ACTIVITY GUIDE

MacGillivray Freeman's

Into America's WILD

The Search for the Hidden Wonders of Nature

NARRATED BY MORGAN FREEMAN

WELCOME

Dear teachers, parents and informal educators:

Welcome to the Activity Guide for *Into America's Wild*, a film for IMAX® and giant screen theaters about the wonders of nature. As filmmakers, we have been making educational documentaries for more than forty years. This film is one of our most important efforts because in this age of technology-driven society, it reminds us of the importance of spending more time in nature. This is especially true for our children, who now spend, on average, approximately seven hours per day in front of some sort of screen—cell phones, TVs or computers.

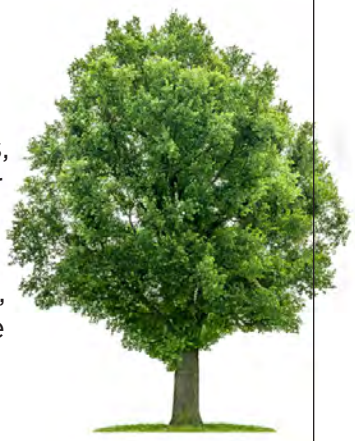
We hope the film and the activities in this guide will strengthen a lifelong appreciation and enjoyment of our natural world and build a sense of responsibility to preserve and protect it. We also hope it highlights the importance of finding new ways for all people to have access to nature. *Into America's Wild* was inspired, in part, by the work of author Richard Louv, who writes eloquently about the human right to nature-connection, and the inequities to access that some experience due to race and income among other factors. In the back of this guide, you will find a list of organizations that are working tirelessly to connect more people to nature and create greater access everywhere.

Studies show that spending time in nature makes us more creative, more energetic, and it's important to our overall well-being. Our guides in the film—pioneering Native American astronaut John Herrington and Alaskan pilot and youth advocate Ariel Tweeto—are inspiring role models as they share their passion for the out-of-doors.

Now is the time to leave our indoor spaces and learn in one of our best classrooms: outdoors in nature. So let's go outside into our wild places—in our backyards, city parks, fields and streams—to explore, discover and learn, and at the same time be filled with joy and wonder about the plants, animals and natural systems that sustain us.

—The filmmaking team at MacGillivray Freeman Films

Activities Overview



This Activity Guide provides activities and challenges aligned with the Next Generation Science Standards (NGSS) to inspire all educators, including teachers, parents, group leaders and neighbors, to get our children back outside and immersed in nature wherever they find it —in their local park, neighborhood, school, or in America's wild. It is intended for use by schools, home school groups, informal educators, scouts, families, and anyone wishing to share nature with others. Since we are all life-long learners, this guide will use the term "students" throughout the activities to encompass the student in each of us.

Teachers are encouraged to adapt these activities for their own grade levels. Remember to share the Fun Facts and challenge students with the Nature Boost suggestions provided throughout the guide!

CONTENTS

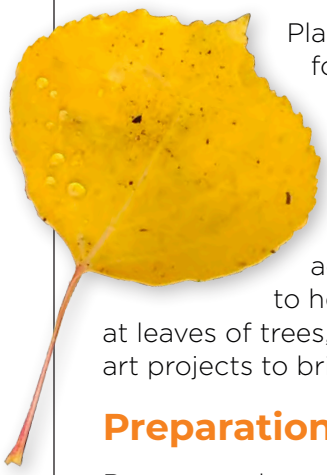
Grades Pre-K to K and above

Leaves and Lasting Impressions

Filmmaker's Note:

Into America's Wild takes us into Utah to meet Pando, the Trembling Giant, a forest of quaking aspen trees all connected with a single root system. Trees like the quaking aspen help to make North America the place where more trees turn color in the fall than any other place on Earth.

Introduction:



Plants use their leaves to create food using sunlight. The chlorophyll in the chloroplasts of the leaves makes them green, and those chloroplasts convert the energy in sunlight into food energy. In this activity, you will go into nature to help students take a closer look at leaves of trees, then create one or more leaf art projects to bring nature indoors.

Preparation:

Be prepared to collect leaves. Lots of them, if you are creating pressed leaf projects. Be sure to practice the techniques for your chosen activity before working with your students.

MATERIALS

(these depend on the season and the project):

Leaf Prints—Spring

- ☐ Sturdy, fresh leaves
- ☐ Tempera paint
- ☐ Brushes
- ☐ Art paper, any kind

Pressed Leaf Projects—Autumn

- ☐ Leaves that have fallen from trees, but are still flexible enough to flatten
- ☐ Phone books or other thick books that you don't mind getting damp, (such as used SAT or ACT test practice books—high school counselors are a good source for these)
- ☐ White glue
- ☐ Card stock

Leaf Rubbings— Autumn or Spring

- ☐ Sturdy, flexible leaves
- ☐ Crayon pieces without paper wrappers
- ☐ Printer paper, plus scrap paper or newspaper to protect the table

Get into nature and begin the activity:

Take your students out into nature to find several different trees in your schoolyard or neighborhood. Ask the students to observe the trees and their leaves carefully. How are leaves the same and how are they different? How are the leaves positioned on the plant to absorb sunlight? Are the topsides of the leaves identical to the undersides of the leaves? Consider the methods plants use to obtain nutrients and compare them to the methods animals use to obtain nutrients—plants process sunlight with chloroplasts to create nutrients, but animals eat plants or other animals to survive. This is why we say that plants are producers, and animals are consumers.

Collect a variety of leaves, then create an art project by making leaf prints, leaf rubbings, or pressed leaf pictures. What do the leaf prints and rubbings show? Look for the venation patterns—the lines made by the veins of the leaf where the nutrients flow. Trees and bushes can be identified by their leaf shape and venation patterns, so help your students spot the similarities and differences.

FUN FACT

The three primary venation patterns in leaves are:

Leaf print procedures:

Leaf prints work best with fresh leaves. Have students gather a variety of whatever leaves they can find. Help students feel the difference between the upper smooth side of the leaf and the bumpy underside where the veins stick out. Spread tempera paint with fingers or brushes across the underside of the leaf. With clean fingers, press the painted side of the leaf onto paper and press evenly, then carefully peel the leaf away. You may want to practice first! For more tips, go to the following two websites:
teacher.scholastic.com/lessonrepro
www.firstpalette.com/craft/leaf-prints

Pressed leaves procedures:

In autumn, as colorful leaves begin to fall, take advantage of North America's glorious display by collecting the leaves and pressing them (make sure they are dry first) in the pages of old books (see Materials), or between sheets of white paper under stacks of heavy books. Some leaves are ready after one week. Other leaves need to dry for two or three weeks before they can be arranged into pictures or patterns using glue on stiff paper. Inspire your students by showing them the book *Look What I Did with a Leaf* by Morteza E. Sohi.

Leaf rubbings procedures:

Leaf rubbings work best with sturdy, flexible leaves. Have your students protect their table or workspace. Place the leaf vein side up and cover it with a sheet of paper. Using the tip or side of a crayon, gently rub the crayon over the entire leaf, holding both the leaf and the paper steady to keep them from sliding. Use a variety of leaves and colors for a creative display. You might also have the students cut the leaf rubbing images apart, then sort them by leaf size, leaf shape, or leaf venation pattern (pinnate, palmate or parallel veins).

EXPLORE FURTHER

Continue your investigation into leaves by having students watch how drops of water roll across the leaves or how they flutter if you blow over them. How would these characteristics help the tree survive? What would happen if rainwater did not roll off the leaf? How could students investigate these questions?

Grades Pre-K to K and above

Seed Shakers and Plant Percussion

Filmmaker's Note:

In *Into America's Wild*, John and Ariel take us to Crater Lake, Oregon, to observe a community of plants and creatures in a healthy ecosystem: "everything in nature has a purpose." Birds, Ariel explains as an example, feed on the seeds from trees. As they do so (because poop happens!), they distribute the seeds "far and wide, propagating new trees and expanding the forest."

Introduction:

Most plants create seeds to reproduce. Some plants, such as Scotch broom, make their own percussion as they fling their dried seeds from the seedpods on a warm summer day. In this activity, your students will focus on seeds as a form of plant reproduction. They will use seeds to create percussion seed shakers and compare sounds made by the various shapes and sizes.

MATERIALS

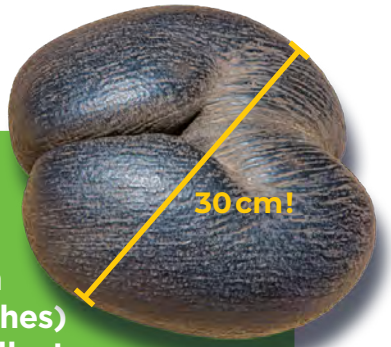
- A variety of seeds, collected from nature and from grocery stores or plant nurseries. Examples:

  From nature: Grass seeds, maple seeds, sweet gum ball tree seeds (shaken from the balls), locust seeds, acorns, buckeyes, chestnuts, pecans, walnuts, and many more (be cautious of tree nut allergies with your students)
  From stores: caraway, poppy, sesame, or quinoa seeds, or a wide variety of dried beans, peas, rice, sunflower seeds, pumpkin seeds, birdseed, or even tree nuts
- Toilet paper tubes or paper towel rolls, cut to smaller sizes (or empty and dry plastic water bottles with caps)
- Paper circles or squares to cover the ends of the tubes, 9-10 cm (3.5-4 inches) across
- Rubber bands
- Tape (clear or masking)

Many maracas contain seeds.

Preparation:

1. Find several plants outside that have visible seeds, perhaps a dandelion growing near the sidewalk, a maple tree, an evergreen tree, tall grasses or others growing nearby.
2. Prepare one toilet paper tube per student, or cut paper towel tubes into halves or thirds, or collect empty and dry plastic water bottles with caps as an alternative.
3. Prepare squares or circles of paper to cover and seal the ends of the tubes. Practice doing this by wrapping the paper over one end of the tube, holding it in place with a rubber band, wrapping it with tape until the paper is secure, then removing the rubber band. You may wish to cover one end of each tube before class to save time.



FUN FACT

The largest seed belongs to the coco de mer palm tree and can reach up to 30 cm (12 inches) in length. The smallest seed belongs to a species of orchid and at 85 micrometers in length (1/300th of an inch), it cannot be seen by the naked eye!

Get into nature and begin the activity:

Guide students to the plants you have located outside with the visible seeds. Ask students to observe the seeds closely. How would they describe the size and shape of the seeds? Discuss the similarity between the seed and an egg—both are the structures for reproduction and are necessary for the next generation of the organism. After observing several different seeds, challenge students to consider how the seeds are the same between the different plants, and how they are different.

Next, create a plant percussion seed shaker for each seed variety. To create the seed shakers, simply place a handful of seeds into the toilet paper tubes or dry water bottles. For the tube, cover one end as described in Preparation, pour a handful of seeds into the tube, then form the other piece of paper tightly over the other end and secure it. Give the tube a light shake to test the strength of the ends, then be percussive and create a plant percussion musical band! Enjoy the different sounds each of the different seeds can produce. Allow students to decorate the tubes with images of seeds and plants if they wish.

EXPLORE FURTHER

Challenge students to collect even more seeds as homework, either by foraging outside (with adult assistance to avoid poison ivy or poison oak or other surprises) or exploring in the spice or dried beans or bulk section of your grocery store.
Try planting some of the seeds and consider what the plants need to survive, then compare those needs to the needs of animals.

Grades 1 to 2 and above

Pollinating Flowers, Preserving Flowers

Filmmaker's Note:

While making the film, John and Ariel went to Middleton Gardens in South Carolina to meet Native American ecologist Melissa Nelson, whose ancestors, the Chippewa people, knew that "every living thing had a purpose."

Introduction:

The purpose of flowers is to attract pollinators, and the pollinators, in turn, help move pollen from one flower to another in order to create seeds. In this activity, your students will consider the challenge of moving pollen from one flower to another, then create an art project to demonstrate their understanding of methods used by animals, birds, bats, bees, butterflies and others, when they pollinate the plants.

Preparation:

Identify areas outside where your students can find a variety of flowering plants, shrubs or trees. If you see some pollinators such as butterflies, encourage more to visit the area before your lesson day by providing shallow plates with water and moist fruit. Be conscious of the presence of bees, however, for those students with bee sting allergies. As an indoor alternative, share a video on pollination (see Resources, page 39).

MATERIALS

- Flowers from your schoolyard, neighborhood or garden, such as tiny lawn daisies, violets, pansies or even dandelions (sadly, the dandelion is a poor choice for the pressing activity due to its high moisture content, but it will be fine for exploring pollen and pollinators). Look for flowering trees and shrubs, such as fruit trees, dogwood, redbud, hawthorn or others common in your area.

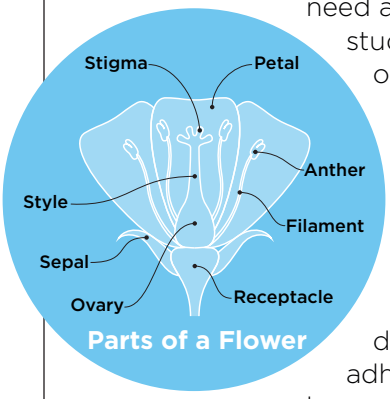
  Flowers from a florist will also be fine, and lillies are an excellent choice for discussing pollen and flower anatomy (for pressing flowers, see the list of best flowers for pressing on the Fine Gardening website in Resources, page 39)
- Magnifying lenses or microscopes
- Papers for pressing
- Heavy books for pressing, or wooden pressing kits, or microwave pressing kits

FUN FACT

All fifty of the United States, along with U.S. territories, have designated a state flower. Do you know yours?

Get into nature and begin the activity:

Take students on an outdoor excursion to discover the flowering plants you've identified (bring along the flowers from the florist if you need a wider variety). Give the students time to carefully observe the flowers. Ask them to find structures in the flowers that are the same, and structures that are different . Point out the pollen on the anthers, and the sticky stigma where the delivered pollen will adhere. Use the magnifying lenses to give the students a closer view of the pollen and the flower anatomy (USB microscopes with laptops or tablets are also excellent tools for those willing to combine technology with nature).



Parts of a Flower

Elizabeth, a first grader, with her preserved garden and pollinators picture.

After exploring the source of the pollen in the flowers, let students know that many flowers need to be pollinated with pollen from another flower of the same variety in order to produce a seed. How might that happen? Take a step back from the flowers, then sit and wait to see if any pollinators come to visit. Ask students what kinds of animals might provide a pollinating service for the flowers. The four main pollinators are: birds, bats, bees and butterflies. How else might pollen move?

Next, have students help collect flowers, with permission of course, for preserving. Let students know that the best flowers for pressing are those that are simple, fairly flat, and fairly dry like a pansy (show them the moisture in a dandelion stem as an example of a flower that would likely mold rather than flatten and dry, though they may try it).

Carefully lay the flowers between sheets of paper and place under heavy books or in wooden pressing kits. Then explore nature in other ways for the next three weeks (or three minutes, if you are using a microwave press). When the flowers are dry, allow the students to create a picture with the pressed flowers, either individually, in small groups, or as a whole group, depending on the number of flowers. Use drawings, photographs, small objects or petal arrangements to represent pollinators in your pressed flower artwork.

NATURE BOOST

Where can you go in nature to find your state flower? How about your state tree? Don't stop there! Propose a contest to see who can be the first in your group to find your state's flower, tree, bird, insect, rock, mineral, and any other state-designated natural element!

EXPLORE FURTHER

What would happen if these pollinators no longer existed in this habitat? Make a list of foods we eat that wouldn't be available without pollinators, such as strawberries, apples and chocolate. As a group, brainstorm ways to help preserve the pollinators of your area.

Grades 1 to 2 and above

Plants and Sunlight

Filmmaker's Note:

Into America's Wild visits Paul Rogers, a botanist who inspires kids by introducing them to Pando, a forest of quaking aspen trees all connected with a single root system. Instead of having a canopy of leaves that completely block sunlight from reaching the ground, the physiological design of the aspen leaf stem allows the leaf to twist, or quake, allowing light to reach the ground. This, in turn, encourages the sprouting of more aspen trees from the extensive root system.

Introduction:

In this activity, your students will design an investigation to test whether or not plants really need sunlight to grow properly, then carry out their investigation.

Preparation:

Plan an outdoor excursion where your students will be able to see plants growing in full sunlight, areas where plants have partial sunlight (perhaps only morning or afternoon sun) and areas where plants grow beneath large trees or under a building overhang. Finding similar plants in each of these different areas would be a bonus, such as dandelions or grass.

MATERIALS

- Indoor or outdoor plants for experimentation (two or more identical plants for the experimental and control subjects). These can be weeds, grass, groundcover plants or even starter plants from grass seeds or a plant nursery
- Materials based on student designs for light-blocking containers, such as dark buckets, black construction paper, black garbage bags, cardboard boxes, or others

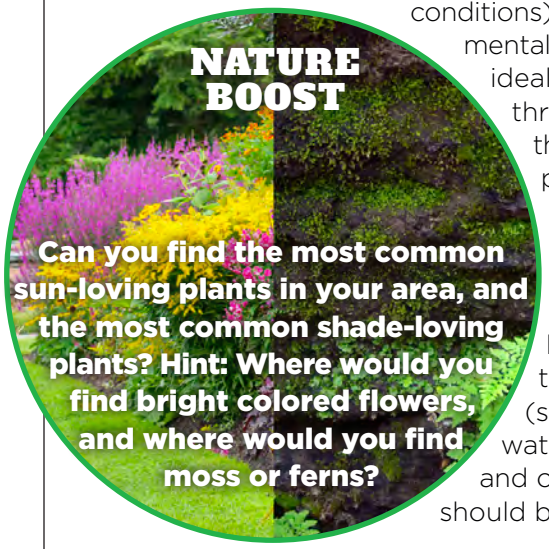
Get into nature and begin the activity:

With your students, discuss the needs of all (with some exceptions) living things: air, water, food and space. For plants, some nutrients are drawn up through the roots, but more of the "food" for the plant is processed by chloroplasts from sunlight. Take your students out on the excursion and have them closely observe the plants and the amount of sunlight those plants receive. If you have found similar plants in varying sunlight conditions, examine them for possible differences due to the difference in lighting.

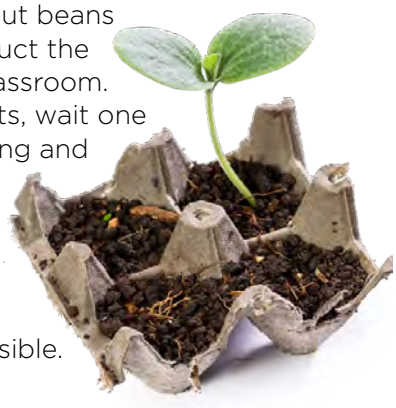
FUN FACT

Plants do photosynthesize on cloudy days. If you can see your food, they can, too! Just like people and calories, however, some plants require little sunlight and others require lots.

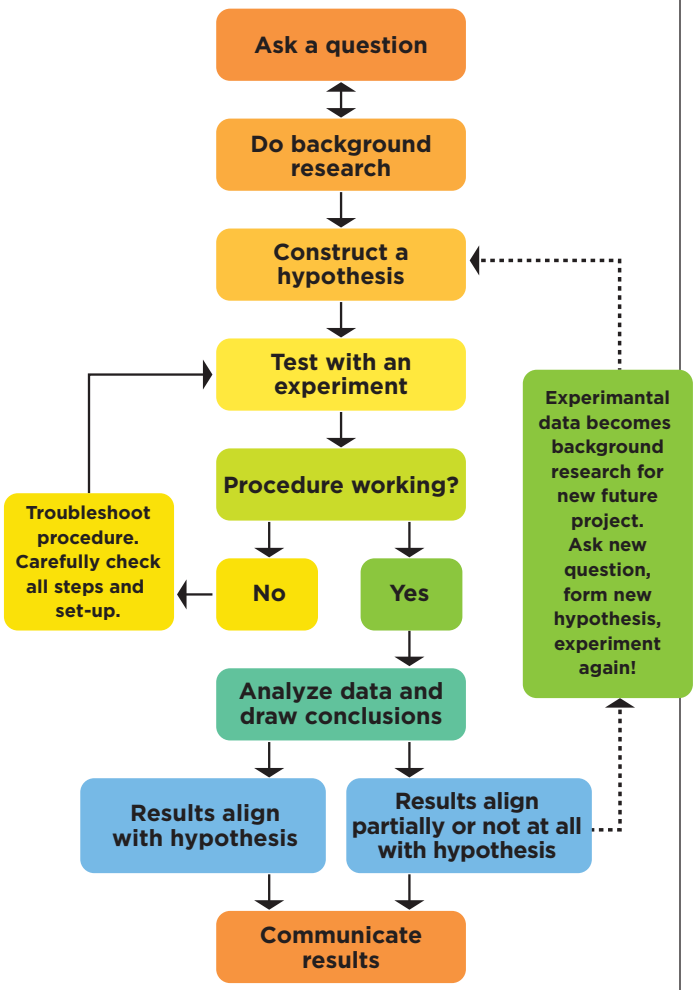
Next, have your students brainstorm ideas about what might happen if plants were unable to receive any sunlight, and how they could test their theories. If your students are entering the world of the scientific method for the first time, Science Buddies has an excellent introduction to share with them: www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method. Allow students to work in groups as they plan their investigation. Remind them that a fair test requires an *experimental group* and a *control group* (this group is not subjected to the change in conditions). The experimental group has, ideally, at least three trials, or three different plants. Also, only one variable should change between the groups (sunlight), so water, space and other factors should be identical.



Help students plan their design and methods for blocking the sunlight, but encourage creativity. The tests can be performed on outdoor plants, or students can sprout beans or grasses and conduct the experiment in the classroom. For established plants, wait one week before observing and recording changes. New sprouts will need to account for germination time. Block the light for several weeks, if possible.



The Scientific Method



As students wrap up their experiments and consider their conclusions, remind them of Pando, the quaking aspen, whose roots send up shoots, thereby enlarging the tree colony. Ask them to consider what might happen if no light ever fell through the leafy canopy to the forest floor below. Would the new shoots thrive? Discuss the physiological design of the aspen leaf stem which allows the leaf to twist, or quake, providing space for sunlight to reach the ground. This, in turn, encourages growth of the ground cover and the sprouting of more aspen trees from the extensive root system.

EXPLORE FURTHER

Have students design and conduct an investigation to determine if water really is a necessary component in a plant's life, using similar methods to the sunlight investigation.

Grades 1 to 2 and 3 to 5 and above

Engineer a Bird's Nest

Filmmaker's Note:

John and Ariel show us the energetic courtship ritual of grebes as the courting birds test their compatibility of feather color, body size, and overall fitness for one another. Other birds, such as the house wren, involve nest building in their courtship. The male wren builds several starter nests, then allows the female to choose one, which she will strengthen and finish with soft lining materials. Male and female bald eagles work together to build their nest during courtship. The male weaver bird begins weaving a hanging nest for his mate, and willingly dismantles it and starts again if she is unimpressed with the engineering. Even birds employ the design-build-test-redesign-rebuild-retest engineering model!

Introduction:

In this activity, your students will design and build a bird nest that would meet the needs of a robin or sparrow using twigs, grasses, leaves, moss, and other materials. Is the nest strong and protective, yet soft and effective? If not, redesign and rebuild.

Preparation:

Before the lesson day, have students help, if possible, by collecting the nest-building materials and objects to represent the egg. Use outdoor materials if available: twigs and long grasses (both dried and green if possible), roots and rootlets, soft materials such as Dusty Miller leaves, birch bark, mosses and lichens, goats beard, seed fluff from dandelion or fireweed plants, feathers, and even bits of animal fur can all be used. Also consider that robins use mud to form their nests, and some hummingbirds use spiderwebs and empty spider egg cases, if they can be safely collected, though this is extremely challenging for those of us without beaks. (Swiftlets use their own saliva, but let's not go there, shall we?)

If outdoor materials are not available: use supplies such as craft sticks or bamboo skewers with their sharp tips removed, thin strips cut from brown paper grocery bags, and cotton balls. You may also provide shredded paper and bits of dryer lint. Note, however, that those are not recommended to be set outside for real bird nests due to their

MATERIALS

- Nest building materials (see Preparation)
- Paper plates, 2 per pair of students
- Pebbles or marbles or other "egg" representatives

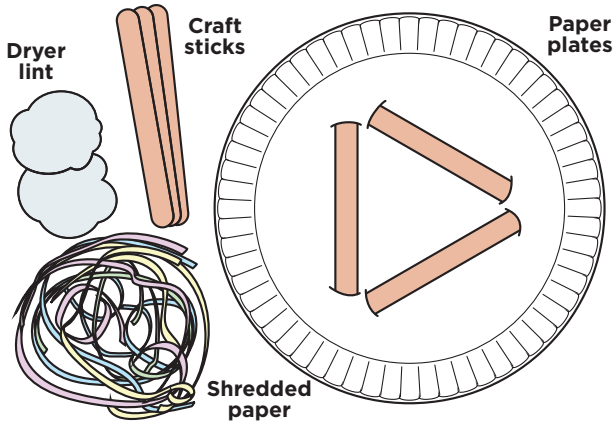
tendency to retain water or contain harsh chemicals. Create a "Forest Materials Station" where students will gather their supplies. Birds do not have scissors, tape or glue, so neither should we as we attempt to emulate them.

Get into nature and begin the activity:

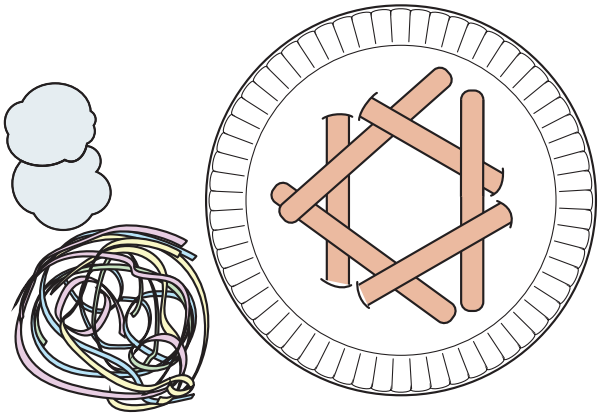
Allow students to observe nests and nest building in the wild or on video (see Resources). A classic robin nest, combined with techniques from the weaver bird, is an excellent model to consider. Working in pairs, have students design a nest, paying close attention to the structure and function of the nest. Provide two paper plates for each pair—one for a work-space and one to collect and hold the nesting materials gathered from the Forest Materials Station. Birds can gather just one beakful of nesting material at a time, but the paper plate will speed up the collection process as students gather their supplies.

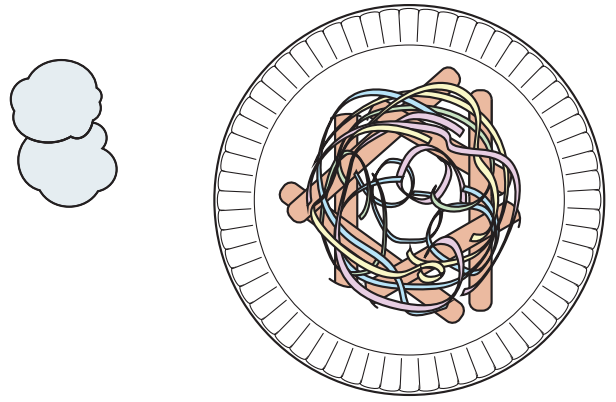
Building a Bird Nest with Craft Materials

Insert craft sticks into slits that you have made in the paper plate.

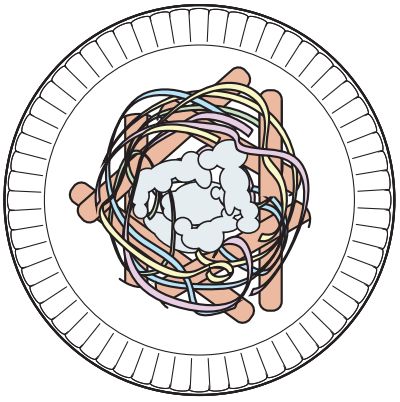


Weave in additional craft sticks to create a base structure.





Weave the shredded paper strips into the craft sticks to create a ring shaped structure.



Add the dryer lint and other soft material to line the inside of the nest.

PREPARATION TIP

Teachers should attempt to build a nest before teaching this lesson. Depending on your efforts toward authenticity, it can be challenging! Sticks arranged in a circle on the plate and lined with softer materials would be sufficient for younger students, or poking holes into the plate and "weaving" the first sticks through the holes will provide a good starting structure. More advanced students may wish to create a nest that is structurally sound enough to be lifted off the plate. To do this, try starting with a triangle of semi-flexible twigs, alternating the tips over and under. Add a second stick beside the first on all sides, again alternating over and under (see illustrations). It is doubtful that a robin could perform the task in this way, but she has the sense to start in the crook of a tree with three or more branches for support! The male weaver bird uses a strategy that is also helpful for us non-birds. He takes a long blade of grass, folds it near one end, then feeds the folded section around a stick. Using feet and beak, he pulls the loop around the back of the stick then guides the other end of the grass through the loop from the front, skillfully forming multiple half-hitch knots. Students may find this strategy necessary to keep the twigs together as they add to their structure.

Allow plenty of experimentation time as students work to create the nest from their design. As students work, have them discuss how the shape of the nest helps it function to solve the problem of holding the eggs and baby birds. Also, challenge them to consider the structure and function of the nest they are creating. Is the nest strong and protective, yet soft and effective? Can it withstand a strong wind or hold a clutch of eggs? If not, redesign and rebuild.

After students have completed their nests, have them add their "egg" items, the pebbles or marbles, to test the nest for effectiveness. If the nest fails to hold the eggs, allow students the chance to re-engineer their nest.

Does this activity give the students a deeper appreciation for the skills of nest-building birds? How might the size or shape of a bird, the size and number of the eggs in a "clutch" (the eggs laid together, perhaps over several days, by the bird), or the bird's natural nesting area (a tree branch, a hole in the trunk of a tree, or a rocky shore) affect the type of nest the bird will build? (For more of this discussion, see the Activity Extension for older students, on page 17.)

After the activity, students may wish to return their natural building materials to the wild, as birds may use them in their own nests.

Bird eggs come in all different colors and sizes.

Activity Extension

for Grades 3-5 and above

The size of the bird will, of course, affect the size of the nest. Challenge students to research the relative sizes of birds and their nests. An excellent website for nest information is the Cornell Lab of Ornithology's Nest Watch: https://nestwatch.org/ learn/focal-species/. Be sure to click on the "All About Birds—Species Profile" link in the Resources section at the bottom of the web page for more notes about each bird, including relative size and measurements.

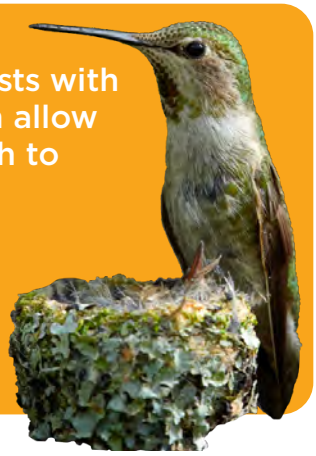
Just as birds vary in size, their eggs also vary. Have students research and compare different egg sizes. To get them started, provide a tennis ball, a medium and an extra-large chicken egg (hard boiled for safety), and a navy bean as a stand-in for a hummingbird egg. The hummingbird egg weighs about 1 gram (0.03 ounces), the medium chicken egg weighs about 50 grams (1.75 ounces), the extra-large chicken egg weighs about about 64 grams (2.25 ounces), and a bald eagle's egg, which is about the size of a tennis ball, weighs just under the equivalent of two extra-large chicken eggs, about 125 grams (4.4 ounces). Show students the illustrations of egg sizes relative to a dime on the Sialis website: http://www.sialis.org/eggcompare.html, and the bald eagle eggs beside the tennis ball on the Center for Conservation Biology website: https://ccbbirds org/2011/03/04/what-size-are-bald-eagle-eggs/, then have students create a diagram or chart showing relative sizes of a variety of bird eggs. They could extend this to show the average number of eggs in a clutch for each bird, and the average size of the bird and its nest.

NATURE BOOST

Birds are not the only engineers in the animal world. Brainstorm a list of animals in your area (don't forget the ants!) and go on a search to find their structures for shelter, snaring prey, or raising their young. Can you spot squirrel nests, spider webs, wasp nests or tell-tale dirt mounds from mole tunnels?

FUN FACT

Hummingbirds create their tiny nests with spider webs which allow the nests to stretch to accommodate the growing babies. That's using resources effectively!



Habitats and life styles also affect nests and nest building. While robins nest in trees, other birds build nests on cliffs, under tree branches or palm fronds, on the beach or lakeshore, on the ground under a shrub, or even on the roofs of caves.

Get into nature and begin the activity:

Take time outside to observe birds in your neighborhood. Notice how they fly, how they land on a surface, and how they perch on that surface. Next, choose and research a different type of bird that lives in a different habitat from yours. Habitats may include urban, shoreline, woodland, prairie, desert or other areas. Consider the body size, foot type, and beak of the bird from your neighborhood and the bird from another habitat, then design and build a bird nest that would be effective for each of your chosen birds. Before you begin, consider your criteria for success for your project. Again, nests should be strong and protective, yet soft and effective. Do your nests meet your criteria? If not, redesign and rebuild.

Grades 3 to 5 and above

Habitat Haiku
Sharing Nature's Wonder with Words

Filmmaker's Note:

Hiking in the wild, according to *Into America's Wild*, makes us twice as effective at coming up with creative solutions, and tests show that exposure to nature can also improve our mental health.

Introduction:

In this activity, your students will consider traits of living things and explore how environmental variations in habitats can affect those traits in both plants and animals, including humans. Can our environment affect our traits of creativity (and our well-being)?

FUN FACT

Matsuo Basho is considered to be the master of haiku. He lived in Japan from 1644 to 1694. One of his most well-known haiku awakens the senses. An English translation:

An ancient pond
A frog jumps in
The splash of water.

—BASHO, 1686

MATERIALS

- ☐ Activity Pages #1 and #2 (pgs. 19-20) or nature journals
- ☐ Pencils

Preparation:

Before the lesson, explore in your schoolyard, neighborhood or surrounding areas for two different habitats, such as a strip of grass beside a sidewalk, an area beneath trees, a playfield, a park, or, if you are so lucky, an area with natural wetlands where you can take your students.

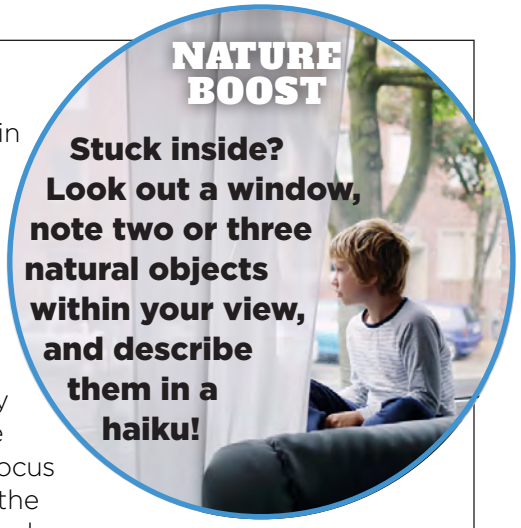
Get into nature and begin the activity:

Have your students search for living organisms in the first of the two different habitats you have chosen outdoors. Remind them of the definition of a habitat, so they are considering the area in its entirety: a habitat is the natural area where an organism normally lives and where it can find the appropriate food, water, shelter, and weather for its needs (see the National Geographic link in Resources for a comprehensive description to share with your students). What plants can be found in this habitat? What animals? Have students record their observations on the Habitat

俳句

Haiku Activity Page or in their nature journals (see the Nature Journal Activity, page 26). Next, go to the second area to observe and record again. Pay particular attention to similarities and differences. How are the plants and animals the same between the two habitats, and how are they different? Ask students how the differences in the habitats may affect the differences in the living organisms. Help the students identify how some organisms' inherited traits can be influenced by the environment, such as how reduced amounts of water or sunlight affect plant growth, how reduced amounts of plant growth and leaf litter can affect the size of invertebrates such as slugs or snails, or perhaps how being in close proximity to human food waste can prompt naturally shy animals to become bold (or even unhealthy).

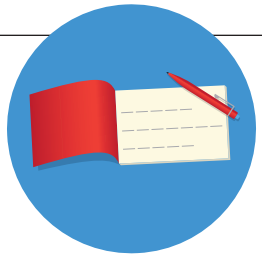
Next, while outdoors in your chosen natural environment, have students combine their scientific observations with their creative writing skills and create a haiku. Inspired by the Haiku Society of America's charter member Sydell Rosenberg, the Cornell Lab of Ornithology reminds us of the form of haiku. "In English it is usually characterized by a total of seventeen syllables contained within three lines of five, seven, and five syllables respectively—but it's also fine to deviate from this format. It's easy but can also be challenging!" Focus on the traits of the plants and animals you have observed in your natural environments. For example, sitting on the ground under the enormous leaves of the Pacific Northwest's *Acer macrophylum*, the bigleaf maple, inspired this:



Understory plant
Struggles to reach the sunlight
Thrives when sunbeams dance.
—Vicky Latz

On another day, when your students haven't been outside, have them try again to create a haiku. Is it easier to be creative outdoors while immersed in nature, or indoors? Ask students to carefully consider: How are *you* influenced by your environment?

Habitat Haiku



Name: _____

Habitat #1: _____

Date & Time: _____ Location: _____ Weather: or

Description of the habitat: _____

Plants found in the habitat: _____

Animals found in the habitat: _____

Water sources found in the habitat: _____

Amount of natural sunlight found in the habitat: _____

Other material found in the habitat, such as rocks, nests or decaying plants: _____

_____

Involve your other senses, too! Describe what can you hear and smell and touch: _____

_____

_____

_____

Create drawings showing the habitat and two or more organisms on the back of this page.

Habitat #2: _____

Date & Time: _____ Location: _____ Weather: or

Description of the habitat: _____

Plants found in the habitat: _____

Animals found in the habitat: _____

Water sources found in the habitat: _____

Amount of natural sunlight found in the habitat: _____

Other material found in the habitat, such as rocks, nests or decaying plants: _____

_____

Involve your other senses, too! Describe what can you hear and smell and touch: _____

_____

_____

_____

Create drawings showing the habitat and two or more organisms on the back of this page.

Habitat #1 Sketches

Habitat #2 Sketches

Habitat Haiku Ideas

Using the three-line structure of haiku (five syllables, seven syllables, five syllables, though variations are acceptable), create a poem describing an aspect of the habitats and the traits of the organisms you have observed.
Use this space for your creative thinking, then write out your final haiku in the space below.

My Habitat Haiku

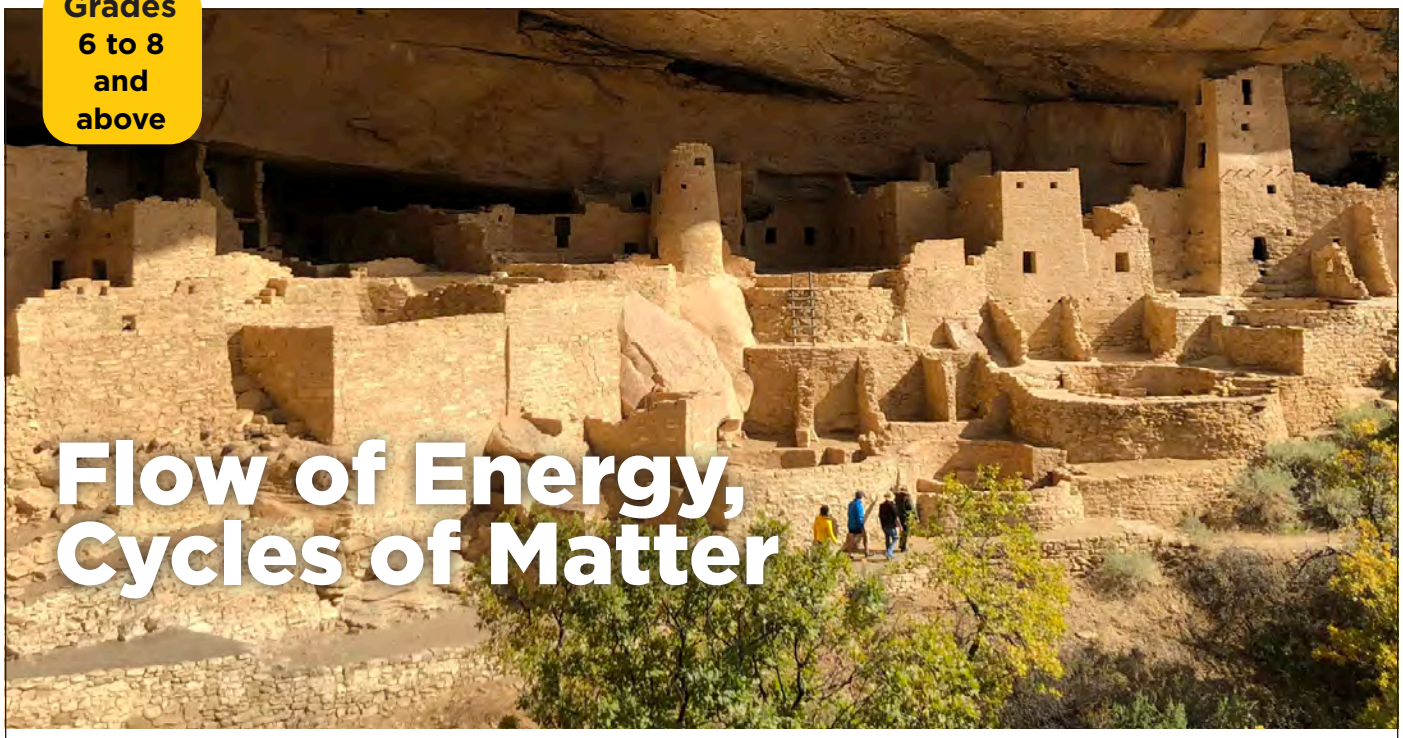
By: _____

_____

_____

_____

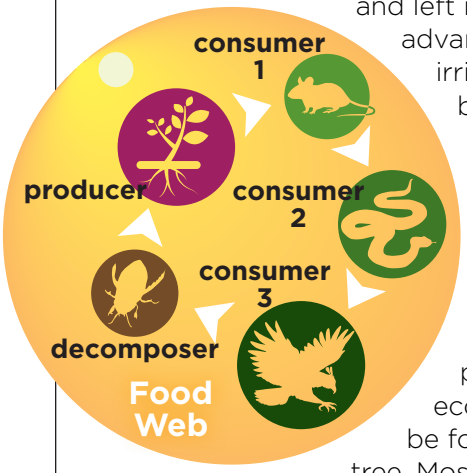
Grades 6 to 8 and above



Flow of Energy, Cycles of Matter

Filmmaker's Note:

Ariel and John visit Mesa Verde, Colorado, where the Pueblo people built magnificent dwellings over one thousand years ago. The inhabitants exhibited keen engineering skills and left indications of advanced farming and irrigation techniques, but also indications of a rapid departure due to failing ecosystems.



Ariel also visits Crater Lake, Oregon, and points out the ecosystem that can be found within a dead tree. Moss and lichens find nutrients in the old wood, then trap moisture. The moist decomposing log feeds nutritious mushrooms, which in turn feed animals. Energy continues to flow, matter continues to cycle.

Introduction:

In this activity, your students will find an ecosystem they can observe over days, weeks or months, whether it is a mini city "park" with a tree and few flowers and some resident ants and worms, or a tree-lined edge of the schoolyard. They will focus on the flow of energy through the ecosystem, from the sunlight and through the producers, consumers and decomposers, while noting the cycle of the matter through those organisms.

Students will then create a model showing the flow of energy and the cycling of matter through that ecosystem. How do energy and matter flow through an ecosystem? What happens when the flow is interrupted?

Evidence shows that the Pueblo left the plateau quite suddenly, and researchers believe an extensive drought was to blame. Without water, the ecosystem, and the producers, consumers and decomposers, failed. Plants died, leaving

MATERIALS

- Activity Page (pg. 23)
- Pencils
- Materials from nature (see activity)
- Projection system to share the Khan Academy video on Flow of Energy, optional (see Resources)

the consumer animals with no produce. Then with the producers and consumers gone, the decomposers eventually had nothing to decompose. This example of energy and matter in an ecosystem shows what happens during a catastrophic failure. Consider both successes and failures within observed ecosystems.

Preparation:

Plan to have students spend time outside, observing a natural ecosystem you have identified in your schoolyard or neighborhood. Print copies of the Activity Page for your students.

Get into nature and begin the activity:

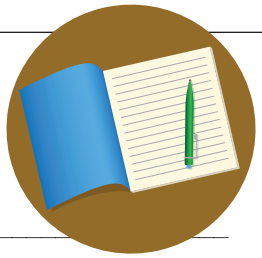
Take students on an excursion outside to carefully observe the ecosystem you have chosen. Have them quietly absorb the environment as a whole, then focus more and more closely on the organisms and nonliving elements within the ecosystem. Identify several organisms in the ecosystem that are producers, some that are consumers, and some that are decomposers, plus identify the important nonliving elements that are most crucial to the ecosystem. Students should record their observations on their Activity Page, noting the flow of energy and matter.

FUN FACT

The primary decomposers are bacteria, fungi and worms. Fungi are key in breaking down plant matter, bacteria work on the animal matter, and worms turn it all into grand and poopy nutritious soil.

After students have completed their observations, challenge them to be creative in developing a model or drawing a diagram to show how matter and energy flow through the ecosystem, including sunlight and food sources. Use materials from nature to create the model, such as bits of soil or sand, mosses or grasses, and even drawings of organisms on bits of bark to create a memorable representation. After students have developed their understanding of the ecosystem, continue on to the Nature Tales Activity (pg, 24).

Flow of Energy, Cycles of Matter



Name: _____

Date and Time: _____

Location: _____

Weather: _____

Go on an excursion outside to carefully observe an ecosystem. Consider the environment as a whole, then focus more and more closely on the organisms and nonliving elements within the ecosystem. Identify several organisms in the ecosystem that drive the cycles of matter: the producers, the consumers, and the decomposers, plus identify the important nonliving elements that are most crucial to the ecosystem. Note the flow of energy through your ecosystem beginning with the sunlight. Record your observations below.

Producers: _____

Consumers: _____

Decomposers: _____

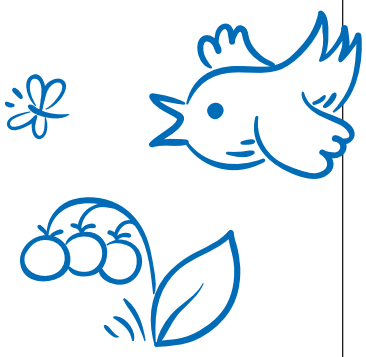
Sources of water or moisture: _____

Other important non-living elements (boulders providing shade and protection for invertebrates, for example): _____

What questions come to mind about your ecosystem? I wonder: _____

_____

Draw a detailed and labeled picture of your ecosystem and show the flow of energy and the cycling of matter through the living and non-living matter. Use your notes and drawings to create a model or poster for display.



Grades 6 to 8 and above

Nature Tales

Introduction:

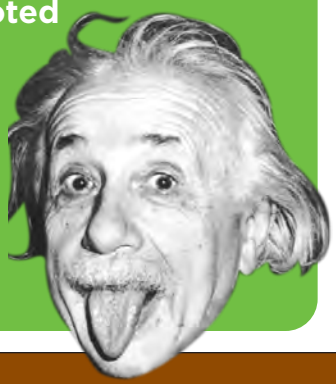
After completing the activity for the Flow of Energy, Cycles of Matter lesson (pg. 21) , have your students imagine a possible change to their chosen ecosystem, either a physical change or a biological change, then use their narrative-writing skills to develop a story. The lesson on Habitat Haiku (pg. 17) mentioned studies showing the connection between exposure to nature and creativity, so encourage your students to immerse themselves in nature as they create their Nature Tale.

Preparation:

Plan to work on this writing activity when students can be outside, if possible.

FUN FACT

Albert Einstein greatly appreciated nature and is quoted as writing "Look deep into nature, and then you will understand everything better."

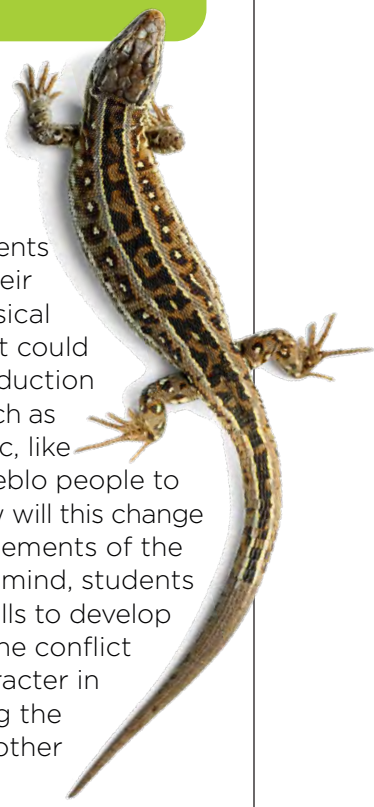


MATERIALS

- Notes taken during the Flow of Energy, Cycles of Matter lesson (pg. 21)
- Pencils
- Paper

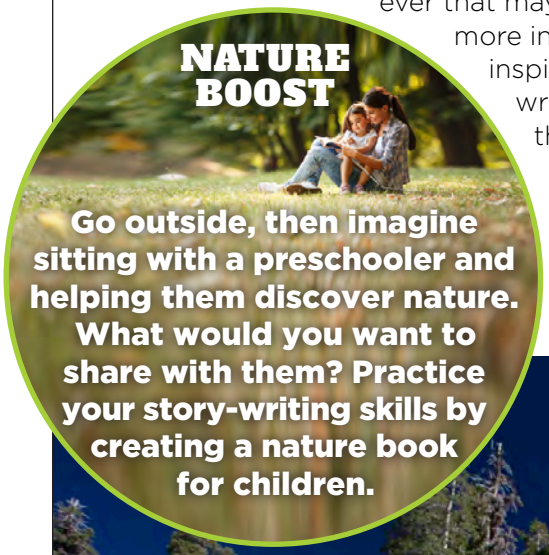
Get into nature and begin the activity:

Review with your students the aspects of the ecosystem they observed earlier. Have your students imagine a possible change to their chosen ecosystem, either a physical change or a biological change. It could be a small change, like the introduction of a new consumer character, such as a lizard or mouse, or catastrophic, like the drought that caused the Pueblo people to abandon their cliff dwellings. How will this change affect the living and nonliving elements of the ecosystem? With these ideas in mind, students should use their story-writing skills to develop a nature tale. They will narrate the conflict and resolution for the main character in their ecosystem while describing the struggles and successes of the other plants and animals within the



neighborhood, reflecting those changes. Be sure to indicate how the flow of matter and energy through your ecosystem will be altered.

For a refresher on the elements of a short story, remind your students to set the scene of their chosen ecosystem, introduce the main characters, identify the problem caused by the change in the ecosystem, build the story to the climax, then bring about the resolution of the problem, whatever that may be. For more information on inspiring young writers, go to the Literacy Ideas website (see Resources).



EXPLORE FURTHER

Students enjoying the Nature Tales activity might appreciate participating in the Young Writers Program of NaNoWriMo, the National Novel Writing Month challenge: ywp.nanowrimo.org/. We could all use more nature stories in the vein of *My Side of the Mountain*, by Jean Craighead George, *The Trumpet of the Swan*, by E. B. White, *Hatchet*, by Gary Paulsen, *Martin Marten*, by Brian Doyle, or so many others.

All grade levels

Nature Journals

Introduction:

Into America's Wild reminds us, "To feel nature's power, you just need to get outdoors, any way you can." Nature journaling is an ideal way for us to spend time in the wild, while challenging ourselves to take a closer look. Look down, look around, look up! Delve into the details below you, see the changes of the sky above, then celebrate and preserve your close observations in a journal.

Preparation:

A number of excellent guides for nature journals exist, including *Keeping a Nature Journal: Discover a Whole New Way of Seeing the World Around You,* by Clare Walker Leslie and Charles E. Roth, and *Opening the World Through Nature Journaling,* by John Muir Laws, Emilie Lygren, Emily Brueunig and Celeste Lopez, sponsored by the California Native Plant Society.

The latter, a free downloadable book available through Laws' website johnmuirlaws.com/journaling-curriculum, provides suggestions on creating your nature journal. To encourage observation skills, the authors note the benefits of recording observations in a nature journal:

> Imagine seeing a bird for the first time. The novelty of the experience helps us concentrate and focus more carefully than we would on the familiar House Sparrows that are always present in your garden. Now imagine how hard you might look if you knew you were seeing something for the last time. How can you bring such focus to every observation that can be employed in your own nature observations or with students? Telling yourself or your students to "look carefully" or "look hard" is not helpful. The human brain quickly clears itself of details that are not necessary for survival. This is useful because it frees up working memory for new things. You will find that if you observe a bird with a group of students until it flies away, and then ask them what they saw, you will only get a few superficial responses. You want your students to really see what is happening in front of them and we assume it is just a matter of looking harder, but it requires deep observation, a skill which must be learned.

MATERIALS

- [ ] Nature Journal Activity Pages (pg. 29) or notebooks
- [ ] Pencils
- [ ] Colored pencils, optional

FUN FACT

Many journals from early scientists have been carefully preserved, such as the works of Henry Bates. Bates discovered and documented over 8,000 species new to science in the 1800s, and his journal entries include details of date, time, weather, wildlife descriptions and detailed pencil sketches or water-color paintings. The journals in this photo are housed at the Natural History Museum in London.

> Developing that skill will change the way both you and your students experience the world. It will enhance the experience of field sketching and enrich a wide range of other undertakings.
> —Laws, J. et al. *Opening the World Through Nature Journaling*, page 5.

For each entry, be sure to write the date, the time of day, your location, and the weather during your observation. *Opening the World Through Nature Journaling* also suggests three basic prompts for each journal entry: "I notice... I wonder... It reminds me of..." These focus our thoughts on what we see, what we may wish to observe or research further, and how our observations connect to our prior knowledge, which will help to turn the experiences into lasting memories.

When looking over completed students' journal entries, avoid giving a judgement such as "That is really pretty." Instead "we momentarily put aside our art values to shift the students' focus, and in doing so, free them to draw." Do say:

> "The way you use both writing and drawing to describe this flower is really clear." "I see you measured the distance between the branches and added a scale." "Oh, you found a spider on top of the flower! Great observation." "The insect damage on that leaf you have illustrated really helps me pick out which flower you were looking at."
> —Laws, J. et al. *Opening the World Through Nature Journaling*, page 7.

Print the Nature Journal Activity Pages for your students. Alternatively, you may choose to use a blank notebook for your students' journals, or folded papers bound together, or loose 5x7 cards which you may bind together at a later date, or simply allow them to create their own.

Read through the following prompts, with their accompanying Next Generation Science Standards, to find directed nature journaling activities appropriate for your learning group. Then get out there and be a scientist! Remember, scientists observe, then communicate their observations, often while forming questions based on those observations. Remind students to include their questions in their journal entries. Students may wonder "Do ants sleep?" "Where do butterflies go when it rains?" "How long will it take this plant to grow six inches?" The questions may spark an eye-opening investigation!

Enjoy your immersion into nature as you observe, question and document with the following journal prompts.

Get into nature and begin the activity:

Challenge your students with the following age-appropriate prompts.

Kindergarten Prompt
Patterns of Survival

Find an animal to observe for a while—ant, robin, pigeon, squirrel. Next, find a plant to observe for a while—in a park or in a crack in the sidewalk. Which one is foraging for food? What is it consuming? Which one is not foraging? What does it need to survive and how does it get it? Observe both the plant and the animal over several minutes, hours or days. Compare the patterns of what each needs to survive. Draw a picture in your Nature Journal showing the patterns—the moss

receiving moisture from morning dew or the ant carrying a nugget of seed. Remember to consider sources of water for survival. Where do the animals and plants in your neighborhood get their water? Rain comes from clouds, so make careful observations of clouds that produce rain in your area and add those observations to your journal entry.

1st-2nd Grade Prompt
Animals Spreading Seeds

Find a plant that has flowers that will be pollinated or seeds that are ready to be dispersed. Observe the plant carefully. In your Nature Journal, show how an animal could assist the plant in pollinating the flowers or dispersing the seeds.

1st-2nd Grade Prompt
Where do Plants and Animals Live?

Explore outside to find living plants and animals in two different habitats. How are the plants and animals the same between the two habitats, and how are they different? Draw pictures and write observations describing how the difference in the habitats may affect the differences in the living organisms.

3rd-5th Grade Prompt
Habitats and Survival

In your schoolyard, neighborhood or surrounding areas, find two different habitats, perhaps one near buildings and the other far from buildings, such as in a park. Next, observe the different living organisms in each habitat. Provide evidence in your Nature Journal that in a particular environment, some organisms will thrive, some will barely survive, and some will not survive at all.

3rd-5th Grade Prompt
Structures and Functions and Survival

Conduct an exploration to find living plants or animals in nature. How do some of the plants or animals have different structures and characteristics from others, allowing them to be more successful in life? Show how the variations in the organisms may provide advantages for surviving, finding suitable mates, and producing offspring.

3rd-5th Grade Prompt
Sensing and Responding

Search for animals living in your neighborhood. Quietly observe them interacting with their environment. What methods do they use to see, hear, feel, smell and taste their environment? Write and draw in your Nature Journal to illustrate and explain how the animal senses, processes, and responds to the environment.

3rd-5th Grade Prompt
Producers, Consumers, Decomposers, and Energy

Carefully examine natural areas in your neighborhood to find both living and dead plants (or animals). What happens to the dead organisms? Can you find any evidence of decomposers working to break down the material, thereby returning nutrients to the environment? Illustrate and explain the cycle of producers, consumers and decomposers in your neighborhood habitat.

Middle School Prompt
Successful Parents, Successful Offspring

Look for differences between common organisms in your nature study area. How do some of the plants or animals have different attributes allowing them to be more successful in life? Draw pictures and write observations in your Nature Journal describing how the variations in the organisms may provide advantages for surviving, finding suitable mates, and producing offspring.

Nature Journal Activity Page

Name: _____

Date and Time: _____

Location: _____

Weather: _____

I see _____

_____

I hear _____

_____

I smell _____

_____

I feel _____

_____

(Be safe! Avoid investigating "I taste" unless an adult in-the-know is with you!)

I wonder: _____

_____

Sketches:

All grade levels

Nature Investigation Bingo Game

Introduction:

Astronaut John Harrington returned to Earth from his mission at the International Space Station and knew he wanted his experience to make a difference. "I want kids to get into science like I did, and study the wonders of nature." Studying those wonders doesn't need to be serious business—this kind of studying can be fun! In this activity, get your students outside for some fun and games, and they're bound to learn in all the best ways.

FUN FACT

The history of the game of Bingo can be traced back to Italy in the 1530s. A toy inducted into the Toy Hall of Fame in 2008, however, is considered the oldest toy in the world. Can you guess what it is? Make your guess, then read this word backwards to find out: *kcits a*. Surprised?

MATERIALS

- Nature Investigation Bingo Game Cards, printed from the following pages, or Bingo cards you or your students create
- Pencils
- Whistle or other noisemaker to signal the start of the game. An acorn cap makes an excellent nature whistle if you have the patience to learn to do it!

  For instructions: www.wnit.org/outdoorelements/pdf/1102-acorn-cap-whistle.pdf

Preparation:

Print out the Nature Investigation Bingo Game cards for everyone in your learning group, or create your own grids and randomly assign nature words specific to your area (see the Bingo Words Suggestion List). Be as general or as specific as is appropriate for your group's level of experience in nature. Outside in your schoolyard or neighborhood, define a search area, perhaps by creating a random shape from a loop of string on the ground for each student, or from one landmark to three others for the group as a whole. Be sure to have the students fill in the blanks in the "Add your own nature

BINGO WORDS SUGGESTION LIST

When creating a Vocabulary Bingo game for emerging readers, write out the alphabet, brainstorm words for each letter, then choose one best word for each letter. This way, students can "read" their Bingo card after an introduction simply by finding initial letters. Utilize adjectives! These word suggestions are for both younger and older students. Choose accordingly.

- **A** animal, ant, algae, acorn
- **B** bug, butterfly, bird, berry, bark, brown leaf, blade of grass, breeze
- **C** curly leaf, cloud, conifer tree, consumer
- **D** dirt, dead leaf, deciduous tree, decomposer
- **E** enormous rock, erosion evidence, evergreen
- **F** feather, fern, flower, fungus, fruit, flat rock, fuzzy plant
- **G** green leaf
- **H** huge leaf
- **I** insect
- **J** juniper bush
- **K** kinky stem
- **L** leaf, little leaf, lichen
- **M** moss, mushroom
- **N** nest, non-living object
- **O** orange leaf, organism
- **P** pebble, plant, puddle, pollen, predator animal, prey animal, producer
- **Q** quiet animal
- **R** root, rock, round rock, reptile, roly poly, rotting log
- **S** soil, sand, stem, spider web, slug slime, something brown (or green, or ...)
- **T** twig, trail
- **U** unusual object (perhaps something that doesn't belong in the area)
- **V** vine, velvety leaf, vibrant color
- **W** worm, wood, wing, water droplet
- **Y** yellow leaf
- **Z** zippy bug

word" box on the Nature Investigation Bingo Game cards before beginning the game to increase the variation between the Bingo cards.

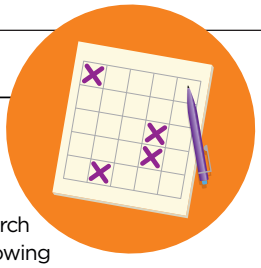
Get into nature and begin the activity:

To play the game, have students prepare their individual search area, or agree on the large search area based on landmark boundaries. When a signal is given, search for plants, animals and non-living things within the search area based on the words written in the Bingo squares. Place cards on the ground and weigh them down with rocks or clipboards so they don't blow away. Have students either place the item, or draw a sketch of where to find the item, in the appropriate box on the Bingo grid. Set a time limit, perhaps five minutes, based on the complexity of your objects and the size of the search area. The players who find a Bingo—a straight vertical, horizontal or diagonal line of completed boxes within the time limit—are the winners for that round! Change cards by writing in new nature objects and play again.

NATURE BOOST

Go outside and invent a game (safely, please!) with the "world's oldest toy." See the Fun Fact to find out what it is! What other games can you invent with items from nature?

Name:_____



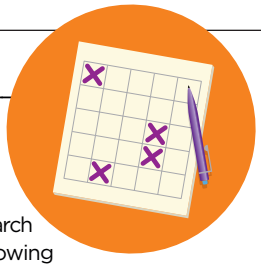
Nature Investigation Bingo Game Card

Before your Bingo game begins, fill in the blank for your own nature word. When the game leader calls "Start," search for the items on your Bingo card. If you find the item, you may place it on your card, or draw a quick sketch showing where the item can be found. Call out "Bingo!" when you find three in a row.

ant	bark	dead leaf
flower	_____ Add your own nature word here before the game begins!	little leaf
moss	pebble	spider web

For the "Fill in your own" box, choose something in your natural area that isn't already listed on your Bingo page. Examples: short plant, tall plant, a specific plant such as dandelion, green leaf, brown leaf, flower, stem, twig, root, moss, fungus, animal, insect, a specific insect such as bumble bee, worm, feather, cloud, rock, dirt, sand, water, sounds—choose something you're likely to find!

Name:_____



Nature Investigation Bingo Game Card

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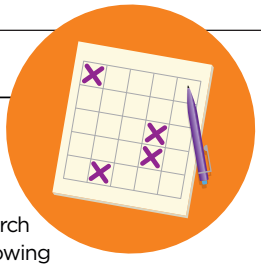
bug	curly leaf	dirt
feather	_____ Add your own nature word here before the game begins!	pollen
root	twig	water droplet

For the "Fill in your own" box, choose something in your natural area that isn't already listed on your Bingo page. Examples: short plant, tall plant, a specific plant such as dandelion, green leaf, brown leaf, flower, stem, twig, root, moss, fungus, animal, insect, a specific insect such as bumble bee, worm, feather, cloud, rock, dirt, sand, water, sounds—choose something you're likely to find!

Name:_____



Nature Investigation Bingo Game Card

Before your Bingo game begins, fill in the blank for your own nature word. When the game leader calls "Start," search for the items on your Bingo card. If you find the item, you may place it on your card, or draw a quick sketch showing where the item can be found. Call out "Bingo!" when you find three in a row.

animal	blade of grass	evergreen tree
fruit	_____ Add your own nature word here before the game begins!	puddle
round rock	sand	wood

For the "Fill in your own" box, choose something in your natural area that isn't already listed on your Bingo page. Examples: short plant, tall plant, a specific plant such as dandelion, green leaf, brown leaf, flower, stem, twig, root, moss, fungus, animal, insect, a specific insect such as bumble bee, worm, feather, cloud, rock, dirt, sand, water, sounds—choose something you're likely to find!

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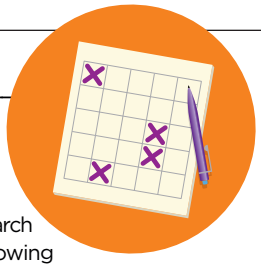

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animal	brown leaf	flat rock
nest	_____ Add your own nature word here before the game begins!	plant
rotting log	slug slime	yellow leaf

For the "Fill in your own" box, choose something in your natural area that isn't already listed on your Bingo page. Examples: short plant, tall plant, a specific plant such as dandelion, green leaf, brown leaf, flower, stem, twig, root, moss, fungus, animal, insect, a specific insect such as bumble bee, worm, feather, cloud, rock, dirt, sand, water, sounds—choose something you're likely to find!

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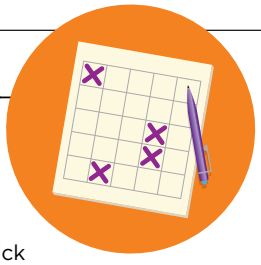


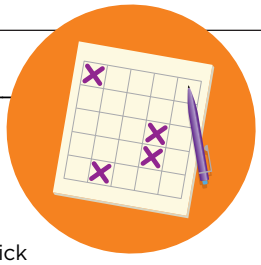
Nature Investigation Bingo Game Card

Before your Bingo game begins, fill in the blanks with your own nature words. When the game leader calls "Start," search for the items on your Bingo card. If you find the item, you may place it on your card, or draw a quick sketch showing where the item can be found. Call out "Bingo!" when you find five in a row.

non-living object	flower	flat rock	_____ Add your own nature word here before the game begins!	fungus
_____ Add your own nature word here before the game begins!	predator animal	prey animal	spider web	vibrant color
bark	flat leaf	_____ Add your own nature word here before the game begins!	something yellow	brown leaf
deciduous tree	evergreen tree	rotting log	vine	_____ Add your own nature word here before the game begins!
producer	_____ Add your own nature word here before the game begins!	consumer	decomposer	root

For the "fill in your own" boxes, choose things in your natural area aren't already listed on your Bingo page. Examples: short plant, tall plant, a specific plant such as dandelion, green leaf, brown leaf, flower, stem, twig, root, moss, fungus, animal, insect, a specific insect such as bumble bee, worm, feather, cloud, rock, dirt, sand, water, sounds—choose something you're likely to find!

Name:_____



Nature Investigation Bingo Game Card

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deciduous tree	_____ Add your own nature word here before the game begins!	non-living object	flower	prey animal
producer	evergreen tree	rotting log	predator animal	_____ Add your own nature word here before the game begins!
consumer	flat rock	_____ Add your own nature word here before the game begins!	bark	curly leaf
_____ Add your own nature word here before the game begins!	fungus	vine	root	something green
decomposer	spider web	vibrant color	_____ Add your own nature word here before the game begins!	yellow leaf

For the "fill in your own" boxes, choose things in your natural area aren't already listed on your Bingo page. Examples: short plant, tall plant, a specific plant such as dandelion, green leaf, brown leaf, flower, stem, twig, root, moss, fungus, animal, insect, a specific insect such as bumble bee, worm, feather, cloud, rock, dirt, sand, water, sounds—choose something you're likely to find!

Next Generation Science Standards

Leaves and Lasting Impressions: pages 4-6
K-LS1-1. From Molecules to Organisms: Structures and Processes. Use observations to describe patterns of what plants and animals (including humans) need to survive. (Examples include air, water, food, space, and plants require sunlight for "food.")

Seed Shakers and Plant Percussion: pages 7-8
K-LS1-1. From Molecules to Organisms: Structures and Processes. Use observations to describe patterns of what plants and animals (including humans) need to survive. (Examples include air, water, food, space, and plants require sunlight for "food.")

Pollinating Flowers, Preserving Flowers: pages 9-10
2-LS2-2. Ecosystems: Interactions, Energy and Dynamics. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Plants and Sunlight: pages 11-12
2-LS2-1. Ecosystems: Interactions, Energy, and Dynamics. Plan and conduct an investigation to determine if plants need sunlight and water to grow.

Engineer a Bird Nest: pages 13-16
3-5-ETS1-2. Engineering Design. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Habitat Haiku: Sharing Nature's Wonder with Words: pages 17-20
3-LS3-2. Heredity: Inheritance and Variation of Traits. Use evidence to support the explanation that traits can be influenced by the environment. (Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted, and a pet dog that is given too much food and too little exercise may become overweight.)

Flow of Energy, Cycles of Matter: pages 21-23
MS-LS2-3. Ecosystems: Interactions, Energy and Dynamics. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.)

Nature Tales: pages 24-25
MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations based on changes to ecosystems.)

Nature Journals: pages 26-29
K-LS1-1. From Molecules to Organisms: Structures and Processes. Use observations to describe patterns of what plants and animals (including humans) need to survive. (Examples include air, water, food, space, and plants require sunlight for "food.")
2-LS2-2. Ecosystems: Interactions, Energy and Dynamics. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
2-LS4-1. Biological Evolution: Unity and Diversity. Make observations of plants and animals to compare the diversity of life in different habitats.
3-LS4-3. Biological Evolution: Unity and Diversity. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
4-LS1-1. From Molecules to Organisms: Structures and Processes. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
4-LS1-2. From Molecules to Organisms: Structures and Processes. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
5-LS2-1. Ecosystems: Interactions, Energy, and Dynamics. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
MS-LS1-4. From Molecules to Organisms: Structures and Processes. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (Examples of behaviors that affect animal reproduction could include nest building to protect young from cold and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, or creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, and hard shells on nuts that squirrels bury.)

Resources

Print Resources:

Cornell, Joseph. *Sharing Nature with Children*. Dawn Publications, Nevada City, CA 1998.

Laws, John M., Lygren, Emilie; Brueunig, Emily; and Lopez, Celeste. *Opening the World Through Nature Journaling*. California Native Plant Society (available online at no cost). 2012.

Leslie, Clare Walker, and Roth, Charles E. *Keeping a Nature Journal: Discover a Whole New Way of Seeing the World Around You*. Storey Publishing, LLC, Massachusetts 2003.

Louv, Richard. *Last Child in the Woods*. Algonquin Books, North Carolina 2016.

Louv, Richard. *Vitamin N: The Essential Guide to a Nature-Rich Life*. Algonquin Books, North Carolina 2016.

Sampson, Scott. *How to Raise a Wild Child: The Art and Science of Falling in Love with Nature*. Houghton Mifflin Harcourt Publishing Company, New York 2015.

Sohi, Morteza E. *Look What I Did with a Leaf*. Walker and Co., New York 1995.

On-line Resources (by activity):

Leaves and Lasting Impressions: pages 4-6
http://teacher.scholastic.com/lessonrepro/lessonplans/ect/classact1097.htm
https://www.firstpalette.com/craft/leaf-prints.html

Seed Shakers and Plant Percussion: pages 7-8
https://www.pre-kpages.com/corn-shakers-music-activity/
For information on edible seeds:
https://www.farmersalmanac.com/culinary-seeds-for-seasoning-chart-90

Pollinating Flowers, Preserving Flowers: pages 9-10
https://www.calacademy.org/educators/lesson-plans/flowers-seeking-pollinators
https://www.pollinator.org/pollinator.org/assets/generalFiles/What-is-a-pollinator.pdf
https://plants.usda.gov/pollinators/Native_Pollinators.pdf

Videos on pollination:
Disney:
https://video.disney.com/watch/the-beauty-of-pollination-wings-of-life-4da84833e06fd54fff590f49
Missouri Department of Conservation:
https://www.youtube.com/watch?v=ge3EM8AERV0

Pressing flowers:
https://www.finegardening.com/article/pressing-flowers

State trees and flowers:
https://statesymbolsusa.org/categories/state-tree
https://statesymbolsusa.org/categories/flower

Simple flower anatomy:
https://extension.illinois.edu/gpe/case1/c1facts2d.html

Plants and Sunlight: pages 11-12
https://www.education.com/science-fair/article/plants-and-light/
https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method

Engineer a Bird Nest: pages 13-16
This lesson is adapted from:
https://www.scientificamerican.com/article/build-a-bird-nest/

Bird nests:
https://www.worldatlas.com/articles/how-many-types-of-nests-are-built-by-birds.html
https://www.thoughtco.com/types-of-bird-nests-4001370

To see both a novice and an experienced weaver bird in action, watch the amusing five and a half minute video "BBC Home Making: Weaver Bird:"
https://www.youtube.com/watch?v=6svAIgEnFvw

A two-minute video from Bowdoin College follows a biologist with a permit for collecting nests as he dissects a nest found on forest floor:
https://www.youtube.com/watch?v=y3KgsFdtgjo

An excellent website for nest information is the Cornell Lab of Ornithology's Nest Watch:
https://nestwatch.org/learn/focal-species/

Have students do research on-line about other birds on the Cornell Lab of Ornithology's website:
https://www.allaboutbirds.org/guide/browse/shape.

Eggs:
http://www.sialis.org/nests.htm

Eagles:
https://ccbbirds.org/2011/03/04/what-size-are-bald-eagle-eggs/
https://www.nationaleaglecenter.org/wp-content/uploads/IMGP33261.jpg

Habitat Haiku-Sharing Nature's Wonder with Words: pages 17-20
This lesson is adapted from the Cornell Lab of Ornithology:
https://celebrateurbanbirds.org/learn/arts/inspiring-bird-art-through-haiku/
A comprehensive description of a habitat to share with your students:
https://www.nationalgeographic.org/encyclopedia/habitat/
Examples of haiku written by students can be found at Creative Writing Now:
https://www.creative-writing-now.com/how-to-write-a-haiku.html

Flow of Energy, Cycles of Matter: pages 21-23
An excellent ten-minute video for your students on the flow of energy and matter (intended for high school, but great for most middle schoolers, also):
https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/v/flow-of-energy-and-matter-through-ecosystems

Nature Tales: pages 24-25
Elements of short story writing:
https://www.literacyideas.com/narratives
http://www.scholastic.com/browse/lessonplan.jsp?id=1351

Nature Journals: pages 26-29
https://johnmuirlaws.com/journaling-curriculum/
https://www.nhm.ac.uk/discover/henry-walter-bates-amazon-butterflies.html

Cloud observations:
https://www.weather.gov/media/owlie/cloud_chart.pdf

Nature Investigation Bingo Game: pages 30-37
For more ideas on a Bingo game in nature:
https://www.fundanabandanas.com/search?q=nature+bingo
Acorn cap whistle:
https://www.wnit.org/outdoorelements/pdf/1102-acorn-cap-whistle.pdf
Toy Hall of Fame:
https://www.toyhalloffame.org/toys/stick

Resources for Creating A Greater Nature Connection

Children & Nature Network www.childrenandnature.org
One of the first national organizations created to connect children, families and communities to nature. Provides excellent research, reports and resources to promote equitable access to nature for all children.

Discover the Forest www.discovertheforest.org
An excellent site for families to find local forests and parks, as well as suggested activities and downloadable lessons.

Families in Nature https://familiesinnature.org
Provides programs, resources, guided trips and guide training to encourage more families to get out into nature.

Latino Outdoors https://latinooutdoors.org/
A national organization committed to connecting Latino communities to the outdoors and growing leadership and mentor opportunities.

National Education Association
http://www.nea.org/tools/EnvironmentalEducationActivitiesAndResources.html
Provides a wonderful list of resources, suggested activities and interesting lesson plans for furthering environmental education.

National Environmental Education Foundation
www.neef.org
Educator resources, tool kits, and a network of hands-on learning opportunities and field classrooms on public land. Also offers a portal for educational resources to encourage Greening STEM or E-STEM education.
www.neefusa.org/greening-stem-learning-center

National Forest Foundation
https://www.nationalforests.org
Provides resources and grants for supporting the preservation of our national forests. Its tree-planting campaign aims to plant 50 million trees in forests across the U.S.

National Wildlife Federation's Nature Play at Home
https://www.nwf.org/-/media/PDFs/Be-Out-There/NPatHome_Guidelines20120823.ashx?la=en&hash=29825E325AD8DEFE90093F629D5FA51EF44D5098
A joint project between the National Wildlife Foundation and the Natural Learning Initiative, Nature Play at Home provides the tools and resources that bring nature to the forefront of children's everyday play and learning environments.

National Wildlife Federation's Great American Campout
https://www.nwf.org/Great-American-Campout/About
A national campaign created to get families excited about exploring the wild outdoors, whether camping in their backyard, neighborhood or national park, whether in a cabin, RV or a treehouse. Be creative!

Nature Watch www.fs.fed.us/naturewatch
An excellent resource site for educators and families sponsored by the U.S. Forest Service and the U.S. Department of Agriculture. They offer toolkits, conservation education sites, environmental education guidelines and outdoor skills journals and handbooks.

North American Association for Environmental Education
www.naaee.org
An international non-profit organization that links in-school and out-of-school STEM learning and promotes the advancement of E-STEM.

Outdoor Afro https://outdoorafro.com/
A national organization committed to connecting African American people with nature and changing the face of leadership in the outdoors.

Outdoors Empowered Network
https://www.outdoorsempowered.org/
A national network of independent programs that offers outdoor leadership training and outdoor equipment libraries to help grow communities of educators trained to use nature as a tool for youth development.

Project Learning Tree www.plt.org
One of the most widely used preK-12 environmental education programs in the U.S. and abroad. Provides curriculum offerings, free lesson plans, information on Green Schools, and resources and activities for families.

Think Earth Environmental Education Foundation
www.thinkearth.org
A non-profit organization dedicated to helping communities create and maintain a sustainable environment through education. Offers environmental science standards-based lesson plans.

Tree People www.treepeople.org/schools
Provides toolkits, guidelines and conservation opportunities and ideas for building greener neighborhoods.

Acknowledgements

Project Supervisor
Lori Rick, MacGillivray Freeman Films

Activity Concepts
Diane Carlson, Giant Screen Cinema Consulting, LLC

Activity Development
Vicky Latz, Science Educator
Shoreline School District, Shoreline, WA

Design and Illustration
Jeff Girard,
Victoria Street Graphic Design

Photo Credits
Vicky Latz, pages 6, 8, 14
Allison Gossett, page 10
Images on pages 2, 4, 6 - 9, 11, 17, 18, 21, 22, 24 - 26, 30, 31 © VisittheUSA.com

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