Lesson 1: Energy Flow in the Garden Ecosystem

Grade
4

Standards
GPS S3P1a, b, c, d;
NGSS PS3a, b

Time
approx 1.5 - 2 hours over 1 or 2 days

Overview
4th grade students learn about the flow of energy and matter in a garden ecosystem.

What they will learn
• Energy/ecological pyramid
• Roles in ecosystem
• Characteristics of predators, prey
• Hidden energy flow in the garden
• Loss of energy from one level to next
• Ways to care for the Earth

How they will learn it
• Make a living model
• Role-playing simulation
• Garden critter hunt and observation
• Soil food web
• Dissect an owl pellet to recreate food web and calculate energy flow
• Remove non-native species or release beneficial insects in garden

Essential / Guiding Question
How are the organisms in the garden interrelated and where do we fit in?

Engaging Students
Students will participate in “It’s Lonely at the Top”, a simulation activity, by playing the parts of organisms in an ecosystem and assigning themselves roles (producer, consumer, decomposer). Their classmates will decide if they agree or disagree with this classification.

Exploration
Pairs of students will investigate what an owl ate by dissecting a pellet and identifying the bones, skull, and/or fur inside. Students will then research what the prey animal(s) consumed from level to level until a food chain or web can be diagrammed and labeled, including some garden inhabitants. Given the formula for energy loss from one level to the next, students will calculate how much energy was present at each level of the pyramid.

Supplies
(per pair of students)
• owl pellet
• skewer or tweezers
• paper bowl
• bone chart
• mammal field guide or Web access
• Owl Pellet Dissection worksheet
• Owl Pellet Bone Chart Grid
• magnifiers

(per class)
• organism cards
• seats with role signs
Students will screen garden soil to find soil organisms; observe their features; hypothesize whether they are predators or prey; and identify their place within a soil food web.

**Explanation**
Students will articulate how energy is lost at every level of an ecological pyramid and describe roles of organisms.

**Debriefing**
Teacher will draw students out in a discussion to reiterate key concepts and clear up any student misconceptions, using the Background Information provided. Roles in ecological pyramid = sun; producer; first level consumer / herbivore / prey; second level consumer / carnivore / predator and prey; third level consumer / carnivore / predator; decomposer or scavenger.

**Environmental Stewardship**
Students will demonstrate mastery of key concepts by being able to diagram and label a garden food chain, identify roles, and accurately calculate energy at each level of the ecological pyramid. Completion of the lab report is expected.

**Evaluation**
Students will demonstrate mastery of key concepts by being able to diagram and label a garden food chain, identify roles, and accurately calculate energy at each level of the ecological pyramid. Completion of the lab report is expected.

**CONTEXT FOR LESSON ACTIVITIES**

**Standards**

Georgia Performance Standards
S4L1. Students will describe the roles of organisms and the flow of energy within an ecosystem.
   a. Identify the roles of producers, consumers, and decomposers in a community.
   b. Demonstrate the flow of energy through a food web/food chain beginning with sunlight and including producers, consumers, and decomposers.

Next Generation Science Standards
LS2 Ecosystems: Interactions, Energy and Dynamics
LS2.a Cycles of Matter and Energy Transfer in Ecosystems

**Background Information**
All things related to owls and owl pellets: [http://www.putnamscienceonline.com/owlpellets.htm](http://www.putnamscienceonline.com/owlpellets.htm)

**Teacher Preparation**
- Assemble the supplies and materials needed for the lesson
- Make copies of the Owl Pellet Dissection Lab Report (attached)
- Print a copy of each organism card and ecosystem role sign. Tape the ecosystem role signs to benches or chairs set up in a straight line, a la Musical Chairs.
- Provide students with access to an Internet-connected computer and one of these web sites, when they are researching owl prey: [http://mdc.mo.gov/discover-nature/field-guide](http://mdc.mo.gov/discover-nature/field-guide) OR [http://www.enature.com/home/](http://www.enature.com/home/)
- OR have a classroom set of mammal field guides available.
- Provide students studying the garden soil with a soil food web.

**PROCEDURES FOR LESSON ACTIVITIES**
“It’s Lonely at the Top” Ecosystem Role Play
• Pass out a role play card to each student and have them play a simulation game much like musical chairs, with ecological roles marked on chair backs. After each round, have students identify their organism and its ecological role, and let the class peer-review this choice.

Owl Pellet Dissection and Food Chain
• Pass out the Owl Pellet bone chart, the Owl Pellet Dissection Worksheet, and one owl pellet to each pair of students, along with a paper bowl, water, a bamboo skewer or forceps, and gloves (optional - pellets are sterile).
• Direct students to dissect the owl pellet, compare contents to bone chart, and determine what the owl ate.
• Let students research the prey animal recovered from owl pellet and determine its diet from a field guide.
• Students should reconstruct the owl’s food chain or web down to the garden (producer) level with Sun as source.

Soil Food Web
• Students will explore the hidden soil food web by sifting soil in the garden to find and identify animals; observing their characteristics and guessing whether they are predators or prey; and looking up their place in soil food web.

Environmental Stewardship
• Students will go on a non-native worm hunt in the garden and remove any large alien, invasive worms that eat native worms and cut roots of plants OR students will release beneficial organisms like ladybugs, who keep the pest population in the garden under control organically.
Owl Pellet Dissection Lab Report

Pellet Length: ____________

Pellet Width: ____________

How many of the following bones did you find?

Humerus: ________

Femur: ________

Lower Jaw: ________

Skull: ________

Vertebrae: ________

Shoulder Blade: ________

Ulna/RADIUS: ________

Ribs: ________

Pelvic Bones: ________

Tibia/Fibia: ________

How many animals did this owl eat?

What prey species did this owl eat?

What habitat do you think this owl would be hunting in?

What species of owl made this pellet? why do you think so?

Draw a food web for the owl, based on the prey found in the pellet and research you have conducted with field guides, to determine what the owl’s prey eats. Be sure your web includes producers and that arrows between organisms point from the lower level (food source or prey animal) towards the upper level (predator/eater). Include garden plants or animals and the Sun in your food web with an arrow indicating energy flow to producers.

Draw an ecological pyramid with the owl as third order consumer and its prey as second order consumer. Assuming the solar energy reaching this site is 72,000,000 kcal/m²/year, calculate the amount of energy available at each trophic level if only 10% of energy flows from one level to the next. Remember to include producers!
Ecosystem Role Cards for "It's Lonely at the Top" Game

Directions:
- Print out the Ecosystem Role Cards and Organism Cards and cut apart
- Arrange chairs in a line and tape Ecosystem Role Cards to seat backs
- Let students draw Organism cards
- Start the music (or sing) and have everyone walk around the chairs in the same direction
- When they music stops, students sit on a chair with the correct Role card for their Organism
- Have students tell which Organism they are, and let the class decide if they are in the right spot
- Collect Organism cards, shuffle, pass them out again, and play next round with one less chair
<table>
<thead>
<tr>
<th>PRODUCER</th>
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<tr>
<td>1ST LEVEL CONSUMER</td>
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<td>PRODUCER</td>
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<td>TERTIARY CONSUMER</td>
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<td>DECOMPOSER</td>
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<td>GRASS</td>
<td>MOSS</td>
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<td>OAK TREE</td>
<td>MILKWEED</td>
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<td>KUDZU</td>
<td>DOGWOOD TREE</td>
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<td>PUMPKIN PLANT</td>
<td>LIVERWORT</td>
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<tr>
<td>BROCCOLI PLANT</td>
<td>CARROT PLANT</td>
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<tr>
<td>JOE PYE WEED</td>
<td>WHEAT</td>
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<tr>
<td>HONEYSUCKLE VINE</td>
<td>BEE</td>
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<tr>
<td>DEER</td>
<td>OWL</td>
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<tr>
<td>SPIDER</td>
<td>FIELD MOUSE</td>
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<td>SQUIRREL</td>
<td>CHIPMUNK</td>
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<td>FERN</td>
<td>CRABAPPLE TREE</td>
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<tr>
<td>WORM</td>
<td>PILL BUG</td>
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<td>BACTERIA</td>
<td>VULTURE</td>
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<td>FUNGUS</td>
<td>MUSHROOM</td>
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<td>BLACKBERRY BUSH</td>
<td>SNAKE</td>
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<tr>
<td>ROBIN</td>
<td>HUMAN</td>
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<tr>
<td>TRUMPET VINE</td>
<td>STRAWBERRY PLANT</td>
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<td>FROG</td>
<td>SALAMANDER</td>
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<td>FISH</td>
<td>KELP</td>
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<td>SHARK</td>
<td>WHALE</td>
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<td>ALLIGATOR</td>
<td>SEAGULL</td>
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<td>RABBIT</td>
<td>FOX</td>
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<td>BEAVER</td>
<td>PENGUIN</td>
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<tr>
<td>COW</td>
<td>ELK</td>
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<tr>
<td>CORN</td>
<td>BUTTERFLY</td>
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</tbody>
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## Assessment for Energy Flow in the Garden Ecosystem

<table>
<thead>
<tr>
<th>Level of Mastery</th>
<th>Benchmark or Performance Measure</th>
<th>Mastered task @ 90%+ accuracy: 5 pts</th>
<th>Mastered task @ 85% accuracy: 4 pts</th>
<th>Mastered task @ 80% accuracy: 3 pts</th>
<th>More learning needed</th>
<th><strong>TOTAL POINTS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecosystem role</strong></td>
<td><strong>Playing simulation</strong></td>
<td>Participated</td>
<td>n/a</td>
<td>n/a</td>
<td>Did not participate</td>
<td><strong>TOTAL POINTS</strong></td>
</tr>
<tr>
<td><strong>Owl pellet</strong></td>
<td><strong>Dissection</strong></td>
<td>Dissected owl pellet, determined owl prey, researched prey animal's diet, reconstructed owl food web to producer level, sketched and labeled food chain on lab report</td>
<td>Dissected owl pellet, determined prey, attempted food chain reconstruction with some flaws or lack of labels, arrows</td>
<td>Dissected owl pellet</td>
<td>No attempt</td>
<td><strong>TOTAL POINTS</strong></td>
</tr>
<tr>
<td><strong>Owl</strong></td>
<td><strong>Energy</strong></td>
<td>Calculate the energy loss at every level of the pyramid, from sun to tertiary consumer</td>
<td>Calculated incorrectly at some levels</td>
<td>n/a</td>
<td>No attempt</td>
<td><strong>TOTAL POINTS</strong></td>
</tr>
<tr>
<td><strong>Soil food web</strong></td>
<td><strong>Investigation</strong></td>
<td>Sift soil and investigate creatures living in the garden; observe characteristics; guess whether predator or prey; find their place in soil food web</td>
<td>Sifted soil, did not identify creatures or discover their place in food web</td>
<td>n/a</td>
<td>No attempt</td>
<td><strong>TOTAL POINTS</strong></td>
</tr>
<tr>
<td><strong>Environmental Stewardship</strong></td>
<td></td>
<td>Remove invasive non-native worms from the garden OR release beneficial insects such as ladybugs; articulate how this helps the Earth</td>
<td>Engaged in activity but unable to articulate how it helps the Earth</td>
<td>n/a</td>
<td>No attempt</td>
<td><strong>TOTAL POINTS</strong></td>
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<tr>
<td><strong>TOTAL in LAST BOX</strong></td>
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<td>_/25 pts</td>
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Lesson 2: Predicting Whether the Weather is Good for the Garden

Overview
4th grade students will explore weather instruments and maps, as well as the impact of weather on the garden.

What they will learn
• How weather is predicted
• How weather instruments work
• How weather data is used
• Ways to care for the Earth

How they will learn it
• Online simulation
• Make weather instruments
• Collect and interpret data
• Track seasonal trends for database or design/build season extender in garden

Essential / Guiding Question
How can we predict the weather in advance, anticipate seasonal changes, and use this knowledge to grow a better garden?

Engaging Students
Technology Connection: Weather Prediction Simulation
Students will report and predict the weather three days in advance based on simulated weather fronts to the West, using the Predict-O-Matic software at the Edheads interactive web site: [http://www.edheads.org/activities/weather/](http://www.edheads.org/activities/weather/)

Exploration
Students will make a working weather vane, a wind sock, an anemometer, a barometer, and a thermometer. Over a period of two weeks, students will collect weather data from all 5 instruments. They will use this data with wind maps ([http://hint.fm/wind/](http://hint.fm/wind/)) to forecast the weather and see how accurate their predictions are.

Using a vegetable planting guide ([http://cmg.colostate.edu/garden-notes/720.pdf](http://cmg.colostate.edu/garden-notes/720.pdf)), previous Georgia frost dates ([http://www.caes.uga.edu/publications/pubDetail.cfm?pk_id=7778](http://www.caes.uga.edu/publications/pubDetail.cfm?pk_id=7778)) and/or a farmer’s almanac as references, students will predict when soil and air temperatures will be...
conducive to planting seeds and transplanting seedlings in spring.

**Explanation**
Students will be able to articulate that weather is the result of different systems and conditions, and that instruments can be used to observe trends in data, make predictions.

**Debriefing**
The teacher will use background info from AAAS to reiterate key concepts and correct misperceptions.
- Weather is the result of several earth systems, and is interrelated and global, as well as local.
- Students can use instruments to collect and interpret weather data.
- Weather trends can be recognized by interpreting data over time.

**Environmental Stewardship**
Students will use the information they learned in this lesson to care for the Earth by observing seasonal changes and contributing to a national phenology database such as Project Budburst or Journey North. Additionally, students may accept a design challenge to find a way to extend the growing season of tender plants, during winter.

**Evaluation**
Students will demonstrate mastery of Edheads weather prediction simulations at all three levels, collect current weather data with home-made devices, record and interpret weather data, predict when it will be safe to plant.

**CONTEXT FOR LESSON ACTIVITIES**

**Standards**
Georgia Performance Standards in Science
S4E4. Students will analyze weather charts/maps and collect weather data to predict weather events and infer patterns and seasonal changes.
- Identify weather instruments and explain how each is used in gathering weather data and making forecasts (thermometer, rain gauge, barometer, wind vane, anemometer).
- Using a weather map, identify the fronts, temperature, and precipitation and use the information to interpret the weather conditions.
- Use observations and records of weather conditions to predict weather patterns throughout the year.
- Differentiate between weather and climate.

Next Generation Science
ESS2 Earth Systems
ESS2.D Weather and Climate

**Background Information**

**PROCEDURES FOR LESSON ACTIVITIES**

**Predicting Weather**
- Provide students with access to Internet connected computers and tell them to complete the Edheads weather reporting and prediction game, mastering it at all three levels. [http://www.edheads.org/activities/weather/](http://www.edheads.org/activities/weather/)  

**Wind**
- Show the class this Wind Map, which is updated throughout the day: [http://hint.fm/wind/](http://hint.fm/wind/)
• Initiate a discussion about what causes wind (temperature differentials and the fact that warm air rises).
• Provide students with materials for making wind vanes.
• Provide the materials necessary to make a wind vane, in addition to students’ sleeves.
• Wind vane directions: http://familycrafts.about.com/od/gardendecor/ss/Shirt_Sleeve_Windsock_Craft.htm
• Provide students with materials to make an anemometer.

Air pressure
• Ask students whether they think air has mass. Discuss air masses and weather fronts (the edge between an air mass of one temperature and one of a different temperature). High pressure is indicative of “good” weather.
• Provide students with materials to make barometers.

Thermometer
• Ask what thermometers measure? (temperature) And what temperature indicates? Heat level.
• Provide supplies and these directions for making a thermometer: http://www.weatherwizkids.com/experiments-thermometer.htm

Collecting, Recording and Interpreting Data
• Provide students with a chance to collect and record weather data from 5 instruments every day for two weeks.
• Compare data from home-made instruments to that in the news or collected from commercially made instruments.
• Allow students to display in an graphic form they choose. One possibility is a simple line plot such as this: http://illuminations.nctm.org/LessonDetail.aspx?id=L287
• Ask students to analyze trends in data collected, both short and long term.

Predicting Trends in Weather Data related to Seasonal Change: Spring Planting Weather
• Analyze changes in weather to predict the date of last freezing temperatures in spring.
• Why is this an important date to estimate correctly? (planting too early could result in freeze-damaged plants; planting too late could fail to take advantage of the longest growing season possible).
• Ask students to consult a farmer’s almanac and this vegetable planting guide http://cmg.colostate.edu/gardennotes/720.pdf and compare their estimates of frost-free date to student’s.
• Have the class vote on the first date to plant outdoors in the school garden this spring.

Environmental Stewardship
Using information they have learned in this lesson, students will care for the Earth by taking on one of the following projects:
Design Challenge: Extend the Growing Season for Tender Plants
• Challenge students to think of a way to extend the growing season of plants in the garden. For inspiration: http://webecoist.momtastic.com/2012/03/02/diy-greenhouses-10-structures-you-can-build-yourself/2/
• One possibility: make a mini-greenhouse from two old empty CD jewel cases: http://recycle.hu93.com/cds/make_a_mini_greenhouse_from_recycled_cd_cases__curbly__diy_d.htm
• Provide students with materials to complete a project of the class’ choosing.

Citizen Science Project: Phenology
• Students may contribute data on the first appearance of spring to a citizen science program such as Journey North http://www.learner.org/jnorth/pde/PhenDataAbout.html or Project Budburst http://neoninc.org/budburst/.
## Assessment for Whether the Weather is Good for the Garden

**Student Name(s):** ________________________________  **Date:** ________________

<table>
<thead>
<tr>
<th>Level of Mastery</th>
<th>Benchmark or Performance Measure</th>
<th>Edheads Weather Prediction Simulation</th>
<th>Weather Instrument making and data collection</th>
<th>Frost Free Prediction</th>
<th>TOTAL POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mastered task @ 90%+ accuracy: 5 pts</td>
<td>Completed and mastered all three levels of the simulation.</td>
<td>Predicted frost free planting date for school, based on research into previous frost free dates and recent weather trends.</td>
<td>No attempt.</td>
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<td>Mastered task @ 85% accuracy: 4 pts</td>
<td>Completed and mastered two levels of the simulation.</td>
<td>Prediction made without reference to any research or recent weather trends.</td>
<td>No attempt.</td>
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<td></td>
<td>Mastered task @ 80% accuracy: 3 pts</td>
<td>Completed and mastered one level of the simulation.</td>
<td>n/a</td>
<td>No attempt</td>
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<td>More learning needed</td>
<td>No attempt.</td>
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**TOTAL in LAST BOX**

__/25 pts__
Lesson 3: Frog Garden Party!  
Toads and Triangles in the Math Garden

Overview
4th grade students will explore geometry and frogs in the garden.

What they will learn
• Types of triangles
• Right triangles
• Measuring angles
• Lines of symmetry
• Drawing triangles
• Role of toad as a consumer
• Changes in environment, community
• Measuring liquid volume
• Health and nutrition

How they will learn it
• Making a garden banner
• Squaring a garden frame
• Finding triangles in garden
• Making fly (cootie) catchers
• Decorating a toad abode
• Make a toad abode in garden
• Introduce toads to eat “pests”
• Creating a recipe for Frog Juice
• Triangle garden party snacks

Essential / Guiding Question
How can I recognize, measure and create angles and triangles in the garden?
How can I attract toads to the garden, so they will help control unwanted pests?

Engaging Students
Fly (cootie) catchers
Students will make fly (cootie) catchers to observe lines of symmetry and “catch” triangle facts for future reference.

Exploration
In preparation for hosting a garden party for frogs, students will. . .

Triangle hunting
Use completed fly catchers to look for triangles in the garden; measure angles and side lengths to confirm what types of triangles are found; sketch and label the triangles.

**Miniature pennant banners**
Demonstrate their ability to recognize, measure and draw different types of triangles by creating festive, frog-sized pennant-banners for the garden party.

**Frog Juice**
Measure and record liquid volumes of different ingredients, while inventing their own special tasty and healthy “frog juice” to drink at the party.

**Triangle Snacks**
Brainstorm and choose healthy snacks for human and toad guests at the garden party, including garden-grown and triangular-shaped foods.

**Explanation**
Students will be able to articulate what makes a triangle, tell about triangle types, and describe a healthy snack.

**Environmental Stewardship**
Students will use what they learned about triangles and toads to design, create and decorate a Toad Abode that features every type of triangle (equilateral, isosceles, scalene, obtuse, acute, right) and provides a suitable habitat. Students may also become part of the FrogWatchUSA citizen science efforts, and collect data to contribute.

**Evaluation**
Students will demonstrate mastery of triangles by labeling all types on their toad abode.

**CONTEXT FOR LESSON ACTIVITIES**

**Standards**
Georgia Performance Standards: Science
- **Life Science**
  - S4L1. Students will describe the roles of organisms and the flow of energy within an ecosystem.
    - a. Identify the roles of producers, consumers, and decomposers in a community.
    - c. Predict how changes in the environment would affect a community (ecosystem) of organisms.

Next Generation Science Standards
- **Core Idea LS2: Ecosystems: Interactions, Energy and Dynamics**
  - **LS2.A**: Interdependent Relationships in Ecosystems
  - **LS2.C**: Ecosystem Dynamics, Functioning and Resilience

Health Ed GPS
- **HE4.5**: Students will demonstrate the ability to use decision-making skills to enhance health.
  - e. Determine a healthy choice when making a decision.

Common Core: Math
- **Measurement and Data 4.MD**
  - Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.
  - **MCC4.MD.2** Use the four operations to solve word problems involving . . . liquid volumes. . . Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
  - **MCC4.MD.5** Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:
    - a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering
the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a “one-degree angle,” and can be used to measure angles.

b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees.

MCC4.MD.6 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

MCC4.MD.7 Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.

Geometry 4.G
Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

MCC4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

MCC4.G.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

MCC4.G.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Background Information
Triangle Basics: http://www.mathsisfun.com/triangle.html
FrogWatch USA citizen science program: http://www.aza.org/become-a-frogwatch-volunteer/

Teacher Preparation
Assemble supplies needed for the lesson. Ask students or a garden store for used plastic flower pots.

PROCEDURES FOR LESSON ACTIVITIES

Explain the premise of the lesson: to hold a garden party for frogs and toads that will encourage them to live in the school garden. Ask why a toad might be a better solution than pesticides, for controlling the population of insects eating fruits and vegetables in the garden. (Residual pesticides in and on food are not healthy for humans to eat). Also tell students that the theme of the garden party will be triangles. Introduce Triangle Basics http://www.mathsisfun.com/triangle.html, if the class does not have this background knowledge.

Fly (cootie) Catchers
• Provide each student with a piece of paper. (If the paper is 8 1/2” x 11”, students should fold a corner to the opposite side, making a square, and cut off the excess.
• Follow directions for making a cootie catcher http://www.billybear4kids.com/holidays/ChineseNewYear/CootieCatcher.shtml, if needed: As students are folding, unfolding and refolding their papers, ask if they recognize any lines of symmetry (on either side of which is a matching shape).
• http://www.billybear4kids.com/holidays/ChineseNewYear/CootieCatcher.shtml
• Ask whether people, animals and plants also have lines of symmetry. (People and most animals are bilaterally symmetrical. However, plants are radially symmetrical, as is a circle).

Triangle hunting
• Tell students to use completed fly catchers to look for triangles in the garden.
• Students will use a protractor to measure angles and side lengths, to confirm what types of triangles are found.
• Students will sketch and label the triangles.

Design Challenge: Miniature pennant banners
• Challenge students to use every type of triangle when creating a festive, frog-sized pennant-banners for the party.
• Provide twine, tape, fabric scraps or colored paper, and markers (to label triangles).

**Design Challenge: Frog Juice**
• Provide an assortment of juices, graduated measuring cups, paper cups.
• Challenge students to measure and record liquid volumes of different ingredients, while inventing their own special tasty and healthy “frog juice” to drink at the party. The recipe may be copied on a recipe card.

**Triangle Snacks**
• Ask the class to brainstorm snacks for human and toad guests at the garden party, including garden-grown and triangular-shaped foods. Sort the list of possibilities into healthy and not-so-healthy columns.
• Challenge the class to develop criteria for distinguishing healthy from unhealthy eating.

**Debriefing**
Ask students to reflect on what they learned in this lesson and guide the discussion to include the following:

**Properties of triangles**
• All triangles have 3 sides and angles that total 180 degrees.
• Scalene triangles have no equal angles; isosceles have two equal angles; equilaterals have three equal angles.
• Right triangles have a 90 degree angle
• Right triangles can be useful.
• Geometric shapes can have more than one line of symmetry; most animals have bilateral symmetry.

**Reasons for attracting frogs and toads to the (organic) garden**
• Toads help the garden with organic pest removal (1 toad can eat 10,000 insects in a season, per USDA).
• The garden can help toads (toad and frog populations are in decline due to loss of habitat, disease, pesticides).

**Choosing healthy party refreshments**
• It is healthy to eat five 1-cup fruit and/or vegetable servings a day.
• Fresh fruits and vegetables are healthiest to eat when they are plain, unadulterated, unprocessed.
• Children can choose to eat healthy food.

**Extension**
**The Delta Kite**
Making a delta kite can be a great lesson extension if used to reinforce measuring angles and classifying triangles. Students use inexpensive common items to create their own Delta wing kites. Simple directions with photos are available at: [http://www.my-best-kite.com/how-to-build-a-delta-kite-s.html](http://www.my-best-kite.com/how-to-build-a-delta-kite-s.html)

**Supplies for each delta kite**
• 30 lb. kite string
• 2-ply trash bag (lg)
• electrical tape
• ruler
• (2) 70 cm (32”) 5mm dowels
• (2) 80 cm (36”) 5mm dowels
Triangle Hunt in the Garden

Name: ________________________________

Date: _______ Location: ______________

Hunt for triangles in the schoolyard, measure their angles and sides, sketch each type, label its measurements, and tell where you found it. You may sketch a third "imagined" side opposite an angle with a dotted line, to create a triangle that does not physically exist.

Right

Obtuse

Acute

Isosceles

Scalene

Equilateral
<table>
<thead>
<tr>
<th>Level of Mastery</th>
<th>Benchmark or Performance Measure</th>
<th>Task Details</th>
<th>Level of Mastery</th>
<th>Benchmark or Performance Measure</th>
<th>Task Details</th>
<th>More Learning Needed</th>
<th>TOTAL POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Name(s):</td>
<td>Date: ____________________</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Assessment for (Lesson Plan Title)</strong></td>
<td></td>
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<tr>
<td>Triangle facts caught in cootie (fly) catchers</td>
<td>Student drew and correctly labeled right, acute, obtuse, scalene, isosceles, and equilateral triangles for reference, in cootie catcher</td>
<td>Mastered task @ 90%+ accuracy: 5 pts</td>
<td>Student participated without a lot of accuracy</td>
<td>n/a</td>
<td>No attempt</td>
<td></td>
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</tr>
<tr>
<td>Triangle Hunt in the Garden</td>
<td>Correctly identifies several types of triangles by measuring angles with protractors and sides with rulers.</td>
<td>Mastered task @ 85% accuracy: 4 pts</td>
<td>Triangles incomplete or in error.</td>
<td>n/a</td>
<td>No attempt</td>
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<tr>
<td>Frog-Scale Miniature Party Banners</td>
<td>Correctly draws triangles and labels angles and side lengths. Makes pennant banner featuring each type of triangle</td>
<td>Mastered task @ 80% accuracy: 3 pts</td>
<td>Creates a banner with some triangle shapes, but not all; or triangles are incorrectly labeled.</td>
<td>n/a</td>
<td>No attempt</td>
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<tr>
<td>Frog Juice Frog Party Food</td>
<td>Creates a recipe by measuring and combining different types of juices, to taste. Selects healthy triangular shaped food for snacks.</td>
<td>More learning needed</td>
<td>Creates fruit juice blend without measuring.</td>
<td>n/a</td>
<td>No attempt</td>
<td></td>
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</tr>
<tr>
<td>Toad Abode</td>
<td>Creates a mini-habitat in the garden that depicts every type of triangle, and attracts toads that will help eat garden pests. Student may also choose to join FrogWatch and contribute data to national database to protect frogs</td>
<td>More learning needed</td>
<td>Mini-habitat created for toads, but all triangles not depicted on it.</td>
<td>n/a</td>
<td>No attempt</td>
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<tr>
<td>TOTAL in LAST BOX</td>
<td></td>
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<td>_ /25 pts</td>
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