Outdoor Wonders and Learning™

OWL

an initiative of The NC Arboretum

K-5 Curriculum Guide for N.C. Educators

Funded by a grant from the North Carolina GlaxoSmithKline Foundation
The North Carolina Arboretum Society

Table of Contents

Suggestions for Use:

Each of the lessons in this Educator's Guide are intended to work both as part of a more complete unit as well as to be stand-alone lessons in conjunction with an outdoor space.

These lessons follow the 5E Instructional Model within each activity, and are also labeled as their own phase of a larger Instructional Model to be use in a unit or larger lesson.

Acknowledgements

Writers and Editors

Jenna Kesgen

Michelle Pearce, Project OWL Program Manager

Lunsford R. (Rich) Preyer, III

Supplemental Reading Consultants

Marilyn Arnone, Professor of Practice at Syracuse University, NY
Director of Nature Booklist Project

Beverly McBrayer, Hall Fletcher Elementary, NC

Logo Design

Timberdoodle Studios

Page Art

Jenna Kesgen

Curriculum Reviewers—2017

Katianne Balchak, W.D. Williams Elementary, NC

Simone Randazzo, Evergreen Community Charter School, NC

Susie Rubidoux, Rainbow Community School, NC

Melissa Scott, Rainbow Community School, NC

Sarah Torry, North Cove Elementary, NC

Curriculum Reviewers and Consultants—2019

Carla Billups, STEM Coach for Buncombe County Schools, NC

Mark Ethridge, Haywood County Schools, NC

Kelly Hanna, Invest Collegiate Imagine, NC

Patty Long, Charles C. Bell Elementary, NC

Sarah Torry, W.D. Williams Elementary, NC

Introduction to the Guide

The field of Environmental Education, or place-based education, encompasses more than nature and science. Once thought of as an optional "add-on" to required science curriculum, today place-based education can be used as an incorporating technique across many subject areas and can connect subjects already being taught in a real-world context. As it is interdisciplinary in approach, environmental education has developed to incorporate the standards of learning for all subjects including math, language arts, and social studies. At the same time, place-based education offers students the opportunity to learn reasoning skills that enable them to think critically about real-world situations. Additionally, the method of teaching and learning in a natural setting has resulted in an improvement in student behavior, a renewed enthusiasm towards learning, and an improvement in student performance on standardized tests.

OWL (Outdoor Wonders and Learning) is an initiative focused on encouraging North Carolina educators to utilize outdoor spaces in delivering high-quality interdisciplinary educational opportunities with a science focus, for children in grades K-5. Educators will be able to use outdoor lessons that are carefully aligned with the Essential Standards set by the North Carolina Department of Public Instruction. This will be accomplished with the following objectives:

- Increase each educator's understanding of science content included in grade level curriculum;
- Equip classroom and non-formal educators with activities that encourage inquiry-based, outdoor approaches to science education standards;
- Build confidence in non-formal educators to use and align their environmental education programs to the N.C. Essential Standards; and
- Building confidence in classroom teachers to use and align environmental education activities to their classroom lessons.

This bridging of formal and non-formal education will encourage regular and sustained use of outdoor spaces to enhance science lessons and create greater interest, understanding, and retention of concepts among students.

Overview

The main themes of this curriculum guide are:

Unit 1: Get to Know the Great Outdoors

- Nature is made of living and non-living things.
- Though there are different types of environments in nature, each meets the specific needs, in quality and quantity, of the plants and animals that live there – habitats.

Unit 2: Animals and Adaptations

- Animals can be grouped based on like characteristics. Common categories are Vertebrates and Invertebrates. Vertebrates can be grouped in the subcategories of Mammals, Birds, Reptiles, Amphibians, and Fish.
- Some animals have very distinct life cycles.
- Animals have special adaptations that help them survive in their habitat. An adaptation can be a physical feature or a behavior.

Unit 3: Plants and Trees

- Plants and trees are considered Producers because they "produce" their own energy through photosynthesis.
- Plants and trees have a life cycle and change seasonally.
- Like animals, plants and trees also have adaptations that help them survive in their habitats.

Unit 4: Weather and Climate

- Weather conditions change daily and can be predicted by studying patterns in factors such as temperature, wind speed and direction, and precipitation.
- Weather patterns are seasonal and depend on particular place and time of day. Climate is the observation of weather patterns in a particular location over a long period of time.

Unit 5: Ecosystems

- An ecosystem is the interactions between living and non-living things in an environment. Ecosystems can be on land or in the water.
- The living organisms in an ecosystem interact as producers, consumers, or decomposers.
- When plants and animals are introduced into new habitats by humans, they often become invasive

Activity Organization

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Summary is the brief description of what information the activity will cover.

5E Phase

Supplemental Reading

Lists books that are relevant, but not required, for the activity.

Grade Levels:

Indicates the grade range that would benefit the most from the activity.

Curriculum Correlation:

A list of numerical codes that show how the activity addresses aspects of the NC Essential Standards.

Materials:

Lists the suggested materials needed to do the activity.

Duration:

Estimated time it will take to implement the activity. This time does not include set up or material preparation.

Location:

A suggested area where the activity can be implemented. Options include: classroom, open space, Outdoor Study Area, etc.

Procedure:

Provides the step by step method for implementing the activity. **Bolded** words can be found in the Glossary section of the Appendix.

Variation:

Offers alternative procedures for implementing the activity.

Extensions:

Additional activities that expand the scope of the topic.

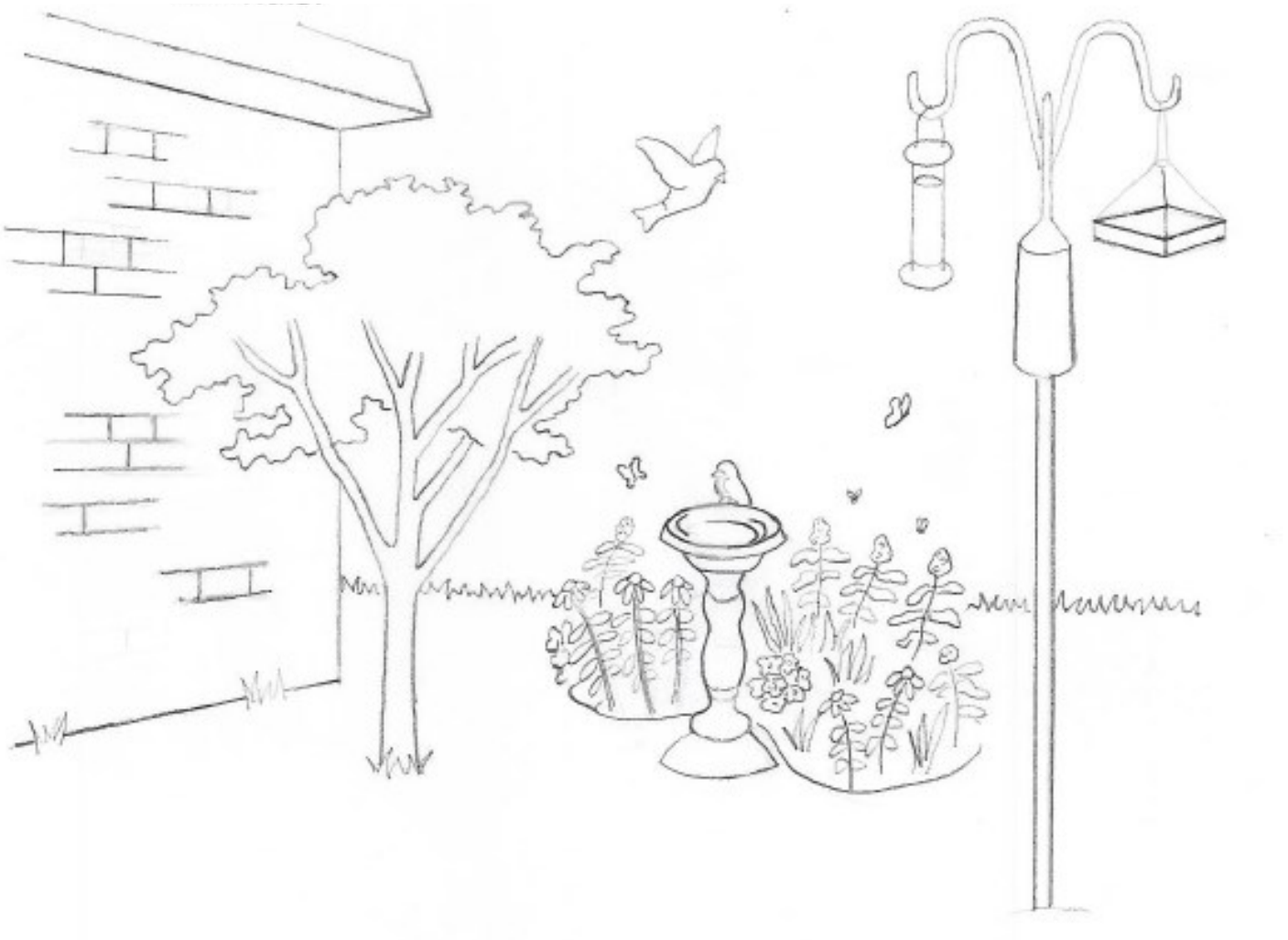
Learning Targets:

Provides educational objectives for teachers to assess the students' comprehension of the activity.

Unit 1:

Get to Know the Great Outdoors

The environment is everything that surrounds us. An environment can, and often does, contain natural and human-made things, and living and non-living things. In this unit, students will learn to identify the differences between living and non-living things and how the specific quality and quantity of these things customize habitats for plants and animals.



Topic 1A:

The World Around You

Background

Nature is made of both living and non-living things. Living things are organisms that grow and change, need nutrients and air, and reproduce. The living things in our environment are plants and trees, animals, and fungus. Non-living things are parts of the environment that have never been alive. The non-living things are air, soil, water, and sunlight. These things could also include natural items that came from animals but were never alive like spider webs, excrement, feathers, and fur. Non-living things can also be part of the built environment such as buildings, sidewalks, cars, tables, books, and backpacks. Nature also has things that are dead or were once living. These can be logs on the ground, piles of leaves and sticks, or an animal carcass. Things that are dead still play a large role in how the environment works.

What's Alive?

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The students will observe an indoor and outdoor location to compare and contrast the living and non-living things they find there.

Engage

Supplemental Reading

Grades K-2:
What's Alive? By Kathleen Weidner Zoehfeld

Grades 3-5:
Is It A Living Thing? By Bobbie Kalman
What Is A Living Thing? By Bobbie Kalman

Grade Levels:

K, 1, 2, 3, 4, 5

Curriculum Correlation:

NCSCS—Science
K.L.1.2, 1.L.2.1, 1.L.2.2, 4.L.1.2, 5.L.2.2, 5.L.2.3

Materials:

Whiteboard or Smart Board; notebook paper; pens or pencils

Duration:

30-45 minutes

Location:

Indoor classroom space and Outdoor Study Area

Procedure:

1. Draw a two-column chart on a board with the headings Living and Non-Living. Have the students look around the classroom for 3-5 minutes to see how many living things they can find. List their ideas in the "Living" column on the chart. Complete the same for the non-living column.

2. Ask the students questions such as:

   - What makes something a living thing?
   - Are you a living thing? How do you know?
   - What does it mean to be non-living?

   Write the student's definitions of Living and Non-Living on the board. If necessary, take the time to explain the difference between non-living and once living.

3. After the classroom chart is complete, have each of the students make a new chart on a sheet of paper. Take the group to an outdoor space to find a quiet ***Sit Spot***. Ask them to use more of their senses, like listening (bird songs, airplanes), feeling (wind blowing, warmth from the sun), or even smelling (flowers, car exhaust) before they use their eyes to identify what is living or non-living in the area. Here they will repeat the classroom activity on their own charts, starting with living things, then non-living. Come back inside once their charts are complete.

What's Alive?

Outdoor Wonders and Learning™

4. ***Think, Pair, Share:*** Have the students think on their own first to compare and contrast the classroom list to the outdoor list. Next, ask the students to find a partner to share what they found. Then ask the group to come together for a larger discussion. The following questions can be asked during the group discussion:

- What surprised you about the amounts of living and non-living things?
- Which chart has more living things? Why do you think that is?
- Did any of the non-living things listed once come from a living thing?
- Looking at both charts, how do the living things use the non-living things?
- Do the living things use other living things? Do the living things use any once living things?

Extension: (Grades 3-5)

1. Design a visual map that illustrates the relationships discussed between living and non-living things. Try to incorporate the vocabulary and concepts discussed.

Learning Targets:

1. Compare the characteristics of living and non-living things.
2. Recall what living things need to stay alive.
3. Infer simple connections between living and non-living things in different environments.

Topic 1B:

A Home for A Habitat

Background

All living things have basic needs that must be met in order for them to stay alive. They need air, water, light (plants only), space, food, and shelter. Plants and animals can get these things from their environment, but they must be of the proper quality and quantity required. An environment becomes a ***habitat*** for a plant or animal when the arrangement of air, water, light (for plants), space, food, and shelter are suitable for its needs.

People may consider a house as their shelter, and they have many different kinds of housing options that suit their needs (traditional houses, apartments, trailers, condos). In a human's home they have access to water, food, and a place to sleep. An animal may find shelter underground, in a bush, under the bark of a tree, or in a pile of rocks, but they likely do not have food and water in that location. Animals need space to live in and it needs to be the right size for them to find the things they need (food, water, shelter). An animal's home is more like a neighborhood. Plants do not need to move around, but they still need enough space to spread their roots to find water, and for their branches to grow to reach the sunlight for photosynthesis.

Plants and animals will be affected if any of these components are missing or are changed so much that the arrangement is no longer suitable. The impact may not be catastrophic, but it certainly could be. There are also other ***limiting factors*** such as disease, predation, pollution, and climatic conditions that can affect the survival of all living things.

My Home is Your Home, Or Is It?

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Students will make maps of their homes and maps of outdoor habitats to learn how and where living things get the components they need for survival.

Engage

Supplemental Reading

A House is a House for Me By Mary Ann Hoberman

Even an Octopus Needs a Home By Irene Kelly

Grade Levels:

K, 1, 2

Curriculum Correlation:

NCSCS—Science
K.L.1.2, 1.L.1.1, 1.L.2.1, 1.L.2.2
NCSCS—Social Studies
K.G.1.1, K.G.2.2, 1.G.1.2, 1.G.2.2, 2.G.2.1

Materials:

Habitat Images (see Appendix); notebook paper; pens, pencils or crayons

Duration:

30 minutes

Location:

Indoor classroom space and Outdoor Study Area

Procedure:

1. Split the class into small groups and hand out Habitat Images from the appendix, or some you've created. (*Have you ever seen a place like this?*) Have the groups list what they see in the picture (*What did you discover?*) then compare it to what the other groups listed about their photos. (*How is this the same or different from Group X's photo?*)

2. Ask the students to draw a picture or map of the inside of their home, being sure to include all the things they need in their home. If they get stuck, guide them with questions like- where does their food come from, where do they get water from, where do they sleep?

3. When the maps are finished, gather the group to talk about what they included in their drawings. Possible discussion questions may include:

- Is your sleeping space on a different level from your food? When does this happen in nature? **Think of a forest with layers – canopy, sub canopy/understory, ground level.*
- How many places can you find water in your home? How far do you have to travel to get there?
- Do you have a special area just for games, toys, or TV? Do you think animals have an area like this?

**Animals may need a certain amount of space in their habitat to allow for play or for basking and rest.*

Now explain that there is a word used to describe where plants and animals live and get their food, water, shelter, air, and space to grow and move—**Habitat**.

4. Next have the students visit a natural outdoor space and draw what they see. Have them label sources of food, water, shelter or cover, and space that various plants and animals might use. Use can reference a specific example like a bird, squirrel, or nearby tree to get them started.

5. Have the students compare the outdoor habitat to their habitat. This can be done using a T-Chart or Venn Diagram. Discuss differences and similarities among the two homes with the students. Summarize the discussion by emphasizing that although the habitats are different, every living thing needs a home.

Extensions:

1. Look at a neighborhood or city map that includes places like the school and grocery stores. Have the students draw circles around the communities that share resources (see Appendix for example. To make a map of your area use Acme Mapper at mapper.acme.com)
2. Students can select a plant or animal native to North Carolina to research and draw its habitat. Write a paragraph to describe how the habitat meets the survival needs of the plant or animal.
3. Create a song or poem that highlights the components plants and animals need in a habitat.

Learning Targets:

1. Summarize the basic needs of plants and animals for energy and growth.
2. Give examples of ways humans depend on their environment to meet their needs.

Habitat Connections

Outdoor Wonders and Learning™

Students will become more familiar with each other and their local habitat with this hands-on demonstration to learn the importance of interdependence.

Engage

Supplemental Reading

Step Into the Forest
By Howard Rice

Bridge to Terabithia
By Katherine Paterson

Grade Levels:

3, 4, 5

Curriculum Correlation:

NCSCS—Science
3.L.2.2, 4.L.1.1, 5.L.2.2, 5.L.2.3

Materials:

None

Duration:

20 minutes

Location:

Large indoor classroom space; Outdoor Study Area preferred

Procedure:

1. Have the students hold hands to make a circle. Walk around the circle, first naming one student as plant or animal of the schoolyard habitat (robin, worm, blue jay, squirrel, oak tree). Name the next four students in the circle as food, water, shelter, and space for that animal. Repeat the process until all the students are involved. When all students have been designated as a plant, animal, or a habitat component, comment on the fact that they are holding hands and that it represents the idea that all things in a habitat are ***interrelated***.

2. Next, tell the students to slowly turn to the right to look at the back of the head of the person in front of them. Then have them take one side step toward the center of the circle. Ideally they will be standing close together in order for the activity to work best, but if they don't feel comfortable enough to be close in the first round, you can discuss the benefit of standing closer during the processing of the activity and they can try again.

3. Once they are placed, have them put their hands on the shoulders of the person in front of them. The next step is very important so make sure you have everyone's attention: they will need to slowly sit down on the knees of the student behind them, but they'll also need to keep their own knees together to make a chair for the student in front of them. Tell them you will countdown from three to make sure everyone moves at the same time. If the circle can remain intact, they are representing the ***interdependence*** of elements in a habitat.

4. Settle the group and have them sit on the ground. Remind the students of when they noticed all elements of the ecosystem were interrelated when they were holding hands. How was it the same or different from when they had to try supporting each other? Help them come to a better understanding of the connection and balance between food, water, shelter, and space for any living thing's survival in its habitat.

5. Let them try the activity again. This time ask them to hold the posture. As they are representing an animal/plant, food, water, shelter, and space – identify a student who represents water. Tell the group, "It is a drought year and the water supply is reduced." Then have the student remove themself from the lap-sit circle. At this point the circle will either collapse or suffer from some other disruption. Other ways you can illustrate varying conditions:

- Remove a student because of pollution of the water supply.
- Remove two students because of forest fires limiting shelter and space.
- Remove a student or students because of urban development, limiting the availability of all habitat components.

6. Ask the students to discuss what this activity means to them. Ask them to summarize the main things they have learned. This could include:

- Food, water, shelter, and space in an appropriate arrangement can be called a habitat.
- Humans and other living things depend on habitat.
- Loss of any elements of habitat influences the ***biotic factors*** living there.

Variation:

1. As you are naming students as a plant or animal in the habitat, assign them in the order of a food chain. When you discuss interrelationships, see if any of them realize that *they* are food or shelter for another living thing.

Suggestion: Dogwood tree, cardinal, black rat snake, red-tailed hawk, worm, mushroom.

2. Instead of the lap sit, the food chain could be mixed into the circle out of order. The students can pass a ball of string around to each other to make connections and form a visual food web.

Learning Targets:

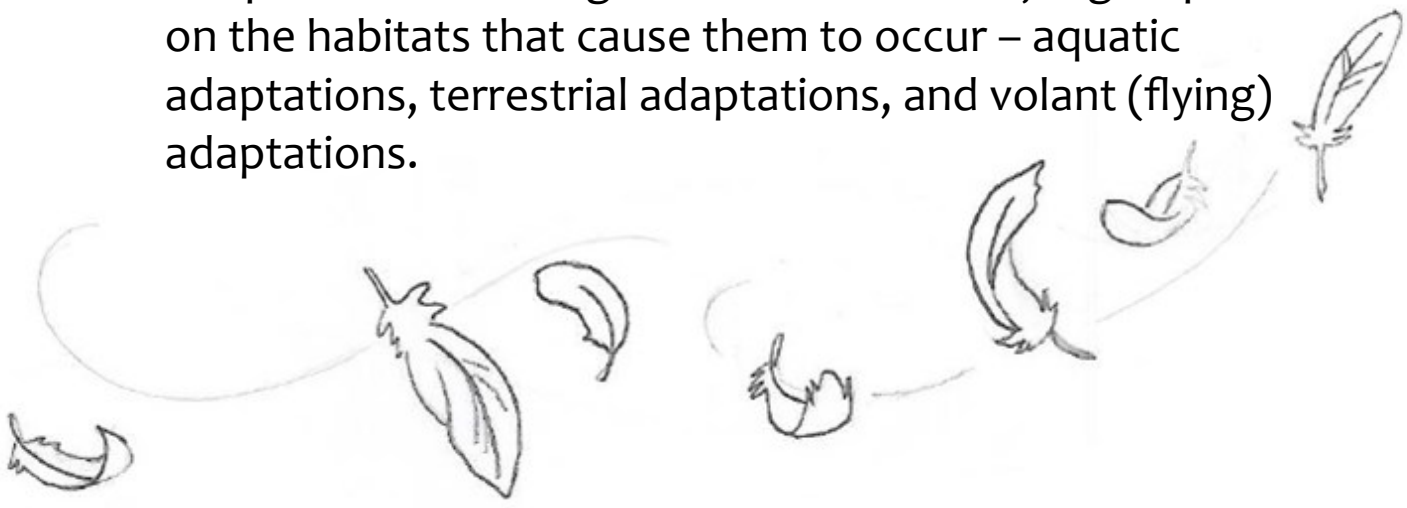
1. Identify the components of a habitat.
2. Recognize how humans and other living things depend upon habitats.
3. Interpret the significance of loss or change in a habitat.

Unit 2:

Animals and Adaptations

Animals are the group of living organisms characterized by both their ability to move and their requirement to consume other living things (such as plants or animals) for proper nutrition. Animals are commonly divided into two major groups: vertebrates (those with a backbone or spinal column) and invertebrates (those without). Over 50,000 species of vertebrates have been described and they make up the most common animals that we think of. These are often mammals, reptiles, amphibians, fish, and birds. However, more than 95% of described animal species are invertebrates. This includes various species of insects, squids, snails, worms, corals, and many more.

Adaptation occurs in response to changes in the environment, lifestyle, or relationship to other organisms. Adaptations can be physical, physiological, or behavioral. Adaptations are categorized into three major groups based on the habitats that cause them to occur – aquatic adaptations, terrestrial adaptations, and volant (flying) adaptations.



Topic 2A:

Classifying Categories

Background

Living things are classified based on unifying characteristics. Scientists start at broad levels of differences (vertebrates vs. invertebrates) and refine their classification for groups in greater detail as they become more specific. Groupings are done based on like characteristics – students do not need to follow "official" classification structures – they just need to be able to recognize that you start with broad differences and become more specific in successive groupings. For example, you may look first at all animals with backbones, then group the animals with scales by looking at both fish and reptiles, and group them again by animals with fins and animals without. This leaves you with the fish group, categorized as an animal with a backbone, scales, and fins.

The five most common classes of animals belong to the vertebrates. They are mammals, birds, reptiles, amphibians, and fish. They are categorized by the following common features:

- Mammals - Fur or hair, warm-blooded, live birth
- Birds - Feathers, warm-blooded, hard-shelled eggs, most fly
- Reptiles - Scales, cold-blooded, leathery-shelled eggs
- Amphibians - Slimy skin, cold-blooded, jelly eggs, metamorphosis
- Fish - Slimy scales, cold-blooded, jelly eggs, fins, gills

It is important to keep in mind that there are always exceptions to a rule, which is why these are very general descriptions of these classes of animals. For example, the platypus is an egg-laying mammal, penguins and ostriches are birds that do not fly, and some sharks, which are fish, have live birth.

Invertebrates are also grouped into classes, though because there are so many of them, there are also a lot of classes. Some common ones to remember are:

- Arthropods - Exoskeleton, jointed legs, and a segmented body. Grouped further into Insects, Arachnids, Crustaceans, and Centipedes/Millipedes.
- Cnidaria (neye-dare-ia) - Members include jellyfish, corals, anemones.
- Mollusks - Members include snails/slugs, clams/mussels, squid/octopus
- Annelids - Worm species including earthworms

What Am I?

Outdoor Wonders and Learning™

Students will collect and analyze data comparing characteristics of familiar animals to learn how to classify them into groups

Elaborate/Apply

Supplemental Reading

Grades K-2:
Animal School: What Class Are You? By Michelle Lord

Grades 3-5:
Tree of Life: The Incredible Biodiversity of Life on Earth By Rochelle Strauss

Grade Levels:

K, 1, 2, 3, 4, 5

Curriculum Correlation:

NCSCS—Science
K.L.1.1
NCSCS—Mathematics
K.CC.4, K.CC.5, K.CC.6, K.MD.3
1.MD.4
2.MD.10
3.MD.3

Materials:

Whiteboard and markers; class set of Common Backyard Animals photos (see Appendix); six animal category signs

Duration:

30 minutes

Location:

Classroom for grades 3-5; Outdoor Study Area for grades K-5

Procedure (K-2):

1. Ask students to feel their backbones. Ask the students "What do you know about backbones?"

2. Show the students one animal picture at a time, let them decide if it also has a backbone like they do, then place the picture in one of two piles—animals with backbones and animals without. Have the students count and compare the numbers in each pile.

3. Now you can introduce the concept of bones on the inside or bones on the outside (exoskeleton) and have the students re-evaluate their answers, moving pictures if needed.
   *At this point a chart or graph can be made to compare these two numbers.

4. Next ask the students if these animals have other things in common. Is there another way we can group these animals? Choosing one of the insects in the pile as an example, ask the students what things make an insect an insect (six legs, three body segments, exoskeleton). Have them find other insects in the picture pile and line them up as a pictograph. Use the animal category signs as labels.

5. Repeat Step 3 with the other animal categories (Mammals, Birds, Reptiles, Amphibians, Fish).

6. Looking at the pictograph, have the students compare the number of animals in each category. Which group has the most animals? Which has the least? Could you see any of these animals in your schoolyard habitat? Why or why not?

Procedure (3-5):

1. Ask students to feel their backbones. Ask the students "What do you know about backbones?"

What Am I?

Outdoor Wonders and Learning™

2. Make a fill in the blank Concept Map with the students (see Appendix for Sample Category Chart example), listing the following categories: Invertebrates and Vertebrates; subcategories under Vertebrates are Mammals, Birds, Reptiles, Amphibians, and Fish. Give the students some common characteristics of each category of animal and list one example of each type. Then have each student name an animal and which category they think it goes into based on its characteristics.

3. Outside, have the Animal Categories set up in a line in an open area, spaced evenly about five feet apart. Have the students lined up perpendicular to the line of animal categories. Ask everyone to listen carefully, and to think about the characteristics of the different animal groups. Call out an animal from one of the Common Backyard Animals picture cards. When the students hear the animal, they will run and line up in the category they think that animal falls into. For example, if you say Blue Jay, the students should run to the Bird category and line up. If they don't all go to the best category choice, take a moment to discuss with the group the key characteristics of a bird and see if anyone wants to change their answer.

4. Place the picture next to the Animal Category, have the students go back to the starting line, and call out another animal. Repeat Steps 3 and 4 until all of the animals are sorted. The pictures can be counted and the results recorded so the students can make a bar graph back inside.

5. Looking at the bar graph, have the students compare the number of animals in each category. Which group has the most animals? Which has the least? Could you see any of these animals in your schoolyard habitat? Why or why not? Do you think this graph is a good representation of our school yard habitat? Why or why not?

Extensions:

1. To help students practice the characteristics that make up each group of animals, they can play these online interactive games: http://www.sheppardsoftware.com/content/animals/kidscorner/games/animalclassgame.htm OR http://unctv.pbslearningmedia.org/resource/lspso7.sci.life.oate.animalclass/animal-classification-game/
2. To help students learn more about different ratios of animal groups that may live in different habitats, use the games on this website: http://www.sheppardsoftware.com/content/animals/kidscorner/gamesforkids.htm

Learning Targets:

1. Classify animals into different groups that demonstrate similar characteristics and understand that individual differences show group variation.
2. Analyze data from the animal sort using charts and graphs.

Topic 2B:

Amazing Adaptations

Background

An adaptation is an internal or external feature or behavior that allows an organism to survive in its habitat. Some animals, such as birds, can have both physical and behavioral adaptations, i.e. having wings allows them to fly and many birds migrate due to seasonal changes in their environment. Birds also have specialized beaks and feet that allow them to survive in their habitats. A pelican has webbed feet for swimming and a beak with a pouch so it can carry its food and move to a safer place to eat it. Other birds like raptors can carry their food in their sharp talons, and have a large hooked beak to shred their food into smaller pieces for easier digestion. Most animals have a combination of adaptations that help them survive in their habitats.

Adaptations are also a way to classify animals. Adaptations are grouped according to the habitats that cause them to occur - aquatic adaptations, terrestrial adaptations, and volant (flying) adaptations. These adaptation categories could be subcategorized further. Consider terrestrial adaptations, for example, which can be grouped more specifically into desert adaptations, arboreal (tree) adaptations, arctic adaptations, subterranean (underground) adaptations, and so on. Just like classifying animals based on their characteristics alone, classifying adaptations based on the habitat is a way to show similarities and differences between animals that look different but still need to survive in the same way.

Bird Study

Outdoor Wonders and Learning™

Students will spend time studying birds to better understand how special beak shapes help birds eat certain foods in their habitats.

Complete 5E

Supplemental Reading

Fine Feathered Friends: All About Birds By Tish Rabe

The Boy Who Drew Birds: A Story of John James Audubon
By Jacqueline Davies

Little Ornithologist (My First Field Guide) By E.L. Botha

Grade Levels:

K, 1, 2

Curriculum Correlation:

NCSCS—Science
K.L.1.1, K.L.1.2
1.L.2.2
2.L.2.2
NCSCS—Mathematics
K.CC.4, K.CC.5, K.MD.2
1.MD.1, 1.MD.2
2.MD.1, 2.MD.3, 2.MD.4

Materials:

Bird photos from the Common Backyard Animals set or a variety of magazine photos of birds; bird size comparison chart (see Appendix); pencils and paper for the teacher to record data; online access to National Geographic's Backyard Bird Identifier or download the free Merlin Bird App; beginner field guides featuring birds (optional); observation journals for the students (optional)

Duration:

Introduction session is 30 minutes; follow up with four 15 minute sessions. Same time of day is preferable.

Location:

Outdoor Study Area or classroom

Procedure:

1. Show the students the bird photos, encouraging them to make observations about things that are the same on all of the birds (What do you notice about these animals? What is your evidence?) - feathers, wings, beaks, feet. Even though all of the birds have these features, are they all the same?

*Ask them to compare:

- Color
- Shape and Size (may be difficult with photos)
- Do they know where the birds lives? If not, where to they think it might live?
- Have the students look at the beaks of the birds. Have they ever seen a bird eat? What do birds use to eat? As they make observations about the bird beaks, encourage them to wonder what food each type of beak can eat best.

2. Go outside to watch the bird feeder for at least 15 minutes. Be sure to leave enough space between the students and the feeder so the birds feel comfortable visiting, but so the students are also close enough to see the birds. As a bird appears, ask the students to give you the following details to record:

- What do you notice? (color, size)

*For younger students this can be a size comparison using common classroom objects - glue bottle or stick for small birds (wrens and sparrows), pencil box for medium birds (cardinals, blue jays, robins), backpack for larger birds (crows).

- What is it doing? (eating from the feeder, landing on a tree, walking on the ground)

- If you've downloaded the Merlin App, you can identify the bird as the students give you the details. Otherwise, you can use this same data inside looking at the National Geographic website.

3. While identifying the birds that visited the feeder, take a closer look at their beaks. Ask the students how they think that beak might be used - for crunching, for digging/poking in the ground, for fitting into small spaces like holes or flowers, etc. Practice the Scientific Method by asking the students to make a guess about what food the bird might eat based on how they think the beak is used. Remind them of what they observed the bird doing outside as well. After you have a hypothesis for each bird, read further about the bird's food either on the website, app, or in a field guide. What are the results? Do any of the birds have similar shaped beaks but eat different things? Is this because they live in different habitats?
4. Repeat Steps 3 through 5 for four more 15 minute sessions. It's best to observe the study site close to the same time of day each time - mornings are best for bird activity. This way the results will be consistent.
5. After the last day, count the totals of each species of bird observed. Which species did you see most often? Which feeder had the most visitors? What type/shape of beak did most of the birds have? Why do you think birds with that beak came to that feeder? Were there any special differences you were able to observe (a male and a female cardinal, a woodpecker climbing a tree trunk instead of sitting on a branch, etc.)?

Extensions:

1. Students learning units of measure can use the Bird Size Comparison Chart, the National Geographic website, the Merlin App, or the beginner field guides to research the size of the different birds they observed. They can measure the size of each bird species using rulers to get a better understanding of their true size. They can compare the different species, order them largest to smallest or smallest to largest, and discuss how the size of the birds plays a role in how they live in their habitat.
2. In the Project WILD activity "Thicket Game," students (grades Pre-K through fourth grade) play the roles of predator and prey as they learn about the importance of adaptations through a hide-and-seek simulation.

Learning Targets:

1. Utilize different types of technology to research bird species.
2. Observe and compare characteristics of different bird species and identify how those characteristics help them in their habitats.
3. Analyze data collected from observations and draw conclusions based on what was learned.

Advanced Bird Study

Outdoor Wonders and Learning™

Students will study the birds of their school yard and birds across the country to learn more about their adaptations to their habitats.

Complete 5E

Supplemental Reading

National Geographic Kids Bird Guide of North America
By Jonathan Alderfer

For the Birds: The Life of Roger Tory Peterson
By Peggy Thomas

United Tweet of America
By Hudson Talbott

Grade Levels:

3, 4, 5

Curriculum Correlation:

NCSCS—Science
4.L.1.2
5.L.2.3
NCSCS—Social Studies (Variation only)
3.G.1.6
5.G.1.2
NCSCS—ELA
3.RI.7, 3.W.2, 3.W.7, 3.W.8, 3.SL.4
4.RI.7, 4.RI.9, 4.W.2, 4.W.7, 4.W.8, 4.SL.4
5.RI.7, 5.RI.9, 5.W.2, 5.W.7, 5.W.8, 5.SL.4

Materials:

Bird photos from the Common Backyard Animals set or a variety of magazine photos of birds; bird size comparison chart (see Appendix); online access to National Geographic's Backyard Bird Identifier or download the free Merlin Bird App; beginner field guides featuring birds (optional); pencils and observation journals for the students; Bird Biography student page (see Appendix)

Duration:

Introduction session is 30 minutes; follow up with four 15 minute sessions. Same time of day is preferable.

Location:

Outdoor Study Area or classroom

Procedure:

1. Group Brainstorm:: Ask the group "What kinds of structures and behaviors do you have that might help you survive in your habitat?
2. Go outside to watch the bird feeder for at least 15 minutes. Be sure to leave enough space between the students and the feeder so the birds feel comfortable visiting, but so the students are also close enough to see the birds. As a bird appears, ask the students to give you the following details to record:
   - What do you notice? (color, size)

     *For younger students this can be a size comparison using common classroom objects - glue bottle or stick for small birds (wrens and sparrows), pencil box for medium birds (cardinals, blue jays, robins), backpack for larger birds (crows).

     *For older students be sure to take a ruler outside with you so they can estimate the size of the birds they observe.
   - What is it doing? What are you wondering about its behavior? (eating from the feeder, landing on a tree, walking on the ground)
   - If you've downloaded the Merlin App, you can identify the bird as the students give you the details. Otherwise, you can use this same data inside looking at the National Geographic website.
3. Repeat Step 1 for four more 15 minute sessions. It's best to observe the study site close to the same time of day each time - mornings are best for bird activity. This way the results will be consistent.

Advanced Bird Study

Outdoor Wonders and Learning™

Procedure:

4. After five days of observing and identifying birds, assign each student one the species for a more in depth research project. Use the Bird Biography (see Appendix) student page as a project sheet or a reference to create your own. **When students are researching adaptations of their bird, it's probably best to make "flying" off limits as an option.** This can be done as group work as well.
5. Students can present their projects to the class to practice public speaking. Projects can be displayed in the classroom, or copied for each student as a personal field guide.

Variation:

If your observations did not produce enough options for your student reports, assign the students a different State Bird from across the country. This way they will definitely have the opportunity to study the different habitats and even climates of the country and how these birds survive.
Use State Symbols USA as a resource. Also, many states have their own website that includes information about their state symbols - State Websites for Kids is a good resource.

Extensions:

1. In the Project WILD activity "Thicket Game," students (grades Pre-K through fourth grade) play the roles of predator and prey as they learn about the importance of adaptations through a hide-and-seek simulation.

2. Third grade students can grow the seeds from the birdseed in a classroom experiment to see what plants they will grow into and how the birds might find this food in their habitat without human help.

Learning Targets:

1. Observe and compare characteristics of different bird species and identify how those characteristics help them in their habitats.
2. Utilize different types of information/technology to research bird species.
3. Analyze data collected from observations and draw conclusions based on what was learned.
4. Conduct a research project based on focused questions, demonstrating understanding of the subject under investigation.

Web Designers

Co-written with Julie Travaglini, Allegheny Land Trust

Students will explore various types of spider webs and learn how math plays a part in spider web design and effectiveness.

Outdoor Wonders and Learning™

Elaborate/Apply

Supplemental Reading

Spinning Spiders: Let's Read and Find Out Science By Melvin Berger

Spiders By Gail Gibbons

Grade Levels:

3, 4, 5

Curriculum Correlation:

NCSCS - Science 4.L.12, 4.L.1.4, 5.P.1.1

NCSCS - Mathematics 3.NF.1, 4.G.1

Materials:

Set of Spider Webs and Descriptions Cards (see Teacher Resources); paper plates; writing utensils; rulers; protractors (optional); class set of 12" embroidery hoops; selection of strings, yarns, dental floss, threads, twine, etc.; small (1/2") pom-poms or cotton balls

Duration:

40 minutes

Location:

Classroom or Outdoor Study Area

Procedure:

1. Turn and Talk: Tell your neighbor about an experience you've had with a spider web. After a few minutes, ask the students to share what their partner said about their experience. This open forum will likely lead to sharing the function of a web, so another prompt could be "How could the structure of a spider web affect the way it works?"
2. Put the students in four smaller groups. Provide each group with a Spider Web image and ask them to make observations of what they see: What do you notice, what do you wonder, what does it remind you of? After sharing their answers with each other in their groups, rotate the images and ask the questions again. Add on the question of "How is this one the same or different from the previous one?" Continue the rotations until all the groups have seen all the images.
3. Guess Who? Game: Once students have seen all four of the web designs, they will use their observations to identify each web. The Web Description cards have clues about each of the Web Designs. The clues start with a general description and get more specific as you reach the final clue. For each Web Description, read the first clue and see if the students can guess which Web Design it refers to. Continue reading the clues until they guess correctly. Once they guess, tell them the name of that Web Design.

*Consider making it into a team game where groups score points based on which clue helped them get the correct answer, i.e. Clue #1 equals 3 points, Clue #2 equals 2 points, Clue #3 equals 1 point. Be sure to share the Fun Fact with them about that Web Design!

*It is also important to note that not all spiders build webs. All make silk, and some use that silk in different ways, but the end result is the same: stickiness to catch food.

Web Designers

Co-written with Julie Travaglini, Allegheny Land Trust

Outdoor Wonders and Learning™

Elaborate/Apply

4. Either in their small groups, or individually, students will now have a chance to design their own webs. For this activity students will mimic an orb web design using different materials and working through the scientific method to see which will catch the most "insects".

   Provide each student with a paper plate, a ruler, and a marker or pencil.

   A. Fractions of a whole:

   First ask the students to divide the paper plate (circle) in half using the ruler, and mark the line all the way across the circle. Next have the students divide the circle into fourths using the ruler first, then marking the line. *For older students you can have them divide the first two halves into thirds, creating 6 equal parts of the circle. Finally have the student divide the circle into 8 equal parts using the ruler and the marker.

   B. Now the students will have to decide how they will design the inner framing of the web. Ask them to reflect back on their observations of the Orb Web. Were the connecting pieces loose or taught? Were they a series of circles or more of a spiral pattern? What do they think will work best to catch an insect?

   C. Once the students have completed their web design, they can choose from the materials provided to build their web by using the drawing as a template. Have them record why they made their selection as a hypothesis: I chose [this material] because it is [adjective] and I think it will collect the most insects.

*Note: Here the students can continue using the paper plate, wrapping their string around it to trace over the design. You could also provide embroidery hoops in order for their webs to have open space behind them (like in nature). They can secure the inner framing by wrapping and weaving or by taping the parts that intersect.

   D. Time to test! Have the students work in small groups. They will try tossing the pompoms or cotton balls into each other's webs and seeing which web material and patterns collect the most "insects". Have them record their results about their webs, and compare their results with the other students in their group. What did you learn about your web design? How was it the same or different from other people in your group? How would you modify your web to be more effective?

   E. Group reflection questions: How did the different designs and materials affect the way the webs worked?

5. To reflect on their work, ask the students "What did you learn about how the structure of a spider web affects the way it works?" or "Did any of your ideas change today? What made your ideas change?"

Learning Targets:

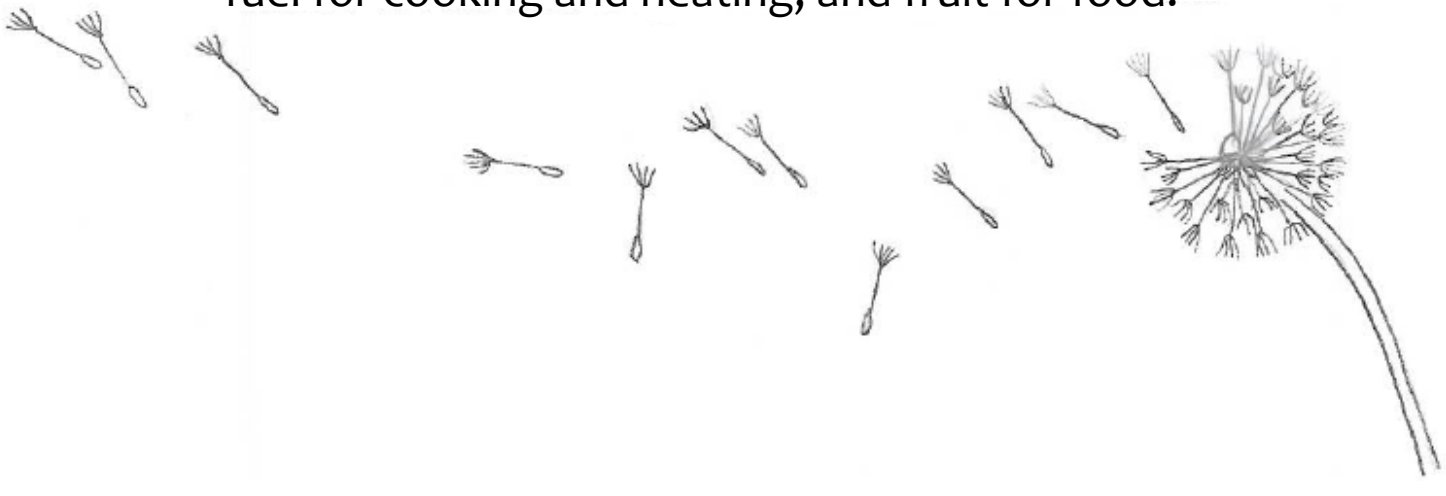
1. Students will identify and represent different types of unit fractions, lines, perpendicular lines, rays, and angles when designing an Orb Web.
2. Students will observe and compare different characteristics of spider webs and how those characteristics help spiders survive in their habitats.

Unit 3:

Plants and Trees

Plants are living organisms and differ from animals in that generally, they do not move. The defining characteristic of plants is that most perform **photosynthesis**. Green plants produce most of the world's molecular oxygen and are the basis of many of the planet's ecosystems. Many grain, fruit, and vegetable producing plants have been domesticated for ages, becoming the foundation of humankind's diet. Plants have been used as ornaments and decorations, in medicines and drugs, and play a role in many cultures.

A tree is a plant with an elongated stem, or trunk, supporting branches and leaves or needles. Trees play a significant role in reducing erosion and moderating the climate. They remove carbon dioxide from the atmosphere and store large quantities of carbon in their tissues. Trees and forests provide a habitat for many species of animals and plants. Trees provide shade and shelter, timber for construction, fuel for cooking and heating, and fruit for food.



Topic 3A:

The Power of Producers

Background

The process of photosynthesis is what makes a plant a **producer**. Photosynthesis is the method by which plants use carbon dioxide, water, and light from the sun to create sugars to feed the plant and oxygen as a byproduct. This method is essential for life on earth because it produces oxygen for the atmosphere, but also because it is the source of energy for all living things. Photosynthesis not only produces
energy for the plant itself, but because the plant has produced energy, primary consumers (herbivores) can consume the plant to receive energy.

In order to understand how plants perform photosynthesis, it is important to understand the different parts of a plant. This unit will focus on **vascular plants**, meaning they contain the plant form of a circulatory system.

The **roots** of the plant help to anchor it into the ground. They also absorb water and the nutrients carried with it into the plant. The **stem** (or trunk when referring to trees) provides support for the plant. It is also where the vascular tissue is housed. Woody plants like trees and shrubs feature a complex anatomy, including:

- **Xylem**, or sapwood, brings the water and the nutrients up from the roots to the leaves.
- **Cambium** is a very thin layer of tissue that helps the plant grow new xylem cells, phloem cells, or new cambium cells.
- **Phloem**, or inner bark, carries the **sap** (sugar made during photosynthesis) from the leaves to the rest of the plant.

The **leaves** create the food for the plant with the process of photosynthesis. They capture energy from the sun with **chlorophyll** (the green pigment in the leaves), absorb carbon dioxide through tiny pores on their surface called **stomata**, and mix it with water to produce oxygen as a byproduct and sugar as food for the plant. The **flowers** of the plant are the hub for pollination. Flowers are designed to spread pollen from one plant to another using various methods. The **fruit** of a plant, botanically speaking, is the ripened portion of the flower and contains one or more seeds. It can be dry or fleshy, and is often edible.

Power Plant!

(adapted from Project Learning Tree's Tree Factory)

Outdoor Wonders and Learning™

Students will have the opportunity to "become" a plant by role-playing the different parts and seeing how they function as a whole.

Elaborate/Apply

Supplemental Reading

The Busy Tree
By Jennifer Ward

How Plants Grow (Time for Kids Nonfiction Readers)
By Dona Herweck Rice

The Magic School Bus Gets Planted: A Book About Photosynthesis
By Lenore Notkin

Grade Levels:

K, 1, 2, 3

Curriculum Correlation:

NCSCS—Science
K.L.1.2
1.L.1.1, 1.L.1.2
3.L.2.1

Materials:

Paper & pencils (optional)

Duration:

30 minutes

Location:

Outdoor Study Area for activity; Classroom for extension;

Procedure:

1. Introduce a Group Brainstorm: What do trees and plants need to grow? (sunlight, air, water, soil, space) Collect student ideas to review later in the activity.
2. Have the students observe and explore a tree and verbalize or write down everything they notice about the tree and its parts. Use the focus question "I wonder how this helps the tree grow?" Ask the follow up question "What does this remind you of about people?" (Think, Pair, Share)
3. How does the water get into the tree? (Roots) How does it get around to all of the parts of the tree? As they discuss each question, have them act out the answers. They can simulate roots by laying on their backs with their arms and legs spread out as they make slurping sounds and by chanting, "Gurgle, gurgle, gurgle. Water to the tree."
4. How do trees and plants get the food they need? Do they chase after animals or grab things with their branches? (Plants make food in their leaves by using energy from the sun. This is called **photosynthesis**.) Students can imitate how the leaves make food by holding their arms up and opening and closing their hands chanting, "We make food; we make food."
5. How does the food and water get from place to place? (Plants have stems to hold them up and support their leaves. Trees have a modified stem - a trunk, and branches to support the leaves). The trunk of the tree also contains the "veins" or "pipes" of the plant that move the water and food to different parts. Have the students feel how solid the trunk and branches are on the tree. They can pretend to be the trunk or stem by standing up strong and tall, tightening their muscles and saying, "I am the heartwood, I support."

Power Plant!

(adapted from Project Learning Tree's Tree Factory)

Outdoor Wonders and Learning™

6. How do they stay protected from bugs? (The bark of the tree protects it from pests and disease. Like our skin, the bark keeps the "veins" of the tree safe from harm.) Have the students feel the bark of the tree and describe what it feels and looks like. They can act out the role of bark by forming a circle and linking arms or holding hands with all students facing out. They can shout, "Bark, bark, bark!" like protective guard dogs.
7. Physical Demonstration—Using their bodies, ask them to relate the parts of plants and trees to the parts of a human body and how they each work in a similar fashion. Roots=feet and toes to hold the plant in place; trunk=body and bones to help the plant stand up strong; *xylem and phloem–veins of the plant, moving food and water to all parts*; bark>skin to protect the tree from damage and insects; leaves> hands to make food.
8. Next, put all of the plant parts together to build a "Power Plant." Split the students into three smaller groups, one being the roots, one being the bark, and the last being the leaves. The root group will stand close together linking arms and chanting "Gurgle gurgle gurgle. Water to the tree." The bark group will form a circle around the roots, join hands, and shout, "Bark, bark, bark!" The leaves should stand at various distances around the bark chanting, "We make food; we make food" while opening and closing their hands.
9. Review by asking the students how a plant or tree is similar to a factory. Ask them what different departments are this "factory" and what jobs are done by each.

   A. Roots Department - the plant is anchored to the ground and water is absorbed from the soil.
   B. Leaves Department - use sunlight, air, and water to manufacture food for the plant. When the plant is able to get enough food it can grow and produce more leaves, flowers, and even fruits and nuts/seeds.
   C. Stem/Trunk Department - Supports the branches and leaves; contains all of the "pipes" or "veins" that transport the food and water around the plant.
   D. Bark Department - perimeter defense of the plant, keeping it protected from pests and disease.

Extensions:

Have the students draw what the inside of the "Power Plant" or "Tree Factory" might look like based on the jobs done by the different departments.

Learning Targets:

1. Understand the basic structures of plants and how those structures are used to acquire resources and fulfill the plant's basic needs.

Topic 3B:

The Importance of Change

Background

Because plants are living things, they go through many changes both throughout the year and throughout their lives. Some of these changes occur during their growth cycle from seed to soil, while others occur due to seasons (See more in the Weather unit) or more severe changes in their environment. Like many animals, plants have a **life cycle** and many display some fascinating **adaptations** in order to survive in their habitats. These life cycle changes and adaptations play an important role in the different ecosystems where we find plants.

A Tree Like Me

Outdoor Wonders and Learning™

Students will compare human life cycles to plant life cycles and identify the various roles that a plant plays in its habitat during its life.

Elaborate/Apply

Supplemental Reading

Grades K-2:
In A Nutshell
By Joseph Anthony

From Seed to Plant
By Gail Gibbon

A Dead Tree by Alvin Tresault

Grades 3-5:
Treecology: 30 Activities for Exploring the World of Trees and Forests
By Monica Russo

The Tree Book for Kids and Their Grown Ups
By Gina Ingoglia

Grades K-5
A Log's Life
By Wendy Pfeffer

Grade Levels:

K, 1, 2, 3, 4, 5

Curriculum Correlation:

NCSCS – Science

K.L.1.2

1.L.1.1, 1.L.1.2

2.L.2.1, 2.L.2.2
3.L.2.2, 3.L.2.3
4.L.1.1
5.L.2.3

NCSCS – Social Studies

2.H.1.1

NCSCS - English Language Arts

K.W.3, K.SL.4, K.SL.5

1.W.3, 1.SL.4, 1.SL.5

2.W.3, 2.SL.4, 2.SL.5

3.RI.7, 3.W.2, 3.W.7, 3.W.8, 3.SL.4

4.RI.7, 4.RI.9, 4.W.2, 4.W.7, 4.W.8, 4.SL.4

5.RI.7, 5.RI.9, 5.W.2, 5.W.7, 5.W.8, 5.SL.4

Materials:

Human Life Cycle images (see Appendix), Tree Life Cycle images (see Appendix), Plant Biography student page (See Appendix)

Duration:

K-1: 30 minutes; 2-5: 30 minutes in the classroom and additional research time required.

Location:

Outdoor Study Area; classroom for research time

Procedure (2-5):

1. Ask the students to describe how a person grows and changes during their life. Try to include baby/infant, early years of childhood, teenage years, young or middle aged adult, and older adult. Show them the images of the Human Life Cycle (see Appendix) and have them arrange the photos from beginning to end. Next, see if the students can name different "jobs" or roles a person might have during each of those life stages. Also discuss with them the different things that might happen during that life cycle: the birth of a sibling, moving to a new place, a broken bone, changing schools, having a baby, getting a job, etc.
2. Take a walk around the school yard and record observations of trees or plants in the different stages of their life cycle. They can look for seeds (acorns, pinecones, maple samaras, dandelion fluff), sprouts and saplings, adult trees or fully grown flowering plants, injured or unhealthy trees, and dead plants, trees or logs.
3. As they find different examples, ask broad questions such as: What is the role of the tree during that stage of its life.? What is it likely trying to do to survive? How is it affecting the environment around it? Use the Tree Life Cycle (see Appendix) images as a reference.

4. Have the students work individually or in small groups on a plant life cycle research project on one of the 50 state trees or 50 state flowers. They should include either hand drawn or internet photos of at least five stages in the plant or tree's life cycle (seed, sprout, sapling - trees only, mature plant/tree, dead plant/tree, rotting plant/tree). They can use websites such as statesymbolsusa.org or field guides like A Field Guide to Wildflowers: Northeastern and North-central North America, Peterson's First Guide to Trees, or the NWF Field Guide to Trees of North America to find images and growth information about their plant or tree.
5. Remind the students of how the tree or plant might be interacting with its environment during each of the different stages and what events might occur that will change that plant's life (forest fire, bad storms, drought). It will be important for the students to do some research about their plant's habitat as well, so they can better understand some of the changes that plant will go through during its life.
6. Have the students use the information they collected to write a biography about their tree or plant using the student worksheet (see Appendix). Students can connect their project to the Human/Plant Life Cycle comparison, personifying the plant and what it might be doing as a human in a similar stage of life, i.e. growing a different heights during the teenage years.

Extensions:

1. Have the students research and identify ways that their tree or plant can be used by humans, i.e. wood from oak trees has been used for flooring and furniture, rose hips (fruit of the rose plant) have been used as an herbal supplement.
2. Have the students research whether or not this tree or plant has a historical or cultural significance to that state, i.e. the longleaf pine being used for turpentine production in North Carolina and across the Southeast.

Learning Targets:

1. Utilize different types of information/technology to research tree/plant species.
2. Conduct a research project based on focused questions, demonstrating understanding of the subject under investigation.
3. Represent a sequence of events in a timeline.
4. Summarize a plant/tree life cycle and the similarities and differences that plant/tree may have compared to others of the same species.
5. Explain the effects of environmental conditions and interconnected relationships on a plant/tree.

A Tree Like Me

Outdoor Wonders and Learning™

Elaborate/Apply

Procedure (K-1):

1. Have the students describe a plant or tree life cycle in a way that is similar to that of a human.
2. Show them the Tree Life Cycle images and have them arrange those in order from beginning to end. As the class looks at each photo have them imitate the shape and movement moving through the life cycle.

   A. Curl up small to be a **seed**.

   B. Slowly open up, kneeling to sticking out leg as a root to show that you've **sprouted**.

   C. If kneeling, stick out your arms and spread out your fingers to show your branches and leaves, then slowly stand up as you become a **sapling**.

   D. Spread out your feet and wiggle your toes, keeping arms and hands wide open to show you are an **adult tree** growing and taking up space.

   E. Wiggle your fingers all around to show how **pollen** spreads, making seeds that fall to the ground.

   F. Start scratching all over—you're being eaten by insects.

   G. A storm blows in and strong winds knock off a branch. Make a loud noise like thunder, lightening strikes and you lose another limb.

   H. Smile and sigh as you become a cozy home for animals in your old age. Now you are a **snag**. A snag is a dead tree that is still standing.

   I. Make a creaking and crashing sound, falling to the ground as a **rotting log**. Stick up one arm with hand spread wide to show that a new **seed has sprouted** from the soil you are helping to create.
3. Review the photos of the life cycle and ask the students what the job was of the tree during each stage. How was it similar to a human life cycle? Have the students compare the Tree Life Cycle and Human Life Cycle images.
4. How can the tree help its environment as a seed? What about when it is a sapling? (Food for some animals, home or shelter for birds) What did the tree do for it's environment as an adult tree? (Make flowers and pollen for bugs, able to make seeds that could be more trees or food for animals) How was the tree used as a snag? (Woodpeckers, owls and squirrels could move in, bugs lived in the tree) What happened to the tree when it fell and became a rotting log? (The tree decomposed and turned back into soil.)

A Tree Like Me

Outdoor Wonders and Learning™

(The new soil helped more seeds grow to make more plants. The rotten log was also food for bugs and worms.) Have the students decide if the life cycle should be a straight line, or if a circle would be more appropriate.

5. Have the students draw and write about their own version of a tree's life story, making sure to include the main stages of the life cycle (bolded words above).

Learning Targets:

1. Explain a sequence of events using narration and drawings.
2. Compare characteristics of plants/trees in terms of their growth and changes.
3. Identify the basic needs of plants/trees and give examples of how those needs can be met by their environments.

Ready, Set, GROW!

(adapted from Project Learning Tree's Every Tree for Itself)

Outdoor Wonders and Learning™

Students interpret the different effects an environment can have on a growing plant with this fun and slightly competitive game—while learning about competing for resources.

Elaborate/Apply

Supplemental Reading

Temperate Forests
By Peter Benoit

Plants and Tree Ecosystems: From Wetlands to Forests
By Left Brain Kids

Hungry Plants
By Mary Batten

The Wild Trees: A Story of Passion and Daring
By Richard Preston

Grade Levels:

3, 4, 5

Curriculum Correlation:

NCSCS – Science
3.L.2.2
4.L.1.1
5.L.2.3
NCSCS – Mathematics
3.MD.3
4.NF.4, 4.NF.6
5.OA.3

Materials:

Four to six colors (yellow, green, blue, orange, red, black/brown) of popsicle sticks, counting chips or cubes - at least 2 per student of each color; paper plates; markers; rulers with inches and centimeters.

Duration:

30 minutes

Location:

Classroom for introduction and extension; Outdoor Study Area for activity

Procedure:

1. Ask the students: Have you ever seen the inside of a tree? Draw a large cross section of a tree on the board. Each ring represents a year of growth for that tree. Ask the students: How might you explain the different sizes of the rings? (Wider rings mean the tree grew more and narrow rings mean the tree grew less) To follow up, ask the students: Can you explain what makes you think that? Review the requirements that a plant/tree need for growth (sunlight, air/carbon dioxide, soil, water, and space). Ask the students: How can we use what we just learned/discussed to answer the questions about the different sized rings? The differences in the size of the rings represent how well the tree was able to get its resources for survival.
2. Give each student a paper plate and a marker and have them make a dot roughly the size of their marker cap in the middle. Then take them outside to play the game. Explain that each student is going to be a "tree" trying to collect as many resources as they can for growth. The main resources will be represented by the colored popsicle sticks/counting chips - yellow for sunlight, green for nutrients from the soil, blue for water, orange for air.
3. Arrange the students in a grid pattern, equally spaced about three feet apart. Tell them that their feet are their roots and must remain planted in one spot. If their feet move they will be disqualified for this round. They will only be able to pick up their resources using their branches (arms).
4. Randomly distribute the four main colors of resources around the grid of students.
5. Using the signal "Ready, Set, Grow!", give the students 10 seconds to gather what they can. Once the time is up, have them count how many they got of each color. The students will then draw a ring on their paper plate to represent that year of growth using the following assigned values:

A. Multiples of any one color, but not a full set with each color equals a poor growth year. Students will draw a ring 0.5 cm (1/8 in) from the center dot on the plate. *Ex. Blue, blue, yellow, green*
B. One of each of the colors equals an average growth year. Students will draw a ring 1 cm (1/4 in) from the center dot on the plate. *Ex. Yellow, green, blue, orange*
C. Multiples of any two colors and a full set with each color equals a superior growth year. Students will draw a ring 1.5 cm (3/4 in) from the center dot on the plate. *Ex. Yellow, green, green, blue, blue, orange*

Discuss why there are different growth rates when different amounts of resources are collected. When trees lack certain requirements they grow less, and when they receive too much of some requirements they can become stressed and are unable to grow as well.

6. Now have the students stand in groups of 3-5. Gather the colored resources and spread them around the "trees" again. Play another 10 second round so they can gather what they can. Compare what they collected in this round to the last round and have them draw their growth ring according to the assigned values. Did they collect more or less resources in this round? What conclusion can they reach about trees that grow close together? (The lack of space is a **limiting factor**. It is causing limited growth for the trees and increasing competition between the species.)
7. Complete a few more rounds and compare the results each time. Variations in each round can include the following:
   Use fewer water resources, representing drought; Use fewer nutrient resources, representing poor soil quality; Add a new color (red for forest fire, black/brown for negative insect infestation or positive pollinator population) but don't tell the students what it's for. After the round is complete and their data is collected, tell them what the color represents. How did this affect the "trees"?
8. Ask the students: What helped you learn about how plants and trees grow? What surprised you?

Variation:

Have the students study a local tree and how it gets the things it needs to survive, i.e. Maple trees can grow in varying soil types, Flowering Dogwoods don't need large amounts of sunlight, Tuliptrees need a lot of sunlight, etc. Then when they play the game have them collect their resources in a way that represents the tree they studied.

Extension:

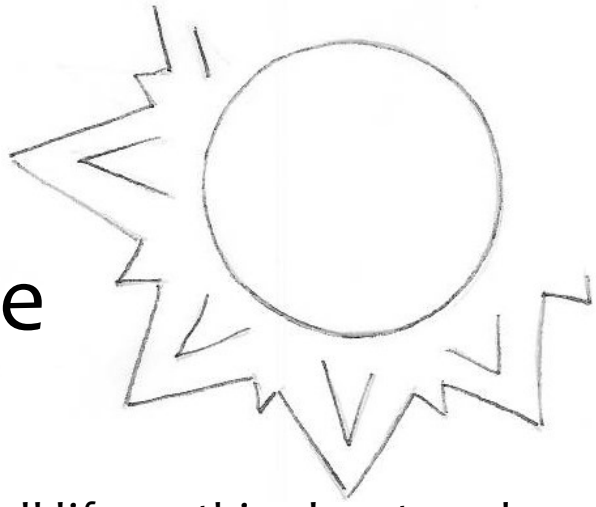
After the students have played a few rounds of the game, have them graph the results of the growth of the whole "forest" as if each round represents a year. Each round/year can display the number of trees with poor growth, the number with average growth, and the number with superior growth.

Learning Targets:

1. Explain how environmental conditions, and changes in those conditions, can be beneficial or harmful to a plant's growth and survival.
2. Analyze data collected and draw conclusions based on what was learned.

Unit 4:

Weather and Climate



What is always around us, affects all life on this planet, and has the ability to get you out of school? It's the weather! Weather is the culmination of all phenomena happening in the atmosphere (thin layer of gases surrounding the earth's surface) at a given time. This means that to measure weather, several factors must be looked at, all occurring at once. This is not to be confused with climate, which is a measure of the average atmospheric conditions during an extended period of time. Observing both weather and climate are crucial in understanding, predicting, and preparing for changes within our Earth's cycles and systems.

Topic 4A:

Watching Our Weather

Background

Weather affects ecosystems as well as the everyday lives of humans. Human activities such as recreation, construction, travel and others are dependent upon weather conditions. For scientists to predict future weather events, they must analyze many factors that include temperature, wind, and precipitation.

Temperature is a measurement of heat. In meteorology, the study of weather, the temperature of the air is typically measured because changes in temperature often lead to air movement and storms. There are several scales for measuring temperature, including Fahrenheit and Celsius (the most universally used in everyday instances).

Wind is the flow of air. Air flows when it is heated by the sun and begins to rise (because warm air rises). Wind speed is often noted because it can be a factor in severe weather. Wind direction is of importance because it indicates the direction a weather system is coming from.

Visible, floating masses of water droplets or ice crystals in the atmosphere are known as **clouds**. There are several classifications of clouds that are grouped in two separate categories: layered (stratus clouds) and convective (cumulus clouds).

Precipitation occurs when water molecules are deposited onto the earth's surface. There are a number of types of precipitation, including rain, snow, hail and fog. Rain occurs when water condenses into water droplets which then fall from the clouds. If the water vapor freezes instead of forming water droplets, it is called snow. When water droplets freeze within the cloud and are blown in a cycle through the upper and lower portion of that cloud, forming layers, hail is formed. Once hail is too heavy to be blown throughout the cloud any longer, it falls to the earth. Fog does not exist as an individual drop or crystal, but is instead simply a cloud that makes contact with the ground.

Weather Trackers

Students will learn about the tools used in measuring weather, make observations about the weather using their outdoor weather station and analyze data to draw conclusions .

Outdoor Wonders and Learning™

Explore

Supplemental Reading

Grades K-2:
How Artists See the Weather
By Colleen Carroll

Grades 3-5:
The Kids Book of Weather Forecasting
By Mark Breen and Kathleen Friestad

Grade Levels:

K, 1, 2, 3, 4, 5

Curriculum Correlation:

NCSCS – Science
K.E.1.1, K.E.1.2, K.E.1.3
2.E.1.2, 2.E.1.3, 2.E.1.4
5.E.1.1, 5.E.1.2
NCSCS – Mathematics
K.MD.1, 1.MD.4, 2.MD.10, 3.MD.3, 5.MD.2

Materials:

Weather journals, clipboards/cardboard to write on, pencils, weather instruments

Duration:

Introduction is 45 minutes; periodic visits to weather station for 15 minutes throughout the year; 45 min– 1 hour for concluding day.

Location:

Classroom and Outdoor Area with either a Flowering Dogwood tree or a Red Maple tree for observation.

Procedure:

Introduction (Day One)

1. If weather permits, this entire lesson can be taught outdoors. Encourage students to lay down and stare at the sky while you ask them the following questions. (If students are uncomfortable laying in grass you can provide blankets or have them lay on a paved surface). Keep them silent during this time, just thinking about the answers. When you are ready, have them sit up and share their thoughts with the class.

Questions:

* Focus on this experience you are having with weather. What do you notice? (Feel, see, smell, hear)

* What do you wonder/What questions do you have?

* What do you know about the characteristics of weather conditions? How would you measure these things?

2. Students can be grouped into weather teams or the entire class can be one team. Have them come up with a weather name for their team, such as "The Hurricane Hunters". If they really get into it, they can come up with a special handshake or cheer. Then distribute their Weather Journals.

3. Go over the first page of the weather journal together. To amp up their enthusiasm, they can create their own weather team symbol. Encourage them to use their keen sense of observation when describing the site location.

4. Tour your weather instruments. Have students gather around and ask them to explain the tools and how to use them. Fill in information as needed. In addition to recording the weather, the younger students will be looking at the dogwood tree to see where it is in its yearly growth cycle. The older students will be observing cloud conditions and wind speed, both of which have reference charts within their Weather Journals.

Weather Trackers

Outdoor Wonders and Learning™

Weather Station Observation Days

When setting up additional observations, try to schedule them at the same time of the day. Other than this, there is a lot of flexibility in how to arrange your weather station visits. One option is to visit within a 2-week span and see how the weather changes day to day. Alternatively, you could visit weekly or monthly to get a larger scope of how weather changes over time.

Final Day

Their final day of the project can be combined with their last day of observation or stand alone. Students will draw line graphs that track the changes in temperature and precipitation, and answer the questions that follow. Alternatively, students could draw these as large-scale graphs outside, using sidewalk chalk on a paved surface. Questions could then be answered as a group discussion. For the older students, the back of their weather journal is a place for them to write about their new understanding of their local weather.

Extensions:

K-2nd Grade:

1. Use the computer interactive "Dress The Bear" to prepare the character for the weather. http://static.lawrencehallofscience.org/kidsite/portfolio/whats-the-weather/
2. Students can use their own weather instruments (thermometer, rain gauge and breath to show humidity) and demonstrate how they can use them outside.

Grades 3-5:

1. Over the course of a week or more, compare the weather data received from your school grounds with the weather data from a location with a different latitude or hemisphere such as Anchorage, Alaska or Sao Paulo, Brazil using the website https://www.wunderground.com/
2. Use NOAA's Climate Data Online (https://www.ncdc.noaa.gov/cdo-web/datasets) to track monthly or yearly weather patterns from weather stations within the area and compare it to the data you collected.
3. Become a global weather watcher by joining the GLOBE program (for more information go to www.globe.gov)

Learning Targets:

1. List and describe tools used to measure weather.
2. Predict weather conditions tomorrow based on weather conditions today.
3. Compare and contrast weather conditions from different days of observation.

Topic 4B:
Climate Clues

Background

All living things on this planet are subject to the climatic conditions of their environment such as the extremes in temperature and the amount of rainfall. Over time, plants and animals have evolved adaptations specific to surviving in their habitat. During the cold winter months, many animals must escape the low temperatures by burrowing deep into the ground, hibernating, growing thicker coats, or even migrating to warmer locations. Plants have adapted other means to withstand cold temperatures. Deciduous trees lose their leaves and slow down their metabolism in order to go into dormancy during the winter. They use very little energy when the tree is making no new food, only surviving off of the energy they have already stored.

The climate of an area is determined by multiple factors, including the rotation of the Earth around the sun, the angle that sunlight hits the Earth's surface, and the prevailing wind and water currents. The United States has predictable weather phenomena that help to shape its varied climates. The jet stream is a high altitude air current that flows from the west to the east and can dip lower into the South depending on global conditions. The gulf stream is a warm water surface current that flows from the tip of Florida along the eastern coastline and out into the Atlantic Ocean. A front is a boundary between two air masses of different densities, one being made of warm air and the other cold air. They are important to study because storms often arise from them. During the summer months, hurricanes can often arise that can cause extensive damage along the Atlantic and Gulf coasts. El Niño/La Niña is a weather phenomena that occurs within the Pacific Ocean bringing warm waters to the western coastline causing droughts in the Pacific Northwest and floods in the Southwest.

Schoolyard Sky Trees

Outdoor Wonders and Learning™

During the course of the school year, students will observe a tree go through the different seasons and weather. They will document this with drawings, words, and/or pictures.

Explore

Supplemental Reading

Cloud Dance
By Thomas Locker

Grade Levels:

K, 1, 2

Curriculum Correlation:

NCSCS – Science
K.E.1.1, K.E.1.3, 1.L.1.1, 2.E.1.3

NCSCS – Language Arts
K.W.3, 1.W.3, 2.W.3

Materials:

Composition notebooks and/or cameras, pencils, various art supplies, *Sky Tree: Seeing Science Through Art* by Thomas Locker

Duration:

30 minutes continued throughout the year

Location:

School grounds

Procedure:

1. Turn and Talk: What do you think of when you hear the word change?
2. Using photos of trees or animals that change their appearance seasonally, promote small group discussions about how plants and animals change in appearance or behavior depending on the time of the year. Why do you think this change happens?
3. Read the book "Sky Tree: Seeing Science Through Art" by Thomas Locker.
4. As a class or individually, have the students choose a tree (or shrub) within the school grounds to "adopt." Spend the first day having the students become acquainted with the tree. Some options include doing a leaf rubbing, measuring its circumference, identifying it by species, giving the tree a name, or writing a poem about the tree. Make sure to make observations about the sky and weather conditions as well. As the school year progresses, choose days of varying seasons and weather for the students to revisit their tree and make similar observations. How does the tree look different? How does the sky look different? Have them note the time of the day/year and weather conditions to tie together seasons and change.
5. For the final day, take a tour of the class trees, allowing all or some of the students to introduce their tree to the group. Have them share the changes they witnessed the tree going through and how they think this related to the weather.

Variation:

1. Combine with "A Tree Like Me" with plant life cycle images and human life cycle images
2. Create a graphic organizer with four sections labeled "picture, words, details, sample" to focus their thinking.

Learning Targets:

1. Illustrate the ways tree change according to the changing of the seasons.
2. Carry out a procedure that continues for an extended period of time.

Weather Phenomena Match-Up

Outdoor Wonders and Learning™

Students act out certain weather phenomena that occurs within and around the United States in a matching game.

Elaborate/Apply

Supplemental Reading

El Niño: Stormy Weather for People and Wildlife
By Caroline Arnold

How the Weather Works
By Christiane Dorian

Grade Levels:

5

Curriculum Correlation:

NCSCS – Science
5.E.1.3

Materials:

Cones marked North, South, East, West and placed on a large clear area on the school grounds to represent boundaries of the United States, cards describing five different weather phenomena.

Duration:

20-30 minutes

Location:

Open space

Procedure:

1. Set up the four cones in a compass pattern, allowing enough space for the group to run between them. Have the students imagine the cones are placed on the ground to mark the boundaries of the United States. Ask everyone rush to where California would be, then North Carolina! Stand in the Gulf of Mexico, the Atlantic Ocean, Canada, etc.

2. Give each student a card that describes one of five weather phenomenon that occurs in or around the United States. Also on the card are instructions for bodily movements. Allow a minute or two for them to read their card silently (and secretly!).

Movements are the following:

Gulf Steam: Hands down beside waist, fingers wiggling

Jet Steam: Hands above head, fingers wiggling

El Niño: Body in a surfing motion

Front: Hands on hips, elbows out

Hurricane: Spin around

Weather Phenomena Match-Up

Outdoor Wonders and Learning™

3. When the game starts, everyone will simultaneously act out their weather phenomena according to their cards' movements in the correct place on the imaginary map. Then, they must look around and group up with the others that are portraying the same weather phenomena as they are, all with no talking, just like charades!
4. Once five groups have formed, the round has ended. Have each group verify that they all share the same card. Ask the students: What do you know about the characteristics of your weather phenomena? How can you use that information to make sure you're in the right location on the map? (Continue the round until everyone finds their location.)
5. Optional: Play a few more rounds, mixing up the cards each time so students can try different weather phenomena.
6. Ask the students: What helped you learn about these different weather phenomena today?

Variation:

1. Have the students choose other types of weather phenomena and create their own cards using their own movements.

Extensions:

1. Students can choose one of the weather phenomena and research its history and importance. Their findings can be presented to the class or made into a poster.

Learning Targets:

1. Interpret the movement of air and water currents through bodily movements.
2. Describe the types of weather phenomena that occur in and around North America.

Unit 5:
Ecosystems

An ecosystem is the interaction between living and nonliving things in any given environment. These interactions can occur in two different types of ecosystems: terrestrial, or land-based, or aquatic which occur in either freshwater or saltwater ecosystems. In this unit, students will also learn how living organisms interact as either producers, consumers, or decomposers in terrestrial and aquatic ecosystems and what can happen when non-native plants and animals are introduced into new habitats by humans.

Topic 5A:
Putting the Eco in Ecosystem

Background

All plants and animals need air, water, food, light (plants only), shelter, and space to survive, but does that mean a polar bear could live in the Sahara desert or a cactus on the top of Mount Mitchell? Although these hypothetical questions have probably never been tested, the answer is probably no because both the polar bear and cactus have very specific needs in order to survive in their appropriate environments. A polar bear needs an ecosystem that will support plenty of space and prey for it to hunt, and is cold enough to prevent the polar bear from overheating. Cacti have water-retaining adaptations that enable them to live in dry, desert climates but would not serve them well in the wet, spruce-fir ecosystem of Mount Mitchell. An ecosystem differs from a habitat in that it is a community of different species that interact with each other and in conjunction with the abiotic factors that make up its nonliving environment. This includes but is not limited to rocks, the sun, air, soil, and water.

Recipe for an Ecosystem

(adapted from The ABCs of Ecology)

The students will observe, identify, and define the components of an ecosystem using the classroom and outdoor study area.

Engage

Supplemental Reading

Grades K-2:
Tree of Life: The Incredible Biodiversity of Life on Earth
By Rochelle Strauss

Because of an Acorn
By Lola and Adam Schaefer

Grades 3-5:
DK Eyewitness Books: Ecology
By Brian Lane and Steve Pollack

Grade Levels:

K, 1, 2, 3, 4, 5

Curriculum Correlation:

NCSCS – Science
1.L.2.1, 1.L.2.1,
4.L.1.1,4.L.1.2, 4.L.1.3
5.L.2.1, 5.L.2.2, 5.L.2.3

Materials:

Whiteboard or Smart Board

Duration:

20-30 minutes

Location:

Classroom or Outdoor Space

Procedure:

***It is important to note that this activity is more about how their fractions add up and if they can provide evidence and reasoning for their claim about the proportions of their ecosystem.**

1. With a group brainstorm, ask the students: What have you heard about an ecosystem? Write down their answers.
2. Based on their notes, ask the students if they think their classroom is an ecosystem. Ask them to explain their answers and make comparisons to other examples they might be thinking of.
   - Let students debate but because the classroom has living things (students and teacher) and nonliving things (desk, chairs, whiteboard, sunlight, air, etc.) the classroom fits within the definition of an ecosystem.
3. Think, Pair, Share: Have the students write down their own definition of a ecosystem, then share with a partner, then with the group. Work together as a class to agree on the main components of the definition, aligning it to the standard definition provided:
   - The interaction of living (***biotic***) and nonliving (***abiotic***) things in any given environment
4. As a class, generate a list of different types of ecosystems both near where they live and around the world. This could include but is not limited to: forest, field, lake, beach, ocean, wetland, tundra, rainforest, stream, desert, estuaries, salt marshes, etc.
   - Assign pairs or small groups to an ecosystem and have them generate another list of all the different biotic and abiotic factors within their assigned ecosystem. Have each group share with the rest of the class the different components from their ecosystem.

Recipe for an Ecosystem

(adapted from The ABCs of Ecology)

Outdoor Wonders and Learning™

- Encourage the groups to format their biotic and abiotic factors as an actual recipe.

  Example: Ocean

  Abiotic- 3/4 Salt water

  1/4 Sand or sediment on the ocean floor

  Biotic- 1/3 plant life (seaweed, kelp, algae, phytoplankton)

  5/6 invertebrates (coral, jellyfish, urchins, crustaceans, zooplankton)

  1/6 vertebrates (sharks/rays, whales, dolphins, turtles, fish)

5. Ask the students: How did you figure out the portions of your ecosystem? Did any of your ideas change during this activity?

Variation:

1. Use one ecosystem as an example and ask the class what would happen to this ecosystem if something was removed from the ecosystem.
   - For example, if your class analyzes the different components of a forest ecosystem, ask them to think about what would happen if all of the trees were removed or if all of the insects disappeared, or if there was no water left.
   - Ask students what humans might be able to do to help this ecosystem

     *Plant native species

     *Reduce development and human impact

Learning Targets:

1. Compare the proportions of living and nonliving things in different ecosystems.

2. Infer what might happen to an ecosystem or a living thing within an ecosystem if another component (food source, water source, shelter source, space, etc.) within the ecosystem was removed.

Who Lives Here?

A Schoolyard Ecosystem

Outdoor Wonders and Learning™

The students will observe, characterize, and research different ecosystems to learn how each support different species.

Explore

Supplemental Reading

One Small Square series: Woods, Pond, Backyard
By Donald Silver and Patricia Wynne

Grade Levels:

K, 1, 2, 3, 4, 5

Curriculum Correlation:

NCSCS—Science
1.L.2.1, 1.L.2.1,
4.L.1.1,4.L.1.2, 4.L.1.3
5.L.2.1, 5.L.2.2, 5.L.2.3

Duration:

30-40 minutes

Location:

Outdoor Space

Materials:

5 pieces of string cut into 2ft lengths; paper and pencil for recording

Procedure:

1. Prepare the students for this outdoor activity by splitting them into groups of 3-4. In their groups have them write down what they expect to find living in the Outdoor Space (around your school or center).
2. Give each group a piece of string 1-2 feet long. Try to make sure everyone has approximately the same size string. Explain that the string will be used to encircle one small section of a larger ecosystem. The students will walk around the outdoor space with the group and every time you yell, "stop" the group should kneel, make a circle with their string, and count the number of different species (plant and animal) living within their circle. Encourage them to look for subtle differences in the grass species, or to look for the tiny insects in the dirt. The goal of this exercise is not to identify particular species but to count the total number of different species found.
3. Have someone in each group record the number of varying species found each time you shout, "stop." Be selective in the different spots that you choose to have students count species. For example, have students count in two separate places in the Outdoor Space, then walk to different areas of your location like the playground, the parking lot, underneath a shaded area, in the middle of a soccer field, next to trees, etc.
4. Return to the classroom and ask students: What did you discover about the different places you looked? Make a table on the board that tallies the amount of species found at each site. After looking at the numbers ask students:

    - Which site/ecosystem had the largest amount of living things in it? Why do you think more things could live there?
    - Which site/ecosystem had least amount of different things living in it?
      What could be some reasons for this?

    Introduce the word **biodiversity** (variety of species present in an ecosystem), asking the students to create a definition first, then fill in any missing content with the above definition.

5. Ask the students: What do you know about the characteristics of an ecosystem? Provide any content refreshers like—interactions of living and non-living things; one of those non-living things can be weather; consider location, etc. Next ask about the living things they found at their locations:

   What did you notice about the different species you found at the different sites? Where any the same or different? Were there any species that appeared in all of the sites? Why were some species found in some spots but not others? What do you think is the explanation for that?
   * Let's zoom out and think about our larger ecosystem in our area. Have the students compare a well known natural feature in the area (river, lake, forest) to their observations of the area they just explored. Ask some of the same questions as before (How are they similar or different?)

6. Ask the students: What questions do you still have about ecosystems and biodiversity?

Variation:

Students can do a "Zoom In" version of the activity where they will first observe their spot from 3 feet away, then 1 foot away, then looking within the circle. They can record the different number of species they were able to see during each observation.

Extensions:

1. Have students pick and research a common ecosystem in North Carolina (estuaries and salt marshes, oceans, lakes and ponds, forests, and grasslands) and write or present a report on some of the species that live in that ecosystem. Make sure to ask if some of those species live in other ecosystems around the state. Why are they able, or not able, to do so?
   - What are some of the characteristics of their ecosystem that make it unique?
   - Would any of the species found in the Outdoor Study Plot live in this ecosystem? What could help them live here? Which components of the ecosystem are not a good fit?

2. For second graders, have students go outside and do the "Who Lives Here?" exercise throughout the year to see how seasons and weather affect an ecosystem.

Learning Targets:

1. Utilize different types of technology to research an ecosystem.
2. Observe and compare characteristics of different ecosystems.
3. Explain how different ecosystems support different types of plants and animals.

Topic 5B:

Producers, Consumers, Decomposers: A Sustainable Cycle

Background

All organisms in an ecosystem have a different role or **niche** to fill within that environment. Although many organisms share similar roles, no one is exactly the same. When all of the organisms in an ecosystem function in their niche unimpeded, the energy flow within an ecosystem remains balanced and constant. Organisms can fit into three different categories of niches in regards to a balanced energy flow in an ecosystem.

Producers: Are organisms that use photosynthesis —> (sunlight + carbon dioxide + water) to create their own food and energy.

Consumers: Use or gather the energy from producers (herbivores) or by eating other consumers (omnivores or carnivores).

Decomposers: Return energy back to producers by breaking down dead or decomposing organisms. An acronym to remember what organisms make up decomposers is the FBI (no, not the Federal Bureau of Investigation but Fungus, Bacteria, and Invertebrates).

It's All Connected!

(An ecosystem simulation adapted from Halton Children's Water Festival)

Outdoor Wonders and Learning™

Students will play the roles of producers, consumers, and decomposers to simulate how a food chain works to maintain energy in an ecosystem.

Elaborate/Apply

Supplemental Reading

Producers, Consumers, and Decomposers
By Dava Pressberg

What Are Food Chains and Webs?
By Bobbie Kalman

Grade Levels:

3, 4, 5

Curriculum Correlation:

NCSCS—Science
3.L.2.1
4.L1.2
5.L.2.2, 5.L.2.3

Materials:

White board or Smart Board; colored identifiers—bandanas, headbands, etc.; approx. one dozen items (foam balls) that can be easily thrown; hoops or rope to mark a safety zone

Duration:

Part A 30 minutes, Part B 30 minutes

Location:

Classroom for introduction and Outdoor Study Area or open space for activity

Procedure:

Part A

1. ***Think, Pair, Share***: Ask the students: What have you heard about how energy and food are related? Give students an opportunity to either share with their neighbor, then out loud with the rest of the class. Make sure that students realize that the sun plays a critical role on Earth by introducing energy into every ecosystem, enabling producers to make their own food.
2. Next ask them to brainstorm a list of organisms that live in and around their school (including plants, animals, and fungi/bacteria/invertebrates). As they suggest organisms, write them on the board into three columns (producers, consumers, decomposers), unlabeled at first, without mentioning why the organisms are separated into different columns. Once a substantial list of **native** (no sharks or crocodiles) organisms have been made, ask the following questions:

   - What do you notice about these lists? How might you explain your ideas?

3. Based on the student answers to describing the columns, label them with the terms producers, consumers, and decomposers and have them define the terms.
4. Ask the students: How can we use what we've discussed about food, energy, and these groups of living things to create a food web?

   Group work: Have the students illustrate a food web on the whiteboard. Provide the same prompts for all groups. Where does the flow of energy start? Where does it go? What other ways can energy be moved around the food web?

   (Ideally they will start with the sun and follow the flow of energy from producers to consumers to decomposers and then back to producers, demonstrating how decomposers give energy back to the ecosystem by providing nutrients to producers. Make sure to use native plants and animals to highlight the school's local ecosystem and the organisms living there.)

It's All Connected!

(An ecosystem simulation adapted from Halton Children's Water Festival)

Outdoor Wonders and Learning™

Part B—The game involves the basic food chain: Starting with abiotic components taken up by producers being eaten by consumers broken down by decomposers return abiotic components to the environment. The overall idea is to maintain the ecosystem while each group fulfils its goal.

5. Explain that students will be randomly picked to be producers, consumers, or decomposers for the next simulation. Each organism has different needs that they must meet in order to survive and they will be playing a game similar to tag to get what they need.
6. Participants form three groups:
    - Decomposers – e.g., insects, bacteria
    - Consumers – e.g., animals/humans (about twice the number of decomposers)
    - Producers – e.g., plants (about twice the number of consumers)

    Have each student randomly choose an identifier that signifies what type of organism they are, example- green (producer), red (consumer), or brown (decomposer)
7. Set a boundary for the playing area which represents the environment. Players must remain in the playing area. Objects such as soft throwing items represent abiotic components (i.e. nutrients, sunlight, water). The number of items equals the number of producers. Place items in two or more piles within the playing area.
8. Producers are the only players who can take items from the piles. A safety zone (which represents the soil) around the pile protects the producer from being tagged only when he or she is picking up a ball. Their goal is to get all the items out of the safety zone and keep the items in the hands of the producers only.
    - Producers must always be holding the items they collect.
    - Consumers' goal is to obtain and hold on to as many items as possible. They can only get items by making a two-handed tag on a producer holding a ball.
    - Decomposers can only get items my making a two-handed tag on a consumer holding an item. They return items to the safety zone and their goal is to get all the items back to safety.
9. When the players are tagged, they must give up all the items they are holding. Players can toss and pass the items to members of their own group. Items cannot be intercepted during a pass.
10. Players continue as long as you wish (producers keep taking items, decomposers keep returning them).

It's All Connected!

(An ecosystem simulation adapted from Halton Children's Water Festival)

Outdoor Wonders and Learning™

11. After finishing the game, have students sit in the grass or head back to the classroom to discuss what happened over the course the game. Begin the conversation by asking what it felt being a part of the food chain?
    - Was it stressful? How might a wild animal feel?
    - What strategies did you use to avoid being caught? Do plants or animals use these strategies?
    - What strategies did you use to catch other students? Do plants or animals use these
    - What did you feel when you played the game. Is this how a wild animal might feel?
    - Did you use any strategies?
    - If humans were introduced to this game, what rules would you give them? What about disease? What about famine?
    - How are all the groups dependent on one another?
        Consumers need producers to take the nutrients out of the safety zone
        Decomposers need consumers to take nutrients from producers
        Producers need decomposers to put nutrients back in the safety zone
    - How does each group contribute to the continuous functioning of the ecosystem?
        The groups must balance their needs with each other to continue functioning

Learning Targets:

1. Identify the components of an ecosystem.
2. Summarize how energy is maintained in an ecosystem: Sun—> Producers—> Consumers—> Decomposers—> Producers
3. Describe the roles of producers, consumers, and decomposers in an ecosystem.
4. Interpret how humans might positively or negatively impact a North Carolina ecosystem and the natural resources within them.

Topic 5C:

When Humans Meddle

Background

When an ecosystem is healthy and functioning efficiently, energy from the sun remains in the system. Producers grow, consumers eat, reproduce, and die, and decomposers break down biotic factors into soil, thus returning energy back to producers. These processes in an ecosystem are sometimes interrupted by natural factors such as hurricanes, droughts, and earthquakes or by unnatural events caused by humans. Development and habitat loss, erosion, pollution, and the introduction of nonnative species to new ecosystems have all influenced the makeup of the environment today. For example, the Wooly Adelgid, a small insect native to East Asia, was accidentally introduced to the United States in the 1950s. This introduction has had devastating consequences for hemlock trees across the eastern U.S., as the Wooly Adelgid has slowly killed off these native trees. The Wooly Adelgid did not just impact hemlocks but also all of the other organisms that rely on the hemlock for food, shelter, and shade.

When a foreign species is introduced to a new ecosystem this is called an invasive species. Many invasive species are able to thrive in their new environment because they are able to outcompete other plants and animals native to that area. Different invasive species introduce different problems for ecosystems. Some jeopardize the health of the entire ecosystem while other invasives might threaten the population of just one species within an ecosystem. Even worse, invasive species sometimes eat, attack, or damage native species which can reduce population sizes or even cause extinction. Native species are susceptible to foreign plants and animals because they have no natural defense or adaptation to protect themselves from the invading species.

Does This Belong Here?

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The students will discuss differences between native and non-native species and how an ecosystem can be harmed for benefit from them.

Explore

Supplemental Reading

Aliens From Earth: When Animals and Plants Invade Other Ecosystems
By Mary Batten

Attack of the Zebra Mussels (Animal Invaders: Destroying Native Habitats)
By Michael Rajczak

Grade Levels:

4, 5

Curriculum Correlation:

NCSCS—Science
4.L.1.1, 4.L.1.2
5.L.2.1, 5.L.2.3

Materials:

Popsicle sticks with printed images of animals and plants taped or glued on (use a mix of the Common Backyard Animals images and the Non-Native Organisms images in the Appendix)

Duration:

20-30 minutes

Location:

Outdoor Study Area

Procedure:

Before class, place the photos of different types of plants and animals around the outdoor classroom and school grounds. Photos could be taped onto popsicle sticks and then stuck into the ground. Choose photos of animals and plants that are both native and nonnative to western NC. Have students define and discuss the difference between native and nonnative species.

1. *Turn and Talk*: What do you think of when you hear the word invade (or alien, or non-native)? This can be a drawing or writing exercise.
2. After the group share, ask the students: What do you notice about these drawings/descriptions? How are they similar or different? What do you think is the explanation for this?
3. Next, tell the group they will be going on an observation walk, looking for pictures of plants and animals "living" in the area. Ask them to tally the number of plant and animals species that they find as they walk.
    - For each species have students write a guess if that species is native or non-native to their North Carolina Ecosystem
    - Once they have found all of the pictures go over their answers for which is native or non-native. Ask for evidence for their claims (What makes you think that? Can you say more about that? What is your evidence?
4. Ask the students: Why are some species able to live in this North Carolina ecosystem and some are unable? Can some of the animals or plants could be found in other parts of the US or world?
    - For those species that might be found elsewhere, ask students to think about why some animals or plants might be able to survive in different types of ecosystems.
5. How might you explain what you learned about native and non-native species to a family member?

Learning Targets:

1. Explain how different ecosystems support different types of plants and animals.

In the [Alligator] Weeds

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Students will learn how introduced non-native species can affect the populations of native species in this competitive game of survival.

Elaborate/Apply

Supplemental Reading

Invasive Plant Species (Invaders from Earth)
By Richard Spilsbury

Grade Levels:

3, 4, 5

Curriculum Correlation:

NCSCS—Science
3.L.2.2
4.L.1.1, 4.L.1.2, 4.L.1.3
5.L.2.2, 5.L.2.3

Materials:

100 blue poker chips, 100 white poker chips
Species indicators (name cards, pictures, etc.)

Duration:

40 minutes

Location:

Outdoor Study Area or open space

Procedure:

1. Ask students what the needs of all living organisms are (food, water, shelter, space, and air).
2. Introduce the game by describing to students that they will participate in a simulation. Explain to the students they will randomly be picked to be dragonfly larvae, crayfish, or bass over the course of the simulation. Ask students if these organisms need the same amount of food or oxygen in order to survive.
    - Discuss the relationship of the different species within this ecosystem. Ask them which organism is highest on the food chain and which one is lowest. Which need more or less energy? What makes you think that? Could this b
3. Make a circular boundary that indicates the borders of the aquatic ecosystem. Scatter 100 blue poker chips and 100 white chips inside the circle. When you are ready to begin round one of the simulation, tell students that they need to collect as many poker chips as possible.
4. ROUND 1: Have the students play until all of the poker chips have been collected. Explain to students that each species needed to collect a certain amount of food and oxygen:

	Oxygen (White Poker Chips)	Food (Blue Poker Chips)
Dragonfly Nymph	5	5
Crayfish	7	7
Largemouth Bass	10	10

5. Each species mush have the minimum number of white and blue chips to survive and make it to the next round of the simulation. Survivors continue as the same species for next round while the students that did not make it will sit out with the teacher.
    - Record the number of surviving species and the number of deceased species

In the [Alligator] Weeds

Outdoor Wonders and Learning™

6. ROUND 2: Remove all of the chips that were collected by the non-surviving animals in the game. Scatter the chips from all of the survivors back into the ecosystem. Mention to students that the ecosystem has changed. An invasive species called alligator weed has been introduced to the ecosystem and begun to multiply, this has caused some of the food and oxygen resources to disappear. Begin the next round reminding students that even though there are less chips, each species still have the same amount of requirements to survive. Students that did not survive the first round will observe during the second round.
    - Do not be surprised if most of the students survive this round. Record the number of surviving species and the number of deceased species.

    NOTE: Alligator weed disrupts the aquatic environment by blanketing the surface and impeding the penetration of light. Such blanketing can also prevent gas exchange (sometimes leading to anaerobic conditions) which negatively affects aquatic plants and animals. It also competes with and displaces native plant life along river and creek banks and in wetlands.

7. ROUND 3: Explain to students that the alligator weed population has exploded. As a result, the surface of the ecosystem has become completely covered by the plant which has greatly reduced the amount of sunlight that penetrates to the native plants at the bottom of the water. These native plants cannot photosynthesize which causes them to die off and therefore affect the food supply and habitat of herbivores. Remove half of the food chips and half of the oxygen chips.
    - Before starting the round have students predict and discuss what will happen to the remaining native species in the game.

8. If there is time, keep playing rounds until all of the resources are depleted or start over and try the simulation again so that students who were eliminated in earlier rounds have a chance to play again.
9. Return back to the classroom and graph the results of the three rounds (or more rounds). Ask students if their predictions were correct after alligator weed populations proliferated?
    - Ask students to describe why native species' populations declined so sharply?
    - Can you think of other ecosystems and native species where something similar could happen?
    - What can humans do to help against invasive species? (Prevention, eradication, etc.)

Learning Targets:

1. Explain how plants or animals that are introduced to an ecosystem may become invasive and negatively affect the interrelationships between native plant and animal species.
2. Analyze the data collected and draw conclusions from population dynamics.

Appendix

Glossary

Abiotic - a non-living factor in an environment (light, water, air, soil).

Adaptation - an internal or external feature or behavior that helps an organism survive in its habitat.

Biodiversity - variety of species present in an ecosystem.

Biotic - a living factor in an environment (plants and animals).

Cambium - the thin layer of living tissue just under the bark of trees. This layer is where the tree grows from.

Chlorophyll - the pigments that produce the green color of plants and are essential for photosynthesis to occur.

Cloud - a visible mass of water droplets or ice crystals that is suspended in the air at high altitude. Basic classifications are cirrus, stratus, and cumulus.

Consumer - an organism that obtains energy by feeding on another living thing (plant or animal).

Decomposer - an organism that feeds obtains energy by feeding on dead material and breaks it down physically and chemically.

Dichotomous Key - a tool used to identify items in the natural world, consisting of a series of choices to lead the user to the correct option.

Ecosystem - the interactions between biotic and abiotic factors in an environment.

El Niño - the warm phase of the fluctuations in temperature between the ocean and the atmosphere, typically occurring in the Pacific Ocean around December and affecting the weather patterns across North America.

Flower - the reproductive structure of a plant.

Front - regarding weather, it is a boundary separating two masses of air of different densities, typically warm and cold.

Fruit - the seed-bearing structure in flowering plants.

Gulf Stream - a warm and swift Atlantic Ocean current that originates in the Gulf of Mexico and stretches to the tip of Florida, then follows the eastern US coastline north.

Habitat - a place where a plant or animal lives and is able to get food, water, shelter, and space.

Hurricane - a large tropical storm system with high-powered circular winds.

Interdependence - when two or more organisms depend on each other for survival.

Interrelated/Interrelationship - the way two or more organisms relate to each other.

Jet Stream - a fast flowing narrow air current in the upper atmosphere over North America. It flows from west to east and greatly affects the weather patterns.

Leaves - flattened parts of a plant, typically green and filled with chlorophyll; these are the main organs of photosynthesis and transpiration.

Life Cycle - the phases or changes of an organism during its lifetime.

Limiting Factor(s) - environmental conditions that limit the growth, abundance, or distribution of an organism or population of organisms in an ecosystem.

Native - occurring naturally in an area or habitat.

Niche - the role played by a plant or animal in its ecosystem.

Phloem - the tissue in plants that moves the nutrients down from the leaves into the other parts of the plants.

Photosynthesis - the process where green plants produce sugars as food by combining sunlight, carbon dioxide, and water. Chlorophyll must be present.

Pollen - microscopic grains that are moved from the male part of the plant (anther) and collect on the female part of the plant (stigma) by wind, insects, or other animals.

Precipitation - water that falls to the ground from the atmosphere in different forms depending on its temperature—snow, rain, sleet.

Glossary

Producer - an organism that makes its own food using photosynthesis (green plants) or chemosynthesis (bacteria).

Roots - the part of the plant that attaches to the ground for support and to move water and minerals to the rest of the plant.

Sap - the liquid inside a vascular plant that moves through the xylem and phloem.

Sapling - a young tree with a slender trunk no wider than 4 inches in diameter.

Seed - an object produced by a plant after pollination and fertilization, from which a new plant can grow.

Sit Spot - a quiet place for a student to settle down, cultivate awareness, and quiet their mind.

Snag - a dead tree that is still standing, often providing a home to many animals.

Sprout - the small new growth from a plant seed.

Stem - the stalk of a plant that supports a fruit, leaf, or flower.

Stomata - microscopic openings in a leaf that allow gas to move in and out (transpiration).

Temperature - the degree of heat present in a substance, object, or area.

Think, Pair, Share - a collaborative learning strategy where a student first thinks about the topic or question, the pairs up and shares ideas with a partner, then concludes with sharing ideas with the group.

Vascular Plants - any type of plant with the vascular tissues xylem and phloem. This includes all seed-bearing plants.

Wind - air moving naturally across the earth's surface at any speed.

Xylem - woody tissue in plants that moves water from the roots to the rest of the plant, stores nutrients, and offers structural support.

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