Classroom Connections!

Post-Trip Lessons to Enhance the Science Learning of the Vida Verde Program

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Introduction

The *Vida Verde Classroom Connections* are designed to enhance the academic science learning of fourth, fifth, and sixth grade students participating in the Vida Verde Outdoor Education program. The lessons are designed around three primary criteria: (1) the Next Generation Science Standards, (2) relevance to students, and (3) flexibility for the classroom teachers.

Standards Based Lessons

These lessons are designed around the Next Generation Science Standards (NGSS). The content of the lessons was selected because it addresses content standards at multiple grade levels from 4th through Middle School.

The first series of lessons focuses on the NGSS Cross-Cutting Concept of Structures and Functions. Through this series, students learn the primary structures of vascular plants and animals by studying the California bay laurel tree and the banana slug. They learn how the specialized structures of these particular organisms support survival, growth, and reproduction.

The second series of lessons addresses the way in which organisms in an ecosystem are linked through food chains and food webs. In this lesson series, students use photo cards to create models of food chains and food webs. This lesson series culminates in an exercise in which students use their food web models to predict the effects of a forest fire on a redwood forest ecosystem.

The third series of lessons addresses natural resources—their uses and the environmental impact of their use. In the first lesson, students identify the various energy sources used at the Vida Verde Farm and learn the different between renewable and non-renewable resources. In the second lesson, students identify waste produced at the Vida Verde Farm and the environmental impact thereof. In the final lesson, students write persuasive letters to Vida Verde directors Shawn and Laura Sears, recommending actions to reduce the environmental impact of the program.

Relevance to Students

These lessons are designed to build on key experiences students have during the Vida Verde Education program. As such, students first-hand experience the subject matter about which they are learning and will be able to make personal connections to the subject matter. The first two lesson series focuses on the redwood forest ecosystem and the third lesson focuses on the Vida Verde farm—two locations that every student

who attends Vida Verde has the opportunity to visit. Furthermore, the second two lesson series culminate with an application activity. These activities allow students to apply their science content learning to a real-life situation.

Additionally, the *Vida Verde Classroom Connections* are designed to meet the academic and linguistic needs of diverse learners. Language supports for writing and discussion are included in the lessons. Picture support, via Pictorial Input Charts and Photo Cards provide important language scaffolds for English Language Learners.

Flexibility

The lessons in *Vida Verde Classroom Connections* are designed with the classroom teacher in mind. They are specifically designed such that a teacher may teach them all in sequence, may teach one lesson series in sequence, or may teach specific lessons individually. The lessons are divided into three lesson series, such that teachers with limited time could select to teach the lesson series that best suits their classroom curriculum.

All materials needed for the lessons—apart from paper and writing instruments—is provided in *Vida Verde Classroom Connections* for teachers to reproduce. In many cases, instructional choices are provided for the teacher—presenting a more labor intensive and less labor-intensive option.

Conceptual Framework

Lesson Series	Lessons	Key Concepts	NGSS Standards	Vida Verde Connection
1. Structures and Functions	1.1 Vascular Plants 1.2 The Banana Slug	Plants and animals have **structures** that **function** to support survival, growth, behavior, and reproduction.	**(Grade 4)** Plants and animals have internal and external **structures** that **function** to support survival, growth, behavior, and reproduction. (4-LS1-1) **(Middle School)** Characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LS1-4)	Banana Slug Lesson Forest Hike Vegetable Garden Lesson Goat-milking Lesson
2. Ecosystems	2.1 Organisms of Sam McDonald Park 2.2 Mapping the Food Web 2.3 Changes to the Ecosystem	Organisms in an environment are linked through food chains and **food webs**.	**(Grade 5)** Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. (5-LS2-1) **(Middle School)** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)	Redwood Hike Food Cycle (at meals) Coastal Marsh/Beach exploration
3. Natural Resources	3.1 Energy Sources at the Vida Verde Farm 3.2 Waste at the Farm 3.3 Reducing Our Impact	**Energy** that humans use is derived from natural sources. Use of natural resources impacts the Earth in various ways**.** **Reducing the impact** depends on understanding climate science and human behavior.	**(Grade 4)** Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1) **(Grade 5)** Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1) **(Middle School)** Human activities, such s the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	Food Cycle Biodiesel Vans Waste Reduction (Lunch at the farm)

Structures and Functions

Lesson 1.1 Vascular Plants

Getting Ready:

- Copy Structures and Functions matching cards for each pair students. Either cut cards out ahead of time, or plan for students to cut cards.
- Copy California Bay Laurel Diagram for each pair.
- Consider writing all **bold** words on sentence strips to create a Science Word Wall.
- Consider preparing a pencil outline of the Bay Tree Pictorial.

NGSS Standards: Plants and animals have internal and external **structures** that **function** to support survival, growth, behavior, and reproduction. (4-LS1-1); Characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LS1-4)

Guiding Question: What are the structures and functions of a vascular plant?

Learning Objective:

- Students explain how a specialized structure of a redwood tree helps it to survive, grow, or reproduce.

How to Teach and Assess Learning Objective:

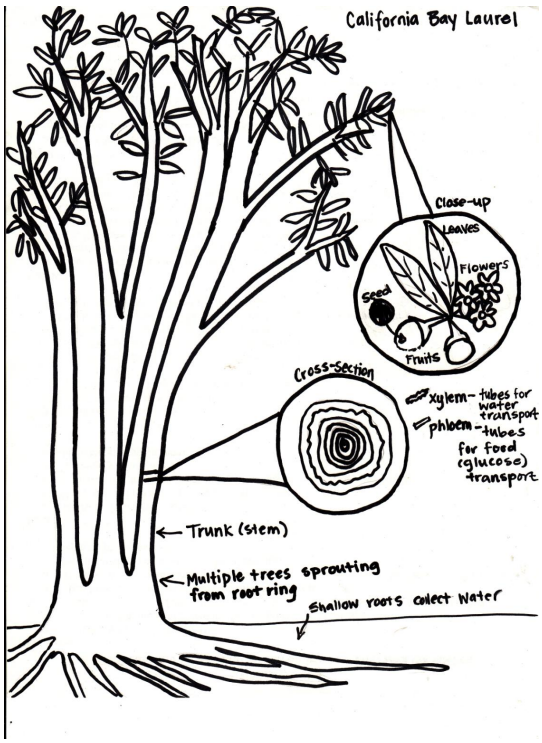
- Have students brainstorm in groups of four plants they saw, grew, or ate while at Vida Verde. Have students record their ideas in a notebook or on a whiteboard. Solicit ideas and record in a list on the whiteboard.
- Tell students that most of these plants are called **vascular** plants because they have veins. Circle all of the vascular plants listed. (This will be all except moss and lichen, if mentioned.) Tell students that over 90% of the plants on Earth are **vascular plants** and that all vascular plants are similar in that they have six main **structures**, or parts, and that these structures have specific **functions**, or jobs, which help the vascular plants to survive.
- Distribute Structures and Functions cards to each pair of students and challenge students to match each structure card with one function card.
- Monitor and assess progress. If students struggle with this foundational knowledge, consider using additional resources (See Appendix A).
- Tell students that the California Bay Laurel and the Redwood trees they saw in Sam McDonald Park at Vida Verde are vascular plants. Challenge students to locate the six plant parts on the Bay Laurel tree.

- Distribute one Bay tree diagram to each pair and have them place the structure cards on the diagram as labels.
- Guide a class discussion using the following prompts:
    - Discussion Prompts:
        - Do California bay laurel trees have all six plant structures?
        - What makes you think so?
        - If bay laurel trees did not have flowers or fruit, how would they reproduce? (They are similar to redwood trees in that they can sprout from the root crown and form a ring/family circle)
    - Optional Scaffolds:
        - I think _____ because _____.
        - I agree with _____ and can add _____.
        - I respectfully disagree with _____ because _____.
- Following the discussion, teach students the following information about bay trees. Consider drawing a diagram in front of the students while narrating the content.

Bay Tree Pictorial

Tip: You may want to use a projector to enlarge the Bay Tree Pictorial onto chart paper and trace it lightly in pencil beforehand. Then go over the pencil marks in marker in front of the students.

For full-size version, see Appendix B.



Bay Tree Information to Tell Students

- The CA Bay tree has all six plant parts. These plant parts are **specialized** to help the bay tree grow and survive in its environment, the redwood forest.
- **Roots**. Bay trees have roots that help to collect water close to the surface of the soil before it can evaporate.
- **Stems**. The trunk of the bay tree is its stem. Inside the trunk is a network of thin tubes, the xylem and the phloem, which act as the delivery system of the tree. The xylem carry water up from the roots and the phloem carry food down from the leaves.
- **Leaves**. The leaves of the bay tree are long and thin, and in the shape of a surfboard. The leaves have a very strong scent from oil inside them that repels insects and is also edible and used in cooking. In the leaves, the bay tree produces all of the food it needs to survive through a process called photosynthesis.
- **Flowers.** The bay tree flowers every year. Its flowers are very small and yellow in color. From these flowers, a small green fruit grows. Bay trees flower in the spring and produce fruits in fall.
- **Fruit**. The fruit of the bay tree is small and greenish yellow. They are just smaller than a quarter and hold one seed inside.
- **Seeds**. The seed inside the fruits are very small—about the size of a pinto bean. Luckily, the bay tree has another way to reproduce. The bay tree can sprout new trees from the root crown or burls near existing roots. This is what creates the "fairy rings" or "family circles" we saw at Vida Verde. Redwood trees act similarly.

- To close, have students write out an answer to the Focus Question: What are the structures and functions of a vascular plant, like the California bay tree?
    - **Optional Scaffolds:**
        - One structure of the bay tree is _____. Its function is _____ _____.
        - Another structure of the bay tree is _____. Its function is _____ _____.
    - **Expected Student Response:**
        - One structure of the Bay tree is its trunk, or stem. Its function is to transport food and water to the rest of the tree.
        - Another structure of the Bay tree is the long, smooth leaves. The leaves collect sunlight and make food, but don't let water out. They also have a strong scent from oil that repels insects.
- Look at samples of student writing to assess understanding.

Optional Extension:

Take students out to your schoolyard. Have them observe and sketch schoolyard vascular plants. Challenge students to identify the six plant parts and to identify any specialized structures (i.e. thorns, leaf shape) that make help the plant to survive in its environment.

Structures and Functions Cards: Vascular Plants

CUT APART CARDS AND MATCH STRUCTURES WITH FUNCTIONS.

STRUCTURE Roots	FUNCTION transport water and glucose (sugar) to all the cells of a plant
STRUCTURE Stems	FUNCTION protect the seed and attract animals to help disperse (spread) the seeds
STRUCTURE Leaves	FUNCTION collect water and nutrients
STRUCTURE Flowers	FUNCTION grows into a new plant
STRUCTURE Fruits	FUNCTION collect sunlight and perform photosynthesis (making food)
STRUCTURE Seeds	FUNCTION hold the pollen and attract pollinators (birds and bees)

Structures and Functions Cards: Answers

STRUCTURE	FUNCTION
Roots	collect water and nutrients
STRUCTURE	FUNCTION
Stems	transport water and glucose (sugar) to all the cells of a plant
STRUCTURE	FUNCTION
Leaves	collect sunlight and perform photosynthesis (making food)
STRUCTURE	FUNCTION
Flowers	hold the pollen and attract pollinators (birds and bees)
STRUCTURE	FUNCTION
Fruits	protect the seed and attract animals to help disperse (spread) the seeds
STRUCTURE	FUNCTION
Seeds	grows into a new plant

California Bay Laurel Tree Diagram

Additional Resources for Teaching Basic Structures and Functions of a Vascular Plant

Recommended Readings:

Aston, Dianna Hutts., and Sylvia Long. A Seed Is Sleepy. San Francisco: Chronicle, 2007. Print.

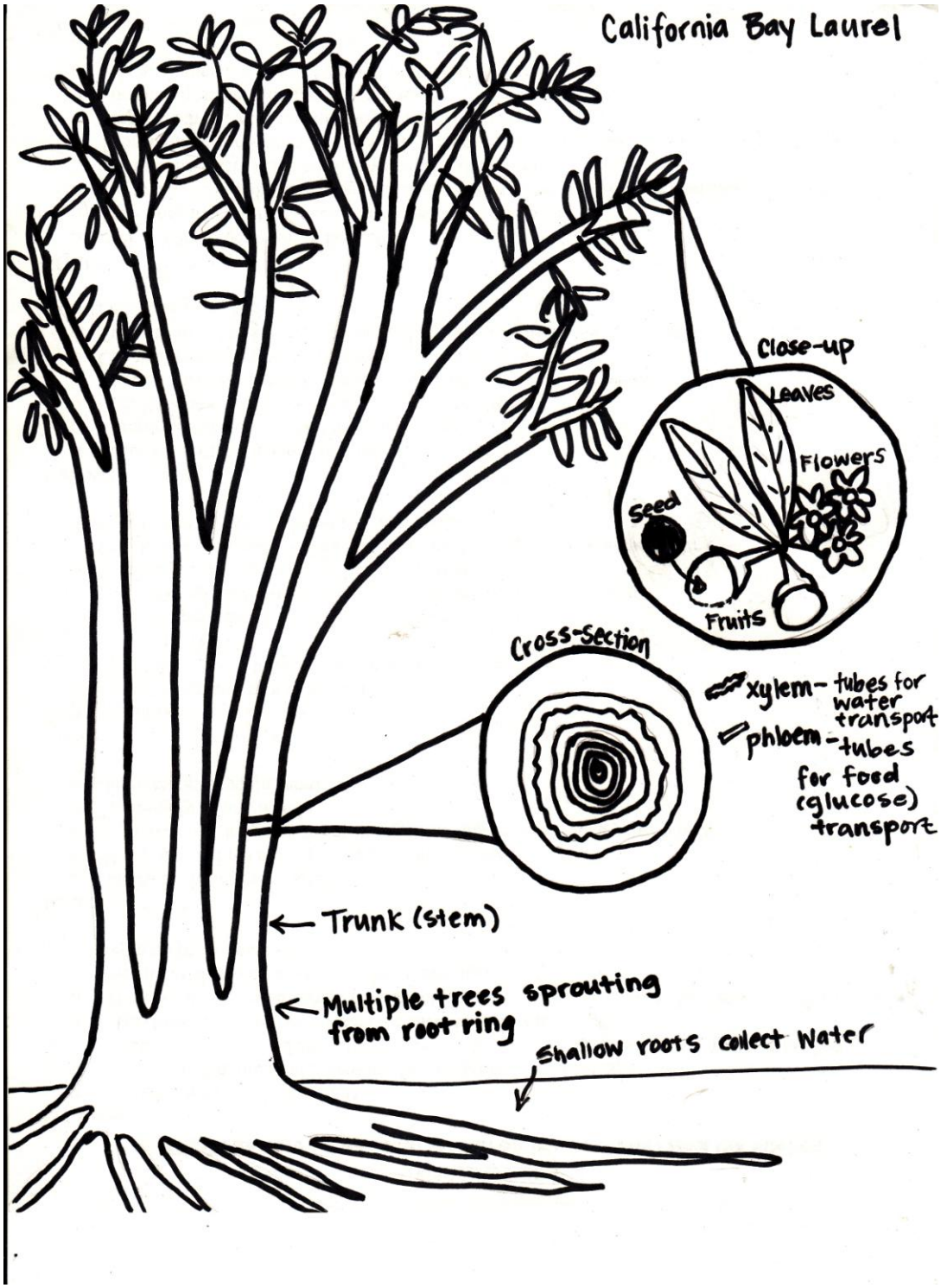
Gibbons, Gail. From Seed to Plant. New York: Holiday House, 1991. Print.

Heller, Ruth. The Reason for a Flower. New York: Grosset & Dunlap, 1983. Print.

Song:

Banana Slug String Band. *Roots, Stems, Leaves*. N.d. CD.

California Bay Laurel Tree Pictorial (Intended for projecting)



Structures and Functions

Lesson 1.2 The Banana Slug

Getting Ready:

- Copy Banana Slug handout and article "Slugs for every student
- Prepare technology to show online video
- Consider writing all **bold** words on sentence strips to create a Science Word Wall
- Consider copying "Banana Slug" lyrics for each student

NGSS Standards: Plants and animals have internal and external **structures** that **function** to support survival, growth, behavior, and reproduction. (4-LS1-1); Characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. (MS-LS1-4)

Guiding Question: What are the structures of a banana slug that function to support survival, growth, and reproduction?

Learning Objective:

- Students explain how a specialized structure of a banana slug helps it to survive, grow, or reproduce.

How to Teach and Assess Learning Objective:

- To activate prior knowledge, ask students to brainstorm animals they saw in the redwood forest at Vida Verde in teams of four or partners. Consider having students record ideas on a whiteboard or in a notebook. Tell students that today, they are going to investigate the **banana slug** and the specialized structures, or parts, which help it **survive**, **grow**, and **reproduce**.
- Introduce and post the Guiding Question: What are the structures of a banana slug that function to support survival, growth, and reproduction?
- Tell students that all of these animals have the same basic needs. In order to live and survive as a species, they all need:
    - food
    - air/oxygen
    - water
    - to get rid of waste
    - to stay safe from predators
    - the ability to reproduce
- Distribute Banana Slug handout to students. Have students work in teams or pairs to te identify the structures the banana slug has to meet these needs. They will base their ideas on prior knowledge from Vida Verde. Consider having students share their initial ideas verbally or in writing.
    - **Optional scaffold:**

        - I think the banana slug uses_____ to _____ because_____.
    - **Expected Student Response**:
        - I think the banana slug uses the hole on its head to breathe because Sasquatch told us that when we were at Vida Verde.
- Explain to students that so far, their ideas come from their experience at Vida Verde. Tell students that scientists try to get information from many sources. Today they will look at two different sources, a video and an article. Their next job is to find information they can add to their handouts.
- Show video "Science on the Spot: Banana Slugs Unpeeled" from KQED Quest at http://science.kqed.org/quest/video/science-on-the-spot-banana-slugs-unpeeled/.
- Have students add any new information to their handout.
- Distribute the article, "Slugs." Guide a shared reading of the article. Then, have students work in pairs to add information from the article to their handout.
- To close, have students reflect on their learning, either orally or in writing by responding to one of the following prompts:
    - I used to think _____ but now I think _____.
    - I was surprised _____.
    - I am still wondering about _____.
- Briefly discuss other sources students to explore to get additional information (i.e. library, Internet research.)
- Look at samples of student handouts to assess understanding.
- Optional Extension: sing the song "Banana Slug"

Banana Slug

What are the structures of a banana slug that function to support survival, growth, and reproduction?

Draw a banana slug. Label the structures you remember.

Banana Slug

What are the structures of a banana slug that function to support survival, growth, and reproduction?

Need	Structure	How it Functions
Food		
Air/ oxygen		
Water		
Get rid of waste		
Stay safe from predators		
Ability to reproduce		

Choose the structure that you find most interesting. How does it help the banana slug survive?

Slugs

Slugs belong to the phylum Mollusca, which includes clams, oysters, squid, octopi, and snails. They belong to the class Gastropoda, which means “belly foot.”

British Columbia has six species of native slugs. The biggest is the banana slug, so named because it is often green or yellow with brown spots or “bruises.”

Slugs are similar to snails, but have a leathery mantle, rather than a shell. The mantle provides protection for the head. The hole, or pneumostome, on the right side of the mantle lets air into the breathing cavity.

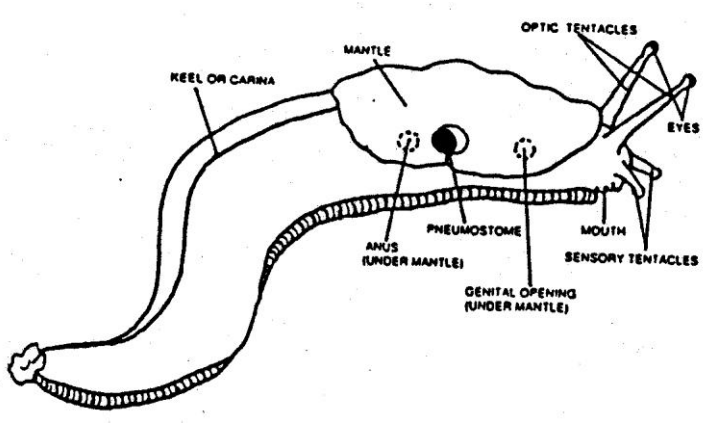
Slugs have two sets of tentacles on their head. The long, upper tentacles each have an eyespot. The short, lower tentacles are for taste, smell, and touch.

A slug's mouth is between the two lower tentacles. Food is obtained with a tongue or radula, which has hundreds of tiny rough projections for rasping food. Slugs eat plant detritus, carrion, and excrement.

Dry air and sunlight are a slug's worst enemies because they have no built-in defense against dehydration. They are covered with multi-purpose slime to aid breathing and locomotion. The slime also serves as a defense against predators as it is quite noxious.

Slugs are hermaphrodites, that is, they have both sets of reproductive organs. A partner is required for fertilization. After mating, one or both partners will lay a slime-covered mass of eggs in a moist, protected place. Eggs take about a month to hatch.

Slugs usually survive mild west coast winters, but in colder areas, slugs find a protected area below the frost line to spend the winter.



Copied with Permission from the Richmond Nature Park Society
http://www.richmondnatureparksociety.ca/index.php?pr=hwl2

Banana Slug

(From the Banana Slug String Band)

You know I love my baby (love my baby)
I love the way that she hugs (way that she hugs)
Some people don't understand it (don't understand it)
She's a banana slug (banana slug)

Chorus
BAAA-NAAA-NAAA SLUG! SLUG! SLUG! SLUG!
BANANA SLUG, BANANA NANA NANA
BANANA SLUG, BANANA NANA NANA
BANANA SLUG, BANANA NANA NANA
BANANA SLUG!

He's just got one food
He ain't got no toes
He hangs out in the forest
And helps it decompose.
Chorus

Well some folks say she's gross
But I won't take that jive
Cause if it weren't for my baby
The forest might not survive
Chorus

The way you wiggle your antenna
You know you give me much bliss
Come on come on come on banana slug
Won't you blow me a kiss
Chorus

The way you slide through the forest
You know you look so fine
Come on come on come on banana slug
Won't you show me your slime
Chorus

You know I love my baby
But he don't need me
That's because he's hermaphroditic
That means he's also a she
Chorus

Sticky as peanut butter
Shade of yellow
Looks like a banana
But oh so mellow
Chorus

Shake it up baby
Twist and slime
Come on come on banana slug
Oh you slime so fine
Chorus

She's got 20,000 teeth
But she never ever smiles
It takes her 9 whole days
To go just one mile
Chorus

Ecosystems

Lesson 2.1 Organisms of Sam McDonald Park

Getting Ready:

- Copy 1 set of Organism Cards for each group of 4 students. If possible, copy in color. Consider copying on cardstock and/or laminating cards to reuse in future years.
- Copy Food Chain student sheet.
- Consider writing all **bold** words on sentence strips to create a Science Word Wall.

NGSS Standards: Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. (5-LS2-1)

Guiding Question: How are organisms in Sam MacDonald Park connected?

Learning Objective:

- Students model food chains to show feeding relationships and record diagrams of their food chain models.

How to Teach and Assess Learning Objective:

- Activate prior knowledge by asking students to brainstorm with a partner or group of four all of the **organisms**, plants and animals, they remember seeing in Sam McDonald Park. Consider having students record answers on a whiteboard or in a notebook.
- Introduce Organism Cards. Explain that each group will get a set of Organism cards. Give students about 5 minutes to study the organism cards. Each card has the following:
    - Picture of organism
    - Name of organism
    - What it eats
- Introduce and post Guiding Question: How are organisms in Sam McDonald Park connected? Challenge students to find two organisms that are connected in a feeding relationship because one organism eats the other. Have them place the cards side-by-side. Share the following example: "The black-tailed deer eats the redwood sorrel, so these two are a feeding pair. I'm going to put the redwood sorrel first, because it has to be around first, and then the deer comes along and eats it."
- Circulate and monitor progress.

- Pose the following question: "We already paired the redwood sorrel and the black-tailed deer. Do you think there's an organism that could eat the deer?" Challenge students to make other chains of three or more organisms.
- Give students about 5 more minutes to manipulate cards and create food chains.
- Teach mini-lesson about food chains. You will be demonstrating how to record a food chain. Choose to either do this on a whiteboard or on chart paper. You may want students to temporarily put away Organism Cards, or move to a separate area of the classroom (i.e. carpet).
    - These chains of organisms are called **Food Chains**. Scientists use food chains to see how organisms in an environment are connected.
    - Food chains usually start with green plants, because they make their own food using energy from the Sun. Since they produce, or make, their own food, scientists call green plants **producers**. Write "Redwood Sorrel."

Redwood Sorrel
Producer

    - Producers are eaten by animals. Animals that eat living plants or animals for food are called **consumers**. Some food chains have one consumer. Some food chains have two or more consumers. Write "Black-tailed Deer" and "Mountain Lion."

Redwood Sorrel	Black-tailed Deer	Mountain Lion
Producer	Consumer	Consumer

    - At the end of the food chain, we have organisms like the banana slug and fungi. They don't eat living plants and animals. They eat dead plants and animals and turn them into soil. They are called **decomposers**. They're sort of like nature's recyclers. Banana Slug and Fungi decompose, or break down, dead plants. They don't generally break down dead animals. There's another decomposer that does this. They're the most common decomposer in the world. They do most of the work of decomposing, but they're too small to see. They're microscopic organisms called **bacteria**. Add Bacteria Organism card to the food chain.

Redwood Sorrel	Black-tailed Deer	Mountain Lion	Bacteria
Producer	Consumer	Consumer	Decomposer

    - Tell students the last thing scientists do to complete a food chain is they add a symbol to show how energy moves through a food chain. The symbol is an arrow, and the arrow always points towards the organism that's getting the food energy.

Redwood Sorrel →	Black-tailed Deer →	Mountain Lion →	Bacteria
Producer	Consumer	Consumer	Decomposer

- Show students the Food Chain student sheet. Have students use the sheet to record the food chains they created with the cards.
- Collect student sheets to assess student understanding.

Organism Cards: Page 1 of 3

Redwood Tree

Producer

http://commons.wikimedia.org/wiki/Sequoia_sempervirens#mediaviewer/File:Redwood_slope.jpg

Redwood Sorrel

Producer

http://commons.wikimedia.org/wiki/File:Oxalis_oregana_1853.JPG

Douglas Fir

Producer

http://commons.wikimedia.org/wiki/File:White_Fir_and_Douglas-fir_near_2700_m_on_Wheeler_Peak_Scenic_Drive_on_July_14th_2013.jpg

Sword Fern

Producer

http://commons.wikimedia.org/wiki/File:Giant_Sword_Fern_(Nephrolepis_biserrata)_5.jpg

Gray Squirrel

Consumer: acorns, seeds, nuts

http://commons.wikimedia.org/wiki/Sciuridae#mediaviewer/File:Tamiasciurus_douglasii_000.jpg

Black-Tailed Deer

Consumer: leaves

http://commons.wikimedia.org/wiki/File:Sitka_black_tailed_deer_with_fireweed.jpg

Organism Cards: Page 2 of 3

Mountain Lion

Consumer: smaller animals

http://commons.wikimedia.org/wiki/File:Mountain-lion-01623.jpg

Great Horned Owl

Consumer: smaller animals

http://commons.wikimedia.org/wiki/File:Great-horned_Owl_RWD_at_CRC2.jpg

Coyote

Consumer: small mammals

http://commons.wikimedia.org/wiki/Canis_latrans#mediaviewer/File:Coyote2008.jpg

Raccoon

Consumer: plants, insects, birds' eggs

http://commons.wikimedia.org/wiki/Procyon_lotor#mediaviewer/File:Procyon_lotor_(Common_raccoon).jpg

Scrub Jay

Consumer: acorns, seeds, insects, worms

http://commons.wikimedia.org/wiki/File:California_Scrub-Jay.jpg

Slender Salamander

Consumer: small insects and worms

http://commons.wikimedia.org/wiki/File:Batrachoseps_gavilanensis_-_Gabilan_Mountains_Slender_Salamander_01.jpg

Organism Cards: Page 3 of 3

Dusky-footed Woodrat

Consumer: acorns, seeds, fungi, plants

http://www.discoverlife.org/mp/20q?guide=Mammalia&search=Neotoma+fuscipes

Bark Beetles

Consumer: Tree bark

http://commons.wikimedia.org/wiki/File:Dendroctonus_ponderosae.jpg

Earthworm

Decomposer: dead leaves

http://commons.wikimedia.org/wiki/Earthworms#mediaviewer/File:Regenwurm1.jpg

Banana Slug

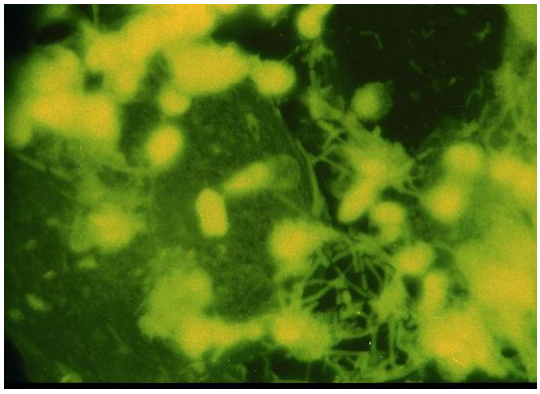
Decomposer: dead plants

http://commons.wikimedia.org/wiki/File:Banana_slug_at_UCSC.jpg

Turkey Tail Fungus

Decomposer: dead trees

http://commons.wikimedia.org/wiki/File:Turkey_Tail_(Trametes_versicolor).JPG



Bacteria

Decomposer: dead plants and animals

http://commons.wikimedia.org/wiki/Category:Bacteria#mediaviewer/File:Bakterien_2742a.jpg

Food Chains

Example:

Redwood Sorrel →	Black-tailed Deer →	Mountain Lion →	Bacteria
Producer	Consumer	Consumer	Decomposer

Food Chain #1

_____ → _____

Producer Consumer

Food Chain #2

_____ → _____ → _____

Producer Consumer Decomposer

Food Chain #3

_____ → _____ → _____ → _____

Producer Consumer Consumer Decomposer

Bonus Food Chain: Free Choice

Ecosystems

Lesson 2.2 Mapping the Food Web

Getting Ready:

- Have Organism Cards for each group of 4 students.
- Provide poster paper and markers to each team.
- Consider writing all **bold** words on sentence strips to create a Science Word Wall.

NGSS Standards: Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. (5-LS2-1)

Guiding Question: How can we model the connections between all of the organisms in Sam MacDonald Forest?

Learning Objective:

- Students work collaboratively to create posters of a Redwood Forest Food Web.

How to Teach and Assess Learning Objective:

- Link to the previous lesson by reminding students that they learned that scientists use **Food Chains** to show connections between organisms in an environment. Review the example:

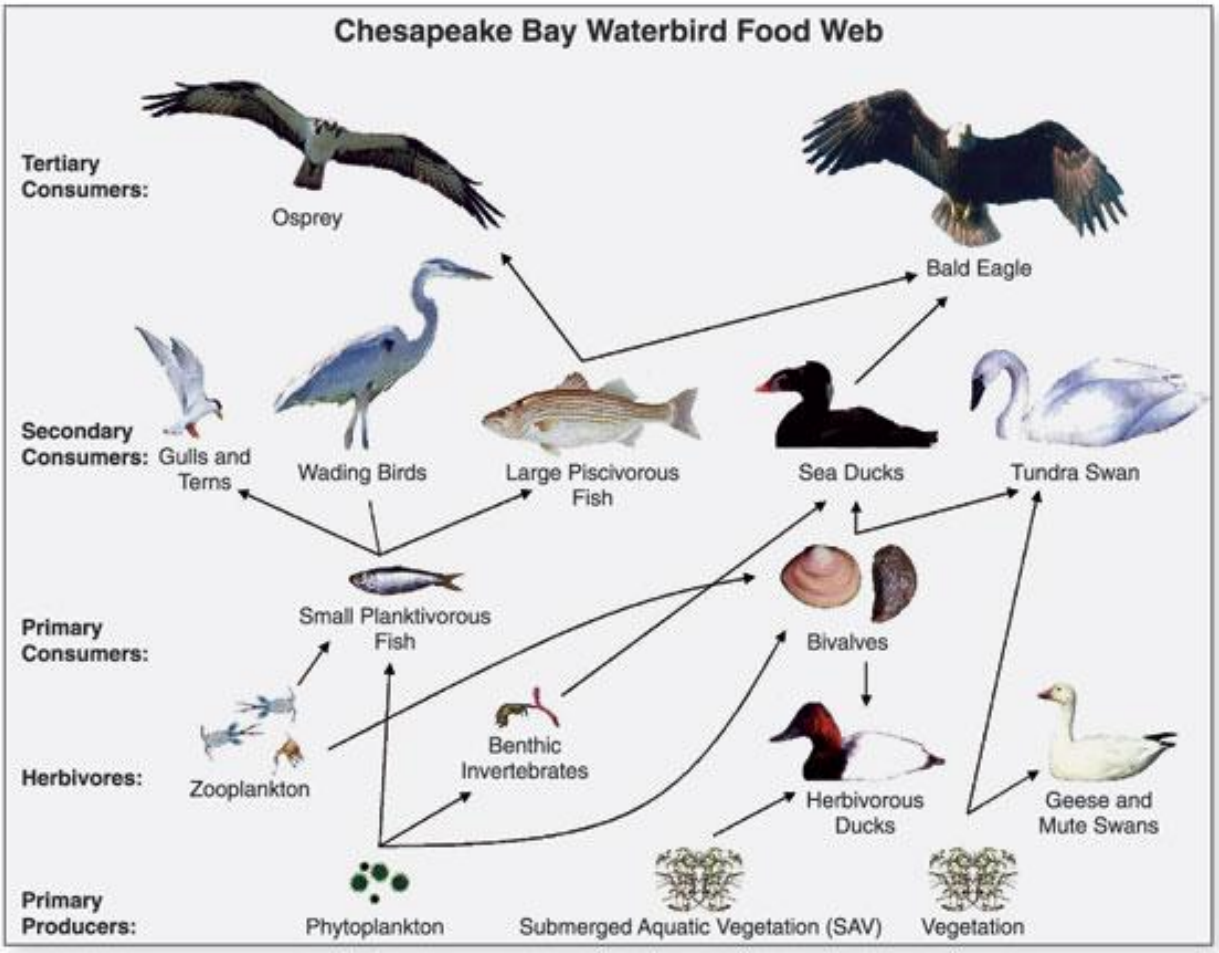
Redwood Sorrel →	Black-tailed Deer →	Mountain Lion →	Bacteria
Producer	Consumer	Consumer	Decomposer

- Ask students if they think that *every* spotted deer in Sam McDonald park gets eaten by a mountain lion. Explain that a food chain shows one possibility of what could happen. If scientists want to show all the possibilities, they create a **food web**. A food web shows *all* the possible interactions between organisms.
- Show examples.
- Explain that food webs still use arrows. Food webs still include **producers** (like green plants), **consumers** (like animals), and **decomposers** (like fungi, banana slugs, and bacteria).
- Introduce and post the Guiding Question: How can we model the connections between all of the organisms in Sam McDonald Forest?
- Tell students they are going to make a food web of Sam McDonald County park. The steps are as follows (consider posting these for students):

1. Write organism names in any order. (Spread out, not lined up.)
2. Draw arrows to show interactions between organisms.
3. Add a title.
4. If time, draw pictures.
    - Tip: Use pencil first!!

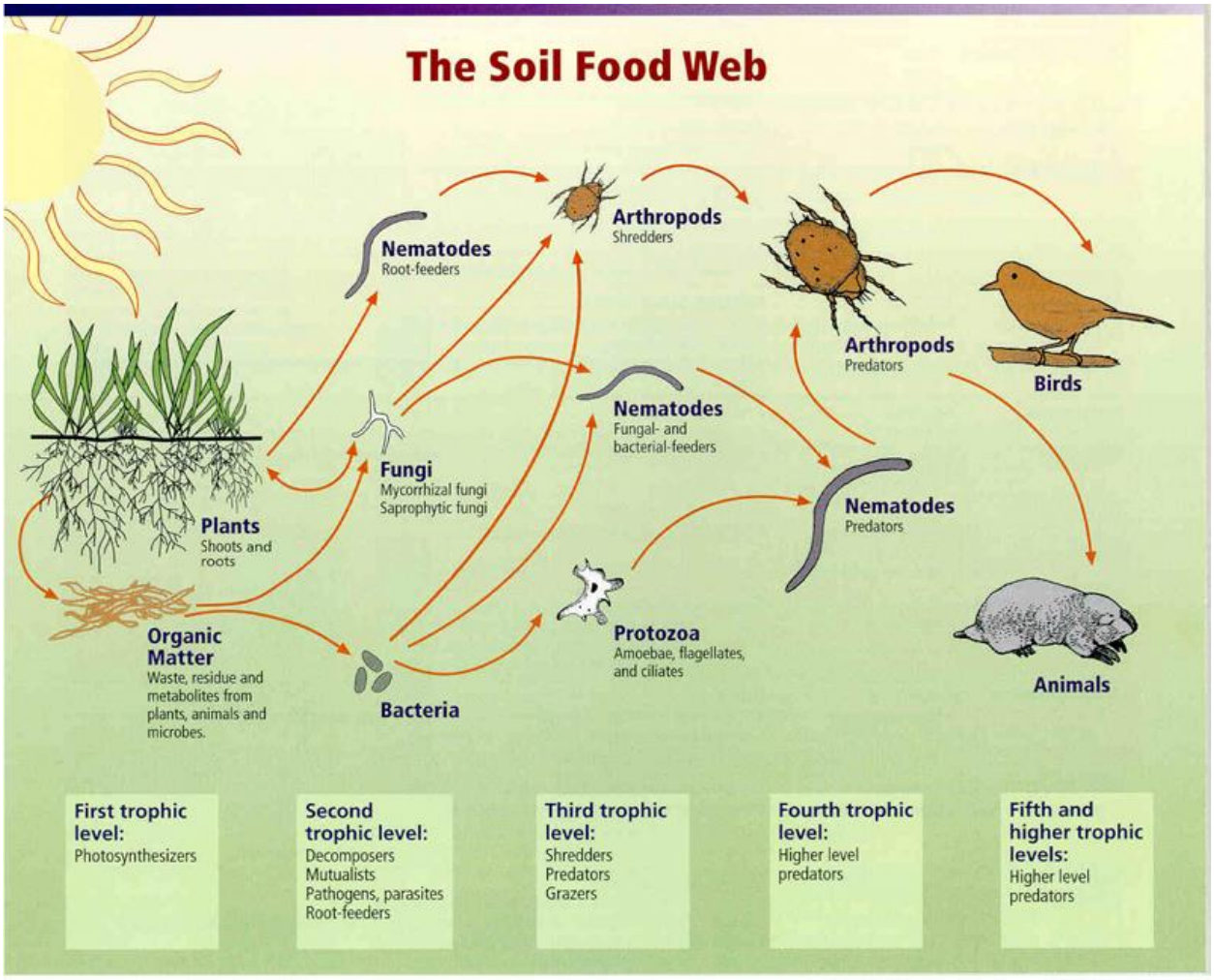
- Monitor and assess progress. The process will give you insight into students' understanding more than the end product.
- While circulating and monitoring progress, consider asking students:
    - How did you know which way to draw arrows?
    - What would the black-tailed deer eat? What would eat the black-tailed deer?
    - Do you see any organisms that are in competition for the same food?
- To close, consider a quick gallery walk.

Example Food Web



"Chesapeake Waterbird Food Web" by Matthew C. Perry, courtesy of the U.S. Geological Survey

Example Food Web



Relationships between soil food web, plants, organic matter, and birds and mammals
Image courtesy of USDA Natural Resources Conservation Service
http://soils.usda.gov/sqi/soil_quality/soil_biology/soil_food_web.html.

"Soil food webUSDA" courtesy of
USDA http://soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html

Ecosystems

Lesson 2.3 Changes to the Ecosystem

Getting Ready:

- Copy Food Web handout for each student
- Consider writing all **bold** words on sentence strips to create a Science Word Wall.

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

Guiding Question: What would happen to the organisms of Sam McDonald Forest in the event of a forest fire? How could a food web model help us understand?

Learning Objective:

- Students use a food web model to predict which organisms would be affected by a forest fire.

How to Teach and Assess Learning Objective:

- Link to previous lesson by sharing Food Web posters and reminding students that food webs show all of the connections between organisms. Tell students that scientists also use food webs to predict what will happen if an environment changes.
- Introduce and post the Guiding Question: What would happen to the organisms of Sam McDonald Forest in the event of a forest fire? How could a food web model help us understand?
- Ask students to discuss with a partner, which organisms would be affected if there was a fire in Sam McDonald park? Why?
- On the Food Web handout, have students write their initial prediction about an organism that would be affected by a forest fire. Teach students that **initial** means first idea. Explain that scientists change their ideas over time as they get new information.
- After students have finished, have students look at the Food Web. Have students cross out any organisms that they think wouldn't be able to survive the fire.
- Guide a class discussion using the following prompts; (consider having students bring Food Web handouts or having Food Web posters visible):
    - Discussion Prompts:
        - Which organisms would be affected by a forest fire?
        - Which organisms would be able to escape? Which organisms wouldn't?
        - Imagine it's a month after a fire. Which organisms would be left? What would they eat to stay alive?

    - Optional Scaffolds:
        - I think _____ because _____.
        - I agree with _____ and can add _____.
        - I respectfully disagree with _____ because _____.
- Summarize students' ideas. It's okay if there's some disagreement. Reinforce the idea that when an environment changes, *many* organisms are affected. Some organisms are affected right away; some are affected later on because their food source has disappeared.
- Have students write their final predictions about which organisms would be affected by a forest fire.

Food Web

How would a forest fire affect the organisms of Sam McDonald Park?

Imagine lightning struck a Douglas fir tree and a forest fire spread through Sam McDonald Park. Which organisms do you think would be affected? Why?

Initial Predictions

If there was a forest fire, I think _____

would be affected because_____

_____

_____

If there was a forest fire, I think _____

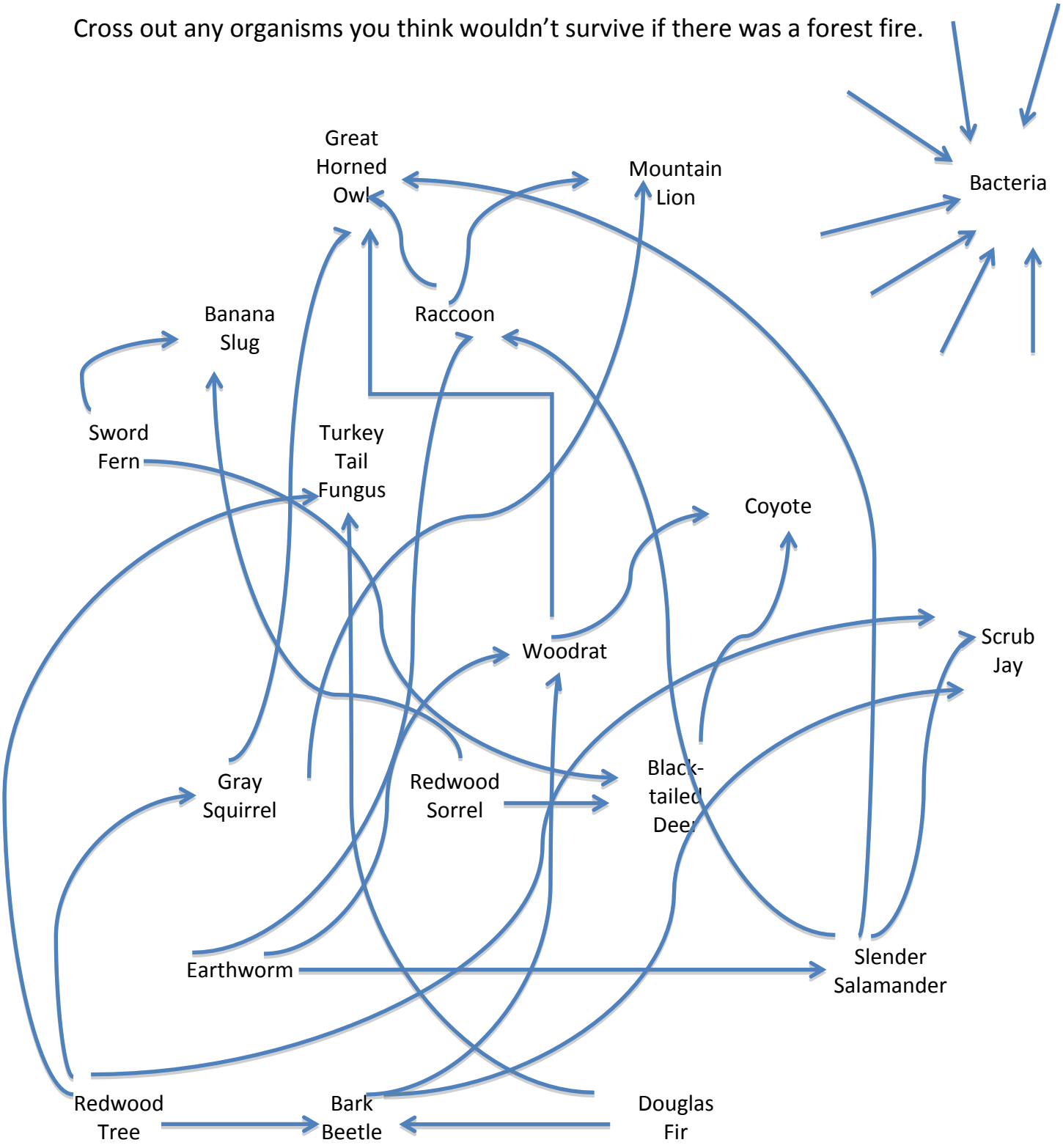
would **not** be affected because_____

_____

_____

Food Web

Cross out any organisms you think wouldn't survive if there was a forest fire.



Final Prediction

If there was a forest fire, I think _____

_____ because _____

_____

_____

_____

At first, I thought _____

_____ and now I think _____

_____

_____

Natural Resources

Lesson 3.1 Energy Sources at the Vida Verde Farm

Getting Ready:

- Copy Vida Verde Farm Map and Energy at the Farm handout for each student (consider copying back-to-back
- If showing film clip, prepare technology
- Consider writing all **bold** words on sentence strips to create a Science Word Wall.

NGSS Standards: Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

Guiding Questions: What uses energy at the Vida Verde farm? What are the sources of energy used?

Learning Objective:

- Using a diagram of the Vida Verde Farm, students identify components that use energy and the natural sources of those components.

How to Teach and Assess Learning Objective:

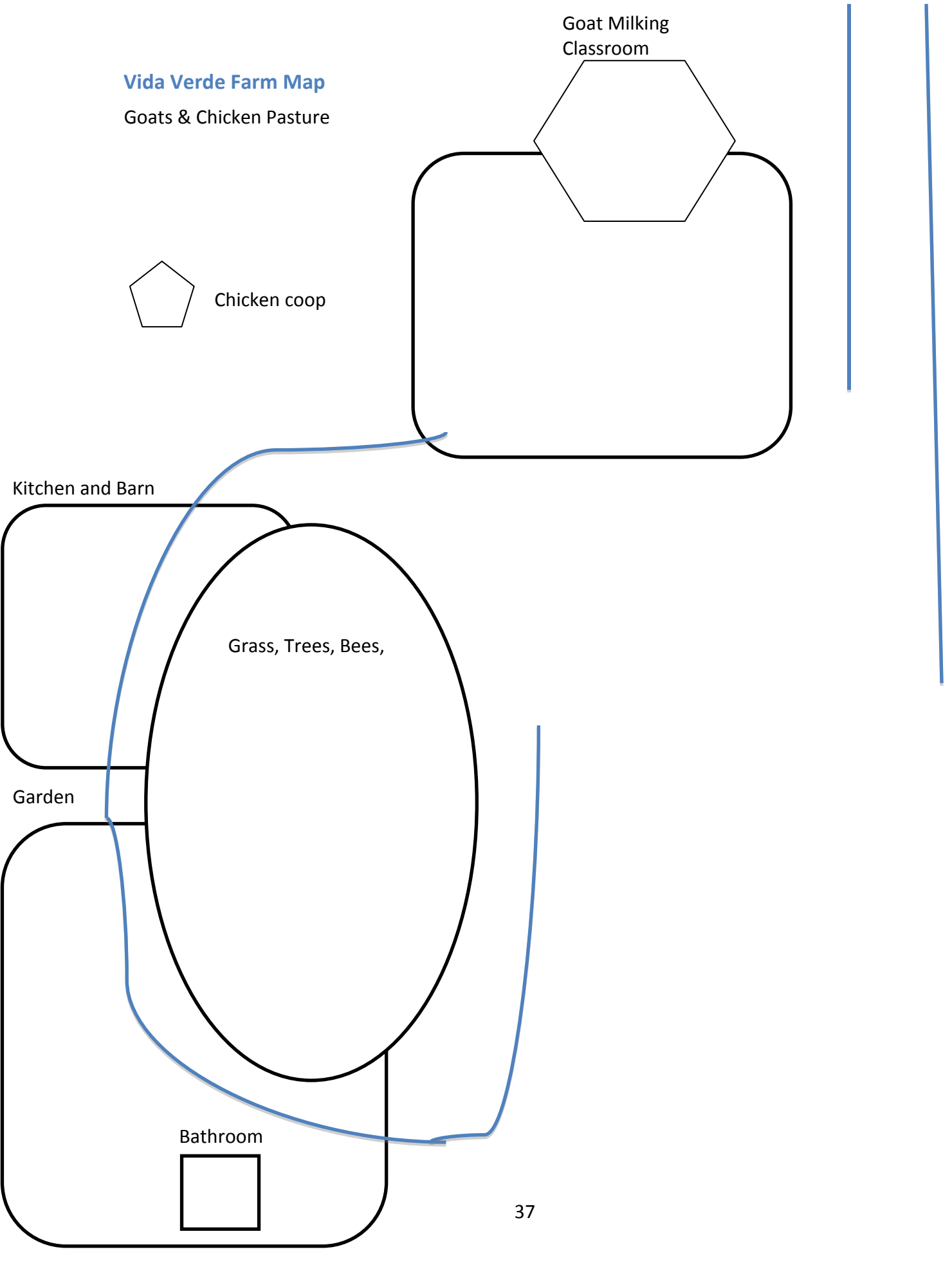
- Ask students if they remember their trip to the Vida Verde farm. Have students quickly brainstorm parts of the farm. Be sure the list includes:
    - The garden
    - The animal pens
    - The kitchen
    - The barn attached to the kitchen (with the tractor and farm tools.)
- Distribute Vida Verde Farm Maps. Give students about 5 minutes to sketch all the parts of the farm they remember.
- Introduce and post the Guiding Questions: What uses energy at the Vida Verde farm? What are the sources of energy used?
- Then, have students draw all of the things on their maps that use **energy**. You may direct students to circle, or highlight items that use energy. Hint: anything that moves, grows, or does work uses energy. Some items students may identify include: animals, plants, tractor, stove, refrigerator, farm tools.
- Tell the students that all of the items they identified have to get their energy from somewhere. These are called **energy sources.**
- Consider showing students a 4 minute YouTube film clip "Where Does Energy Come From (Accessible Preview)" at https://www.youtube.com/watch?v=P-T7iz4U1Do, or the

23 minute episode of “Bill Nye the Science Guy: Episode 45 Energy” at https://www.youtube.com/watch?v=xw5qtadMSno.

- Have students work in pairs to identify the sources of the items they identified on their worksheet maps. Reassure students that they may not know all of the answers, and they should take their best guess based on what they remember from their trip.
- Have students share their ideas out loud.
- Let students know in the next lesson they will be learning about how these different sources of energy **impact**, or affect, the environment.

Vida Verde Farm Map

Goats & Chicken Pasture



Energy at the Farm

Energy Sources		
Sun/ solar 	Biodiesel 	Chemical energy stored in food 
Gasoline 	Electricity 	Chemical Energy stored in batteries 
Natural Gas 	Wind 	Burning wood 
Burning coal 	Nuclear energy 	Water/ Hydroelectric 

What uses energy at the farm?	Where does the energy come from?

Natural Resources

Lesson 3.2 Energy Impact

Getting Ready:

- If showing film clip, prepare technology.
- Consider writing all **bold** words on sentence strips to create a Science Word Wall.

NGSS Standards: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

Guiding Question: How does energy use at the Vida Verde farm impact the environment?

Learning Objective:

- Students evaluate the environmental impact of energy use at the Vida Verde farm and make a claim about whether the sources are renewable or non-renewable.

How to Teach and Assess Learning Objective:

- Link to previous lesson by reviewing some of the ways energy is used at the Vida Verde farm (growing plants, feeding animals, cooking, fueling machinery) and some of the **energy sources** (sun, food, gas, biodiesel). Tell students that all of these energy sources come from nature, so scientists call them **natural resources.** However, just because they all come from nature, this doesn't mean that they are all good for the environment. Some natural resources can be reused again and again, like wind energy and solar energy, which are often less polluting. These are called **renewable** resources or **renewable** energy sources. Other natural resources, such as the fossil fuels (coal, oil, gasoline) are limited in supply and often create a lot of pollution when they're used. These are called **non-renewable** resources or **non-renewable** energy sources.
- Consider showing the 3 minute film "Safety Smart Science with Bill Nye the Science Guy: Renewable Energy Preview" at https://www.youtube.com/watch?v=grI3BDSGEC4.
- With students, generate a list of renewable and non-renewable energy sources. Record ideas on the board or chart paper, where they're visible to students.

Renewable Energy Sources	Non-renewable Energy Sources
Sun/ solar	Gasoline
Wind	Natural Gas
Hydroelectric	Coal
Biodiesel	Batteries
Food	

Note to teachers: Not all renewable resources are "good" and not all non-renewable resources are "bad." For example, nuclear energy is generally considered to be renewable and is cleaner than burning fossil fuels; however, it's highly controversial because of how volatile nuclear materials are. Natural gas and coal are both non-renewable; however, natural gas is much, much cleaner when burned. With that said, its environmental impact is still debated because methods of extracting natural gas, such as hydraulic fracturing, or "fracking," pose additional environmental risks.

- Tell students that everyone uses energy, and using energy **impacts** the environment. Sometimes, energy use has a large **impact** on the environment. Sometimes energy use has a smaller **impact** on the environment, or almost no impact at all.
- Introduce and post the Guiding Question: How does energy use at the Vida Verde farm impact the environment?
- Have students look back at their Vida Verde Farm maps and consider: how does the Vida Verde farm impact the environment?
- Guide a class discussion using the following prompts:
    - Discussion Prompts:
        - What uses energy at the farm that has a big **impact** on the environment?
        - What uses energy at the farm that has little or no **impact** on the environment?
        - What do you think Sasquatch and Farmer Bobby have already done to reduce their **impact** on the environment?
        - What else do you think they could do?
    - Optional Scaffolds:
        - I think _____ because _____.
        - I agree with _____ and can add _____.
        - I respectfully disagree with _____ because _____.
- Assess student understanding during class discussion.
- Consider having students respond to the Guiding Question—How does energy use at the Vida Verde farm impact the environment?—in writing, or even writing letters with recommendations to Sasquatch.

Sasquatch and Farmer Bobby
Vida Verde
3540 La Honda Rd.
San Gregorio, CA 94074

Natural Resources

Lesson 3.3 Reducing Our Impact

Getting Ready:

- Prepare chart paper and markers
- Paper for student responses
- Consider writing all **bold** words on sentence strips to create a Science Word Wall.

NGSS Standards: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

Guiding Question: How can we use what we learned at Vida Verde to reduce our impact on the environment back at school?

Learning Objective:

- Students think critically to understand the various sources of energy and the impact they have. This will create an understanding of energy sources at their homes and school and what they can do to reduce their impact on the environment.

How to Teach and Assess Learning Objective:

- Ask students to brainstorm with a partner about things they did at Vida Verde to limit their **impact** on the environment and nature. List ideas on the board. Ideas may include:
    - Biodiesel vans
    - Reusable napkins, plates, silverware
    - Feeding leftovers to animals
    - Composting food waste
    - Eating everything on your plate
    - Using reusable water bottles
    - Using teamwork to clean up

- Pose the following question to students: now that we're back at school, are there things we can still do to reduce our impact on the environment?
- Introduce and post the Guiding Question: How can we use what we learned at Vida Verde to reduce our impact on the environment back at school?
- Tell students that they are going to work in teams to come up with ideas of **action projects** the class can do to help the environment.
- Give each team a ½ piece of chart paper and markers. Tell students their first step is to make a list of as many ideas as they can. Select one student from each team to be recorder. At this point, they shouldn't worry about whether the ideas are realistic. Solicit some ideas to help students get started. Ideas may include: picking up litter, planting a garden, using reusable napkins at school, etc.
- After 5-10 minutes of brainstorming, tell students they their next step is to **evaluate** their ideas. This means, they will look back at their ideas and think about whether or not they will work.
- Tell students that when they are thinking about whether or not their ideas will work, they should consider the following three questions (post on the board):
    - Is it something I can really do?
    - Will it make a big difference?
    - Am I excited about it?
- Tell students that they are all going to score the ideas of their group. Each person will need his or her own marker. They will look at ideas, one at a time, and use check marks to score them. If they answer "yes" to one of the questions, they should mark one check mark next to it; for two "yeses," two check marks; three "yeses," three check marks.
- After scoring, have students total the scores and identify their top idea.
- Then, on the back of the paper, have students create a quick poster to show the rest of the class their top idea.
- Have each group quickly present their top idea and answer any clarifying questions from their classmates.
- After all the groups have presented their posters, have students quickly write which action project they think their class should choose.
    - **Optional Scaffold:**
        - I think we should_____ . This would help the environment because _____. I think this is a good idea because _____.
    - **Expected Student Response:**
        - I think we should stop using paper towels at school and instead use real towels. This would help the environment because we wouldn't have to cut down so many trees. I think this is a good idea because lots of people have extra towels at home.
- Review student responses for understanding on environmental impact.
- Consider implementing action project ideas as on-going group projects or a class project.

APPENDIX A

Additional Resources for Teaching Basic Structures and Functions of a Vascular Plant

Recommended Readings:

Aston, Dianna Hutts., and Sylvia Long. A Seed Is Sleepy. San Francisco: Chronicle, 2007. Print.

Gibbons, Gail. From Seed to Plant. New York: Holiday House, 1991. Print.

Heller, Ruth. The Reason for a Flower. New York: Grosset & Dunlap, 1983. Print.