it is lost to the system as heat; once it is lost it cannot be recycled. Without the continued input of solar energy, biological systems would quickly shut down. Thus, the earth is an ***open system*** with respect to energy.

Elements such as carbon, nitrogen, or phosphorus enter living organisms in a variety of ways. Plants obtain elements from the surrounding atmosphere, water, or soils. Animals may also obtain elements directly from the physical environment, but usually they obtain these mainly as a consequence of consuming other organisms. These materials are transformed biochemically within the bodies of organisms, but sooner or later, due to excretion or decomposition, they are returned to an inorganic state. Often bacteria complete this process, through the process called decomposition or mineralization.

During decomposition these materials are not destroyed or lost, so the earth is a ***closed system*** with respect to elements (with the exception of a meteorite entering the system now and then). The elements are cycled endlessly between their biotic and abiotic states within ecosystems. Those elements whose supply tends to limit biological activity are called ***nutrients.***

The Transformation of Energy

The transformations of energy in an ecosystem begin first with the input of energy from the sun. Energy from the sun is captured by the process of photosynthesis. Carbon dioxide is combined with hydrogen (derived from the splitting of water molecules) to produce carbohydrates (CH_20). Energy is stored in the high energy bonds of adenosine triphosphate, or ATP (adenosine triphosphate it is the main source of energy in a cell).

The prophet Isaah said "all flesh is grass," earning him the title of first ecologist, because virtually all energy available to organisms originates in plants. Because it is the first step in the production of energy for living things, it is called ***primary production***. ***Herbivores*** obtain their energy by consuming plants or plant products, ***carnivores*** eat herbivores, and ***detritivores*** consume the droppings and carcasses of us all. A simple food chain, in which energy from the sun, captured by plant photosynthesis, flows from ***trophic level*** to trophic level via the ***food chain***. A trophic level is composed of organisms that make a living in the same way that is, they are all ***primary producers*** (plants), ***primary consumers*** (herbivores) or ***secondary consumers*** (carnivores). Dead tissue and waste products are produced at all levels. Scavengers, detritivores, and decomposers collectively account for the use of all such "waste." Consumers of carcasses and fallen leaves may be other animals, such as crows and beetles, but ultimately it is the microbes that finish the job of decomposition. Not surprisingly, the amount of primary production varies a great deal from place to place, due to differences in the amount of solar radiation and the availability of nutrients and water. Oftentimes ***energy transfer through the food chain is inefficient.*** This means that less energy is available at the herbivore level than at the primary producer level, less yet at the carnivore level, and so on. The result is a pyramid of energy, with important implications for understanding the quantity of life that can be supported.

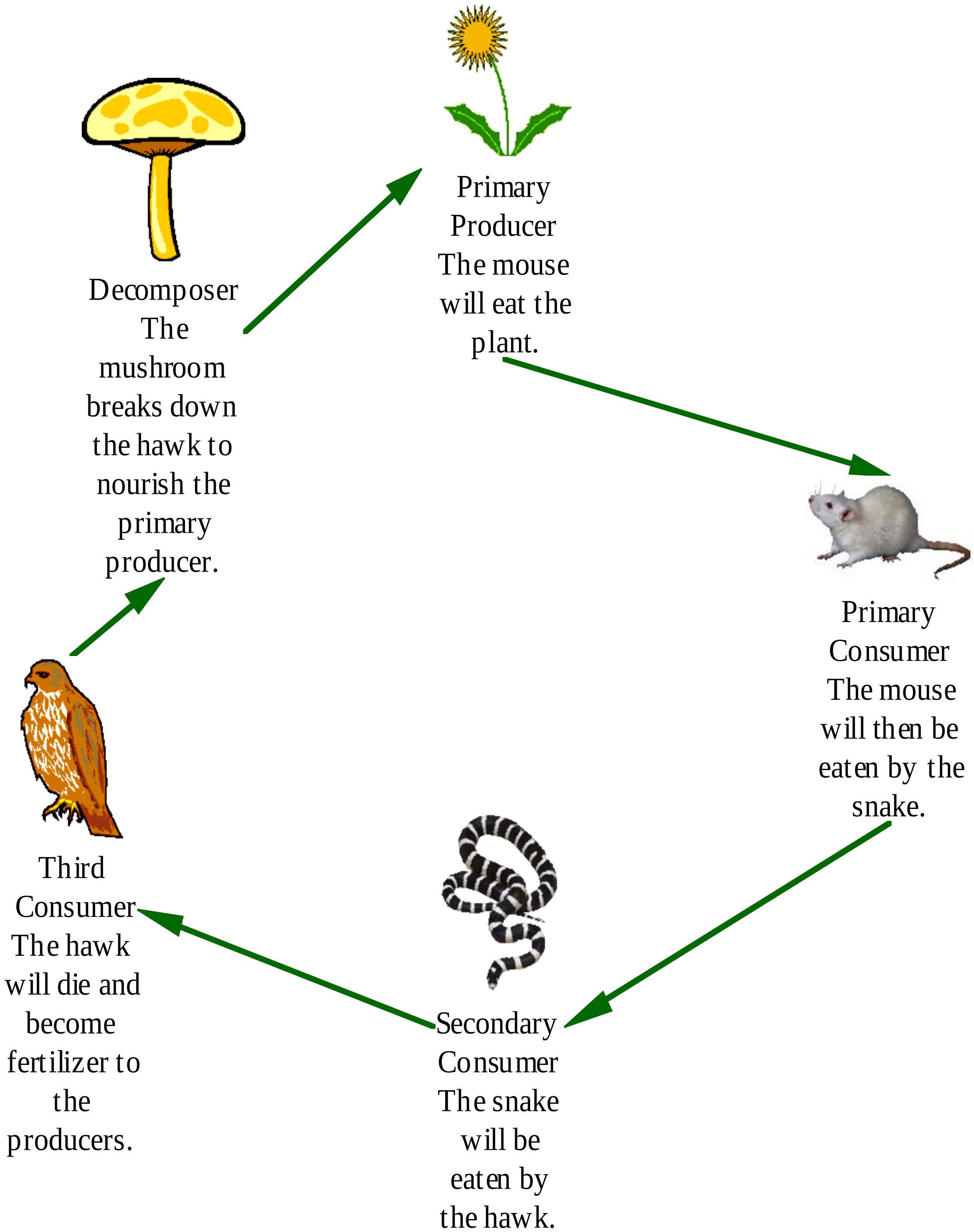
Usually when we think of food chains we visualize green plants, herbivores, and so on. These are referred to as ***grazer food chains***, because living plants are directly consumed. In many circumstances the principal energy input is not green plants but dead organic matter. These are called ***detritus food chains***. Examples include the forest floor or a woodland stream in a forested area, a salt marsh, and most obviously, the ocean floor in very deep areas where all sunlight is extinguished 1000's of meters above.

Finally, although we have been talking about food chains, in reality the organization of biological systems is much more complicated than can be represented by a simple "chain." There are many food links and chains in an ecosystem, and we refer to all of these linkages as a ***food web***. Food webs can be very complicated, where it appears that ***"everything is connected to everything else,"*** and it is important to understand what the most important linkages in are in any particular food web.

Biogeochemistry

How can we study which of these linkages in a food web are most important? One obvious way is to study the flow of energy or the cycling of elements. For example, the cycling of elements is controlled in part by organisms, which store or transform elements, and in part by the chemistry and geology of the natural world. The term ***Biogeochemistry*** is defined as the study of how living systems influence, and are controlled by, the geology and chemistry of the earth. Thus biogeochemistry encompasses many aspects of the abiotic and biotic world that we live in.

There are several main ***principles and tools*** that biogeochemists use to study earth systems. Most of the major environmental problems that we face in our world today can be analyzed using biogeochemical principles and tools. These problems include global warming, acid rain, environmental pollution, and increasing greenhouse gases. The principles and tools that we use can be broken down into 3 major components: ***element ratios, mass balance, and element cycling***.


Primary Producer The mouse will eat the plant.
Primary Consumer The mouse will then be eaten by the snake.
Secondary Consumer The snake will be eaten by the hawk.
Third Consumer The hawk will die and become fertilizer to the producers.
Decomposer The mushroom breaks down the hawk to nourish the primary producer.

The Geography of Ecosystems

Climate differences from place to place largely determine the types of biomes that exist. The word "biome" is used to describe a major vegetation type, such as tropical rain forest, grassland, tundra, etc., extending over a large geographic area. It is never used for aquatic systems, such as ponds or coral reefs. It always refers to a vegetation category that is dominant over a very large geographic scale, and so is somewhat broader than an ecosystem. Every place on earth gets the same total number of hours of sunlight each year, but not the same amount of heat. The sun's rays strike low latitudes directly but high latitudes obliquely. This uneven distribution of heat sets up not just temperature differences, but global wind and ocean currents that in turn have a great deal to do with where rainfall occurs. Add in the cooling effects of elevation and the effects of land masses on temperature and rainfall, and we get a complicated global pattern of climate.

Ecosystems come in a variety of sizes. They can be as small as a puddle of rain or as large as a continent. When any group of living and nonliving things interact, it can be considered an ecosystem. Any type of ecosystem is an **open system** in the sense that energy and matter are transferred in and out of the system. Natural ecosystems are made of both abiotic factors (air, water, rocks, energy) and biotic factors (plants, animals, and microorganisms).Within all ecosystems there are **habitats** that also vary in size. The habitat is where the population lives. A **population** is considered any group of living organisms of the same kind living in the same place at the same time. When all of the populations interact, they form a **community.** Non-living things interact with the community of living things to form the ecosystem. Within the habitat, the needs of the organisms must be met. These needs are food, water, temperature, shelter, oxygen, and minerals. If the needs of the population are not met, that population will move to an area more suited to its needs. The processes of **competition, predation, cooperation,** and **symbiosis** occur because two differing populations cannot occupy the same **niche** at the same time. This means habitats are specific to a population. Each population has its own habitat though several populations may share a habitat.

Summary

Ecosystems are made up of abiotic (non-living, environmental) and biotic components, and these basic components are important to nearly all types of ecosystems. Ecosystem Ecology looks at energy transformations and biogeochemical cycling within ecosystems. Energy is continually input into an ecosystem in the form of light energy, and some energy is lost with each transfer to a higher trophic level. Nutrients, on the other hand, are recycled within an ecosystem, and their supply normally limits biological activity. So, "energy flows, elements cycle".

Energy is moved through an ecosystem via a food web, which is made up of interlocking food chains. Energy is first captured by photosynthesis (primary production). The amount of primary production determines the amount of energy available to higher trophic levels.

A biome is a major vegetation type extending over a large area. Biome distributions are determined largely by temperature and precipitation patterns on the Earth's surface.

Rationale

I am designing a set of materials focused around an Ecosystems Unit for fifth graders. The rationale behind my decision is two-fold. First students have a difficult time understanding the cycling of materials, energy, and food within an ecosystem. Students have misconceptions about how organisms obtain food; they believe it is taken directly from the environment, as we do. In order to better understand the flow of energy students must be able to understand that organisms obtain food in a variety of ways and this concept is directly related to how energy flows through and ecosystem.

Second, as a district we are focusing on varying instruction that is closely related to differentiated instruction. We are working to develop all of our lessons around the idea that all students learn differently, thus we are developing lessons and projects that allow students to have a variety of presentations and activities that focus on a wide range of learning abilities. All of the lessons developed will be focused around the student learning objectives and standards set forth The Next Generation Science Standards. Differentiated instruction can be defined as, “a process to approach teaching and learning for students of differing abilities in the same class, the intent of differentiating instruction is to maximize each student’s growth and individual success by meeting each student where he or she is, and assisting in the learning process”(Hall, 2002). The idea behind differentiated instruction not only allows for students to decide what is the best activity or project for themselves, but it allows the student to feel some sense of entitlement and control over how they learn.

In this field-based activity, students will investigate the water quality and organisms at their local pond and stream. Students will test water samples for pH level, water temperature, air temperature, dissolved oxygen levels, turbidity and the presence of organisms. Students will also note vegetation present along the shore as well as vegetation observed in other areas. Students will record and analyze their findings following the lab.

Class Preparation

Students will have a class period on outdoor learning etiquette. Students will be given an overview of the procedures for the lab. I will give students time to explore pH with other substances in the regular lab setting. Instruction on how to read and record water and air temperature will already be given ahead of time. This lab will reinforce the aquariums and terrariums we made in class although it will probably yield very different results.

Description and Teaching Materials

I will explain that they will be visiting the pond over in South Bridge. The purpose of the trip is to investigate the quality of the water and the presence of organisms that might occupy those habitats.

All materials will be laid out for students to observe as directions for the next day's lab are given. Students will be introduced to the thermometers, pH strips, dissolved oxygen tablets, turbidity tube, collecting vials, and observation trays. I will lead the students step by step through the investigation. Students will record these steps in their journal for future reference. The next day, the students will take their investigation out into the field lab. Students will begin taking their water samples and performing their water tests on their samples. They will collect and record observations of organisms, using guides and charts to aid in identification.

Following the investigations, students will bring their small group findings back to the lab for comparison, collaboration, and further discussion. The teacher will lead the students to draw conclusions based on their findings. Students will also be challenged to come up with a list of factors or variables which might affect the pH, dissolved oxygen levels, temperature, clarity, etc. Students will make a poster to illustrate their findings.

Assessment

Students will turn in their completed work in their science journals. Student work will be evaluated on both the sketches and the writing that went with them. Students should have generated some kind of chart for keeping track of measurements. Students will also be evaluated on their lab performance within their group. Students should use correct labeling for measurements taken and summarize in paragraph form when comparing the stream and pond data.

Overview

This series of lessons was designed to meet the needs of 5th grade students for extension beyond the standard curriculum with the greatest ease of use for the educator. The lessons may be given to the students for individual self-guided work, or they may be taught in a classroom or a home-school setting. This particular lesson plan is primarily effective in a classroom setting. As the environment becomes an ever-increasing matter of national and international importance, the students' knowledge of ecosystem dynamics gains in value. In addition to being a core requirement of science standards across the country, the study of ecosystems is interesting to students, creating an arena in which complex ideas become accessible to learners.

Next Generation Science Standards

5-PS3-1   Energy
Students who demonstrate understanding can:
Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun**.**

5-PS3-1 Relationships
Students identify and describe the relevant relationships between components, including: The relationship between plants and the energy they get from sunlight to produce food. The relationship between food and the energy and materials that animals require for bodily functions (e.g., body repair, growth, motion, body warmth maintenance). The relationship between animals and the food they eat, which is either other animals or plants (or both), to obtain energy for bodily functions and materials for growth and repair. Students use the models to describe causal accounts of the relationships between energy from the sun and animals' needs for energy, including that: Energy from the sun is transferred to animals through a chain of events that begins with plants producing food then being eaten by animals.

5-LS2-1   Ecosystems: Interactions, Energy, and Dynamics
Students who demonstrate understanding can: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. Students develop a model to describe a phenomenon that includes the movement of matter within an ecosystem. In the model, students identify the relevant components, including: Matter, Plants, Animals, Decomposers, such as fungi, bacteria.

Students describe the relationships among components that are relevant for describing the phenomenon, including: The relationships in the system between organisms that consume other organisms, including: Animals that consume other animals and animals that consume plants.

5-ESS2-2 Earths Systems
Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

5-ESS3-1.
Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Guiding Questions

What is an ecosystem and what are its parts and functions?
What can challenge an ecosystem?
What are the roles of the water and food cycles in an ecosystem?

Learning Objectives

After completing the lessons in this unit, students will be able to:
Identify the fundamental structure and function of an ecosystem.

Students will explain how diversity of populations within ecosystems relates to the stability of ecosystems.

Students will explain how plants and animals depend on each other and their physical environment.

Students will make and record observations, then analyze and communicate the collected data, define observations and inferences, make, describe, and/or use models, describe how changes occur and can be measured, conduct scientific tests, use appropriate tools and techniques to gather and display data, use data to construct a reasonable explanation, make predictions based on data, analyze and communicate the adaptations of plants and animals and how they live and possibly survive in a pond and stream.

I provided the following terms along with definitions for students to easily understand. These terms were presented on a power point slide show along with images.

Ecosystem:

- Anywhere living things are found
- All living and nonliving things in an area
- Nonliving things include: Air, Water, Soil, Temperature, Sun

Population: Group of organisms of 1 species that live in an area at same time

Community: Group of populations all in an area.

Biomes: Large ecosystem around world with generally the same climate and organisms. Together they make up the biosphere.

Niche: Role an organism has in an ecosystem.

Habitat: Place in which organisms live

Discuss the composition of an ecosystem, considering both biotic factors (including populations to the level of microorganisms and communities) and abiotic factors.

Show an image of an ecosystem (salt marsh, lake/pond, forest, grassland, etc.) and ask students to identify all the items in they observe.

Create a list or chart of student observations.

Generate deeper thinking by posing the following questions: 1. Are there things we might not be able to see with our eyes? (microorganisms, like bacteria) 2. How are the organisms and objects that you observe interconnected? (living organisms need other organisms for food, shelter, reproduction; they need objects like water and air to survive).

Implementation Strategies: My vision for this unit is implementing it with slide shows since my students are visual learners.

Activity One: Structure and Function of an Ecosystem

Introduction: Ecosystems are normally described by speaking of trophic levels that define the position of organisms according to their level of feeding in comparison to the original energy taken in by primary producers. The energy doesn't cycle and ecosystems need a continuous inflow of high-quality energy in order to maintain their function and structure. For this reason, ecosystems are "open systems" needing a net inflow of energy to continue over time - without the sun, our biosphere would shortly run out of energy! All ecosystems cycle matter and use energy

Instruction: The first lesson will address how an ecosystem is structured and functions.

Whole Group: Students will be presented with a list of vocabulary terms and images of various ecosystems. Students will view the Bill Nye "Ecosystems" video. After the video we will have a class discussion regarding the video to address any misconceptions about ecosystems that students had before we watched the video.

Group Work: Students will be placed in groups of four. I will give each group member a structure and function worksheet which will have six different ecosystems for them to identify and draw a picture that represents the ecosystem and how each system interacts with the environment.

Assessment: Students will have to complete an exit ticket describing the features of an ecosystem

Activity Two: Abiotic and Biotic Factors

Introduction: An ecosystem is an area in which living and nonliving things exist together. Every area in nature contains both living and nonliving things. Living things depend on each other and on nonliving things in order to survive. Ecosystems can be very small or very large. For example, a backyard is an ecosystem and so is an entire desert. There are rainforest ecosystems, underwater ecosystems in oceans and lakes and many other ecosystems as well. The city or town that you live in is an ecosystem. The nonliving things in an ecosystem are known as abiotic factors. The living things are biotic factors. All living things depend on nonliving things like water, minerals, sunlight and air, to survive.

Instruction: I will ask students for the definition of abiotic and biotic factors (living and nonliving materials). I will record the student's definitions on chart paper. The chart paper will be classified as Abiotic and Biotic. All answers will be recorded on the chart paper. I will present to the class a slide show along with images of abiotic and biotic factors. After students have given answers, I will project a slide show along with images to help clarify any misconceptions of abiotic and biotic factors.

Independently: Students will be given a close reading passage on abiotic and biotic factions they will be instructed to read the passage silently, then answer the questions on the worksheet which will be provided for each student to classify. After the reading and worksheet students will be able to distinguish the difference of these factors and how they play a role in an ecosystem.

Journal Prompt: Choose an ecosystem to draw. Their picture should make sense.

Assessment: Students will use a Venn diagram to separate a list of words classifying abiotic and biotic factors.

Activity Three: Land Based Ecosystems:

Introduction: Biomes are defined as "the world's major communities, classified according to the predominant vegetation and characterized by adaptations or organisms to that particular environment. Biomes have changed and moved many times during the history of life on Earth. Recently, human activities have drastically altered these biome boundaries.

Group Work: Students will be placed into groups according to their Biomes (pulled out of a hat). They will use the internet to research their assigned biome and write out all the features using a 4 box Frayer Model on a large piece of construction paper. Group shares with the class their biome poster. As each group shares, students will take notes in their science journal. We will have a short class discussion about the biomes, specifically taking a closer look at the biome we live in.

Independent: Students will complete The Land Based Ecosystems worksheet. I will work more closely with the students who need extra support during the activity.

Assessment: Students will turn in their graphic organizer, not for a grade but so I can look at the organizer for understanding and completeness.

Activity Four: Water Quality Field Experience:

Introduction: This is a mock lab experience before we actually go on the field trip to the Aquatic Resource Center in Southern Delaware. After the experiment is completed, we will hold a class discussion regarding the experience and discuss the various differences of each water type and how human activities impact our water quality. Water quality is one of the most important factors in a healthy ecosystem. Clean water supports a diversity of plants and wildlife. Our actions on land affect the quality of our water. Pollutants, excessive nutrients from fertilizers, and sediment frequently get carried into lakes, and rivers via run-off from urban areas or agricultural fields.

Group Work: Students will be placed into groups of 4 they will be given a water quality testing kit along with a data sheet to test 4 different sources of water. Students will measure the amount of Dissolved Oxygen (DO), Ph (Acidity) Turbidity (Clarity) and Temperature of the 4 various types of water. I will instruct students to record their data on the data sheet. I will monitor students while they are testing and writing down the data results. .

Activity five: Field Trip to The Aquatic Resource Center

Introduction: This Field trip programs are available at the AREC to 5th grade classes statewide as an extension of the Smithsonian Ecosystems curriculum module. Students are challenged to gather, record and interpret data about the tidal salt marsh's plants and animals relative to conditions there, and where possible, role play the work of scientists in surveying such habitats. Aquatic Resources Education Facilities located in the scenic Woodland Beach Wildlife Area bordering Delaware Bay. The 940-foot saltmarsh boardwalk, has an outdoor classroom, & nature trails linking salt marsh, fresh & brackish ponds, swamps and vernal pool wetland habitats. Canoes, fishing tackle, nets, and water monitoring equipment are available.

Group Work: Students will be put into groups of 5. They will have six different lab stations to circulate through. Each lab station runs for approximately 30 minutes. The lab stations are 1. March Pond Macro's – This station consists of questions that students need to identify the name of their macroinvertebrate, draw the macroinvertebrate, describe ways the macroinvertebrate adapted to living in the marsh pond 2. Wetland Plants- Students will identify 8 different plants and saltmarsh grass that grow in the marsh, in addition they will have to brainstorm how wetland plants control erosion and improve water quality. 3. Fishy Findings- students will learn about the common name of fish that are at the marsh they will observe the fish and discuss how they adapt and live in the marsh, along with the food the fish usually eat. 4. Eco-Trail- during this station students will list three factors that make the tidal salt marsh ecosystem a “perfect farm” and what is detritus and how is it important to the marsh ecosystem? 5. Testing the Waters – Students will complete water quality testing on the wetland water that surrounds the marsh; they will test the DO, pH, Salinity, and Turbidity 6. Wildlife Detectives the final station is for students to identify raccoon scant, red fox scant, deer bones, and rabbit bones. All lab stations are have volunteers who work at the Aquatic Resource Center.

Independent: Each student will have an Eco- Explorers worksheet to complete while they are investigating and performers water quality testing.

Appendix 1: The Structure and Function of an ECOSYSTEM

For each section below, read the information in the box on the left, draw a picture to represent the information in the box on the right, and circle the word in the box on the left that you feel is the most important word.

An ecosystem is a group of living organisms interacting with their environment.	
Ecosystems can be very tiny, or they can be as large as the Sahara. For example, a pond in your backyard is an ecosystem.	
Ecosystems that are very large or a series of smaller ecosystems scattered around that have common plants, animals, and qualities are called biomes.	
There are many kinds of biomes; some are terrestrial (on land), and some are marine (water). You may recognize some of them like desert, savannah, tundra, or tropical forest	

Animals and plants live in the ecosystems and biomes that they do because of their Ranges of Tolerance. A Range of Tolerance is the variation a plant or animal can accept in such things as water or temperature. For example, some plants need a lot of water to survive, while others need very little.	
An ecosystem is like a play, with different animals, plants, and non-living things playing the different roles. The role each thing plays is called its ecological niche. Some of the roles are biotic (or living, like plants and animals), while some are abiotic (non-living, like soil, water, wind, or temperature	

Appendix 2: Abiotic and Biotic Factors

Abiotic vs Biotic Factors Worksheet

Name:________________________________ Date: _________________

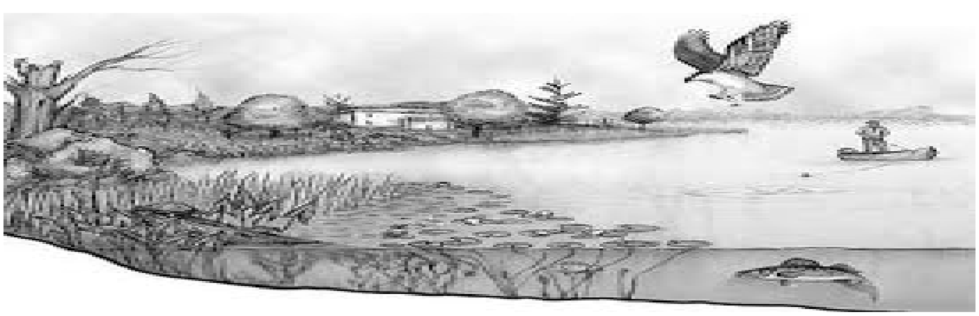
1. The root word BIO means life. What is a BIOTIC factor?
2. The root "A" means not. What is an ABIOTIC factor?

List the abiotic and the biotic factors from the image below

Abiotic Factors	**Biotic Factors**

What is the definition of an abiotic factor?

What is the definition of a biotic factor?



charleslansing.cms**wiki**.**wikispaces**.net/.../**Abiotic**-vs-**Biotic-Factors**

Appendix 3: Part 2 Abiotic/Biotic Factors

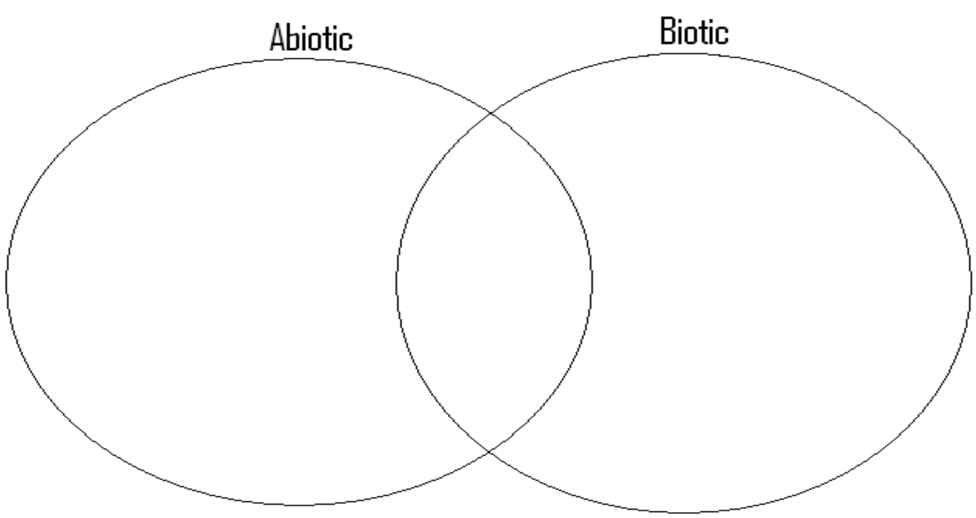
Enter the items from the following list into a Venn diagram

In the center place what contains both biotic and abiotic factors.

- Whale
- Mushroom
- Water
- Desert
- Paper
- Glass
- Temperature
- Coral
- Sand

- Clouds
- Snail
- Steak
- Athletes Foot
- Salad
- Mold
- Grass
- Hair

- Ocean
- Tree
- Rocks
- Dirt
- Gold
- Plastic
- Grapes
- Oxygen
- Tundra



All biotic and abiotic factors are interrelated. In nature you will find that if one factor is changed or removed, it impacts the availability of other resources within the system.

Place either an (**A) for abiotic** or (**B) for biotic** to identify the **bolded** object in the space below.

1. All of the **rocks** ________________ are removed from a desert ecosystem, what would happen to the population of rock dwelling **lizards** _________________ and in turn the animals which eat them.

2. A ten mile area of **trees** _______________ is removed from the tropical rainforest. How will this affect the amount of **water** ________________ and the amount of **oxygen** ____________ in the area?

Choose an ecosystem to draw. In your drawing include the following:

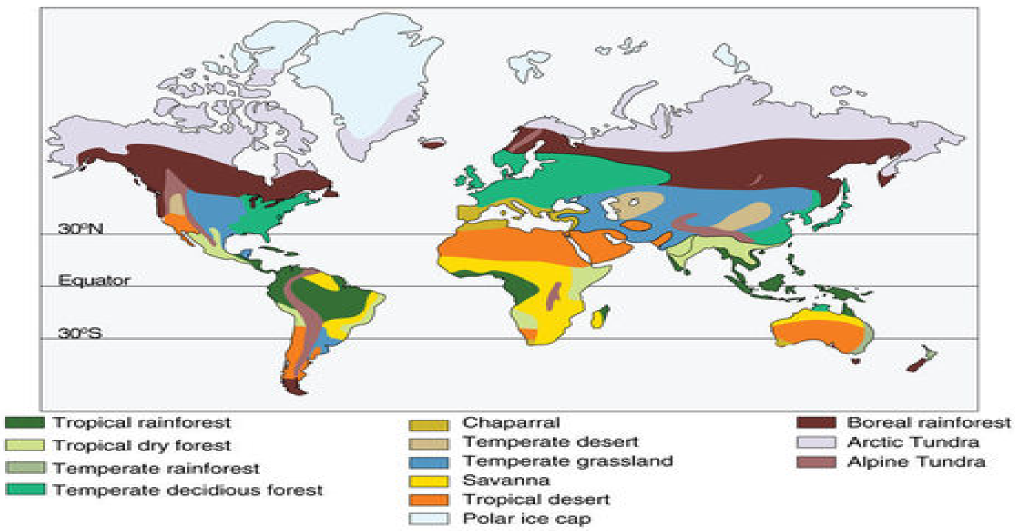
- 10 different biotic factors
- 5 different abiotic factors

Identify all 15 factors and label whether they are **biotic** or **abiotic** factors**.**

- Your picture should make sense. Ex.) There shouldn't be a polar bear in the sand desert!
- Color your picture for extra credit.

Appendix 4: Land Based Ecosystems

Here is a map of the Terrestrial Biomes of the world



Find the areas of the world in the arid desert biome. Based on this map and your knowledge of ecosystems and biomes, answer the following questions:

1. Is the temperate desert biome found on more than one continent? _________

2. What can you infer about the Range of Tolerance of animals and plants living in the Temperate desert?

____

3. What do you think the difference between the desert and Temperate deciduous forest biomes might be?

____

4. Find the biome in which you live. What is it?

____

5. Where else in the world can you find it?

____

6. If you could live in any biome, which one would it be and why?

http://www.bing.com/images/search?q=clip+art+of+terrestrial+biomes&qpvt=clip+art+oterrestial+biomes&qpvt=clip+art+of+terrestial+biomes

Appendix 5: Water Quality Testing through Field Study

Activity: Students make observations and measurements of several water samples. This activity helps students think about different ways to determine water quality.
Key terms: pH, Sediment, Turbidity, Water clarity, Water quality
Objectives
After participating in this activity, students will:
• Develop their own criteria for the quality of water
• Understand that there is more to water quality than "meets the eye"
• Engage in a few water quality tests used by scientists
• Identify solutions as acidic or basic, given their pH
• Identify substances by their chemical properties (pH, acid-base indicators)
• Make accurate measurements with appropriate units
• Identify the need for evidence in making scientific decisions
• Use data/samples as evidence to separate fact from opinion

Water quality is one of the most important factors in a healthy ecosystem. Clean water supports a diversity of plants and wildlife. In turn, our actions on land affect the quality of our water. Pollutants, excessive nutrients from fertilizers, and **sediment** frequently get carried into local lakes and rivers via run-off from urban areas or agricultural fields.

By observing and evaluating several water samples, students begin to consider the factors that influence water quality Scientists measure a variety of properties to determine water quality. These include temperature, acidity (pH), dissolved solids (specific conductance), particulate matter (turbidity), dissolved oxygen, hardness and suspended sediment. Each reveals something different about the health of a water body.

The following water properties are important in determining water quality: These terms are presented in a power point slide show along with images:

Temperature: Water temperature is important to fish and aquatic plants. Temperature can affect the level of oxygen, as well as the ability of organisms to resist certain pollutants.
Acidity - pH: The measurement of pH is a measure of the amount of hydrogen ions ($H+$) present in a substance such as water. Knowing the amount of hydrogen in a substance allows us to judge whether it is acidic, neutral, or basic.
Dissolved Oxygen: A small amount of oxygen, about ten molecules of oxygen per million molecules of water, is dissolved in water. Fish and microscopic organisms need dissolved oxygen to survive.
Turbidity: Turbidity makes the water cloudy or opaque. Turbidity is the amount of particulate matter (such as clay, silt, plankton, or microscopic organisms) suspended in water.
Hardness: The amount of dissolved calcium and magnesium in water determines its "hardness.

Suspended sediment: Suspended sediment is the amount of soil circulating in water. The amount depends in part on the speed of the water flow. Fast-flowing water can pick up and hold, or suspend, more soil than calm.

Materials and Preparation

4 clear glass jars or clear soda bottles with lids
Instant coffee and/or cocoa, salt, and food coloring (to make a purple color)
Local river, pond, creek water
Water Quality Worksheet
Water quality testing kits that can be used to measure oxygen and pH

Preparation for Experiment:

Create water quality jars. Fill the 4 jars with water. (Jar 4 will be filled with local Creek water).
Jar 1 - Add coffee grounds and cocoa powder until the water has a good "dirty" look. Label the jar 1.
Jar 2 - Add food coloring so that the water appears clear purple. Label the jar 2 (Jar 2 will be the school fountain water).
Jar 3 - Mineral water. Label the jar 3.
Jar 4 - Add a few tablespoons of kosher table salt. The salt will dissolve in the water, resulting in a clear colorless solution. Label the jar 4.

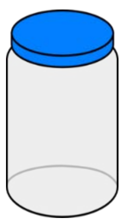
Procedure

1. In small groups, have students examine the water sample jars. You may choose to have students record their observations on the Water Quality Worksheet or in their science journals.
2. Ask groups of students to work together to determine which of the water samples they would be willing to use for such things as fishing, swimming, boating or drinking.
3. After students have observed all the jars, have them share their consensus and rationale for their decisions regarding water use. Prompt students to provide evidence for their decisions. (You may also choose to record the class data in a chart.)
4. Using this shared experience, facilitate a discussion that leads to an agreed upon definition of “water quality.”
5. Have students brainstorm answers to the following questions: What is meant by quality? What is water quality? How can we determine water quality? Why is water quality important to us and to other animals? How did we determine water quality for the bottles? Are these methods trustworthy? How else could we measure water quality? How might scientists measure water quality?

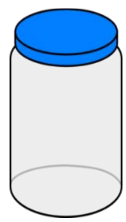
8. Allow groups of students to measure oxygen and pH for the other water samples. Summarize the results on the board. Discuss the results from a scientist's perspective. Which sample has the highest quality based on this data?
9. Discuss whether these results are consistent with the determinations made just by looking at the water.
10. Explain that water quality is a complex concept and there are many other variables that scientists use to measure it. Explain that you can't tell true water quality just by looking at it.

Appendix 6: Water Quality Activity Sheet

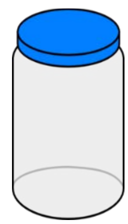
Directions:
1. Look at jars 1-4 that your teacher has provided. Would you use the water in each of those jars to fish? Swim? Boat? Drink? Record your answers on the back of this sheet. Provide reasons for your answers.



Jar 1

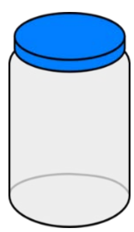


Jar 2



Jar 3

2. Look at jar 4. Would you use the water in that jar to fish? Swim? Boat? Drink?



Jar 4

3. How did we determine water quality for the bottles? Was it an adequate method?

4. How else could we measure water quality?

Bibliography

Borman, F.H. and G.E. Likens. 1970. "The nutrient cycles of an ecosystem." *Scientific American,* October 1970, pp 92-101.

Wessells, N.K. and J.L. Hopson. 1988. *Biology.* New York: Random House. Ch. 44. Biotrackers: Grasslands (3:07)

Physical Geography Video Dialog, 1997. Full Video. *Discovery Education*. Web. 31 July 2013. http://www.discoveryeducation.com

Freshwater Wetlands: Lakes, Ponds, and Pools Box Lunch Media, 2001. Full Video. Discovery Education. Web. 31 July 2013. http://www.discoveryeducation.com

Ecosystem Game Website http://www.sheppardsoftware.com/content/animals/kidscorner/games/producersconsumersgame.swf. Teachers will need to have access to computers for this game. This is a fun website to help students understand the food chain. (assessed December 8, 2015)

Water Quality Testing Website - http://miseagrant.umich.edu/flow/pdf/U2/FLOW-U2-L4-MICHU-08-402.pdf (Accessed December 14, 2014)

What Makes Water Healthy- http://miseagrant.umich.edu/flow/pdf/U2/FLOW-U2-L4-MICHU-08-402.pdf (assessed December 14, 2015)

Ecosystem Structure and Function- http://www.ecosystem.org/structure-and-function, accessed December 14, 2019

The World's Biomes- http://www.ucmp.berkeley.edu/exhibits/biomes/index.php, accessed December 14, 2015

Aquatic Resources Education Center-http://www.dnrec.state.de.us/fw/are.htm, accessed December 14, 2015

Charleslansing.cmswiki.wikispaces.net/file/view/**Abiotic**-vs-**Biotic (**Assessed December 14, 2015)

The Concept of Ecosystem http://www.globalchange.umich.edu/globalchange1/current/lectures/kling/ecosystem/ecosystem.html (assessed December 15, 2015)

5th grade Ecosystems http://www.mensaforkids.org/ (accessed December 8, 2015)

Curriculum Unit Title

Aquatic Organisms – Where Do Organisms Live and How Do They Survive?

Author

Lisa M. Currie

KEY LEARNING, ENDURING UNDERSTANDING, ETC.

Students will be able to identify the fundamental structure and function of an ecosystem

Students will explain how diversity of populations within ecosystems relates to the stability of ecosystems.

ESSENTIAL QUESTION(S) for the UNIT

What is an ecosystem and how can we study one? What are the major controls on an ecosystems function? What are the major factors responsible for the differences between ecosystems?

CONCEPT A

Structure and Function of Ecosystem

CONCEPT B

Landscape Biome

CONCEPT C

Water Quality

ESSENTIAL QUESTIONS A

What is an ecosystem and what are its parts and functions?

What are the abiotic and biotic factors of an ecosystem?

ESSENTIAL QUESTIONS B

What are the roles of water and food cycles in an ecosys-tem?

How do you determine which biome you live in?

ESSENTIAL QUESTIONS C

How can human activities negatively affect water quality? How can human activities positively affect water quality?

Ecosystem Biome
Niche Herbivore
Habitat Omnivores

VOCABULARY B

Population Abiotic
Community Biotic
Turbibity

VOCABULARY C

Dissolved Oxygen Turdbity

Acidic Temperature

ADDITIONAL INFORMATION/MATERIAL/TEXT/FILM/RESOURCES