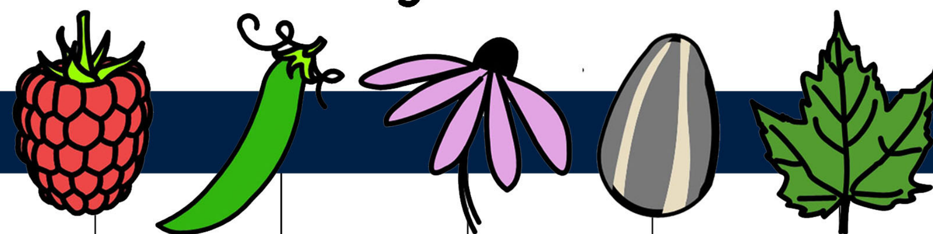
a Curriculum sampler
for the school garden

THE UNIVERSITY OF RHODE ISLAND
COOPERATIVE EXTENSION



STAPLE HERE


a *Curriculum* sampler
for Rhode Island School Gardens

Dear Educator:

Welcome to this sampler of standards-based school garden and classroom activities. Several lessons follow that are examples of the many ways a school garden can serve as a teaching platform for teachers and a “living laboratory” for students. While the selected standards are focused on middle school performance expectations, these activities can be modified for use with younger and older students. A matrix of K-8 activities aligned with Next Generation Science Standards is also included for your reference.

As you embark on this learning adventure, encourage students to actively engage in, and enjoy, real-life investigation and application of concepts in the garden and classroom. There is much to see, hear, smell, touch and learn!

Let’s get growing!
-URI Cooperative Extension

CONNECT WITH US!

Prepared by:
Amy Cabaniss, PhD, *Youth STEAM Education Coordinator*
Kate Venturini, *Program Design Specialist*
Kim Downes, *Program Assistant*
Kate Lacouture, *Registered landscape architect*

Resources for You:

Check out our School Garden Initiative website!

http://uri.edu/sgi
Find garden help, resources, curriculum and information about our annual school garden conference.

Contact our Gardening and Environmental Hotline!

401.874.4836 or gardener@uri.edu

Find us on Facebook!

www.facebook.com/uricoopext

Find us on Instagram!

@uricoopext

Find us on Youtube!

@URICooperativeExtension

URI Cooperative Extension
Mallon Center
3 East Alumni Avenue
Kingston, RI 02881

Phone: 401.874.2900
Fax: 401.874.2259
Email: coopext@uri.edu

Images: Kate Lacouture

THINK BIG WE DO℠

last updated October 17, 2017

SCIENCE

A Garden for All Seasons

Learning Objectives
Students will be able to:

- Understand and describe predictable lunar phases and present a model of the cyclic pattern;
- Define biomes, describe and discuss Rhode Island's biome, and chart the RI garden growing season for different plants;
- Learn the signs of seasonal change in the garden and develop skills to record and describe these changes.

Zero in on Rhode Island...where is it on the globe? At what latitude is Rhode Island? This location on our planet connects to biomes and is defined by temperature and precipitation. With knowledge of Rhode Island's climate, ask students to communicate perceptions of the stages of a garden. How do the seasons affect garden planning and planting? See the RI Planting Calendar for planting vegetables and fruits in Rhode Island.

RHODE ISLAND PLANTING CALENDAR FOR FRUITS AND VEGETABLES

Fruit or Vegetable	Days til Harvest	Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct	
		1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15
ASPARAGUS (purchase crowns)	1-2 Yrs						CR	CR	CR										
BEANS, BABY LIMA	60-100								S	S	S	S	S	S					
BEANS, PINTO	60-80								S	S	S	S							
BEANS, SNAP	60-80								S	S	S	S	S	S					
BEETS	60-80					S	S	S	S	S	S	S	S	S	S				
BLACKEYED PEAS	90-120								S	S	S	S							
BOK CHOY	45			S	S	S	S	S	S						S	S	S		
BROCCOLI	60-90 from transplant		I			T							I		T				
BRUSSEL SPROUTS	100-120 from transplant										I		T						
CABBAGE	80-90 from transplant			I			T				I		T						
CABBAGE, CHINESE	45 from transplant			I			T					I		T					
CARROTS	60-80				S	S	S	S	S	S	S	S	S						
CAULIFLOWER	80 from transplant						I		T	I		T							
CELERY	90 from transplant			I					T										
CHARD	60						S	S	S	S				S	S				
CORN, SWEET	70-90							S	S	S	S								
CUCUMBERS	60-90								S	S	S								
EGGPLANT	60 from transplant					I				T									
ENDIVE/ESCAROLE	80-120				S	S						S	S						
GARLIC	5-7 Mths																	C	C
KALE	60-90					S	S	S					S	S	S	S			
KOHLRABI	45-60 from transplant						I		T				I		T				
LETTUCE, HEAD	45-90					S	IS	S	T										
LETTUCE, LEAF	40-70					S	IS	S	T	S	S	S	S	S	S				
LEEK	160-200 from transplant				I				T										
MELONS	80-120 from transplant						I			T									
ONIONS, BULB	SETS: 4-5 Mths					Sets	Sets												
ONIONS, GREEN	90-100				S	S	S												
PARSNIPS	100-120											S	S						
PEAS	60				S	S	S	S											
PEPPERS	60-100 from transplant				I					T									

In the classroom: Rhode Islanders enjoy four seasons each year. But how do seasons occur? Introduce students to the seasons by first looking at the cyclic patterns of lunar phases. What is the moon phase pattern? How are the Earth's revolution and rotation related to the seasons? Working as partners or in small groups, students can create lunar cycle models (e.g., sketch, draw) and models based on evidence to represent seasonal changes in Rhode Island.

In the garden: Each quarter, bring students to the school garden site. Invite each student to record observations in the garden, such as plant growth, decline and decay, in addition to other seasonal changes. Students can provide an end-of-year reflection on the garden for all seasons.

***Next Generation Science Standards*:**
MS-ESS1-1: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases; Dimension 1 - Developing and using models to describe phenomena; Dimension 2 - Earth and the Solar System; Dimension 3 – Patterns

Images: URI

SCIENCE

The Scoop on Soils

Learning Objectives
Students will be able to:
- Describe how soil is formed and differentiate components of soil;
- Duplicate the water and rock cycles through discussion and model-making;
- Convey the attributes of soil that are essential to plants and care for a potted plant.

Soils are a basis of life on Earth. Soils are constantly being formed by the weathering and sedimentation of rocks and minerals, decayed and decaying organic matter, gases, water and other liquids. Soils are necessary for plant survival because they store nutrients that are absorbed by the plants and serve as a medium for plant growth. Soil also provides a home or habitat to many different types of organisms; and it is essential to the well-being of people for growing food crops and forage for animals.

In the classroom: Hold a discussion with students about how soils are formed through weathering and sedimentation. Provide students with rock samples illustrative of weathering. Discuss the water cycle through Earth's systems and its effects on rocks and soils. How does erosion occur and why can this be a problem? Facilitate model development (e.g., glued construction paper shapes or physical models) to demonstrate the rock cycle and the energy that drives soil formation.

How does soil help a plant survive, grow and reproduce? Have students create their own newspaper seed pots: Obtain newspapers and cut 5" double strips up from the fold. Using un-opened food cans as model frames, students can wrap the doubled newspaper around the cans, securing it with masking tape. Next, fold the top over twice (like gift wrap) and secure with two smaller pieces of tape (in an 'x'); this is bottom of the pot. Lift the pot off of the can and fill it 3/4s full of potting soil. Plant two seeds, water and secure in a plastic zip-loc bag. These can be labeled and kept on the classroom windowsill or sent home for students to record plant growth.

In the garden: Engage students in learning more about soil composition by looking closely at it. Invite students to dig down and collect about a cup of soil. Individually or as partners, students can pour the soil sample onto a piece of white paper and sort through the sample with tweezers or a stick. Using hand lenses, what is seen? Are rocks prevalent? Are plant pieces visible in the soil? Any small bugs or bug remains? Sort the rocks by size. Students can write their observations in field notebooks, including general descriptions of items found in the sample. This simple investigation can yield seasonal differences; repeat in the fall and spring.

Next Generation Science Standards:
MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process; Dimension 1 - Developing and using models; Dimension 2 - Earth's Materials and Systems; The Roles of Water in Earth's Surface Processes; Dimension 3 - Energy and Matter

Images: Pixabay

SCIENCE

It's All Part of the Plan[t]

Learning Objectives
Students will be able to:
- Understand and communicate the structure and function of plant root and shoot systems;
- Describe and distinguish monocots and dicots;
- Determine and detect pollinators and plant preferences; and recognize connections between pollinators and our food supplies

Plants are great conductors with vascular tissues that transport water and dissolved minerals/nutrients within the plant. A typical plant has a "root system" and a "shoot system." Underground, the root system consists of a primary root, lateral roots and root hairs. In addition to conducting water and nutrients, the roots help to anchor the plant in the soil. The aboveground shoot system typically includes a stem or trunk with branches and leaves, buds, flowers, fruit and seeds. Functions of the shoot system include water and nutrient conduction, photosynthesis, reproduction and seed dispersal.

In the classroom: Pull out the compound and stereoscopic (dissecting) microscopes to take a closer look at monocots and dicots. Are the vascular bundles different? Provide students with paper and pencils to illustrate what they see. You'll want to pull an example of each root instead of having students uprooting plants! Look for fibrous roots in peas and marigolds. Sweet potatoes and yams are tuberous roots. Examples of taproots include carrots and beets.

In the garden: School gardens can provide a biologically diverse, living laboratory of plant life. After covering the meanings of structure and function, and the structure and function of the six main plant parts (roots, stems, leaves, flowers, fruits and seeds), provide students with clipboards, paper and pencils. Have them explore the garden looking for varied examples of plants, identifying their common and unique structures. Introduce monocots versus dicots. For an illustrated comparison, see Plants and Their Structure. Are there examples in the garden? Using hand lenses, have students look at the number of cotyledons (embryos), if possible, leaf venation, roots and floral parts for comparison.

Pollination is how plants sexually reproduce. If your school has a pollinator garden, invite students to sit in the garden and observe pollinators that visit the flowers. What kinds of pollinators do they see (e.g., butterflies, wasps, beetles, hummingbirds)? Which flowers do the pollinators prefer? Hummingbirds, for example, specialize on nectar feeding and may be visiting the daylilies, columbines and cleomes. What other associations can be made? Ask students what nighttime (nocturnal) pollinators might visit the garden (e.g., bats, moths) and how they are attracted to the flowers (e.g., strong, thick sweet smells; showy white color). Facilitate a discussion on the importance of pollinators in the consumer food system.

***Next Generation Science Standards*:**
MS-LS1-1: Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.; Dimension 1 - Planning and carrying out investigations; Dimension 2 - Structure and Function; Dimension 3 - Systems and System Models; Structure and Function

Image: Pixabay

Getting Carried Away – Seed Dispersal

Learning Objectives:
Students will be able to:
- Understand how plant structures provide means for wide dispersal of seeds and be able to distinguish probable methods of dispersal for various seed types;
- Design seeds from common materials that display specialized structures and explain how they facilitate seed transport;
- Formulate ideas about similarities between plant structures and features of some consumer products;
- Discuss biomimicry

Plants create seeds for continued survival of their population. Falling beneath the parent plant might not be best for its survival and so seeds are distributed to other places. Seed dispersal occurs with the help of wind, water, animals, fire and force or explosion. Dandelions and milkweed seeds are carried by the wind. So too are the flat seeds of maple trees. Water lilies, foxglove and coconuts disperse by water. "Hitchhiker" seeds, like hooked-burdock burs, cocklebur and sticktights attach to animals' fur and people's clothes, and can be carried long distances. Animals including birds are attracted by plants with brightly-colored, fleshy fruits. They eat the fruit and deposit the seeds when they defecate. Some plants shoot their seeds from their pods, such as peas, geranium and lupin. Some species of pine tree have a waxy coat on their cones that only fire melts and releases the seeds.

In the classroom: Provide students with various craft materials (e.g., craft feathers, velcro, thin cardboard, cotton, cork) to build their own "seeds" that can be transported by wind, water or hitchhiking. Invite student descriptions of their seed transport systems. Have them test their creations! Discuss biomimicry and how consumer products in the marketplace may mimic natural materials and structures.

In the schoolyard and garden: Bring students outdoors to find and collect different types of seeds, looking closely at them with hand lenses. Gather as a group and ask several students to share their findings, explaining how they believe the structures aid in seed dispersal. How widely-dispersed are the seeds or seedlings (e.g., are there small maple seedlings everywhere)?

***Next Generation Science Standards*:**
MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively; Dimension 1 - Developing and Constructing Models; Dimension 2 - Growth and Development of Organisms; Dimension 3 - Structure and Function

Image: Kim Downes

SCIENCE

K-8 SCHOOL GARDEN LESSONS

Aligned with Next Generation Science Standards (NGSS)

Grade	Topic/Concept and Sample Lesson Ideas	NGSS Performance Expectation and Dimension Components
K	Plants need water, carbon dioxide and sunlight for food production (photosynthesis) **Sample lessons:** Observe plant needs and patterns of growth in the garden; experiment with blocking sunlight that reaches selected plants in the garden or classroom	K-LS1-1. Use observations to describe patterns of what plants and animals (incl. humans) need to survive Dimension 1 (Science and Engineering Practices): Analyzing and interpreting data Dimension 2 (Disciplinary Core Ideas): LS1.C: Organization for matter and energy flow in organisms Dimension 3 (Crosscutting Concepts): Patterns; Cause and effect
1	Introduction to the parts of a plant and how each part (e.g., roots, stem) serves a specific function; comparison to human use of materials and tools **Sample Lessons:** Examine plants in the garden and schoolyard; sort produce that we eat by plant part (e.g., asparagus - stem, carrot - root); draw comparisons of plant parts to items we use (e.g., stem and straw)	1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants or animals use their external parts to help them survive, grow and meet their needs Dimension 1 (SEP): Constructing explanations and designing solutions Dimension 2 (DCI): LS1.A: Structure and function Dimension 3 (CCC): Structure and function
2	Seeds are designed for survival and transport to other areas for survival; dispersal depends on various mechanisms (e.g., wind, water, animals) **Sample Lessons:** Collect various seeds outside to closely examine and sort in many ways; test different seed types – actual or fabricated (e.g., capabilities for attachment, becoming airborne, floating)	2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties Dimension 1 (SEP): Analyzing and interpreting data Dimension 2 (DCI): PS1.A: Structure and properties of matter Dimension 3 (CCC): Cause and effect

Image: Kate Lacouture

SCIENCE

Grade	Topic/Concept and Sample Lesson Ideas	NGSS Performance Expectation and Dimension Components
3	Plants, like other organisms, go through many changes during their lives that can be documented and modeled. **Sample Lessons:** Plant flower seeds in root view containers (e.g., 8-10 oz. clear plastic cups) and collect and analyze data on root, root hair and seedlings; predict, track and develop a diagram, flowchart or clay replica of the flowering plant life cycle	3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction and death. Dimension 1 (SEP): Analyzing and interpreting data Dimension 2 (DCI): LS1.B: Growth and development of organisms Dimension 3 (CCC): Patterns
4	Structures such as roots, stems, thorns and flowers are essential to a plant's survival. **Sample Lessons:** Investigate plants in the garden for evidence of structures that aid in survivability; engage in discussion/argument, encouraging explanation for how things work in the natural world	4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. Dimension 1 (SEP): Engaging in argument from evidence Dimension 2 (DCI): LS1.A: Structure and function Dimension 3 (CCC): Systems and system models
5	Soil is not essential to the growth and development of plants **Sample Lessons:** Place cuttings/offshoots of plants in clear plastic cups with water; predict the plants' ability to live and grow; encourage prediction and argument on the idea that plants rely mostly on air and water	5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. Dimension 1 (SEP): Engaging in argument from evidence Dimension 2 (DCI): LS1.C: Organization for matter and energy flow in organisms Dimension 3 (CCC): Energy and matter
MS	Seasonal changes occur in New England and these climate effects are reflected in the garden **Sample Lessons:** Record cyclic patterns of lunar phases; predict and model the seasons of the garden throughout the academic year (e.g., keeping bi-monthly records of changes in the garden; graphically or artistically representing the changes on paper)	MS-ESS1-1: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases Dimension 1 (SEP): Developing and using models to describe phenomena Dimension 2 (DCI): ESS1.B: Earth and the Solar System Dimension 3 (CCC): Patterns

ENGLISH LANGUAGE ARTS

Explaining “Dirt! The Movie”

Learning Objectives
Students will be able to:

- Discuss the value of soil using multiple perspectives;
- Display ability to identify terms and main ideas in the movie;
- Logically organize and present main ideas using precise vocabulary in a short paper;
- Analyze, select and sort soil grains; judge potential soil porosity and theorize benefits to plants

In the classroom: To best understand the importance of soil, older students in grades 6 - 12 can benefit from seeing “Dirt! The Movie,” a 2009 American documentary film. (Note: Due to the graphic nature of parts of the film, it is not recommended for younger children.) Prior to movieviewing, introduce students to writing informative/explanatory texts. Have them prepare to write down facts, examples and quotations during the movie (and plan to leave a light on to make this possible). Students can turn these notes into an outline and subsequently a two-page paper, using precise vocabulary to explain the importance of soil. Encourage a thoughtful, summarizing conclusion.

In the garden: Using a sieve set outdoors or in the classroom, invite students to screen soil samples collected in the school garden or surrounding area. With a ruler, paper and marker in hand, ask them to sort grains by size range and create a matrix that displays the range of sizes. Have them plot the values on a table. Consider percentages such as the percentage of rocks that were smaller than 1”. What assumptions can be made about the soil sample? How does grain size affect soil porosity and water percolation rates? What other materials were found in the soil sample? Discuss other different soil types (e.g., sandy soil, clay).

***Common Core State Standards** for English Language Arts and Literacy*, Writing Standards 6-12
Common Core State Standards for Mathematics, Ratio and Proportional Relationships (6.RP)

Image: Pixabay

ART

Flowers Brushed by Georgia

Learning Objectives

Students will be able to:

- Identify parts of a flower and understand and convey the functions of flower structures;
- Recall information about Georgia O'Keeffe and explain her boldly artistic style;
- Interpret artistic renderings of flowers to explain possible attraction by pollinators;
- Create an abstract painting of a real flower that displays flower structures

Georgia O'Keeffe was one of the first internationally-acclaimed female artists, well known for her enlarged paintings of flowers, among other subjects. She opened the floral world to many with her painted magnification. O'Keeffe's renderings provide a valuable tool for focusing students on flower structure and function.

In the classroom: Using flowers grown in the garden or alstroemeria flowers that can be purchased at a grocery store, introduce students to the parts of a flower. Look at the petals, sepals and pedicel. The anther and filament comprise the stamen, the male part of the flower. The stigma, style and ovary are part of the pistil, the female component of the flower. Invite student partners to gently dissect a flower with their hands or tweezers and look at the parts with magnifying lenses.

Show images of O'Keeffe's flower paintings, such as Oriental Poppies. Ask what is special or different about her renderings. (Note: that with close-up interpretation, O'Keeffe's flowers often go off the canvas. There is also a degree of abstraction.) In the center of butcher paper-covered tables, place vases of individual alstroemeria stems with multiple flowers for students to view and containers of water for brush-rinsing. Provide a sheet of thick paper (80 lb. construction paper, cardstock or watercolor paper) to each student, along with various paint brush sizes and a paper plate of tempera paints that can be used to represent the flowers. First provide students with hand lenses for a magnified view of their flowers, encouraging them to simulate O'Keeffe's style by first sketching and then painting what they see on paper.

***Grade Span Expectation** for 7-8: Visual Arts and Design Visual Understanding 3 - Communication - Visual Art and Design is a vehicle for expression and communication through the use and development of metaphor and symbol systems*

Image: http://www.georgiaokeeffe.net/poppy.jsp

CONSIDER THIS!

Other Disciplines

A school garden is an amazing multi-disciplinary platform for teaching just about any subject. Are you a Spanish teacher? A veggie garden can be used to introduce tomates (tomatoes) and calabacín (zucchini). In Social Studies, demonstrate the Native American companion planting called "the three sisters," where beans use corn stalks to climb and squash is planted at the base to provide protection with its big rough leaves. In Language Arts, write a Haiku related to the stages and seasons of the garden. And don't forget about physical education, health and nutrition. Garden tasks provide great physical activity and stress reduction. Engage your school's food service provider and potentially provide garden harvest tastings at lunch or add your garden vegetables to the school salad bar as an extra (and educational) treat! For more inspiration, visit uri.edu/sgi.

Additional Resources

Following is a sampling of some of the many useful schoolyard and school garden curricula.

- ***Audubon at School: A Schoolyard Habitat Curriculum Guide***
  https://www.fws.gov/northeast/cpwn/pdf/SchoolyardTeachersManual.pdf

- ***Learn, Grow, Eat & Go!***
  Junior Master Gardener: http://jmgkids.us/lgeg/ (for purchase)
  School Garden Lesson Plans: https://www.wholekidsfoundation.org/downloads/pdfs/AHA_WKF_Curriculum.pdf

- ***Schoolyard Habitat Project Guide: A planning guide for creating schoolyard habitat and outdoor classroom projects***
  https://www.fws.gov/cno/pdf/HabitatGuideColor.pdf

- ***The Growing Classroom – Garden and Nutrition Activity Guide***
  http://www.lifelab.org/store/curriculum/#tgc (for purchase; free downloadable units also available); http://www.lifelab.org/standards-database/

- ***Wildlife Gardener: A Junior Master Gardener Golden Ray Series***
  http://jmgkids.us/curriculum/wildlife-gardener/ (for purchase)

THINK BIG WE DO℠

Image: Kate Lacouture

NOTES

THE UNIVERSITY OF RHODE ISLAND
COOPERATIVE EXTENSION

THINK BIG WE DO™