## Berkeley Unified School District

## Garden-Based Learning Curriculum

Preschool - Fifth Grades

September 2015


## Berkeley PUBLIC SCHOOLS <br> Berkeley Unified School District

## Introducing the Garden-Based Learning Curriculum

The Berkeley Unified School District has pioneered garden education since the first school garden was planted at LeConte Elementary in 1983. This single garden inspired many others, and over the next twelve years it evolved into a multi-school Gardening and Cooking Program with annual support from a federal grant of $\$ 1.9$ million from the California Nutrition Network. We lost this funding in 2013, along with many other nutrition and garden education programs, at which point we refocused from a nutrition-based program to one that supports teachers and students in the academic classroom.

This change encouraged us to develop a pilot curriculum in 2013-1014, with support from teachers, garden educators, and consultants from the Edible Schoolyard, Berkeley. Our team of experts gleaned from existing lessons and research to synthesize drafts to best fit our own school gardens. We rewrote the pilot lessons with input from our school communities and with incredible support from P. Rachel Levin, an English Language Coach, to develop academic and health targets accessible to all of our students.
The curriculum builds upon many years of educating our students in the garden and scales up content across grades and lessons for instructional scaffolding. It is designed as an interactive teaching tool to be co-taught with classroom teachers and garden instructors as leads. Each lesson connects directly to standards: Next Generation Science, Common Core State, Physical Education, and Environmental and Health Education. Our concise and easy-to-follow lessons are a packed 45 minutes for preschool through fifth grade. Flexibility is important to us, so some lessons include several activities that teachers can choose from to accommodate their lesson plans. Consistency is also important, so we follow themes and lesson structure found in the Curriculum Map.

During the school year 2014-2015, we received School Board approval for ongoing funding and a grant from the City of Berkeley's Measure D tax, along with school site contributions of $\$ 15$ per student served. These pertinent financial and programmatic steps institutionalized a comprehensive, District-wide Garden-Based Learning Program that marks a shift in education history. Community-driven support, along with unprecedented commitment from the School Board, demonstrates thoughtful leadership and a continued dedication to educating the whole child.

It is with great excitement that I share Berkeley Unified School Districts' Garden-Based Learning Curriculum.

With gratitude,
Jezra Thompson
Gardening and Cooking Program Supervisor

## Curriculum Goals

## SCIENCE

Science is essential for understanding our world. Experimenting with the natural and unnatural world informs students and prepares them to be critical thinkers. We ask questions such as: How do plants use energy from light to make sugars? What happens when the energy from food is transferred from one organism to the next? In what ways do people depend on this flow of energy? How do geographical factors, such as climate, location, water resources, and mountains, affect the availability of food energy?

## ENVIRONMENT

External conditions and factors, living and nonliving, which affect organisms, constitute an environment. Students understand the processes for cultivating food and plants by exploring connections to their environment. We ask questions such as: Where do living organisms get their food energy? What is a food web and what are the different components of a food system? How do the decisions we make about food affect natural systems? How do pollution and other conditions affect the ability of crops and animals to thrive?

## HEALTH

Health is the general condition of the body, mind, and spirit. We encourage students to care for themselves by eating whole food, by connecting with how and where food grows, and by understanding the importance of quality nutrition found in these foods and the role physical exercise plays in keeping us healthy. We ask questions such as: How do decisions about food affect people's health? How does food production and marketing affect our food choices and the nutrient content in the foods we eat? Why is physical activity important for health and how can we incorporate it into our daily lives?

## LANGUAGE

Language development focuses on preparing students to be good communicators. The garden provides the perfect laboratory for practicing speaking and listening, writing comprehension, and building knowledge systematically by investigating a topic within a grade and across grades. We ask questions such as: How do students prepare for and participate effectively in a range of conversations and collaborations with diverse partners? How can individuals build on others' ideas to help express their own clearly and
persuasively? How can students integrate and evaluate information presented in diverse formats and an array of texts, including visually, quantitatively, and orally?

## SOCIAL STUDIES

Food is much more than nourishment, just like gardens are much more than sources for vegetables and fruits. By identifying the food choices and natural experiences that our students have and that different cultures have, we support them as they learn about the world around them and beyond. We ask questions such as: Why do we eat the things that we do? How has farming changed over time? How have these activities affected food production in both local and global contexts? What role does food play in our culture and other cultures and societies?

## STUDENT ENGAGEMENT

It's important for our garden educators to be included in school culture and for our students to see the garden as a fluid extension from the classroom and to the cafeteria. We connect with classroom teachers at the beginning of each school year. We ask them about the strategies and tools they use for student focus and classroom management so we can incorporate common practices and establish norms in the school garden that reflect the larger school climate.

Like other outdoor educators, garden instructors have a lot of competing distractions for student focus. We practice harnessing these distractions as teachable moments, connecting them to lesson content and allowing students to experience and observe while still managing their urges and emotions. We also draw from our district-adopted social and emotional learning guide, The Tool Box Project. Our curriculum offers a structure for responding to open-ended questions such as: How can we work together to meet challenges and solve problems as a group? What tools do we currently use to ground our emotions and responses, and how can we employ them in the garden?

# Garden-Based Learning Curriculum Themes by Month 2015-2016 

## KEY

| Month $\quad$ Theme | Name of Lesson <br> (Grade.Lesson Number) |
| :---: | :---: |
| $\boldsymbol{X}$ denotes months with only one lesson, due to the district |  |
| calendar. |  |

## PREKINDERGARTEN AND KINDERGARTEN

| September | Garden Community | X | Introducing Dirt <br> (K.1) |
| :---: | :---: | :---: | :---: |
| October | Plant Biology | Seeds <br> (K.2) | Tops and Bottoms: Edible <br> and Nonedible <br> (K.3) |
| November | Nutrient Cycles | 4Rs Relay Race <br> (K.4) | Introducing Worms <br> (K.5) |
| December | Soil | What Is Soil Made Of? <br> (K.6) | X |
| January | Cycles in Nature | Changing Seasons <br> (K.7) | Weather <br> (K.8) |
| February | Cycles in Nature | Watering the Garden <br> (K.9) | Shadows <br> (K.10) |
| March | Interdependence | Adaptations <br> (K.11) | Compost Critters <br> (K.12) |
| April | Plants and Animals | Where Do Animals Live? <br> (K.13) | Shapes in Nature <br> (K.14) |
| Mane | Celebration/Reflection | What We Learned in the <br> Garden <br> (K.17) | Plants for Breakfast <br> (K.16) |

## FIRST GRADE

| September | Garden Community | X | The 3 Be's (1.1) |
| :---: | :---: | :---: | :---: |
| October | Plant Biology | $\begin{aligned} & \text { Seeds } \\ & (1.2) \end{aligned}$ | Tops and Bottoms (1.3) |
| November | Nutrient Cycles | What's in Soil? (1.4) | Worm Anatomy (1.5) |
| December | Insects | Investigating Insects (1.6) | X |
| January | Cycles in Nature | Weather and Clouds (1.7) | Earth's Patterns (1.8) |
| February | Cycles in Nature | Temperatures in the Garden (1.9) | Sundials (1.10) |
| March | Interdependence | Introducing FBI (1.11) | The Needs of Plants and Animals (1.12) |
| April | Interdependence | Microhabitats (1.13) | Six Plant Parts (1.14) |
| May | Nutrition | Eat a Rainbow (1.15) | $\begin{gathered} \text { Be Sugar Savvy } \\ (1.16) \end{gathered}$ |
| June | Celebration/Reflection | Words from the Garden (1.17) | X |

## SECOND GRADE

| September | Garden Community | X | The 3 Be's <br> $(2.1)$ |
| :---: | :---: | :---: | :---: |
| October | Plant Biology | Seed Travel <br> $(2.2)$ | From Beans to Plants <br> $(2.3)$ |
| November | Nutrient Cycles | The Compost Pyramid <br> $(2.4)$ | FBI <br> $(2.5)$ |
| December | Soil | Rocks to Soil <br> $(2.6)$ | X |
| January | Cycles in Nature | Graphing Decomposition <br> $(2.7)$ | Gauging Water <br> $(2.8)$ |
| February | Cycles in Nature | Water Cycle <br> $(2.9)$ | The Power of Mulch <br> $(2.10)$ |
| March | Plant Biology | Flower Parts <br> $(2.11)$ | Measuring Our Harvest <br> $(2.12)$ |
| April | Interdependence | Classifying Plants and <br> Animals <br> $(2.13)$ | Pollinators <br> $(2.14)$ |
| May | Nutrition | Garden Herbs <br> $(2.15)$ | Healthy Attractions <br> $(2.16)$ |
| Celebration/Reflection | Creating Reflections <br> $(2.17)$ | X |  |

## THIRD GRADE

| September | Garden Community | X | Establishing Expectations (3.1) |
| :---: | :---: | :---: | :---: |
| October | Plant Biology | Dissecting Beans (3.2) | Companion Planting (3.3) |
| November | Nutrient Cycles | Introducing Nitrogen (3.4) | Worm Bins (3.5) |
| December | Soil | Decomposition Cycle (3.6) | X |
| January | Cycles in Nature | Plants to Compost (3.7) | Native Plants Conserve Water (3.8) |
| February | Cycles in Nature | Hibernation and Migration (3.9) | Mapping the Garden (3.10) |
| March | Interdependence | Pollination Nation (3.11) | Habitats (3.12) |
| April | Plant Biology | Plant Traits (3.13) | Plant Adaptations (3.14) |
| May | Nutrition | Local vs. Non-Local Taste Test (3.15) | Knowing Your Nutrition (3.16) |
| June | Celebration/Reflection | Fruit and Veggie Mania (3.17) | X |

FOURTH GRADE

| September | Garden Community | X | Personalizing the 3 Be's (4.1) |
| :---: | :---: | :---: | :---: |
| October | Plant Science | Plants Need Light (4.2) | Leaf Functions (4.3) |
| November | Plant Science | Dissecting Flowers (4.4) | Seed Dissection (4.5) |
| December | Nutrient Cycles | Winter Harvest (4.6) | X |
| January | Cycles in Nature | Water Cycle <br> (4.7) | Soil Composition (4.8) |
| February | Cycles in Nature | Soil Erosion (4.9) | Mapping Your Watershed (4.10) |
| March | Interdependence | Mutualism (4.11) | Insects in the Garden (4.12) |
| April | Plant Biology | Classification of Plants (4.13) | Plant Families $(4.14)$ |
| May | Nutrition | Whole or Processed (4.15) | Making Healthy Choices (4.16) |
| June | Celebration/Reflection | Garden Reflections (4.17) | X |

## FIFTH GRADE

| September | Garden Community | X | Welcome to the Garden (5.1) |
| :---: | :---: | :---: | :---: |
| October | Plant Biology | What Role Will I Play? (5.2) | Flowering Seeds: Winnowing (5.3) |
| November | Nutrient Cycles | Nitrogen Cycle (5.4) | The Carbon:Nitrogen Ratio (5.5) |
| December | Nutrition | Botany on Your Plate (5.6) | X |
| January | Cycles in Nature | Weather, Climate, and Drought (5.7) | Water Footprint (5.8) |
| February | Cycles in Nature | Pollution Soup (5.9) | Photosynthesis: Part I (5.10) |
| March | Interdependence | Photosynthesis: Part II (5.11) | Apples to Earth (5.12) |
| April | Nutrition | Making Healthy Choices (5.13) | Plant Traits (5.14) |
| May | Food Systems | Food Chains and Webs (5.15) | Tomato Seed to Market (5.16) |
| June | Celebration/Reflection | Drawing from Experience (5.17) | X |

## MONTHLY RECIPES

| Month | Theme | Feature | Recipe |
| :---: | :---: | :---: | :---: |
| September | Garden Community | Tomatoes | Tomato Bruschetta |
| October | Plant Biology | Seeds | Amaranth Seeds Popped |
| November | Nutrient Cycles | Fruits | Ginger Persimmon and Asian <br> Pear Sauce |
| December | Insects \& Soil | Whole Grains | Wild Rice and Dried Fruit Pilaf |

# PreK-Kindergarten <br> Lesson 1 <br> Garden Community 

## Introducing Dirt

## Objectives/Assessment Targets

Students will:

- Explore dirt by touching and playing with soil.
- Sing songs and read books about how to play with dirt safely.
- Practice motions for effective hand washing.


## Activity Preparation

Have a recording or video available to show students the song, "Be Alert in the Dirt." Make student journals by:

1. Stacking at least 36 sheets of $11 \times 17$ construction paper; colored, and white. Line guides for writing and sections for drawing are also helpful to include on the white paper.
2. Layering the paper lengthwise.
3. Stapling the center so the length is folded over.
4. Writing your name and class on the top.

## Materials

- "Be Alert in the Dirt" song: https://www.youtube.com/watch?v=QzVL5Um19eE
- Samples of soil and dirt


## Activity 1: Rules in the Garden

Welcome students to the kinder-garden. Review rules and safety practices. Take students on a guided tour of the garden, highlighting the role of dirt and showing how it is everywhere.

## Activity 2: Exploring Dirt

Explain that we have dirt in the garden. Dirt is what soil is made of. Soil is essential for life. Plants need soil to grow, animals and insects find a home in the soil, and children can have fun playing in it. There are safe ways to play outside, and touching the soil is not harmful.

## Ask:

- What are some things in the dirt that are yucky?
- When we play outside, what parts of our bodies can get dirty? (Hands, face, shoes, clothes, etc.)
- After playing in the dirt, what do you do to get the dirt off? (Stomp-a-stomp, brush-a-brush, scrub-a-dub)
- What else can we do to make sure dirt stays outside? (Take off our shoes-if allowed)


## Activity 3: Singing "Be Alert in the Dirt"

Lead students in a song about playing safely and healthfully in the dirt:
"Be Alert in the Dirt"
By Tickle Tune Typhoon
After playing in the yard, the playground or the park Give your hands a scrub-a-dub (echo) and leave the dirt outside
(Wash hands)
Give your hands a scrub-a-dub (echo)
(Wash hands)
Give your clothes a brush-a-brush (echo)
(Brush off clothes)
Give your shoes a stomp-a-stomp (echo) and leave the dirt outside
(Stomp feet)
CHORUS
Herbicides, pesticides, and toxics you don't want inside
Precaution is the word and remember to not eat the dirt
Wash your fruit and vegetables so tasty and delectable
The garden's where you grow 'em, wear gloves when you dig 'em and hoe 'em
And remember to not eat the dirt
Oh bright colors of life filled with love sing and dance all around us to show that we care.
Yes the colors of all of the children are circling round the green Earth that we share
Soil everywhere we can learn to be aware
For safety here and there be alert when you play in the dirt
CHORUS
Give your hands a scrub-a-dub (echo)
(Wash hands)
Give your clothes a brush-a-brush (echo)
(Brush off clothes)
Give your shoes a stomp-a-stomp (echo) and leave the dirt outside (Stomp feet)

> Scrub-a-dub (echo)
> (Wash hands)
> Brush-a-brush (echo)
> (Brush off clothes)
> Stomp-a-stomp (echo) and safely play outside
> (Stomp feet)

## Activity 4: Cleaning Up Dirt

Group students in a circle and read them the book, "Be Alert in the Dirt." Instruct them to look at the picture of the child with dirty hands. Follow discussion questions from the back of the book. Students share how they are alert in the dirt. Encourage students to agree that the boy needs to wash his hands. Show hand washing steps:

1. Wet hands with water.
2. Put soap on hands and make bubbles.
3. Rub hands together for 20 seconds. Try singing a song like the ABCs or counting to 20.
4. Wash off soap with water.
5. Dry hands with a towel or use an air dryer.

Teach children the parts of their hands they need to wash: palms, backs, between fingers, under nails, and wrists.

## Student Reflection

We wash our hands after playing in the dirt. At what other times do we wash our hands?

## English Language Learning (ELL) Focus: Synonyms

- Be alert
- Be careful
- Be aware


## Additional Information

- "Gregory, the Terrible Eater" by Mitchell Sharmat
- "Scarlette Beane" by Karen Wallace
- "Be Alert in the Dirt" by Tickle Tune Typhoon
- "Wash Your Hands!" by Tony Ross
- "Dirt and Grime Like You’ve Never Seen!" by Vicki Cobb
- "Those Mean Nasty Dirty Downright Disgusting but . . . Invisible Germs!" by Judith Rice

Standards
CCSS
RI.K.1 With prompting and support, ask and answer questions about key details in a text.
SL.K. 3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood.

Health
1.1.S Identify safety rules for the home, the school, and the community.
1.1.P Identify effective dental and personal hygiene practices.
1.5.M Describe and practice situations when it is appropriate to use "Please," "Thank you," "Excuse me," and "I'm sorry."
7.2.P Demonstrate ways to prevent the transmission of germs (e.g., washing hands, using tissues).

## Contributors

Jezra Thompson
Sources
"Be Alert in the Dirt," by Tickle Tune Typhoon

# PreK-Kindergarten 

Lesson 2
Plant Biology

## Seeds

## Objectives/Assessment Targets

Students will:

- Plant carrot seeds.
- Use senses to compare the color, shape, shake, and texture of a variety of seeds.
- Create a collage using seeds.
- Sort objects by color and type.


## Activity Preparation

Prepare a basket of bean and seed samples (coconuts, beans, poppy seeds, etc.). Cut egg cartons cut in half (so there are six holes). Mark the sides of egg cartons (brown for wood, green for leaves, etc.).

## Materials

Materials will vary depending on the activity you choose.

- Egg cartons
- Glue
- Wooden craft sticks
- Journals
- Seeds


## Activity 1: Looking at Seeds

Prompt students to use all five senses to explore seeds. Students listen to the seeds while shaking them, feel their shapes and textures, and notice their colors and shapes. Prompt students to share what they have observed about the seeds in the basket.

## Activity 2: Planting Seeds

Students line up to plant a carrot seed in the soil. Help them use a ruler to identify where and how deep to plant their seeds.

Ask, What will happen to these seeds when you come out to the garden next time?

## Activity 3: Sorting Nature

Distribute egg cartons with markings. Students identify the different types and colors of objects they will collect based on the markings. Students sort objects using the egg cartons as a guide.

## Preschool Focus: Worm through the Apple

Students stand in a straight line with their feet apart. The child at the end is the "worm." They crawl through the "apples" (other children's spread feet/legs). When the player reaches the front of the apple line, the next person in line becomes the "worm."

Cut open four to five apples and count the number of seeds total.
Ask:

- Does each apple have the same amount of seeds?
- Which has more? Less?

Make a list of the different kinds of apples. Sing "Apples Up On Top."

## Student Reflection

What did you find today? What color was it? What shape was it?

## English Language Learning (ELL) Focus: Adjective Placement

- I see brown seeds.
- I found red flowers.
- I saw long sticks.


## Additional Information

- "A Seed Is Sleepy," by Dianna Hutts Aston


## Standards

NGSS
ESS3.A Natural Resources. Living things need water, air, and resources from the land, and they live in places that have the things they need.

## CCSS

K.MD.A. 1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
W.K. 2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
1.1 Travel within a large group, without bumping into others or falling, while using locomotor skills.
2.2 Identify and independently use personal space, general space, and boundaries and discuss why they are important.
2.6 Explain the role of the eyes when striking objects with the hands, arms, and feet.
3.1 Participate in physical activities that are enjoyable and challenging.
4.3 Explain that nutritious food provides energy for physical activity.

## Contributors

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## Sources

"Grow It Try It Like It," by the USDA's Team Nutrition (http://www.fns.usda.gov/tn/grow-it-try-it-it)


Jefferson Elementary School

# Tops and Bottoms: Edible and Inedible 

## Objectives/Assessment Targets

Students will:

- Identify different parts of plants as growing above or below ground and as edible or inedible.
- Draw plants they find in the garden, labeling the parts they see.
- Listen to stories about fruits and vegetables.
- Observe as the teacher plants roots in the garden.


## Activity Preparation

Prepare samples of different types of plant tops and bottoms (leaves and roots), including edible and inedible. Prepare cards with different fruits and vegetables found in the garden for matching activities.

## Materials

- Nature cards or CA Nutrition Network Fruit and Vegetable Cards
- Seasonal seeds or plant starts
- Samples of plants with leafy tops and those with big roots


## Activity 1: Telling Stories about Plant Parts

Read the stories "Tops and Bottoms" and "Growing Vegetable Soup." Pass around samples of plants, pointing out the parts that grow above ground and those that grow below ground. Show students the fruit and vegetable cards as examples of plant parts we eat and don't eat. Students share their favorite fruits and vegetables, noting which ones grow above ground and those that grow below ground.

## Activity 2: Garden Tour

Pass out journals. Students take a guided tour around the garden and draw different plants they find. Students use their senses to document what they observe, noting the characteristics of each part, identifying as many plants as they can, and brainstorming why some areas in the garden or yard have plants and others don't.

## Activity 3: Planting Roots

Demonstrate how to plant vegetable starts with the roots (bottoms) embedded in the earth.

## Preschool Focus: Drawing What You See

Set up visual aids of objects found in nature and the garden (plants, trees, fruits, and vegetables). Students sketch what they see in their journals. Prompt students to use their observation skills to draw what they notice about the object and their surroundings.

## Student Reflection

Where does your favorite fruit or vegetable grow? Does it grow above or below ground?
English Language Learning (ELL) Focus: Prepositions and Lists

- Above ground
- Below ground
- I like to eat $\qquad$ and $\qquad$ and $\qquad$ but I don't like to eat $\qquad$ .


## Additional Information

- "Tops and Bottoms," by Janet Stevens
- "Oliver's Vegetables," by Vivial French
- "Roots, Stems, Leaves" song, by The Banana Slug String Band


## Standards

NGSS
LS1.A Structure and Function. All organisms have external parts. Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

CCSS
SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

## PE

1.1 Travel within a large group, without bumping into others or falling, while using locomotor skills.
2.2 Identify and independently use personal space, general space, and boundaries and discuss why they are important.
2.6 Explain the role of the eyes when striking objects with the hands, arms, and feet.
3.1 Participate in physical activities that are enjoyable and challenging.
4.3 Explain that nutritious food provides energy for physical activity.

## Contributors

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Sources
Farm to Preschool
Life Lab
Linking Science and Nutrition, California Healthy Kids Resource Center, Network for Healthy California

## PreK-Kindergarten

Lesson 4
Nutrient Cycles

## 4Rs Relay Race

## Objectives/Assessment Targets

Students will:

- Use hand gestures to review the 4Rs.
- Sort materials according the criteria of the 4Rs.
- Place materials in their proper containers during a relay race.


## Activity Preparation

Prepare a whiteboard with images of the 4Rs or print the labels below. Prepare sample materials for each of the 4Rs (cleaned garbage, plastic containers, paper, food scraps, etc.) and clean sorting bins with labels for recycling, trash, and compost.

## Materials

- 4 Rs signs and four bins with labels
- Sample trash, recycling, and composting materials in bags


## Activity 1: Reduce, Reuse, Recycle, Rot

Students pair-share where they think trash goes when placed in trash cans, where recycling goes.

Ask, What happens to food scraps when placed in the trash, the compost bins, or piles in the garden?

Write the title for each R on the whiteboard next to your drawing as students share and practice each R gesture. Lead students in using hand gestures to review the 4Rs:

- Reduce (one arrow pointing right, one pointing left): two hands moving from far apart to close together.
- Reuse (one arrow pointing left, one pointing right): hand moving from the right to the left and back, then hand moving from the left to the right and back.
- Recycle (two arrows in a circle): hands moving in a circle.
- Rot (Recover) (two arrows pointing down): hands moving down.
- The optional fifth R is Refuse (shaking your hand or finger back and forth).

Invite students to come up with their own dance moves that correspond with the definition of each of the 4Rs.

## Activity 2: Sorting 4Rs

Students sort materials according to each of the 4Rs. Hold up an example of an item under each category and engage students in identifying the appropriate action and then throwing it in the right bin. Each student takes a turn placing items in the right container.

Ask, What will we all do before we throw something away? (Think!)

## Activity 3: 4Rs Relay Race

Students line up in four lines for a sorting relay race. A sorting bag is placed at the beginning of each line. The first students in line grab an item from the bag, race to the right bin, race back, and tag the next students in line, who reach into the bag and repeat.

## Student Reflection

Students will repeat, "Think Before You Throw!"

## English Language Learning (ELL) Focus: Preposition of Time

- Think before you throw.


## Standards

NGSS
K.ESS3 Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment. Human Impacts on Earth Systems. Things that people do to live comfortably can affect the world around them, but they can make choices that reduce their impacts on the land, water, air, and other living things.

## CCSS

SL.K. 4 Describe familiar people, places, things, and events, and with prompting and support, provide additional detail.

PE
3.1 Participate in physical activities that are enjoyable and challenging.

## Health

1.5.P Identify practices that are good for the environment, such as turning off lights and water, recycling, and picking up trash.

## Contributors

Chris Nakao
Deborah Moore
Erica Woll
Jezra Thompson
Kim Robinson

## Sources

Do the Rot Thing
Green Schools Initiative
Stopwaste.org


# PreK-Kindergarten 

## Lesson 5 <br> Nutrient Cycles

## Introducing Worms

## Objectives/Assessment Targets

Students will:

- Demonstrate respect for living things by handing worms with care.
- Describe the look and feel of worms.
- Collect material for compost.


## Activity Preparation

Add worms, rocks of different sizes, wood chips, and plant debris to the bucket so all students can find something. Provide a piece of butcher paper on the floor or tables, damp and dry paper towels for holding the worms and compost, and microscopes. Draw a chart that has a column for "Friends of the Garden" and a column for "Foes of the Garden." Add rows below for students to add words or pictures identifying friends and foes.

## Materials

- Worm anatomy visual aid
- Wet and dry paper towels and butcher paper, if working inside
- A bucket of amended soil with added materials
- Magnifying lens
- Red Wriggler worms (found at Berkeley Bait and Tackle Shop, 2221 San Pablo Ave.)


## Activity 1: Exploring Worms

Describe the five senses that help students make observations. Initiate the gentle handling of the worms by placing several of them on the back of your hand. Show students how the worms tickle, rather than hurt! Provide student pairs or small groups with worms on damp paper towels. Spread the wigglers out so that the students can handle and observe them. Students use their senses to engage in handling worms, using magnifying lens to investigate.

## Activity 2: Building Worm Habitats

Students collect leaves and other items and add them to the compost pile. Students use shovels to mix the compost pile and add air to help the compost turn into a good "soil helper" for worms.

## Preschool Focus: Activities to Engage in Nature

Identify friends or foes of the garden by having students draw pictures of creatures that fit into each category.

Draw a large chalk worm on the playground. Guide students to walk on it with two feet and see how long they can go and how long it takes them to get from one end to the other. Line students up to race from one end of the worm to the other.

## Ask:

- How long is our playground worm?
- How long is a real worm?
- How many segments does a worm have?


## Student Reflection

How did it feel to handle worms?

## English Language Learning (ELL) Focus: Clarifying Meaning

- What does a worm look like?
- What does a worm like?


## Additional Information

- "Wonderful Worms" by Linda Glaser
- "Wiggly and Waggly" by Paul Field (https://paulfield.bandcamp.com/track/the-wiggly-waggly-song)


## Standards

NGSS
ESS3.A Natural Resources. Living things need water, air, and resources from the land, and they live in places that have the things they need.

CCSS
K.MD.A. 1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

PE
1.1 Travel within a large group, without bumping into others or falling, while using locomotor skills.
2.3 Identify and describe parts of the body: the head, shoulders, neck, back, chest, waist, hips, arms, elbows, wrists, hands, fingers, legs, knees, ankles, feet, and toes.
3.1 Participate in physical activities that are enjoyable and challenging.
4.3 Explain that nutritious food provides energy for physical activity.

## Health

1.1.G Explain that living things grow and mature.
1.6.G Name and describe the five senses.
4.2.M Cooperate and share with others.

## Contributors

Chris Nakao
Jezra Thompson

## Sources

The Worm Cafe


Early Childhood Education Center

# What Is Soil Made Of? 

## Objectives/Assessment Targets

Students will:

- Sort and categorize creatures they find in the soil.
- Observe soil samples.
- Describe the purpose of the soil.


## Preparation

Prepare buckets of amended soil samples (add rocks of different sizes, wood chips, plants, and worms to the bucket so students can find items). Prepare a glass jar with amended soil, add a plant with roots, and press the roots up against the glass so students can observe the components and structure.

## Materials

- Glass jar with soil and plant
- Small containers of amended soil


## Activity 1: Looking Closely at Soil

Show students a clear jar of soil and roots pressed up against the glass. Review past lessons on worms and tops and bottoms, highlighting that both plants and worms rely on soil. Demonstrate that soil allows the roots to hold the plant in place and absorbs water and food for the plants. Prompt students to think about what soil is made of (minerals, organic material, air, water, living things).

Review lesson K.1, Introducing Dirt. Helps students shovel out scoops of amended soil from a bucket and place them on mats or piles in front of them. Instruct students to pull out items they find, identify them, and talk about why they are in soil and why they are important to soil. Students pair-share what they see in their piles of soil. Students draw the different components of soil in their journals.

Ask, How many rocks, insects, plant parts, wood chips, etc., did you find in your pile?

## Preschool Focus: Observing Compost Layers and Critters

Prepare examples of browns (leaves) and greens (compost). Students identify what they think are browns and those that are greens.

Students sketch a single object over time (a tree found in the yard, a leaf that had fallen on the ground, a compost pile, a pile of leaves, or a plant growing in the garden). Students revisit this object over a span of time (an hour, a day, a week). Prompt students to imagine what the object will look like over time, discuss what they observe, and make comparisons.

## Student Reflection

What did you find in the soil?

## English Language Learning (ELL) Focus: Prepositions

- Creatures live in the soil.
- Creature like the soil because $\qquad$ .

Standards
NGSS
K.ESS3.1 Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

ESS3.A Natural Resources. Living things need water, air, and resources from the land, and they live in places that have the things they need.
cCSS
K.SL. 1 Participate in collaborative conversations with diverse partners about Grade K topics and texts with peers and adults in small and larger groups.
K.MD.A. 1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

## Contributors

Erica Woll
Jeanette Kjobmand
Jezra Thompson

## Sources

CVSWMD Organics, "Do the Rot Thing: A Teacher's Guide to Compost Activities"
Life Lab, The Growing Classroom, "Space Travelers"

# Pre K-Kindergarten 

Lesson 7
Cycles in Nature

## Changing Seasons

## Objectives/Assessment Targets

Students will:

- Name the four seasons.
- Identify and describe the current season.
- Collect objects from the garden that reflect the current season.


## Activity Preparation

Draw symbols of each of the four seasons on the whiteboard (winter: rain, spring: seedlings, summer: sun, fall: changing leaves falling to the ground).

## Materials

- Four index cards, labeled 1. Spring, 2. Summer, 3. Fall, and 4. Winter


## Activity 1: Looking at the Seasons in the Garden

Review the Earth's cycle and the resulting seasons using the four-season symbols. The Earth rotates around the sun, so the amount of sunlight hitting each part of the Earth changes as it moves. Different weather is caused by different combinations of sunlight, air, temperature, and moisture in a particular place during a certain time of the year.

## Ask:

- What happens to plants in the garden during spring, summer, fall, and winter?
- Why is it important for gardeners to know what happens in each season?

Pair students up and help them collect objects in the garden that represent the current season. Bring the group back and have students share the objects they found and describe why they think they represent a particular season.

## Student Reflection

What's your favorite season?

## English Language Learning (ELL) Focus: Concrete Descriptive Adjectives

Use color, size, number, and sensory adjectives to describe how things look and feel.

## Standards

NGSS
K.EESS2.D Weather and Climate. Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.
1.ESS1.1 Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.
cCSS
K.SL. 1 Participate in collaborative conversations with diverse partners about Grade K topics and texts with peers and adults in small and larger groups.

PE
1.1 Travel within a large group, without bumping into others or falling, while using locomotor skills.
2.2 Identify and independently use personal space, general space, and boundaries and discuss why they are important.
3.1 Participate in physical activities that are enjoyable and challenging.

## Contributors

Jezra Thompson

## Sources

Collectors Corner, The Growing Classroom, Life Lab

## Weather

## Objectives/Assessment Targets

Students will:

- Name the basic types of weather.
- Explain that wind is a kind of weather and describe its features.
- Make a windsock to measure the speed and direction of the wind.


## Materials

- Rain gauge
- Thermometer
- Sleeve of a large, old long-sleeved shirt
- Needle and thread
- String
- Wire
- Small rock


## Activity 1: What Is Weather?

Weather changes day to day. Read "Maisy's Wonderful Weather Book," by Lucy Cousins. Prompt students to think about the following:

1. Weather changes from day to day.
2. Weather includes clouds, rain, temperature, and wind.
3. Wind is air in motion. We measure the wind with special tools. Two factors are necessary to specify wind: speed and direction.

## Activity 2: Making Wind Socks

Gardeners can observe the wind to plan for activities. Help students make wind socks to specify wind speed and direction. Follow these steps to guide student groups in making wind socks:

1. Cut one sleeve off an old long-sleeved shirt.
2. Bend the wire into a circle. Make sure it is the same size as the top of the sleeve.
3. Place the wire into the top end of the sleeve. Take the needle and thread and stitch it, so the wire will stay in place.
4. You have just now made the mouth of the wind sock.
5. Now, place the rock in some cloth on one edge of the wire. Sew it on tight to hold it in place.
6. Tie the string onto the wire opposite the rock.
7. Tie the other end of the string to a branch where it can move freely. The rock will keep the wind sock facing into the wind.

## Preschool Focus: Making a Collage of Leaves

Students draw an outline of a leaf. Help them cover small areas in glue using a wooden craft stick and then fill in each area with seeds or crunches up dried leaves. Repeat until the entire picture is covered.

## Student Reflection

How does weather, wind especially, affect decisions you make about the clothing you wear and the activities you do?

## English Language Learning (ELL) Focus: Routine Questions

- What's the weather like today?
- What's the weather outside?
- How's the weather?


## Additional Information

You can use a compass and your wind sock to find out which direction the wind is blowing from.

## Standards

NGSS
K.EESS2.D Weather and Climate. Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.
K.ESS3.2 Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.

## CCSS

K.SL. 1 Participate in collaborative conversations with diverse partners about Grade K topics and texts with peers and adults in small and larger groups.

RI.K. 1 With prompting and support, ask and answer question about key details in a text. PE
1.1 Travel within a large group, without bumping into others or falling, while using locomotor skills.
2.2 Identify and independently use personal space, general space, and boundaries and discuss why they are important.
3.1 Participate in physical activities that are enjoyable and challenging.

## Contributors

Jezra Thompson
Sources
Weather Wiz Kids

## Example of a Wind Sock



# Watering the Garden 

## Objectives/Assessment Targets

Students will:

- Explain how plants get the water they need to grow.
- Identify and describe and/or illustrate the plants that need watering.
- Water the garden.


## Activity Preparation

Identify plants in the garden that need watering and place a marker next to it.

## Materials

- Watering cans
- Printed worksheets and clipboards with pencils for each student
- Dry soil and dry plants


## Activity 1: Searching for Water

Review that plants need water, sun, and soil to live.

## Ask:

- How do we know when a plant needs water?
- Where do we get water for our plants?

Review lessons on seasonality.
Ask, Has it rained lately?

## Activity 2: Watering the Garden

Prompt students to think about ways gardeners water their plants when it doesn't rain (irrigation, hoses, sprinklers, etc.) Demonstrate what dry soil and dry plants look like. Hand out watering cans to each pair of students and assist them in watering the garden, as a gardener or farmer would have to do if the plants needed more water. Student pairs search the garden for water with the following prompts:

1. Find something that is wet and something that is dry.
2. Stick your fingers in the soil and think about how wet it is.

## Student Reflection

Which season brings the garden the most rain?
English Language Learning (ELL) Focus: Adjective Placement

- The wet soil does not need more water.
- The dry soil needs more water.


## Additional Information

This activity can include drawing the plants that need water and labeling them.
Standards
NGSS
K.ESS3.3 Communicate solutions that will reduce the impact of humans on the land, water, air and or other living things in the local environment.
K.ESS3.A Living things need water, air, and resources from the land, and they live in places that have the things they need.

## CCSS

RI.K. 1 With prompting and support, ask and answer question about key details in a text.
WW.K. 2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
K.CC Counting and cardinality

## Contributors

Jezra Thompson

## Sources

Ocean Literacy, Oregon Coast Aquarium, Newport

# Pre K-Kindergarten 

Lesson 10
Cycles in Nature

## Shadows

## Objectives/Assessment Targets

Students will:

- Draw each other's shadows on the ground.
- Indicate how the position of the sun affects the shape and location of their shadows.
- Observe changes in shadows over time.
- Explain why the sun's location affects the garden.


## Activity Preparation

Identify a place in the garden or yard that has enough space and a hard surface for chalk drawing. Draw a chart on the whiteboard with two categories. Use the titles "What we know about the sun and shadows" and "What we want to know about the sun and shadows."

## Materials

- Chalk
- Books below


## Activity 1: Discussing the Earth and the Sun

Review lesson K. 7 on Changing Seasons. Show students the chart on "What We Know," and "What We Want to Know." Prompt students to discuss what they know about the sun and shadows.

Ask, What do you want to know about shadows?
Record their "want to knows" on the whiteboard. Read one of the books in the Additional Information section. Review the ideas presented in the book. (The Earth rotates, or spins, and day and night occurs as a result of this. Define sunrise, day, noon, sunset, and night as the Earth spins.)

## Activity 2: Drawing Shadows

Sunshine is the source of shadows. Emphasize that people should never look at the sun directly because their eyes can get damaged. Review the following points:

1. If there is sunshine, there will be shadows.
2. Without the sun, we would not have shadows.
3. If the sun is shining behind us, we will see our shadows in front of us.
4. Shadows are present when an object (or a person) gets between the sun and the surface of the Earth.

Demonstrate how to draw a shadow by following these steps:

1. Note the position of the sun in the sky.
2. Identify a connection between the direction of the shadow and the location of the sun.

Students partner up and receive chalk before they go into the yard to trace their partner's shadow, following these steps:

1. Partner 1 positions themselves to make shadows.
2. Partner 2 uses the chalk to trace the outline of their partner's shoes.
3. Switch partners and repeat.

## Ask:

- Did anything change in your tracings? What looks different?
- How many of your shadows moved?
- What do you think made the shadows move?


## Student Reflection

Ask, How do the sun and shadows affect the plants in our garden?

## English Language Learning (ELL) Focus: Location

- in front of us
- behind us
- to the side of us
- high in the sky
- low in the sky


## Additional Information

- "The Sun: Our Very Own Star," by Jeanne Bendick
- "What Makes Day and Night," by Franklyn M. Branley


## Standards

NGSS
K.ESS3.3 Communicate solutions that will reduce the impact of humans on the land, water, air and or other living things in the local environment.
K.ESS3.A Living things need water, air, and resources from the land, and they live in places that have the things they need.

CCSS
RI.K. 1 With prompting and support, ask and answer questions about key details in a text
WW.K. 2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.
K.CC Counting and cardinality.

## Contributors

Jezra Thompson

## Sources

Plant Behavior, Science 2.0
UC Berkeley educators and scientists at the Center for Science Education @ SSL in partnership with classroom teachers.
"What Makes Day and Night: The Earth’s Rotation," by Eye on The Sky

## Adaptations

## Objectives/Assessment Targets

Students will:

- Describe the similarities and differences between birds (in particular the shape of their beaks and size of their stomach).
- Simulate the experience of foraging for food using representations of beaks, stomachs, and food.
- Explain why it is advantageous for all of the birds to have beaks suited to eat only certain kinds of food.


## Activity Preparation

Collect pictures or examples of plants and animals that have adapted to their environment (ex. The humming bird, as used for as an example for the activity below). Prepare water and food coloring in jars to represent nectar for humming birds to feed from. Mix water with yellow food coloring in a pitcher and pour the "nectar" in the baby food jars. Wrap felt around baby food jars with rubber bands to represent flowers. Keep all the "food" out of view from the students and close to the area where you will have them forage.

## Materials

- Pictures of the different birds
- Yellow food coloring
- Baby food jars
- Felt
- Rubber bands
- Three different sized cups
- Tweezers
- Eyedroppers
- Nutcrackers
- Tongs
- Toothpicks
- Fruits and nuts for student tasting


## Activity 1: Comparing the Features of Birds

Explain that you will be studying a humming bird. Students will look at the samples or picture of a hummingbird and describe their similarities and differences. Prompt students
to describe the shape and size of the beak. Explain that because birds do not have hands, they eat with their beaks. They can only eat what will fit in their stomachs.

Ask:

- What size stomachs do these birds have?
- How much food do you think they can fit in their stomachs?


## Activity 2: Foraging for Food

Explain that each student will pretend to be a bird. The birds will have either small (hummingbird), medium (parrot), or large (harpy eagle) "stomachs," represented by three different-sized cups. Each bird will have a "beak" that represents the beak of the animal. As you introduce the different sizes of "beaks," show the representative tool (tweezer for hummingbird, eyedropper for parrot, tong for toucan, and toothpick for harpy eagle).

Each student will get one of the five tools that represent a bird's beak and one of three different-sized cups to represent a bird's stomach. Pass out tools and cups to the students.

Explain that birds do not have hands, so students may use only their "beaks" to collect food and may gather only what fits in their stomachs (cups).

## Ask:

- Why can't all the birds eat all the different kinds of food?
- Why do certain birds eat only certain foods?


## Preschool Focus: Birdfeeders

Demonstrate how to make bird feeders out of found objects:

- Pine cones
- Leaves
- Bark
- Birdseed
- Butter
- String

Students affix birdseeds with butter to these found objects. Use string to display the bird feeders in places where students can observe birds in nature, such as on tree branches.

## Student Reflection

What features do you have that help you eat lots of different kinds of food?

## English Language Learning (ELL) Focus: Possessives

- A hummingbird's beak is $\qquad$ .
- A parrot's beak is $\qquad$ —.
- A harpy eagle's beak is $\qquad$ .

Standards
NGSS
K.ESS2.1 Use observations to describe patterns in the natural world in order to answer scientific questions.
K.ESS3.1 Use a model to represent the relationship between the needs of different plants or animals and the places they live.
K.PS3.2 Use tools and materials provided o design and build a device that solves a specific problem or a solution to a specific problem.

CCSS
K.MD.B. 3 Classify objects into given categories; count the number of objects in each category and sort the categories by count.

## Contributors

Jezra Thompson

## Sources

Bird Adaptations, Biology Junction
Claudia Scharff, Academic Coordinator, University of San Francisco
Science and Health Education Partnership, University of San Francisco


# PreK-Kindergarten 

Lesson 12
Interdependence

## Compost Critters

## Objectives/Assessment Targets

Students will:

- Examine and describe the ingredients of soil, sorting living and nonliving things.
- Identify living things in the soil.
- Explain the importance of worms.


## Activity Preparation

Prepare containers of amended soil and non-amended soil samples (add rocks of different sizes, wood chips, plants, and some worms).

## Materials

- Compost Critter worksheet
- Buckets of amended soil and non-amended soil


## Activity: Digging for Compost

Discuss why worms are so important (their role in decomposition, water/air, burrows or tunnels, and mixing soil). Students shovel out scoops of amended soil from a bucket, pull out items they find and talk about why they are in soil and why they are important to soil.

Ask, What does compost have that soil doesn't?
Hand out the worksheets. Students identify living things found in the soil and count how many they find. Students pick one nonliving item and talk with a partner about what they found.

## Preschool Focus

Make flashcards of the different insects below with the picture on one side and the name on the back. Help students cut out the images of the insects and color them in. Write the name of the insect on the back and have them sound out the spelling. Through call and response, help students identify what the insects are called, where they live, and what they need to live.

## Student Reflection

What did you find in the soil that surprised you?

## English Language Learning (ELL) Focus: Science Verbs

- Sorting
- Examining


## Additional Information

Include activities and concepts from Lesson 4.9 on Soil Composition to reinforce and connect concepts and to add on to vocabulary.

## Standards

NGSS
K.ESS3.1 Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

CCSS
K.SL. 1 Participate in collaborative conversations with diverse partners about Grade K topics and texts with peers and adults in small and larger groups.

## PE

1.1 Travel within a large group, without bumping into others or falling, while using locomotor skills.
2.2 Identify and independently use personal space, general space, and boundaries and discuss why they are important.
2.3 Identify and describe parts of the body: the head, shoulders, neck, back, chest, waist, hips, arms, elbows, wrists, hands, fingers, legs, knees, ankles, feet, and toes.
2.6 Explain the role of the eyes when striking objects with the hands, arms, and feet.
3.1 Participate in physical activities that are enjoyable and challenging.
4.3 Explain that nutritious food provides energy for physical activity.

## Contributors

Ben Goff
Erica Woll
Jeanette Kjobmand
Jezra Thompson

## Sources

CVSWMD Organics, A Teacher's Guide to Compost Activities, "Compost Critters"
Kids Grow CA

## Color and Count Critters Found in Soil

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Which critters did you find in your soil? Circle the ones you found.
How many critters did you find in your soil? Write the number of how many you found next to the matching critter.


# PreK-Kindergarten <br> Lesson 13 <br> Plants and Animals 

## Where Do Animals Live?

## Objectives/Assessment Targets

Students will:

- Observe ladybugs as they travel.
- Hypothesize about where ladybugs might find food.
- Find objects that are attractive to birds.
- Make bird feeders to attract birds.


## Activity Preparation

Prepare a bird feeder base, sticks, or pieces of wood for students to glue objects to (pine cones and bark). Tape ladybug larvae release starts onto trees and guide students to set them free.

## Materials

- Ladybug larvae


## Activity 1: Observing Ladybugs

Show students the ladybug larvae and describe how they will hatch into ladybugs. Students count how many ladybugs there are and hypothesize how far they will travel. Throughout the week, students observe the ladybugs, identifying where they land, where they may live, and where they may get food.

## Activity 2: Other Insects

Prompt students to think about what insects are in the garden, what they like to eat, and where they like to live. Students pair up to find various objects in the garden that they think insects would be attracted to.

Ask, Why would insects like these objects?

## Student Reflection

How do these insects help the garden and how do they hurt the garden?

## English Language Learning (ELL) Focus: Auxiliary Verbs

- The ladybugs might $\qquad$ .
- Maybe the ladybugs will $\qquad$ .


## Additional Information

You can order ladybug larvae online at insectlore.com/ladybug-larvae-refill
Standards
NGSS
K.ESS3.1 Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

CCSS
SL.K. 5 Add drawings or other visual displays to descriptions as desired to provide additional detail.
W.K. 2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.

PE
3.1 Participate in physical activities that are enjoyable and challenging.
5.3 Demonstrate the characteristics of sharing in a physical activity.

## Contributors

Jezra Thompson

## Sources

Shelburne Farms Early Childhood Development

# Shapes in Nature 

## Objectives/Assessment Targets

Students will:

- Create rubbings or pressings to reveal the features of tree bark and leaves.
- Compare and contrast the various shapes, sizes, and textures of natural objects.
- Observe and describe features in the natural world that surrounds them.


## Activity Preparation

Prepare clipboards with paper for each student.

## Materials

- Butcher paper
- Tape
- Crayons
- Double-sided sticky paper
- Small cups for students to collect natural materials


## Activity 1: Making Bark Rubs

Assist students wrap butcher paper around the trunk of a tree. Distribute crayons and instruct students to rub the butcher paper with their crayons to reveal the sizes, shapes, and textures of the bark. Prompt students to walk around the tree to see what others have done.

Ask, What shapes do you see?

## Activity 2: Outlining Shapes in Nature

Students pair up and search for leaves of different shapes and sizes. Distribute crayons and butcher paper to each group. Guide student as they make leaf prints by placing leaves under the butcher paper and use the crayons to rub outlines of the leaves. Students observe the differences and similarities. Prompt students to describe the features of the leaves (smooth or rough, long or short, stems or no stems, etc.).

## Ask:

- What do you notice about the shapes of the leaves?
- What can the shapes of the leaves tell us about the type of tree or plants?
- Why would gardeners want to know the shapes of the leaves?


## Activity 3: Flower Press Art

Students pair up to pick flowers and colorful leaves for flower pressing art. Students regroup. Distribute double-sided sticky paper and demonstrate how to press flowers onto the paper, cover the paper with the sticky side, and then press.

## Preschool Focus: Eye Spy in Nature

Prompt students to play Eye Spy in Nature, an outdoor game that asks students to use their senses to observe their surroundings. Students use their eyes to identify clouds, trees, leaves, and soil according to prompts; use your nose to smell flowers, use your fingers to feel bark, and use your taste buds to try fruit.

## Student Reflection

What was your favorite object that you observed today?

## English Language Learning (ELL) Focus: Concrete Descriptive Adjectives

Use adjectives for color, size, and the senses to describe how objects look, feel, and sound.

## Standards

NGSS
K.LS1.1 Use observations to describe patterns of what plants and animals (including humans) need to survive.

CCSS
K.MD.A. 2 Directly compare two objects with a measurable attribute in common, to see which object has "more of" /"less of" the attribute, and describe the difference.

## Health

1.1.G Explain that living things grow and mature.
1.6.G Name and describe the five senses.

## Contributors

Jezra Thompson

Rivka Mason

## Sources

"Grow It, Try It, Like It," Team Nutrition

# Growing Vegetable Soup 

## Objectives/Assessment Targets

Students will:

- Plant seeds in soil.
- Water plants, as needed.
- Weed plants, as needed.


## Activity Preparation

Prepare bowls of soil, egg cartons, and seeds for students.

## Materials

- Egg cartons
- Seeds
- Soil
- Watering cans and water spray bottles


## Activity 1: Planting Vegetables

Read the book, "Growing Vegetable Soup." Prompt students to think about what is growing in the garden to put in vegetable soup. Students fill the egg carton cups with soil, plant a seed, and then spritz the seed start with water from a water spray bottle.

Explain that soil needs to be mixed around to allow for air and moisture to get in. Students use their shovels to mix the soil in all of the boxes.

Ask:

- What do you think will happen to the seed starts over time?
- What will you see tomorrow, the day after, and in a week?


## Activity 2: Weeding and Watering Plants

Help students weed the garden by identifying what a weed is, what a helpful garden plant is, and how to pull weeds. Students compare similarities and differences.

Distribute watering cans and prompt students to hypothesize how much water the plants need and how much comes from rain.

## Student Reflection

What plants that you planted today are you looking forward to eating? How should we prepare and eat them?

English Language Learning (ELL) Focus: Nouns to Verbs

- Plants, planting
- Weeds, weeding
- Water, watering

Standards
NGSS
K.LS1.1 Use observations to describe patterns of what plants and animals (including humans) need to survive.
K.ESS3.1 Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

## CCSS

K.SL. 1 Participate in collaborative conversations with diverse partners about Grade K topics and texts with peers and adults in small and larger groups.

## Health

1.1.G Explain that living things grow and mature.
1.6.G Name and describe the five senses.

## Contributors

Jezra Thompson
Sources
"Growing Vegetable Soup," by Lois Ehlert

# Plants for Breakfast 

## Objectives/Assessment Targets

Students will:

- Observe characteristics of plant parts
- Identify the plant parts that are represented in typical breakfast foods.
- Plan a meal that uses different plant parts.


## Activity Preparation

Collect a variety of fruits and vegetables. Place five food items that represent each plant part into one brown bag. Place one food item representing one plant part in one brown bag. Label each bag and include the following: Team 1 (wheat-seed), Team 2 (sweet potatoroot), Team 3 (broccoli-stem), Team 4 (strawberry—fruit), and Team 5 (parsley—leaf).

## Materials

- Brown paper bags (five for group work and 1 for activity 2 )
- Variety of fruits and vegetables for each team
- Samples of plants with leaf, stem, root, flower, and seed for each student (cut flowers are good)


## Activity 1: Describing Plant Parts

Show students a plant and review all of the parts: leaf, stem, roots, flower, and seed. Distribute a plant sample with all of the parts (a cut flower) to each student.

Ask, What are some characteristics of each plant part? (Roots are long and round; stems are long and flexible; flowers are brightly colored and have many petals; seeds are small and hard).

## Activity 2: Planning Breakfast

Introduce the brown paper bag that contains all of the food items. Prompt students to identify the plant parts that we eat for breakfast (seeds ground into flour, potatoes, sliced fruit).

Divide students into five groups, Teams 1-5. Distribute the worksheets and a prepared brown bag with only one plant part in it for each group. Instruct them to work together to determine what part of the plant the food item represents and complete Parts 1 and 2 of
the student worksheet. Each group selects a "reporter" to share the team's food item in the brown bag and the results from Part 1 and 2 with the class.

## Preschool Focus: Natural Collages

Make a plant collage with pictures of products and a sample of the plant it comes from. For example, paper comes from a tree; a shirt comes from the cotton plant.

## Student Reflection

What breakfast choices come from plants?

## English Language Learning (ELL) Focus: Routine Questions

- What's for breakfast?
- What's for lunch?
- What's for dinner?

Standards
NGSS
LS1.A Structure and Function. All organisms have external parts. Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

CCSS
SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

PE
4.3 Explain that nutritious food provides energy for physical activity.

Health
1.4.N Recognize the importance of a healthy breakfast.
7.2.N Plan a nutritious breakfast.
7.3.N Choose healthy foods in a variety of settings.

## Contributors

Jezra Thompson

## Sources

Linking Science and Nutrition, California Healthy Kids Resource Center, Network for Healthy California

## Plan a Plant Part Breakfast for Your Family!

Name: $\qquad$
I. Match the foods to the plant parts:

2. Choose one or two of the plant parts from above to make a family breakfast. Draw the breakfast on the plate below:

My Family Plant Part Breakfast


# What We Learned in the Garden 

## Objectives/Assessment Targets

Students will:

- Observe wind streamers and bubbles to review the direction and speed of the wind.
- Sort various animals according to their natural habitats.
- Describe various natural objects.


## Activity Preparation

Prepare a large piece of cardboard for students to collectively create a collage that expresses the current season. Prepare drawing materials for each student.

## Materials

- Cardboard
- Collage materials
- Glue and tape
- Construction paper
- Bubbles and wind streamers
- Stuffed animals and bins or containers
- Animal and plant visual aids


## Activity 1: Reviewing Weather and Climate

Students use wind streamers and bubbles to observe the direction and speed of the wind. Prompt students to notice how fast the wind is going, whether it changes direction, and whether it is warm or cold.

Ask, What season is it and why is the wind like it is today.

## Activity 2: Reviewing Animals

Gather stuffed animals and large bins, boxes, or baskets. Place the stuffed animals in three piles on one side of the room. Place large bins on the other side of the room with labels of different places in the garden. In pairs, students run to a pile, choose an animal, and get it to its "home."

## Activity 3: Reviewing Nature

Prepare tubs full of items from nature that students collect (pine cones, rocks, dried herbs, bugs). Students use their senses to find objects and describe what they have found. Prompt students to match what they have found with visual aids or examples of similar objects.

## Student Reflection

What is your favorite thing that you learned this year in the garden?
What is your favorite thing about the garden?

## English Language Learning (ELL) Focus: Commonalities

- I like the garden because $\qquad$ .
- My favorite thing about the garden is $\qquad$ because $\qquad$ .

Standards
NGSS
K.ESS2.1 Use and share observations of local weather conditions to describe patterns over time.
K.LS1.1 Use observations to describe patterns of what plants and animals need to survive.

LS1.A Structure and Function. All organisms have external parts. Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

CCSS
SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

PE
3.1 Participate in physical activities that are enjoyable and challenging.

## Contributors

Jezra Thompson

## Sources

Preschool Plan It

# First Grade <br> Lesson 1 <br> Garden Community 

## The 3 Be's

## Objectives/Assessment Targets

Students will:

- Name the rules to be followed in the garden.
- Sort images of objects as plants or non-plants.
- Discuss what they know and want to know about plants.


## Activity Preparation

Prepare a large piece of butcher paper. Divide it into sections lengthwise by drawing a line down the middle. Title one section "Is it a plant?" and the other "Why or why not?" Prepare another large piece of butcher paper and title it, "Questions we have about plants."

Make student journals by:

1. Stacking at least 36 sheets of $11 \times 17$ construction paper, colored and white.
2. Layering the paper lengthwise.
3. Stapling the center so the length is folded over.
4. Writing your name and class on the top.

## Materials

- Garden tools
- Large construction paper or cardboard
- Collage materials of a variety of objects, living and nonliving
- The 3 Be's poster or list used in the classroom


## Activity 1: The 3 Be's

Write the 3 Be's on the whiteboard. Here in Berkeley Unified, each school has its own set of 3 Be's principles that help with classroom management and student engagement. Remind students that we follow these same rules and practices in the garden. Invite students to share ways they currently practice each one and how they will practice each one in the garden this year.

1. Be Safe
2. Be Respectful
3. Be Responsible

## Activity 2: Welcome to the Garden

Show students the butcher paper divided into sections, "Is it a plant?" and "Why or why not?" Revisit this list during the garden tour and afterwards. Guide students on a quick tour and a tasting of a seasonal fruit, such as tomatoes, apples, or raspberries. Interactively discuss all of the tools used in the garden and discuss safety and respect for the garden; its plants, animals, and insects; each other; and ourselves.

Regroup students to list "Questions we have about plants," and revisit this at the end of the year with students.

## Student Reflection

Today we learned how to appropriately practice safety, respect, and responsibility in the garden. Tell your partner one behavior you learned.

## English Language Learning (ELL) Focus

- I am respectful.
- I am safe
- I am responsible


## Additional Information

Add a fruit/vegetable name game to learn each student's names.

## Standards

## Health

1.1.S Describe characteristics of safe and unsafe places.
1.4.G Describe how members of a family have various roles, responsibilities, and individual needs.
1.5.S Identify ways to reduce risk of injuries at home, at school, and in the community
1.13.S Identify refusal skills when in personal-safety situations (e.g., use a clear "no" statement, walk or run away, change subject, delay).
4.1.S Describe how to report dangerous situations.

## Contributors

Ben Goff
Chris Nakao
Jezra Thompson

## Sources

Life Lab Science Program, 2007


# First Grade <br> Lesson 2 <br> Plant Biology 

## Seeds

## Objectives/Assessment Targets

Students will:

- Compare seeds by their shake, feel, shape, texture, and color and whether they are for eating or planting.
- Describe seeds with a partner.
- Plant seeds, using a ruler to identify where and how deep to plant their seeds.
- Hypothesize, using words/drawings, about what students will see the next time they are in the garden.


## Activity Preparation

Prepare one tray with mixed edible seeds (lentils, corn, wheat, garbanzos, amaranth, and poppy seeds) and one with mixed nonedible seeds.

## Materials

- Mixed seed samples
- Egg cartons


## Activity 1: Sorting Seeds

Show students the seeds in the trays. Discuss the characteristics of the seeds.
Ask:

- How can the seeds be grouped together?
- How are different?
- How they are the same?

Explain that some seeds are eaten by people and some are eaten by animals. Other seeds are used for planting only. Seeds that are eaten by people are called edible. All other seeds are called nonedible.

Students compare and contrast the shake, feel, texture, color, and shape of the seeds through careful observation. Students share their observations in pairs.

## Activity 2: Planting Seeds

Students plant carrot seeds (or similar seasonal seeds) in the egg cartons or in the garden beds, using a ruler to help identify the location and the depth. Lead students in a conversation about how to care for the seeds.

Ask, What will happen to the seeds you have planted, and what will you see the next time you are in the garden?

## Student Reflection

What surprised you about seeds?
What will you tell the people at home about what we did today?

## English Language Learning (ELL) Focus: Prepositions and Future Tense

- I planted my seed in the ground/soil.
- When we come back to the garden, I think we will see $\qquad$ .
- I planted my seed in the ground.
- When I come back to the garden, I will see $\qquad$ .


## Additional Information

The story "A Seed is Sleepy," by Dianna Hutts Aston.
Standards
NGSS
1.LS1 Make observations to construct evidence-based accounts that young plants and animals are like, but not exactly like, their parents.

## CCSS

1.SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and larger groups.

PE
1.1 Demonstrate an awareness of personal space, general space, and boundaries while moving in different directions and at high, medium, and low levels in space.
5.3 Demonstrate the characteristics of sharing and cooperation in physical activity.
5.4 Invite others to use equipment or apparatus before repeating a turn.
5.6 Identify and demonstrate effective practices for working with a group without interfering with others.

## Contributors

Daria Wrubel
Jeanette Kjobmand
Jezra Thompson
Sources
Steven Hicks, "From Seed to Plant: A Unit to Help Grow Your Students' Knowledge of Plants," Scholastic Inc.

# First Grade <br> Lesson 3 <br> Plant Biology 

## Tops and Bottoms

## Objectives/Assessment Targets

Students will:

- Explain that plant parts need sun, soil, water, and air.
- Assist in preparing the garden beds.
- Plant tomatoes or cucumbers using plant starts.


## Activity Preparation

Prepare samples of roots and stems that we eat and those that we don't eat.

## Materials

- Plant starts with roots, stems, leaves, and flowers


## Activity 1: Labeling Plant Parts

Lead a conversation about plant parts by reading the book "Tops and Bottoms." Show the plant starts to review the four basic parts of a plant (roots, stems, leaves, and flowers).
Explain the functions of roots and leaves, and that all plants need sun, soil, water, and air to grow.

## Ask:

- What are the [leaves, roots] on a plant for?
- What do plants need to live?

Students pair share what they know about the function of roots and leaves.

## Activity 2: Getting to Know Plants

Lead students on a walk through the garden. Explain that when caring for a garden, we add extra water and take care of the soil by adding compost.

Ask, Is it a plant or not
Regroup students. Write on the butcher paper, "Is it a plant?" Students share what they saw on their tour, if it was a plant or not, and why or why not.

Write on the second piece of butcher paper, "Questions we have about plants." Students share their remaining questions they have about plants. Review and answer with student
participation. Post these questions in a place that can be seen throughout the year. Answer the remaining questions throughout the year, engaging students to consider the answers each time they are in the garden.

## Student Reflection

Plants need sun, soil, water, and air to live and grow. How are humans like plants?

## English Language Learning (ELL) Focus: Asking Questions

- What are the four parts of a plant?
- What do plants need to live?
- Why can't plants live without water? Sun? Soil? Air?
- Which are "tops?" Which are "bottoms?"
- Which are the leaves? Which are the roots? Which are the stems? Which are the flowers?

Standards
NGSS
LS1.A Structure and Function. All organisms have external parts. Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

CCSS
1.SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

## Contributors

Erica Woll
Jezra Thompson

## Sources

Evergreen University
Pondering Plants, First Grade Science Exploration, Life Lab
"Tops and Bottoms," by Janet Stevens

## Plant Parts

Can you fill in the blanks with the correct words?

## stem flower leaf roots



Name:

# First Grade <br> Lesson 4 <br> Nutrient Cycles 

## What's in Soil?

## Objectives/Assessment Targets

Students will:

- Identify and categorize the basic components of soil.
- Compare minerals and organic material.
- Analyze the content of soil samples.


## Activity Preparation

Fill plastic containers with mixtures of soil, compost, plant materials, and rocks. Fill water pitchers. Prepare a sample of amended soil.

## Materials

- Plastic containers with mixtures of soil, compost, plant materials, and rocks
- Water pitchers
- Sample of amended soil


## Activity 1: Sorting Soil

Prompt students to think about what soil is made of. Show the different components of soil by pulling out the items out of the prepared soil sample. Make a list on the whiteboard of all the items found:

- Rocks
- Dead plants
- Bugs
- Compost
- Clay
- Sand

Explain that soil is mostly clay, fine sand, tiny rocks, dead plants and leaves, and bugs.
These components can be put into two categories: "Minerals" and "Organic Material." Show a T-diagram to illustrate how to categorize these materials:

| Mineral | Organic Material |
| :---: | :---: |
| Rocks | Dead plants |
| Clay | Dead leaves |
| Sand | Bugs |
|  | Compost |

Add water to illustrate that water and air combine the ingredients to help them stick together.

Ask:

- What's the difference between minerals and organic material?
- How do air and water get into the soil?


## Activity 2: Collecting Soil Samples

Students pair up to collect soil samples in the plastic containers. Help students sort containers of soil, separating out the different components and categorizing them as minerals, water, and organic material. Prompt students to think about how air and water get added to the soil and why they're important.

Ask, Did you find anything that isn't on our list?

## Student Reflection

What is soil made of?

## English Language Learning (ELL) Focus: Listing Nouns

- Soil is made of $\qquad$ , ___ $\qquad$ , and $\qquad$ _.
- ________________ and combine to make soil.
- The four components of soil are $\qquad$
$\qquad$ and $\qquad$ .

Standards
NGSS
1.ESS3.C Human Impacts on Earth Systems. Things that people do to live comfortably can affect the world around them, but they can make choices that reduce their impacts on the land, water, air, and other living things.

## CCSS

1.SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

## Contributors

Daria Wrubel
Erica Woll
Jezra Thompson

## Sources

Space Travelers Lesson, Growing Classroom, Life Lab

# First Grade <br> Lesson 5 <br> Nutrient Cycles 

## Worm Anatomy

## Objectives/Assessment Targets

Students will:

- Identify basic worm anatomy though observation and handling of worms.
- Compare and contrast worm anatomy to human anatomy.
- Share at least two reasons that worms are important for the garden.


## Activity Preparation

Set up workstations for small student groups. Provide a piece of butcher paper on the floor or tables if inside the classroom, damp and dry paper towels for holding the worms and compost, and microscopes for each student group. Print and distribute worm parts quiz for each student.

## Materials

- Worm quiz worksheets
- Wet and dry paper towels
- Butcher paper or newspaper if working inside
- Microscopes
- Soil samples


## Activity1: Identifying Worm Anatomy

Review the components of soil: air, water, minerals, and organic material. Remind students that organic material is "living" material. That includes dead plants and many kinds of living creatures, such as bugs and worms. Explain that worms help the soil in two ways:

- They mix the soil by making holes and tunnels in it.
- Their castings help with decomposition.

Worms and other creatures, such as beetles and spiders, are called invertebrates, because they do not have a backbone. Prompt students to feel their own backbones for reference. Share more facts about worm anatomy:

- Worms have a mouth at one end and an anus at the other end. In between they have segments (setae).
- Worms move by retracting and expanding their muscles.
- Worms have 150 segments (setae).
- Unlike other invertebrates, worms don't have any eyes, teeth, pincers, or stingers.

Ask, How are worms different from humans? How are they the same?

## Activity 2: Worm Observation

Demonstrate how to gently handle worms by placing several of them on the back side of your hand. Distribute a handful of worms and compost to each prepared workstation.
Spread the worms out so that the students can handle and observe them. Assist students as they handle and observe the worms with microscopes. Students identify the parts of worm anatomy by completing the worm worksheet provided.

Ask, What are the two reasons that worms are important for the garden?

## Student Reflection

What is the most surprising thing you learned about worms today? What will you share with the people at home about what you learned?

## English Language Learning (ELL) Focus: Conjunctions

- Worms have segments, but they do not have backbones.
- Worms have mouths and anuses, but they do not have eyes and or teeth.
- Worms have segments, but they do not have legs.
- Worms have $\qquad$ but they do not have $\qquad$
- Humans have backbones, but invertebrates do not.


## Additional Information

Reading list: "Diary of a Worm," by Doreen Cronin.

## Standards

NGSS
1.LS1.A Structure and Function. All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air.

CCSS
1.SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and larger groups.

## Contributors:

Chris Nakao
Daria Wrubel
Erica Woll

## Jezra Thompson

## Sources

Enchanted Learning
Growing Minds, Appalachian Sustainable Agriculture Project, Farm to School Program
Worm Anatomy Quiz Answers


## Worm Anatomy Quiz

Name: $\qquad$ Classroom Teacher: $\qquad$


# First Grade <br> Lesson 6 <br> Nutrient Cycles 

## Investigating Insects

## Objectives/Assessment Targets

Students will:

- Explain the difference between garden friends and foes.
- Match insects in soil samples and in the garden with illustrations on the insect handout.
- Assist in preparing the garden for plant starts.
- Explain why insects and soil need each other.


## Activity Preparation

Collect soil samples in a large container. Collect insects from the garden or purchase some of the recommended insects from your local horticulture stores.

## Materials

- Amended soil samples with added insects (spiders, praying mantis, ladybugs, worms, beetles, roly-polies)
- Print-out of critters worksheet
- Magnifying glasses
- Small collection cups for each student


## Activity 1: Identifying Insects in Soil Samples

Explain that insects and soil need each other. Helpful insects help mix up the soil by making tunnels and holes. They also pollinate, decompose, and eat unhelpful insects. Insects need the soil for their food and as a warm, wet place to live.

Some insects can be friends and foes because they eat garden plants and they eat garden foes. Make a T-chart of helpful and unhelpful insects:

| Helpful insects <br> (Garden friends) | Unhelpful insects <br> (Garden foes) |
| :---: | :---: |
| Bees | Aphids |
| Butterflies |  |
| Worms |  |
| Beetles |  |
| Spiders |  |
| Ladybugs |  |
| Roly-polies |  |

Help students scoop soil samples from the large container and place them into their small cups. Handout the worksheets. Students find insects in the soil samples. Students match the insects they find with the ones that appear on the handout. [See below.]

## Activity 2: Finding Insects in the Garden

Explain that some plants will attract beneficial insects into the garden, such as dill, butterfly weed, fennel, coriander, and marigold. Take students on a garden tour to show them the plants and flowers that the insects like and why. Students can document what they find in their journals, matching the plants with the insects that like them.

## English Language Learning (ELL) Focus: Adjectives and Conjunctions

- Some insects, like $\qquad$ and $\qquad$ are helpful for the soil.
- Other insects, like $\qquad$ and $\qquad$ are unhelpful for the soil.
- These insects are helpful.
- Those insects are unhelpful.


## Additional Information

"I Wish I Were A Butterfly," by James Howe
"Insects Are My Life," by Megan McDonald

## Standards

NGSS
1.LS1.A Structure and Function. All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air.

CCSS
1.SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and larger groups.

## Contributors

Ben Goff
Jezra Thompson

## Sources

CVSWMD Organics, "Compost Critters: A Teacher's Guide to Compost Activities"
UC Davis entomologist Mary Louise Flint, "Pests of the Garden and Small Farm" and "The Natural Enemies Handbook"

## Critters Found in Soil

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Circle the critters you find in the garden and draw or write the name of the plant or flower that they life in the garden. (Hint: some of these critters like the compost best)


# First Grade <br> Lesson 7 <br> Cycles in Nature 

## Weather and Clouds

## Objectives/Assessment Targets

Students will:

- Define weather as a combination of sunlight, air, temperature, and moisture.
- Name the ingredients of a cloud.
- Observe an experiment that illustrates the formation of a cloud.
- Illustrate the process of cloud formation.


## Activity Preparation

Pour hot water into a thermos. Gather ice and dark colored paper for a backdrop. Print out About Clouds worksheet for each student.

## Materials

- Glass jar with a lid
- Hot water (a thermos helps keep it hot)
- Ice
- Dark colored paper for a backdrop
- About Clouds worksheet


## Activity 1: There Are Different Clouds

Review the different types of clouds and their characteristics with students. Distribute the worksheet below for students to label the different clouds they see.

1. Stratus: low-level cloud characterized by horizontal layering with a uniform base
2. Cirrus: generally characterized by thin, wispy strands
3. Cumulus: puffy or "cotton-like," with a flat base
4. Cumulonimbus: dense, towering vertical cloud associated with thunderstorms

Ask, What are clouds made of?

## Activity 2: Making a Cloud

Explain that weather is a combination of sunlight, air, temperature, and moisture. Explain that we need moisture, dust particles, and temperature change to make a cloud. Explain what they will observe: Moisture and warmth are provided by the hot water. As this moist, warm air rises in the jar, it gets cooler at the top of the jar near the ice. When the water vapor cools, it turns into liquid through condensation. The smoke from the match provides
a surface for the condensation, which produces tiny cloud drops. The cloud swirls inside the jar because of the circulation of warm air rising and cold air sinking.

Demonstrate to students how to make a cloud in a jar by following these steps:

1. Fill the bottom of the glass jar with an inch of hot water.
2. Swirl the hot water on the sides of the jar to warm up the glass.
3. Light a match.
4. Blow it out.
5. Throw the smoking match inside the jar quickly.
6. Replace the lid.
7. Place ice on top of the lid.
8. Hold the jar against a dark backdrop to observe the formation of a cloud.
9. Lift the lid so students can touch the cloud

Students observe cloud patterns, condensation, and how sunlight, air, temperature, and moisture interact with each other and draw illustrations of what they observed in their journals. Students label sunlight, air, temperature, and moisture in their drawings.

## Student Reflection

What is necessary for a cloud to form?

## English Language Learning (ELL) Focus: Adjectives

- Cool
- Warm
- Moist

Standards
NGSS
1.ESS2.D Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region and time. People record weather patterns over time.

CCSS
1.SL.1: Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

## Contributors

Jezra Thompson
Sources
National Weather Service Weather Forecast Office, Honolulu, HI

## About Clouds Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Fill in the clouds with your observations. Write what you notice about each of the different types of clouds.


# First Grade <br> Lesson 8 <br> Cycles in Nature 

## Earth's Patterns

## Objectives/Assessment Targets

Students will:

- Describe the day's weather.
- Compare today's weather with yesterday's.
- Forecast tomorrow's weather.
- Explain how shadows are made.


## Materials

- Rain gauge
- Journals and pencils
- Cups for collecting rain


## Activity Preparation

Set up cups around the garden during rainy weeks to collect rain.

## Activity 1: Observing Weather

Prompt the students to look outside and notice the weather.

## Ask:

- Is it sunny or cloudy?
- Are the clouds big or small?
- Is it windy?
- In what direction is the wind blowing?
- Is it raining?
- Does the temperature feel hot, cold, cool, or warm?
- What season is it?
- What was the weather like yesterday?
- What do you think the weather will be tomorrow?

Initiate a discussion about the sun. Examples: The sun gives us light and heat. The sun warms the sky (air), sea (water), and sand (land). Light from the sun or its absence causes the weather. Students draw the current weather in their journals.

## Ask:

- How does the weather change when the sun comes up or goes down?
- How does the sun feel on your skin?

Distribute and assist students in completing the Know Your Shadows worksheet to review weather patterns and the Earth's rotation. This activity is great to repeat throughout the year to allow students to observe many different types and patterns in weather.

## Students Reflect on the Lesson

Tell a partner about your favorite kind of weather.

## English Language Learning (ELL) Focus: Weather Adjectives

- Hot, warm
- Cold, cool
- Rainy, cloudy, sunny, clear
- Fast, slow
- Heavy, light

Standards
NGSS
1.ESS1.2 Make observations at different times of year to relate the amount of daylight to the time of year.

## CCSS

W.1.7 Participate in shared research and writing projects (e.g., explore a number of "howto" books on a given topic and use them to write a sentence of instructions).

## Contributors

Jezra Thompson

## Sources

Brain POP Jr.

# Knowing Our Shadows Worksheet 

Name: $\qquad$ Classroom Teacher: $\qquad$

| What we know | What we want to know <br> Ex. Shadows are images of <br> things. | Ex. Why sunflowers follow the <br> direction of the sun? |
| :---: | :---: | :---: |
| Rlants that are in the shadow of <br> bigger plants extend their <br> height to the sun in order to <br> avoid the shadow and reach the <br> sun. Plants continue to grow <br> and respond to the above <br> environmental cues, including <br> sunflowers that track the sun. |  |  |
|  |  |  |

# First Grade <br> Lesson 9 <br> Cycles in Nature 

## Temperatures in the Garden

## Objectives/Assessment Targets

Students will:

- Explain the connection between the season and the temperatures in the garden.
- Read a thermometer to compare the temperatures in different parts of the garden.
- Explain why temperature varies in the garden.
- Illustrate a thermometer in their journals.


## Activity Preparation

Set up three to four thermometers in hot and cold locations throughout the garden. Consider areas with varying degrees of sunlight and whether the thermometer is close to the ground or up in a tree. Draw a large diagram of a thermometer on the whiteboard that demonstrates the degrees of temperature.

## Materials

- Thermometer
- Diagram of a thermometer
- Portable whiteboard and markers.


## Activity 1: Taking the Garden's Temperature

Review lessons about the weather with students. Prompt students to pair-share characteristics of each season. Review the landscape of the garden, pointing out places that may be different temperatures. Display the thermometer on the whiteboard and demonstrate how to read a thermometer. Lead class in counting by ones, twos, and fives. Group students and lead each group in finding the thermometers and reading the temperature. Bring the whiteboard around to the different locations to illustrate how to count and read the temperature on the thermometers throughout the garden.

Ask, Why are these places colder or warmer?
Regroup students and discuss what they observed. Write down the student observation next to the temperature readings. Assist students in calculating the difference in temperature between the hottest and the coldest locations in the garden. If time allows, students can draw their own illustrations of a thermometer in their journals and practice counting.

## Students Reflect on the Lesson

What happens when you stand in the shade? When you stand in the sun?
English Language Learning (ELL) Focus: Comparatives

- This part of the garden is colder than $\qquad$ .
- The other part of the garden is warmer than $\qquad$ .

Standards
NGSS
1.ESS1.1 Patterns of the motion of the sun, moon, and stars in the sky can be observed, described and predicted.
1.ESS1.2 Make observations at different times of year to relate the amount of daylight to the time of year.

CCSS
1.MD.C. 4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in the other.
1.SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

## Contributors

Erica Woll
Jezra Thompson

## Sources

Temperature Hunt, Life Lab


Cragmont Elementary School

# First Grade <br> Lesson 10 <br> Nutrient Cycles 

## Sundials

## Objectives/Assessment Targets

Students will:

- Build sundials and observe shadows as the sun's position changes over time.
- Measure shadows and note the position of the sun.
- Identify patterns of change in the shadows.


## Activity Preparation

Gather enough materials and group them by what each student will need. This activity needs to be done on a sunny day.

## Materials

Enough for each student:

- Pencils (some are red)
- Straws
- Rulers
- Scissors
- Tape
- Paper plates
- Chalk


## Activity 1: Making Sundials

Review lesson 1.8, Earth's Patterns, and the role of the sun in the garden. Demonstrate how to make a sundial by following these steps:

1. Find the center of the paper plate and mark it with a dot.
2. Place four registration marks along the edge of the paper plate.
3. Make one mark longer than the others. These marks will help students reposition their sundials for taking measurements throughout the activity.
4. Make four half-inch cuts in one end of the straw section.
5. Flare out the cut portion of the straw and tape it onto the center of the paper plate.

6. The straw should be perpendicular to the surface of the plate.
7. Measure and cut the straw to a two-inch length.

Distribute plates, straws, pencils, rulers, scissors, and tape to students. Help students to repeat the process on their own.

## Activity 2: Using Sundials to Garden



Demonstrate how to track the sun and shadows over time by following these steps:

1. Mark the playground with chalk at the four registration points on the edge of their sundials. Remember to make one of the chalk marks longer so the sundials can be correctly repositioned.
2. Trace the straw's shadow with a pencil.
3. Darken in the shadow with the pencil and write the time at the tip of the shadow.
4. Note where the sun is in the sky (make sure that students don't look into the sun).
5. Measure the shadow length and fill in the data sheet.
6. Take more measurements later in the morning, at midday, and in the early afternoon throughout the month.

Distribute pencils, rulers, chalk, and sundials to students. Guide students to place their sundials in a sunny spot on the playground and follow the same steps

Ask:

- Where will the shadows be on your sundial in the late afternoon?
- Where will the shadow be at 2 PM (or any other afternoon time)?

Prompt students use a red pencil to outline the predicted shadow on their sundials.
Return the sundials to their marked locations on the playground the next afternoon, align registration points, and see if the student guesses for the 2 PM shadow were correct. Students may trace the real shadow to help compare it with their guesses.

## English Language Learning (ELL) Focus: Questions and Prepositions about Time.

- Where will the shadows be on your sundial at $\qquad$ ?


## Additional Information

Check in with students about this activity throughout the year.

## Ask:

- What did you observe?
- When was the shadow the longest? Where was the sun?
- When was the shadow the shortest? Where was the sun?
- Why do you think the shadows change length?
- How could you use a shadow to tell the time of day?

Standards
NGSS
1.ESS1.1 Use observations of the sun, moon, and stars to describe patterns that can be predicted.
1.ESS1.2 Make observations at different times of year to relate the amount of daylight to the time of year.

CCSS
MP. 5 Use appropriate tools strategically.
1.MD.C. 4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

## Contributors

Jezra Thompson

## Sources

"Sundials: Observing and Using Shadows," Eye On The Sky
University of California Berkeley educators and scientists at the Center for Science Education @ SSL in partnership with classroom teachers

World Regional Geography: People, Places, and Globalization, Climate and Latitude

# Introducing FBI 

## Objectives/Assessment Targets

Students will:

- Name the three decomposers necessary for decomposition.
- Dissect soil/compost samples for fungi and invertebrates.
- Explain why they are unable to see bacteria in the soil/compost samples.


## Activity Preparation

Collect samples of compost in various stages. Collect various examples of FBI in jars. Write the FBI and examples of them on the whiteboard.

## Materials

- Examples of fungi, bacteria, and invertebrates
- Samples of half-decomposed compost
- Magnifying lens
- Paper plates or paper towels


## Activity 1: Finding the Decomposers

Show students the compost pile. Prompt students to build imaginary compost pile in front of them. Students put down their hands, one on top of the other, and repeat, "Leftover food scraps and dry leaves or straw."

Discuss with students that compost turns back into soil through decomposition. Review key ideas about the relationship between soil and worms. Worms are just one of the three things necessary for turning compost into soil. Compost needs a mixture of FBI.

F-Fungi, such as mold and mushrooms, produce powerful chemicals (enzymes) that break down organic matter.

B-Bacteria are living organisms so small that you need a microscope to see them. Bacteria warm the compost pile and also break down organic matter.

I-Invertebrates, such as worms, beetles, and spiders, are animals that do not have a backbone. They eat decomposing organic matter, like plants and food scraps.

FBI are called the decomposers because they break down organic matter and turn it into soil. Soil bacteria along with fungi are the primary decomposers in the soil. That means they break down virtually everything.

Show students examples of fungi and invertebrates. Hold up each example and describe how it helps decomposition. Remind them that bacteria are necessary, but they are too small to see without a microscope.

Distribute trays with half decomposed compost samples, spoons or forks, and magnifying glasses. Students look for fungi and invertebrates. Prompt them to draw at least three examples of each and label them in their journals.

## Student Reflection

Are there other organisms that break down organic matter like the FBI do?

## English Language Learning (ELL) Focus: Verbal Phrase

To decompose means to break down.

## Additional Information

The FBI song is fun to sing with students at the end of class: "FBI (Fungus, Bacteria, and Invertebrates)" by the Banana Slug String Band (www.BananaSlugStringBand.com).

## Standards

NGSS
1.ESS1.2 Make observations (firsthand or from media) to collect data that can be used to make comparisons.

## CCSS

1.MD.C. 4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

## Contributors

Jezra Thompson

## Sources

Project EAT

First Grade
Lesson 12
Interdependence

# The Needs of Plants and Animals 

## Objectives/Assessment Targets

Students will:

- Sort living and nonliving things according to what they need to survive.
- Compare and contrast the needs of plants, animals, humans, and other organisms.


## Activity Preparation

Draw a Venn diagram on the whiteboard with the title, "What Do Animals, Plants, and Humans Need?" Label the three circles "plants," "humans," and "animals."

## Materials

- Journals
- Living and nonliving things to classify


## Activity 1: Describing Living and Nonliving Things

Review things in the garden that are living and nonliving. Make a list on the board to illustrate the comparison (e.g., living: can move on its own, breathes, can grow, requires energy in the form of food, requires water; nonliving: can't move on its own, doesn't breathe, doesn't grow, doesn't require food/water).

Every living thing has basic needs. Humans need food, water, shelter, oxygen, space, and appropriate temperatures to live. Other living things may have the same needs.

Depending on the organism, these needs may include: air, water, nutrients, food, light, shelter, space, certain temperatures, etc. Plants need soil, nutrients, sunlight, water, space, air, and appropriate temperatures to survive. Animals need food, water, shelter, oxygen, space, and appropriate temperatures.

A habitat is the natural environment where living things thrive, where they find everything they need in their habitat: food, water, and a home. A microhabitat is a habitat within a habitat. It's an extremely small environment, like a tree stump, a dead animal, or the crannies in a rock, where animals and plants live. Some microhabitats are formed naturally. Others are constructed to protect plants and animals.

Students use their journals to record this information, before and/or after they have discussed it. Students can also draw a Venn diagram to sort the needs of plants, animals, and humans.

## Student Reflection

How do animals and plants survive in nature? Where is their habitat?

## English Language Learning (ELL) Focus: Synonyms

- Living things = organisms
- Survive $=$ thrive $=$ live


## Additional Information

The Venn diagram provides the necessary conceptual overlay: a visual tool to think with.
Standards
NGSS
1.LS1.1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs

## CCSS

W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

## PE

5.1 Participate willingly in new physical activities
5.3 Demonstrate the characteristics of sharing and cooperation in physical activity
5.6 Identify and demonstrate effective practices for working with a group without interfering with others.

## Contributors

Jezra Thompson

## Sources

"Needs of Animals and Plants," Let's Do Science, Science Alberta Foundation
"Plant and Animal Needs," Manitoba Government

## Microhabitats

## Objectives/Assessment Targets

Students will:

- Describe several natural microhabitats.
- Create a terrarium as an example of a constructed or planned microhabitat.
- Describe and manage the moisture level in a terrarium.


## Activity Preparation

Clean the recycled containers for the terrarium using soapy water and rinse well. Cut the bottom off the plastic bottle, leaving at least five inches remaining on the bottom portion of the bottle. Alternate options for terrarium containers include glass jars, fish bowls, and food containers. You could use one large container to make a single terrarium for the class or have each student make a small terrarium.

## Materials

- Mason jars, or other clear containers (large enough to hold at least one liter)
- Examples of living (plants) and nonliving things (rocks) found in the garden that you can use in the terrarium
- Scissors
- Clear tape
- Soil
- Small plants
- Filtering charcoal (optional)
- Plants for terrariums


## Activity 1: Describing Microhabitats

Review lesson 1.12, The Needs of Plants and Animals, and demonstrate with examples living and nonliving things. Review that a habitat is the natural environment where living things thrive. The living things in the habitat find everything they need in their habitat: food, water, and a home. A microhabitat is a habitat within a habitat. It's an extremely small environment, like a tree stump, a dead animal, or the crannies in a rock where animals and plants live. Some microhabitats are formed naturally. Others are constructed to protect plants and animals.

## Activity 2: Constructing a Microhabitat

Explain that terrariums are miniature gardens—or habitats—that are enclosed in a clear container.

Ask, What kind of plants will fit best in our terrarium? Why?
Guide students as they set up terrariums using seeds and plants by following these steps:

1. Distribute the containers.
2. Add the charcoal to help with moisture (optional).
3. Fill the container approximately one-third full with moist potting mix, providing enough room for plants to root. The amount of soil you put in will depend on the size of the container.
4. Add a sterilized potting soil mix that is moist to avoid problems with mold and fungi. If water drips from the soil when pressed into a ball, then it is too wet. Add more dry potting soil to your mixture.
5. Add plants with the roots in the soil.
6. Add rocks and other found creatures, such as snails, isopods, and worms.
7. After planting, attach the container lid or cover the opening of the terrarium with plastic. Place the terrarium in a windowsill with indirect lighting or under grow lights. Do not place it in strong direct sunlight or water will evaporate too quickly and the plants may burn.

Prompt students to observe their terrariums closely for the first few days to make sure they have the proper moisture level. The top and sides of the terrarium should get misty with water droplets when in bright light, indicating the proper moisture level. If there is no moisture along the sides, then add more water. If the top and sides remain very wet continuously, making it hard to see the plants, remove the cover for a few hours. This will allow the water vapor to escape (evaporate). Once the terrarium has the proper moisture level, it should not need frequent attention.

## Student Reflection

Think of other ways to construct microhabitats.

## English Language Learning (ELL) Focus: Synonyms

- Wet
- Humid
- Moist


## Additional Information

Plants release water vapor into the air (transpiration) when there is light and heat present. Since the terrarium is an enclosed environment, when the water vapor leaves the plant (evaporation) and comes in contact with the side of the container, it forms droplets of water on the inside of the container (condensation). Once enough water accumulates or the
temperature decreases, the condensation will then fall back down the sides of the container into the soil (precipitation). The water gathers on the ground, whether in the soil, a body of water, or elsewhere (collection), until it evaporates and the water cycle continues. The moisture level of the soil put into the terrarium is very important.

Standards
NGSS
1.LS1.1 All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

## CCSS

W.1.7 Participate in shared research and writing projects (explore a number of "how-tos" books on a given topic and use them to write a sequence of instructions).

## Contributors

Jezra Thompson

## Sources

Kids Gardening: Helping Young Minds Grow
Plants, Animals, Wildlife, FOSS

## Six Plant Parts

## Objectives/Assessment Targets

Students will:

- Dance and chant to pantomime the parts of a plant.
- Identify the parts of a plant.
- Explain the purpose of the parts of a plant.
- Plant and label seed pots to take home.


## Activity Preparation

Print out seed packet labels and glue Popsicle sticks on them to place in seed pots. Draw the plant parts on the whiteboard. Label the six plant parts on several Post-its.

## Materials

- Fruit and vegetable cards
- Seed packet labels and Popsicle sticks
- Newspaper
- Soil
- Seeds
- Flower and plant part diagram
- Post-its


## Activity 1: Review Plant Parts

Review lesson 1.3, Tops and Bottoms. Hold up a flower with stems and leaves and the six plant parts. Show students the plant parts and diagram on the whiteboard. Distribute Postits with plant part names. Students place them on the plant part diagram to match the plant part. After all the Post Its have been placed correctly, explain the function of each plant part:

1. Roots: underground structure that feeds the plant and holds it in place.
2. Stem: part of the plant that carries water and nutrients.
3. Leaf: part of the plant that makes food.
4. Flower: colored and scented part of the plants that attracts pollinators.
5. Fruit: part of the plant that holds seeds.
6. Seed: part of the plant that can help grow a new plant.

## Activity 2: Dancing the Six Parts of a Plant

Demonstrate the "Six-Part Plant Dance" by:

1. Pointing to your toes and saying, "Roots!"
2. Moving your legs and saying, "Stems!"
3. Aiming your hands toward the sun and saying, "Leaves!"
4. Placing your hands around your face and saying, "Flowers!"
5. Clasping your hands together and saying, "Fruit!"
6. Wiggling your fingers to the ground like rain or falling seeds and saying, "Seeds!"

Invite students to dance along several times, with different students leading the group each time.

Demonstrate the "Roots, Stems, Leaves" chant:

1. Everyone sings: "Roots, stems, leaves, flowers, fruits, and seeds" (four times).
2. Teacher: "Well, that's six parts!"
3. Students: "That's six parts!"
4. Everyone sings: "Six plant parts that plants and people need."

## Activity 3: Planting Seed Start Pots

Distribute containers and newsprint to each student.

1. Lay out the newspaper.
2. Roll the container until the newspaper is a cylinder.
3. Tape the edges.
4. Fold the bottom like a present.
5. Fill with soil.
6. Plant seeds and water.

Students plant seeds in the pots after filling them with soil. Students fill out the My Seed cards and place them in their seed start pots to take home.

## Student Reflection

Which parts of the plants do we eat? What are examples of foods that you eat from each plant part?

English Language Learning (ELL) Focus: Plurals

| Regular plural | Irregular plural | Near-regular <br> plural |
| :---: | :---: | :---: |
| Stems | Fruit | Leaves |
| Roots |  |  |
| Flowers |  |  |

## Standards

NGSS
1.LS1.1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

CCSS
R1.1.1 Ask and answer questions about key details in a text.
PE
5.1 Participate willingly in new physical activities.

Contributors
Colette Rowe
Jezra Thompson
Rivka Mason
Sources
Hidden Villa
My Seed
Name:
Plant:
Water daily, $1-2$ Tablespoons.

- If it's in the house, put a plate
under the pot so it doesn't leak.
- After $2-3$ weeks, dig a hole in a
sunny spot and put the whole
pot in the ground. The pot will
decompose!
- Don't forget to keep watering

 My Seed
Name:
Plant:
- Water daily, $1-2$ Tablespoons.
- it's in the house, put a plate
under the pot so it doesn't leak.
After 2-3 weeks, dig a hole in a spot and put the whole
pot in the ground. The pot will
decompose!
- Don't forget to keep watering
your plant to help it grow!







## Plant Part Diagram



# First Grade 

## Eat a Rainbow

## Objectives/Assessment Targets

Students will:

- Name the health benefits of fruits and vegetables through a group chant.
- Taste different fruits and vegetables.
- Assemble cutouts of different fruits and vegetables to represent a rainbow.


## Activity Preparation

Set up workstations with collage materials and the salad recipe below for small groups.

## Materials

- Rainbow salad recipe
- Fruit and veggie cards
- Large butcher paper
- Pencils
- Scissors
- Colored construction paper
- Samples of fruits and veggies of different colors
- Small bowls for tasting and large bowls for mixing the salad


## Activity 1: Health Benefits by Color

Show students the fruit and vegetable cards (or samples of fruits and vegetables) and lead a conversation describing the colors and shapes of each fruit and veggie.

Ask, Have you ever eaten a rainbow?
Students pair-share a color and trait of a vegetable or fruit that they like and describe how it helps their health. Students share with the group why eating a wide variety of fruit and vegetables is like "eating a rainbow."

Demonstrate the fruit and vegetable color chant/dance. Students repeat your movements:

- Red helps my heart.
- Orange and yellow help my eyes.
- Green helps my eyes, my teeth, and my bones.
- Purple and blue help my brain.
- White helps my heart.

Show students the rainbow salad of sliced fruits and vegetables, highlighting their multiple colors. Students sample the food by making the rainbow salad recipe below or by making a crudité.

## Activity 2: Making a Fruit and Vegetable Rainbow Salad

Present a large piece of butcher paper and outline a large rainbow. Distribute pencils, construction paper, and scissors. Students draw fruit and vegetable shapes and cut them out. Prompt students to add their fruit and vegetable cutouts to the rainbow according to each ring of color. See the picture below.

## Student Reflection

Which was your favorite fruit or vegetable that you tried today? How will you describe it to the people at home?

English Language Learning (ELL) Focus: Formal/Informal
Vegetable/veggie
Standards
CCSS
1.MD.A. 1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.
W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

SL.1.1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and larger groups.

## PE

4.3 Explain that nutritious food provides energy for alertness and mental concentration.

## Contributors

Chris Nakao
Jezra Thompson
Rivka Mason

## Sources

Life Lab
Whole Kids Foundation

## Rainbow Salad Recipe

## Ingredients

- Orange carrots
- Red beets
- Purple cabbage
- Blue radish
- White turnip or cauliflower
- Red tomatoes
- Green lettuce

Dressing

- Olive oil
- Sesame seeds
- Rice vinegar
- Salt and pepper to taste
- Honey
- Lemon
- Tahini or tamari sauce (optional)

Steps

1. Slice up ingredients into bite-sized pieces.
2. Mix in salad dressing and serve.


Malcolm X Elementary School


Rosa Parks Elementary School

## Be Sugar Savvy

## Objectives/Assessment Targets

Students will:

- List foods that contain natural and added sugars.
- Create a poster to compare foods that contain natural and added sugars.
- Explain why foods with added sugar should be eaten in moderation.


## Activity Preparation

Print out worksheets for each student. Set up a demonstration station with sugar, water, teaspoons, and a cup.

## Materials

- Added Sugar worksheet
- Teaspoons and sugar
- Coloring materials


## Activity 1: Sorting Natural and Added Sugar

Review the following facts with your students and engage them in a discussion about foods that have added sugar (candy, cookies, etc.) compared to foods that are naturally sweet (fruit, milk, etc.).
"Naturally sweet" means that a food naturally contains sugar. Foods like fruits, vegetables, and dairy products contain natural sugar, along with vitamins, minerals, and fiber. Many foods contain natural sugars, including apples, carrots, mangos, sweet peas, bananas, and milk.
"Added sugar" means that sugar was added to the food. Many treats, like candy and soft drinks, are sweet because the sugar is added. Many foods contain added sugars, including crackers, cookies, cakes, and cereals, to name a few. The number-one source of added sugar in our diet is soft drinks (cola, soda pop). These foods are high in sugar and may also be low in vitamins, minerals, fiber, and other healthful things that your body needs to grow. Also, eating sugary foods can lead to cavities.

That is why foods with added sugar should not be everyday foods. They should be special treats, eaten once in a while.

Pass out the Added Sugar handout. Students divide a large piece of paper with a line down the center. Students cut out pictures of food they find in magazines, placing the foods with "natural sugar" on one side and foods with "added sugar" on the other side. Prompt students to label their posters and present them to the class.

## Activity 2: Counting Out Sugar

Show your students a teaspoon of sugar. Measure out piles of sugar to represent each item on the Added Sugar handout. Prompt students to count aloud as you measure each teaspoon.

Students color in the number of spoons of sugar, and then discuss the higher-sugar foods versus the lower-sugar foods. Clarify the meaning of "added sugar." Discuss where different sweeteners come from:

- Honey comes from bees.
- High-fructose corn syrup comes from corn.
- Granulated sugar comes from sugar beets or sugar cane

None of these sugars are found naturally in foods; these are all added sugars.

## Student Reflection

How do you think your body would feel if you had too much added sugar in foods or drinks?

How do you think your body would feel if you had healthy foods to eat and water to drink instead?

## English Language Learning (ELL) Focus: Series

Apples, carrots, mangos, sweet peas, bananas, and milk contain natural sugars.
Crackers, cookies, cakes, cereals, and soda contain added sugars.

## Additional Information

Have students hold and manipulate utensils; pour, stir, and shake; put things in the "right" place; and sort vegetables and fruits. Encourage children to eat a greater variety of foods for better nutrition and explore different foods with senses. Talk with students about their preferences and the characteristics of a variety of foods, such as color, shape, texture, and taste.

## Standards

CCSS
W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.

SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

Health
1.3.G Identify a variety of behaviors that promote healthy growth and development.

## Contributors

Jezra Thompson
Sources
California Department of Public Health, Network for a Healthy California
Healthy Living for Life, Alameda County Public Health Department— Nutrition Services
Rethink Your Drink

## Added Sugar Handout

20 oz. Soda
17 teaspoons
16 oz. Flavored Milk 15 teaspoons

16 oz. Energy Drinks 13 teaspoons

16 oz . Sweetened Iced Tea 12 teaspoons

12 oz. Coffee Drinks 8 teaspoons


20 oz. Sports Drinks 8 toaspoons


20 oz . Sweetened Bottled Water 8 teaspoons


6 oz. Fruit Drinks 6 teaspoons


# Words from the Garden 

## Objectives/Assessment Targets

Students will:

- Write and illustrate a story to share an idea or event they remember from the garden program.
- Use their senses to identify and document patterns in the garden.
- Tell and answer riddles about objects, plants, and animals related to the garden.


## Materials

- Garden journals and pencils


## Activity 1: Mystery Plant Riddles

Share several riddles with students and prompt them to guess the answer. For example, "I'm thinking of a plant that grows on vines. My plant provides us with large orange fruit, and you see my orange fruit in the month of October" (pumpkin). Students create their own riddle about their plant in their journals and then read them for all students to guess or pair-share.

## Activity 2: Sensory Scavenger Hunt

Guide students on a Sensory Scavenger Hunt to explore the school garden using all five senses. Students observe what they find in the garden, group them into living and nonliving categories, and discern what distinguishes the two. Prompt students to discover patterns and create criteria for distinguishing between living and nonliving.
Ask, What is a pattern, and where can we see a pattern in the garden?
Students draw the patterns they see and label the type of pattern in their journals. Invite students to write at least three sentences about the patterns, prompting them to think about:

1. Where they found them.
2. What they look like.
3. If there are other things in the garden that have similar patterns.

Ask, What can we learn from patterns in nature?

## Student Reflection

What will you share about what you learned today at home? What was surprising about today's lesson? What is the most surprising thing you learned this year in the garden?

## English Language Learning (ELL) Focus: Past Tense

- In the garden, I saw $\qquad$ .
- I heard $\qquad$ .
- I planted $\qquad$ .
- I ate $\qquad$ .
- I made $\qquad$ .

Standards
NGSS
1.LS3.1 Make observations to construct an evidence-based account for natural phenomena.
W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

SL.1.1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and larger groups.

## CCSS

R1.1.1 Ask and answer questions about key details in a text.
W.1.8 With guidance from adults, recall information from experiences or gather information from provided sources to answer a question.

## Contributors

Jezra Thompson

## Sources

University of Missouri Extension, Eating from the Garden, 2010

## The 3 Be's

## Objectives/Assessment Targets

Students will:

- Assemble journals to use during the garden program.
- Discuss the garden rules, practices, and guidelines.


## Activity Preparation

Write the 3 Be's on the whiteboard.

## Materials

- Examples of garden tools students will use throughout the year
- Materials to make a 3 Be's poster
- $11 \times 17$ construction paper, colored and white (at least 36 sheets per student)
- Stapler
- Drawing materials


## Activity 1: Our 3 Be's

Welcome students to the garden and facilitate introductions among garden teachers, teacher, volunteers if applicable, and students. Remind students that:

1. The garden and school are filled with diversity, and respecting other people and living things is valuable.
2. We have the same expectations in the garden as the classroom.

Invite a student to read the 3 Be 's on the whiteboard. Invite the full class to share examples of how they will practice each Be; write them on the whiteboard.

- Be Respectful: Respect all living things, including plants, animals, insects, and each other. Point out that some students may be frightened by certain insects and spiders in the garden and review appropriate ways to deal with fear. Highlight respect for each other by explaining one voice in circle and generating reasons this expectation is important.
- Be Safe: Use tools safely and responsibly (real tools for real jobs). Explain that the garden jobs students will work on together throughout the year are authentic to the needs of the garden and require the use of real tools. Explain that students will also learn where the toolshed is so that they know where to find tools, clean tools, and put tools back. Demonstrate how to walk on paths respectfully in the garden.

Explain that there will certainly be moments when students will be able to run in the garden, but in general walking is the safe way to get around in the garden.

- Be Responsible: Prompt students to think about this phrase and how it ties into being safe and respectful. Point out that not all plants are edible. Emphasize picking fruits and vegetables when they are ripe and ready. Explain that many fruits and some vegetables appear to be ready and mature when, in fact, they are still unripe. Use examples of apples, kiwis, strawberries, etc. Explain that asking before picking ensures students get to enjoy what is growing in the garden when it tastes the best. Explain picking responsibly and safely further, touching upon throwing crops and hoarding garden favorites (e.g., strawberries).


## Activity 2: Making Journals

Distribute construction paper and lined white paper to demonstrate how to make a garden journal:

1. Place a colored construction paper down lengthwise
2. Layer the white paper ( 36 sheets) over lengthwise.
3. Staple the center so the length is folded over.
4. Write your name and class on the top.

Students write their first journal entry.
Ask:

- What is growing in the beds?
- What happens when we step on the soil? (It becomes compacted/hard.)

Additional guidelines include:

- Ask questions: Explain that asking questions can help students be respectful, safe, and responsible. Encourage students to ask questions to a peer or teacher whenever they are unsure about something.
- Emphasize that the garden is a place to ask all sorts of questions about curiosities!
- Practice teamwork: Prompt students to think about what teamwork means and why it is so important in the garden. Explain that the garden only exists because of the student and teacher teamwork and collaboration that go into maintaining it.
- Introduce the "Try it!" principle. Emphasize that we always try a little of whatever is offered. It's okay if we don't like it. We make sure not to yell out how much we don't like something; instead, we can quietly put our food in the compost.


## Ask:

- What do people do when they are being safe in the garden?
- What do people do when they are being respectful in the garden?
- What do people do when they are being responsible in the garden?


## Student Reflection

Students name examples of how they can help and support one another in the garden.
Explain that the above expectations are important so that the garden can be a safe and fun place for all the students at school.

## English Language Learning (ELL) Focus: Routine Statements

- When I'm being safe, I $\qquad$ .
- When I'm being respectful, I $\qquad$ -.
- When I'm being responsible, I $\qquad$ .


## Additional Information

Tips from our garden educators: Begin each class with additional observation questions for students as they enter the garden.

## Ask:

- What fruits and vegetables are ready to eat in the garden right now?
- Can you find flowers of every color of the rainbow?
- What is new in the garden? What do you see that you've never seen before?
- What is missing? What have you seen before in the garden that you don't see anymore?


## Standards

## Health

4.1.M Identify and demonstrate ways to express needs and wants appropriately.
4.2.M Demonstrate how to ask for help from trusted adults or friends.
5.1.M Use a decision-making process for solving problems with peers and family members.
7.1.M Manage emotions appropriately in a variety of situations.
7.2.M Show respect for individual differences.
8.2.M Support peers in school and community activities.

## Contributors

Daria Wrubel
Jezra Thompson

## Sources

Berkeley Unified School District Gardening and Cooking Program

# Second Grade <br> Lesson 2 <br> Plant Biology 

## Seed Travel

## Objectives/Assessment Targets

Students will:

- Use the materials provided to experiment with different types of seeds, exploring their speeds and modes of travel.
- Compare and contrast the modes, speeds, and distances at which seeds can travel.
- Share observations in pairs or in journals.


## Activity Preparation

Prepare a collection of seeds (coconut, popcorn, milkweed, etc.), a slope for seeds to travel down, fabric or faux fur, and shallow containers of water for floating seeds. Write a list of the seven types of seed travelers on a whiteboard (see Additional Information).

## Materials

- Samples of mixed seeds
- Journals
- Buckets of water
- Slope
- Samples of clothing or faux animal fur


## Activity 1: Seven Ways that Seeds Travel

Use the list on the whiteboard to explain that there are seven ways for seeds to travel. Talk with students to compare and contrast the modes, speeds, and distances at which seeds can travel. Explain that we can test this information through our own experiments.

Ask, How do you and people you know help seeds travel?

## Activity 2: Experimenting with Seed Travel

Use the list on the whiteboard to present the types of traveling seeds and seed helpers. Explain that we can observe seeds traveling by experimenting with different seeds and a variety of materials. Distribute several types of seeds. Students work in pairs or small groups as they use the materials provided to observe how different seeds travel. Students document their experiments in their journals.

## Ask:

- Which seeds travel the most quickly?
- Which seeds travel the farthest?
- Which seeds need other creatures, such as animals or humans, to travel?


## Student Reflection

How do you help seeds travel?

## English Language Learning (ELL) Focus: Prepositions

- Some seeds burr into fur or attach to clothing when animals or people walk by.
- Wind blows some seeds over land.
- Some seeds travel down slopes or hills.
- Some seeds are eaten by animals.
- Some seeds float across the water.


## Additional Information

Below is a list of seed traveling styles, specific seeds, and their modes of transportation:

| Seven types of seed travelers | Examples | Seed helpers |
| :---: | :---: | :---: |
|  |  |  |
| Diggers | Acorns | Animals/people |
| Droppers | Ehrharta grass | Gravity |
| Poppers (exploders) | Broccoli seeds | Wind |
| Processers | Blackberries | Animals/people |
| Flyers | Dandelions | Wind |
| Floaters | Coconuts | Water |
| Stickers | Foxtails | Animals/people |

## Standards

NGSS
LS2.A Interdependent Relationships in Ecosystems. Plants depend on animals for pollination or to move their seeds around.
2.LS2.2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

CCSS
2.SL. 1 Participate in collaborative conversations with diverse partners about Grade 2 topics and texts with peers and adults in small and larger groups.
2.SL. 5 Identify real-life connections between words and their use.
1.1 Move to open spaces within boundaries while traveling at increasing rates of speed.
5.1 Participate in a variety of group settings (e.g., partners, small groups, large groups) without interfering with others.
5.2 Accept responsibility for one's own behavior in a group activity
5.4 Encourage others by using verbal and nonverbal communication.
5.6 Demonstrate how to solve a problem with another person during physical activity.
5.7 Participate positively in physical activities that rely on cooperation

## Contributors

Daria Wrubel
Erica Woll
Jezra Thompson
Sources
Arizona State University, School of Life Sciences
Plants and Animals, FOSS

# Second Grade <br> Lesson 3 <br> Plant Biology 

## From Beans to Plants

## Objectives/Assessment Targets

Students will:

- Review plant parts using the worksheet provided.
- Use materials provided to create a microenvironment for beans to germinate.
- Observe the beans over several days to identify parts of plants as they emerge.
- Hypothesize about the effect of improper care of the beans.


## Activity Preparation

Print worksheets for each student. Draw an outline of a plant (roots, stems, leaves, and flowers) and soil line according to the diagram below. Prepare glass jars or plastic bags, cotton balls, and soaked lima beans for each student pair.

## Materials

- Cotton balls, wool pieces, or paper towels
- Small containers of water
- Glass jars or plastic bags
- Dried lima beans, bean sprouts, or other sprouting beans


## Activity 1: Germinating Beans

Review the basic parts of a plant in lesson 1.3. Students pair up to germinate a dry bean spout following these steps:

1. Moisten several cotton balls or other cotton material with warm water. Allow any excess water to drip off, but do not squeeze it to speed up the process; squeezing the cotton can remove too much water and reduces the surface area of the cotton available for the beans' roots.
2. Place the cotton in a clear plastic bag or glass jar. The size of the jar or bag will depend on the amount of cotton you're using and how many beans you hope to germinate. A small sample bag can be used for a single bean, while a sandwich bag or quart-sized freezer bag should be used if germinating several beans. Once the beans start to grow, you can plant them in a garden or harvest the sprouts for use in salad or stir fry.
3. Place the beans you wish to germinate on top of the cotton in the bag. You don't need to press the beans into the cotton; just make sure they are in contact with it and not on top of other beans.
4. Seal the plastic bag and place it on a windowsill or other location where it will receive direct sunlight. Take care not to shift the beans around while moving the bag; you want them to remain on top of the cotton at all times.
5. Check on the beans each day until you notice germination beginning, after which you should open the bag to allow extra oxygen to reach the seed. Allow the beans to grow for several days until they are two to three inches long. This should be large enough to use in recipes or to transplant to your garden if you wish to grow full bean plants. Beans don't tolerate transplanting well, so you must sprout them without soil and plant them in the garden before they begin to form roots.

Prompt students to check on the beans each day and look for plant parts as they begin to emerge. Lead a discussion about what will happen to the beans over the next several days.

Ask, What will our beans need in order to grow into healthy plants?

## Student Reflection

In our experiment, we used cotton because it holds onto water, just like soil. What other kind of material could we use that holds water like soil?

## English Language Learning (ELL) Focus: Would, Should

- What would happen to our beans didn't get sunlight? They would $\qquad$ .
- What would happen if our beans didn't get enough water? They would $\qquad$ .
- What should we do if the beans get dry? We should $\qquad$ _.
- Why shouldn't we give the beans too much water? We shouldn't give the beans too much water because $\qquad$ .


## Standards

NGSS
PS1.1 Patterns in the natural and human designed world can be observed. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

PS1.3 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

PS1.4 Events have causes that generate observable patterns.
LS2.1 Plan and construct an investigation to determine if plants need sunlight and water to grow.

LS1.A Structure and Function. All organisms have external parts. Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

ESS2.C The roles of water in Earth's surface processes.

ESS2.1 The shape and stability of structures of natural and designed objects are related to their functions.

CCSS
RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
2.SL. 1 Participate in collaborative conversations with diverse partners about Grade 2 topics and texts with peers and adults in small and large groups.

## Contributors

Daria Wrubel
Jeanette Kjobmand

## Sources

Science of Life Explorations


# Second Grade <br> Lesson 4 Nutrient Cycles 

# The Compost Pyramid 

## Objectives/Assessment Targets

Student will:

- Identify the types of materials used to create a compost pile.
- Gather and assemble appropriate materials to build a compost pile.
- Explain why using organic materials to create compost can reduce waste.


## Activity Preparation

Prepare a whiteboard with images of the 4Rs and sample materials for each of the 4Rs: cleaned garbage, plastic containers, paper, food scraps, and cleaned sorting bins for recycling, trash, and compost. Draw the compost pyramid or cycle on the whiteboard. Prepare a collection of apple cores at different stages of decomposition.

## Materials

- Apple cores at different levels of decomposition
- Trash, recycling, and compost bins
- 4Rs signs
- Food scraps from past garden tastings
- Clippers (used for cutting compost materials)


## Activity 1: Organic vs. Inorganic

Review Lesson 1.4 on the 4Rs. Students share what they have learned about food scraps and compost in earlier grades. Explain that food scraps are organic matter because they are made up of living matter. Organic material is also called biodegradable, because it decays. "Decay" means the same thing as "rot" or "decompose." Inorganic matter is made of nonliving matter. Prompt students to share other examples of living and nonliving matter. As an example, show the decomposing apple cores.

Ask, What else do we use in school that can be put into the green compost bins?

## Activity 2: Making Compost Piles

Describe the ideal compost pile using the compost pyramid to demonstrate the importance of the ratio of proper materials. Point out that food scraps are in the green section of the pyramid. Review the following points:

- Worms use brown materials, such as trees, that will decompose.
- All fruits, vegetables, small pieces of eggshells, teabags without staples, and coffee grounds are great food for decomposers.
- Do not add dairy, meat, citrus fruits, or lots of oily food, which will cause the pile to smell bad and can attract unwelcome animals.
- When adding your browns, avoid weeds. Their seeds usually don't decompose and can cause a weed problem in your compost and garden beds.

Students collect "browns" and "greens" in the garden. Help students build the ideal compost pile with the material they find according to these steps:

1. Chop or break pieces into six inches or less.
2. Mix browns and greens so that there is half of each by volume.
3. Water the pile to keep it as wet as a wrung-out sponge.

Encourage students to add in food scrap materials from past garden tastings or the cafeteria throughout the year. Select a student to finish the pile with a layer of browns (finished compost or soil) to prevent flies from nesting.

## Student Reflection

Why is this ratio of browns to greens ideal for decomposition and the living organisms?

## English Language Learning (ELL) focus: Verbs

- Chop, chopping
- Mix, mixing
- Sort, sorting
- Water, watering


## Additional Information

Some materials, such as metal and plastics, are non-biodegradable, which means they do not decompose. Many of them can be recycled and reused into other items we use every day. Food scraps, used napkins, and other biodegradable material decays and can be composted to create rich soil amendments, reducing the amount of trash we add to our landfills. See the Story of Stuff video at http://storyofstuff.org/.

## Standards

NGSS
2.ESS1.1 Earth Systems. Understand processes that shape the earth. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
2.SL. 1 Participate in collaborative conversations with diverse partners about Grade 2 topics and texts with peers and adults in small and large groups.
2.SL. 5 Identify real-life connections between words and their use.

## Contributors

Daria Wrubel
Erica Woll
Jezra Thompson

## Sources

Do the Rot Thing

## Compost Pyramid

Name: $\qquad$ Classroom Teacher: $\qquad$


List all of the materials you added to the compost pile today according to their category in the Compost Pyramid above

# Second Grade <br> Lesson 5 <br> Nutrient Cycles 

## FBI

## Objectives/Assessment Targets

Students will:

- Observe evidence of fungus, bacteria, and invertebrates in soil samples.
- Explain the relation between FBI and healthy soil.
- Compare and contrast organic and inorganic material.
- Document their observations in charts.


## Activity Preparation

Set up workstations of butcher paper on the floor or tables and distribute scoops of compost with FBI on paper towels. Print out several copies of the Examples of FBI sheet for making FBI cards.

## Materials

- Samples of FBI found in the garden
- Wet and dry paper towels and butcher paper
- Microscopes
- Samples of half-finished compost
- Print-outs of Examples of FBI sheet


## Activity 1: Introducing Bacteria, Fungus, and Invertebrates to Compost

Review Lesson 2.4, Decomposition, and lesson 1.11, Introducing FBI. The garden has its own FBI: fungus, bacteria, and invertebrates.

Ask, What is the perfect compost pile made of?
Review that compost turns into soil through the process of decomposition. Students pairshare what they know about FBI found in the garden.

Ask, What are decomposers?
Discuss why FBI are important (their role in decomposition, water/air, burrows or tunnels, and mixing soil). Students observe amended soil samples and identify at least three different FBI:

1. Fungi, such as mold and mushrooms, produce powerful chemicals called enzymes that break down organic matter.
2. Bacteria are living organisms that are so small you need a microscope to see them. They heat up the compost pile and break down organic matter.
3. Invertebrates, such as worms, beetles, and spiders, are animals that do not have a backbone and eat decomposing plant material and food scraps.
Students draw what they see in their soil samples, name the type of FBI they see, and write a brief description about what they do to help compost decompose and turn into soil.

## Student Reflection

What materials did you use today that would be good for the compost pile?

## English Language Learning (ELL) Focus: The Language of Decomposition

- Fungi
- Bacteria
- Invertebrates
- Healthy, rich, amended soil


## Standards

NGSS
2.LS1.A Structure and Function. All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air.
2.PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

LS4.D There are many different kinds of living things in any area, and they exist in different places on land and in water.

CCSS
2.SL. 1 Participate in collaborative conversations with diverse partners about Grade 2 topics and texts with peers and adults in small and larger groups.
2.SL. 5 Identify real-life connections between words and their use (Ex. Describe foods that are spicy or juicy).

RI.2.1 Ask and answer such questions as who, what, where, why, and how to demonstrate understanding of key details in a text.
2.MD.D. 10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories.

## Contributors

## Erica Woll

Jezra Thompson

## Sources

Gardening for the Environment

## Project Eat

## Examples of Some FBI Found in Our Garden

Name: $\qquad$ Classroom Teacher: $\qquad$

## F.B.I.

1. What does the F.B.I. stand for?

F
B $\qquad$
I $\qquad$
2. What does the F.B.I. do?
3. Please draw 5 different things you observed in the compost in each box below:

4. Please draw 3 things that would be good to add to the compost pile.

|  |  |  |
| :--- | :--- | :--- |
|  |  |  |

## Rocks to Soil

## Objectives/Assessment Targets

Students will:

- Review the components of healthy soil.
- Describe the relationship between the amount of rocks in soil and its ability to retain water.
- Collect and analyze soil samples from the garden.
- Document the components of soil samples.


## Activity Preparation

Set up glass jars with lids and place masking tape on each jar. Label jars (enough for each group of four students) with the following titles: "organic matter," "sand," "silt," "clay," and "small rocks." Prepare additional samples of sand, silt, and clay to demonstrate the different consistencies.

## Materials

- Journals
- Several glass jars with lids
- Masking tape and markers
- Small containers for collecting soil samples
- Strainer or sieve
- Watering cans
- Samples of sandy and clay soils for demonstration with added rocks of varying sizes


## Activity 1: Why Are Rocks in Soil?

Review Lesson 1.4, What's in Soil? (Minerals, water, air, and organic material) Provide students with a handful of dirt and a handful of soil to investigate. Students identify the different contents and list them in their journals. Explain that soils differ in their color, texture, capacity to retain water, and ability to support the growth of many kinds of plants. Dirt is:

1. Broken-down rocks.
2. Not soil until it has organic, living material in it.
3. Breaks down and turns to dust or mud when it's wet.

Demonstrate with a handful of dirt and a handful of healthy soil with varying amounts of rocks. Pour water over each of your pre-prepared soil samples with varying amount of rocks. Initiate a conversation about what happens to the contents of the jar.

## Ask:

- Why do you think there are rocks of different shapes and sizes?
- What would happen if the wind picked up and blew over our soil samples?
- What would happen if a flood came through our soil samples?


## Activity 2: Collecting Soil Samples

Show students the glass jar filled with soil that you collected from the garden. Students work in pairs as they collect their own soil samples, noting the location where they found, the contents, and the soil characteristics (smell, feel, etc.) in their journals.

Regroup students with their samples. Assist them as they use a sieve to sort the different components of the soil and document what they've found. Students look for organic matter, sand, silt, clay, and small rocks.

## Activity 3: Testing Why Rocks Are Important in Soil

Demonstrate why we need rocks in soil by pouring water in each of your pre-prepared soil samples with varying amount of rocks. Prompt students to observe the jars as the components settle to the bottom.

## Ask:

- What do you think will happen?
- What actually has happened?


## Student Reflection

Why do we call dirt "dead soil?" What can we add to make it alive?

## English Language Learning (ELL) Focus: The Language of Science

- We analyze dirt and soil when we take it apart to look at the different components.
- We compare soil types when describe what is the same and different about types of soil.

Standards
NGSS
2.PS1.2 Analyze data obtained from testing different materials to determine which materials have properties that are best suited for an intended purpose.
2.PS1.3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
2.ESS. 1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

CCSS
2.SL. 1 Participate in collaborative conversations with diverse partners about Grade 2 topics and texts with peers and adults in small and larger groups.

MP. 4 Model with mathematics.

## Contributors

Jezra Thompson
Sources
Nitty Gritty, The Growing Classroom, Life Lab

# Second Grade <br> Lesson 7 <br> Cycles in Nature 

# Graphing Decomposition 

## Objectives/Assessment Targets

Students will:

- Observe and document varying stages of decomposition in their journals.
- Compare organic and inorganic material.
- Identify organic and inorganic material in their daily breakfasts, lunches, and snacks.


## Activity Preparation

Collect items for decomposition trivia, including wood chips, plant material, pencil, paper, undecomposed food, glass, plastic, metal, and ceramics.

## Materials

- Decomposition trivia items
- Glass jars with soil from Lesson 2.6
- Flower or vegetable seeds


## Activity 1: Reviewing Rocks to Soil

Review lesson 2.6, Rocks to Soil, and highlight soil composition. Return to the jars that students made during the last lesson. Help students plant flower or vegetable seeds in the different types of soil. Assign a student to water them over the course of a couple weeks and place them in the sun. Assign a student to monitor the development of the seeds and ask that they report monthly to the class.

## Ask:

- Can you determine which soil type is better for plant development?
- Why is this soil type the best for this?


## Activity 2: Decomposition Trivia

Show students the items collected for decomposition.
Ask, Which items will decompose, and which will not?
Students break into groups to brainstorm similarities and differences and group items into similar and different groups using the Picture Graph of Decomposition. Students make lists
and draw a picture graph and the number of objects in the worksheets, grouping objects according to whether or not they decompose.

## English Language Learning (ELL) Focus: Vocabulary

- Rot
- Decay
- Decompose
- Organic
- Inorganic


## Standards

NGSS
2.PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
2.PS1.2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. Every humanmade product is designed by applying some knowledge of the natural world and is built by using materials derived from the natural world.
2.PS1.4 Events have causes that generate observable patterns.
cCSS
RI.2.1 Ask and answer such questions as who, what, where, why, and how to demonstrate understanding of key details in a text.

RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
2.SL. 5 Identify real-life connections between words and their use (describe items that are smooth or rough).

MP. 5 Use appropriate tools strategically.
2.MD.D. 10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories.

## Contributors

Jezra Thompson

## Sources

Edible Schoolyard, NYC

## Picture Graph of Decomposition

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: List the object by name, count how many of each object, and place an x in the box if they will decompose. Does the object do something else to support the garden? If so, fill in the box, What else will they do?

| Objects | How many? | Will they <br> decompose? | What else will they <br> do? |
| :--- | :--- | :--- | :--- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
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|  |  |  |  |
|  |  |  |  |

## Bar Graph of Objects That Decompose

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Draw a picture and count the number of objects by putting an $x$ under the number.

| Draw the Object | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |  |  |

# Second Grade <br> Lesson 8 <br> Cycles in Nature 

## Gauging Water

## Objectives/Assessment Targets

Students will:

- Practice reading a ruler in preparation for reading a rain gauge.
- Use a rain gauge to calculate how much to water a plant.
- Evaluate the moisture in soil to determine whether to add additional water.


## Activity Preparation

Put dry garden soil in shallow buckets or containers. Add water to only one bucket and mix until the soil is very damp. Draw a diagram of a rain gauge on the whiteboard and use it to help students count and multiply inches of rain caught in the cylinder.

## Materials

- Garden soil
- Two shallow buckets or containers
- Rain gauge or beakers
- Rulers
- Plant starts in containers with holes on the bottom and plates underneath them
- Watering cans


## Activity 1: Counting Inches of Rain

Review that plants need water almost every day, in addition to sunlight, soil, and air.
Introduce measurement in the garden and why we measure how much water plants are getting.

Ask:

- What can we measure in the garden?
- Why do we measure these things?

We measure a plant's growth. We measure how deep to plant the seeds, we measure the spacing between seeds, and we measure the size of full-grown plants.

## Ask:

- How does nature provide water for plants?
- What do gardeners need to do if it hasn't rained?

Gardeners use a rain gauge to determine how much additional water they need to give their crops. Rain gauges are thought to be the most ancient weather instruments. A rain gauge is a cylinder that catches rain. If an inch collects in the cylinder, it means an inch of rain has fallen. Most standard rain gauges have a wide funnel leading into the cylinder and are calibrated so that one-tenth of an inch of rain is equal to one inch when it collects inside. Rainfall as low as 0.01 inches can be measured with this instrument. Anything under 0.01 inches is considered a trace. Guide students in reading a rain gauge by multiplying by 10s.

Distribute rulers. Guide a discussion on how to measure in inches using your ruler and rain gauge, using the following questions and answers:

1. Where do you begin measuring something on a ruler? (0)
2. How many small equal measures is one inch divided into? (8)
3. What do you call one fraction part of the inch? $(1 / 8)$
4. Find the halfway line for one inch. What is it called? $(1 / 2)$
5. How many $1 / 8$ equal $1 / 2$ ? (4)

## Activity 2: Using a Rain Gauge

Distribute beakers or rain gauges to groups of students. Assist students in taking turns pouring water up to the one-inch lines, measuring the total inches of water, and pouring this water onto the potted plant starts. Students then use their fingers to tests the dampness of the soil and report how many inches of water they needed to add in order for the soil to be damp at depths of one inch, two inch, three inches, and enough so that the water leaves through the bottom holes of the containers.

## Ask:

- How many inches of water does our plant starts need to be fully damp through to the roots?
- If we only had two inches of rain, how much additional water would we need to add to fully soak the plant to the roots?


## Student Reflection

How does nature provide water for plants? What do gardeners need to do if it hasn't rained?

## English Language Learning (ELL) Focus: Verbs to Nouns

- We measure the amount of rain to find out how much it has rained.
- We are measuring the amount of rain using a rain gauge.
- The measurement is the amount shown on the rain gauge.


## Additional Information

Rain gauges are believed to have been used in India more than 2,000 years ago.

## Standards

NGSS
2.ESS2.3 Obtain information to identify where water is found on Earth and that it can be solid or liquid.
2.ESS2.2 Develop a model to represent the shapes and kinds of land and bodies of water in an area.

CCSS
W.2.8 Recall information from experiences or gather information from provided sources to answer a question.
W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
2.NBT.A. 3 Read and write numbers to 1,000 using base-ten numerals, number names, and expanded form.

MP. 24 Model with mathematics.

## Contributors

Jezra Thompson

## Sources

Growing Minds, ASAP (Appalachian Sustainable Agriculture Project)
Math in the Garden: Hands-On Activities That Bring Math to Life, Botanical Garden, UC Berkeley

## Rain Gauge



# Second Grade <br> Lesson 9 <br> Cycles in Nature 

## Water Cycle

## Objectives/Assessment Targets

Students will:

- Mime the steps in the water cycle as review.
- Compare the moisture in several soil samples.
- Describe the temperature and texture of several soil samples.
- Determine when more water is necessary.


## Materials

- Watering can
- Two or more plant starts
- Dry and wet soil samples
- Water Hunt worksheet for each student


## Activity 1: Water Cycle Motion

Review lesson 1.7, Weather and Clouds. Guide the students in hand motions to review the water cycle following these steps:

1. Water starts in the clouds and falls to the earth as rain, snow, or hail.
2. Once the water reaches the ground, it is absorbed by the soil.
3. Plants take in water from the soil through their roots.
4. The water is absorbed from the roots and into the stem, leaves, flowers, or fruit.
5. The sun causes water to evaporate back into the air.
6. Clouds form when the air has a lot of water.
7. The clouds hold rain that falls back down onto the soil.

Ask, What are other kinds of cycles happen in the garden? (Seasons, decomposition, etc.)

## Activity 2: Testing Soil for Dampness

Present two or more plant starts at varying degrees of dampness.

1. Help students take turns feeling the dry soil and the wet soil with their fingers before and after watering.
2. Prompt students to pair-share as they describe the soil.

Ask:

- Does it feel cool, warm, crumbly, or clumpy?
- Does the soil look light or dark?
- What would it mean if the soil felt squishy or muddy? (Too much water.)

Select three students as "watering leaders" each week. Guide those students in testing the garden soil and watering the garden every day of their week. Rotate through the entire class.

Hand out the Water Hunt worksheet on a clipboard with pencils to each student. Guide students to explore the garden looking for various degrees of moisture or wetness. Students pair up to use the Water Hunt worksheet to identify plants that need water.

## Student Reflection

What are all the materials and tools gardeners need to make sure the garden is watered properly?

## English Language Learning (ELL) Focus: Adjectives of Texture

- Clumpy
- Crumbly
- Dry
- Smooth
- Rough
- Muddy
- Squishy


## Additional Information

Water is essential to life on Earth. In its three phases (liquid, gaseous, and frozen), water ties together the major parts of the Earth/climate system: air, clouds, ocean, lakes, vegetation, snowpack, and glaciers. It influences the intensity of climate variability and change. It is the key part of extreme events such as drought and floods. Its abundance and timely delivery are critical for meeting the needs of society and ecosystems.

## Standards

NGSS
ESS2.C The Roles of Water in the Earth's Surface Processes. Water is found in the ocean, rivers, lakes, and ponds. Water exists in solid ice and in liquid form.

ESS1.C The History of Planet Earth. Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

CCSS
RI.2.9 Compare and contrast the most important points presented by two texts on the same topic.

SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

## Contributors

Ben Goff
Jezra Thompson
Sources
Edible Schoolyard, NYC
Life Lab
The National Oceanic and Atmospheric Administration (NOAA) Education Resources

## Water Hunt Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Explore the garden. Find places that have different soil and plants. Note whether they are moist, damp, or wet.

| Location in the garden <br> Ex. Under the apple tree | Plant name/picture and how many <br> Ex. 3 Kale, 5 dandelion | Water observations <br> Ex. Wet, damp, dry |
| :---: | :---: | :---: |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# Second Grade <br> Lesson 10 <br> Cycles in Nature 

## The Power of Mulch

## Objectives/Assessment Targets

Students will:

- Measure the temperature of the soil using thermometers.
- Compare the temperature of mulched soil and un-mulched soil.
- Explain the relationship between the temperature of the soil and amount of weeds.
- Use a four-step process to make and test a hypothesis about how to influence the temperature of the soil.


## Activity Preparation

Prepare a garden bed with mulch and one without. Write the prompt questions (Experimenting with Temperature Using Mulch in the Garden) on the whiteboard to revisit after the activities.

## Materials

- Mulch
- Thermometers
- Journals and pencils


## Activity 1: Taking the Soil Temperature

Review lesson 1.9, Temperatures in the Garden. Refer to seasonality and focus on characteristics of the current season. Students pair-up and use thermometers to take the temperature of the soil in various locations in the garden beds. Students record this information in their journals, noting the location where they took the soil temperatures, whether there were a lot of plants, how much sunlight the area received, etc.

## Ask:

- How does temperature change the soil? (The temperature of the soil will help determine how many weeds are in the garden.)
- How we could change the temperature of the soil enough to kill the weeds, but not enough to hurt it?


## Activity 2: Experimenting with Mulch

Students observe the garden bed that has mulch and the one that does not.
Ask, How can we change the temperature of the soil enough to kill the weeds, but not enough to damage the soil?

Write some of the ideas on the whiteboard. Explain that they can test their ideas by using a step-by-step process. Present the following steps, along with the explanations:

1. Name the problem: How can we change the temperature of the soil to kill the weeds and keep the other plants healthy?
2. Make a hypothesis (a smart guess) about how to solve the problem.
3. Test the hypothesis with an experiment. (Describe your experiment. What will you do?)
4. Observe and document the results. (What happened? Did you experiment solve the problem? If not, make another hypothesis about how to solve the problem and conduct another experiment.)

Help students use the worksheet below to test and document their experiment. Remind students that they will check on the temperature of the soil in these exact same places next week.

## Student Reflection

Why do we want to kill the weeds? Why are weeds bad for the garden?

## English Language Learning (ELL) Focus: The Language of Science

- Hypothesis
- Educated guess
- Prediction
- Smart guess

Standards
NGSS
2.PS1.4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
2.PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

## CCSS

RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.

## Contributors

Jezra Thompson

## Sources

Soil Sterilization Lesson Plan, Bay Farm Elementary

## Experimenting With Temperature Using Mulch: Questions

1. Name the problem: How can we change the temperature of the soil to kill the weeds and keep the other plants healthy?
2. Make a hypothesis (a smart guess) about how to solve the problem.
3. Test the hypothesis with an experiment. (Describe your experiment. What will you do?)
4. Observe and document the results. (What happened? Did you experiment solve the problem? If not, make another hypothesis about how to solve the problem and conduct another experiment.)

# Second Grade <br> Lesson 11 <br> Plant Biology 

## Flower Parts

## Objectives/Assessment Targets

Students will:

- Name the parts of a flower, including their functions.
- Dissect flowers.
- Document the parts and their functions in their journals.


## Activity Preparation

Collect samples of flowers that illustrate similarities and differences and samples of weeds found in the garden. Print out a copy of the Flower Part diagram for student groups.

## Materials

- Microscopes
- Tweezers
- Tape or glue sticks
- Pieces of paper
- Flower samples
- Flower diagram


## Activity 1: Dissecting Flowers

Distribute flowers and the Flower Part diagram, and review the different parts and their functions (see below). Prompt students to talk in pairs to name as many parts as they can remember. Students take the flowers apart and tape them to the Flower Part diagram according to these steps:

1. Locate the outermost layer of flower parts. These are the sepals. Carefully remove the sepals. Record the numbers of sepals, attach one to the paper, and describe the function in your data table in your journal.
2. Identify the petals. These form the next layer of flower parts. Carefully remove each petal.
3. Locate the stamen, the male flower parts that are now being exposed. Record the number of stamen, attach one, and describe the function.
4. Record the number of pistils, attach one to the Flower Part Diagram.

## Student Reflection

Think of three reasons flowers are important for the garden.

## English Language Learning (ELL) Focus: Language of Science

- Locate
- Observe
- Identify
- Record
- Document


## Additional Information

The parts of the flower are usually found in whorls, or rings. Petals are one of the sets of whorls. Sepals lie outside the petals to protect the bud. The reproductive organs, the stamens and pistils, lie inside the petals. A stamen is a male reproductive part. It consists of an anther that is held up by a filament. The anther produces pollen grains. A pistil is a female reproductive part. Its top is called the stigma. It is sticky to ensure that when pollen grains land on it, they stick to it. The middle supporting structure is the style, and the large base is the ovary, where the eggs are produced.

## Standards

NGSS
LS1.A Structure and Function. All organisms have external parts. Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

CCSS
1.SL. 1 Participate in collaborative conversations with diverse partners about Grade 1 topics and texts with peers and adults in small and large groups.

## Contributors

Daria Wrubel
Jeanette Kjobmand
Jezra Thompson

## Sources

Flower Power, Growing Classroom, Life Lab

## Flower Part Diagram

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions:

1. Locate the outermost layer of flower parts. These are the sepals. Carefully remove the sepals. Record the numbers of sepals, attach one to the paper, and describe the function in your data table in your journal.
2. Identify the petals. These form the next layer of flower parts. Carefully remove each petal.
3. Locate the stamen, the male flower parts that are now being exposed. Record the number of stamen, attach one, and describe the function.
4. Record the number of pistils and detach one to the Flower Part Diagram.


# Measuring Our Harvest 

## Objectives/Assessment Targets

Students will:

- Create a scale using materials provided.
- Gather and weigh the harvest from the garden.
- Compare the weights of different fruits and vegetables.
- Use the My Hand Span method to measure various fruits and vegetables.


## Activity Preparation

Make a weight out of a hanger for weighing harvest:

1. Drill a small hole in each corner of the plastic containers.
2. Take one 18 -inch string and thread each end through two adjacent holes, securing each end with a knot.
3. Thread another string similarly on the opposite side so the strings are relatively even in length. Do the same for the second container.
4. Place a paper clip through each hook of the hanger to create a hook for the hanging containers.
5. Make a plumb line by tying a heavy washer to one end of the 12 -inch string and tying the other end to the middle of the hanger at the hood.
6. Test to see if the containers are even and balanced (see diagram below).

## Materials

- Two plastic containers with four holes drilled on the sides of each
- One hanger with hooks on the ends.
- One weight/heavy washer
- A roll of string


## Activity 1: Harvesting Our Garden

Assign student groups to harvest fruits and vegetables (only one or two per group) based on the suggested categories:

1. Brightly colored
2. Heavier than your shoe
3. Grows on a tree
4. Grows on a bush

## 5. Dug up from the soil

## Activity 2: Weighing Our Harvest

Guide students in weighing harvest on a balancing scale. Demonstrate how to use the balancing scale following these steps:

1. Have a student hold the balance.
2. Select a student to place an item from the harvest on one container of the balance.
3. Select other students to add items from the harvest to the other container until the plumb line is on the midpoint and the containers are balanced.
Students guess the weighs of the fruits and vegetables using the following questions:

- Which fruit or vegetable weighed the most?
- Which weighed the least?
- How did the balance scale results compare to your predictions?
- How could you check to see if a fruit and vegetable weighs the same as another?
- How do standard weights make it easier for gardeners to sell their harvest? (They know more accurately how much is being bought and sold.)


## Activity 3: Measuring Our Harvest

Demonstrate how gardeners use their hands to measure by following these steps:

1. Spread your hand on the surface of the whiteboard and mark the outer tips of your thumb and pinkie finger.
2. Use a ruler to connect the two points with a straight line and label the length "My Hand Span."
3. Count your hand span using one of the harvested items.

Assist students to measure their hand spans in their journals. Students measure the length of items in the harvest and record the number of hand spans of each item in their journal.

Ask, Why is the My Hand Span method useful for gardeners?

## Students Reflect

Show someone at home how to use the My Hand Span methods of measuring. What will you tell them?

## English Language Learning (ELL) Focus: Adjectives of Size

- Heavier than
- Lighter than
- Heaviest
- Lightest
- Smaller than
- Bigger than
- Smallest
- Biggest

Standards
NGSS
2.PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
K.2.ETS1.2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K.2.ETS1.3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

CCSS
MP. 4 Model with mathematics.
MP. 5 Use appropriate tools strategically.

## Contributors

Jezra Thompson

## Sources

Math in the Garden: Hands-On Activities that Bring Math to Life, Botanical Garden, University of California, Berkeley

## Hanger Scale



# Classifying Plants and Animals 

## Objectives/Assessment Targets

Students will:

- Identify how animals depend on plants and how plants depend on animals.
- Classify plants and animals found in the garden.


## Activity Preparation

Print out a copy of the worksheet for each student. Place identifying markers in the garden that highlight where students can collect different plants to collect.

## Materials

- Worksheets
- Crayons or other coloring materials


## Activity 1: Animals Need Plants

Give examples of ways animals depend on plants and ways plants depend on animals. For example, plants serve as a source of food and shelter, and animals help spread pollen and seeds. Students collect a variety of plant samples from the garden, according to your markers. Based on other lessons students have had in the garden, ask:

- What are examples of plants that animals depend on?
- How do they depend on them?
- Are there different types of animals that depend on the same plants for similar reasons?


## Activity 2: Identify and Group Animals According to Their Needs

Classify some common local plants found in the garden and animals that students have seen in the garden into groups on the basis of visible characteristics, for example, claws, beaks, and prickles. Distribute the two worksheets below. Students will:

1. Observe the Plant and Animal Needs drawing and think about what each animal in the picture may need to survive. Compare this to what the plants and animals in the garden need to survive.
2. List all of the animals that may need the same things. For example, trout and ducks need water to swim in, and pelicans and frogs need plants to eat.
3. List all of the things the animals in the picture may need to survive and how they get them. For example, trout need water to live in and smaller fish to eat, and they get these things by living in healthy ponds.
4. Color in the landscape. Encourage students to draw in additional things that the animals may need to survive.

## Student Reflection

What will you share about what you learned today at home? What was surprising about today's lesson?

## Additional Information

Read the book "Whose House Is This? A Look at Animal Homes-Webs, Nests, and Shells," by Elizabeth Gregoire, with the class and ask them to think about all the things animals need to survive.

Standards
NGSS
2.LS4.1 Make observations of plants and animals to compare the diversity of life in different habitats.

CCSS
W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

## Contributors

Jezra Thompson

## Sources

Needs of Animals and Plants, Let’s Do Science, Science Alberta Foundation
Plant and Animal Needs, Manitoba Government

## Plant and Animal Needs

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Examine the picture below. Use the boxes to list the needs of at least three animals you find in the picture. Answer the questions, how do the animals get their needs met. Ex. Fish need water. Fish get water from the pond.


Three Animals in This Picture:

| Need | How do they meet this need? |
| :--- | :--- |
|  |  |
|  |  |

Instructions: Explore the garden. Find animals and list them below. Describe what they need to live and how they get their needs met.

The Animals in Our Garden:

| Name of animal | Name of animal | Name of animal | Name of animal |
| :---: | :---: | :---: | :---: |
| Needs | Needs | Needs | Needs |
|  |  |  |  |
| How do they meet <br> their needs? | How do they meet <br> their needs? | How do they meet <br> their needs? | How do they meet <br> their needs? |
|  |  |  |  |
|  |  |  |  |

# Pollinators 

## Objectives/Assessment Targets

Students will:

- Hand-pollinate flowers using cotton swabs or paint brushes.
- Describe the flowers different pollinators prefer.
- Explain the importance of pollinators for plants and humans.


## Activity Preparation

Print out and glue or tape the Bee Sentence Stem poem and Flower Part diagram so that you can flip it back and forth to present the information to students. Outline the Pollinator Preferences chart with cells and titles on the whiteboard, which you can fill in with student participation in Activity 1.

## Materials

- Cotton swabs or paint brushes
- Flowers (one per student)
- Bee Sentence Stem poem and Flower Part diagram
- Chart of pollinator preferences


## Activity 1: Matching Pollinators with their Preferences

Review the plant parts and their functions: roots, stem, leaf, flower, fruit, and seed. Review the flower parts, identifying the stamen as the center of the flower that holds the pollen.

Explain that without pollinators, fruit plants and trees would not produce strawberries, plums, apples, apricots, etc. Show the Flower Part diagram and Bee Sentence Stem poem to reinforce this idea. Review that:

1. Pollinators are insects that transfer pollen so those plants can make seeds.
2. Plants have flowers to attract pollinators that take the pollen from one flower to another flower. This is called pollination, and we rely on pollinators to do this so that flowers can turn into fruits.
3. Pollinators are called "beneficial insects."
4. Pollinators prefer some flowers to others. If we plant certain flowers, we can expect their pollinators will come to help spread the pollen.

Share the Pollinator Preferences chart below.

Ask, What kind of flowers do $\qquad$ prefer?

## Activity 2: Pollinating by Hand

Explain that we can pollinate flowers by hand using a cotton swab or paint brush. Review that:

1. When a pollinator moves pollen from one flower to another, the pollen travels down the pistil.
2. At the bottom of the pistil, the pollen reaches an area called the ovary, where a fruit begins to form.
Distribute flowers and cotton swabs to each student and demonstrate how to pollinate the flowers following these steps:
3. Identify the petals.
4. Search for pollen inside the flower center, or stamen, by gently pinching the stamens.
5. Use the cotton swab or paintbrush to lightly dust the pollen from one flower's stamen to the next.

Students continue to care for the plant for the next two to three weeks. Prompt students to watch what happens to the flowers that were hand pollinated and share their observations.

## Student Reflection

Flowers need pollinators. People need pollinators, too. Can you explain why?

## English Language Learning (ELL) Focus: Parts of Speech

- Pollination= abstract noun
- Pollinators = noun
- Pollinate, pollinating = verb

Standards
NGSS
2.LS2.2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
2.LS4.1 Make observations of plants and animals to compare the diversity of life in different habitats.

CCSS
W.2.7 Participate in shared research and writing projects.

RI.2.9 Compare and contrast the most important points presented by two texts on the same topic.

## Contributors

## Colette Rowe

Jezra Thompson

## Sources

Kids Gardening: Helping Young Minds Grow
Science and Health Education Partnership, University of California, San Francisco
Pollinator Reference Chart

| Pollinator | Preferred flower |
| :---: | :---: |
| Beetle | White or dull colored, fruity or spicy fragrance |
| Honeybee | Showy, bright petals, often blue or yellow |
| Mosquito | Small flower, often white or green |
| Butterfly | Red, orange, blue, or yellow flowers |
| Bat | Large flower with fruity fragrance |
| Hummingbird | Red flower, tubular shape |
| Moth | White or yellow flowers with heavy fragrance |
| Wind | Small, odorless, colorless flowers |
| $[*$ This is a pollinator |  |
| that is not an insect.] |  |

Bees
There would nt be $\qquad$
Would rit be $\qquad$
Wouldn't be $\qquad$ on $\qquad$ trees
If it weren't for fuzzy old Buzzy old bees
Dusting pollen
From off their knees.


## Garden Herbs

## Objectives/Assessment Targets

Students will:

- Identify and describe various herbs in the garden.
- Gather herbs for a homemade herbal tea mix.
- Describe some of the medicinal properties of herbs.


## Activity Preparation

Make labels for the herbs in the garden with their names and their health benefits. Write the names of the herbs and their health benefits on the whiteboard for review.

## Materials

- Herb collection bowls
- Journals and pencils
- Pot with hot water and small cups for tasting


## Hunting for Herbs

Explain that herbs are plants with a particular medicinal quality. They have a unique smell and taste and are edible. For thousands of years, before modern medicine, people used herbs and other plants to treat illnesses.

Review the list of herbs in the garden and their medicinal uses. Lead students in a guided tour reviewing the different medicinal uses of garden plants that you previously labeled, many of which are common weeds. Students pair up and explore the garden to identify at least three herbs using the prompts below. Find an herb that:

1. Smells sweet
2. Textured
3. Small leaves

Students draw pictures of the herbs and describe their features (touch, smell, sound, appearance) in their journals.

## Activity 2: Using Herbs for Good

Students collect samples from the garden to make a topical herb mix. Make herbal tea with the class by adding the collected herbs to hot water, letting it steep, adding lemon and
honey, and then serving to students to taste. See examples of plants to include in the mix below.

## Student Reflection

What can you use herbs for? What are examples of herbs you have in your kitchen or garden?

## English Language Learning (ELL) Focus: Vocabulary

- Herb
- Herbs
- Herbal
- Herbicide


## Additional Information

1. Calendula flowers help to heal your skin when you have small scrapes and cuts.
2. Chickweed helps with skin itchiness.
3. Plantain is good for drawing out stingers and splinters.
4. Lavender is an anti-inflammatory that helps bring down swelling.
5. Mallow is related to the marshmallow plant that marshmallows were once made of and is moisturizing and soothing to the skin.
6. Mint is cooling to your skin, so it can be nice to put on inflamed, itchy spots, and it is good for stomachaches.
7. Ceonothus is a California native plant that is good for helping decrease the itching of poison oak. It was also used by the Native Americans in California.
8. Mugwort is for treating poison oak.
9. Lemon balm is soothing and calming when drunk in a tea.
10. Borage helps boost moods when eaten.
11. Aloe helps with burns and can be used after sunburn on the skin.

## Standards

NGSS
2.PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
2.PS1.2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

CCSS
W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

RI.2.3 Compare and contrast the most important point presented by two texts on the same topic.

Health
1.5.N Describe the benefits of drinking water in amounts consistent with current research based health guidelines.
1.8.N Identify and explore opportunities outside of school for regular participation in physical activity

## Contributors

Jeanette Kjobmand
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## Sources

Bay Farm Alameda Unified School District


Jefferson Elementary School

# Healthy Attractions 

## Objectives/Assessment Targets

Students will:

- Analyze the nutritional information on various cereal boxes.
- Compare and contrast the methods for attracting pollinators with the methods for attracting consumers.
- Work in teams to present a summary of methods for attracting consumers.


## Activity Preparation

Have students collect cereal boxes from home ahead of time. Collect or cut our nutrition facts labels. Print the three worksheets below for each student.

## Materials

- Empty cereal boxes (one per student team)
- Flower/cereal observation sheet
- Journals and pencils


## Activity 1: Nutrition Facts

Show students the nutrition facts on the cereal boxes. Demonstrate how to read a nutrition fact label. Call on a student to read the sugar, vitamins, and minerals content. Students compare the nutrition facts from their cereal boxes. Create a chart on the whiteboard to record the content of each type of cereal on the board.

## Ask:

- Which cereal has the most sugar and the least added sugar?
- Which one is the healthiest and why?
- What else could you choose for breakfast that would have less added sugar?
- Why is it important to eat a healthy breakfast?


## Activity 2: Attracting Consumers

Review the attraction between bees and flowers.
Ask, How do flowers and plants attract bees?
(Student theories may include: bees are attracted by the flowers' color, scent, or patterns.) Explain that as flowers try to attract bees, food labels try to attract you to buy their foods, like cereal. Show students the cereal boxes, and ask them which they prefer and why.

Ask, Are you attracted to a cereal box because of the way it looks or smells?
Group students into teams of four or five. Distribute Flower, Fruit, and Cereal Observation worksheets and cereal boxes to the teams (one per team). Students investigate and compare the ways cereal boxes and flowers attract attention. Team members share their notes and choose a "reporter" to present their observations.

## Ask:

- Why are the cereal boxes attractive?
- What have you discovered about attraction?
- What could you eat for breakfast that doesn't have packaging?


## Student Reflection

What other foods that you eat have packaging designed to attract you?

## English Language Learning (ELL) Focus: Attractive to, Attracted to

- Cereal boxes are attractive to consumers.
- Flowers are attractive to pollinators.
- Consumers are attracted to brightly colored cereal boxes.
- Pollinators are attracted to brightly colored flowers.


## Additional Information

You could pair this lesson with making a healthy breakfast with fruits, including the following:

- Cereal with berries
- Yogurt, granola, and fruit
- Peanut butter on whole-grain bread
- Hard-boiled egg and wheat toast
- Cottage cheese and fruit


## Standards

NGSS
2.PS1.1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

CCSS
W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

Health
1.1.N Classify various foods into appropriate food groups.
1.3.N Discuss the benefits of eating a nutritious breakfast every day.
1.4.N List the benefits of healthy eating (including beverages and snacks).
2.1.N Discuss how family, friends, and media influence food choices.
5.1.N Use a decision-making process to select healthy foods.
7.2.N Plan a nutritious meal.
8.1.N Practice making healthy eating choices with friends and family.

## Contributors

Jezra Thompson
Sources
Harvest of the Month
Linking Science and Nutrition: Tips, Lessons, and Resources for Integrating Instruction, California Healthy Kids Resources Center

## Flower, Fruit, and Cereal Observation

Name: $\qquad$

Date: $\qquad$

Names of Student Scientist Team Members: $\qquad$

| Flower or Fruit | Cereal |
| :---: | :---: |
| Name of Flower of Fruit | Name of Cereal |
| WHAT DO YOU SEE? <br> How many colors are on the flower or fruit? $\qquad$ <br> What are they? <br> Are the colors bright? Yes No <br> What shape is it? <br> Draw a picture of it below. | WHAT DO YOU SEE? <br> How many colors are on the box? $\qquad$ <br> What are they? <br> Are the colors bright? Yes No <br> What pictures are on the box? <br> Do the pictures draw your attention? Yes No <br> What words are on the box? <br> Are there any special toys on the box? $\square$ Yes $\square$ No <br> List any special toys below: |
| WHAT DO YOU SMELL? <br> Does it smell sweet? Yes No <br> Does it smell good? Yes No <br> Does it smell strong or faint? $\qquad$ | HOW DO YOU THINK THE CEREAL SMELLS? <br> Would it smell sweet? Yes No <br> Would it smell good? Yes $\square$ No <br> Would it smell strong or faint? $\qquad$ |
| ANY OTHER OBSERVATIONS? <br> Do you like this flower or fruit? $\square$ Yes No Why do you like or dislike it? | ANY OTHER OBSERVATIONS? <br> Would you eat this cereal? Yes No <br> Why would you eat or not eat this cereal? |

Flower or Fruit Observation Results

| Team | I | 2 | 3 | 4 | 5 | 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Flower or Fruit | Rose |  |  |  |  |  |
| Color(s) | Red |  |  |  |  |  |
| Shape or Box Design | Cup |  |  |  |  |  |
| Smell | Sweet, Good |  |  |  |  |  |
| Smell Strong or faint | Strong |  |  |  |  |  |
| Other Observations |  |  |  |  |  |  |
| Like it? | Yes |  |  |  |  |  |
| Reasons | Smells good Like the color |  |  |  |  |  |

## Cereal Box Observation Results

| Team | 1 | 2 | 3 | 4 | 5 | 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Cereal Box | Sugar Puffs |  |  |  |  |  |
| Color(s) | Red <br> Yellow <br> Bright colors |  |  |  |  |  |
| Box Design | Cartoon dog |  |  |  |  |  |
| Smell | Sweet |  |  |  |  |  |
| Smell Strong or faint | Strong |  |  |  |  |  |
| Other Observations | Toy inside |  |  |  |  |  |
| Like it? | Yes |  |  |  |  |  |
| Reasons | Smells good Like the color Want the toy |  |  |  |  |  |

# Creating Reflections 

## Objectives/Assessment Targets

Students will:

- Make leaf and flower presses.
- Reflect on what they have learned by writing poems, stories, or instructions.


## Materials

- Construction paper
- Art sponges
- Journals and drawing materials
- Glue or tape


## Activity 1: Making Leaf and Flower Presses

Prompt students to think about their favorite thing about the garden. Students collect leaves and flowers in the garden. Guide them to make leaf and flower prints by following these steps:

1. Use a sponge dipped lightly in paint to cover the leaf and press the painted leaf onto the paper.
2. Press flowers between paper towels and place a heavy object over them.
3. Remove the heavy object and layered paper to reveal a pressed flower or leaf.
4. Add glue to the plant and place it on a piece of construction paper.
5. Glue other garden objects onto the paper.

## Activity 2: Reflecting with Words

Prompt students to pick one or two of the following to add to their flower and leaf presses to reflect on what they learned about leaves and flowers:

1. A poem that describes the parts of a leaf and/or a flower.
2. A diagram/drawing to show what plants need in order to survive.
3. Instructions on how to make compost.
4. An imaginary conversation between a flower and a pollinator.

## Student Reflection

What was the most interesting thing you learned about the garden this year?

## English Language Learning (ELL) Focus: Superlatives and Past Tense

- The most interesting thing I learned was $\qquad$ .
- The most surprising thing I learned was $\qquad$ .


## Additional Information

The projects produced from these activities make excellent thank-you cards that support your relationships with various funders and donors who have supported your gardenbased education throughout the year.

## Standards

NGSS
2.PS1.2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
2.PS1.3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

CCSS
RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

RI.2.3 Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.

## Contributors

Jezra Thompson

## Sources

Berkeley Unified School District Gardening and Cooking Program


## Establishing Expectations

## Objectives/Assessment Targets

Students will:

- Make journals for use during the garden lessons.
- Review the rules, practices, and guidelines for the garden.
- Compare and contrast edible and nonedible plants.


## Activity Preparation

Review your school's 3 Be's and write them on the whiteboard.

## Materials

- $11 \times 17$ construction paper, colored and white (at least 36 sheets per student)
- Stapler
- Drawing materials


## Activity 1: Behavior Expectations

Be clear on expectations for student participation and behavior in the garden. Create a vision statement for how students will behave in the garden with student and teacher participation. Review and add practices for the 3 Be's:

1. Be Respectful
2. Be Safe
3. Be Responsible

## Activity 2: Making Garden Journals

Distribute construction paper and white paper to demonstrate how to make a garden journal:

1. Layer the paper lengthwise.
2. Staple the center so the length is folded over.
3. Write your name and class on the top.

## Activity 3: Review Tools and Safety

Practice what it looks like to be respectful, safe, and responsible in the garden. Ask for student volunteers to assist role-playing. Offer examples and invite students to contribute ideas of how students can practice each B:

## 1. Be Respectful

a. Listen to attentively to each other and instructions
b. Raise your hand
c. Ask before you pick
d. Stay on the paths
e. Don't yuck my yum when trying new foods
f. Use quiet voices
g. Don't disturb animals and plants
2. Be Safe
a. Handle tools with care
b. Don't raise tools above your waist
c. Ask before you use tools
d. Use tools as they are demonstrated by teachers

## 3. Be Responsible

a. Clean up tools when you are done
b. Keep a tidy garden and learning space
c. Lead garden tasks, such as watering, distributing and collecting journals, or feeding the chickens
d. Help your fellow students

Lead students through a guided tour of the garden while practicing some of the roleplaying examples, pointing out plants that are edible and nonedible. Invite students to taste new plants and describe their observations. Students describe their ideal garden in their journals. Prompt students to think about whether their garden contains both edible and nonedible things and which plants specifically.

## Student Reflection

How will you practice safety in the garden this year?

## English Language Learning (ELL) Focus: Vocabulary

- Respect
- Responsivity


## Standards

CCSS
W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons.

## Health

4.2.G Identify how to show respect for individual differences.
8.1.G Encourage peers to show respect for others regardless of differences in growth and development.
1.1.M Describe examples of healthy social behaviors (e.g., helping others, being respectful of others, cooperation, consideration).
4.1.M Demonstrate how to communicate directly, respectfully, and assertively regarding personal boundaries.
8.1.M Promote a positive and respectful school environment.

## Contributors

Jezra Thompson
Sources
Growing Minds, Farm to School

# Third Grade 

Lesson 2
Plant Biology

## Dissecting Beans

## Objectives/Assessment Targets

Students will:

- Identify the three parts of a soybean as an example of the anatomy of all legumes.
- Dissect soybeans and explain the purpose of each part.
- Plant soybeans and hypothesize about what will happen.


## Activity Preparation

Print copies of the Bean Anatomy diagram for each group or copy it onto the whiteboard. Soak soybeans in water for a few hours so students can dissect the bean easily. Prepare paper towels and dissecting materials at each group station. If time allows, prepare beans for students to plant in the garden.

## Materials

- Diagram of bean anatomy
- Soaked soybeans
- Dissection tools, such as tweezers, paper towels, and plastic knives
- Magnifying lens
- Small disposable cups, scoopers, soil, and beans for planting


## Activity 1: Dissecting Soybeans

Explain that all members of the bean family, also called legumes (soybeans, lima beans, kidney beans, green beans, etc.), have the same anatomy. Before dissection, students identify the three main parts of a bean and their functions using the diagram below:

1. Leaves (cotyledons) that form a thick container that stores food (glucose) for the new plant as it grows.
2. Core center of the bean (embryo) that sprouts out of the ground and grows into a plant.
3. Outer coat (hilum), a thin, transparent layer on the outer surface that protects the cotyledons and the embryo.

Students dissect the soybean and identify each part by following these steps:

1. Peel off the seed coat-it is a very thin, almost transparent, layer on the outer surface of the seed.
2. Gently split the seed in half, separating the bean's leaves (cotyledons).

## Activity 2: Planting Soybeans

Review tool safety in the garden. Call on students to demonstrate how to use each tool. Distribute planting materials. Working in pairs, students plant beans in the garden and hypothesize about what the beans will do over the next couple weeks. Note: In five to ten days, a plant will emerge out of each container. If more than one bean sprouts or germinates, have students carefully pull out all but the healthiest plant (thinning).

## Student Reflection

How are the seed's outside coat (the hilum) like our skin?

## English Language Learning (ELL) Focus: The Language of Science and Adjectives

- Seeds root when $\qquad$
- Seeds sprout $\qquad$
- Thick
- Thin
- Transparent


## Additional Information

Before the bean is planted, the cotyledons are usually not green. However, chlorophyll is activated and they appear green when the plant sprouts or germinates.

Standards
NGSS
3.LS3.2 Use evidence to support the explanation that traits can be influenced by the environment. Examples of the environment affecting a trait could exclude tall plants grown with insufficient water are stunted.

CCSS
RI.3.7 Use information gained from illustrations and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

## PE

5.6 Work in pairs or small groups to achieve an agreed-upon goal.

## Contributors

Colette Rowe
Daria Wrubel
Jezra Thompson

## Sources

Bean Seed Cycle, National Agriculture in the Classroom
Gene Networks in Seed Development
Western Sustainable Agriculture Research \& Education (SARE) Farm Internship Curriculum and Handbook: https://attra.ncat.org/intern_handbook/crop_rotation.html.

## Bean Anatomy Diagram



# Third Grade 

Lesson 3
Plant Biology

## Companion Planting

## Objectives/Assessment Targets

Students will:

- Identify different types of companion plants.
- Name several companion plants.
- Explain the purpose of companion plants.
- Design a garden bed using strategically placed companion plants.


## Activity Preparation

Collect your California Nutrition Network (CNN) Fruit and Vegetable Cards. Research companion plants for each CNN card. Glue or tape pictures and labels of companion plants to the back of cards. Write the five types of companion plants on the whiteboard (attractors, confusers, enchanters, protectors, or practice mutualism).

## Materials

- CNN Fruit and Vegetable Cards with labels of companion plants taped on the back
- Journals and colored pencils
- Companion planting matrix


## Activity 1: Identifying Companions

Discuss what companion planting is and why gardeners plan for this. Share the types of companion plants; reference the examples of companion plants in the matrix below.

Show the CNN fruit and veggie cards and review each plant's qualities and needs. Students use the vegetable and fruit cards to group companion plants and identify why certain plants should be grouped together in the garden.

Make a pile with all the cards. Students pick a card from the pile and stand by the person who has their companion plant card. Students guess what type of companions they are by using the information provided.

## Activity 2: Planning a Garden

Students use their garden journals to design their own garden bed based on what they learned about companion plants. Students label the plants and the type of companion they are with a brief description as to how they support each other.

## Activity 3: Planting Companions

Guide students as they plant winter companion plants, or "plants that like each other and help each other grow!" Students practice sowing the seeds of companions, transplanting a bed in companion configuration, or harvesting from two companions. Review the following vocabulary with students:

- Attractor plants attract pollinators to help pollinate the garden fruits. Examples are fruits with coloring, petals, and nectar.
- Confuser plants confuse pests by distracting them from eating or disturbing plant parts. One example is wispy parsley tops that confuse white flies into thinking that it is a carrot plant.
- Enchanter plants have a chemical reaction with certain other plants that make both plants grow larger together. Examples are basil and tomatoes.
- Protector plants physically help our other plants. One example is squash, which grows around corn stalks to protect them against weeds.
- Mutualism is when two living organisms help one another out. Some plants demonstrate this by helping each other grow.


## English Language Learning (ELL) Focus: Prepositions of Location

- I would plant $\qquad$ next to $\qquad$ .
- I would plant $\qquad$ near $\qquad$ _.
- I would plant $\qquad$ in front of $\qquad$ .
- I would plant $\qquad$ in between $\qquad$ .


## Additional Information

CA Nutrition Network (CNN) Harvest of the Month Fruit and Vegetable Cards can be ordered at no cost for education programs here:
http://www.harvestofthemonth.com/EdCorner/botanical.asp.

## Standards

NGSS
3.LS4.3 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.
3.LS4.4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. CCSS

RI.3.3 Describe the relationship between a series of historical events, scientific ideas, or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

## Contributors

Daria Wrubel
Jeanette Kjobmand
Jezra Thompson

## Sources

Companion Planting, Life Lab

## Sample Companion Plant Matrix

| Plant Name | Companion Plants |
| :---: | :---: |
| Beans | Potatoes, carrots, cucumbers, cabbage |
| Beets | Onions |
| Cabbage | Potatoes, celery, beets, onions |
| Carrots | Peas, lettuce, onions, tomatoes |
| Celery | Tomatoes, beans, cucumbers, squash |
| Corn | Potatoes, peas, beans, cucumbers, squash |
| Cucumber | Beans, corn, peas, radishes |
| Lettuce | Carrots, radishes |
| Onion | Beets, strawberries, lettuce |
| Peas | Carrots, radishes, cucumbers, beans |
| Potato | Beans, corn, cabbage |
| Radish | Peas, lettuce, cucumber |
| Squash | Corn |
| Strawberry | Beans, onion |
| Tomato | Onion, carrots, basil |

# Introducing Nitrogen 

## Objectives/Assessment Targets

Students will:

- Review the basic functions of soil.
- Identify the components of the decomposition cycle.
- Illustrate their own version of the decomposition cycle, representing the major steps.


## Activity Preparation

Print out a copy of the compost cycle diagram or draw it on the whiteboard. Print out a copy of the worksheet for each student.

## Materials

- Decomposition cycle diagram
- Examples of nitrogen-fixing organic and inorganic material, such as fava beans, dried blood, or fertilizers


## Activity 1: Introducing Nitrogen

Review Lesson 1.3 (Tops and Bottoms), and Lesson 2.4 (The Compost Pyramid). Review that soil performs four major functions:

1. Habitat for organisms
2. Recycles raw materials
3. Provides the foundation for engineering projects such as buildings, roads, and bridges
4. Supports plant growth

Review the role of organic material, decomposers, worms, and invertebrates (FBI). Show examples of nitrogen-fixing organic and inorganic material, such manure. Show fava beans with nodes to describe how they fix nitrogen into the soil.

## Fun facts:

1. Nitrogen is the most common gas found in the earth's atmosphere and is necessary for plant growth.
2. Gardens get nitrogen from the atmosphere, animal waste, and decaying and dead organisms.
3. Compost requires aerobic conditions for air or oxygen in order for decomposing bacteria to keep nitrogen in the soil.
4. This cycle reduces the amount of food waste we use in our landfill and produces rich soil for planting.

Divide students into small groups:

1. Plant fava beans
2. Add nitrogen fixing amendments to the soil
3. Turn the soil to aerate it

## Student Reflection

What is our role as humans in the decomposition cycle?

## English Language Learning (ELL) Focus: Definition of "Cycle"

- A series of events that happen over and over in the same order
- A series of events that are repeated over and over in the same order


## Additional Information

Aerobic Conditions: Requiring air or oxygen for life or survival. Some bacteria are obligate aerobes that require oxygen for respiration.

Anaerobic Conditions: Not requiring air or free oxygen.

## Standards

NGSS
3.LS4.4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. (Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.)

CCSS
RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

## Contributors

Jezra Thompson
Sources
Candela Open Course: Prokaryotes, Bacteria and Archaea, Candela Learning

# Third Grade <br> Lesson 5 <br> Nutrient Cycles 

## Worm Bins

## Objectives/Assessment Targets

Students will:

- Identify worms as important contributors to decomposition.
- Work in small groups to build a worm compost pile using materials provided.
- Provide appropriate food for the worm compost pile approximately once a week.


## Activity Preparation

Pre-shred newspaper. Set up small group tables for three to four students with shared materials for making worm bins.

## Materials

- Newspaper
- Scissors
- Rulers
- 3-5 buckets for groups to make worm bins
- Worms in compost
- Buckets of water
- Recycled containers to hold worms


## Activity 1: Worms are the "I" in FBI

Review lesson 2.5, FBI, and the role of decomposers. Describe how decomposers break things down and turn organic matter, like decaying plants and animals, into vitamin-rich compost.

Ask, What are the different ways that decomposers break food down?

## Fun facts about decomposers:

- Not only do sow bugs (scientifically called woodlice) eat decaying leaves, they also carry bacteria and fungi around the pile on their rounded backs.
- Snails and slugs chew rotting material into pieces that other decomposers like to eat.
- Millipedes and beetles feed directly on decaying plants and animals.


## Activity 2: Making a Worm Compost Bin

Show students worms in compost. Worms are a favorite decomposer. Students practice handling worms with care and confidence.

Ask, What do worms use for beds?

## Fun facts about worms:

- A worm can consume about half of its weight each day.
- A worm weighing 1 gram might eat $1 / 2$ gram of food in a day.

Review how to build a worm pile in a container using the steps below. Divide students into small groups and help them work in each of the four stations. Student groups switch activities every five to seven minutes. Students are grouped according to the four workstations:

1. Station 1: Work on shredding old newspaper. Model for students how large the pieces should be. They can use a ruler or scissors to help.
2. Station 2: Take the shredded pieces of paper, put them in a small bucket of water, and carefully squeeze out the excess water. Have students open up the pieces of paper and spread them out on the bottom of the worm bin.
3. Station 3: Observe the worms in small containers. Students can gently hold a worm. Model how to handle worms respectfully.
4. Station 4: Help students add fruit (no citrus) and vegetable scraps to the worm bin.

## Ongoing Activity

Student volunteers bring scraps from home to feed the worms approximately once a week. When feeding the worms, put the food in one area of the bin so it is easier to find the worms. They usually can be found closest to the food source.

## Student Reflection

How will we care for our worms going forward?

## English Language Learning (ELL) Focus: Vocabulary and Verbs

- Sow bugs eat decaying leaves.
- Sow bugs carry bacteria and fungi around the pile on their rounded backs.
- Snails and slugs chew rotting material into pieces.
- Millipedes and beetles feed on decaying plants and animals.


## Additional Information

Worms use brown materials, such as trees, that will decompose. All fruits, vegetables, small pieces of eggshells, teabags without staples, and coffee grounds are great food for decomposers. Do not add dairy, meat, citrus fruits, or lots of oily food, which will cause the
pile to smell bad and can attract unwelcome animals. When adding your browns, avoid weeds. Their seeds usually don't decompose and can cause a weed problem in your compost and garden beds.

## Standards

NGSS
3.LS4-3 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.

CCSS
RI3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

## Contributors

## Jezra Thompson

## Sources

University Extension: Garden and Yard, University of Maine
Worms, Worms, and Even More Worms: A Vermicomposting Guide for Teachers, California Environmental Protection Agency, Integrated Waste Management Board

# Third Grade 

Lesson 6
Soil

## Decomposition Cycle

## Objectives/Assessment Targets

Students will:

- Review the functions of FBI in decomposition.
- Identify the components of the decomposition cycle.
- Model decomposition and document it over time.


## Activity Preparation

Draw the decomposition cycle on the whiteboard. Draw a table on the whiteboard with two columns, one labeled "decompose" and the other "not decompose." Print out the worksheet for each student or student pairs.

## Materials

- Plastic bottle (large enough to fit small objects)
- Examples of items that will decompose (wood chips, plant material, newspaper, food)
- Examples of items that will not decompose (glass, plastic, metal, ceramic) small enough to it into a larger plastic bottle
- Materials for making posters
- Decomposition Cycle worksheet


## Activity 1: To Decompose or Not to Decompose

Show students examples of items that will decompose and those that won't. Students share other examples of items according to each category, as you write them on the board. (Little microbes will only eat certain things you throw in the trash.)

## Ask:

- What do we need for decomposition?
- How long does it take a banana peel, Kleenex, newspaper, plastic bottle, aluminum can, or glass bottle to decompose in a dump?
Students place objects from both categories, decompose and not decompose, into plastic bottles without lids. Students place masking tape on the bottles and write the class, their name, and the date. Students bury the bottles in the garden and mark their location.
Student journal their hypotheses about what will happen to the buried bottles over time and make a list of all of the items they placed in the bottle. Prompt them to make a timeline
and list the stages of decomposition or non-decomposition over the remainder of the school year.

Hand out the Decomposition Cycle worksheets for students to fill out as their exit ticket.

## Student Reflection

How is this exercise similar to what happens to fossils?

## Standards

NGSS
3.LS4.4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. LS2.C Ecosystems Dynamics, Functioning, and Resilience. When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

CCSS
RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

## Health

1.5.P Describe how a healthy environment is essential to personal and community health.
1.6.P Discuss how reducing, recycling, and reusing products make for a healthier environment.

## Contributors

Jezra Thompson

## Sources

Edible Schoolyard, NYC
Education Outside, Spring Valley Green Schoolyard, San Francisco Public School


## Decomposition Cycle

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Identify the stages and materials necessary for The Compost Cycle. Fill in the Stage names. Use the circles to draw or list the organic and inorganic materials that are necessary for each stage in the cycle.


Stage in the cycle $\qquad$
Stage in the cycle $\qquad$


# Third Grade <br> Lesson 7 <br> Cycles in Nature 

## Plants to Compost

## Objectives/Assessment Targets

Students will:

- Review the relationship between compost and healthy plants.
- Conduct an experiment to test the health of different soil compositions.
- Document the parameters and hypothesize about the results.


## Activity Preparation

Set up work stations with materials on each table for small student groups. Print out copies of the Plants to Compost worksheet for each student.

## Materials

- Compost or worm compost (add one part worm compost to three parts compost)
- Three containers, labeled: "1 Compost," "2 Compost/Soil," and "3 Soil"
- Seasonal seeds that sprout easily for planting in the containers (beans, sunflowers)
- A sample of soil and compost mixture


## Activity 1: Review the Roles of Compost

Compost improves soil by helping it hold water, adding nutrients for plants, and achieving good airflow. Compost also decreases the risk of plants getting diseases.

## Ask:

- What is compost made of?
- Why do we use compost in the garden?

Present different types of compost and soil mixtures and prompt students to use their senses to observe and hypothesize why certain soils may be better and why we add compost to soils.

## Activity 2: Plants to Compost

Show students the containers with the different labels. Help students fill the planter containers with soil and compost according to the labels on the containers.

Assign a student to place three seeds in each of the containers. Each student waters the containers until they are soaked.

Distribute the worksheet below to students. Students describe what is in each container, the types of seeds planted, and the different composition of soil and compost.

## Ask:

- What do you think will happen to the seeds in the different containers and why?
- Which seeds will grow the fastest and why?

Students keep the worksheets so they can document the changes they observe in each container over time. Assign a student to monitor for each container who reports back to the class next time you meet.

## Student Reflection

Call and repeat: Healthy soil means healthy plants!

## English Language Learning (ELL) Focus: Superlatives

- The $\qquad$ seeds will grow the fastest
- The $\qquad$ seeds will grow the slowest.
- The $\qquad$ container has the healthiest soil.


## Standards

NGSS
3.LS3-3 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.

LS2-C Ecosystem Dynamics, Functioning, and Resilience. When the environment changes in was that affect a place's physical characteristics, temperature, or availability of resources, some organism survive and reproduce, other move to new locations, yet others move into the transformed environment, and some die.

## CCSS

RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
W.3.7 Conduct short research projects that build knowledge about a topic.

## Contributors

Jezra Thompson

## Sources

Plants to Compost, Do The Rot Thing

## Plants in Compost

## Name:

$\qquad$

Plant Species: $\qquad$ Date Planted: $\qquad$

## Potting Mixtures:

\#1. $\qquad$
\#2. $\qquad$
\#3. $\qquad$


| Sprouting | Plant | Date | \# of Seeds Sprouted |
| :--- | :--- | :--- | :--- |
| Section \#1 |  |  |  |
| Section \#2 |  |  |  |
| Section \#3 |  |  |  |


| Growth | Plant | Date |  |
| :--- | :--- | :--- | :--- |
| Section \#1 |  | $\square$ | Height |
| Section \#2 |  | $\square$ | $\square$ |
| Section \#3 |  | $\square$ | $\square$ |

Name: $\qquad$ Date: $\qquad$

# Third Grade <br> Lesson 8 <br> Cycles in Nature 

## Native Plants Conserve Water

## Objectives/Assessment Targets

Students will:

- Observe and document the results from the Plants to Compost lesson.
- Define drought.
- Explain the value of native plants, especially in times of drought.
- Plant native seedlings.


## Activity Preparation

Present soil samples on tables from lesson 3.7. Prepare materials for each student to plant a native plant seed.

## Materials

- Soil samples from Lesson 3.7
- Native plant seeds
- Small seeding containers, one for each student
- Soil
- Watering cans with recycled water
- Garden journals and pencils


## Activity 1: Documenting New Data for Plants to Compost Experiment.

Review lesson 3.7, Plant to Compost. Ask each student monitors to share what they observed in the containers over time.

## Ask:

- Which seeds grew the fastest? The slowest?
- How do the results compare with your hypotheses?

Hand out Plant to Compost worksheet back to students. Students to continue to use the worksheet to record what they observe, including height of the plant, leaves, soil composition, etc. After a few weeks, students examine the data they collected and add this information to their worksheet.

## Activity 2: Conserving Water at Home

Review the basic needs of plants: sun, soil, and water. When water is very scarce because it hasn't rained in a long time, it's called a drought. Plants conserve the water they do have and struggle to conserve during a drought. Certain plants, such as the grass in your lawn, respond to a drought by slowing down so they don't grow as much or as fast. We call this process "going semi-dormant."

Students share ways they can conserve water at home.. These are two ways to save water that usually goes to waste:

1. Get a bucket to catch extra water when you run the water before a shower to water trees, shrubs, and nonedible plants.
2. Place a bucket under downspouts to catch runoff from any rain that falls.

Ask, Can you think of other ways to conserve water at home?

## Activity 3: Native Planting

Explain that you can conserve water and prepare your garden before a drought by planting native plants instead of non-native plants. Native plants naturally occur in the local environment and have evolved under local conditions to adapt to the climate. They require less care (water and fertilizers) than non-native plants and are more likely to survive a drought.

Demonstrate how to make seed starts:

1. Fill a small compostable container with amended soil
2. Make a small indentation and place the seed inside.
3. Cover the seed with soil and water.
4. Place in a well light space

Students prepare seedlings for native plants in small groups. Encourage students to think of ways they can use recycled water to water the seedlings over time.

Ask, Why will native plants survive better than other plants in the garden?

## Student Reflection

What is our role in helping our garden survive a drought?

## English Language Learning (ELL) Focus: Prepositions

- During a drought we can $\qquad$ .
- While we're in a drought we can $\qquad$ .
- Since we're in a drought we can $\qquad$ .


## Standards

NGSS
3.LS4.3 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.

CCSS
RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
W.3.2 Write informative/explanatory texts, supporting a point of view with reasons.

## Contributors

Jezra Thompson
Sources
Plants to Compost, Do the Rot Thing

# Third Grade <br> Lesson 9 <br> Cycles in Nature 

# Hibernation and Migration 

## Objectives/Assessment Targets

Students will:

1. Compare the meaning of "hibernation," "hibernate," "migration," and "migrate."
2. Sort animals into two groups: Those that hibernate and those that migrate.
3. Make a bird feeder.

## Activity Preparation

Prepare materials for student groups of three or four to make bird feeders.

## Materials

- An empty plastic milk or water bottle, or a milk carton
- Scissors
- String
- Bird seed


## Activity 1: Where Do Animals Go When They Hibernate?

Review lessons on seasonality and focus on winter, the current season.

## Ask:

- What do you do in the winter?
- What do plants and animals do in the winter?

Define the word "hibernation." Read from the recommended books in the Additional Information section on animal hibernation. Certain mammals are able to sleep through the winter to conserve energy, which we call hibernate. They bed down in the fall and don't wake up again until the spring. Raccoons and skunks do it. So do woodchucks and chipmunks, hamsters and hedgehogs, bats and bears.

Explain the word "migration." Many animals migrate in order to find food and escape bad weather. Some birds that migrate are hummingbirds, nightingales, and orioles. Insects migrate, too.

Distribute the worksheet to students in groups. Students record what they know about hibernation and add new vocabulary they learned today to their worksheets.

## Activity 2: Making Bird Feeders for Winter

Student groups make bird feeders for the garden or for their home garden by following these steps:

1. Wash the bottle or carton and rinse it well.
2. Cut several small holes in the sides, about two inches from the bottom.
3. Cut or poke two small holes near the top and thread a long piece of string through them.
4. Fill the bird feeder with seeds and hang from a tree or shrub. Scattering some seeds on the ground can help the birds find the feeder.
5. Watch the birds. Be patient.
6. Try different types of seeds and different locations.
7. Record observations in garden journals.

## Student Reflection

Think of an animal that hibernates. Explain to the person next to you why.
Think of an animal that migrates. Explain to the person next to you why.

## English Language Learning (ELL) Focus: Nouns to Verbs

- Hibernation > Hibernate
- Migration > Migrate


## Additional Information

Cold weather requires warm-blooded animals to use lots of energy to maintain their body temperatures. Hibernation allows animals to consume lots of food when the weather is warm and food is plentiful. This food is then stored as fat, which is used as energy during the winter. Animals can hibernate anywhere from days to months. The animal's low body temperature and metabolic rate of hibernation require less energy than the animal would normally use.

## Supplementary reading:

- "More Bears!" by Kenn Nesbitt
- "Animals Hibernating: How Animals Survive Extreme Conditions," by Pamela Hickman
- "Do Not Disturb: The Mysteries of Animal Hibernation and Sleep," by Margery Facklam
- "Animals in Winter," by Henrietta Bancroft and Richard G. Van Gelder
- "Bear Essentials of Hibernation," by Peter Tyson

Standards
NGSS
3.LS4.3 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.
3.LS4.4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

LS2.C Ecosystem Dynamics, Functioning, and Resilience. When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

## CCSS

RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

## Contributors

Jezra Thompson
Sources
How Do Animals Spend the Winter, Science Made Simple

Hibernate or Migrate Worksheet
Name $\qquad$ Classroom Teacher: $\qquad$
Instructions: Look at the animals at the bottom. Decide if they hibernate or migrate. Write the name of the animal in the correct box for hibernating or migrating animals. Are there other animals that hibernate or migrate that are not shown? Add them in the correct box.


# Mapping the Garden 

## Objectives/Assessment Targets

Students will:

- Observe and document all the environmental factors in the garden.
- Use measurement, cardinal directions, directional keys, and scales to create a map of the garden.
- Hypothesize about what plants and animals would thrive in which areas of the garden.


## Activity Preparation

This lesson could be a two-part lesson if you have students make their own maps of the garden in Activity 1. Alternatively, you can map out the garden, print a copy for each student, and have them complete Activities 2-3. Print out a copy of the Environmental Factors worksheet or write it on the whiteboard for students to copy in their journals.

## Materials

- Clipboards and pencils/markers
- Garden journals
- Rulers


## Activity 1: Mapping Our Garden

Prepare a rough draft map of the garden, including perimeters, garden beds or boxes, fences, shed, etc. Hand out paper on clipboards or journals. Direct students on how to:

1. Locate the cardinal directions, north, south, west, and east.
2. Label their maps.
3. Note foliage.

## Activity 2: Understanding Our Garden

Prompt students to observe and share what they notice about the environmental factors in the garden: temperature, air movement, animals, plants, sounds, and light. Hand out the map attached to the clipboard with pencils and journals to student pairs or small groups of students (no more than five). Prompt students to pair-share items that they can observe and document on these maps. Help students orient their maps with directional keys and
scales. Students head out to the garden and make a list of environmental factors and their qualities:

| Environmental Factors | Qualities |
| :---: | :---: |
| Sunlight | Sunny/shady |
| Moisture | Wet/dry |
| Cover | Foliaged/open space/clear |
| Air movement | Windy/calm |
| Sounds | Noisy/quiet |

Ask, Why are some areas warmer and others colder, and how does this affect living things?

## Activity 3: Investigating Our Garden

Student pairs choose one area of the garden that they have mapped out to conduct further investigation. Students write or draw all objects in this focus area. Encourage them to use the rulers to take measurements of the surfaces, the plants, and any other objects and note their dimensions on the map next to their descriptions. Prompt students to take note of the soil quality, moisture, temperature, color, living creatures, and smells and add this information to their lists above.

## Student Reflection

How will the time of day affect your focus area? Why would some animals and plants survive well in one location of the garden and not another?

## English Language Learning (ELL) Focus: Adjectives

- Sunny/shady
- Wet/moist/dry
- Foliaged/clear
- Windy/calm
- Noisy/quiet


## Additional Information

Students can continue mapping the garden on later visits by using cameras or drawing pictures to fill in their maps with more detail. They can also practice making detailed descriptions or drawings of specific areas and write journal entries documenting the changes in the garden over time.

## Standards

NGSS
3.LS4.3 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.
3.LS4.4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. CCSS
W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

## Contributors

Jezra Thompson

## Sources

Schoolyard Ecology, Lawrence Hall of Science, Great Explorations in Math and Science, University of California at Berkeley

## Environmental Factors Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Observe the different environments you find in the garden. Use the blanks below to fill in the information you notice, describe the location, the environment, and other qualities.

| Location | Environmental factors | Qualities |
| :--- | :--- | :--- |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

# Third Grade 

Lesson 11
Interdependence

## Pollination Nation

## Objectives/Assessment Targets

Students will:

- Review flower dissection to understand the structure and function of flower parts.
- Explain the importance of interdependent relationships for the health of plants, animals, and humans.
- Play a game demonstrating how bees and flowers interact to distribute pollen.


## Activity Preparation

Practice this game to get the hang of it first. Write on the board different groups of pollinators: moths, bats, butterflies, bees, beetles, flies, and hummingbirds.

## Materials

- Different-colored Post-it notes (white and yellow)
- Two tennis balls
- Stopwatch


## Activity 1: Review the Anatomy of a Flower and Pollinator Basics

Review lesson 2.14, Pollinators. Explain the basics of pollination and review the pollinators that students have learned in past lessons and grades. Flowering plants can only reproduce with a little help from their friends, the pollinators.

Review the different pollinators on the whiteboard. When a honeybee flies to a flower looking for nectar, pollen from the blossom sticks to the fuzzy hairs on its body. When it visits the next flower, the pollen rubs off, pollinating the flower. If it were not for honeybees performing pollination, many fruit trees would not produce fruit.

Ask, What are other pollinators?
Remind students that:

1. Plants and animals are interdependent.
2. All living things have basic needs and depend on other living things to meet those needs.
3. Most flowering plants depend on animals for effective pollination and sexual reproduction.
4. Animals are vital to the reproductive process of many plants, and many animals rely on plants for food and shelter.

## Activity 2: We Are Pollinators

Arrange the students in a circle and give each student a mini Post-it of the same color, with numbers that represent half the number of students in the class. Show them a ball, which represents the pollinator. We will play two rounds of the pollination game. Each student represents a flower. The ball represents the honeybee.

Ask, What kind of flower are you?
The Rules of The Game: You will give the ball to a "flower" with a Post-it. This student will put his or her Post-it on the ball and throws it to another student (representing a honeybee that has just left the hive and has gone to the next flower). The student who catches the ball takes the Post-It and places his/her Post-It on the ball, if they have one.

In order to get pollinated, you must catch the ball, take off a Post-it, put your Post-it on the ball, and pass the ball on. In each round, the ball must always get a Post-it (pollen) from each student (flower).

The goal is to transfer the pollen as quickly and efficiently as possible, because the honeybee needs to get back to the hive and you want to ensure the survival of all the flowers in the field.

Round 1: Set a stopwatch for 30 seconds and begin passing the ball and exchanging PostIts with different numbers. The only number a student cannot take is the same number she/he already has. When the timer goes off, explain that students who did not get a different number on a Post-It were not fertilized and therefore cannot reproduce. The "flowers" that don't reproduce are removed from the circle.

Round 2: Most flowers can't pollinate themselves. The pollen must come from another flower of the same species. This round shows that not only does the right type of pollen have to be transferred by the pollinator to the flower, but in addition, not all flowers can be pollinated by all pollinators (some pollinators pollinate during the day and some at night).

Set a stopwatch for 30 seconds and begin passing the ball and exchanging colored Post-Its. Each student now gets one of three different colored Post-its to represent different types of flowers in a field (white Post-Its are bats and yellow Post-Its are honeybees). Give the group two balls (two pollinators). One ball represents a bat and the other a honeybee.

In order to pollinate, the flower must exchange a Post-it that is the same color (i.e., from the same type of flower). The bat can only pollinate a night-blooming white flower, such as from a Saguaro cactus (so only the students with white Post-its). The honeybee ball can still pollinate the other day-blooming flowers (so the students with the yellow Post-Its).

When students catch the ball and it has the same color Post-it, they can exchange Post-its and then pass it on. If the Post-It color on the ball is different from the one on the ball they must be passed on (since the types of flower types don't match). Students put on a Post-it even if they can't take one.

## Student Reflection

What do we mean when we say, "Flowers and honeybees are interdependent?"

## English Language Learning (ELL) Focus: Nouns of Biology

- Dependence is when $\qquad$ .
- Interdependence is when $\qquad$ .
- Independence is when $\qquad$ .


## Standards

NGSS
3.LS4.4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. CCSS

RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.

SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understanding pace. PE
1.9 Throw a ball, using the overhand movement pattern with increasing accuracy.
1.10 Throw and catch an object with a partner, increasing the distance from the partner and maintaining an accurate throw that can be easily caught.

## Contributors

Jezra Thompson

## Sources

Anastasia Pickens, University of California, San Francisco
Arthur Millius, University of California, San Francisco
Science and Health Education Partnership, University of California, San Francisco
Kids Gardening: Helping Young Minds Grow

# Third Grade 

Lesson 12
Interdependence

## Habitats

## Objectives/Assessment Targets

Students will:

- Explain the concept of a habitat.
- Observe and document the different features of the garden.
- Compare their own needs as humans with those of plants and animals.


## Activity Preparation

Write the habitat hunt clues on the whiteboard, or provide a printout to student pairs. Add items that students can search for in the garden. Include items that could be considered evidence of how plants and animals get food, water, and shelter. For example: damp soil samples, edible plants and fruits, holes in the ground, rocks, etc.

## Materials

- Magnifying glasses
- Habitat Hunt worksheets
- Thermometers


## Activity 1: Habitat Hunt

Review lesson 1.13, Microhabitats. Prompt students to think about the garden as a large habitat, a home to many animals, insects, and plants. Describe characteristics of a habitat and a microhabitat. A habitat has all the necessary features for a creature or plant to grow and survive: food, water, and shelter.

Ask, What do living things need to survive?
Students pair up to observe and document their garden in search of different habitats. Distribute Habitat Hunt worksheets, thermometers, and magnifying glasses.

Regroup students, and have student pairs present on their findings, explaining why they think certain plants or animals live there.

## Student Reflection

How are human habitats similar to habitats for plants and animals?

## English Language Learning (ELL) Focus: Conditional

- Unless a habitat has food, water, and shelter, living things won't be able to survive.


## Standards

NGSS
3.LS4.3 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.
3.LS4.4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. CCSS
W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

## Contributors

Elena Garcia
Jezra Thompson
Rachel Harris

## Sources

Leave no Trace Schools
National Wildlife Federation

## Habitat Hunt Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Explore three different habitats in your garden. Fill in the information for location, temperature, light, moisture, and the type and name of the living things found in your habitat in the boxes below.

| Habitat | Location | Temperature | Light <br> quality | Moisture | Type and <br> name of <br> plant and <br> animals | Number <br> of each <br> plant <br> and <br> animal |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |

# Third Grade 

Lesson 13
Plant Biology

## Plant Traits

## Objective/Assessment Targets

Students will:

- Explain that botanists categorize plants into families according to their features.
- Collect and sort plant samples into two groups: useful for the garden and not useful for the garden.
- Explain the purpose of weeding.
- Taste a nutritious snack made of edible weeds.


## Activity Preparation

Prepare a list of plant families commonly found in the garden using the resource below. Use fruit and veggie cards to show examples of plants that fit into the same families. Glue seeds to index cards and write the names of the seeds on the back.

## Materials

- Samples of at least six different varieties of flowers (gladiolas, freesia, lilies, tulips, petunias, gloxinia, honeysuckle)
- Index cards
- Plant seeds
- Fruit and Vegetable cards


## Activity 1: Similarities and Differences

Show students the different flower samples. Explain that the flowers that look similar are part of the same family.

Ask, What are the similarities, and what are the differences?
Prompt students to think about their own families and the similarities they share in looks. Students group themselves according to similarities and differences (shoelaces, no shoelaces; shorts, pants).

## Ask:

- How do you think plants are grouped together?
- Why did you group yourselves that way?
- Do you think this is how plants also group themselves? (Yes. The biological reasons are reflected in the "superficial" reasons. Students get more depth in fourth grade when they learn about the plant families.)


## Activity 2: Weeding the Garden

Explain that botanists identify the families of flowers based on the number of parts they have. Similarities and differences are important to gardeners because they help to identify helpful and non-helpful plants. Identifying plants that are weeds and those that aren't is an example of this.

Describe that weeding is what gardeners do to sort the different plant families and allow plants room to grow. Students pair up to find two or more examples from different plant families. Students sort weeds into those that support the garden and those that don't and remove those that don't.

Regroup students and have them share what they found. Students identify different plant families in the garden and make "weedos" to eat from leafy greens and edible weeds found in the garden (layer and wrap sour sorrel, milk thistle, mustard flowers, and dandelion).

## Student Reflection

What did you learn about weeds? Why do we have some weeds and not others?

## English Language Learning (ELL) Focus: Comparatives

- Similar to
- Different from


## Additional Information

Edible weeds grow in fields, near streams, on rocky hillsides, along sidewalks, in empty lots, and in your own yard. Some plants are starchy, while others are rich in vitamins and minerals. Different parts of plants are edible; some only the blossoms are safe to eat, while you can eat other plants' roots, leaves, and stems. "Weedos" are an invention of Malcolm X students and garden educators that invite students to think about all plants and their uses, including weeds, and encourage students to taste those that are edible because many of them have a lot of nutrition.

Standards
NGSS
3.LS4.3 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.

LS4.D Biodiversity and Humans. Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

CCSS
W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

## Contributors

Colette Rowe
Daria Wrubel
Jeanette Kjobmand
Jezra Thompson
Rivka Mason

## Sources

Exploring Nature Educational Resources: A Natural Science Resource for Students and Educators

Western Sustainable Agriculture Research \& Education (SARE) Farm Internship Curriculum and Handbook and All Classification of Living Things Flip Chart Set, found at https://attra.ncat.org/intern_handbook/crop_rotation.html

# Third Grade 

Lesson 14
Plant Biology

## Plant Adaptations

## Objectives/Assessment Targets

Students will:

- Explain how plants adapt to conditions in their environment.
- Identify and describe different adaptations of drought-tolerant plants.
- Document and describe the types of drought-tolerant plants in the garden.


## Activity Preparation

Make labels with the names and qualities for each drought-tolerant plant in the garden by affixing notecards to a stick or Popsicle stick. Place these next to each plant in the garden. Write the plant tolerance chart on the whiteboard for students to copy in their journals.

## Materials

- Journals and pencils
- Labels for drought-tolerant plants growing in the garden


## Activity 1: Drought-Tolerant Plants

Review the importance of water conservation and lesson 3.8, Native Plants Conserve Water. Certain plants have adapted to conditions in their environment, such as the drought in California. Drought-tolerant plants survive months with little or no water.

## Ask:

- Why is water conservation important in a time of drought?
- How have plants adapted to become more drought tolerant over time?
- How long does it take for a plant to adapt to an environment?

Discuss drought and plant adaptations in more detail. Plants that have adapted to very dry conditions are called drought-tolerant plants because they can survive months without little or no water. Drought-tolerant plants have certain features that help them absorb and retain as much water as possible. That way, even if it doesn't rain for a long time, the plant can rely on its water storage. Drought-tolerant plants are perfect for the current conditions in California: very dry weather and very little rain.

Students share and answer questions why they think plants have adapted to their environment through color, roots, leaf shape, and texture using these questions and answers as prompts:

## Q: How does a plant stay cool in the bright sun?

A: With light colors, especially white flowers.

## Q: How does a plant absorb as much water as possible?

A: With long roots that go deep into the ground.

## Q: How does a plant retain as much water as possible (avoid evaporation)?

A: With needles, which are leaves that have very little surface area.

## Q: How does a plant store as much water as possible?

A: Waxy, fat leaves hold the water.

## Activity 2: Getting to Know Your Garden's Drought-Tolerant Plants

Students pair up to explore the garden for drought-tolerant plants. Explain that they will find the plant labels in the garden and then identify each plant and its adaptive traits in their journal using the plant tolerance chart on the whiteboard as a guide. Students describe each plant's features and how those features help them stay cool, absorb water, retain water (prevent evaporation), and store water. Prompt students to think about:

- Color: If you were a drought-tolerant plant, what color clothes would you want to wear to stay cool and not evaporate as much water? (White)
- Water Absorption: How could you pull up the most water from the soil? (Long roots)
- Water Retention: What size and shape of leaves would you want to retain water? (Needles with less surface area mean less evaporation from leaves)
- Water Storage: How could you store water in your leaves? (Waxy and bulbous leaves, like those of succulents)


## Student Reflection

How can we practice water conservation like plants?

## English Language Learning (ELL) Focus: Verbs to Nouns

- Absorb, absorption
- Retain, retention
- Store, storage


## Standards

NGSS
LS4.C Adaptation. For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

CCSS
RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

## Contributors

Jezra Thompson
Rachel Harris

## Sources

Kids in Gardens

## Plant Tolerance Chart

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Find three adaptive plants in the garden. Fill in the boxes for each. Write the name of the plant, their environmental characteristics, their adaptive plant characteristics, and how they use these adaptions to better survive in their environment.

| Plant name | Environmental <br> characteristic | Plant adaptation <br> characteristics | Adaptation use |
| :--- | :--- | :--- | :--- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## Third Grade

## Local vs. Non-Local Taste Test

## Objectives/Assessment Targets

Students will:

- Compare and contrast the taste of a variety of apples and other foods.
- Explain that some fruit are sold locally but grown in other states.
- Explain the difference between local and non-local.


## Activity Preparation

Prepare and slice at least three different varieties of apples for students to try and observe.
Materials:

- Apples
- Knives for slicing
- Tasting plate (sugar, salt, cocoa, ascorbic acid powder)
- Teaspoon and plastic spoon for student tastings
- Plates for each student
- Tasting worksheet


## Activity 1: Local vs. Non-Local

Provide three varieties of apples. Students use their senses to describe the differences and similarities between the different apples (taste, smell, touch). Draw an apple on one side of the whiteboard and an apple farm on the other. Students hypothesize how the apple gets from the farm to the table. Record their hypotheses on the whiteboard, tracing it all back to the apple. Compare the steps a local apple takes to get from the farm to your table with an apple from another state.

## Activity 2: Taste Test

Slice apples that are local and those from another state and distribute them to students to taste. Students pair-share their preferences for apples they tried. Students divide into small groups of no more than four. Each group has a recorder to record tasting experiences of their group member or partner. Students switch roles so each one gets a chance to taste and record. The recorder asks the questions and writes the answers of the taster down using the worksheet. Regroup after each person has an opportunity to complete the worksheet.

Ask, Was there a difference in taste between the apples?

## Student Reflection

What are the differences between the two apples? How did they taste? How far did they travel from the farm to our table?

## English Language Learning (ELL) Focus: Adjectives, Comparatives

- Sweet. Sweeter than $\qquad$
- Crunchy. Crunchier than $\qquad$
- Juicy. Juicier than $\qquad$


## Additional Information

Add some math to the lesson: Apples are a member of the rose family, along with pears, peaches, plums, and cherries. There are 2,500 varieties of apples grown in the United States; 7,500 varieties are grown throughout the world. $25 \%$ of an apple's volume is air, which is why they float. Americans eat an average of 50.4 pounds of apples and apple products each year. California grows more varieties of apples than any other western US state. Some examples include: Fuji, Gala, and Gravenstein.

## Supplementary Reading Resources:

- "Apple Farmer Annie," by Monica Wellington
- Flash cards that show the different steps the apple takes from farm to market.
- "Secrets of the Garden: Food Chains and the Food Web in Our Backyard," by Kathleen Weidner Zoehfeld

Standards
CCSS
R1.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

## Health

7.1.G Determine behaviors that promote healthy growth and development.

## Contributors

Jezra Thompson

## Sources

CA Farm-to-School, California
Choice, Control, \& Change. LIFE, Linking Food and the Environment: An Inquiry-Based Science and Nutrition Program, Teachers College at Columbia University

## Tasting Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Each student gets a chance to taste and record the answers to the questions below. The recorder asks the questions and fills in the taster's answers.

| Questions | Answers |
| :---: | :---: |
| What was your partner's reaction to tasting each <br> apple? <br> Why do you think they reacted that way? |  |
| What was your partner's reaction to the |  |
| sweetness? |  |
| Why do you think they reacted this way? |  |
| What was your partner's reaction to the |  |
| tartness? |  |
| Why do you think they reacted that way? |  |
| What were your partner's other reactions? <br> Why do you think they reacted that way? |  |
| How might these reactions to the basic tastes |  |
| influence the food choices that we make? |  |

## Third Grade

Lesson 16
Nutrition

# Knowing Your Nutrition 

## Objectives/Assessment Targets

Students will:

- Calculate the amount of sugar in foods, according to nutrition labels.
- Pledge to become more "sugar savvy."
- Compare grams and teaspoons.
- Interpret an infographic for information about added sugar in common drinks.


## Activity Preparation

Collect food labels from a variety of processed foods. Write the different foods and their nutritional benefits on the whiteboard, per below.

## Materials

- Rethink Your Drink worksheets
- Nutrition labels from multiple types of processed foods and drinks
- Teaspoons and a glass of water
- Bag of sugar
- Sample soda can


## Activity 1: Nutrition Information

Prompt students to think about foods that they ate the previous day. Students group their foods listed (meat, grains, fruits, vegetables, and milk). Students share the foods they listed. Find common foods and write them bon the whiteboard.

## Ask:

- What are the five main food groups? (meat, grains, fruits, vegetables, and milk)
- Why do we need to eat food from each group?

Review the main nutrients that we need to grow and suggest some sources of plant-based foods that provide those. Below are suggestions:

- Kale: Iron
- Banana: Potassium
- Spinach: Vitamin C
- Sweet potato: Beta Carotene
- Wheat: Protein
- Broccoli: Vitamin K
- Soybeans: Calcium
- Avocado: Vitamin B
- Artichoke: Magnesium
- Cantaloupe: Vitamin A
- Mushroom: Vitamin D
- Blueberries: Vitamin E
- Plum: Vitamin K

Students form small groups to discuss the different foods we eat from the garden and their health benefits.

- List the items they ate the other day.
- Identify and describe the main nutrients discussed that are found in the foods they ate.


## Activity 2: Calculating the Sugar in Soda

Review the six main categories of nutrients found in food: protein, fat, carbohydrates (sugar and starch), vitamins, and minerals. Display the Rethink Your Drink poster to review the sugar content in sweetened beverages.

Ask, According to the poster, how much sugar is in a soda? (17 teaspoons)
Demonstrate the relationship between the amounts of sugar in a soda compared with a glass of water. Measure out 17 teaspoons of sugar, adding each to the glass of water. Prompt students to count along.

Distribute a handful of nutrition labels to student groups. Explain that the sugar content is displayed on the nutrition facts label in the form of grams. ( 4.2 grams equals a teaspoon, but the nutrition facts round it to four grams. Using this equation, you can look at the grams per serving for any food product containing sugars and convert this quantity into a familiar measurement of teaspoons by dividing by four.)

Students work in groups to calculate the number of teaspoons of sugar in each food serving according to the information on the nutrition labels.

Prompt students to make a pledge to either drink fewer sugary drinks or drink no sugary drinks at all. Once they choose, prompt them to complete one of the following pledges:

1. This summer, I $\qquad$ will drink fewer sugary drinks and eat fewer foods with added sugars, like $\qquad$ and $\qquad$ . I will choose more foods with natural sugars, like $\qquad$ and $\qquad$ _.
2. This summer, I $\qquad$ will go "soda free" and not drink any sugary drinks. I will choose water. I will also choose fewer foods with added sugars, like $\qquad$ and $\qquad$ , and choose more foods and drinks with natural sugars, like $\qquad$ and $\qquad$ ..

Students share their pledge with a partner and discuss how they can share with their families what they have learned about the amount of added sugar in food. Encourage them to talk to the people at home about going "soda free."

## Student Reflection

How will you share what you learned today about added sugar in food and drinks with your families?

## English Language Learning (ELL) Focus: "Fewer" (Countable) vs. "Less"

 (Uncountable)- I will eat less sugar.
- I will drink fewer sugary drinks.

Standards
CCSS
R1.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

R1.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

## Health

7.1.G Determine behaviors that promote healthy growth and development.

## Contributors

Jezra Thompson
Joyce More

## Sources

Healthy Living for Life, Alameda County Public Health Department—Nutrition Services
Rethink Your Drink


## Did You Know?

- The average person eats almost 100 pounds of added sugar a year - that's about one quarter of a pound of added sugar a day!
- Soda is the \#1 source of added sugar in the American diet.
- Over 30\% of all calories from added sugars consumed daily are from sweetened beverages.
- Extra calories from all this sugar may lead to weight gain, putting people at risk for lifelong health problems such as diabetes and heart disease.
- 2 out of 3 Americans are overweight or obese.

Be Sugar Savuy!
Take a look at how much sugar is in these popular drinks:


Challenge yourself to make a difference in your health. Commit to drinking:

- Water
- Unsweetened iced tea
- Non-fat or low-fat mille
- 100\% fruit juice in limited amounts
rethink YOURC DRINK

WRITE
IN THE
DATES
Week:

| Week: |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

# Fruit and Veggie Mania 

## Objectives/Assessment Targets

Students will:

- Name the main nutrients of several fruits and vegetables.
- Describe how fruits and vegetables grow.
- Identify the parts of plants and flowers.
- Identify a range of plants that make up a healthy meal.


## Activity Preparation

Write the scoreboard on the whiteboard for the Fruit and Veggie Mania card game, as described below.

## Materials

- Fruit and Veggie Mania cards


## Activity 1: Fruit and Veggie Mania

Divide the students into groups of two to four. Distribute a set of the Fruit and Veggie Mania cards and instructions to each group. Direct students that they are going to play a game that will help them review:

1. The main nutrients of several fruits and vegetables
2. How these fruits and vegetables grow
3. The parts of the plant and flowers that are eaten

When the game is over, ask the players what they learned about fruits and vegetables. Challenge them to try to eat at least one fruit and one vegetable from the card game. Students pair-share:

1. Name a fruit or vegetable high in vitamin A? Vitamin C? Fiber?
2. Name two fruits and their plant parts.
3. Name two vegetables and their plant parts.

## Student Reflection

What are you favorite vegetable or fruit plants that you planted or ate this year?

## English Language Learning (ELL) Focus: Superlatives and Past Tense

- The best part of the working in the garden was $\qquad$ .


## Additional Information

You can make more fruit and veggie mania cards to cover as many fruits and veggies as you like by drawing pictures or pasting pictures and writing a brief description of the plants' nutritional value and other fun facts on the back. Flashcards are excellent items to use as a base. Laminate these for years of use.

## Standards

CCSS
RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

## Health

5.1.G Examine why a variety of behaviors promote healthy growth and development.
1.3.P Identify positive health practices that reduce illness and disease

## Contributors

Jezra Thompson

## Sources

Veggie Mania, Bringing Healthy Eating and Vegetables to Life, Ontario Agri-Food Education


## VeggieMania!

## Number of Players: 2-4

Object of the Game: Be the first player to make a group of colours (red, green, white and yellow/orange) and to have the highest number of total points.

## How to Play:

1. Any player shuffles the pack thoroughly and deals four cards, one at a time, to each player. A discard pile is placed in the middle face down.
2. The players look at their hands, while keeping them from the other players' view.
3. Each player passes one card to the left, face down and picks up the card passed by the player on his right OR places that card beside the discard pile and takes one from the discard pile.
4. When the dealer says "Pass" - the passing continues. As soon as a player assembles four cards of all colours, such as one red, green, white and yellow/orange, he/she says "VeggieMania!".
5. The other players must immediately stop passing.
6. Everyone places their cards on the table face up and calculates the total points using the scoring rules and chart below. The highest point total wins the game!

## Scoring Rules:

1. You need one of each colour (green, orange/yellow, red and white) and the highest points to win!
2. Dark green or orange $=$ add 2 extra points per card.
3. Deduct 1 point for missing colours

| Name | Colours |  |  |  |  |  |  |  | Total Points |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Green |  | Yellow/Orange |  | Red | White | Buddy or Salty | Four Colours |  |
|  | Light Green | Dark Green | Yellow | Orange |  |  |  |  |  |
|  |  | Bonus (odd 2 poins) |  | Bonus (odd 2 poins) |  |  |  |  |  |
|  |  |  |  |  |  |  | 0 |  |  |
|  |  |  |  |  |  |  | 0 |  |  |
|  |  |  |  |  |  |  | 0 |  |  |
|  |  |  |  |  |  |  | 0 |  |  |

The game can become more challenging if the rate of passing the cards happens more quickly so that players have a difficult time keeping up the pace!

NOTE: For younger players, it may be easier to change scoring slightly. Instead of deducting any points for missing colours, which may be confusing, the player who has the VeggieMania 4-colour combo hand, gets 10 bonus points.

# Fourth Grade <br> Lesson 1 <br> Garden Community 

## Personalizing the 3 Be's

## Objectives/Assessment Targets

Students will:

- Explain the rules, practices, and guidelines for working in the garden.
- Make a journal.
- Make a poster to highlight the 3 Be's.
- Plant a mystery plant and prepare to document its growth.


## Activity Preparation

Write the 3 Be's on the whiteboard. Gather samples of garden tools to demonstrate tool safety.

## Materials

- $11 \times 17$ construction paper, colored and white (at least 36 sheets per student)
- Stapler
- Collage and drawing materials


## Activity 1: Respect, Safety, and Responsibility

Introduce students to the garden by taking them on a garden tour and identifying plants and flowers. Get them excited about being in the garden by inviting them to taste what is growing. Introduce the garden tools and practice safety, including but not limited to:

1. Never hold a garden tool, including shovels, above your waist.
2. Ask before you pick.
3. Be careful of where you walk, and do not step on plants.
4. Walk along the paths.
5. Walk, don't run.
6. Notice the squirrel distractions, but then refocus.

Practice the 3 Be's that your school follows. Here in Berkeley Unified, each school has its own set of these that help with classroom management and student engagement. Remind students that we follow these same rules and practices in the garden:

1. Be Safe
2. Be Respectful
3. Be Responsible

## Activity 2: Making Garden Journals

Distribute construction paper and white lined paper to demonstrate how to make a garden journal:

1. Hand out $11 \times 17$ construction paper (multiple colors or single color).
2. Layer sheets one on top of the other.
3. Fold down the middle lengthwise.
4. Staple the middle where the fold is.
5. Hand out drawing materials to have students write their name and classroom number on the front.

## Activity 3: Creating a 3 Be's Poster

Distribute collage materials and invite students to create a collage in their journals that is reflective of the 3 Be's and how they will interpret them in the garden. Hang this poster in a visible space to remind students and reflect throughout the year.

## Student Reflection

What are you most interested to learn about in the garden this year?

## English Language Learning (ELL) Focus: Abstract Nouns

- Practice tool safety.
- Respect the garden and each other.
- You have a responsibility for taking care of the garden.

Standards
CCSS
W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

## Health

7.4.N Practice how to take personal responsibility for engaging in physical activity.
8.1.N Support others in making positive food and physical activity choices.
7.3.S Use appropriate protective gear and equipment.

## Contributors

Jezra Thompson

## Sources

Edible Schoolyard, Berkeley


# Fourth Grade <br> Lesson 2 <br> Plant Science 

## Plants Need Light

## Objectives/Assessment Targets

Students will:

- Conduct an experiment to demonstrate the importance of sunlight for healthy plant growth.
- Make recycled plant containers using newsprint.


## Activity Preparation

Cut long strips of newspaper for the plant container activity.

## Materials

- Masking tape and markers
- Leaves
- Newspaper strips
- Glass jars
- Soil
- Seeds
- Popsicle sticks for seed labels


## Activity 1: Making Plant Containers

Review the things that plants need to survive: sun, water, soil. Make two recycled plant containers by following these steps:

1. Cut up newspaper in vertical strips
2. Lay the newspaper out so you can roll glass jars neatly along the strips so that the newspaper is wrapped around the jars.
3. Pull out the glass to leave a newspaper mold.
4. Round the bottom of the newspaper mold by folding newspaper points like a present on the bottom.
5. Fill the mold with soil and place popsicle sticks with labels of the seeds (suggested seeds are butterfly bushes/milkweed) you will have students plant in them.
6. Have students place seeds and water.

## Activity 2: Experimenting with Light

This activity will demonstrate that a plant cannot make its own food in the absence of sunlight. Students observe the two plants they planted over several weeks and make notes regarding their observations following these steps:

1. Label half of the plants made in Activity 1 "light" and the others "dark."
2. Place the plants labeled "dark" in a dark place.
3. Place the other plants outside or by a bright window
4. Water both sets of plants regularly.
5. Have children sketch pictures of the two plant sets over several weeks and make notes regarding their observations.
6. After two weeks, have students share what they have observed about the "light" and "dark" plants.

## Student Reflection

What do you think will happen to the plants that don't get light? What do you think would happen if a plant didn't get carbon dioxide?

## English Language Leaning Focus: Analogies

- If plants do not get enough light, they will $\qquad$ .
- If the plants do not get enough carbon dioxide, they will $\qquad$ .


## Additional Information

Plant leaves absorb sunlight differently. There are red and blue light wavelengths that plants absorb. When you see a color, it is actually a color that the object does not absorb. For example, green plants do not absorb light from the green range.

## Standards

NGSS
4.LS1.1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
4.PS4.2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. (Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.)

## CCSS

RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

## Contributors

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Sources
Life Cycle of Plants, Utah Education Network

# Fourth Grade <br> Lesson 3 <br> Plant Science 

## Leaf Functions

## Objectives/Assessment Targets

Students will:

- Observe plants parts and describe many types of plants.
- Record their observations and discuss the function of each part.
- Conduct an experiment to reveal the importance of the sun for plant survival.


## Activity Preparation

Collect the plants that students potted during the last lesson. You may want to include some edible plants in the bags for students to explore.

## Materials

- Variety of leafy plants
- Petroleum jelly
- Large piece of paper
- Paper clips
- Clear tape


## Activity 1: Reviewing Plant Part

Review plant parts: flower, stems, leaves, roots. Help students create a foldable flower to review the functions of the parts of a plant by demonstrating these steps:

1. Take a $8 \frac{1}{2} \times 11$ sheet of paper and fold it horizontally.
2. Draw a plant and its parts on the outside of the folded paper. The inside of the sheet will be used for recording the functions of plants.
3. Cut parts of the drawn plant into four sections (flower, stem, leaves, and roots; see sample).
4. Record the function of the leaves for plants.
5. Revisit this foldable flower to complete the function portions for roots, stem, and flower sections, as those concepts are studied in later labs.


Review the different parts and their functions. Students identify the different parts of the plants (e.g., flower, stem, leaf, and roots). Explain vital functions of each plant part.

## Ask:

- What is the main function of a plant's leaves?
- How do the structures of plants support their roles in food production?


## Activity 2: Observing Leaves and Light

Revisit Lesson 4.2, Plants Need Light. Distribute the leafy plants that each student. Tell students that plants make their own food using light. Food production could not take place without light. Students place items on the leaves to experiment with varying degrees of light absorption. Guide students in a light experiment by following these steps (this experiment will need to be set up for five days):

1. Have the students cut pieces of cardboard large enough to make a cut-out patch and place it on their plant leaf.
2. Use paper clips to attach patches to a few of the leaves.
3. Be sure that students do not cover all of the leaves. The uncovered leaves should be able to continue to absorb sunlight.
4. Place clear tape over some parts of the leaves.
5. Place small amounts of petroleum jelly on other parts of the leaves.
6. Students record these steps with drawings in their journals.
7. After five days, remove the patches. Have students record their observations in their science notebooks.
8. Students examine the lighter-colored spots on the leaves.

Ask, What do you think happened to create lighter-colored spots in the leaves? (The patches prevented the light from reaching the leaves.)

## Student Reflection

Which part of the plant is vital in order for it to be able to make its own food? (Leaves)
What helps the leaf make food for the plant? (The sun)

## English Language Learning (ELL) Focus: Adjectives

- Small
- Slender
- Wide
- Prickly
- Hairy
- Soft
- Hard
- Smooth


## Additional Information

All leaves change sunlight into energy through photosynthesis, which they learn about in the fifth grade lessons. The leaves are the primary food-making part of the plant. Leaves absorb carbon dioxide from the air, combine it with water that comes through the roots of the plants to make food (a sugar molecule known as glucose), and release oxygen into the air.

Standards
NGSS
4.LS1.1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. CCSS

RI.4.7 Interpret information presented visually, orally, or quantitatively and explain how the information contributes to an understanding of the text in which is appears.

## Contributors

Jezra Thompson

## Sources

Orange County Public Schools, June 2010

# Fourth Grade <br> Lesson 4 <br> Plant Science 

## Dissecting Flowers

## Objectives/Assessment Targets

Students will:

- Dissect flowers, identifying and labeling their parts.
- Plant edible flowers to beautify the garden and control pests.


## Activity Preparation

Print a flower part diagram handout and worksheet for each student. Collect flowers and place them in jars of water for each small group of students to use during flower dissections.

## Materials

- Printouts of the diagrams
- Leaves and flowers such as foxglove, sweet pea, bean, lily, poppy, and apple blossoms. (Avoid composite flowers, such as daisies and sunflowers.)
- Tweezers
- Magnifying glasses
- Pencils
- Flower seeds or starts


## Activity 1: Flower Parts

Show students a flower in the jar and review the different flower parts, their features, and their functions:

1. Sepals: green leaf-like parts under the petals that hold the petals together.
2. Petals: different colors, shapes, and smells designed to attract pollinators (bees and birds).
3. Stamen: the male part of the flower that holds the pollen at the very top.
4. Pollen: a powder-like grain that travels from flower to flower.
5. Pistil: the female part of the flower that holds the seeds.

Describe the different leaf parts, their features, and their functions:

1. Veins: carry water throughout the leaf.
2. Mid-rib: the main vein the runs through the center of the leaf.
3. Stomata: very tiny openings, too small to see without a microscope, on the underside of the leaf that take in gas and diffuse it throughout the leaf.

## Activity 2: Dissecting Flowers

Student work in small groups around a jar of water and flowers. Distribute dissecting materials and Flower Part worksheet. Demonstrate how to dissect the flower by gently taking their flower apart using the tweezers and magnifying glasses for identifying the sepal, petal, pistil, and stamen, per the diagram below. Students choose a flower to examine and dissect. Students label the flower parts in the worksheet below.

## Activity 2: Planting and Tasting Edible Flowers

Students plant edible flowers in the garden, per the guide below. Invite students to taste edible flowers, collect them, and add them to a prepared quick salad with mixed greens and vinegar and olive oil dressing for tasting.

## Student Reflection

Now you've dissected seeds, leaves, and flowers. What's important to know about dissecting plants?

## English Language Learning (ELL) Focus: Contractions

- I'm thinking of $\qquad$ .
- You're thinking of $\qquad$ .


## Additional Information

Consider planting these edible flowers for pest control:

- Borage: deters hornworms and cabbage worms and can help increase plant resistance to disease.
- Chrysanthemums: contain a chemical called pyrethin that's toxic to insects but safe for humans and animals, used for repelling beetles.
- Lavender: repels pests, particularly fleas, moths, and mosquitos, and smells great.
- Marigolds: the scented variety repels whiteflies from tomatoes and protects the health of soil under the plants.
- Calendula: resembles saffron, and the petals are edible.
- Dandelions: the stems and leaves can be salted or tossed in a salad, and the buds are tastier than the flowers.
- Clover: sweet and anise-like and can be used for teas.


## Standards

NGSS
4.LS1.1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
4.PS4.2 Develop a model to describe phenomena.

RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

RI.4.9 Integrate information form two texts on the same topic in order to write or speak about the subject knowledgeably.
W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
4.LS. 1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on Grade 4 topics and texts, building on each other's ideas and expressing their own clearly.

## Contributors

Jezra Thompson

## Sources

The Growing Classroom, Life Lab

## Flower Part Diagram Answers



Flower Part Diagram Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$


Name the Flower Part
A: $\qquad$ F: $\qquad$

B: $\qquad$ G: $\qquad$
C: $\qquad$

H $\qquad$

D $\qquad$ I: $\qquad$

E: $\qquad$ J: $\qquad$

# Fourth Grade <br> Lesson 5 <br> Plant Science 

## Seed Dissection

## Objectives/Assessment Targets

Students will:

- Dissect a seed.
- Use a magnifying lens to identify the parts of a seed/bean.
- Plant seeds or beans and hypothesize about what will happen to the plants.


## Activity Preparation

Prepare a whiteboard or print student handouts with the Seed/Bean Parts diagram (see below). Gather examples of seeds (lentils, rice, and sunflower seeds) to demonstrate the variety of seeds. Punch holes in paper or plastic cups for drainage on the bottom. Layout paper towels for dissecting seeds/beans. Soak seeds/beans in jars of water for 24 hours.

## Materials

- Diagram of seed parts
- Magnifying glasses
- Small paper cups with holes punched out in the bottom for drainage
- Paper towels
- Soaked and non-soaked fava, pinto, or soy beans (any other large seed)


## Activity 1: Examining Seeds

Explain that seeds and beans come from flowering plants. Given the right amount of water, oxygen, and warmth, most seeds germinate and develop into mature plants. Seeds vary in physical appearance both on the outside and on the inside. Distribute the Bean/Seed Anatomy diagram and discuss the functions of the six parts of seed/bean anatomy in full germination:

1. Seed coat: a thin, protective outer covering of the seed.
2. Cotyledon: the largest part of the seed, where the seed's nutrients are stored.
3. Embryo: the growing part of the seed.
4. Plumule: becomes the plants' leaves.
5. Epicotyl: elongates so that cotyledons remain in the soil.
6. Hypocotyle: becomes the plant's stem and first root.

Demonstrate how to dissect a seed/bean by following these seven steps:

1. Inspect the outside of the beans and identify the seed coat (hilum).
2. Use your fingernails to carefully remove the seed coat from one of the beans.
3. With a fingernail, gently pry open the rounded side of the bean like a book.
4. Spread open the two halves of the bean.
5. Use the magnifying lens to study the inside of each bean half.
6. Use the magnifying glass and the second diagram to identify the parts of a seed in full germination.
7. Open several beans/seeds and compare their parts for differences in size, shape, and organization.

## Activity 2: Planting Seeds

Students plant a bean that has not been soaked in the garden or in planting containers provided. Students write their name on the cups with a permanent marker, place soil in cups, and use a spray bottle to moisten, if they are not in the garden).

## Student Reflection

How many parts of the seed were you able to identify with the magnifying lens? What parts did you identify without a magnifying lens?

## English Language Learning (ELL) Focus: Verbs for Dissection

- Inspect the outside
- Remove the seed coat
- Pry open the bean
- Spread the two halves open
- Examine the parts


## Additional Information

Given the right amount of water, oxygen, and warmth, most seeds germinate and develop into mature plants. Seeds vary in physical appearance both on the outside and on the inside.

## Standards

NGSS
4.LS1.1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

## CCSS

4.LS1.1 Construct an argument with evidence, data, and/or a model.
W.4.7: Conduct short research projects that build knowledge through investigation of different aspects of a topic.

## Contributors

Daria Wrubel
Jezra Thompson

## Sources

Bean Seed Cycle, National Agriculture in the Classroom
Department of Biology, Miami University

## Education.com

## Life Lab

Plant Parts and Functions, by Alisa Kowalski, Jessi Spry, and Alyson Wilson

## Seed/Bean Part Diagram



# Fourth Grade <br> Lesson 6 <br> Nutrient Cycles 

## Winter Harvest

## Objectives/Assessment Targets

Students will:

- Describe the ideal compost pile.
- Identify and explain the purpose of chlorophyll in kale leaves.
- Assemble a kale salad using the ingredients provided.
- Use metaphors to describe decomposition.


## Activity Preparation

Prepare the whiteboard with a review of the compost pyramid, including the role of fungus, bacteria, and invertebrates (FBI). Print out the digestive system diagram or draw it on the whiteboard. Wash kale leaves, and gather materials for kale salad dressing.

## Materials

- Human digestion diagram
- Washed kale leaves
- Whisk and large bowl
- Salad dressing ingredients (oils, vinegars, lemon, salt, pepper)
- Small bowl for each student


## Activity 1: Decomposition Is Like Human Digestion

Review the ingredients for a perfect compost pile and past lessons on FBI: fungus, bacteria, and invertebrates, focusing on the decomposition cycle:

1. Organic materials are converted to nutrients.
2. The soil brings the nutrients into the roots and through the plant.

Explain that plants rely on decomposition in the same way that we rely on our digestive systems. Review the digestive system diagram to connect the two processes.

Ask, What is similar and what is different between human digestion and compost decomposition?

Distribute kale salad materials to each student and instruct them how to make kale salad by following these steps:

1. Break up kale leaves away from the spine.
2. Add salt and lemon to break down plant cell walls in the leaves.
3. Mash the leaves with your hands until texture becomes soft and the color becomes dark green.
Ask, What do you notice happening to the kale leaves?
Review that the green color is chlorophyll. Chlorophyll is found in the green leaves of plants. It absorbs the sun's light and combines with carbon dioxide to produce sugars that plants use for food. Review lesson 4.2, Plants Need Light and 4.3, Leaf Functions.

Assign a student the role of making the salad dressing with your help by following these steps:

1. Add a small amount of vinegar to the larger bowl.
2. Whisk oil in gradually as you add small amounts of honey and pepper.

Ask, What happens to the vinegar as you whisk in the oil?
Distribute small amounts of the salad dressing into the students' bowls. Students taste the kale salads.

## Ask:

- What part of the plant do we eat?
- How do we digest this part?
- How do the FBI digest this part?


## Student Reflection

How is decomposition similar to digestion?

## English Language Learning (ELL) Focus: Figurative Language—Metaphors

- The chlorophyll in leaves suck up the sunlight through the chloroplast.
- The chloroplast is a sun-harvesting molecule.
- The FBI digest the decomposing material to make food.
- The FBI are the intestines of the earth.


## Additional Information

The browns, oranges, and reds of fall leaves are the colors "underneath" that are revealed after the chlorophyll (green) dies in the autumn leaves.

## Standards

NGSS
4.LS1.1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

RI.4.7 Interpret information presented visually, orally, or quantitatively and explain how the information contributes to an understanding of the text in which is appears.

Health
1.1.N Identify and define key nutrients and their functions

## Contributors

Ben Goff
Colette Rowe
Jezra Thompson
Sources
Food for Thought: Elementary Lessons on Nutrition and Healthy Living, Nutrition Services Branch of the North Carolina Division of Public Health

K-12 Soil Science Teacher Resource, Soil Science Society of America

## Human Digestion



# Fourth Grade <br> Lesson 7 <br> Cycles in Nature 

## Water Cycle

## Objectives/Assessment Targets

Students will:

- Identify the main processes in the water cycle.
- Draw a diagram to illustrate the main processes in the water cycle.
- Explain the relationship between the decomposition and water cycles.


## Activity Preparation

You may want to show the video about the water cycle (link below) before taking your students out to the garden to explore the water cycle in more depth. Print out a copy of the Global Precipitation Measurement Mission worksheet for each student. Cut the top off of enough plastic bottles for each student group.

## Materials

- Global Precipitation Measurement Mission worksheets
- NASA Water Cycle diagram
- Plastic bag
- Soil
- Pebbles
- Soda bottle bottoms
- Grass seeds
- Watering can


## Activity 1: What is a Water Cycle?

Remind students that they already know about two different types of cycles: decomposition cycle and human digestion cycle.

Ask:

- What is a cycle?
- How does water travel in a cycle?

Explain that:

- All of the water on the planet is all the water that we have forever.
- Water makes up three-fourths of the planet and three-fourths of our bodies.
- Most of the planet's water is in the ocean.
- All living things need water to survive.

Outline each step in the water cycle, including these steps.

1. A cloud that causes a big rainstorm
2. An arrow from the ocean to the cloud, labeled "evaporation"
3. An arrow from the cloud to the planet, labeled "precipitation"
4. An wiggly line across the board, labeled "rising temperatures"
5. Dashes from the wriggly line to the planet, labeled "evaporation"
6. Gathered dashes in the clouds, labeled "condensation"

Review the three major processes in a water cycle with students, having them repeat after you (perform hand gestures according to each step):

1. Precipitation (fingers sprinkling down like rain)
2. Evaporation (hands rising into the air)
3. Condensation (hands coming together above their heads, pretending to hold a cloud)

## Activity 2: Biome in a Baggie

Group students and distribute one of each of the following items to each student group: plastic baggie, bottom of a plastic bottle, bag of soil, bag of pebbles, grass seeds in a cup, and water in container. Demonstrate how to make a biome in a baggie by following these steps:

1. Fill the bottom of the plastic bottle with one inch of pebbles.
2. Add twice as much soil.
3. Make a half-inch well in the soil and add the grass seeds.
4. Cover the grass seeds with the soil already in the bottle.
5. Add enough water to seep through the soil.
6. Place the entire plastic bottom inside a plastic bag and seal it.

In about four weeks you will see a plant growing. The plant uses the water cycle to recycle all the water it needs and has enough light from the sun to help regenerate the soil it uses for food. Review with students that:

1. There will be condensation on the inside of the bag from the water evaporating.
2. That condensation goes back into the soil through precipitation, like rain.
3. The plant's roots absorb the water through the leaves and roots.
4. The leaves release water back into the biome to cycle all over again.

## Student Reflection

Think about cycles within cycles. Why is the water cycle necessary for decomposition and human digestion?

English Language Learning (ELL) Focus: Nouns to Verbs

- Transportation > Transport
- Precipitation > Precipitate
- Evaporation> Evaporate
- Condensation > Condense


## Additional Information

Watch the "Biome in a Baggie" video (see Sources, below) for student instructions on how to make a biome in a baggie. Water is essential to life on Earth. In its three phases (liquid, gaseous, and frozen), water ties together the major parts of the Earth/climate system—air, clouds, ocean, lakes, vegetation, snowpack, and glaciers. It influences the intensity of climate variability and change. The water cycle significantly impacts our daily lives, the local and global ecosystems, and even economic systems.
"Show Me The Water" is a short video, derived from the Science on a Sphere film Water Falls, that explores how Earth's freshwater resources are allocated and used:
http://pmm.nasa.gov/education/videos/show-me-water.

## Standards

NGSS
4.ESS. 1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, or vegetation.
4.ESS2.2 Analyze and interpret data from maps to describe patterns of Earth's features.
4.ESS3.2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

## CCSS

RI.4.1 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements) and explain how the information contributes to an understanding of the text in which it appears.

## Contributors

Jezra Thompson

## Sources

## Delaware River Basin Commission

http://www.pbslearningmedia.org/resource/tdc02.sci.life.stru.baggiezoom/biome-in-abaggie/

National Aeronautics and Space Administration (NASA) Scientific Visual Studio (SVS)
https://svs.gsfc.nasa.gov/index.html
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Name-
Date-
Period-

## Earth's Water Student Capture Sheet

## Guiding Questions

How much water is on Earth?
Where is water found and what forms is it in?
Why is it important to know about our water resources?

## Engage

1. Riddle me this:
a. What runs and never gets tired?
b. What runs buthas $n$ feet, roars but has $n$ mouth?
c. What lives in winter, dies in summer, and grows with its root upward?
2. Water on Earth

| What I KNOW | What I WANT to know | What I LEARNED |
| :---: | :---: | :---: |
|  |  |  |
|  |  |  |

## Explore

Predict: Of the 5 gallons of water representing all of Earth's water, how much do you think is available to humans? $\qquad$

## Explain

97\% of Earth's water is
$2.5 \%$ of Earth's water is
$98.7 \%$ of fresh water is $\qquad$
$1.3 \%$ of fresh water is
In summary: What percent of Earth's water is available to humans? $\qquad$

# Fourth Grade <br> Lesson 8 <br> Cycles in Nature 

## Soil Composition

## Objectives/Assessment Targets

Students will:

- Identify and describe the purpose of the two main components of soil.
- Explain the origin and composition of loam.
- Describe the visual and textural characteristics of various soil samples.
- Test soil samples from the garden for their loam content.


## Activity Preparation

Prepare the four soil samples. Print out the Soil Composition pie chart or draw it on the whiteboard. Set up materials for soil testing on each student table or group area.

## Materials

- Soil samples with gravel, sand, silt, and clay in four separate trays
- Glass jars with lids (one for every three to four students)
- Clear plastic containers (one for each group)
- Shovels
- Masking tape
- Marker
- Soil layer diagram
- Watering cans


## Activity 1: Understanding Soil

Review the four ingredients that plants need: sun, water, organic matter, and minerals.
Explain the two main materials that make up soil (the organic matter and minerals of a plant's needs):

Abiotic components of soil are the minerals. Explain that gravel, sand, silt, and clay are all tiny rocks of various sizes. Rocks are broken down and eroded over thousands of years to become sand, silt, and clay.

Draw a pie chart on the whiteboard to illustrate that soil is $40 \%$ sand, $40 \%$ silt, and $20 \%$ clay. This is called "loam."

Biotic components of soil are organic material (FBI). The organic material (plants and leaves) combine with water and air to keep the rocks together.

Display the four different soil samples in separate trays. Allow time for students to observe similarities and differences between the samples. Invite students to touch the contents and organize them in two groups: abiotic (minerals) or biotic (organic matter). Students observe characteristics that are different and similar between the samples.

## Activity 2: Loam Tests

Divide students into four groups, according to the numbers below. Direct each group to a section of the garden where they can use shovels to dig one or two scoops of dirt into plastic containers. Regroup students and have each group use masking tape and markers to label their containers according to where in the garden they found the soil and their group name. One student from each group adds water to their container. Students in each group follow the same steps according to their number:

1. Add sand, silt, and clay into separate jars.
2. Add water to each jar.
3. Close the lids on each jar tightly.
4. Place masking tape on each jar and labels each one "sand," "silt," or "clay."

Each student takes a turn shaking or mixing the container until the water is mixed in.
Students observe what happens to the contents in the jar. Prompt them to look for the one contents that fall to the bottom of the container first. Group all of the soil samples from the class.

Ask, Which one of the soil samples (sand, silt, or clay) is closest to loam?

## Student Reflection

What can we do to change the composition of our soil to make the perfect balance of sand, silt, and clay?

## English Language Learning (ELL) Focus: Verbs for Science

- Observing soil samples
- Analyzing soil samples
- Comparing soil samples
- Testing soil samples


## Additional Information

Gardeners add sand or organic matter to bring the percentages closer to that of loam.

Standards
NGSS
4.ESS2.A Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
4.ESS2.1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4.ESS3.2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

CCSS
4.SL. 1 Engage effectively in a range of collaborative discussion (one on one, in groups, and teacher led) with diverse partners on Grade 4 topics and texts, building on each other's ideas and expressing their own clearly.

RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g. in charts, graphs, diagrams, timelines, animations, or interactive elements) and explain how the information contributes to an understanding of the text in which it appears.

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

## Contributors

## Erica Woll

Jezra Thompson

## Sources

Nitty Gritty, Life Lab
Why Compost, Composting Across the Curriculum: A Teacher's Guide to Composting, Marin County Office of Waste Management

## Soil Composition Pie Chart



# Fourth Grade <br> Lesson 9 <br> Cycles in Nature 

## Soil Erosion

## Objectives/Assessment Targets

Students will:

- Observe and document the results of erosion in several erosion demonstrations.
- Compare the effects of various amounts of organic material on erosion.
- Explain the importance of minimizing erosion.


## Activity Preparation

Prepare three trays of soil: one with organic materials (sticks, roots, leaves, dead bugs, and other rotting plants); one with living organisms (worms, roly-polies, and centipedes), and one with various sizes of rocks (pebbles, sand, silt particles). Make sure that each tray has different amounts of organic materials (grasses and roots) so that the erosion experiment demonstrates water drainage and erosion with less and more organic material.

## Materials

- Three trays of soil with varying amounts of organic matter
- Journals and pencils


## Activity 1: Observing Erosion

Review lesson 4.8, Soil Composition. Use soil sample trays to demonstrate how erosion occurs.

Ask, What are ways soil can erode?

## Fun Facts:

- The three main causes of erosion are wind, water, and glaciers (large masses of frozen water).
- One inch of topsoil can be removed from land by erosion in one year.
- Erosion is a problem because it takes 600 years or more for nature to create one inch of topsoil.

Prop the trays up on a slope so that students can observe water absorption and drainage. Demonstrate pouring water continuously and systematically over a tray. Students write in their journals what they think will happen.

Ask, Which hillside will experience the most severe erosion and why?

Select a different student to pour water in the same way over the next trays. Students observe the differences and explain what they observed and why in their journals.

Students pair-share ideas about why the tray with the most organic matter is not losing soil. Lift the plants to show them the roots that are wound around the soil, holding it in place.

## Ask:

What would happen to our plants if all the topsoil washed away?
What can be done to stop erosion in our garden?

## Activity 2: Preventing Erosion

Students turn over the compost pile to aerate and allow for drainage, prepare beds with mulch to retain water and heat, and plant seasonal seeds to reinforce soil with organic matter.

## Student Reflection

What can be done to stop erosion on hills and fields nearby?

## English Language Learning (ELL) Focus: Would, Should, Could

- If all the topsoil washed away, our plants would $\qquad$ .
- To stop erosion on hills and fields nearby, we could $\qquad$
- To stop erosion in our garden, we should


## Additional Information

When water, wind, and ice move rock, soil, or another material, it is called erosion. Erosion is the mover, and weathering is the breaker. Wind carries away loose bits of soil and rock, particularly in dry areas with no plants to cover and protect the land. Water can erode in several different ways. Flowing water carries soil and rock particles down streams and rivers into lakes and oceans. Ocean waves pounding the shore and ocean currents can also carry particles away. Finally, glaciers, massive, slow-moving rivers of ice, gouge the land beneath them and scrape away particles and rocks.

Conduct further investigations on erosion and have students research and journal about their predictions, findings, and what surprised them:
http://www.uen.org/Lessonplan/preview?LPid=9862

Standards
NGSS
4.ESS2.1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4.ESS2.2 Analyze and interpret data from maps to describe patterns of Earth's features.
4.ESS3.2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
4.ESS3.B Natural Hazards. A variety of hazards result from natural processes. Humans cannot eliminate the hazards, but can take steps to reduce their impacts.

CCSS
RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., charts, graphs, diagrams, timelines, animations) and explain how the information contributes to an understanding of the text in which it appears.

RI.4.9 Integrate information from two texts on the same topic in order to write and speak about the subject knowledgably.

## Contributors

Ben Goff
Jezra Thompson

## Sources

"Slip Sliding Way," Utah Education Network

# Mapping Your Watershed 

## Objectives/Assessment Targets

Students will:

- Make a map of their watershed.
- Simulate the effect of residual pesticides on the watershed.
- Explain the difference between permeable and impermeable land.


## Activity Preparation

Distribute butcher paper, white card stock, and markers for each small student group.

## Materials

- Watershed map for demonstration
- Large butcher paper, one sheet per group
- Cardstock paper, one sheet per group
- Permanent markers with multiple colors, one washable in a bright color and one in blue
- Tape
- Filled spray bottle or other water tool


## Activity 1: What Is a Watershed?

Review lesson 4.9, Soil Erosion, to reiterate the importance of stable soil and the ability of water to move through land in different ways. Explain to students that everyone lives in a watershed. Watersheds include water that is above and underground and support habitats of all kinds. There are ten major creeks in Berkeley that make up the Berkeley watershed, including Wildcat Creek, Codornices Creek, Strawberry Creek, Derby Creek, and Hardwood/Temescal Creek.

Prompt students to think about their watershed at their school. Show students a watershed map created that indicate the location of above-ground and below ground water sources.

Watershed maps also indicate where the land is permeable (water seeps up through the surface) and where it is impermeable (water cannot seep up through the surface). Permeable spaces include soils and gravel. Impermeable land is covered with concrete, asphalt, and cement.

## Ask:

- Where are some permeable and impermeable surfaces around school?
- How does water get through these permeable surfaces?
- What happens to water if it can't get through the surfaces?


## Activity 2: Mapping Your Watershed

Explain that gardeners need to know where they can get their water from for their plants. Gardeners use maps to plan safe locations to grow food, where the water is of good quality, without pesticides, and far away from runoff that might pollute the water source.

Distribute paper and markers to student groups. Students work in small groups to draw a map of their watershed using paper and markers. Demonstrate that the paper represents the land and show how to note cardinal directions. Explain that students will draw permeable (allows water to seep through) and impermeable (doesn't allow water to seep through) spaces found along our watershed.

Guide students to follow these steps to create their own watershed map. (You could also do this with a whole class and ask a student to come up and add each step to the larger map.)

1. Title the map and cardinal directions.
2. Add a key at the bottom for roads, agriculture, mountains, forests, urban development, streams, and other waterways.
3. Draw a grid that represents roads and streets.
4. Add creeks and other bodies of water with the blue washable marker.
5. Draw squares for land uses, including urban, agriculture, industry, etc.
6. Place dots in the squares to represent natural and non-natural pesticides, including manure and Roundup.
7. Use the marker colors to represent:
a. Brown: Mountain areas
b. Green: Agricultural areas
c. Gray: Urban areas
8. Add color in the agricultural areas with brightly colored washable markers.
9. Add lines across each urban and industrial squares to signify spaces where water cannot be absorbed.
10. Crumple up the paper to represent varying topographies.
11. Tape their paper to a wall or vertical area.
12. Use the spray bottle to lightly mist the paper to represent rain.
13. The brightly colored markers represent pesticide residuals that run into waterways. Students share what they observed when the "rain" fell on their land (permeable and impermeable).

Ask, What are other types of contaminates that get into watersheds, and how do they get there?

Prompt students to recall the types of living organisms that live in watersheds. Students share what they think might happen to organisms that live in these watersheds when pesticides end up there. Students journal what they learned about watersheds.

## Student Reflection

What happens to pesticides and other contaminates in urban areas when they get washed into the watersheds?

## English Language Learning (ELL) Focus: Prepositions for Water

- Permeable land allows water to seep through to the surface.
- Impermeable land blocks water so it cannot seep through to the surface.
- Contaminated water runs into waterways.
- Contaminate water washes into waterways.


## Additional Information

You can access a watershed map of Oakland and Berkeley to demonstrate to students here: https://www.museumca.org/creeks/MapOak.html.

## Standards

NGSS
4.ESS2.A Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
4.ESS2.1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4.ESS2.2 Analyze and interpret data from maps to describe patterns of Earth's features.
4.ESS3.2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

## CCSS

4.SL. 1 Engage effectively in a range of collaborative discussion (one on one, in groups, and teacher led) with diverse partners on Grade 4 topics and texts, building on each other's ideas and expressing their own clearly.

RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g. in charts, graphs, diagrams, timelines, animations, or interactive elements) and explain how the information contributes to an understanding of the text in which it appears.

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

## Contributors

Erica Woll
Jezra Thompson

## Sources

Explore Your Watershed, Rangers in the Classroom, National Park Service

## Examples of Mapping Watersheds



# Fourth Grade <br> Lesson 11 <br> Interdependence 

## Mutualism

## Objectives/Assessment Targets

Students will:

- Explain mutualism and mutualistic relationships between plants and animals.
- Match mutualistic animals and plants using a worksheet.
- Hypothesize about the effect of extinction on mutualistic relationships.


## Activity Preparation

Print out a Mix and Match Mutualism worksheet for every student.

## Materials

- Flowers and animal pictures or samples
- Diagram of plant parts and flower parts
- Mix and Match Mutualism worksheet


## Activity 1: Matching Mutualistic Relationships

Mutualism is when two organisms of different species (a plant and an animal) exist in a relationship where each individual benefits. The behavior of the species benefits the other species and vice-versa. Explain that plant-animal mutualistic relationships are believed to be partly responsible for the large diversity of flowering plant species that showed up 90130 million years ago. For example, approximately 750 species of fig tree are pollinated by approximately 750 species of fig wasps. Distribute the worksheet to each student. Instruct them to fill in the missing information in order to match mutualistic species and plants.

## Student Reflection

How is a mutualistic relationship affected if one of the pair goes extinct?

## English Language Learning (ELL) Focus: Nouns to Adjectives

- Mutualism
- Mutualistic


## Additional Information

An extreme form of mutualism, called an obligate mutualism, occurs when the interdependence between a plant and a pollinator is so specific that no other organism can
take its place. In this case, one specific pollinator is required to pollinate one specific plant, and that pollinator needs that specific plant in turn. This is the most precarious kind of mutualism, because if one partner becomes extinct the other can't survive and goes extinct. An example of an obligate mutualism is the yucca plant and the yucca moth. The yucca plant is dependent on the yucca moth to pollinate its seeds. The yucca moth larvae cannot survive without yucca seeds to eat. The system works because the larvae eat only somenot all—of the seeds.

## Standards

NGSS
4.ESS2.1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4.ESS3.2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

CCSS
RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

## Contributors

Jezra Thompson

## Sources

Honey Bee Suite
North American Pollinator Protection Campaign (NAPPC)

## Mix and Match Mutualism Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Fill in the blanks to match the plant with the organism. Describe how they are mutualistic (help each other out).

| Plant | Animal/insect | How they are mutualistic |
| :---: | :---: | :---: |
|  | An insect | The insect pollinates the flower to help with <br> reproduction |
| A plant with huge <br> leaves that creates a <br> shaded dark area |  | Protection from herbivores |
|  |  |  |
| A plant with yellow <br> flowers |  |  |
|  | A mammal with fur |  |

# Insects in the Garden 

## Objectives/Assessment Targets

Students will:

- Name several insects and their basic anatomy.
- Explain the influence insects have on a healthy garden.
- Conduct an investigation to solve a common garden problem.


## Activity Preparation

Print out a How Do Insects Benefit The Garden worksheet for each student pair.

## Materials

- Diagram of insects
- How Do Insects Benefit The Garden worksheets


## Activity 1: Describing Insects

Explain that entomology is the study of insects and bugs. Entomologists study bees, ants, beetles, termites, and mosquitoes as well as related animals (known as arthropods), such as spiders and scorpions. Review common traits of insects:

- All insects have six legs, three body sections (head, thorax, abdomen), and usually two pairs of wings.
- Insects include flies, mosquitoes, bees, crickets, dragonflies, beetles, butterflies, and many others.
- Spiders, ticks, and centipedes are not insects. One feature that sets them apart from insects is the fact that they have more than six legs.
Present the anatomy of insects as compared to that of humans using the diagram below. Prompt students to identify the following body parts as you point them out on the diagram, overhead projector, or whiteboard drawing:
- Six legs
- Three body parts (head, thorax, and abdomen)
- Hard exoskeleton
- Compound eyes
- Antennae
- Two pairs of wings

Review behaviors of insects that allow them to survive in their environment:

- Insects can be herbivores (eat only plants) or carnivores (each only meat).
- Some insects are pests to humans: mosquitoes feed on mammalian blood, aphids and scale insects infest our gardens, and wasps produce a nasty sting.
- Most insects are beneficial: bees, beetles, and butterflies pollinate our gardens and crops, making possible such foods as chocolate, nuts, and most fruits.
- Some insects are decomposers, helping to break down dead material. Other insects, like ladybugs and praying mantises, feed on pest insects.
Ask, Can you think of a problem or benefit in the garden that involves insects?


## Activity 2: How Do Insects Benefit the Garden?

Explain that since we know some insects are beneficial and others are pests, we need to be aware of how insects are affecting our garden. There may be too few insects, because there are not enough flowers turning into fruits (lack of pollination), or a lot of mosquitos biting kids (too much standing water where mosquito larvae hatch).

Distribute worksheets to student pairs. Students identify a problem they would like to solve. Prompt them to work in pairs to propose a hypothesis for how the problem could be solved and create an experiment to test their hypothesis. For example: the problem is that we have mosquitos that bite kids. The solution is that mosquitos can be avoided by removing standing water. The experiment is removing standing water from one section of the garden and not from another and then comparing which section has more mosquitos over time.

Revisit this worksheet with students in the following weeks so they can observe their experiments and record their final observations (what happened, what worked, what didn't work, how they could do it better).

## Student Reflection

Why is it important to try to solve problems in the garden using hypotheses and experiments?

## English Language Learning (ELL) Focus: Conditional Statements

- If there are not enough flowers in the garden, then $\qquad$ .
- If there are too many mosquitos in the garden, then $\qquad$ .


## Standards

NGSS
4.LS1.1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
4.LS1.2 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. Emphasis is on systems of information transfer.

LS1.A. Structure and Function. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

CCSS
RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

## Contributors

Jezra Thompson

## Sources

Dr. Toby Schuh, an entomologist at the American Museum of Natural History
Honey Bee Suite
North American Pollinator Protection Campaign (NAPPC)
Anatomy Diagram


## How Do Insects Benefit the Garden?

Name: $\qquad$ Classroom Teacher: $\qquad$
Definitions:
Identify the Problem: A situation that is bad for the garden.
Create a Hypothesis: A proposed answer to how to solve the problem.
Conduct an Experiment: The act of conducting a controlled test or investigation to test the proposed answer to the question

Make Predictions: Best guesses for what will happen during the experiment.
Problem: $\qquad$
$\qquad$
$\qquad$

Hypothesis: $\qquad$
$\qquad$
$\qquad$

Experiment: $\qquad$

Predictions: $\qquad$
$\qquad$
$\qquad$
Final Observations: $\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

# Fourth Grade 

Lesson 13
Plant Biology

## Classification of Plants

## Objectives/Assessment Targets

Students will:

- Explain the concept of plant families using potatoes and/or wildflowers as examples.
- Prepare potatoes for growing slips.
- Prepare potato slips for planting in the garden.


## Activity Preparation

Write the classification of plants on the board.

## Materials

- Photo or samples of roses, potentillas, and morning glories
- Plant Family chart from Lesson 4.13
- Toothpicks
- Shallow bowls for harvesting slips
- Bowls of water


## Activity 1: Tracing Plant Families

Review that botanists group seeds/plants into groups called plant families. "Family" is an official botanical classification that is important to gardeners. These plant families share features and characteristics. In botany, the word "family" has a definite meaning that extends beyond what flowers and plants may look alike. Looks are not always the common denominator, just like in your own family. Show and discuss examples; below are two prominent wildflower families represented in North America:

Acanthus family (Acanthaceae): These wildflowers are similar to the snapdragon family but are distinguished by having seeds attached to a two-cavity capsule. Many of the species of this family can be found in rich, moist woods. The Midwestern native wild petunia is a famous member of the Acanthus family.

Amaranth family (Amaranthaceae): A weedy family with inconspicuous flowers made up of 71 genera and about 800 species, mostly herbs. "Amarantos" is a Greek word meaning "unfading," referring to the fact that if moistened with water, many of the species in this family will revive. Most members of this family have a sort of plumed flower cluster.

Garden cockscomb is a showy member, and one of the world's most common weeds, pigweed, is an amaranth.

## Activity 2: Growing Potato (Convolvulaceae) Slips

Sweet potatoes and morning glories are examples of flowers within the Convolvulaceae family, mainly recognizable for their colorful funnel shape. Other members of the family grow like vines, tree, or shrubs. The roots are usually fibrous and sometimes form rootstalks or tubers, such as the sweet potato (Ipomoea batatas).

Explain that slips are small sprouts that are grown from pre-existing sweet potatoes. Guide students through these steps to root a potato slip for planting during the next lesson.

1. Choose 1-2 mature, healthy sweet potatoes.
2. Wash them well in the sink.
3. Cut the potatoes in half. If they are particularly large, consider cutting them into thirds or fourths.
4. Stick 4-5 toothpicks out of the sides of your potato, equidistant and near the middle, like spokes on a wheel.
5. Fill a jar with water.
6. Place the potato in the jar with the cut side down, balancing the toothpicks on the edge of the jar, so that half of the potato is submerged in the water.
7. Follow the same steps for each potato piece.
8. Move the jar with the potato onto a windowsill that gets a lot of sunlight.
9. Allow 2-4 weeks for the small, leafy slips to begin sprouting out of the top of the potato.

## Student Reflection

How is your family like a plant family?

## English Language Learning (ELL) Focus: Collective Nouns

$\qquad$ are members of the $\qquad$ family.

- ___ belongs to the $\qquad$ family.


## Additional Information

Plants are classified in several different ways. The further away from the garden we get, the more the name indicates a plant's relationship to other plants. Usually, only the family, genus, and species names are of concern to the gardener, but we sometimes include subspecies, variety, or cultivar to identify a particular plant.

## Standards

NGSS
LS1.A Structure and Function. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. CCSS

RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g. charts, graphs, diagrams, timelines, animations, or interactive elements) and explain how the information contributes to an understanding of the text in which it appears.
W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

## Contributors

Jezra Thompson

## Sources

Getting to Know Plant Families, Eat Think Grow, Portland Partners for School Food and Garden Education

Plants (Botany), Teacher Vision

# Fourth Grade <br> Lesson 14 <br> Plant Biology 

## Plant Families

## Objectives/Assessment Targets

Students will:

- Describe various features and characteristics of plants and group them into families.
- Plant sweet potato slips directly in the garden.


## Activity Preparation

Prepare the whiteboard with a list of the plant families below and create seed cards for each family (you can create seed cards with students instead).

## Materials

- Two to three seed cards from each family featured
- Making Seed Cards
a. Heavy paper stock for seed cards
b. Scissors and glue
c. Markers and tape
d. Colored pencils
- Plant Family chart
- Several sweet potatoes
a. Several glass jars large enough to fit a potato.
b. Toothpicks
- Shallow bowls for harvesting slips
- Sweet potato sprouts (You can order these online or from a garden center, but students can also grow their own.)


## Activity 1: Matching Seeds to their Plant Families

Review lesson 4.13, Classification of Plants, and how botanists group seeds and plants into groups they call "plant families." Present the plant family chart below and discuss the characteristics of the plants in each family. Distribute two to three seed cards to pairs of students. Students compare and contrast the seeds/plants according to color, shape, size, and other features they notice. Students move around to match each seed/plant with other members of its family. When a proper match has been made, help students attach their seed cards on the appropriate place on the chart.

## Activity 2: Plant Sweet Potato Slips

Distribute the sweet potato slips students made during the last lesson, 4.13. Explain that once the top of the potato pieces are covered in slips, students will carefully twist each one off individually. The slips won't have roots yet and will resemble small leaves with a short stem. Guide students through the following steps to harvest the potato slips:

1. Put your slips in water.
2. Fill a shallow bowl with a bit of water, around one inch or less depending on the number of slips you have.
3. Set the slips in the bowl so that the stems are submerged in the water.
4. Let them stand for several days, until roots have formed from the bottom.
5. Add fresh water once a day or so to keep the slips healthy until they develop roots at the bottom. If any of the slips are not forming roots or begin to wilt, throw them out.
6. Plant the roots directly in the garden.

## Student Reflection

What family does your favorite vegetable belong to?

## English Language Learning (ELL) Focus: Collective Nouns

- $X$ are members of the $X$ family.
- $X$ belongs to the $X$ family.

Standards
NGSS
4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-ESS1-1Patterns can be used as evidence to support and explanation.
CCSS
RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on the Web) and explain how the information contributes to an understanding of the text in which it appears.

## Contributors

Jezra Thompson

## Sources

Variations in Families/Populations of Plants, The Science Behind Our Food.

## Plant Family Chart

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Study the seed cards you have been given. List the features and characteristics you observe or have learned about each seed.

| Plant family | Their plants | Shared features and characteristics |
| :---: | :---: | :---: |
| Apiaceae | Carrots, celery, celery root, cilantro, dill, fennel, parsley, parsnip |  |
| Asteraceae | Artichoke, chicory, dandelion, endive, lettuce, sunflower, tarragon |  |
| Brassicaceae | Arugula, broccoli, Brussels sprouts, cabbage, cauliflower, collards, cress, kale, kohlrabi, mizuna, mustard, radish, rutabaga, tat soi, turnip, watercress |  |
| Chenopodiaceae | Beet, orach, spinach, Swiss chard |  |
| Convolvulaceae | Sweet potato, morning glory |  |
| Cucurbitaceae | Cantaloupe, cucumber, gourd, loofa, melon, pumpkin, summer squash, winter squash |  |
| Fabaceae | Beans, peas, peanuts, soybeans |  |
| Lamiacea | Basil, lavender, marjoram, mint, oregano, sage, savory, thyme |  |
| Liliacea | Asparagus, chives, garlic, green onions, leeks, onions, shallots |  |
| Malvaceae | Okra, hollyhock, hibiscus |  |
| Poaceae | Corn, wheat, barley, rice |  |
| Solanaceae | Eggplant, sweet pepper, hot pepper, potato, tomato |  |

# Fourth Grade 

# Whole or Processed 

## Objectives/Assessment Targets

Students will:

- Compare processed and unprocessed foods based on nutritional value.
- Analyze nutritional facts labels.
- Graph the nutritional content of processed and unprocessed foods.


## Activity Preparation

Print out worksheets for small groups or individual students.

## Materials

- Samples of processed food containers, such as soup cans
- Nutrition Label worksheet


## Activity 1: Comparing Processed and Unprocessed Foods

Describe the difference between whole and processed foods. For example, an apple, an orange, and a tomato are considered whole, natural, or fresh foods because they are unprocessed. The apple pie, orange soda, and tomato soup are processed foods because they contain one or more plant foods that are treated by a chemical or industrial process, such as drying, cooking, canning, and freezing.

Distribute nutrition facts labels on the processed food samples to student pairs. Review how to read the labels, including energy, total fat, sodium, and carbohydrates. Explain that carbohydrates and fat are measured in grams and sodium is measured in milligrams. Point out that calories are the unit for measuring energy in foods. A calorie is a unit of energy. Our bodies need energy to survive, and plants produce energy from the sun. Different nutrients provide different amounts of energy.

A gram:

- Of fat has 9 calories
- Of carbohydrates has 4 calories
- Of protein has 4 calories

Ask, Which foods have the highest amount of calories, fat, carbohydrates, sugar, and sodium?

## Activity 2: Graphing Nutrients

Review the amount of nutrients per serving. Ask the following questions and assign a student recorder to fill in the class predictions using the Whole or Processed worksheet.

Group students into groups of four and distribute the worksheets (one per group). Each group assigns a role for the team members: Material Coordinator, Teamwork Facilitator, Data recorder and Safety Coordinator. Students use the food labels to complete the worksheets. Student pairs compare one serving size of whole and processed foods.

Students use the information from their completed worksheets to create a bar graph to represent and compare the amount of calories, fat, sodium, and sugar in each of the two food items.

Regroup students. Students report the amount of nutrients they would consume if they ate the whole package.

Ask, How does this compare to the recommended daily amount of each nutrient?

## Student Reflection

What will you notice about the foods you choose the next time you're at the market?

## English Language Learning (ELL) Focus: Measurements

- Grams
- Milligrams
- Servings
- Calories

Standards

CCSS
4.MD.A. 1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr., min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

Health
1.1.N Identify and define key nutrients and their functions.
1.2.N State the recommended number of servings and serving sizes for different food groups.
2.2.N Analyze advertising and marketing techniques used for food and beverages.
3.2.N Use food labels to determine nutrient and sugar content.

## Contributors

Jezra Thompson
Sources
California Department of Public Health, Network for a Healthy California, 2010.
Linking Science and Nutrition, Tips, Lessons, and Resources for Integrating Instruction.

## Whole Food Nutrition Facts Labels



## Whole or Processed

## CLASS PREDICTIONS AND RESULTS

|  | Class prediction | Results |
| :---: | :--- | :--- |
| Most calories |  |  |
| Most carbohydrates |  |  |
| Most total fat |  |  |
| Most sodium |  |  |

## DATA SUMMARY

|  | Nutrition Facts Label Data |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Food item | Energy <br> (calories) | Total fat <br> (grams) | Carbohydrates <br> (grams) | Sodium (milligrams) |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

## Investigate Whole and Processed Foods

## Name of Team:

$\qquad$
Instructions: Every team member should have an assignment, and there may be more than one student assigned to one role. Fill in the names of each team leader and answer the questions.
Material Coordinator: $\qquad$
Teamwork Facilitator: $\qquad$
Data Recorder: $\qquad$
Safety Coordinator: $\qquad$

## Read the food fact labels distributed to your group. Record the data from the food label for the two food items you are investigating.

1. Which food is whole?
2. Which food is processed?
3. Which food has more calories?
4. Which has more total fat?
5. Which has more sodium?
6. How does processing change the whole food you investigated?
7. Which group (whole or processed) does the team think is healthier?

# Fourth Grade 

Lesson 16
Nutrition

# Making Healthy Choices 

## Objectives/Assessment Targets

Students will:

- Make a kale salad using kale from the garden.
- Compare suggested serving amounts for fruits and vegetables.
- Identify vitamins, minerals, and fiber content associated with different groups of fruits and vegetables.


## Activity Preparation

Prepare a chart that illustrates the natural sources of vitamins, minerals, and fiber (see below).

## Materials

- Nutritional chart
- Kale from the garden (have students pick the kale during the lesson or prior lessons)
- Bowls for tasting and mixing
- Lemon, oil, and vinegar or soy sauce for light salad dressing
- Additional options: seeds, dried fruits, nuts


## Activity 1: Making Healthy Choices

Explain that fruits and vegetables are excellent sources of healthy nutrients: vitamins, minerals, and fiber. Most fruits and vegetables are naturally low in fat and cholesterol. Present the chart below to illustrate the nutrients found in common fruits and vegetables.

Ask, How many fruits and vegetables should we eat each day?

- 5-8-year-olds: $1 \frac{1}{2}$ cups vegetables and $11 / 2$ cups fruits ( 3 medium fruits).
- 8 -11-year-olds: 2 cups vegetables and $11 / 2$ cups fruits.

Show students the equivalent amounts using the samples you've prepared. For example, one cup is equal to one small apple, eight strawberries, 12 baby carrots, or one cup of cooked greens. A half-cup of fruits/vegetables is equal to one small box of raisins, half a grapefruit, or one large plum.

## Activity 2: Making a Kale Salad

One way to ensure that we get the nutrients we need is to eat the colors of the rainbow every day. Prompt students to use the nutritional chart to find out what vitamins are in kale.

Ask, What are other reasons that it's good to eat kale?
Show students the ingredients in kale salad. Have them pick the kale from the garden and wash the leaves off. Distribute kale and small bowls. Prompt students to rip the kale leaves and massage them until the color is dark and the leaves are soft. Help students make and add salad dressing.

## Student Reflection

What are other vegetables we could use to make a healthy salad?

## English Language Learning (ELL) Focus: Cause and Effect

## -

$\qquad$ is important to eat because $\qquad$ .

## Additional Information

The shorter the distance your food travels from farm to your plate, the less time the produce has to lose nutrients and flavor. Buying locally also supports the community and means that less gasoline was used in transportation.

## Standards

CCSS
RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgably.

## Health

4.1.N Demonstrate effective communication skills to ask for healthy food choices.
6.1.N Make a plan to choose healthy foods and beverages.
7.1.N Practice how to take personal responsibility for eating healthy foods.
7.2.N Practice how to take personal responsibility for limiting sugar consumption in foods, snacks, and beverages.
7.3.N Identify ways to establish and maintain healthy eating practices consistent with current research-based guidelines for a nutritionally balanced diet.
8.1.N Support others in making positive food and physical activity choices.

## Contributors

## Jezra Thompson

## Sources

California Department of Public Health, Network for a Healthy California.
Linking Science and Nutrition. Tips, Lessons, and Resources for Integrated Instruction.

## Nutrition Chart

| Vitamin/Mineral <br> /Fiber | Benefits | Occurs in these fruits and vegetables |
| :---: | :---: | :---: |
| Vitamin A | Keeps eyes and skin healthy <br> and helps to protect against <br> infections. | Dark leafy greens (like spinach and kale) and <br> orange fruits and vegetables (like sweet <br> potatoes, carrots, and mango). |
| Vitamin C | Helps heal cuts and wounds <br> and keeps teeth and gums <br> healthy. | Citrus fruits like oranges and vegetables like <br> broccoli and bell peppers. |
| Potassium | Keeping fluids in balance in <br> your body | High sources of potassium include bananas, <br> melons, and avocados. |
| Fiber | Keeps food moving through <br> the digestive tract. | Some of the highest sources of fiber include <br> apples, berries, pumpkins, and beans. |

# Garden Reflections 

## Objectives/Assessment Targets

Students will:

- Reflect on themes and concepts they learned in the garden this year.
- Identify the most important concept they would like to share with others.
- Write and/or draw to communicate their ideas.


## Materials

- Journals and pencils
- Select visual aids from past lessons
- Poster making materials for each small student group


## Activity 1: Sharing What We Learned about the Garden

Distribute student journals and display any projects or posters made throughout the year. Students review their journals and other materials that were used and take a quick tour of the garden to reflect.

Distribute poster making materials to student groups. Prompt students to think about what they are most grateful for in the garden. Direct them to make a poster, write a letter or speech, or create a diagram to explain the concept they most want to share with others. If writing thank you cards or letters, prompt them to think about whom their letters and speeches are addressed to: their families, teachers, donors, etc.

## Student Reflection

What is the most important thing you learned this semester-so important that you want other people to know?

## English Language Learning (ELL) Focus: Modals

- People should know that $\qquad$ -.
- People need to know that $\qquad$ .
- People ought to know that $\qquad$ _.
- People must know that $\qquad$ _.


## Additional Information

The results from this lesson can be used to make thank-you cards to supporters, funders, and donors who have supported garden-based learning throughout the year. Include a fun activity that allows students to make a snack together, such as smoothies using a bike blender, or making pizzas if you have a pizza oven.

Standards
CCSS
W.4.2 Write informative/explanatory texts to examine a topic in order to write or speak about the subject knowledgably.
W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Contributors
Jezra Thompson

## Sources

## Berkeley Unified School District Gardening and Cooking Program

# Fifth Grade <br> Lesson 1 <br> Garden Community 

## Welcome to the Garden

## Objectives/Assessment Targets

Students will:

- Explain the rules, practices, and guidelines for working in the garden.
- Hypothesize about themes and topics related to the garden program.
- Pose 2-3 questions they hope to answer during the year.


## Activity Preparation

Write the 3 Be's on the whiteboard.

## Materials

- Sample garden tools
- 3 Be's
- Construction paper, colored and white (at least 36 sheets per student)
- Stapler
- Drawing and writing materials


## Activity 1: Welcome to the Garden

Explain that behavior expectations in the garden are the same as in the classroom. Review the 3 Be's.

## Ask:

- How can we interpret the classroom Be's into garden Be's?
- How will you practice the 3 Be's in the classroom, garden, and cafeteria?

Introduce key elements of the garden with a garden tour, focusing on tools and safety.

## Activity 2: Making Journals

Distribute construction paper and white lined paper to demonstrate how to make a garden journal:

1. Layer sheets one on top of the other.
2. Fold down the middle lengthwise.
3. Staple the middle where the fold is.
4. Hand out drawing materials to have students write their name and classroom number on the front.

## Activity 3: What Is a Garden?

Students create their first journal entry. Prompt students to answer one or two of the questions:

- What's the difference between soil and dirt?
- What does safe drinking water have to do with gardens?
- People get their food from plants. How do plants get their food?
- Why do animals need plants? Why do plants need animals?
- What's the connection between gardens, farms, and grocery stores?
- What does healthy eating have to do with gardens?


## Student Reflection

What are you most interested in learning about in the garden this year?

## English Language Learning (ELL) Focus: Asking Questions

- Who, what, when, where, why, and how.


## Addition Information

Prompt students to revisit this first journal entry at the end of the year. Ask them the same questions at the last lesson and invite them to compare their answers to see if there is any change in response, expectations, or assumptions.

## Standards

CCSS
W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

## Health

5.1.P Use a decision-making process to determine personal choices that promote personal, environmental, and community health.

## Contributors

Jezra Thompson

## Sources

Students Learning Through Urban Gardening (SLUG)

Fifth Grade
Lesson 2
Plant Biology

## What Role Will I Play?

## Objectives/Assessment Targets

Students will:

- Discuss "The Gardener," by Sarah Stewart (or a similar book).
- Describe and compare the roles of a gardener.
- Identify students' responsibilities in the garden.
- Make a plan for how for how to carry out students' responsibilities.


## Activity Preparation

Prepare the whiteboard outlining the roles and responsibilities required for the garden throughout the year. List tasks for each responsibility. Highlight sections in the book, "The Gardener," that you would like students to read during group reading and discussion.

## Materials

- Journals and pencils


## Activity 1: Reviewing Roles and Responsibilities of a Gardener

Lead a garden tour with students, asking them to identify plants and characteristics of the different plots. Lead a reading and discussion of "The Gardener" with students. Allow students to compare roles a gardener plays in the garden.

Ask, What did you learn about garden responsibility in your garden tour and after reading "The Gardener?"

## Activity 2: Writing Out Garden Roles and Responsibilities

Present the five main responsibilities and call on students to share the tasks involved in each one. Explain that each responsibility involves several steps and will need to be completed according to seasonality. Students make a commitment to take on a responsibility as an individual, pair, or small group.

Ask, Is there a responsibility or task that you think is important that is not on the whiteboard?

Students write in their journals what they will do in the garden, their responsibility, each task, the schedule and timing for each task, and who will be involved. Students pair-share their responsibility and what they are looking forward to doing most.

## Activity 3: Getting the Garden Started

Assist students as they prepare garden beds for planting: turning soil, collecting items for compost, and/or adding ripe compost to the beds. Demonstrate how to plant a plant start with the roots down in the earth, such as tomatoes or cucumbers. Help students plant starts. As they work, prompt students to consider how each plant part uses the sun, soil, water, and air.

## Student Reflection

If you were going to a store that sells supplies for a gardener, what would you buy?

## English Language Learning (ELL) Focus: Noun and Verb Form

- In the garden, I am responsible for $\qquad$ .
- In the garden my responsibility is $\qquad$ .


## Additional Information

Another book that connects to garden roles is "Just a Dream," by Chris Van Allsburg. After reading this book with students, you can use the following questions to prompt discussions:

- What is an environmentalist?
- Is Lydia Grace an environmentalist?
- Is she a philanthropist?
- How did Walter use his talent for the common good? (What is the common good?)


## Standards

NGSS
LS2.1 Engage effectively in a range of collaborative discussion with diverse partners on Grade 5 topics and texts, building on each other's ideas and expressing their own clearly.

## CCSS

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
W.5.8 Recall relevant information from experiences or gather relevant information from print.

## Contributors

Jezra Thompson
Sources
Clare Friend, Curriculum Consultant, Learning to Give

# Fifth Grade 

Lesson 3
Plant Biology

## Flowering Seeds: Winnowing

## Objectives/Assessment Targets

Students will:

- Explain the reason for winnowing.
- Compare methods of winnowing.
- Experiment with two winnowing methods.


## Activity Preparation

Collect samples of seeding flowers from the garden. Prepare stations for winnowing.

## Materials

- Sieve, screens, or strainers
- Metal bowls
- Small containers (paper boats used in the cafeteria work well)
- Sheets of newspaper
- Cloth sacks
- Wooden boards


## Activity 1: Why Winnowing?

Show students a plant with the seeds and the flower intact. Review flower anatomy in lesson 4.4, Dissecting Flowers. Discuss a brief history of seed saving in farming:

- European settlers and Native Americans established an important agriculture seed saving base.
- The wealthy formed agriculture societies to save and trade seeds during the colonial era.
- The society of the treasury initiated a seed saving program in the early 1800 s.
- The USDA established a budget for collecting and distributing seeds to farmers across the country in 1862.
- Today, roughly 10 top companies control $65 \%$ of the seed property.


## Activity 2: Methods for Winnowing

Review the different travel modes of seeds from lesson 2.2, Seed Travel. Explain that winnowing is the process of separating the seeds (the grain) from the flower (the chaff). Demonstrate techniques for winnowing different seeds from flowers found in the garden. Discuss the different methods for winnowing seeds, prompting students to share different ways they think the chaff could be removed from the seed.

1. Threshing: Perhaps the most common method. Place seed pods in a pillowcase or cloth sack and thrash ("thresh") it against a hard surface to break the seeds from their coverings.
2. Apply gentle pressure to crack open the pods with boards. Take care not to press so hard you split the seeds.
3. Separate dirt from seeds with screens or strainers: Screens with meshes of varying sizes provide a quick way to separate debris from seeds. A single screen is a vast improvement over hand picking. Screens work especially well for seeds (such as lettuce) that do not have pods. A set of graduated screens will cut out about $80 \%$ of the hand work. You can build screens yourself or order seed cleaning screens from sources like Horizon Herbs.
4. Wind power: Outside on a breezy day, drop seeds from one container into another and let the wind blow away the unwanted chaff. Use your breath to slightly blow on the seeds at an angle to separate them from the chaff. This method works particularly well for amaranth.
5. Gravity: This works well for round seeds. Use gravity to help roll seeds down a newspaper into a container. The heavier seeds roll down, while the chaff remains behind.

Once the grain has been separated it can be milled into flour, which is used to make bread.

## Activity 3: Practice Winnowing

Demonstrate how to collect flowers that are seeding in the garden. Students work in small groups to practice winnowing flowers using two of the methods discussed for amaranth, hollyhock, wheat, and/or cosmos. Students compare how the chaff of seeds from different plants is different and pair-share with their small groups or journal entry.

## Student Reflection

What are the benefits of saving seeds?

## English Language Learning (ELL) Focus: Phrasal Verbs

- Separate from
- Blow away
- Roll down
- Blow on
- Crack open


## Standards

NGSS
5.LS1.A Structure and Function. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
5.LS2.A Interdependent Relationships in Ecosystems. The food of almost any kind of animal can be traced back to plants.
5.ESS3.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

CCSS
5.SL. 1 Engage effectively in a range of collaborative discussion with diverse partners on Grade 5 topics and texts, building on each other's ideas and expressing their own clearly.

## Contributors

Daria Wrubel
Elena Garcia
Jezra Thompson
Rachel Harris

## Sources

History of US Seed Development and Patent Regimes, Center for Food Safety
Northwest Farm and Food

# Fifth Grade <br> Lesson 4 Nutrient Cycles 

## Nitrogen Cycle

## Objectives/Assessment Targets

Students will:

- Explain the importance of nitrogen.
- Illustrate and label the nitrogen cycle.
- Illustrate and label nitrogen nodules.


## Activity Preparation

Draw the nitrogen cycle diagram on the whiteboard.

## Materials

- Butcher paper for each student group to examine soil
- Perfect compost pile pyramid
- Fava beans or other legumes with nodules on their roots.
- Thermometer


## Activity 1: Carbon and Nitrogen in Compost

Review the perfect compost pile by showing students the compost bin and reviewing the layers of the compost for decomposition and the importance of nitrogen from lesson 3.4, Introducing Nitrogen. Present the nitrogen cycle diagram below. Explain that nitrogen is essential for plant growth. To absorb nitrogen, a plant must form a mutual relationship (also called a symbiotic relationship) with bacteria in the soil called "nitrogen-fixing bacteria." This relationship is good for the plant, good for the bacteria, and good for our garden.

There is plenty of nitrogen in the world, although most of it is in a gas form. These types of plants rely on gardeners to add nitrogen through healthy compost and soil. Adding nitrogen through chemical assistance, such as manure, blood, and fertilizers, can be damaging to the watershed.

There are only a few plants (legumes) that are able to draw the nitrogen gas from the air and store it in their roots, with the help of bacteria. An environmentally friendly approach to adding nitrogen is to plant a winter crop of legumes or alfalfa that naturally will add nitrogen to the soil. As these plants decompose, they will raise the total nitrogen in the soil and will make it available for plants that are unable to get nitrogen from the air (gas form).

## Activity 2: Observing Nitrogen Nodules

Show students a legume plant with nodules on its roots. Explain that when a plant stores nitrogen in its roots, it produces a lump on the root called a nitrogen nodule; this is where bacteria is stored. These nodules are harmless to the plant and very beneficial to your garden.

Assign a student to take the temperature of the compost every week and compare rising heat levels.

Ask, How do legumes in our garden affect rising heat levels in our compost or soil?

## Student Reflection

How can too much nitrogen damage our garden and our environment?

## English Language Learning (ELL) Focus: Language of the Nitrogen Cycle

- Bacteria
- Nodules
- Nitrogen
- Mutual or symbiotic relationship
- Legumes


## Additional Information

Composting breaks the paper down into small particles of organic matter that return essential nutrients back into the ecosystem. Compost heats up when legumes turn the nitrogen gas into a solid. Plants and soil absorb less than half of the nitrogen added to them. Too much nitrogen can create additional heat trapping gasses, which goes into our air and water.

## Standards

NGSS
5.LS1.A Structure and Function-Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
5.LS2.A Interdependent Relationships in Ecosystems. The food of almost any kind of animal can be traced back to plants.
5.ESS3.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

## Contributors

Elena Garcia
Jezra Thompson
Rachel Harris

## Sources

"Closing the Loop," California Academy of Sciences
What a Waste: K-6 Waste Management Education Curriculum, Minnesota Office of Environmental Assistance:

The Climate Friendly Gardener, Union of Concerned Scientists

## Nitrogen Cycle Diagram



# Fifth Grade <br> Lesson 5 <br> Nutrient Cycles 

## The Carbon:Nitrogen Ratio

## Objectives/Assessment Targets

Students will:

- Review the components of a compost pile.
- Explain the importance of the $\mathrm{C}: \mathrm{N}$ ratio for creating rich compost.
- Analyze organic material for content, temperature, and weight.
- Gather organic materials to create and/or add to the compost.


## Activity Preparation

Write the different C:N ratios for healthy compost piles on the whiteboard. Draw the perfect compost pile pyramid on the whiteboard.

## Materials

- Butcher paper for student groups examining soil
- Compost pile pyramid
- Scale for weighing compost materials
- Thermometer for taking the temperature of each compost pile
- Journals and pencils


## Activity 1: Carbon and Nitrogen in Compost

Review Lesson 5.4, Nitrogen Cycle, and the components of a compost pile, the role of fungus, bacteria, and invertebrates (FBI), and clarify the difference between organic and nonorganic materials in breaking down compost layers. Show students the compost pile and review the brief outline:

- Organic materials will decompose more efficiently if the compost pile is made with the proper balance between carbon-rich and nitrogen-rich materials.
- Carbon and nitrogen provide the necessary environments for microorganisms (FBI) to live.
- Generally, carbon-rich materials are brown, although we can find carbon in many colored organic materials.
- Generally, nitrogen-rich materials are green, but there is nitrogen in many kinds of organic material. Red meat, for example, is rich in nitrogen. Brown walnuts are rich in nitrogen, too.
- Browns (carbon) can be identified as dry and greens (nitrogen) as fresh and moist.
- The balance between these two types of materials is referred to as the carbon:nitrogen ratio and shown as C:N. The ideal C:N ratio is around 25 to 30 parts carbon to one part nitrogen, or 25-30:1.

Ask, Why do we need to include nitrogen-rich materials in the compost?
The correct mix of carbon and nitrogen is needed to create an ideal environment with the right amount of heat and rot to produce compost. This ratio describes the chemical composition of a material and does not mean that you need a volume of brown materials that is thirty times greater than the amount of green matter.

Ask, What do you think will happen if there is too much carbon or too much nitrogen?
(If the $\mathrm{C}: \mathrm{N}$ ratio is too high (excess carbon), decomposition slows down. If the $\mathrm{C}: \mathrm{N}$ ratio is too low (excess nitrogen), you will end up with a stinky pile.)

## Activity 2: Compost and Soil Examination

Students collect compostable materials in two groups (browns and greens) and add them in layers to the garden compost pile. Demonstrate how to take the temperature of a compost pile using a thermometer. Guide them in taking the temperature of each collection before adding it to the compost pile.

Ask, What does it mean for the C:N ratio when the heat rises or falls?

## Student Reflection

How does maintaining a healthy compost pile reduce the use of fertilizers and other chemicals?

## English Language Learning (ELL) Focus: Prepositions

- Ratio of C:N means the ratio amounts of C to N .


## Additional Information

Microorganisms that digest compost need about 30 parts of carbon for every part of nitrogen they consume. If there's too much nitrogen, the microorganisms can't use it all, and the excess is lost in the form of smelly ammonia gas. Nitrogen loss due to excess nitrogen in the pile (a low C:N ratio) can be over $60 \%$. At a C: N ratio of 30 or 35 to 1 , only one half of $1 \%$ of the nitrogen will be lost. That's why you don't want too much nitrogen (fresh manure, for example) in your compost.

Most fresh plant material contains 40\% carbon. The C:N ratio varies because of differences in nitrogen content, not carbon content. (Note: dry materials are generally in the range of $40 \%$ to $50 \%$ carbon, and sloppy, wet materials are generally $10 \%$ to $20 \%$ carbon.

Therefore, the most important factor in estimating the C:N ratio of plant or food waste is how much water is present).

An example of a compost thermometer is the Mantis 201101 Compost Bin Thermometer, which you can purchase online, at garden stores, or use a large meat thermometer.

Standards
NGSS
LS2.B Cycles of Matter and Energy Transfer in Ecosystems. Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die.
Organisms obtain gases, and water from the environment and release waste matter (gas, liquid, or solid) back in the environment.

CCSS
MP. 4 Model with mathematics.
5.NF.B. 7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection , and research.

MP. 2 Reason abstractly and quantitatively.

## Contributors

Jezra Thompson
Rachel Harris

## Sources

Cornell Composting, by Tom Richard at Cornell Cooperative Extension. Cornell Waste
Management Institute, Cornell University.
Home Composting Made Easy

## Perfect Compost Pile Pyramid



# Fifth Grade <br> Lesson 6 Nutrient Cycles 

## Botany on Your Plate

## Objectives/Assessment Targets

Students will:

- Name and explain the functions of the parts of a plant.
- Demonstrate how the garden produces the food they eat by gathering and assembling the ingredients for a burrito from the garden.


## Activity Preparation

Draw the six plant parts on the whiteboard or prepare a laminated diagram that is large enough to show a full class (this is helpful preparation for future lessons and will save on time). Gather the plant parts from all six categories and prepare them in bowls (this can also be done as part of the activity). Boil beans and sauté leafy green stems. Prepare tortillas to wrap the plant part ingredients in.

## Materials

- Edible plant parts from each category: roots, stems, leaves, flowers, fruits, and seeds
- Lettuce leaf (Leaves), shredded carrots (Roots), chopped celery or sautéed leafy green stems (Stems), basil and fennel flowers (Flowers), chopped tomatoes (Fruit), and hummus or sunflower butter or beans (Seeds).
- Knives and chopping boards for students
- Collecting and mixing bowls


## Activity 1: Reviewing Plant Parts and Their Functions

Review lesson 4.4, Dissecting Flowers. Show students a plant with all six parts: roots, stems, leaves, flowers, fruits, and seeds (bonus if it is a legume with nitrogen nodules). Students share descriptions of the parts of the plants. Students answer each question as a group or in their journals.

[^0]What is the purpose of leaves? | Leaves turn the sugar into plant food through their stomata, which |
| :---: |
| get energy from the sun and absorb carbon dioxide. They then |
| breathe out the energy in the form of oxygen. |

What is the purpose of flowers? | Flowers attract pollinators with their pollen. The flowers also turn |
| :---: |
| into a fruit. |

What is the purpose of fruits? | Fruits hold the seeds and often taste sweet, which attracts animals. |
| :---: |
| The animals eat the fruits and disperse the seeds through |
| defecation. |

What is the purpose of seeds? | Seeds are the offspring of the plant that can be planted to grow |
| :---: |
| new plants. |

| What is the purpose of nitrogen |
| :---: |
| nodules? | | Nitrogen nodules store the nitrogen that, with the help of bacteria, <br> the draws from the air. Not all plants store nitrogen in this <br> way. Peas, alfalfa, and beans are especially good at this. |
| :---: |

Ask, What are other traits that roots, stems, leaves, flowers, fruits, and seeds have?

## Activity 2: Harvesting Plant Parts for Burritos

Students pair up to receive harvest containers/bowls and harvest produce according to the four groups below. Harvest groups:

1. Green leaves from lettuces
2. Edible flowers
3. Carrots
4. Fruits

Students regroup. Set up the garden burrito ingredients like an assembly line. Demonstrate how to make garden burritos with the items they harvested and the items you had prepared: begin with a lettuce leaf (Leaves), fill the leaf with shredded carrots (Roots), chopped celery or sautéed leafy green stems (Stems), basil and fennel flowers (Flowers), chopped tomatoes (Fruit), and hummus or sunflower butter (Seeds).

## Ask:

- What did you pick and why?
- What's one nutritional value or each?


## Activity 3: Planting for Next Season

It's not quite time to start warm-weather seeds outside, but it's time to start seeds in the greenhouse for plants that like to grow in warm weather.

## Ask:

- What kind of plants do we plant in cool weather? (Plants that tend to grow well in cool weather are plants that we eat the leaves and roots of, although root crops will grow faster in the warmer months.)
- What kind of plants do we plant in warm weather, and why? (Plants that grow in the summer tend to be more colorful, and we eat their seeds or fruits.)

Students share some plants that like cool weather:

- Lettuce
- Kale
- Collard greens
- Swiss chard
- Cabbage
- Spinach
- Celery

A couple of exceptions to the leaf rule:

- Broccoli and cauliflower (We eat the closed flowers.)
- Fava beans (This is the only bean that grows well in winter!)
- Sweet peas
- Roots and bulbs, like carrots, beets, onions, and turnips (Although most will grow faster in warmer months.)


## Student Reflection

Why are plants important to eat?

## English Language Learning (ELL) Focus: Verbs

- Plants store nitrogen. This plant is storing nitrogen.
- Flowers house seeds. These flowers are housing seeds.
- We plant foods in our garden. We are planting foods in our garden.


## Standards

NGSS
LS1.A Structure and Function. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
5.LS2.A Interdependent Relationships in Ecosystems. The food of almost any kind of animal can be traced back to plants.
5.ESS3.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

CCSS
5.SL. 1 Engage effectively in a range of collaborative discussion with diverse partners on Grade 5 topics and texts, building on each other's ideas and expressing their own clearly.

## Health

1.9.N Explain how good health is influenced by healthy eating and being physically active.

## Contributors

## Jezra Thompson

## Sources

"Garden Burritos," Jennifer Bedrosian, science teacher, Edible Schoolyard, Greensboro Children's Museum, Greensboro, NC.
"Morphology of Flowering Plants," Dr. Aarif Kanadia, biology teacher in Mumbai, India.

# Fifth Grade <br> Lesson 7 <br> Cycles in Nature 

# Weather, Climate, and Drought 

## Objectives/Assessment Targets

Students will:

- Define drought.
- List some of the consequences of drought.
- Explain the cause-and-effect relationships between weather, climate, and drought.
- Interview several people to investigate how they conserve.
- List actions they can take to help conserve water.


## Materials

- Journals and pencils


## Activity 1: Explaining Drought

Review lesson 4.7, Water Cycle, emphasizing that water is a finite resource. Explain that drought is a period of water shortage, when a lack of normal precipitation (weather) produces dry conditions lasting as long as several years (climate).

## Fun Facts:

- In many areas of the world, droughts are a normal, recurring climate condition.
- Some of the earliest human climate accounts describe droughts and their consequences.
- Some hunter-gatherer and animal migrations are attributed to drought.

Ask, Where do we get fresh water? What is it used for?

## Activity 2: Water Diaries

Distribute journals or have students make new journals for water diaries to record events, habits, conversations, and observations related to drought. Help students develop several questions that they will ask themselves, friends, neighbors, and family members in order to investigate awareness of drought over the next week. For example:

1. How do you describe drought?
2. How has drought affected you personally? If you haven't been affected, why not?
3. How can we conserve water?
4. Why are farmers and city water managers concerned about snow and rain amounts?
5. How can policymakers help residents conserve water?

Prompt students to use these questions to initiate conversations with the people around them to learn about how people are affected by drought. Student will present their findings at the next class.

## Student Reflections

How do you currently conserve water? What else can you do to save more?
English Language Learning (ELL) Focus: Auxiliary Can and Do Questions

- Why do we study drought?
- What do you think causes drought?
- What can policy do to conserve water?
- How can gardeners conserve water?


## Additional Information

As of August 7, 2012, the National Drought Mitigation Center reported that 52\% of the United States and Puerto Rico are experiencing moderate drought or worse.

## Standards

NGSS
5.ESS2.C The Roles of Water in Earth's Surface Processes. Nearly all of our Earth's available water in in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.

CCSS
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

## Contributors

Jezra Thompson

## Sources

Drought beyond Borders, Bilingual Lesson Plans for the Binational Santa Cruz Watershed Project WET Discovering Drought, Project EAT

# Fifth Grade <br> Lesson 8 <br> Cycles in Nature 

## Water Footprint

## Objectives/Assessment Targets

Students will:

- Explain the difference between salt water and freshwater and why freshwater is so important for humans.
- Observe and describe a representation of the distribution of salt and fresh water on earth.
- Brainstorm ways to conserve water.


## Activity Preparation

Cut sponges into twelve pieces. Fill a pitcher with one quart of water. Draw the Water Use Chart on the whiteboard representing the planet's water percentages according the diagram below.

## Materials

- Pitchers of water (one for each student group)
- Eye dropper
- Three cups
- Small plastic cups (one for each student)
- Two sponges cut into 12 pieces (one piece per student)
- Water Use Chart


## Activity 1: Drop in the Bucket

Review lesson 5.7, Weather, Climate, and Drought. Remind students that our planet's water is finite. Explain the difference between fresh and salt water. Demonstrate how much of the planet's water is drinkable by following these steps:

1. Hold up the pitcher and fill it with water, which represents all of the water on the planet, $97 \%$ of which is salt water.
2. Pour six teaspoons from the pitcher into a cup, which represents the $3 \%$ of the planet's water that is fresh.
Ask, What portion of the Earth's water is drinkable?
3. Pour one teaspoon into another cup to demonstrate the amount of freshwater that is liquid.
4. Hold up the remaining water left in the pitcher. Students share where they think the remaining freshwater is found. (Most of the remaining fresh water is deep underground).
5. Use an eyedropper to pull out a single drop of water from the small cup of "fresh water" and place it on your finger, representing the freshwater on the planet that is drinkable.

## Ask:

- What percentage of the planet's water is solid? (glaciers or polar ice caps)
- Which percentage is liquid? (waterways)
- Which percentage is gas? (transpiration)


## Activity 2: Observing Our Water Footprint

Explain that our water footprint is the amount of water we as individuals consume and the impact our use places on the planet. Students work in pairs to brainstorm all the ways that they use the $3 \%$ of drinkable water, other than for drinking.

Distribute small cups and small pieces of sponge to each student. Students observe their water consumption by following these steps:

1. Dip your sponge into the pitcher of water each time you think of an activity that you do that uses water.
2. Retain as much water in the sponge as possible without wringing it out in between actions.
3. Squeeze your sponge into the small cup, which represents your water footprint. Students compare the amount of water in their water footprint with the amount of water that represented all of the drinkable water on earth.

## Ask:

- What is conservation?
- How can you conserve water?


## Student Reflection

How will you conserve water?

## English Language Learning (ELL) Focus: Verb to Noun

- Conserve water
- Water conservation


## Additional Information

The reservoir that Berkeley gets its water from is located on the Mokelumne River in the Sierra Nevada Mountains. We share this reservoir with other living organisms.

## Standards

NGSS
5.LS1.1 Support an argument that plants get the materials they need for growth chiefly from air and water.
5.LS2.1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. Emphasis is on the idea that matter that is not food (air and water) is changed by plants into matter that is food.

CCSS
MP. 2 Reason abstractly and quantitatively.
RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgably.

## Contributors

Elena Garcia
Jezra Thompson
Rachel Harris

## Sources

Project EAT

## Water Use Chart



# Fifth Grade <br> Lesson 9 <br> Cycles in Nature 

## Pollution Soup

## Objectives/Assessment Targets

Students will:

- Identify the types of pollutants created by various human and natural activities.
- Explain why watershed contamination is harmful for plants, animals, and humans.
- Observe and describe a representation of several pollutants as they are introduced into a clean "watershed."


## Activity Preparation

Label seven containers and fill them with the following materials to represent different types of pollutants created by that group/process/category.

1. Weather: rocks and dirt
2. Trash: wrappers and crumpled paper
3. Car owner: metal, pennies, rubber bands
4. Homeowner: paint chips, soap
5. Pet owner: Tootsie roll or chocolate-covered raisins to represent pet waste
6. Gardener: water and food coloring to represent fertilizers and pesticides
7. Heavy industry: soy sauce and water to represent industrial discharges

## Materials

- Seven containers with the above labels
- Glass jar or bucket
- Container of water
- Samples of pollutants from the seven groups
- Photo example of how polluted watersheds affect animals


## Activity 1: Reviewing Watersheds

Review basic information about watersheds from lesson 5.8, Water Footprint, and lesson 4.10, Mapping Your Watershed. Students report their findings from the previous week/lesson's drought interviews.

Explain that a watershed is an area of land where all water drains off and goes into a common body of water, such as a storm drain, a creek, or the Berkeley Bay. A watershed can be thought of as a large bathtub. When a drop of water hits the edge of a bathtub, it eventually finds its way into the drain (the lowest point).

## Ask:

- What do we use our watershed for?
- What happens if the watershed gets filled with other material besides water?


## Activity 2: Observing Pollutants

Review the seven containers that represent different types of pollutants created by a group/process/category. Explain that the objects in the containers represent the type of pollutant that is created by each group and ends up in the watershed. Students provide examples for each and highlight how they could destroy the watersheds.

| Weather | Heavy rainstorms push dirt from construction sites onto streets, into storm drains, <br> and into the bay. Sediment in the water can decrease the amount of light available <br> to plants in the water, increasing temperatures and smothering aquatic life. <br> Litter is tossed on the streets and creeks, which is washed down the storm drains <br> or directly into our watersheds when it rains or during street cleaning. Plastics, <br> aluminum, and other trash do not degrade and contain toxic materials. <br> All vehicles contribute to urban runoff that goes down our storm drains and into <br> our watersheds. They are major sources of metals, such as copper, lead, cadmium, <br> and chromium that are toxic to all life. |
| :---: | :--- |
| Cars Homeowner | Repairs and home upkeep may contain paints that have heavy metals, fungicides to <br> inhibit mold, and dyes. When paint is poured down the storm drain or brushes and <br> rollers are cleaned outside, our watershed becomes polluted. <br> Pet waste that is not picked up collects bacteria and parasites that are carried into <br> the watershed when they are washed down the streets or seep into creeks. |
| Pet owner |  |
| GardenersWhen pesticides, fertilizers, herbicides, and weed killers are used on our <br> landscapes and gardens, they leave remaining contaminates that sit on the surface <br> of the earth. These are washed into our storm drains and creeks more quickly <br> when these landscapes are overwatered. <br> There are more regulations for industrial pollution than home pollution; however, <br> some industries illegally dump toxic waste or discharge hot water into rivers and <br> bays. |  |
| Heavyindustry |  |

Demonstrate how a watershed can be contaminated by displaying a large container of water (the watershed). Each student adds materials from the containers one at a time. Students share which of these materials might contain substances that are harmful to the environment.

Ask, How do these pollutants get into the watershed?
Review examples of how these pollutants get into our watershed by writing down examples that students share on the whiteboard next to each of the seven activities. Add more details as the activity proceeds.

Ask, How might these pollutants affect animals, humans, and plants?

## Student Reflection

What can you do to help keep the watershed clean and free of pollutants?
English Language Learning (ELL) Focus: Noun, Collective Noun, and Verb

- Pollutants are individual material that contaminates water, air, or land.
- Pollution is a collection of materials that contaminates water, air, and land.
- Gardeners pollute the watershed when they use pesticides, fertilizers, and herbicides.


## Standards

NGSS
LS1.A Structure and Function. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
5.LS2.A Interdependent Relationships in Ecosystems. The food of almost any kind of animal can be traced back to plants.
5.ESS3.1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

CCSS
5.SL. 1 Engage effectively in a range of collaborative discussion with diverse partners on Grade 5 topics and texts, building on each other's ideas and expressing their own clearly.

## Health

6.1.P Monitor progress toward a goal to help protect the environment.
8.1.P Encourage others to minimize pollution in the environment.

## Contributors

Erica Woll
Jezra Thompson

## Sources

Kids in the Garden

## Pollution Affects Our Watersheds, Animals, Humans, and Earth



The Perils of Plastics: Two New Perspectives on Seabirds and Marine Pollution International Bird Rescue

# Photosynthesis: Part I 

## Objectives/Assessment Targets

Students will:

- Describe the different steps in the process of photosynthesis.
- Explain the role of humans in photosynthesis.


## Activity Preparation

Draw the diagram of photosynthesis using the diagram below. Prepare cheat sheet cards that outline the steps in photosynthesis: Cut strips of paper or note cards, write the name of each of photosynthesis process and draw the plant parts involved in each one on the front side of the card, label the description of each step in the process on the back. Laminate the cheat sheet cards for repeated use. These cheat sheet cards will come in handy throughout the year and will continually save you time. Place tape on the back of each cheat sheet card when using them on the whiteboard.

## Materials

- Photosynthesis diagram
- Strips or paper or notecards
- Journals and drawing materials


## Activity 1: Diagramming Photosynthesis: Sun + Water + CO2

Review lesson 4.2, Plants Need Light. Explain how plants make their own food by absorbing sunlight and carbon dioxide $\left(\mathrm{CO}_{2}\right)$ through the surface and stomata in their leaves and turning it into sugar food for themselves, other plants, and humans. This process is called photosynthesis. The "recipe" for photosynthesis $=\mathrm{Sun}+\mathrm{Water}+\mathrm{CO}_{2}$. Organisms obtain gases and water from the environment and release waste matter (gas, liquid, or solid) back into the environment. With student participation, follow these steps to demonstrate the equation for photosynthesis using the photosynthesis diagram and your cheat sheet cards.

1. Sunlight hits the leaf.
2. The stomata in the leaf absorb carbon dioxide $\left(\mathrm{CO}_{2}\right)$. This is how plants breathe in what we breathe out.
3. The stomata turns carbon dioxide into sugar and releases oxygen into the air. This is how we breathe in what plants breathe out.
4. Water travels up from the roots to the stem through the ribs into all parts of the leaf.
5. Plants absorb energy from light through "stomata" in their leaves and turn it into food.
6. Sugar travels down the stem roots. Specific nutrients are turned into plant sugars that the plant uses as energy.

Students draw their own diagrams of photosynthesis in their journals, labeling the plant parts and their function in turning sunlight into plant food. Students will use their diagram for the next lesson.

## Student Reflection

What is our role in the cycle of photosynthesis?

## English Language Learning (ELL) Focus: Vocabulary of Photosynthesis

- Carbon dioxide is what we breathe out.
- Oxygen what we breathe in.
- Carbon dioxide is what plants absorb.
- Oxygen and sugar is what plants produce.


## Additional Information

Plants are the only living things on Earth that can make their own food. Thus, they are able to live almost everywhere on earth in a wide range of habitats. This is one of the special adaptations they've developed to help them survive.

## Standards

NGSS
5.PS3.1 Use models to describe that energy in animals' food (used for body repair, growth, motions, and to maintain body warmth) was once energy from the sun. Examples of models could include diagrams and flow charts.
5.LS1.1 Support an argument that plants get the materials they need for growth chiefly from air and water.

LS1.C Organization of Matter and Energy Flow in Organisms. Food provides animals with the materials they need for bodily repair and growth and the energy they need to maintain body warmth and for motion. Plants acquire their material for growth chiefly from air and water.
5.LS2.1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

LS2.B Cycles of Matter and Energy Transfer in Ecosystems. Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die.

## CCSS

RI.5.1 Quote accurately form a text when explaining what the text says explicitly and when drawing inferences from the text.

## Contributors

Ben Goff
Jezra Thompson
Rivka Mason

## Sources

Life Cycle of Plants, Utah Education Network
Ph-ocusing on Photosynthesis In and Out of the Garden, Yale-New Haven Teachers Institute How Does Photosynthesis Work?


## sunlight



# Photosynthesis: Part II 

## Objectives/Assessment Targets

Students will:

- Review the steps in photosynthesis.
- Compare the results of the sunlight experiment to illustrate the importance of sunlight for healthy plants.
- Observe how water travels through the vascular system of a plant by using a stalk of celery, water, and food coloring.


## Activity Preparation

Prepare glass jars with celery stalks for every pair of students. Draw the diagram of photosynthesis using the diagram and cheat sheets from lesson 5.10, Photosynthesis: Part I, for review.

## Materials

- Photosynthesis diagram and cheat sheets
- Student journal entries from previous lesson
- Samples of plants with large, green leaves
- Tall, clear glass jars
- Water pitchers
- Red food coloring
- Knife
- Celery stalks with leaves


## Activity 1: Reviewing Photosynthesis

Review Lesson 5.10, Photosynthesis: Part I, introducing photosynthesis as (Photosynthesis = Sun + Water $+\mathrm{CO}_{2}$ ). Students pair-share what they know about how plants make their own food while reviewing their journals and their diagram of photosynthesis. You can have students try to walk through the process for the whole class.

Ask, How do plants use water and sunlight?

## Activity 2: Chlorophyll's Role in Photosynthesis

Show a sample of a plant with large, green leaves. Focus on the leaves. Photosynthesis happens with the help of chlorophyll that is found in the green leaves of plants. Chlorophyll
absorbs the sun's light and turns it into sugars that plants use for food. Demonstrate this with your photosynthesis diagram and cheat sheet cards to locate the chlorophyll.

Ask, How is this similar to how we get our food?
Students collect leaves no larger than their hand and experiment with chlorophyll. Help students observe the process of roots "sucking up water" and moving through their vascular system and into their leaves, which will highlight the chlorophyll, by following these steps:

1. Fill a tall, clear glass jar half full with water.
2. Add a few drops of red food coloring and mix well.
3. Trim the bottom edge of the large stalk of celery, keeping the leaves on.
4. Put the celery stalk in the glass jar and leave it overnight.
5. Observe what has happened the next morning.
6. Students identify that the water has been absorbed in to the celery stalk, tinting the stem and leaves red.
7. Prompt students to think about how the whole plant got water and why the color moves to the leaves.
8. Students journal what they observe.

## Student Reflection

How does a plant's vascular system help it get the nutrients (food) it needs?

## English Language Learning (ELL) Focus: Comparative Adjectives

- Plants are similar to humans because $\qquad$ .
- Humans are different than plants because $\qquad$ .
- Plants are the same as humans because $\qquad$ .

Standards
NGSS
5.PS3.1 Use models to describe that energy in animals' food (used for body repair, growth, motions, and to maintain body warmth) was once energy from the sun. Examples of models could include diagrams and flow charts.
5.LS1.1 Support an argument that plants get the materials they need for growth chiefly from air and water.
5.LS2.1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

LS1.C Organization of Matter and Energy Flow in Organisms. Food provides animals with the materials they need for body repair and growth and the energy they need to maintain
body warmth and for motion. Plants acquire their material for growth chiefly from air and water.

LS2.B Cycles of Matter and Energy Transfer in Ecosystems. Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die.
Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

## CCSS

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

## Contributors

Ben Goff
Jezra Thompson

## Sources

Ph-ocusing on Photosynthesis In and Out of the Garden, Yale-New Haven Teachers Institute

## How Does Chlorophyll Work?



## Apples to Earth

## Objectives/Assessment Targets

Students will:

- Calculate the amount of topsoil that is available on the Earth's surface.
- Conduct an experiment that examines topsoil's structural ability to filter water.


## Activity Preparation

Familiarize yourself with the necessary fractions and the Earth's resources, per the activities below.

## Materials

- Large Apple
- Knife
- Journals
- 5-oz.cups
- 3-oz. cups
- Kool-Aid
- Soil
- Coffee filters


## Activity 1: Representing the Amount of Topsoil on Earth

Review components of soil (mineral particles, organic materials, air, and water). Topsoil is the fertile, upper part of the soil. Soil is formed from parent materials by biological, chemical, and physical processes. Soils are degraded primarily by erosion, loss of organic matter, salinization, and acidification.

Ask, What are ways that topsoil can degrade? (Too much rain and not enough organic matter to hold the soil together.)

Show students an apple as a representation of the entire Earth. Students make two hypotheses based on these questions:

1. How much of the Earth's surface is soil?
2. How much of it is fertile soil capable of growing food?

Demonstrate the amount of water on our planet with an apple and a knife. Cut the apple in four equal sections to demonstrate the following:

- $3 / 4$ of the Earth's surface is ocean.
- $1 / 4$ of the surface represents all the land on Earth.

Take half of the apple (2/4) and explain that half of all the land on Earth is considered inhospitable, meaning too cold, too steep, or too dry (polar, high mountains, or deserts). The other half of this remaining $2 / 4$ represents land that is hospitable to humans, though not all of it is used to grow food. Of this remaining 2/4ths:

- $1 / 4$ has soil that is too poor, too wet, too steep, or too cold.
- $1 / 4$ is covered in concrete (parking lots, highways, roads).
- $1 / 4$ is where people have homes
- $1 / 4$ has fertile topsoil that is available to grow enough food to support the world's population.

Distribute journals and pencils. Challenge students to calculate the fraction of the whole to describe how much topsoil is available to grow food for the entire world's population.

## Activity 2: Filtering Topsoil

Demonstrate how water filters through soil by following these steps:

- Put a layer of sand the width of your pointer finger in the bottom of the 5-oz. cup with holes in it.
- Add topsoil until the cup is half full.
- Put the 5-oz. cup into the 3-oz. cup.
- Pour some of the grape Kool-Aid into the top cup.

Students record observations in their journals.
Ask, What does the Kool-Aid represent? (Chemicals added to water)
What to expect from the experiment:
The soils will vary in color from gray to red to brown to the light brown sand on the right. The color of the water in the bottom cup will range from purple (about the same color as the grape Kool-Aid began), to bright pink, to almost colorless, to a murky red.

Explain that soil naturally filters water that falls as rain and goes into rivers. Soil filters many chemicals out of water, just like it did with the Kool-Aid. These same techniques are used to purify wastewater that comes from houses, cities, industry, and large animal feeding operations.

## Student Reflection

Why are some natural resources called "limited?"
English Language Learning (ELL) Focus: Phrasal Verbs

- Soil filters out chemicals.
- Soil filters out pollutants.


## Additional Information

It takes 300-500 years to form one inch of topsoil, depending on the environment.
Standards
NGSS
ESS3.C Human Impacts on Earth Systems. Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. Individuals and communities are doing things to help protect Earth's resources and environments.

CCSS
RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

MP. 4 Model with mathematics.

## Contributors

Elena Garcia
Jezra Thompson
Rachel Harris
Sources
Dr. Dirt, K-12 Teaching Resources, Clay Robinson, PhD, CPSSc, PG

# Making Healthy Choices 

## Objectives/Assessment Targets

Students will:

- Use fresh ingredients from the garden to make and eat a healthy recipe.
- Create an original recipe using at least three ingredients from the garden.


## Activity Preparation

Print out a copy of the Healthy Choices worksheet for each student.

## Materials

- Bowls and utensils for mixing and tasting
- Large pan and burner for sautéing
- Recipe ingredients (enough for the whole class)
- Healthy Choices worksheet (one per student)


## Activity 1: Making a Garden-Fresh Recipe Together

Students pick and cook some of the vegetables that they have been tending all year. Review lesson 4.14, Plant Families. Students focus on the brassica family (broccoli), which has the following qualities:

- Broccoli is high in calcium for your bones, teeth, and muscles. It is also high in iron, which helps your blood carry oxygen.
- A head of broccoli is actually just a bunch of closed flowers-if you leave them on the plant, they open into yellow flowers that are also edible. These have a sour smell, a sweaty taste, and fibrous stalks. The leaves are also edible and equally good for you.

Each student adds an ingredient and participates in stirring, serving, and tasting.
Ingredients

- Broccoli (or other any other brassica family veggie you have growing in the garden)
- 1 Tbsp. olive oil
- 1 Tbsp. broth (optional)
- Lemon pepper to taste
- Lemon for zest (optional)

Steps

1. Sautee the ingredients together until the broccoli is tender.
2. You can make your own lemon pepper dressing by zesting a lemon and mixing the zest with pepper and whisking in some olive oil.
After cooking and tasting, students pair up to design a recipe using at least three garden ingredients. Distribute the Healthy Choices worksheet for students to complete in pairs or small groups.

## Student Reflection

How can you identify a plant in the brassica family? What are the nutrition facts about brassicas? What part of the brassica plant do we eat?

## English Language Learning (ELL) Focus: Verbs with Prepositions

- Broccoli belongs to the brassica family of vegetables.
- Spinach belongs to the group of vegetables that like cool weather.


## Standards

NGSS
5.PS1.3 Make observations and measurements to identify materials based on their properties.

CCSS
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
5.MD.A. 1 Convert among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step, real-world problems.

## Health

2.2.N Recognize that family and cultural influences affect food choices.
1.6.N Differentiate between more nutritious and less nutritious beverages and snacks.
1.8.N Describe the benefits of eating a nutritionally balanced diet consistent with current research-based dietary guidelines.
5.1.N Use a decision-making process to identify healthy foods for meals and snacks.
7.2.N Demonstrate how to prepare a healthy meal or snack using sanitary food preparation and storage practices.
8.1.N Encourage and promote healthy eating and increased physical activity opportunities at school and in the community.

## Contributors

Jezra Thompson
Sources
Bay Farm Alameda Unified School District

## Healthy Choices Worksheet

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: You have been hired to design a garden-fresh menu for a trendy restaurant. We need to know the one recipe you would like to feature on our menu. Include the ingredients and the nutritional content. Tell us why we should be serving this recipe.

1. List the ingredients and their nutritional value.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
2. List the recipe title and the steps to making the recipe using at least three of the ingredients you listed above. List the units of measurement for each ingredient.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
3. Let us know why we should serve your recipe to our customers and how it could improve their health.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

## Plant Traits

## Objectives/Assessment Targets

Students will:

- Compare and contrast different seeds and their corresponding plant families.
- Prepare the garden to plant sweet potatoes, including tilling, amending the soil, applying mulch, digging holes, and planting starts.


## Activity Preparation

Prepare the whiteboard with a list of the plant families that correspond to the seeds that you distribute. Identify a sunny and warm garden plot for students to plant potatoes. Have a potato with leaves and roots to demonstrate plant parts.

## Materials:

- Potato with roots and leaves
- Plant families list
- Potato starts for student groups to plant
- Seed cards


## Activity 1: Matching Seeds to Plant Families

Review Lesson 4.14, Plant Families (a review of the families is below). Distribute seed cards to small groups of 2-3 students. Students observe the seeds, compare their features, and share any other information they know with the group. Prompt students to recall lessons on companion planting.

## Ask:

- What are the characteristics of the seed cards that you have?
- What plant family do they belong in?


## Activity 2: Planting Sweet Potatoes

Review lesson 4.15, Classification of Plants. We previously focused on the Brassica family. Today, we focus on the Convolvulaceae family (sweet potato and morning glory). Show students examples of the Convolvulaceae family growing in the garden. Highlight a potato and ask them to identify the traits they notice.

## Ask:

- How do the potato's traits support its growth?
- How will the potato change as it grows?

Explain that sweet potatoes grow primarily underground, so they don't need much garden space. Choose an area that gets a lot of sunlight, has deep earth, and is well drained. Demonstrate how to plant potatoes with students:

1. Till the soil 12 inches ( 30.5 cm .) deep, loosening soil and incorporating gardening soil if necessary.
2. Prepare or amend the soil by adding a layer of good planting soil and removing any large rocks that might be present.
3. Choose a mulch over the top to trap heat.
4. Dig your holes $12-24$ inches ( $30.5-61.0 \mathrm{~cm}$.) apart (sweet potatoes need a more space than other garden vegetables).
5. Dig holes as deep as the root ball, about half an inch up the base of the plant.
6. Place each small start in your pre-dug holes and cover the stems with soil about half an inch up the base.

Ask, Why are we planting sweet potatoes to grow and eat rather than other white potatoes? (They are high in vitamin A, vitamin B5, B6, thiamin, niacin, riboflavin, and, due to their orange color, are high in carotenoids, fat-free, relatively low in sodium and have fewer calories than white potatoes - although they do have more sugar.)

## Student Reflection

How do the potatoes' plant traits support their growth?

## English Language Learning (ELL) Focus: Verbs for Gardening

- Planting
- Tilling
- Digging
- Amending
- Mulching


## Additional Information

The leafy part of the potato plant will begin to sprawl its vines outward while the roots will produce the tubers between 6 and 12 inches ( $15.2-30.5 \mathrm{~cm}$ ) deep in the soil. Assign a watering student lead to continue watering on a weekly basis and weed the beds if necessary to keep the plants healthy. Sweet potatoes will be ready to harvest in the fall. Prepare baked potatoes or sautéed potatoes and have students taste them.

Standards
NGSS
5.LS1.1 Support an argument that plants get the materials they need for growth chiefly from air and water.

CCSS
RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

Contributors
Jezra Thompson

## Sources

"Getting to Know Plant Families," School Garden Exploration. Eat. Think. Grow. Portland Partners for School Food and Garden Education.
"Sweet Potatoes: Health Benefits, Risks, and Nutrition Facts," Jessie Szalay, Live Science, 2014.

## Plant Families and Their Plants

| Apiaceae | Carrots, celery, celery root, cilantro, dill, fennel, parsley, parsnip |
| :---: | :---: |
| Asteraceae | Artichoke, chicory, dandelion, endive, lettuce, sunflower, tarragon |
| Brassicaceae | Arugula, broccoli, Brussels sprouts, cabbage, cauliflower, collards, cress, kale, kohlrabi, mizuna, mustard, radish, rutabaga, tat soi, turnip, watercress |
| Chenopodiaceae | Beet, orach, spinach, Swiss chard |
| Convolvulaceae | Sweet potato, morning glory |
| Cucurbitaceae | Cantaloupe, cucumber, gourd, loofa, melon, pumpkin, summer squash, winter squash |
| Fabaceae | Beans, peas, peanuts, soybeans |
| Lamiacea | Basil, lavender, marjoram, mint, oregano, sage, savory, thyme |
| Liliacea | Asparagus, chives, garlic, green onions, leeks, onions, shallots |
| Malvaceae | Okra, hollyhock, hibiscus |
| Poaceae | Corn, wheat, barley, rice |
| Solanaceae | Eggplant, sweet pepper, hot pepper, potato, tomato |

## Food Chains and Webs

## Objectives/Assessment Targets

Students will:

- Simulate a food chain by role playing different animals, plants, and the sun.
- Explain the relationship between the different members of a food chain.
- Discuss the implications if any one of the members of the food chains were to die.


## Activity Preparation

Print out Food Web Pyramid diagram for each student or student pair.

## Materials

- Food web pyramids
- Journals and pencils


## Activity 1: Food Chain

Unlike plants, animals can't make their own food. Energy passes from one animal to another as they eat plants or one another. Some animals eat plants. Some animals eat other animals. The lives of these plants and animals are interconnected. They depend upon one another for survival. Science calls that a food chain.

A food chain follows one path with many steps:

- Grass grows using the energy from the sun.
- A grasshopper eats the grass
- A frog eats the grasshopper, which has eaten the grass.
- A snake eats the frog, which has eaten the grasshopper, which has eaten the grass.
- A hawk eats a snake, which has eaten a frog, which has eaten a grasshopper, which has eaten grass.

Explain that a food chain has many different producers and consumers. Scientist calls this a food web, which involves the following:

- Producers use energy from the sun, like plants.
- Primary consumers eat the producers, which makes them herbivores in most communities.
- Secondary consumers eat the primary consumers, which makes them carnivores. Some eat producers and consumers; these are omnivores.
- Tertiary consumers eat the secondary consumers; these are usually carnivores. Distribute the A-D Food Web Pyramid diagrams below to each student group. Students pair up to fill in the worksheets.


## Student Reflection

Where do you fit into the food chain? Where do you fit into the food web?

## English Language Learning (ELL) Focus: conditional

- What would happen if $\qquad$
- If $\qquad$ then humans would $\qquad$ .


## Additional Information

Show students the PBS Learning Media video "Food Web":
http://www.pbslearningmedia.org/resource/idptv11.sci.life.eco.d4kfwb/food-web/
You can also share the Food Myth Busters video, "The Real Story About What We Eat," by Anna Lappé: http://foodmyths.org/myths/hunger-food-security/

## Standards

NGSS
LS2.A Interdependent Relationships in Ecosystems. The food of almost any kind of animal can be traced back to plants. 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 (both plants or plant parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

CCSS
SL.5.5 Include multiple components and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

## Contributors

Jezra Thompson

## Sources

Critters, AIMS Education Foundation, 1989
Hands on Nature, Vermont Institute of Natural Science, 1986
Kaleidoscope, Aid for Primary School Science Ed. Feb 92 Vol. 7 \#5
Science on the Go! The Chicago Academy of Sciences

## Food Web Pyramids

Name: $\qquad$ Classroom Teacher: $\qquad$
Instructions: Use the examples below to draw a food web pyramid divided by three levels. Each level represents an actor in a food web. Label the different sections for producers and consumers. List examples for each level in the boxes below.
A.

B.

C.

D.


# Tomato Seed to Market 

## Objectives/Assessment Target

Students will:

- Identify the processes for getting a tomato from the farm to the table.
- Talk about the effects of drought on our many different communities and food resources.
- Plant tomatoes.


## Activity Preparation

Prepare a whiteboard on the processes in the regional food system using the food pyramids from lesson 5.16, Food Chains and Webs. You can also prepare this with student participation on the whiteboard. Prepare tomato seedlings for planting and observation.

## Materials

- Tomato seedlings
- Journals
- Food system diagram


## Activity 1: What is A Food System?

Review lesson 5.15, Food Chains and Webs. Students focus on the big picture, food chains and food webs. Present the five main processes in the regional food system using the diagram below. Students share a food that they like to eat. Use this food as an example to trace the several steps it takes before it gets to the students:

1. Agricultural production: Planting, tending, and harvesting
2. Processing: Harvesting and packing
3. Distribution: Loading, delivering, and unloading
4. Retail: Displaying, selling, cooking, and eating
5. Composting/Recycling: Collecting food scraps and digesting

Use the example of a tomato to explain the life of a tomato from seed to market to fork. With student participation, reference the five main processes; naming each one that is particular for a tomato. Prompt students to use the example of their food choice to develop a narrative outlining as many steps as possible for each process. Students imagine the effects of the following scenarios:

1. The farmers picked tomatoes at their very ripest
2. Farmers needed to pay more for the people that worked in the fields (agricultural labor).
3. There was a drought and farmers were required to cut back their water use by 30\%.
4. There was a big rise in demand for tomatoes at the grocery store.

Ask, What are some consequences of buying and eating tomatoes that are grown very far from your home?

## Activity 2: Planting Tomato Seeds

Students prep beds and plant tomato seedlings in pairs. Students hypothesize how this tomato plant will taste, given how they are planting it, the type of soil, the position of the sun, and the amount of water they will give it.

## Students Reflect on the Lesson

Fill in the blank: $\qquad$ (ex. labor costs) affect(s) $\qquad$ , which affect(s)
$\qquad$ , which affect(s) $\qquad$ _.

## English Language Learning (ELL) Focus: would

- The first, second, third.... steps in the process are $\qquad$ .
- If there were a drought, the farmers would $\qquad$ .
- If the farmers needed to pay more for the agricultural labor, they would $\qquad$ .
- If the farmers picked their tomatoes at their ripest, the tomatoes would $\qquad$ .


## Standards

NGSS
5.LS1.A Interdependent relationships in ecosystems. The food of almost any kind of animal can be traced back to plants.
5.ESS2-1 Systems and system models. A system can be described in terms of its components and their interactions.
5.LS2-1 Engage effectively in a range of collaborative discussion with diverse partners on grade 4 topics and txt, building on each other's ideas and expressing their own clearly. CCSS

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
W.5.8 Recall relevant information from experiences or gather relevant information from print.

## Health

2.1.N Describe internal and external influences that affect food choices and physical activity.
4.1.N Use communication skills to deal effectively with influences from peers and media regarding food choices and physical activity.
5.1.N Use a decision-making process to identify healthy foods for meals and snacks Contributors

Jezra Thompson

## Sources

Bean Seed Cycle, National Agriculture in the Classroom
Diagram by Carsten Rodin, SPUR: Ideas and Actions for a Better City
Education.com

# Drawing from Experience 

## Objectives/Assessment Targets

Students will:

- Identify one theme, idea, or concept they decide is memorable.
- Communicate the importance of the concepts in words and/or pictures.


## Activity Preparation

Print out garden bingo cards for each student.

## Materials

- Examples of fruits and vegetables or Fruit and Vegetable Cards
- Garden bingo cards printout for each student
- Markers


## Activity 1: The Most Important Thing about the Garden

Distribute garden journals and display other projects or posters made throughout the year. Students review their journals and other materials and take a quick tour of the garden, reflecting on what will change next time they see it. Students share the most important idea, concept, or theme covered in the garden.

## Activity 2: Test Your Nutrition Knowledge

Distribute the bingo cards to each student. Hold up a picture of each food sample, including fruit and veggie cards if needed. Students fill in their bingo cards until a few bingos have been won.

## Student Reflection

Why is it important to share the garden with each other?

## English Language Learning (ELL) Focus: Modals

- Community leaders should know that $\qquad$ _.
- Teachers need to know that $\qquad$ .
- Parents ought to know that $\qquad$ -
- Students must know that $\qquad$ .

Standards
CCSS
W.5.8 Recall relevant information from experiences or gather relevant information from print or digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

Health
1.6.N Differentiate between more-nutritious and less-nutritious beverages and snacks.
3.1.N Locate age-appropriate guidelines for eating and physical activity.
5.1.N Use a decision-making process to identify healthy foods for meals and snacks.

## Contributors

Jezra Thompson
Sources
Healthy Living for Life, Alameda County Public Health Department, Nutrition Services

| B | $\mathbf{I}$ | $\mathbf{N}$ | $\mathbf{G}$ | $\mathbf{O}$ |
| :---: | :---: | :---: | :---: | :---: |
| amino <br> acids | apples | berries | boil | calcium |
| calories | carbohydrate | cardiopsasular | carrots | cheese |
| cholesterol | diet | Free <br> Space | dietary <br> fiber | energy |
| exercise | fatS | Fruit | metabolism | milk |
| minerals | nutrition | obesity | oranges | protein |

# September Recipe 

Tomatoes

## Tomato Bruschetta

## Materials

Mixing bowl(s)
Sauté pan
Ingredients
3 cloves garlic, minced
5 Tbsp. olive oil
8-10 slices of whole wheat or other whole-grain bread
$1 / 2$ onion, finely diced
6-8 tomatoes, diced
6-8 basil leaves, finely chopped
Salt and pepper
Steps

1. In a small bowl, mix together garlic and olive oil.
2. Brush mixture on top of bread and toast using a sauté pan.
3. Sauté onion in a small pot with remaining olive oil.
4. Mix raw tomatoes, basil, salt, and pepper with sautéed onion.
5. Spoon tomato-onion mixture onto toasted garlic bread and serve.

# Amaranth Seeds Popped 

## Materials

Sauté pan
Mixing bowl

## Ingredients

$1 / 4$ cup ( 50 g ) raw amaranth or popcorn
Olive oil
Salt and pepper
Brewer's yeast, cheese, or other herbs and spices from the garden (optional)
Steps

1. Heat a small, heavy stainless-steel sauté pan over high heat. Add amaranth seeds and cook until they have all popped, no longer than 30 seconds.
2. Shake the pan frequently until they crackle and swell up and are just starting to color, about 2 minutes.
3. Remove to a bowl. Add olive oil, salt and pepper, and other seasonings to taste.

# Ginger Persimmon and Asian Pear Sauce 

## Materials

Chopping knives
Cutting boards
Sauté pan
Mixing bowl
Ingredients
5 Fuyu persimmons, cut into $1 / 2$-inch slices
3 Asian pears, cored and cut into $1 / 2$-inch slices
$1 / 2$ cup orange juice
2 Tbsp. maple syrup
$1 / 2$ tsp. sea salt
1 Tbsp. grated fresh ginger
$1 / 4$ tsp. ground cardamom
1 tsp. orange zest
Yogurt to taste

## Steps

1. Oil a sauté pan and add fruit, juice, and spices. Cook until soft.
2. Serve over yogurt.

## Wild Rice and Dried Fruit Pilaf

## Materials

Chopping knives
Cutting boards
Sauté pan
Mixing bowl

## Ingredients

$1 / 4$ cup canola oil
1 medium onion, diced
2 stalks celery, diced
1 tsp. fresh sage, minced
1 tsp. fresh thyme, minced
1 tsp. fresh rosemary, minced
$1 / 2$ cup dried cranberries, chopped
$1 / 2$ cup chopped dried pear
$1 / 2$ cup chopped dried apple
1 tsp. sea salt
$1 / 4 \mathrm{tsp}$. pepper
$1 / 2$ cup water
1 cup cooked wild rice
3 cups cooked brown rice
$1 / 2$ cup walnuts
3 scallions, sliced very thin
$1 / 4$ cup minced parsley

## Steps

1. Heat oil in a large skillet or wok. Add onion, celery, sage, thyme, and rosemary and sauté until soft and shiny, about 8-10 minutes.
2. Add dried cranberries, pears, apple, salt, pepper, water, wild rice, and brown rice.
3. Cook until rice is hot and steaming, stirring all the time.
4. To toast walnuts, heat up a cast iron pan and add nuts. Cook nuts while stirring until skins start to peel off, about 8-10 minutes. Then chop.
5. Just before serving, add chopped walnuts, scallion, and parsley.

# Fennel and Blood Orange Salad 

## Materials

Chopping knives
Cutting boards
Sauté pan
Mixing bowl

## Ingredients

$1 / 2$ cup hazelnuts
1 small head of lettuce, torn into bite-sized pieces
1 carrot, grated
1 blood orange, peeled and chopped into small pieces
$1 / 2$ fennel bulb, chopped into thin pieces
Dressing
3 Tbsp. olive oil
$1 / 4$ cup lemon juice
1 Tbsp. maple syrup
$1 / 4$ tsp. sea salt

## Steps

1. Toast hazelnuts on a frying pan until they smell nutty and are getting a little darker. Let nuts cool for a few minutes and then chop. In a salad bowl, mix lettuce, grated carrot, blood orange, and fennel.
2. Whisk dressing ingredients together in a small bowl and pour over salad.
3. Just before serving salad, sprinkle hazelnuts over the top.

# Napa Cabbage Quinoa Rolls with Sesame Sauce 

Materials
Large pot for boiling water
Chopping boards
Knives
Measuring spoons
Water for boiling
Sauté pan
Stove burner
Whisk
Bowls and spoons for tasting

## Ingredients

Cabbage Rolls
8-10 whole cabbage leaves, quickly cooked in a large pot of water
1 Tbsp. olive oil
1 carrot, diced
1 cup finely chopped cabbage
1 stalk celery, finely diced
$1 / 2$ onion, finely diced
1 cup quinoa
2 tsp. vegetable powder
2 cups boiling water
$1 / 2$ tsp. sea salt
$1 / 2$ cup chopped parsley
$1 / 2$ cup toasted, chopped sunflower seeds
Sesame Sauce
$1 / 4$ cup sesame tahini
2 Tbsp. apple cider vinegar
Juice of 1 orange
1 clove garlic, minced
$1 / 4$ tsp. sea salt
Dash of pepper

## Steps

1. Heat olive oil and sauté carrot, celery, and onion for 2 minutes.
2. Add quinoa, vegetable powder, boiling water, and salt and bring to a boil. Reduce heat to low and simmer for 15-20 minutes or until all the water is gone.
3. Add parsley and sunflower seeds and mix well.
4. Roll quinoa pilaf up inside cooked cabbage leaves. If needed, use a toothpick to hold it together.
5. Make sesame sauce by whisking all sauce ingredients together in a small bowl. Serve rolls with sesame sauce.

# Green Bean Salad with Mint Dressing 

## Materials

Chopping board
Knives
Bowls and spoons for tasting
Large pot for boiling water
Whisk
Ingredients
Salad
4 cups green beans cut into 2 -inch pieces
1 tsp. salt
$1 / 2$ red onion, diced
$1 / 4$ cup toasted and slivered almonds
Dressing
4 Tbsp. olive oil
2 Tbsp. cider vinegar
1 Tbsp. maple syrup
1 Tbsp. fresh chopped mint
1 clove minced garlic
$1 / 2$ tsp. salt
Dash of pepper

## Steps

1. Bring 4 cups water to a boil. Add green beans and salt. Boil for $4-5$ minutes.
2. In a small bowl, whisk together all dressing ingredients.
3. Remove beans from water. Add red onion, chopped almonds, and dressing.

# Roasted Asparagus Salad 

## Materials

Chopping board
Knives
Bowls and spoons for tasting
Sauté pan
Stove burner
Measuring spoons
Whisk
Ingredients
Salad
$12-15$ stalks asparagus, bottoms trimmed off
2 yellow summer squash, sliced thinly
3 cloves garlic, finely chopped
2 Tbsp. olive oil
$1 / 2$ tsp. sea salt
Dash of pepper
Dressing
$1 / 4$ cup finely diced red onion
3 Tbsp. apple cider vinegar
$1 / 2$ tsp. sea salt
1 Tbsp. Dijon mustard
$1 / 3$ cup olive oil

## Steps

1. Sauté asparagus and yellow squash with garlic, olive oil, salt, and pepper.
2. Whisk together all dressing ingredients and pour over salad.

# Massaged Kale Salad 

## Materials

Chopping boards
Knives
Measuring spoons and cups
Large bowl
Bowls and spoons for tasting

## Ingredients

1 bunch kale (black kale is especially good), stalks removed and discarded, leaves thinly sliced
1 lemon, juiced
$1 / 4$ cup extra-virgin olive oil, plus extra for drizzling
Kosher salt
2 teaspoons honey
Freshly ground black pepper
1 mango, diced small (about 1 cup)
Small handful toasted pepitas (pumpkin seeds), about 2 rounded tablespoons

## Steps

1. In large serving bowl, add the kale, half of the lemon juice, a drizzle of oil, and a little kosher salt.
2. Massage until the kale starts to soften and wilt, 2 to 3 minutes. Set aside while you make the dressing.
3. In a small bowl, whisk remaining lemon juice with the honey and lots of freshly ground black pepper. Stream in the $1 / 4$ cup of oil while whisking until a dressing forms and you like how it tastes.
4. Pour the dressing over the kale and add the mango and pepitas. Toss and serve.

## Strawberry and Arugula Salad

## Materials

Bowls and spoons for tasting
Mixing bowls
Whisk
Chopping board
Knives
Salad tongs

## Ingredients

Salad (add ingredients according to the number of students you have)
Arugula
Red onion, chopped
Strawberries, sliced
Goat or feta cheese
Dressing (add amounts according to taste and the number of students)
Balsamic vinegar
Honey
Salt and pepper
Olive oil

## Steps

1. Whisk together balsamic vinegar, honey, salt, and pepper. Whisk in oil.
2. Place greens, onions, and strawberries in a bowl.
3. Sprinkle in cheese.
4. Mix all ingredients in a bowl with the dressing and serve.

## Vocabulary

Abiotic: Nonliving, inanimate, characterized by the absence of life; of inorganic matter.
Adaptation: A change in an organism or its parts that make it more fit for the conditions of its environment.

Agriculture: The active production of useful plants or animals in ecosystems that have been created by people.

Agroecology: An ecological approach to agriculture that views agricultural areas as ecosystems and is concerned with the ecological impact of agricultural practices.

Agroecosystem: An ecosystem created when people actively plant flora in order to increase the diversity of available plant resources.

Anatomy: The parts that form a living thing (such as an animal or plant).
Angiosperm: A vascular seed plant in which the ovule (egg) is fertilized and develops into a seed in an enclosed hollow ovary.

Annual: Happening once a year; having a life cycle that is one year or one season long.
Anther: The part of a flower that contains pollen.
Bacteria (singular bacterium): Any of a group of microscopic single-celled organisms that live in enormous numbers in almost every environment on Earth, from deep-sea vents to deep below Earth's surface to the digestive tracts of humans.

Bean: A seed or pod of certain leguminous plants of the family Fabaceae. Rich in protein and providing moderate amounts of iron, thiamin, and riboflavin, beans are used worldwide for cooking in either fresh or dried form.

Biodiversity: The diversity (number and variety of species) of plant and animal life within a region.
Biology: The study of living things and their vital processes. The field deals with all the physicochemical aspects of life.

Biotic: Of, pertaining to, or produced by life or living organisms.
Carbon: The chemical element that forms diamonds and coal and that is found in petroleum and in all living plants and animals.

Carbon Dioxide: A gas that is produced when people and animals breathe out or when certain fuels are burned and that is used by plants for energy.

Carpel: One of the individual female reproductive organs in a flower. A carpel is composed of an ovary, a style, and a stigma, although some flowers have carpels without a distinct style.
Cell: The basic unit of a living organism.
Chlorophyll: The green coloring matter of plants that is found in chloroplasts and is necessary for photosynthesis.

Chloroplast: A cellular part that contains chlorophyll and is the location of photosynthesis.
Climate: The average course or condition of the weather at a place, usually over a period of years, as exhibited by temperature, wind velocity, and precipitation.

Climate Change: Changes in the Earth's climate, especially those said to be produced by global warming.
Climatology: The science that deals with climates and investigates their phenomena and causes.

Community: A group of interdependent organisms inhabiting the same region and interacting with each other.
Compost: The decayed remains of organic matter that has rotted into a natural fertilizer.
Conservation: The discipline concerned with the protection of biodiversity, the environment, and natural resources.

Consumer: An organism that uses other organisms for food in order to gain energy.
Cortex: Tissue of unspecialized cells lying between the epidermis (surface cells) and the vascular, or conducting, tissues of stems and roots.

Cotyledon: The first leaf or one of the first pair of leaves developed by the embryo of a seed plant.

Cultivate: To prepare or use for the raising of crops; also: to loosen or break up the soil about (growing plants); to foster growth.
Cycle: A set of events or actions that happens again and again in the same order.
Decompose: To separate or break down something into its components; to disintegrate or fragment.

Design: To plan and make decisions about (something that is being built or created): to create the plans, drawings, etc., that show how (something) will be made.

Dicot: A plant whose seedlings have two cotyledons.
Dicotyledon (byname dicot): Any member of the flowering plants, or angiosperms that has a pair of leaves, or cotyledons, in the embryo of the seed. There are about 175,000
known species of dicots. Most common garden plants, shrubs, trees, and broad-leafed flowering plants, such as magnolias, roses, geraniums, and hollyhocks, are dicots.

Dicotyledonous: Having two cotyledons.
Disperse: To scatter in different directions.
Disseminating: Spreading widely.
Diversity: The quality or state of having many different forms, types, ideas, etc.
Dormant: Not active but able to become active.
Drought: A long period of time during which there is very little or no rain.
Earth: The planet on which we live; land as opposed to the sea, the air, etc.; the material in which plants grow.

Ecology: The science that deals with the relationships between groups of living things and their environments.

Ecosystem: Everything that exists in a particular environment.
Embryo: A rudimentary plant contained in the seed.
Endosperm: Tissue surrounding the embryo of flowering plant seeds which provides nutrition to the developing embryo.

Energy: The physical or mental strength that allows you to do things; natural enthusiasm and effort; usable power that comes from heat, electricity, metabolism, etc.

Environment: The conditions that surround someone or something; the conditions and influences that affect the growth, health, progress, etc., of someone or something.

Epidermis: The outer, protective layer of a plant.
Equinox: A 24-hour period when day and night are the same length.
Erosion: The gradual destruction of something by natural forces (such as water, wind, or ice).

Farmer: A person who cultivates land or crops or raises animals (as livestock or fish).
Fauna: All the animals that live in a particular areas, time period, or environment.
Fertile: Producing many plants or crops.
Fertilize: To make (soil, land, etc.) richer and better able to support plant growth by adding chemicals or a natural substance (such as manure).

Filament: The stalk of a stamen in a flower, supporting the anther.
Flora: All the plants that live in a particular area, time period, or environment.

Flower: The reproductive portion of any plant in the division Magnoliophyta (Angiospermae), commonly called "flowering plants" or "angiosperms." As popularly used, the term "flower" especially applies when part or all of the reproductive structure is distinctive in color and form.

Food Chain: A series of types of living things in which each one uses the next-lower member of the series as a source of food.

Food System: A network that integrates food production, processing, distribution, consumption, and waste management, affecting the environmental, economic, and social health of a particular place.

Food Web: The totality of interacting food chains in an ecological community.
Fungus: A single-celled or multinucleate organisms that decompose and absorb the organic material that they grow (such as molds, mushrooms, or yeasts) and classified in the kingdom Fungi.

Gamete: A mature sexual reproductive cell, as a sperm or egg, that unites with another cell to form a new organism.

Genetic Diversity: Refers to both the vast numbers of different species as well as the diversity within a species. The greater the genetic diversity within a species, the greater that species' chances of long-term survival. This is because negative traits (such as inherited diseases) become widespread within a population when that population is left to reproduce only with its own members.

Germinate: To develop into a plant or individual, as a seed, spore, or bulb.
Heredity: The sum of all biological processes by which particular characteristics are transmitted from parents to their offspring.

Humus: The dark organic material in soils that is produced by the decomposition of vegetable or animal matter and is essential to the fertility of the earth.

Hypothesis: A proposition, or set of propositions, set forth as an explanation for the occurrence of some specified group of phenomena, either asserted merely as a provisional conjecture to guide investigation (working hypothesis) or accepted as highly probable in the light of established facts.

Inorganic: Not having the structure or organization characteristic of living bodies.
Interdependence: The quality or condition of being mutually reliant on each other.
Invertebrate: Not vertebrate; without a backbone. More than $90 \%$ of all living animal species are invertebrates.

Investigate: To try to find out the facts about and learn more about an object, person, place, thing, situation, etc.

Leaf: One of the expanded, usually green organs borne by the stem of a plant.
Legume: Also called "pod," a fruit of plants of the order Fabales (peas and beans). The dry fruit releases its seeds by splitting open along two seams.

Life: Living matter and, as such, matter that shows certain attributes, including responsiveness, growth, metabolism, energy transformation, and reproduction.

Metabolism: The chemical processes by which a plant or an animal uses food, water, etc., to grow, heal, and make energy.

Monocot: Any of a group of flowering plants (as palms and grasses) having an embryo with a single cotyledon and usually leaves with parallel veins and flower parts in groups of three.

Monoculture: The use of land for growing only one type of crop.
Mulch: A covering (as of woodchips or sawdust) spread over the ground to protect the roots of plants from heat, cold, or evaporation, prevent soil loss, control weeds, enrich the soil, or keep fruit (as strawberries) clean.

Natural Resource: Something (as a mineral, waterpower source, forest, or kind of animal) that is found in nature and is valuable to humans (as in providing a source of energy, recreation, or scenic beauty).

Nitrogen: A colorless, odorless, tasteless gas that is the most plentiful element in Earth's atmosphere and is a constituent of all living matter.

Nitrogen-Fixing Bacteria: Microorganisms capable of transforming atmospheric nitrogen into fixed nitrogen (inorganic compounds usable by plants). More than $90 \%$ of all nitrogen fixation is affected by these organisms, which thus play an important role in the nitrogen cycle.

Nutrient: A substance that an organism must obtain from its surroundings for growth and the sustenance of life. In most living organisms, nutrients provide not only the energy necessary for certain vital processes but also the various materials from which all structural and functional components can be assembled.

Nutrition: The assimilation by living organisms of food materials that enable them to grow, maintain themselves, and reproduce.

Observation: The act of careful watching and listening; the activity of paying close attention to someone or something in order to get information.

Opinion: A personal view, attitude, or appraisal.

Organic: Of, relating to, or obtained from living things; of, relating to, or containing carbon compounds.

Organism: A form of life considered as an entity; an animal, plant, or fungus.
Oxygen: A reactive element that is found in water, rocks, and free as a colorless, tasteless, odorless gas that forms about $21 \%$ of the atmosphere, that is capable of combining with almost all elements, and that is necessary for life.

Petal: One of the often brightly colored modified leaves that make up the corolla of a flower.

Perennial: Living for several years, usually with new leafy growth produced from the base each year.

Pest: A plant or animal harmful to human beings or human concerns (as agriculture).
Pesticide: A substance used to destroy pests.
Photosynthesis: The process by which plants that contain chlorophyll make carbohydrates from water and from carbon dioxide in the air in the presence of light.

Pistil: The seed-producing part of a flower, consisting usually of stigma, style, and ovary.
Pollen: A mass of tiny particles in the anthers of a flower that fertilize the seeds and usually appear as fine yellow dust.

Pollinator: The biotic agent (vector) that moves pollen from the male anthers of a flower to the female stigma of a flower to accomplish fertilization of the female gametes in the ovule of the flower by the male gametes from the pollen grain. Examples include birds, bats, bees, butterflies, beetles, and other small mammals. Creatures that pollinate plants are responsible for bringing us one out of every three bites of food.

Pollination: Transfer of pollen grains from the stamens, the flower parts that produce them, to the ovule-bearing organs or to the ovules (seed precursors) themselves.

Pollution: The action or process of making land, water, air, etc., dirty and not safe or suitable to use; substances that make land, water, air, etc., dirty and not safe or suitable to use.

Polyculture: The raising at the same time and place of more than one species of plant or animal.

Producer: A living thing (as a green plant) that makes its food from simple inorganic substances (as carbon dioxide and nitrogen) and many of which are food sources for other organisms.

Propagate: To cause (an organism) to multiply by any process of natural reproduction from the parent stock.

Propagation: The controlled perpetuation of plants, the most basic of horticultural practices. Its two objectives are to achieve an increase in numbers and to preserve the essential characteristics of the plant. Propagation can be achieved sexually by seed, asexually by utilizing specialized vegetative structures of the plant (tubers and corms), or by employing such techniques as cutting, layering, grafting, and tissue culture.

Protein: Any of numerous substances that consist of chains of amino acids, contain the elements carbon, hydrogen, nitrogen, oxygen, and often sulfur, include many compounds (as enzymes and hormones) essential for life, and are supplied by various foods (as meat, milk, eggs, nuts, and beans).

Reflect: To cast back (light, heat, sound, etc.) from a surface. Also, to think, ponder, or meditate; to reflect on a topic or one's opinion.

Renewable: Capable of being replaced by natural ecological cycles or sound management procedures.

Respect: Esteem for or a sense of the worth or excellence of a person, a personal quality or ability, or something considered as a manifestation of a personal quality or ability.

Responsible: Having the job or duty of dealing with or taking care of something or someone; able to be trusted to do what is right or to do the things that are expected or required.

Root: The leafless, usually underground part of a plant that absorbs water and minerals, stores food, and holds the plant in place.

Season: One of the four periods of the year (spring, summer, autumn, and winter), beginning astronomically at an equinox or solstice but geographically at different dates in different climates.

Seasonality: A pattern, variation, or fluctuation that correlates with a season, day of the week, or other period of time.

Seed: A fertilized, ripened ovule of a flowering plant that contains an embryo and is capable of producing a new plant.

Sepal: One of the specialized leaves that form the calyx of a flower.
Solstice: The point in the apparent path of the sun at which the sun is farthest north or south of the equator.

Stamen: An organ of a flower that consists of an anther and a filament and produces the pollen.

Stele: The central cylinder or cylinders of vascular and related tissue in the stem, root, petiole, leaf, etc., of the higher plants.

Stem: The stalk that supports a leaf, flower, or fruit.
Sustainable: Pertaining to a system that maintains its own viability by using techniques that allow for continual reuse.

Symbiosis: The living together in close association of two different kinds of organisms (as a fungus and an alga making up a lichen), especially when such an association is of benefit to both.

System: A group of related parts that move or work together; a body of a person or animal thought of as an entire group of parts that work together.

Topsoil: The fertile, upper part of the soil.
Trait: A quality that makes one person or thing different from another.
Transplant: To remove (a plant) from one place and plant it in another.
Vascular System: An assemblage of conducting tissues and associated supportive fibers.
Vertebrate: Having a backbone or spinal column.
Weather: State of the atmosphere at a particular place during a short period of time. It involves such atmospheric phenomena as temperature, humidity, precipitation (type and amount), air pressure, wind, and cloud cover.

Weed: A plant that is not valued where it is growing and is usually of vigorous growth; especially, one that tends to overgrow or choke out more desirable plants.

Xylem: A tissue of higher plants that carries water and dissolved materials upward, functions also in support and storage, lies deeper inside the plant than the phloem, and usually makes up the woody parts (as of a plant stem).

## SOURCES

Encyclopedia Britannica
Dictionary.com
Merriam Webster


[^0]:    What is the purpose of roots? Roots hold the plant in the ground and take in water. What is the purpose of stems? Stems move water up the plant and move sugar down the plant. They also hold the plant upright.

