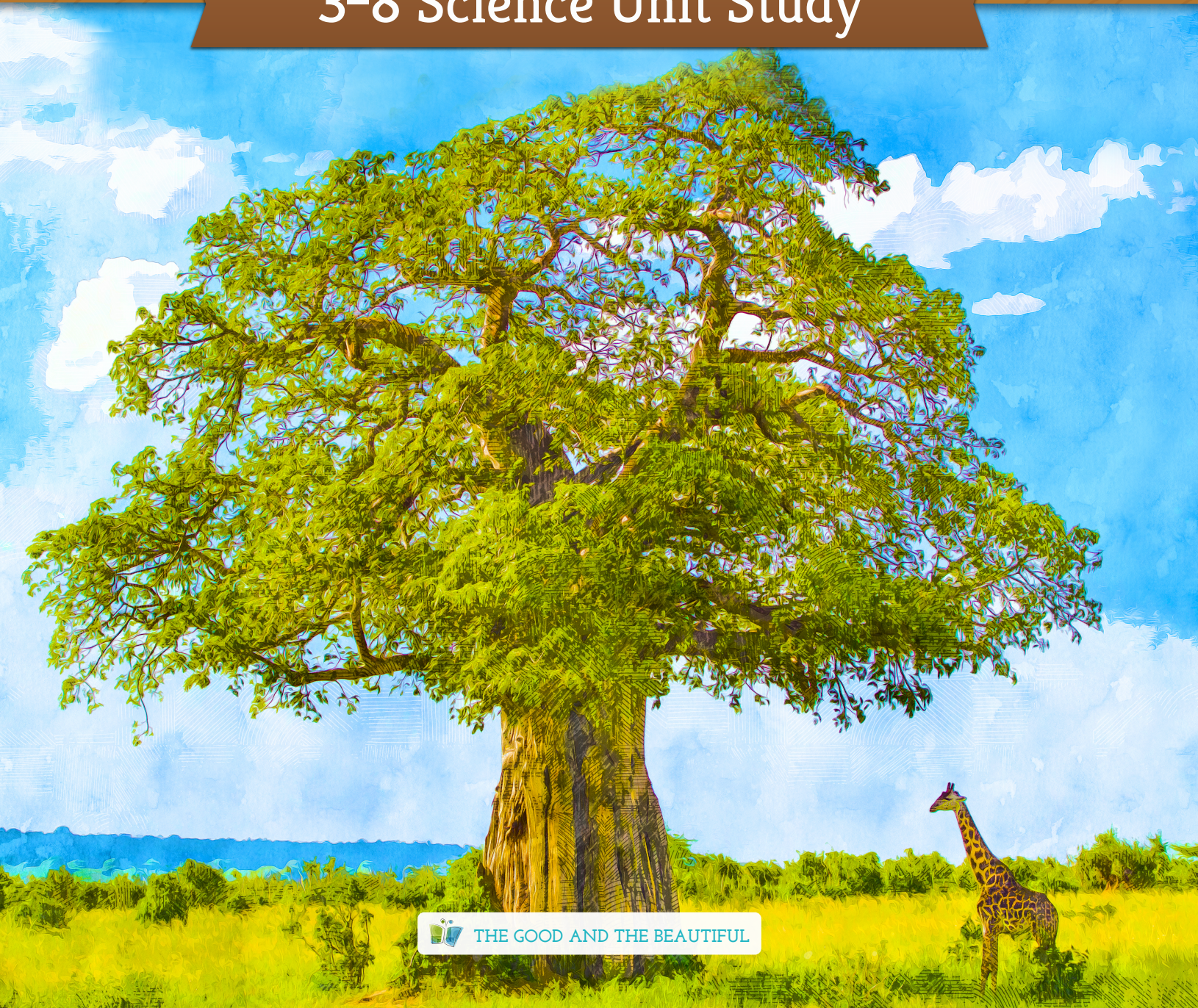


# ECOSYSTEMS

3-8 Science Unit Study



THE GOOD AND THE BEAUTIFUL



# Ecosystems

CREATED BY THE GOOD AND THE BEAUTIFUL TEAM



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# Unit Information

## Student Journal



All The Good and the Beautiful science units include activities in a student journal. Each student should have his or her own student journal, and the parent or teacher will direct the student regarding when to complete the activities in the lessons. Student journals can be purchased by going to [goodandbeautiful.com/science](https://www.goodandbeautiful.com/science) and clicking on the *Ecosystems* unit link.

## Science Wall



All The Good and the Beautiful science units include vocabulary words to be placed on your science wall, which is a wall or trifold presentation board in your learning area on which you can attach the vocabulary words and other images. Cut out the vocabulary word cards at the beginning of the unit. The course will indicate when to place them on the wall.

## Lesson Preparation



All The Good and the Beautiful science units include easy-to-follow lesson preparation directions at the beginning of each lesson.

## Activities



Many of The Good and the Beautiful science lessons involve hands-on activities. An adult should always closely supervise children as they participate in the activities to ensure they are following all necessary safety procedures.



## Unit Videos



Some lessons include videos that were created by The Good and the Beautiful. Have a device available that is capable of playing the videos from [goodandbeautiful.com/sciencevideos](https://www.goodandbeautiful.com/sciencevideos) or from the Good and Beautiful Homeschool app.

## Content for Older Children



Some lessons include extra content that is more applicable for older children (grades 7–8). Parents or teachers may choose to skip this content if instructing only younger children.

## Content for Younger Children



Some lessons include extra content that is more applicable for younger children (grades 3–6). Parents or teachers may choose to skip this content if instructing only older children.

## Versions

New discoveries are being made on an ongoing basis. This course is reviewed and revised periodically to keep information as up to date as possible. This version is the third edition of this unit.



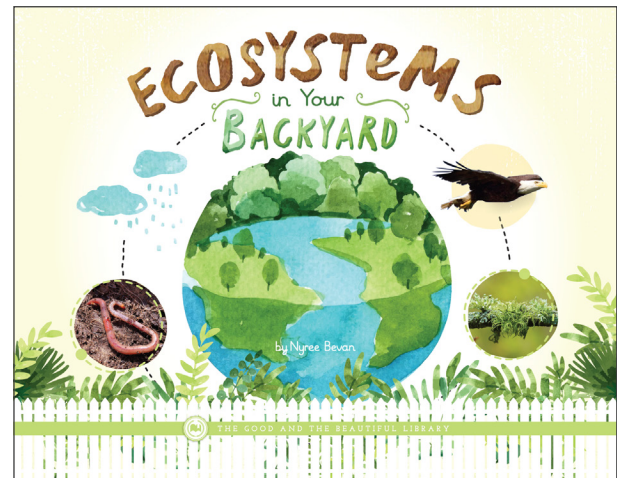


# Read-Aloud Book Pack

The books below are optional read-aloud books that complement this unit. These books can be purchased as a book pack by going to [goodandbeautiful.com/science](http://goodandbeautiful.com/science) and clicking on the *Ecosystems* unit link.



*Elf Owl and His Ecosystem*  
By Megan Noel



*Ecosystems in Your Backyard*  
By Nyree Bevan



## CORRELATED BOOKS

The Good and the Beautiful Library has several books that correlate well with the *Ecosystems* unit. It can be a wonderful experience for children to read level-appropriate books related to the subjects they are learning. The library includes both fiction and nonfiction books that are organized according to reading level. Find the correlated books by going to [goodandbeautiful.com/science](http://goodandbeautiful.com/science) and clicking on the *Ecosystems* unit product page.



# Lesson Extensions

## How the Extensions Work

Each lesson has an optional lesson extension for children in grades 7–8. Complete the lesson with all the children, and then have the older children complete the self-directed lesson extension. These extensions are located in the *Grades 7–8 Student Journal*.

## Answer Key

The answer key for the lesson extensions can be found on the free Good and Beautiful Homeschool app in the science section. Visit [goodandbeautiful.com/apps](http://goodandbeautiful.com/apps) for information on accessing the app. The app can be accessed from a computer, phone, or tablet.

## Flexibility

The amount of time it will take to complete each lesson extension will vary for each child. The average time is about 10–15 minutes per extension. Parents/teachers and children may choose to omit parts of the lesson extension if desired. Encourage the children to stretch their capabilities, but also reduce work if needed.

## Taking Notes

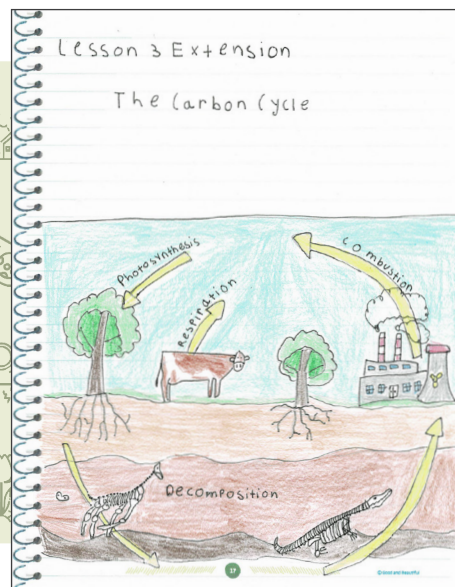
Some of the grades 7–8 lesson extensions have the children summarize the material read. Teach the children to look for key information and summarize the most important points. Students can also add notes with their thoughts and the facts that are most interesting to them.

## Optional Grades 7–8 Reading Book

We recommend *The Amazon Rainforest* by Elizabeth Thuernagle as extra reading for students in grades 7–8. This book can be purchased by going to [goodandbeautiful.com/science](http://goodandbeautiful.com/science) and clicking on the *Ecosystems* unit link.



*The Amazon Rainforest*  
By Elizabeth Thuernagle





# Supplies Needed



You will need the following supplies for **activities**. There are no experiments in this unit.

## Lesson 1

- $\frac{1}{8}$ -tsp measuring spoon
- Small amount of honey

## Lesson 2

- Household items to display, such as a sun hat, scarf, sunglasses, garden gloves, mittens, and umbrella
- Green grapes (optional)
- Small pretzel sticks (optional)
- Banana slices (optional)
- Animal crackers (optional)
- Strawberries (optional)

## Lesson 3

- Drawer full of silverware (or another type of drawer with organizers)
- Scissors
- Glue

## Lesson 4

- None

## Lesson 5

- Cookie sheet (to catch any spills, optional)
- 1 c uncooked rice
- 1-c,  $\frac{1}{2}$ -c,  $\frac{1}{3}$ -c,  $\frac{1}{4}$ -c, and  $\frac{1}{8}$ -c measuring cups (see Trophic Levels Activity note)
- Crayons or colored pencils

## Lesson 6

- None

## Lesson 7

- Scissors
- Glue

## Lesson 8

- 2 clear jars or glasses full of water
- Spoon
- 2 Tbsp salt
- Glue
- 1 sponge per child (optional)
- 1 plastic plate per child (optional)
- Grass seed (lawn grass or another quick-growing grass, such as wheat, optional)
- Container for each child, such as an empty food storage container (optional)

## Lesson 9

- None



# Vocabulary

**Instructions:** Cut out the vocabulary cards in this section. Place them on your science wall when prompted to do so in the lessons. Review the vocabulary words several times during this unit and, if desired, at various times throughout the school year.

## Living

- grows
- moves by itself
- reproduces
- needs food and water to survive
- almost always needs air to breathe



## Nonliving

- does not grow
- does not move by itself
- does not reproduce
- does not need food or water to survive
- does not breathe



## Ecology

the study of how living things are related to one another and to their surroundings



# Decomposer



a living organism that breaks down decaying or dead material or organisms

# Individual Organism

any single living organism in a specific area

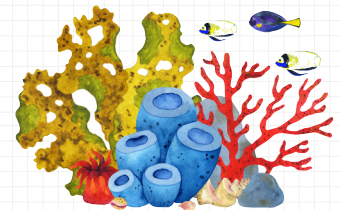


# Population

the organisms of a single species that live in a specific area

# Community

all the populations of all the biotic species that live in a specific area





# Introduction to Ecology

## Objective

Help the children understand what an ecosystem is and what ecologists do.



### Preparation:

- Tape together the two “Landscape” painting pages.

### Activity Supplies:

- 1/8-tsp measuring spoon
- Small amount of honey



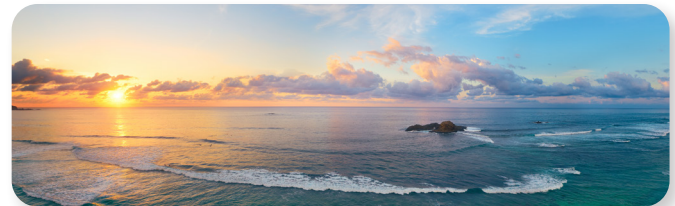
## Introducing Ecology Activity



**Read to the children:** “All things were made by him; and without him was not any thing made that was made” (John 1:3). Each of God’s creations was made with a specific purpose and an intention to function alongside all the other incredible things He created on Earth. If just one of God’s creations were missing, none of the others would function as they should. **Take a brief walk inside or outside and observe a living thing (such as a plant, pet, or family member).** Discuss how the things the children see are connected to each other and to other plants, animals, and humans. Prompt the children as needed (e.g., **If there were no plants, what other things would be affected? If there were no humans, how would our surroundings be different?**). God designed both *living* and *nonliving* things to interact



with each other. As we continue through this unit, we will learn more about how God’s creations work with one another, and we will more fully understand the majesty, grandeur, and wisdom of God.



## Art Study

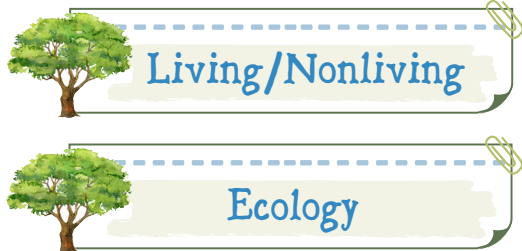
**Show the children the taped-together painting titled “Landscape” by Friedrich Voltz.** Read to the children: Friedrich Voltz was a German artist who loved to paint animals and their surrounding landscapes. Imagine that you are in this scene. **What details do you notice?** Take a moment to look even more closely at the painting and identify a few more details. **How are the animals and plants connected to each other and their environment?** Prompt the children as needed (e.g., **What if the cows did not have water? How would a lack of water affect humans? How do the trees affect the other things in the scene? What would the cows need to eat? What might the ducks be eating?**).



Science Wall: Vocabulary Words



Place the vocabulary cards **LIVING/NONLIVING** and **ECOLOGY** on your science wall. Read and discuss the words and their definitions.



Bees, Ecology, and Me Activity



**Read to the children:** Our world is bigger than we can even imagine! And yet, God knows and loves each one of us. He is aware of each of His creations and its value and contribution to this world. Jesus himself said, “Are not two sparrows sold for a farthing? and one of them shall not fall on the ground without your Father. But the very hairs of your head are all numbered. Fear ye not therefore, ye are of more value than many sparrows” (Matthew 10:29–31).



Not only is every person valuable to God, but each of His creations, no matter how small, is also important to this world. Let’s explore one of God’s small yet important creations, the honeybee.

**Hold the measuring spoon out for the children to see. Drizzle honey into the measuring spoon so that it is three-quarters full. Does this seem like a lot of honey to you?** One honeybee will work its entire lifetime and produce only  $\frac{1}{2}$  teaspoon of honey, about the amount in this spoon. This may not seem like much honey to you or me, but every honeybee is vital to the success of its hive. Bees depend on one another for their survival, and we need bees to survive, too.

Consider that to produce one pound of honey (a substance that in itself has all the nutrients, vitamins, and minerals needed to sustain a human life), the bees from one hive must collectively travel nearly 88,514 km (55,000 mi) and visit millions of flowers. That is more than the equivalent of traveling around the world twice! While visiting a variety of flowers, bees collect sweet nectar that is condensed into honey and transfer pollen between flowers. This pollination enables plants to produce a bounteous variety of fruit that all creatures rely on for food.

Bees are so essential that many other species would become extinct without them. Because of this, they are considered to be a *keystone species*, or a species that is critical to the survival of many other species. God, our masterful Creator, designed our beautiful world for all things to work and connect together to support life and provide abundance.





## □ Ecology and Our World



Have the children turn to the “Ecology and Our World” pages in Lesson 1 of their student journals and answer the questions as you read the paragraphs below. An answer key can be found at the end of the lesson.

**Read to the children:** Man and woman were the greatest of all God’s creations. “And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth” (Genesis 1:26). God gave Adam and Eve dominion; it is important to remember that dominion involves responsibility and care. **Ecology** is the study of all God’s creations and how they interact with each other.

*Ecologists* are scientists who study our world and how the living and nonliving things in our world interconnect. They conduct outdoor research, run tests in laboratories, give advice for policies being made, help solve environmental problems, and assist in managing our natural resources.

Have the children draw or write an answer for question 1 on their journal page.



Humans have a greater impact on this earth than any other being that God created. We have produced marvelous inventions and furthered technology in incredible ways that bless and enhance our lives. Everything humans have made interacts with the natural world. It is important to recognize how our actions affect the world around us. Studying ecology helps us understand these effects and interactions and therefore helps us take better care of our world.

Have the children draw or write answers for questions 2 and 3 on their journal pages.

Water is a vital part of life on Earth. Everything is affected by both the amount and quality of our water.



In the 1960s, ecological research helped us discover a major contributor to poor water quality. The researchers found that fertilizers and detergents had ingredients that were harmful to our water supply. With the research provided, changes could be made to restore our rivers, lakes, reservoirs, and streams.

Have the children draw or write an answer for question 4 on their journal page.

Just like a honeybee, your small contribution makes a huge impact on the world. There are many things you can do to help, whether within your own home or in nature (for example, picking up trash, composting, helping with chores, etc.).

Have the children draw or write an answer for question 5 on their journal page.

## □ Lesson 1 Extension



Have children grades 7–8 complete the self-directed Lesson 1 extension titled “Keystone Species Are Critical!” in their student journals.







"Landscape" by Friedrich Voltz (1817-1886), 1874



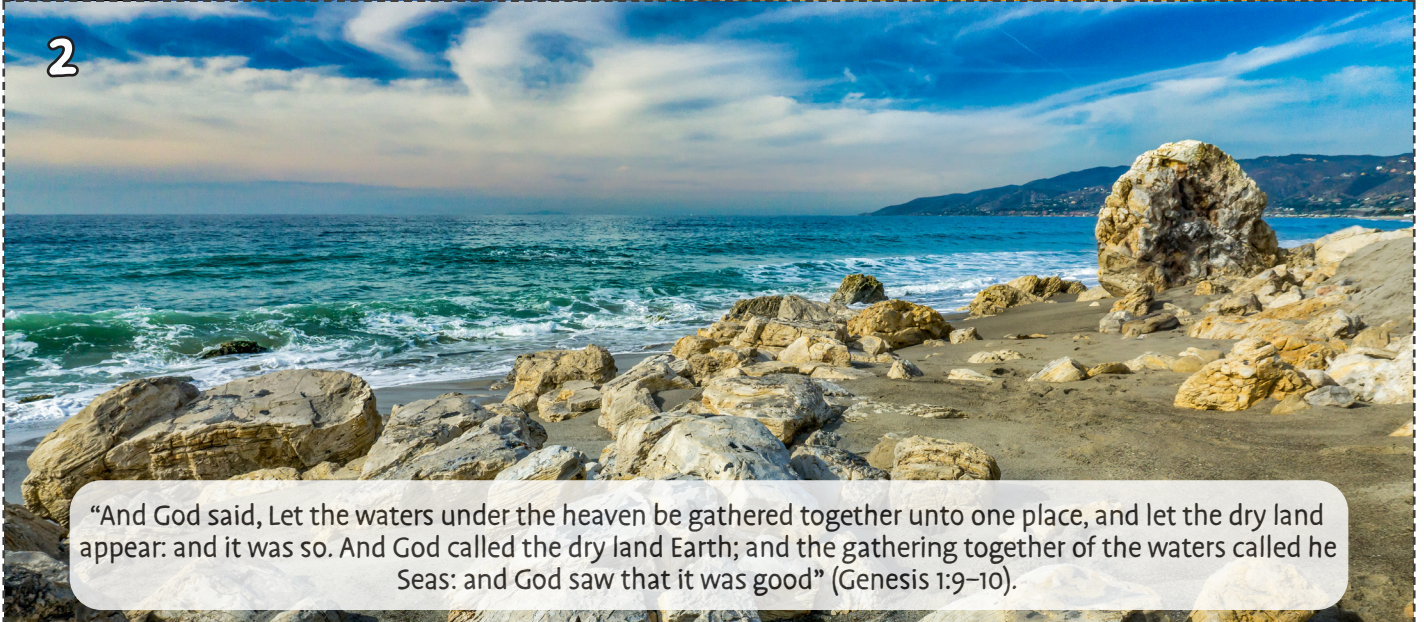
# CREATION CARDS

1



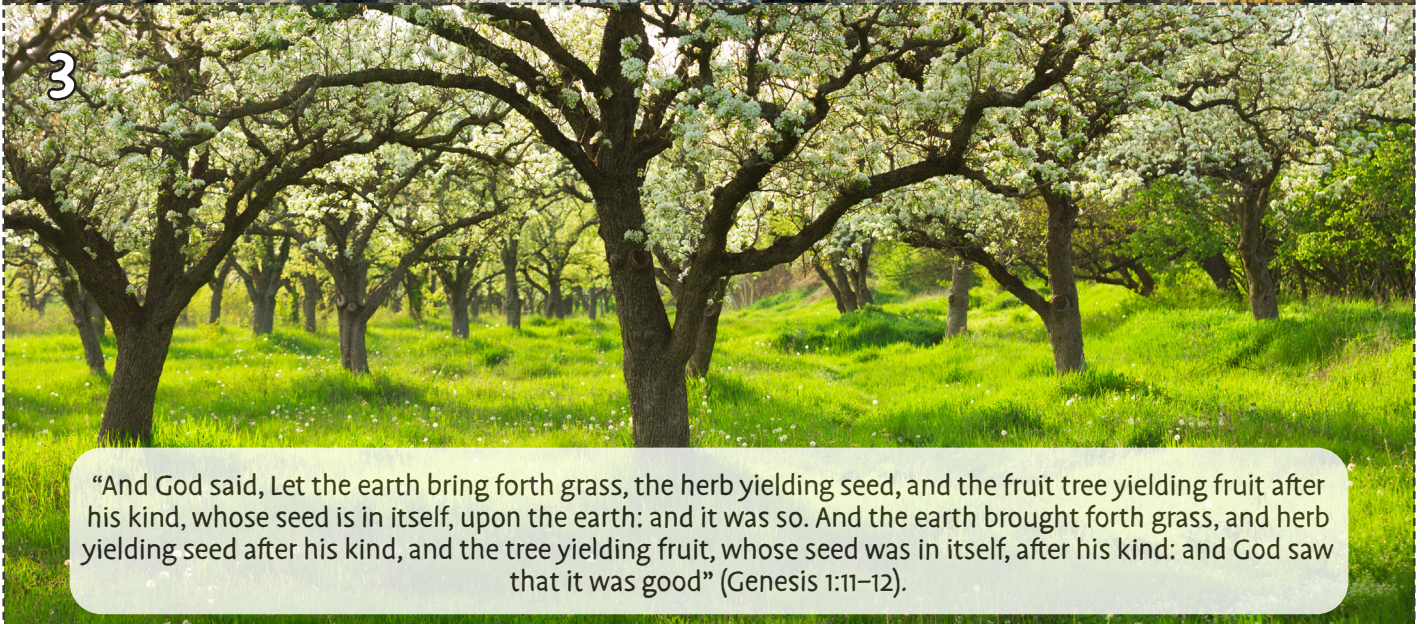
“And God saw the light, that it was good: and God divided the light from the darkness. And God called the light Day, and the darkness he called Night. And the evening and the morning were the first day” (Genesis 1:4-5).

2



“And God said, Let the waters under the heaven be gathered together unto one place, and let the dry land appear: and it was so. And God called the dry land Earth; and the gathering together of the waters called he Seas: and God saw that it was good” (Genesis 1:9-10).

3



“And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so. And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good” (Genesis 1:11-12).



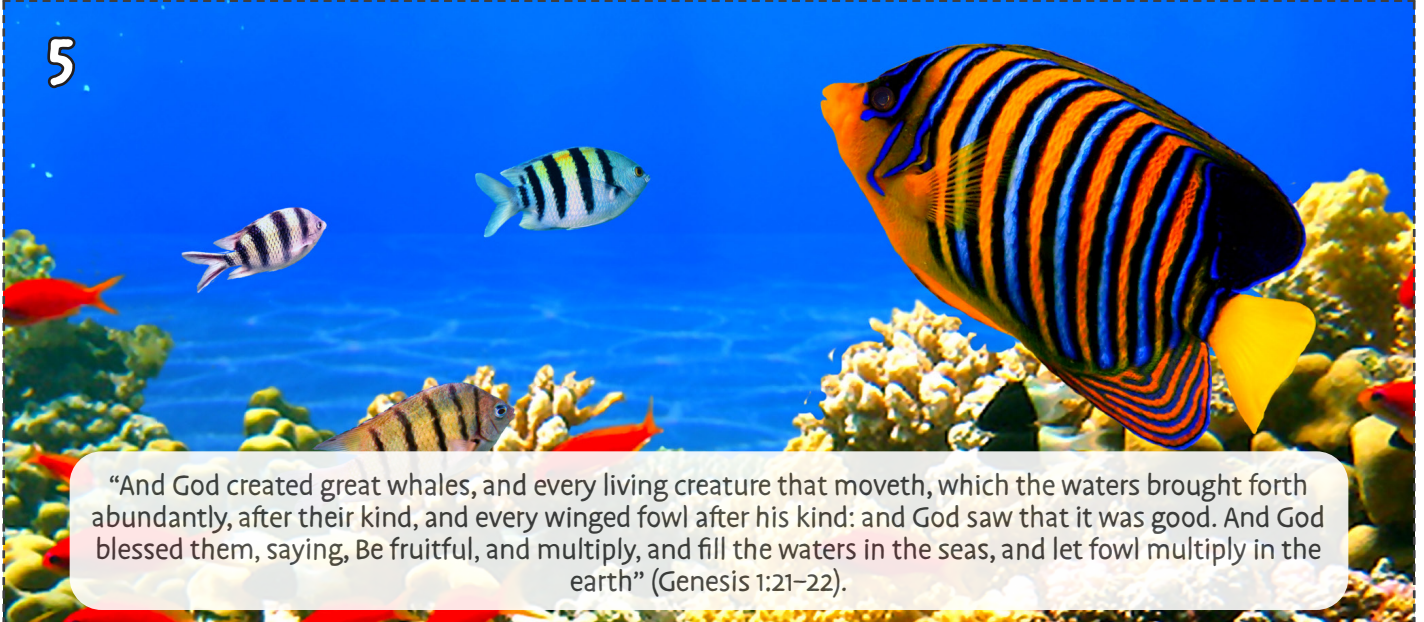
## CREATION CARDS

4



“And God said, Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven” (Genesis 1:20).

5



“And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that it was good. And God blessed them, saying, Be fruitful, and multiply, and fill the waters in the seas, and let fowl multiply in the earth” (Genesis 1:21–22).

6



“So God created man in his own image, in the image of God created he him; male and female created he them. And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth” (Genesis 1:27–28).



# Levels of organization

## Objective

Help the children learn the levels of organization within an ecosystem.



### Preparation:

- None

### Activity Supplies:

- Drawer full of silverware (or another type of drawer with organizers)
- Glue
- Scissors

## Optional Read Aloud



At any point in the lesson, you may read one of the books from the optional Read-Aloud Book Pack. Longer books may be split into more than one reading session. *Elf Owl and His Ecosystem* by Megan Noel is suggested for this lesson.

## Levels of Organization at Home



**Read to the children:** Today, we are going to learn about the levels of ecology and how the creatures within each level interact with other living (biotic) and nonliving (abiotic) factors. **Have the children turn to the “Levels of Organization at Home” page in Lesson 3 of their student journals and complete the page as prompted when you read each section. An answer key can be found at the end of the lesson. *Note:* If you are not in a home, this activity can be done with pencils, pens, and markers in an organizer.**



1. Take the children into the kitchen and open the silverware drawer. Take out a spoon, show it to the children, and ask the children what you are holding. Allow them to respond and discuss the characteristics of the spoon (rounded top, silver, has a long, thin handle, etc.). How many spoons am I holding? [one] That’s right; I am holding one individual spoon. If this were a living (biotic) thing, it would be considered an *individual organism*. **Have younger children draw a line from the spoon to the phrase “individual organism.” Older children will write the phrase “individual organism” on the blank to the right of the image of the spoon.**
2. **Have the children count all the spoons that are the same type and then return them to the drawer. How many spoons of this type do we have in this drawer? This number makes up the *population* of this particular type of spoon in our drawer. **Have younger children draw a line from the spoons to the word “population.” Older children will write the word “population” on the blank to the right of the image of the spoons.****
3. **Read to the children:** Now, this particular type of spoon is not the only type of silverware in the drawer. What other things do you see in the

drawer? [forks, knives, larger spoons, etc.] All of these utensils together make up a **community**. Have younger children draw a line from the image of spoons, knives, and forks together to the word “community.” Older children will write the word “community” on the blank to the right of the image of the spoons, knives, and forks.

4. **Read to the children:** This drawer of silverware is in our kitchen, and so are we, which means this could be considered an **ecosystem**. Our kitchen ecosystem would include all the biotic and abiotic things within it. Have younger children draw a line from the image of the kitchen to the word “ecosystem.” Older children will write the word “ecosystem” on the blank to the right of the image of the kitchen.
5. **Read to the children:** Our kitchen is part of our home, which could be considered our **biome**—a larger environment where similar communities are living and interacting together. Have younger children draw a line from the image of the home to the word “biome.” Older children will write the word “biome” on the blank to the right of the image of the home.
6. **Read to the children:** Our home is part of our larger neighborhood, which could be considered our **biosphere**. The biosphere is an even larger part of where we are living and interacting together. In ecology the earth’s biosphere encompasses the entire planet. Have younger children draw a line from the image of the neighborhood to the word “biosphere.” Older children will write the word “biosphere” on the blank to the right of the image of the neighborhood.

**Read to the children:**  
Ecology organizes things in a similar way to our spoon demonstration.



- A single moose would be an **individual organism**.
- All the moose within the area would make up the **population**.
- The moose along with the deer, elk, grasses, trees,

birds, etc. would make up the **community** of the forest.



- All the animals along with the abiotic features, such as temperature, rainfall, and soil, would make up the **ecosystem**.
- Several forest types with similar climates and communities found in North America create a **biome**.
- These forest biomes combine with other types of biomes to make up our **biosphere**, Earth! Here all living things reside, interacting with each other and abiotic features.

**Science Wall: Vocabulary Words**



Place the vocabulary cards **INDIVIDUAL ORGANISM, POPULATION, COMMUNITY, ECOSYSTEM, BIOME, and BIOSPHERE** on your science wall. Read and discuss the words and their definitions.

Individual Organism

Population

Community

Ecosystem

Biome

Biosphere



□ **Levels of Ecology Organization**



Have the children turn to the “Levels of Ecology Organization” page in Lesson 3 of their student journals. Have younger children cut out the levels of organization and glue them in the correct sections. Have older children write the levels of organization. An answer key can be found at the end of the lesson.

□ **Our Biosphere Is Unique**

**Show the children the “Biosphere Diagram” page as you read:** Our biosphere is unique. It contains all the elements for living things to survive and thrive in three unique areas: the lithosphere, hydrosphere, and atmosphere. Take a deep breath. **[pause]** The atmosphere contains the perfect amount of oxygen for us to breathe. Look at the sunlight coming in through a window. **[pause]** Sunlight from the atmosphere shines down upon the earth, providing light, heat, and essential energy to beautiful plants, flowers, and trees all over the world in all types of biomes.

Water in the hydrosphere not only falls to the earth as fresh rain and snow to renew and cleanse our biosphere, but it is also found within a vast system of lakes, rivers, ponds, reservoirs, and the mighty ocean. Water is vital for all living things to survive. Soil, sand, rocks, boulders, and mountains within the lithosphere

provide us ground on which to stand, nutrients for plants to grow, and majesty upon the earth.

In the 1980s scientists attempted to replicate the earth’s unique biosphere in an ongoing project known as Biosphere 2. (Our earth has been called Biosphere 1.) The structure was built in the barren Arizona, USA, desert as a closed ecosystem created to study the potential for creating ecosystems in space exploration.

In the early years, people attempted to live in Biosphere 2, but they soon found out that there was not sufficient oxygen or food to sustain life. Only God can create a perfect system with all the intricacies and details needed to sustain the diversity of life.

Biosphere 2 contains seven ecosystems, including an ocean system with coral, a tropical rainforest, a fog desert, savanna grasslands, mangrove wetlands, farmlands, and human living quarters. Although people don’t live there now, tours are available, and scientists use it to conduct experiments.

□ **Lesson 3 Extension**



Have children grades 7–8 complete the self-directed Lesson 3 extension titled “The Carbon Cycle” in their student journals.



Biosphere 2





## The Sun



I am the sun, the source of all energy for the food chain!

## Fig Tree

→ Producer



I am a producer (autotroph).  
I am eaten by toucans, monkeys, gibbons, macaws, and fruit-eating bats.

KEYSTONE SPECIES

## Toucan Primary Consumer



I am a primary consumer (heterotroph).  
I eat mostly fruit but also consume tree frogs, caterpillars, and bird eggs.  
I am eaten by jaguars, boa constrictors, and eagles.

OMNIVORE

## The Sun



I am the sun, the source of all energy for the food chain!

## Cecropia Tree

→ Producer



I am a producer (autotroph).  
I am eaten by sloths.

## Three-Toed Sloth Primary Consumer



I am a primary consumer (heterotroph).  
I eat mostly fruit, leaves, and green shoots but may also consume bird eggs.  
I am eaten by jaguars, raptors, and ocelots.

OMNIVORE

## The Sun



I am the sun, the source of all energy for the food chain!

## Mango Fruit

→ Producer



I am a producer (autotroph).  
Blue morpho butterflies drink my rotten fruit. I'm also eaten by katydids, monkeys, macaws, and fruit bats.

## Blue Morpho Butterfly Primary Consumer



I am a primary consumer (heterotroph).  
I drink rotting fruit.  
I am eaten by jacamars and flycatchers.

HERBIVORE



## Abiotic Stressor



Hurricane winds knock down trees; all of your birds fly away!

## Harpy Eagle

→ Secondary Consumer



I am a secondary consumer (heterotroph).

I eat monkeys, sloths, macaws, fruit bats, and agoutis.

APEX PREDATOR

## Cup Fungi

→ Decomposer



I am a decomposer (saprotroph).

I break down dead and decaying material to be used again in the food chain!

## Abiotic Stressor



A volcano erupts and drives all of your carnivores away!

## Crocodile

→ Secondary Consumer



I am a secondary consumer (heterotroph).

I eat monkeys, sloths, macaws, fruit bats, and agoutis. I can even attack jaguars.

APEX PREDATOR

## Velvet Worm

→ Decomposer



I am a decomposer (saprotroph).

I break down dead and decaying material to be used again in the food chain!

## Abiotic Stressor



Rare freezing temperatures destroy your decomposers!

## Puma

→ Secondary Consumer



I am a secondary consumer (heterotroph).

I eat armadillos, monkeys, agoutis, toucans, golden lion tamarins, and tapirs.

APEX PREDATOR

## Termites

→ Decomposer

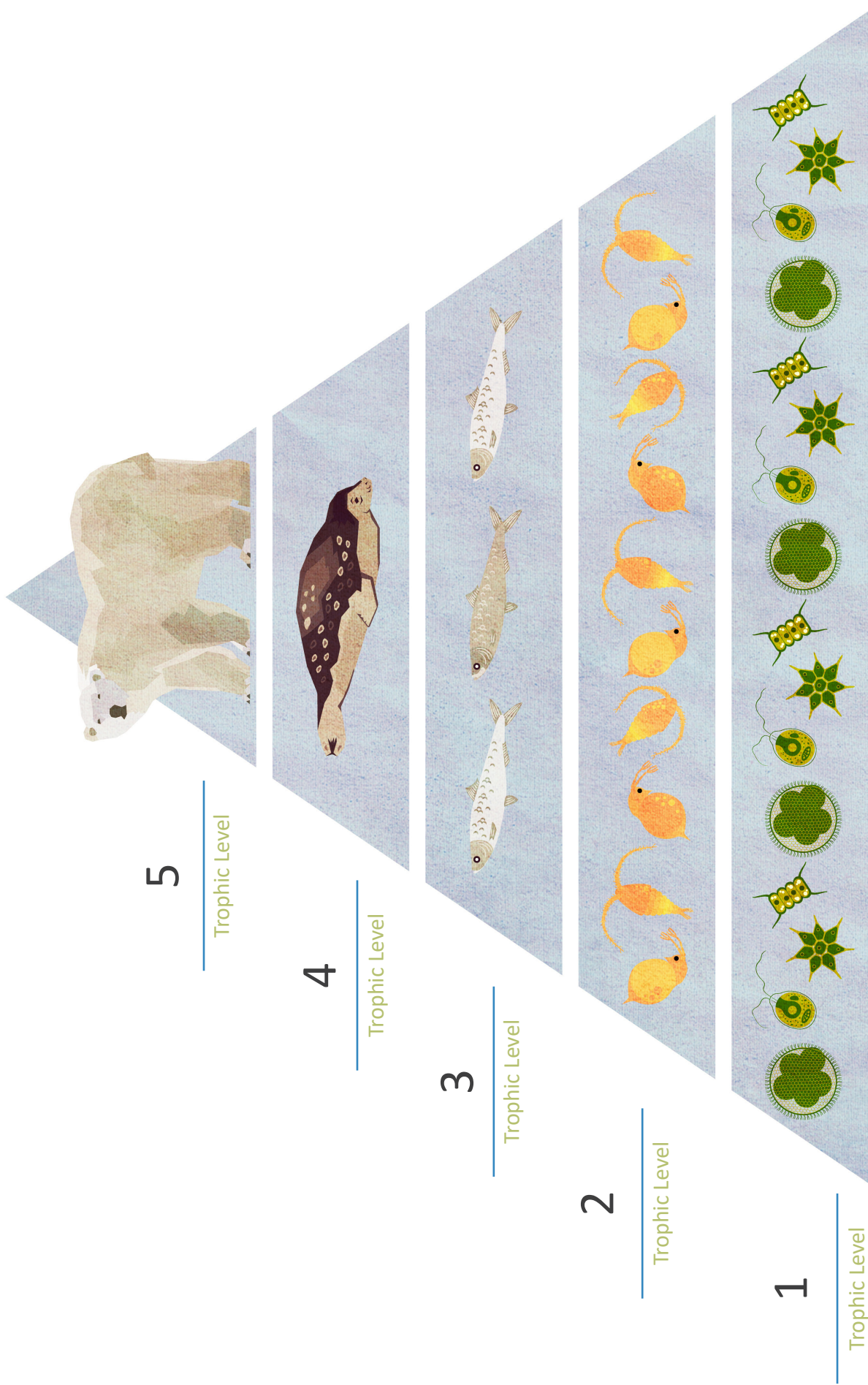


I am a decomposer (saprotroph).

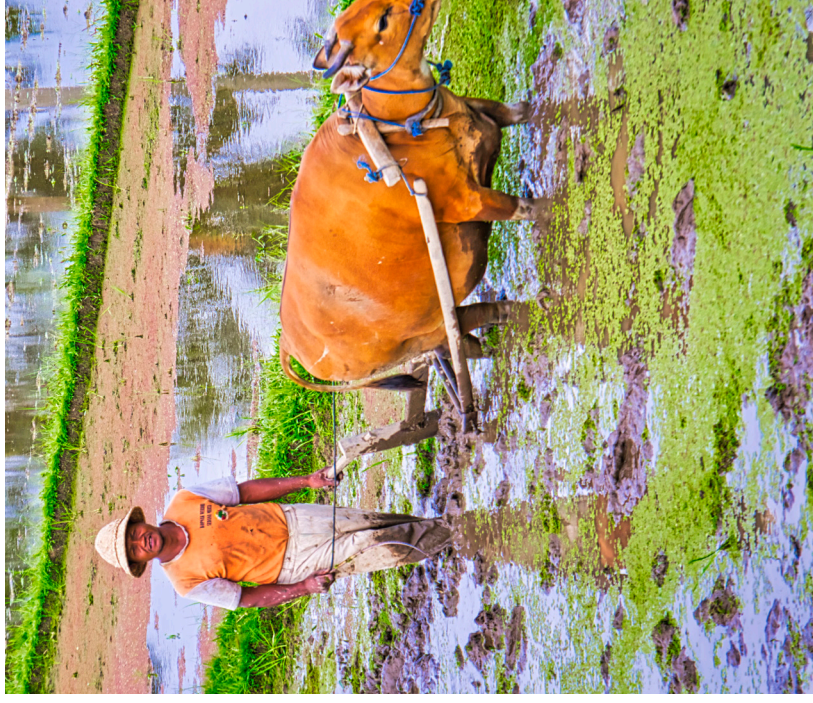
I break down dead and decaying material to be used again in the food chain!



# Trophic Levels of an Arctic Food Pyramid







••••• Rice Paddy Fields •••••



# SYMBIOTIC PUZZLES

## Mutualism

A relationship between two organisms in which both benefit

An oxpecker dwells on a rhinoceros, eating bugs and ticks. The oxpecker gets food, and the rhinoceros gets relief from the pests.



## Commensalism

A relationship between two organisms in which one benefits and the other is unaffected

Golden jackals follow tigers and eat the remains of their kill. The jackal gets food, and the tiger is unaffected.



## Parasitism

A relationship between two organisms in which one benefits and the other is harmed

Aphids feed on a delicious garden plant. The aphids get food, and the plant is harmed.





# Forest (Tropical Rainforest)



# Tundra





# Aquatic Biomes

## Objective

Help the children identify and recognize the major aquatic biomes of the earth and the types of life that are found in each biome.



### Preparation:

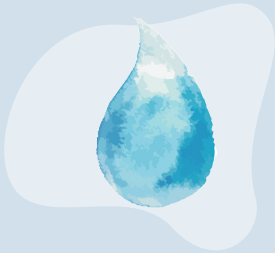
- Cut out the “Marine Biome” and “Freshwater Biome” images.
- Cut out the “Freshwater Biome Plants and Animals Images” in each child’s student journal.

### Activity Supplies:

- 2 clear jars or glasses full of water
- Spoon
- Glue
- 2 Tbsp salt

### Optional Activity Supplies:

- 1 sponge per child
- Grass seed (lawn grass or another quick-growing grass, such as wheat)
- Container for each child, such as an empty food storage container



## Optional Read Aloud



At any point in the lesson, you may read one of the books from the optional Read-Aloud Book Pack. Longer books may be split into more than one reading session. *Ecosystems*

*in Your Backyard* by Nyree Bevan is suggested for this lesson.



## Aquatic Biomes



Show the children two clear jars or glasses full of water. Place 2 Tbsp of salt into one of the jars, stir it, and read to the children: What is the difference between these two

jars? [One contains salt, and one does not.] From which glass of water would you rather drink? Most likely you would choose the fresh water to drink. Salt water is not healthy for humans to consume in large quantities, as it can cause dehydration. However, salt water is vital to our planet as an aquatic (water) biome. Just like these two jars, there are two types of aquatic biomes: saltwater, also called *marine*, and freshwater. Marine biomes keep our atmosphere’s temperature fairly constant and produce at least half of the oxygen on our planet. Freshwater biomes provide us with drinking water and irrigation to grow the food we eat.

Just as you would prefer to drink one type of water over another, aquatic organisms prefer to live in one

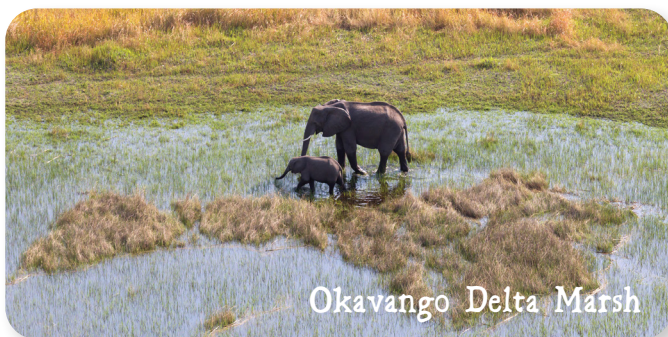


Nile, the longest river in the world, have other rivers and lakes that flow into them.

**Wetlands:** Wetlands are unique as they are made up of land that is either covered or saturated with water for all or part of the year. They are found all over the world and vary greatly in climate, water composition, and plant and animal life. They are usually located near rivers and lakes but can also be found anywhere there is a low-lying, watery area, often called a *slough*.

Wetlands are invaluable because they are able to support countless species of plants and animals, clean and filter water before it flows out to the oceans, and prevent flooding by gradually absorbing and releasing excess water. There are three main types of wetlands: marshes, bogs, and swamps.

A *marsh* is a shallow-water biome where long grasses grow. Marshes are often found surrounding lakes, ponds, or rivers in areas between aquatic and terrestrial biomes. This wetland is typically underwater and can become more flooded during the wet season. The Okavango Delta Marsh in Botswana, Africa, is one of the largest freshwater marshes in the world and a favorite of elephants.



A *bog* is found in cooler climates and is dominated by the peat moss plant, which grows only a few inches above the ground. These mats of moss form a spongy



surface. Sphagnum moss and pitcher plants can also be found in bogs. The water in a bog comes from rain or snow. There is no inlet of water from a stream or river.

A *swamp* is a forested wetland covered by water all year long. It contains shrubs and often tall trees known as cypress trees. The roots of this unique plant life go into the water but come out again to reach oxygen, making them look deceptively like other baby trees just beginning to grow nearby.



## Plants and Animals of Aquatic Biomes



Have the children turn to the “Freshwater Biome Plants and Animals” page in Lesson 8 of their student journals. Give the children the cut-out “Freshwater Biome Plants and Animals Images” from their student journals. As you read to the children, have them glue three types of plants and animals that you mention into their native biome on the journal page. **Note:** Some plants and animals can be found in more than one biome.

### Ponds and Lakes (Still-Water Biomes)

An abundance of plants can be found near the surface of many ponds and lakes. Lily pads and cattails pop up near banks. Bright-green algae coat the surface of the water. Like oceans, lakes have different zones based on the depth at which sunlight penetrates. The first zone is the *littoral zone*, where a lot of sunlight reaches beneath the surface of the water as insects buzz by. Crustaceans (such as crayfish), fish, snails, clams, turtles, snakes, ducks, and amphibians (like frogs and toads) can all be found in this brightly lit zone. Beavers and badgers can also be found here. The *limnetic zone* is the area of open water where light does not reach the bottom. Plankton and a variety of freshwater fish can be found in high numbers in this zone. Diving deeper into a lake is the *profundal zone*, where it is



# Ecological Succession

## Objective

Help the children identify the characteristics and importance of ecological succession.



### Preparation:

- Cut out the “Primary Succession Photographs” and “Secondary Succession Photographs.”

### Activity Supplies:

- None



## □ Introduction



Have the children turn to the “Ecological Succession” page in Lesson 9 of their student journals. Read and discuss the verses from the Bible. Have the children

complete the page by identifying and drawing three pictures of the sequence of succession for the fruit tree as mentioned in the quote. An answer key can be found at the end of the lesson.

## □ Ecological Succession

**Read to the children:** God created the world with specific order and organization. Similarly, God organized distinctive areas of the earth to grow and reproduce continually according to His order and organization. God created the land, followed by the grasses, which were then followed by the fruit trees. The grasses need the land to grow, and the grasses prepare the soil for the fruit trees. This process is called **ecological succession**. *Succession* simply means “to follow.” Ecologists have divided ecological succession into two main categories: primary succession and secondary succession.



## □ Primary Succession



**Primary succession** occurs when brand-new land is formed and new living organisms begin to grow on a bare rock surface. This can occur after a volcanic eruption, which may form new land. After the explosion the lava eventually hardens and forms volcanic rock. Primary succession can also take place after glacial ice melts and retreats to expose bare rock. Primary succession happens over a long period of time.



Place the “Primary Succession Photographs” on the table. Instruct the children to listen carefully as you read the text on the next page. Have the children place the photographs that match the text in order from



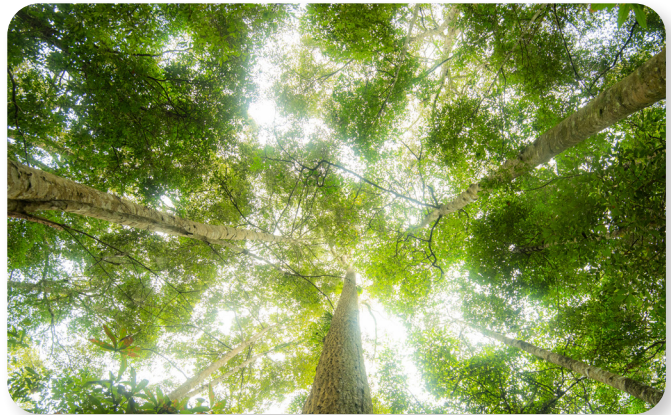


**left to right on the table. The type of succession and the order of the images are listed on the back of each image and can serve as an answer key.**

1. A volcanic blast has occurred far out in the ocean. Massive amounts of lava steam and splatter through the salty, deep water, rising far above the surface and slowly settling, cooling, and hardening to create a new, vast, and barren rock island.
2. Over time, pollen, microbes, and bacteria find their way into the crevices and settle in the hard rock. The wind and weather carry the spores of lichens and mosses to the black rock, and they begin to grow. These small living organisms are known as **pioneer species** because they are the first species to inhabit this land.
3. The lichens and mosses begin to cover the ground. As they die the decomposing process begins, and weathering causes the rock to break into smaller pieces. The tiny rock fragments mix with the decayed remains of the lichens and mosses. This creates a thin layer of soil.
4. With soil present, seeds are now able to grow. Seeds are brought to the area through bird droppings or the wind, and small flowers and grasses begin to grow. As time passes, flowers, grasses, lichens, and mosses continue to reproduce. Once they die, they decompose into a thicker layer of soil.
5. Small shrubs now start growing. Insects and small animals find a home with food and shelter. They are able to reproduce and grow. The decomposing process creates an even thicker layer of soil, enabling more growth of plants and even small trees.
6. Tall trees now grow and create an incredible green canopy, allowing more animals to inhabit the area. The tall trees crowd out some sunlight for the smaller grasses. Fewer mosses and lichens are found at this level. During the course of 200–300 years, what was once a barren rock wasteland has now become a thriving ecosystem in a **climax**



**community.** This is the last stage in the process of ecological succession, when a community reaches its climax or full potential with all the plants and animals existing in balance.



### □ Secondary Succession



**Read to the children: *Secondary succession***

occurs when an already developed ecosystem community is suddenly destroyed or gradually replaced, but the soil remains.

Living organisms begin to grow on the surface of the remaining soil. This can happen after a natural disaster, such as a forest fire, tsunami, tornado, landslide, drought, or flood. It can also result from human effects, such as deforestation, war, contaminant spills, or abandonment of an area.

**Place the “Secondary Succession Photographs” on the table. Instruct the children to listen carefully as you read the text on the next page. Have the children place the photograph that matches the text in order from left to right on the table. The type of succession and the order of the images are listed on the back of each image and can serve as an answer key.**





# ECOLOGICAL SUCCESSION *Key*

With your parent or teacher, read and discuss the verses below from the Bible. Then complete the page by identifying and drawing three pictures of the sequence of succession for the fruit tree as mentioned in these verses.

And God called the dry land Earth: and the gathering together of the waters called he Seas: and God saw that it was good.

And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so.

And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good.

—Genesis 1:10-12



First the earth brought forth ...

seed



and then ...

tree



and then ...

fruit



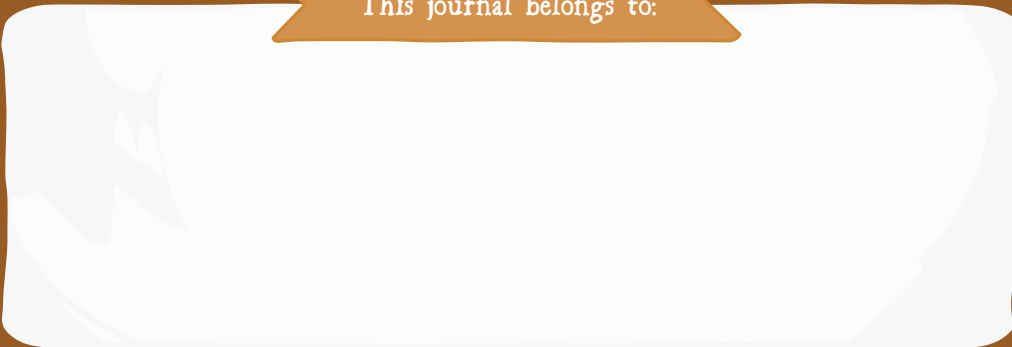


# ECOSYSTEMS

Grades 3-6

# STUDENT JOURNAL

This journal belongs to:





## INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Ecosystems* science unit. It contains all the worksheets and journal pages that are needed to complete the unit. Each student will need his or her own copy of the science journal.

Have each student take his or her time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries when they've finished.





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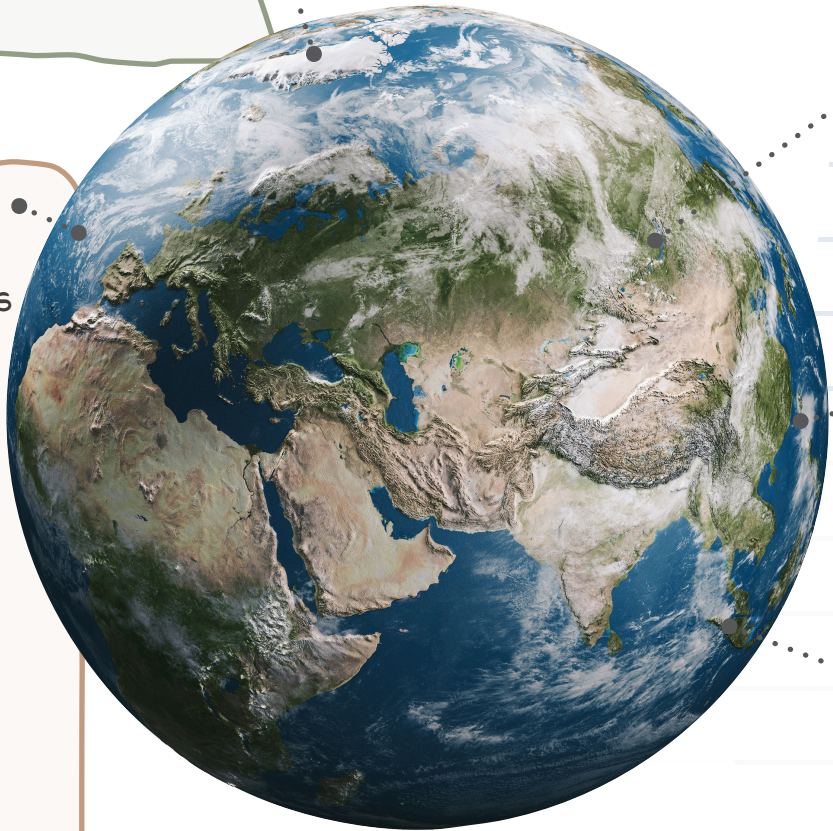
# ECOLOGY AND OUR WORLD

Write or draw a picture to answer each of the five questions below.

① What is one way ecologists care for the earth?



② What is one way that humans interact with nature?



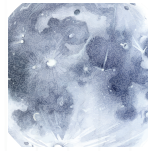


# BIOTIC VS. ABIOTIC

Determine whether each item from the "Creation Cards" activity is biotic (living) or abiotic (nonliving). In the circle next to each image, write a "B" if the item is biotic or an "A" if the item is abiotic.



Sun



Moon



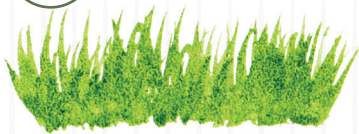
Stars



Land (Earth)



Seas



Grass



Seeds



Fruit Trees



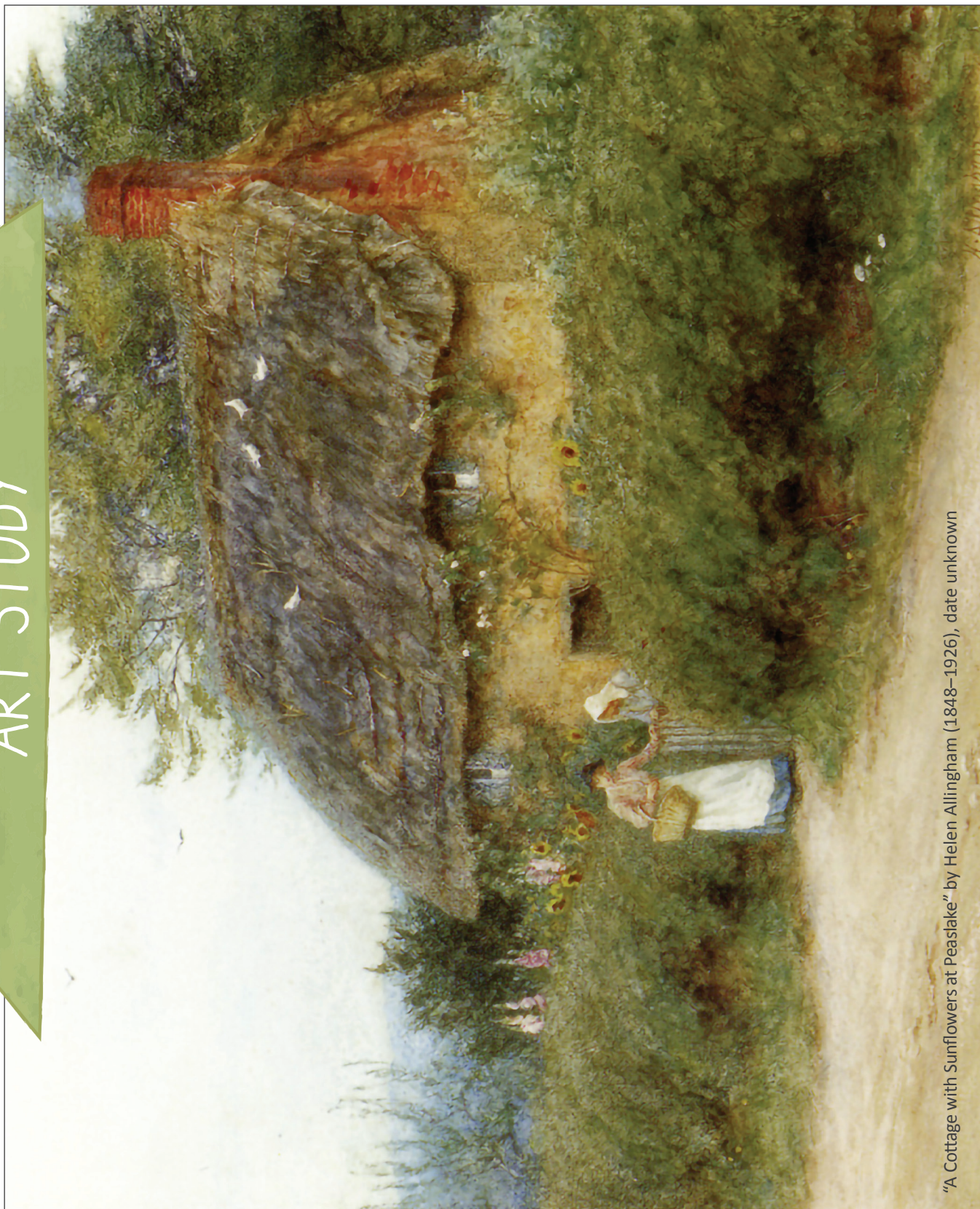
Animals



Humans



ART STUDY



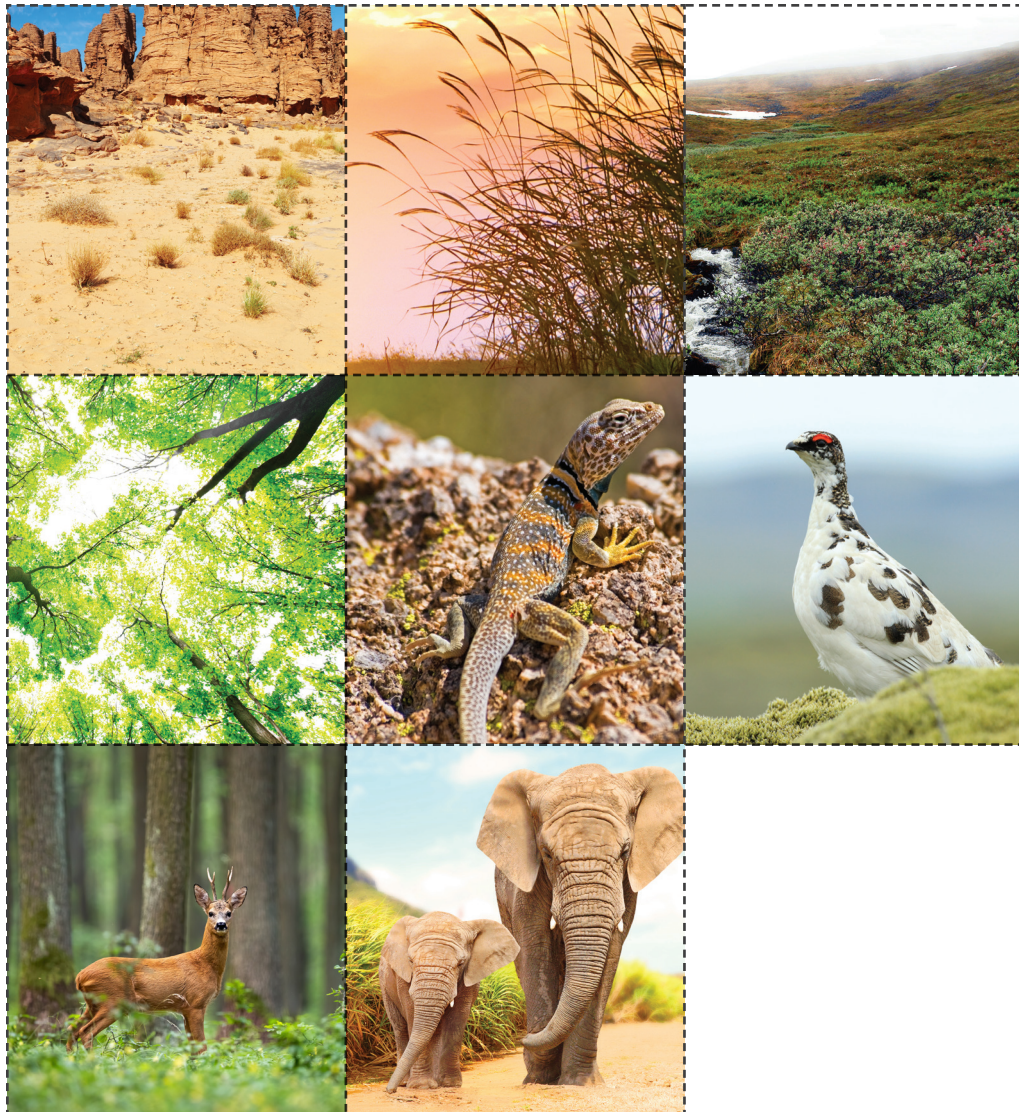
“A Cottage with Sunflowers at Peaslake” by Helen Allingham (1848–1926), date unknown









# TERRESTRIAL BIOMES PHOTOGRAPHS

Cut out the photographs below and glue each one in its correct space on the "Terrestrial Biomes" chart on the following page. Then fill out the climate checklist for each biome.





# TERRESTRIAL BIOMES

Biome	Photo	Types	Climate <small>Check all that apply</small>	Plants & Animals
<b>Desert</b> 	Glue photo here	<ul style="list-style-type: none"> <li>• Arid</li> <li>• Semi-arid</li> <li>• Cold</li> <li>• Coastal</li> </ul>	<p><u>Temperature:</u></p> <input type="checkbox"/> hot <input type="checkbox"/> cold <input type="checkbox"/> moderate <p><u>Precipitation:</u></p> <input type="checkbox"/> little <input type="checkbox"/> heavy <input type="checkbox"/> moderate <p><u>Moisture:</u></p> <input type="checkbox"/> dry <input type="checkbox"/> humid	Glue photo here
<b>Tundra</b> 	Glue photo here	<ul style="list-style-type: none"> <li>• Arctic</li> <li>• Alpine</li> <li>• Antarctic</li> </ul>	<p><u>Temperature:</u></p> <input type="checkbox"/> hot <input type="checkbox"/> cold <input type="checkbox"/> moderate <p><u>Precipitation:</u></p> <input type="checkbox"/> little <input type="checkbox"/> heavy <input type="checkbox"/> moderate <p><u>Moisture:</u></p> <input type="checkbox"/> dry <input type="checkbox"/> humid	Glue photo here
<b>Grasslands</b> 	Glue photo here	<ul style="list-style-type: none"> <li>• Prairie</li> <li>• Steppe</li> <li>• Savanna</li> <li>• Pampas</li> <li>• Downs</li> </ul>	<p><u>Temperature:</u></p> <input type="checkbox"/> hot <input type="checkbox"/> cold <input type="checkbox"/> moderate <p><u>Precipitation:</u></p> <input type="checkbox"/> little <input type="checkbox"/> heavy <input type="checkbox"/> moderate <p><u>Moisture:</u></p> <input type="checkbox"/> dry <input type="checkbox"/> humid	Glue photo here
<b>Forest</b> 	Glue photo here	<ul style="list-style-type: none"> <li>• Tropical Rainforest</li> <li>• Boreal (Taiga)</li> <li>• Temperate</li> </ul>	<p><u>Temperature:</u></p> <input type="checkbox"/> hot <input type="checkbox"/> cold <input type="checkbox"/> moderate <p><u>Precipitation:</u></p> <input type="checkbox"/> little <input type="checkbox"/> heavy <input type="checkbox"/> moderate <p><u>Moisture:</u></p> <input type="checkbox"/> dry <input type="checkbox"/> humid	Glue photo here



# ECOLOGICAL SUCCESSION

With your parent or teacher, read and discuss the verses below from the Bible. Then complete the page by identifying and drawing three pictures of the sequence of succession for the fruit tree as mentioned in these verses.

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And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good.

—Genesis 1:10-12



First the earth  
brought forth ...

and then ...

and then ...

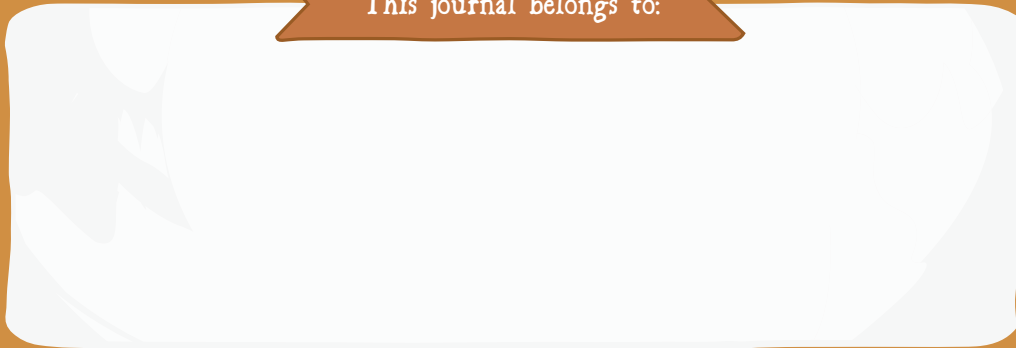


# ECOSYSTEMS

Grades 7-8

# STUDENT JOURNAL

This journal belongs to:





## INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Ecosystems* science unit. It contains all the worksheets and journal pages that are needed to complete the unit. Each student will need his or her own copy of the science journal.

The lesson extensions are also found here. These extensions are optional for older students (grades 7–8) to complete on their own. Each extension is accompanied by lined paper so the student can keep his or her work in one place.

Have each student take his or her time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries when they've finished.





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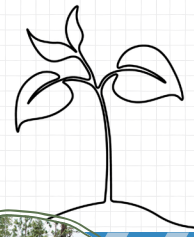




## EXTENSION

## Instructions:

1. Read the information below.
2. Answer the questions in one or two sentences.
  - a. How do you think an earthquake could affect animal life in or near the area where you live?
  - b. What are some possible positive effects of an earthquake?



## Earthquakes and Ecosystems

Thousands of earthquakes happen throughout the world every year. That's about 50 earthquakes every day! We often hear of lives lost and property destroyed in human-inhabited areas, but how do earthquakes affect the living things in other areas? Let's take a look at how an abiotic factor, like an earthquake, can change the lives of wild animals.

### Earthquakes and Animals



Since early times, people have believed that animals can sense earthquakes before they happen. While it is unlikely that an animal can predict an

earthquake, animals have been observed acting strangely prior to earthquakes because they are able to detect an earthquake's first seismic waves—the **P waves**, or pressure waves, that arrive in advance of the **S waves**, or secondary shaking waves. Another way that animals can detect an earthquake is through sound. Elephants can sense much lower sound waves than humans can, so they may hear or feel a quake before it reaches the surface.

How would an animal act if it were to notice something different, like a P wave? It might run, act confused, or seem more alert. While animals have been observed to act differently before an earthquake hits, this behavior was usually remembered *after* the earthquake, not used to predict the quake before it happened. Could animals be used to warn us of earthquakes in the future? Some scientists think it's possible by tracking the activity of tagged animals, including unusual mass migrations, and comparing it to seismic activity from space.

Whether or not animals sense an earthquake before it comes, they can still be affected by it when it arrives. There are several ways that a wild animal's life can be changed because of an earthquake.

### Loss of Life

Just as with humans, there is potential for loss of life in the animal world when earthquakes hit. Depending on the severity of the loss, this could have a drastic impact on an ecosystem, as it could result in too many or not enough of a certain type of animal within the ecosystem. This is called **ecological imbalance**.

### Geographical Changes



Earthquakes can cause significant geographical changes that can affect animal habitats and ecosystems. This lake in Montana, USA, known as both Quake Lake and Earthquake Lake, was formed when a 1959 earthquake caused a landslide that blocked the Madison River. Landslides can also wipe out entire forests. Just think of how that would affect an ecosystem! Forests provide many things for animals, including food and shelter.

### Debris

Animals living in the ocean are also affected by landslides caused by earthquakes. As rocks and dirt rush into the ocean, they sometimes



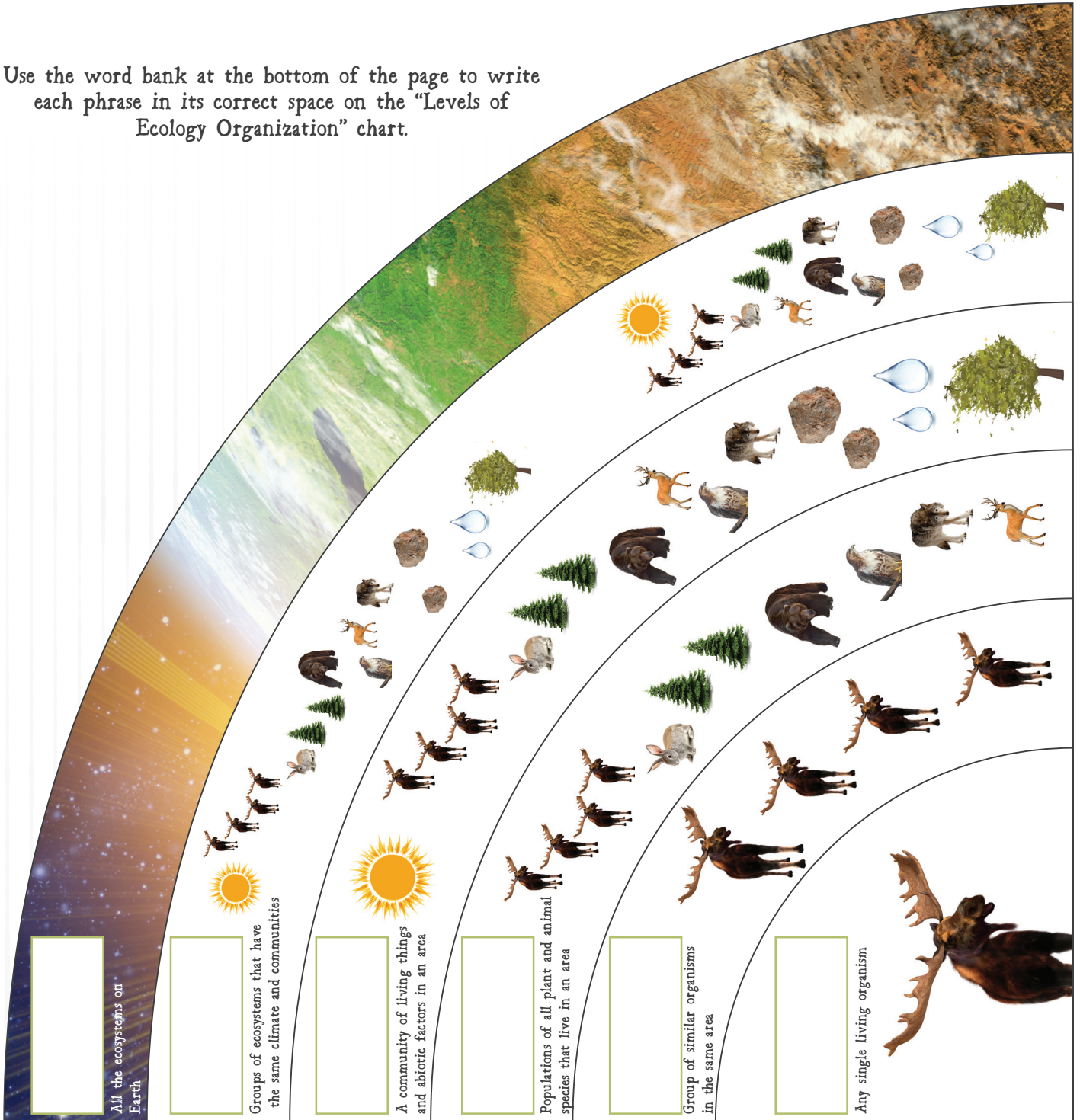
take human household items and rubble with them, which become ocean debris. Animals may get injured by or become trapped in this debris as it floats around or makes its way to the ocean floor.

While humans can't do anything to prevent earthquakes from happening, we can try to help wildlife survive the aftermath.



# LEVELS OF ECOLOGY ORGANIZATION

Use the word bank at the bottom of the page to write each phrase in its correct space on the "Levels of Ecology Organization" chart.



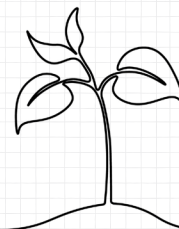
## Word Bank

Ecosystem    Biosphere    Community    Population    Individual organism    Biome



**Instructions:**

1. Read the information below.
2. Draw a carbon cycle diagram in your science journal and label it with the four processes that contribute to the carbon cycle.



## The Carbon Cycle

Our planet and its atmosphere are part of a closed environment where the matter that exists now is all that will ever exist. As the Law of Conservation of Mass states, *Matter is neither created nor destroyed*. For example, water is never destroyed or created; it simply changes forms in a cycle. Carbon also changes forms in a cycle and must be recycled as it is the foundation of all life on Earth—the “building block of life.” This is because carbon can form stable bonds with many elements, including itself, and be part of millions of different compounds.

Most carbon is found in rocks and sediments in the earth, including fossil fuels. The rest is found in living organisms, in the ocean, and in the atmosphere in the form of carbon

dioxide, or  $\text{CO}_2$ . Key molecules that make up organisms, such as protein and DNA, contain carbon.

The carbon cycle is nature’s way of reusing carbon atoms. These carbon atoms travel from the atmosphere into the earth’s organisms and back into the atmosphere again and again. Four major processes contribute to the carbon cycle. As you read about them, refer to the image on the left.

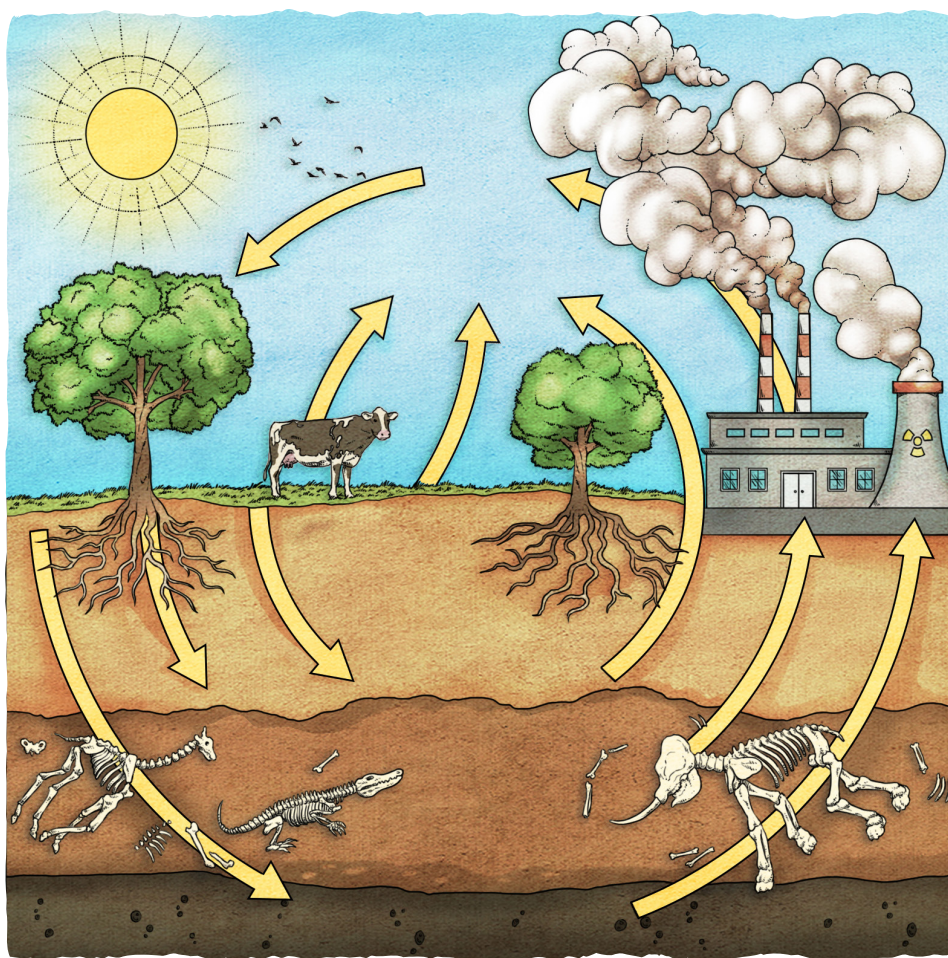
**Photosynthesis**—Plant matter uses energy from the sun to combine carbon dioxide from the air with water and nutrients, creating sugar and oxygen.

**Respiration**—Organisms use the oxygen released by plants to **respire**. They inhale oxygen and exhale carbon dioxide, which goes back into the atmosphere. Even plant roots

respire by taking up oxygen from the air in the soil and combining it with the sugars produced during photosynthesis to create energy for growth.

**Decomposition**—Dead material from plants and animals is broken down and releases carbon into the air, soil, and water.

**Combustion**—When organic material is burned, one of the byproducts is carbon dioxide. Others include water and energy. When we take carbon-filled fossil fuels from the ground and burn them, we are able to power cars and factory motors. This releases more carbon into the atmosphere in the form of carbon dioxide. Carbon dioxide is a pollutant in the atmosphere, but some of it cycles back to plants, which take the carbon dioxide from the air and convert it all over again through the process of photosynthesis!



# ENERGY PYRAMID



0.1 kcal

Apex Predators      Trophic Level 5

90%  
energy loss



Tertiary Consumers

1 kcal

Carnivores



Trophic Level 4

90%  
energy loss



Secondary Consumers



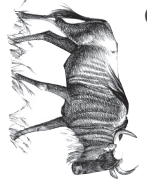
Omnivores



Trophic Level 3

10 kcal

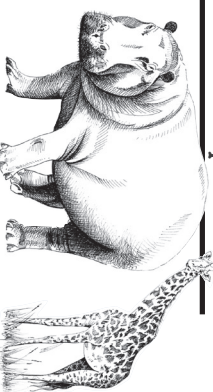
90%  
energy loss



Primary Consumers



Herbivores



Trophic Level 2

\_\_\_\_\_ kcal

90%  
energy loss



Producers



Trophic Level 1

1,000  
kcal

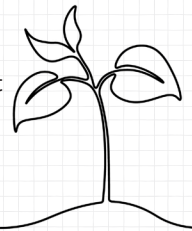




# EXTENSION

## Instructions:

1. Read about apex predators below and study their food chains.
2. Write or draw the food chain for each of the three predators shown at the bottom of the page.



## Apex Predators

Deep in the woods, a black shadow leaps from the branch of a tree to the ground below. Stalking its prey, the predator moves about at will with no fear. This black jaguar is an apex predator, and it resides at the top of a food chain with no natural predators to threaten its life. Apex predators have a strong ecological impact because they greatly affect the populations of their prey species, which can help an ecosystem remain balanced and naturally regulated. Human hunting has caused some apex predator species to reach near extinction, but conservation efforts have helped regain balance and control prey populations in many areas.

**Eagle**

With their sharp beaks and talons as well as their large size, eagles are apex predators of the sky. They safely soar high above the ground while searching for prey.

**Polar Bear**

Polar bears dominate the Arctic region by hunting from the ice. Their powerful paws and jaws can kill a seal with one blow.

**Komodo Dragon**

These giant lizards live on isolated Indonesian islands. Feeding mostly on meat, their venomous saliva can still kill an animal even if it manages to escape after being bitten.

What does the food chain look like for these apex predators?



**Wolf**



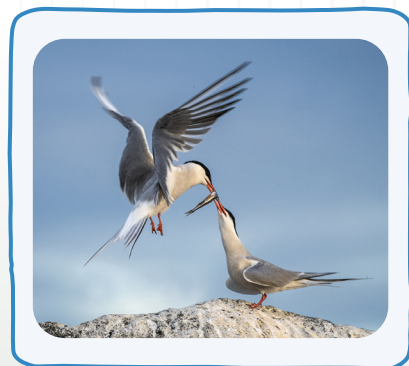
**Lion**



**Orca**

# COMPETITIVE INTERACTIONS

Look at each image below and determine if it shows an **INTRASPECIFIC** or an **INTERSPECIFIC** competitive interaction. Write the answer on the line below each image.





ART STUDY



"A Cottage with Sunflowers at Peaslake" by Helen Allingham (1848–1926), date unknown

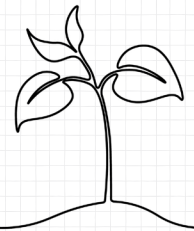




## EXTENSION

## Instructions:

1. Read the information below.
2. Write a paragraph answering two of the questions below:
  - a. How does one of the quotes by Wangari Maathai inspire you?
  - b. How do the trees found in Africa help the people there? How do trees impact your life?
  - c. What are the accomplishments of Wangari Maathai?



“You can make a lot of speeches, but the real thing is when you dig a hole, plant a tree, give it water, and make it survive. That’s what makes the difference.”

“There are opportunities even in the most difficult moments.”



Wangari Maathai

“It is extremely important for adults and especially those who are in charge of cities to make sure that we do not lose touch with the land and with the environment.”

“No matter who or where we are, or what our capabilities, we are called to do the best we can.”

Wangari Maathai was a well-known environmentalist and biologist who made a difference in the world around her. Wangari was born in Nyeri, Kenya, Africa, in 1940 and attended the Mathari Catholic Mission boarding school in 1951. There she joined the “Legion of Mary” and learned to live by the motto “Serve God by serving fellow human beings.” Wangari lived up to this motto during her lifetime as she dedicated countless hours to serving the community around her. After boarding school, Wangari attended Loreto High School, where she was rated first in her class. In 1960 Wangari earned a scholarship and traveled to the United States to attend college, where she studied biology and fostered her love for the natural world around her.

After earning her master’s degree in biology, Wangari went home to Africa. She found her place and mission in the world as she interacted with the community around her. She became known as the Mother of Trees and used her education and wisdom to improve daily life for thousands of families in her homeland of Kenya.

Daily life in Africa was difficult. The streams were drying up, and supplies were becoming scarce. Women had to walk farther and farther to procure

water for their families, fencing for their animals, firewood for cooking, and food for their hungry children. Many women sought out Wangari’s wisdom and pleaded for help. Do you know what Wangari’s response was to all these women? Plant a tree! Wangari founded the Green Belt Movement in Africa that transformed the landscape of Kenya and improved the lives of many Africans. Millions and millions of trees were planted as a result of Wangari’s leadership and vision. Wangari became the first African woman to earn the Nobel Peace Prize. When she passed away at the age of 71, she left a legacy, a movement, and an improved environment that will remain for generations to come.

## Trees of Africa

**Muluhakuha**

This tree provides wood to build homes.

**Mukuyu**

This tree can filter and clean water and is considered sacred to people in Africa.

**Moringa**

Moringa seed oil contains antiseptic and anti-inflammatory properties that can help heal a variety of wounds and insect bites.

**Mubiru muiru**

The delicious fruit of this tree is enjoyed, and the seeds are saved and shared to grow more.

**Mukawa**

The prickly thorns on this tree create a natural fence to keep out unwanted predators.

**Muheregendi**

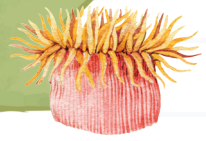
This tree provides food for goats, which in turn provide milk for humans.

**Mukinduri**

The wood of this tree provides firewood for cooking and warmth.



# MARINE BIOMES FACTS



There is one fact about each marine biome in each row below. Beginning with the ocean biome, find the fact in the first row that goes with it and draw a line from "Ocean" to that fact. *Hint: The facts are scrambled.*

Move to the next row, drawing a line from the fact in the previous row to the matching fact in that row, continuing down each row until you reach the last row. Repeat with the next two biome names. The letters on the ocean biome fact boxes will reveal the answer to the riddle:

**What is the strongest creature in the ocean?**

## Ocean

Can also be called bays, inlets, or lagoons, each of which has one or more streams flowing into it. **A**

Because of its depth and lack of oxygen, much of it is still unexplored. It is like visiting the moon! **U**

An example is mangrove swamps, which have a mix of salt and fresh water and are found closer to the ocean. **R**

American alligators live here in the brackish waters. Crocodiles can be found in fresh or salt water. **T**

Filter animals, such as oysters and clams, thrive here. They help clean out impurities in the water. **C**

Many species of fish are born in estuaries before making their way out to the sea. **O**

## Coral Reef

The salt content throughout its large area decreases the freezing temperature, so it rarely freezes. **M**

These form when a freshwater river meets the ocean, forming a mix of salt water and fresh water called brackish water. **T**

The Mariana Trench is the deepest part, reaching depths of over 10,973 m (36,000 ft). **S**

Many animals live in the coral structure, including sea turtles, sharks, fish, rays, and sea anemones. **N**

It's estimated that 50–80% of living organisms on Earth call it home. **E**

The coral gets its many brilliant colors from algae growing inside called *zooxanthellae*. **R**

## Estuary

It is made of coral polyps, which are tiny animals. **S**

Most coral grows very slowly and can take hundreds of years to form. **E**

Some coral reefs have been around for thousands of years. **A**

Plant and animal life varies according to the depth of the water and the amount of light available. **S**

The coral structure is naturally white. **T**

The blue whale, the largest living animal, can only live here in the largest marine biome. **L**



# ECOLOGICAL SUCCESSION

With your parent or teacher, read and discuss the verses below from the Bible. Then complete the page by identifying and drawing three pictures of the sequence of succession for the fruit tree as mentioned in these verses.

And God called the dry land Earth; and the gathering together of the waters called he Seas: and God saw that it was good.

And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so.

And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good.

—Genesis 1:10–12



First the earth  
brought forth ...

and then ...

and then ...

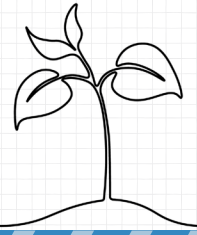




## EXTENSION

### Instructions:

1. Read the information below.
2. Draw a cycle of a pond succession that includes three pioneer species, two plant species that may be found in, on, or around ponds, and five animal species that may rely on the pond. Label each species type.



## Pond Succession

Have you ever seen a caterpillar change into a beautiful butterfly? Just like a butterfly goes through changes in a life cycle, a pond undergoes changes in a cycle called **pond succession**.

Ponds can develop from a simple depression in the earth. This lowered area can be created by humans or natural events and eventually fills with water, which can come from the earth (groundwater), the sky (rain or snow), or humans. As soon as the pond has water, it is ready to support life.

First, smaller organisms, such as algae, begin living in the pond. These are called **pioneer species**. Then animals such as insects, fish, and amphibians move in. Ponds are also an important source of water for other animals, such as birds and deer.



As the organisms and animals that live in the pond grow, die, and decay, the pond begins to fill with **sediment**. As this organic material settles to the bottom of the pond, it plays a major role in the life of the pond. If the pond is man-made and maintained, it will likely experience occasional cleaning. In natural ponds the sediment eventually builds up so much that there isn't much water left, creating a swamp or bog. Once the water is completely gone, another type of ecosystem can form, such as a grassland or a forest.

Animals aren't the only living things that rely on ponds. Many types of plants, such as cattails, water lilies, and water lettuce, grow in, on, and around ponds. Plants also add to the sediment, bringing a pond to the end of its life cycle.

## Pond Wildlife

### White-Tailed Deer



### Mosquito



### Great Cormorant



### Water Lettuce

