Grade Level: 6-8
Time Estimate: 3-5 days

ECOSYSTEMS / INSTRUCTOR INFO

Summary

This lesson includes vocabulary, content, and problem solving activities to help students learn about ecosystems. Students will learn how to identify the components of an ecosystem and will be able to describe how organisms co-exist in an environment. Students will also learn about ecological succession and how changes within an environment can affect multiple components.

Part 1. What is an Ecosystem?
Part 2. Food Chains
Part 3. Biodiversity and Relationships
Part 4. Ecological Succession
Activity 1. Memory Game – Ecosystems
Activity 2. Ecosystem Tag

Goals & Objectives

The students will:

- learn the components of an ecosystem;
- define producers, consumers, and decomposers;
- learn the components of a food chain;
- be able to describe how organisms co-exist;
- learn about biodiversity and conservation measures;
- learn about energy transfer within a food chain.

// STANDARDS

This lesson aligns with the following TEKS:
Grade 6 Science: 1A, 1B, 2A, 3A, 4A, 9C, 12E, 12F
Grade 7 Science: 1A, 1B, 2A, 3A, 4A, 5C, 10A, 10B, 10C
Grade 8 Science: 1A, 1B, 2A, 3A, 4A, 11A, 11B, 11C, 11D

This lesson aligns with the following Next Generation Science Standards:

Framework

1. Asking questions and defining problems.
6. Constructing explanations.
7. Engaging in argument from evidence.
8. Obtaining, evaluating, and communicating information.

MS. Matter and Energy in Organisms and Ecosystems – MS-LS1-6, MS-LS2-1, MS-LS2-3, MS-LS2-4

Disciplinary Core Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)

LS2A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

MS. Interdependent Relationships in Ecosystems – MS-LS2-2, MS-LS2-5

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)

Crosscutting Concepts

Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-5)

Helpful Tips

1) The content in this lesson is based on the conservation work of OCEARCH™ and the Global Shark Tracker™. Spend a few minutes getting familiar with the website and the tracker if you have not done so already. The Global Shark Tracker™ is also available as an app for iPhone and Android.
2) This lesson plan is designed to be adaptable to suit your specific needs. Use the entire lesson plan or just parts of it. This material can be expanded to be an entire unit or condensed for just one day in the classroom.
3) Vocabulary words will be underlined as they first appear in the lesson plan. A complete list of vocabulary words is included as well.
4) Answers to questions and prompts for discussions will appear in *italics*.
5) Optional activities and content (side notes) will appear in a box. Use these to enhance your lesson and adapt it to suit your needs!
6) Have questions for OCEARCH Expedition Leader, Chris Fischer? Email info@OCEARCH.org to schedule a Skype session and let your students/child talk directly to Chris and the OCEARCH crew!
7) Email all questions about this lesson to info@OCEARCH.org.

Vocabulary

Abiotic Factor – Abiotic factors are non-living physical or chemical components in an ecosystem. Abiotic factors include light, temperature, and non-living objects.
Biodiversity – The diversity or variety of living organisms, such as plants and animals, in a particular area.
Biotic Factor – Biotic factors are living organisms in an ecosystem.
Carnivore – An animal that derives its energy and nutrient requirements from consuming other animals.

Climax Community – Dominant organisms or community in a stable, unchanged ecosystem. This is the final stage in succession.
Commensalism – A relationship between two or more kinds of organisms in which one obtains food or benefits from the other without damaging or benefiting it.
Community – Group of organisms living and interacting with each other in the same area.
Consumer – An organism that feeds on plants or other animals. There are three types of consumers: herbivore, carnivore, and omnivore.
Decomposer – Organisms that eat decaying plant and animal matter, usually bacteria and fungi.
Ecological Succession – Gradual process in which ecosystems change and develop over time.
Ecosystem – A community of living organisms and non-living things that function together.
Food Chain – Illustrates the order that animals consume plants or other animals. A food chain consists of linear links in a food web starting with plants and ending with animals that consume other animals.
Food Web – The sum of all interacting food chains in an ecosystem.
Herbivore – An animal that derives its energy and nutrient requirements from consuming plants.
Host – An animal or plant that supports and provides nutrients for a parasite. The host is usually harmed by this relationship.
Mutualism – Relationship between two or more species in which both (all) individuals benefit from the relationship.
Niche – Status of an organism within its environment or community, including its specific role or function. An organism's niche includes its interactions with other species within the community.
Omnivore – An animal that derives its energy and nutrient requirements from consuming both plants and animals.
Parasite – An organism that lives inside or on another organism called the host. Parasites benefit from this relationship by deriving nutrients at the expense of the host.
Pioneer Species – First organism to come into a newly developed or changed ecosystem.
Phytoplankton – Free floating aquatic plants that drift with the currents.
Primary Consumers – Animals that eat primary producers, or plants. Primary consumers are herbivores.
Primary Succession – The gradual change of a barren, new ecosystem that has never been previously colonized.
Producer – Various organisms that produce their own energy from sunlight. Many producers are food sources for other organisms.
Quaternary Consumers – Animals that eat tertiary consumers.
Secondary Consumers – Animals that eat primary consumers, or herbivores. Secondary Consumers include carnivores and omnivores.
Secondary Succession – The gradual change in a community which takes place on a previously colonized habitat.
Seres – A series of ecological communities formed in ecological succession.
Species – One of the lowest taxonomic ranks and is defined as a group of organisms or individuals capable of interbreeding and producing offspring.
Symbiotic Relationship – Symbiotic means living together. A symbiotic relationship is a close and usually long-term interaction or association between two or more species who all benefit from the relationship.
Tertiary Consumers – Animals that eat secondary consumers.
Trophic Level – Position an organism has in a food chain.
Zooplankton – Free floating microscopic animals that drift with the currents.

Grade Level: 6-8

Time Estimate: 5-15 mins

ECOSYSTEMS / PRE-LESSON ASSESSMENT

Use the following true/false and multiple choice questions as an introduction/warm-up to the lesson topics. You can do this in a verbal or written format, as a game, individually, or as a whole class! A handout is provided if you wish to hand the questions out in a quiz format.

The questions do not need to be graded. They are intended to give the students an idea of what they will be learning and to see what they already know.

1) True or False A decomposer is an organism that feeds on and breaks down dead plant or animal matter.
   Answer: *True*
2) True or False An ecosystem is a community of only living things that live and function together.
   Answer: *False*
3) True or False Primary succession is the gradual change in a community which takes place on a previously colonized habitat.
   Answer: *False*
4) What type of relationship is it called when one organism benefits and the other organism is not affected?
   a. parasitism
   b. mutualism
   c. commensalism
   d. predator-prey
   Answer: *c*
5) An omnivore _____.
   a. consumes only plants
   b. consumes only animals
   c. consumes both plants and animals
   d. produces its own food
   Answer: *c*
6) What percentage of energy is transferred from one trophic level to the next?
   a. 15%
   b. 25%
   c. 50%
   d. 10%
   Answer: *d*
7) What is biodiversity?
   a. interactions between two species
   b. variety of species in an area
   c. gradual change or replacement of one community with another
   d. status of an organism within its environment or community
   Answer: b

Name: _____ Date: _____

Ecosystems

Select the correct answer(s) to each of the following questions.

1) True or False A decomposer is an organism that feeds on and breaks down dead plant or animal matter.

2) True or False An ecosystem is a community of only living things that live and function together.

3) True or False Primary succession is the gradual change in a community which takes place on a previously colonized habitat.

4) What type of relationship is it called when one organism benefits and the other organism is not affected?

d. parasitism
e. mutualism
f. commensalism
d. predator-prey

5) An omnivore _____.

a. consumes only plants
b. consumes only animals
c. consumes both plants and animals
d. produces its own food

6) What percentage of energy is transferred from one trophic level to the next?

a. 15%
b. 25%
c. 50%
d. 10%

7) What is biodiversity?

a. interactions between two species
b. variety of species in an area
c. gradual change or replacement of one community with another
d. status of an organism within its environment or community

Grade Level: 6-8

ECOSYSTEMS / LESSON PLAN

INTRODUCTION **3-5 mins**

Ecosystem is an abbreviation for ecological systems. An ecosystem includes both living (plants, animals, and organisms) and non-living (rocks, sun, soil, and water) components. There is no specific size to an ecosystem; they can be small or large. An entire ecosystem can be as small as a tree, under a rock, or in a puddle; or as large as a desert, rainforest, or coral reef. In this lesson, we will define ecosystem and explain how they are constantly changing through a process called ecological succession. We will also discuss how organisms are linked together and how biodiversity is important in maintaining a healthy ecosystem.

Part 1. What is an Ecosystem? (10 minutes)

An ecosystem is a community of living organisms and non-living things that interact and function together. Coral reefs, rainforests, deserts, tundra, ponds, and lakes are all examples of ecosystems. Biotic factors are the living organisms of an ecosystem, such as animals, plants, and microorganisms (e.g., fungus, bacteria). Each biotic factor has a specific role or function in an ecosystem. This specific role or function is called the organism's niche. Abiotic factors are the non-living components of an ecosystem, such as rocks, sediments, water, and sunlight. Figure 1 illustrates a large ecosystem in Simpson Bay, Alaska. Mountains, water, and snow are abiotic factors and sea otters and trees are biotic factors.

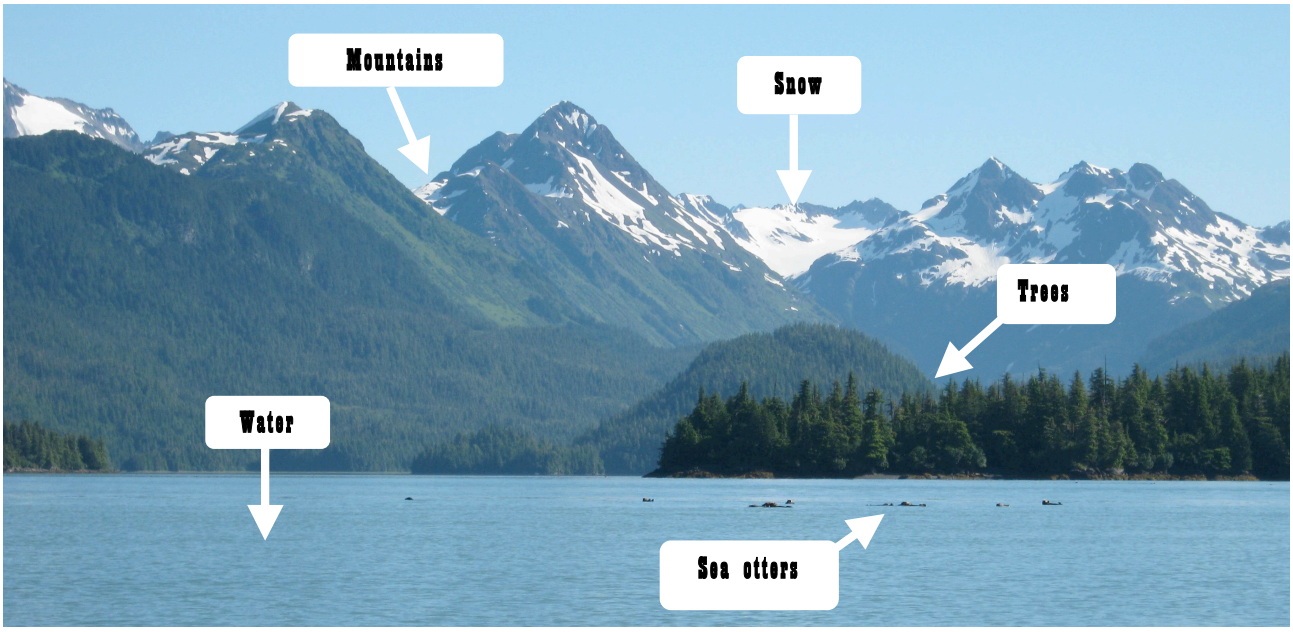

Figure 1. Ecosystem in Simpson Bay, Alaska with biotic and abiotic factors.
Photo Credit: Lori Timm, Ph.D. – Landry's Downtown Aquarium

Optional Activity: Biotic and Abiotic Factors (5-10 minutes)

Ask the students to identify the ecosystem after reading the list of terms. Then categorize the rest of the terms as biotic or abiotic factors.

1. students, chairs, classroom, desks, plants, books, teachers
   Ecosystem: classroom

   Biotic factors: plants, students, teachers; Abiotic factors: chairs, desks, books

2. fish, trees, soil, boat, lake, sunlight

Part 2. Food Chains (15 – 20 minutes)

All living things need to feed in order to get energy, which is used to grow, move, and reproduce. Organisms in an ecosystem are connected to each other based feeding relationships called food chains. A food chain shows the flow of energy through a sequence of organisms. In other words, it shows the order in which animals consume plants and other animals. A food chain consists of linear links in a food web starting with plants and ending with animals that consume other animals. A food chain illustrates how every living organism obtains food and how energy and nutrients are passed from one organism to another (Figure 2).

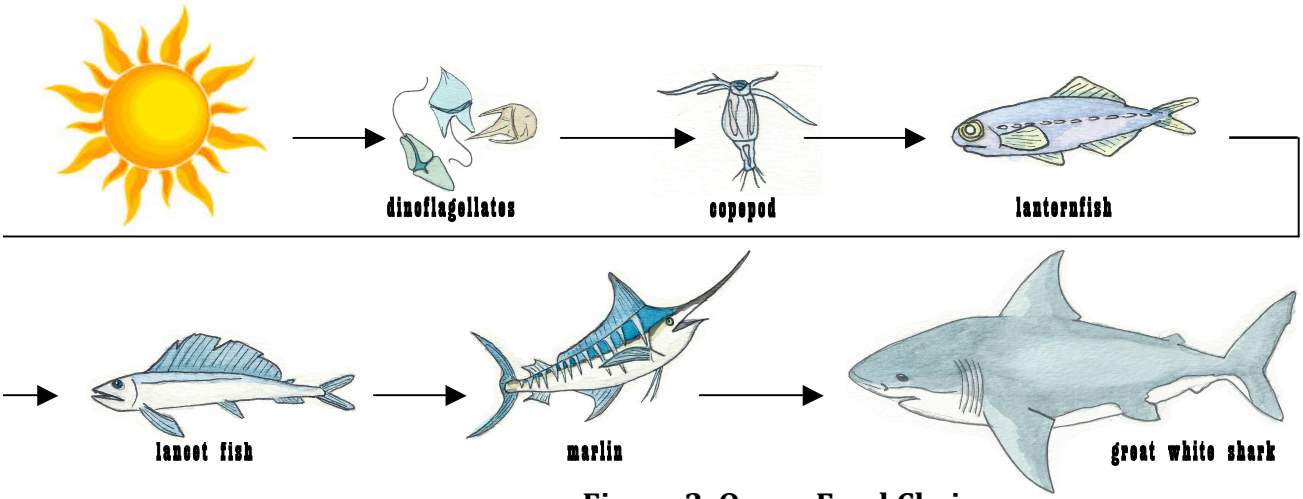

Figure 2. Ocean Food Chain
Illustration Credit: Sarah Rich – Landry's Downtown Aquarium

The sum of all interacting food chains in an ecosystem is called a food web. A food web is a network of many food chains and is much more complex.

Food chains begin with primary producers. Plants are primary producers because they use sunlight, carbon dioxide, and water to produce their own energy (glucose). Phytoplankton, such as dinoflagellates and diatoms are the primary producers in ocean ecosystems.

Consumers are next in the food chain. Unlike plants, animals cannot make their own food and must consume plants or other animals. There are three types of consumers: herbivores, omnivores, and carnivores. Primary consumers are herbivores, or animals that consume plants (primary producers). Examples of primary consumers are deer, giraffes, and zooplankton. Secondary consumers are carnivores and omnivores. Carnivores are animals that consume other animals. Omnivores are animals that consume both plants and animals. Examples of carnivores are mountain lions and great white sharks. Examples of omnivores are black bears.

Higher up on the food chain are tertiary and quaternary consumers, which are carnivores feeding on the next level down (Figure 2). Great white sharks are considered quaternary consumers and are often referred to as "apex predators"!

Decomposers are organisms such as bacteria and fungi that eat decaying plant and animal matter. During the feeding process, decomposers break down the decaying matter even further, releasing nutrients and minerals back into the soil.

Activity: Create Your Own Food Chain (5-10 minutes)

Below are examples of different species within a food chain. Have the students order them from primary producers to quaternary consumers.

1. fish, phytoplankton, great white shark, seal, zooplankton
   Answer: *phytoplankton, zooplankton, fish, seal, great white shark*
2. mice, grass, owl, snake, insects
   Answer: *grass, insects, mice, snake, owl*

Part 3. Biodiversity and Relationships (30 – 60 minutes)

Biodiversity

Biodiversity is the number and variety of different species of plants and/or animals present in a specific area. Species is a group of organisms or individuals capable of interbreeding and producing offspring. For example, great white sharks and whale sharks are two different species of shark and

therefore incapable of interbreeding. A healthy ecosystem has a high biodiversity of species, including both plants and animals. Each species has its own niche, or specific role and function in an ecosystem.

Why is biodiversity so important? Biodiversity increases ecosystem productivity and reduces the risks of an ecosystem collapsing! Biodiversity also allows for an ecosystem to bounce back or adjust to disturbances such as a wildfire or hurricane. For example, if biodiversity is low, and you remove reef sharks (apex predators) from a coral reef ecosystem, herbivorous fish increase (because of lack of a predator) and algae and kelp species rapidly decline because of overgrazing. This could ultimately cause an ecosystem to collapse. In another example, when sea otters (apex predators) are removed from an ecosystem, kelp communities are deforested by herbivorous urchins. Ecosystems with low biodiversity run a greater risk of losing a greater number of a species if another species declines in abundance or becomes locally extinct. In California, for example, a high diversity of different species feeding on sea urchins slowed the collapse of a kelp forest when sea otters were removed. However, in Alaska where consumer diversity was low, the removal of sea otters caused an instant collapse in the local kelp forests. There were no other consumers left to feed on the sea urchins.

Species Interactions

Species interact with each other in numerous and complex ways. The easiest interaction to investigate is the predator-prey interaction. Predator-prey interactions are important links that form the structure of food chains and food webs. A predator is an animal that hunts and kills its food. A prey is the animal that is being hunted and killed by the predator. This interaction is crucial in maintaining a healthy ecosystem. An example of a predator is a great white shark. An example of a prey is a seal.

Some animals act as parasites on other animals called hosts. A parasite is an organism that lives on or in a host and obtains food from this interaction, but at the expense of the host. A great example of a parasite-host interaction is one between remoras and sharks (Figure 3). Remoras, also called shark suckers, attach themselves to sharks. Remoras benefit from this interaction because the shark provides them with safe shelter and remoras can feed on scraps of food left over by the shark. However, remora attachment irritates the shark's skin and can cause hydrodynamic drag. The increase in drag causes the shark to have to swim faster and expend more energy.

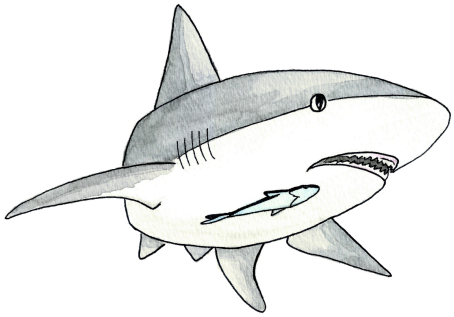

Figure 3. Parasite-host relationship between a remora and shark.
Illustration Credit: Sarah Rich – Landry's Downtown Aquarium

Not all species-species interactions are negative. An interaction between two species, in which both benefit or one benefits and the other is unaffected, is called symbiotic. In biology, symbiosis means living together. In other words, symbiotic relationships are close and usually long-term relationships between two or more different species. There are two types of symbiotic relationships: mutualism and commensalism.

Mutualism is a symbiotic relationship between two species in which both benefit. A great place to explore mutualistic relationships is to observe a coral reef! Clownfish have a special mutualistic relationship with sea anemones (Figure 4). Clownfish are the only fish that do not get stung by the tentacles of anemones. This is because clownfish have a slimy mucus covering that protects them. This relationship is considered a mutualistic relationship because sea anemones provide the clownfish a safe place to hide from predators and in return the clownfish protect the anemones from predatory fishes, such as the butterfly fish, that eat anemones. Clownfish also help to circulate water around the anemone by the movements of their fins.

Figure 4. Mutualistic relationship between clownfish and sea anemone.
Photo Credit: Allison Jobe – Landry's Downtown Aquarium

Commensalism is a symbiotic relationship between two species in which one benefits and the other is unaffected. A great example would be barnacles on right whales. Barnacles are little crustaceans that embed themselves in the whale's skin and use the whale's forward motion to filter feed on plankton floating past. Because the whale is the one moving, barnacles do not have to expend a lot of energy to filter out plankton. Therefore, the barnacles benefit from this relationship. The immense right whales, however, are unaffected by the barnacles presence.

Biodiversity Decline

Today many species are declining at an accelerated rate and are at the brink of extinction. Loss in biodiversity can cause significant changes in ecosystem functioning. Students have already learned

that animals depend on other animals for survival through many different types of relationships. But what happens if we remove one of the animals from the relationship?

If one species is removed from the ecosystem, other species that depends on it may also perish. Think about the clownfish and sea anemone. If clownfish disappeared from a coral reef, sea anemones would have no protection against predators such as butterfly fish. Eventually, the butterfly fish would consume all the anemones and then have nothing left to eat. Butterfly fish would die off and so will the animals that depend on butterfly fish for survival. This will ultimately lead to a decline in biodiversity and ultimately ecosystem collapse. It's a chain reaction that can rarely be stopped.

What Can YOU Do To Help?

There are several ways you can help the environment from your own home! Below are just a few examples of what you can do at home to help protect and maintain a healthy environment. *Have the students discuss their own ideas first.*

1. Reduce the amount of water you use daily. Turn off the water while brushing your teeth or take shorter showers.
2. Recycle reusable products.
3. Don't waste paper. Reuse it as scratch paper instead of throwing it away.
4. Reduce your carbon footprint. Additional carbon in the atmosphere can change the global climate, causing ecological collapse all around the world. By using public transportation or walking instead of using your car everyday can reduce the amount of carbon you add to the atmosphere. Carpooling with friends will also reduce the amount of carbon you add to the environment.
5. Make safe and sustainable seafood choices. Many fish populations are rapidly being depleted due to public demand.. These fish populations are being overexploited, reducing the populations, and thus reducing the biodiversity of our oceans.
6. Use fewer plastics. Unused plastics end up in our oceans and end up in the digestive system of marine life. This can block the digestive system and kill wildlife.
7. Don't buy items that exploit marine wildlife. Many places sell coral jewelry

Activity: Conserving Biodiversity (Take Home)

Students should now understand the different types of interactions between organisms and how biodiversity is essential to maintaining a healthy ecosystem. However, biodiversity is in worldwide decline and conservation efforts are needed to prevent further loss. This is the perfect opportunity to have the students create a conservation logo, poster, or presentation that relays the message of conserving biodiversity of a particular ecosystem.

Students should select an ecosystem, research the types of organisms found in that ecosystem, define biodiversity, and brainstorm ways to protect the ecosystem and its biodiversity.

Part 4. Ecological Succession (20 – 30 minutes)

Ecosystems are continuously changing. The gradual process in which ecosystems change and develop over time is called ecological succession. Succession takes place mainly because organisms are constantly living, growing, reproducing, and interacting with each other and the environment.

Succession is directional, meaning ecosystems change from one stage to another. Each stage is called a sere. The seres are not completely distinct from one another since succession is a slow, gradual process. As communities of organisms within an ecosystem change, the seres will overlap and the ecosystem will keep progressing until the final sere is reached – the climax community. A climax community is characterized by dominant organisms in a stable, unchanged ecosystem. This is the final stage in succession. There are two main types of succession, primary and secondary.

Primary succession is the change that occurs in an entirely new habitat that has never been colonized before (Figure 5). Primary succession begins in barren areas such as exposed rock. The first organisms to grow on this barren surface are typically lichen. Lichen is the result of a symbiotic relationship between a fungus and algae. Since lichen is the first inhabitant of the new habitat, they are called pioneer species. The lichen eventually turns rock into soil, making it suitable for plants to grow. This typically takes hundreds of years. Grasses, shrubs, and trees begin to grow. As plant life progresses, animal species begin to inhabit the habitat and a new ecosystem is developed.

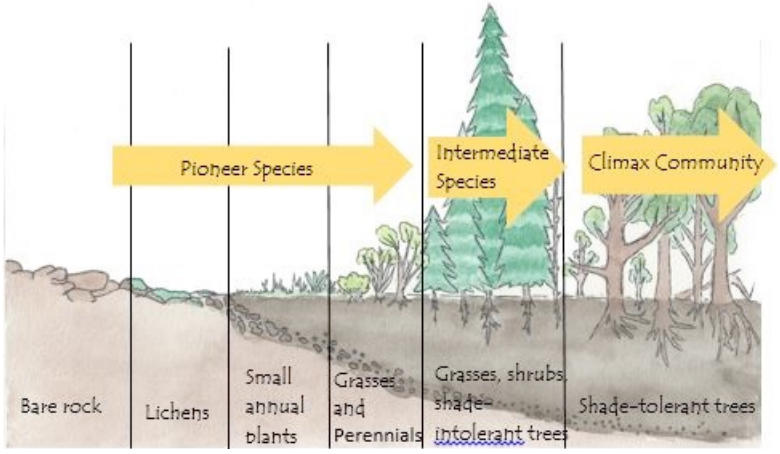

Figure 5. Primary Succession Illustration Credit: Sarah Rich – Landry's Downtown Aquarium

Secondary succession is the change that occurs in a previously colonized habitat. (Figures 6). Secondary succession is highly dependent on the presence of soil. One example of secondary succession is the regrowth of a forest after a forest fire (Figure 6).

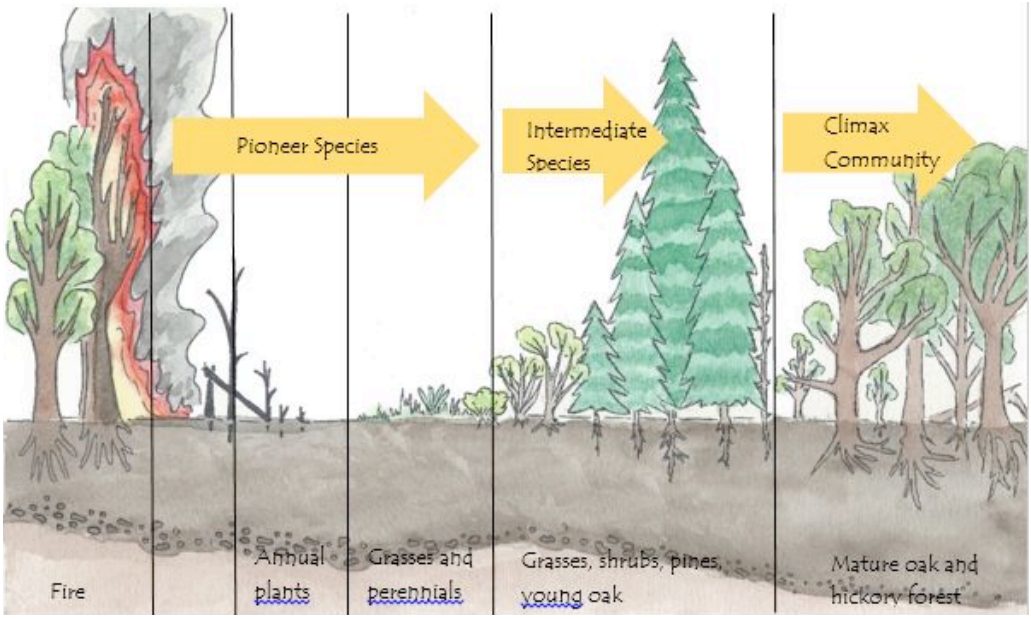

Figure 6. Secondary Succession
Illustration Credit: Sarah Rich – Landry's Downtown Aquarium

Another example would be the regrowth of a coral reef after a hurricane (Figure 7).

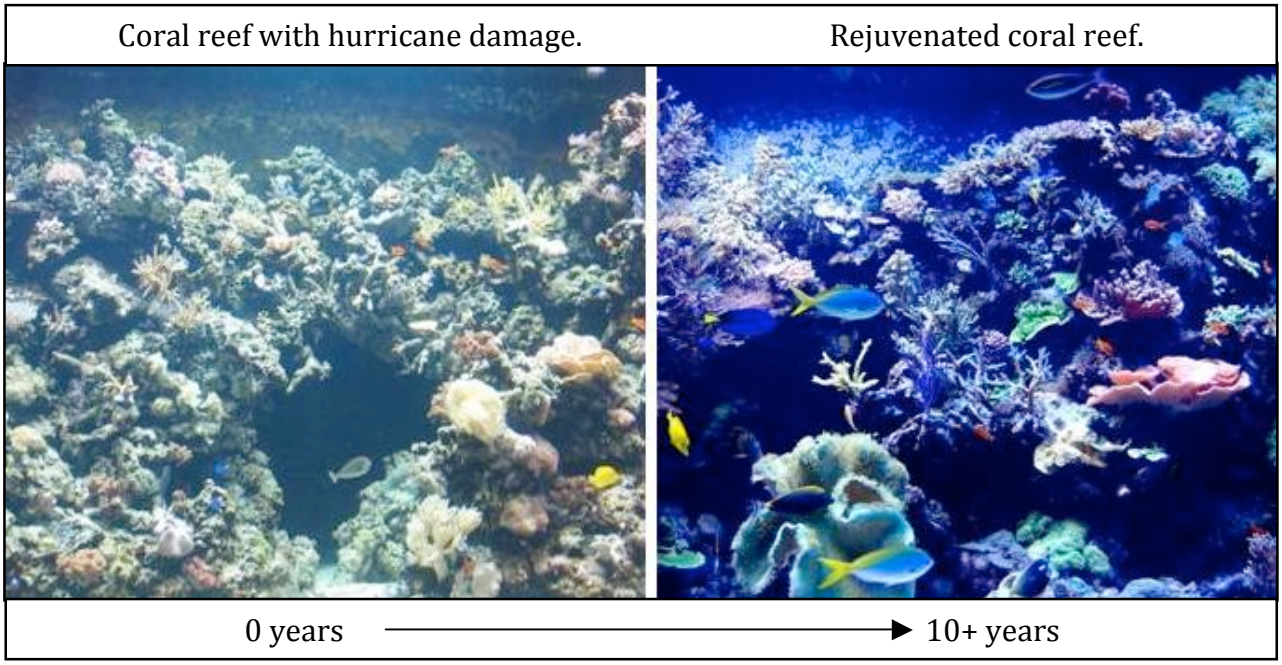

Figure 7. Secondary Succession

Photo Credit: Josh Frey Sr. – Landry's Downtown Aquarium

<u>Optional Activity. Primary versus Secondary Succession</u> (5 – 10 minutes)

Using the worksheet on the next page, students will determine if a scenario shows primary or secondary succession.

Answers:

1. *Primary*
2. *Secondary*
3. *Secondary*
4. *Primary*
5. *Secondary*

Primary versus Secondary

Name: _____

Date: _____

Instructions

Carefully read each scenario below. If needed, highlight key words and phrases. Then determine if the scenario represents primary or secondary succession. Write your answers in the spaces provided.

1. A volcanic eruption in the middle of the ocean forms a new, barren island made of volcanic ash and lava.

2. A wild fire burns through a large savannah, leaving nothing but sand and soil.

3. A forest is washed away by flood waters.

4. Wind and waves create a new sand dune on a beach.

5. A large area of trees in a rainforest was chopped down by loggers. The trees have started to regrow.

ACTIVITY 1. Memory Game – Ecosystems

(45 minutes – 60 minutes)

Introduction

This interactive game is designed to test not only the student's knowledge of vocabulary but also their observation, concentration, and memorization skills. Students will be divided into teams and will be competing to collect the most matching pairs of vocabulary words and definitions.

Preparation

Print the following cards containing vocabulary words and definitions. Print the vocabulary word on one color of paper and the definitions on another. Cut the cards out. Cards may be laminated for sturdiness and/or future use.

Instructions

Students should be divided into teams (4 or 5 students per group will work well).

1. Shuffle the cards and lay them out face down in rows on a table or floor. You may also tape the cards to a wall.
2. Teams will play in turns. Each team will send one team member to select two cards – one vocabulary word and one definition.
3. The student should read both the word and definition out loud for the entire class to hear.
4. The team will then decide if the definition matches the word. The other teams may discuss quietly, but should be careful not help the playing team out.
5. If the team is correct (in deciding if the cards match) and has selected a matching pair, they get to keep the cards and receive a point!
6. If the team is incorrect but has in fact selected a matching pair, they do not get to keep the cards or receive a point. The cards should be turned back over.
7. If the cards do not match, the cards should be turned back over. No point received.
8. Teams will play in turns until all the cards have been matched together.

Hints – Just because it is another team's turn doesn't mean students should stop paying attention! The cards that other teams select could lead you to a point!

Ecosystem

Food Chain

Niche

Omnivore

Biotic Factors

Abiotic Factors

Pioneer Species

Biodiversity

Community

Parasitism

Mutualism

Primary Succession

A community of living organisms and non-living things that function together.

Consists of linear links in a food web starting with plants and ending with animals that consume other animals.

An organism’s specific role or function in an ecosystem.

An animal that derives its energy and nutrient requirements from consuming both plants and animals.

Living organisms in an ecosystem.

Non-living physical or chemical factors in an ecosystem.

First organisms to come into a newly developed or changed ecosystem.

The diversity or variety of living organisms, such as plants and animals, in a particular area.

Group of organisms living and interacting with each other in the same region.

A relationship in which an organism lives inside or on another organism called the host.

Relationship between two or more species in which both (all) individuals benefit from the relationship.

The gradual change in a barren, new habitat that has never been previously colonized.

Answer Key for Memory Game:

Ecosystem – A community of living organisms and non-living things that function together.

Food Chain – Consists of linear links in a food web starting with plants and ending with animals that consume other animals.

Niche – An organism's specific role or function in an ecosystem.

10% Rule – Approximately 10% of the available energy at one trophic level is actually transferred to the next trophic level.

Biotic Factors – Living organisms in an ecosystem.

Abiotic Factors – Non-living physical or chemical factors in an ecosystem.

Pioneer Species – First organisms to come into a newly developed or changed ecosystem.

Biodiversity – The diversity or variety of living organisms, such as plants and animals, in a particular area.

Community – Group of organisms living and interacting with each other in the same region.

Parasitism – A relationship in which an organism lives inside or on another organism called the host.

Mutualism – Relationship between two or more species in which both (all) individuals benefit from the relationship.

Primary Succession – The gradual change in a barren, new habitat that has never been previously colonized.

Ecosystems

ACTIVITY 2. Ecosystem Tag

(45 minutes – 60 minutes)

Introduction

This activity will demonstrate how each part of an ecosystem, including both living and nonliving things, has a specific function. Students will learn that the interactions between all factors in community are delicately balanced, ultimately resulting in a healthy ecosystem.

The game involves the basic food chain:

> Starting with abiotic factors – taken up by producers – producers being eaten by consumers – consumers being broken down by decomposers – decomposers return abiotic factors to the environment

Materials

- Balls, frisbees, crumbled paper, or any other objects that can be easily tossed around (one for every player).

Instructions

1. Students should be divided into 3 groups:
   Decomposers – insects, bacteria, etc.
   Consumers – animals (about twice the number of decomposers)
   Producers – plants (about twice the number of consumers)
   Each group should be easily distinguishable (colored handkerchiefs, shirts, stickers, signs worn around the neck, etc.)
2. Set a boundary for the playing area which will represent the environment. Students must remain in the playing area.
3. Place the balls in two or more piles around the playing area. The balls represent abiotic factors – nutrients, sunlight, water, etc. Draw or create a small "safety zone" (which represents soil) around the pile.
4. **Producers** are the only players who can take balls from the piles. The safety zone protects the producer from being tagged out only while he or she is collecting a ball. Their goal is to get all the balls out of the safety zone and keep the balls in the hands of the producers only.
5. **Consumers'** goal is to obtain and hold on to as many balls as possible. They can only get balls by making a two-handed tag on a producer holding a ball.
6. **Decomposers** can only get balls by making a two-handed tag on a consumer holding a ball. They then return the ball to the safety zone. Their goal is to keep as many balls in the safety zones as possible.
7. When a player is tagged, he or she must give up all the balls they are holding to the player who tagged them.

8. During gameplay, players are allowed to toss and pass balls to members of their own group. Balls cannot be intercepted during a pass!
9. Teachers: Once students have been playing the game for a while, start taking players out. This will illustrate how the ecosystem starts to collapse if there are not enough producers, consumers, or decomposers to re-circulate nutrients and energy.
    - If there are not enough producers, no abiotic factors (energy) will flow through the ecosystem.
    - If there are not enough consumers, plant species will thrive until decomposers are unable to return nutrients to the soil.
    - If there are not enough decomposers, consumers will thrive until soil nutrients are depleted. Once soil nutrients are gone, producers will die, followed by consumers.
10. Game play continues as long as you wish!

Discussion Questions

1. How are the groups dependent on each other?

Answer: *No. Producers need decomposers to put nutrients back into the soil. Consumers need producers to bring nutrients out of the soil. Decomposers need consumers to take nutrients from the producers.*

2. How does each group contribute to the continuous functioning of the ecosystem?

Answer: *The groups must balance their needs with each other in order to function smoothly.*