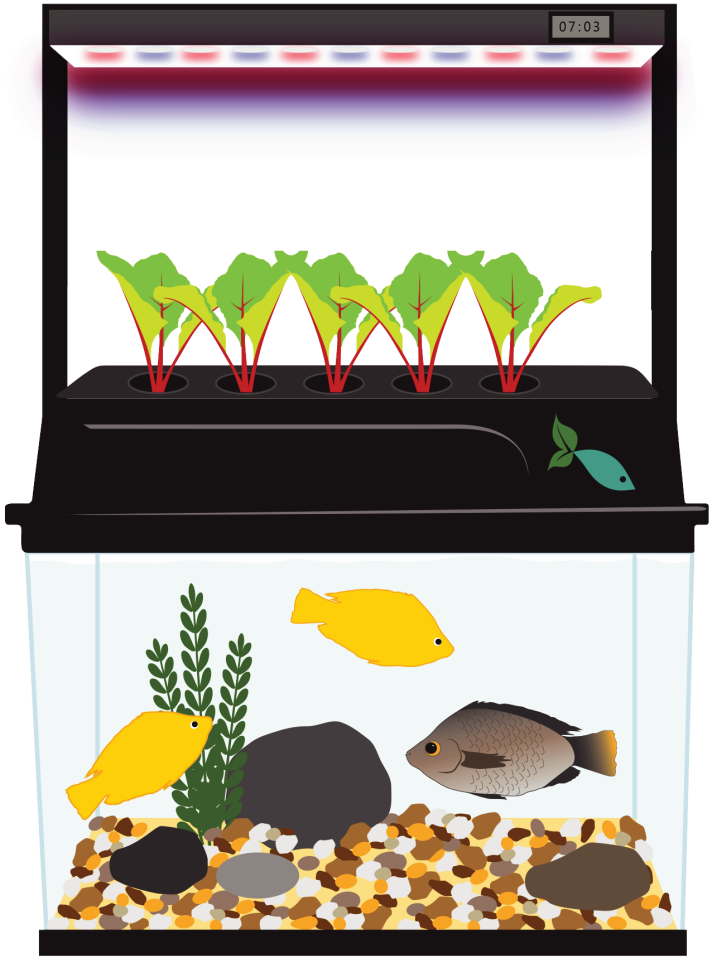
ECOLIFE aquaponics®

3-5

ECO-CYCLE CURRICULUM

What is the ECO-Cycle Aquaponics Kit™?



The ECO-Cycle Aquaponics Kit™ provides students and teachers with an interactive, hands-on tool for learning. The kit may be used to demonstrate concepts such as:

- **Plant and animal anatomy**
- **Photosynthesis and respiration**
- **Living systems**
- **The Nitrogen Cycle**
- **The role of bacteria in ecology**
- **The function of water in ecology**
- **The science of sustainable agriculture**
- **Climate change and ecological issues**

and many others, all while caring for fish and plants, germinating seeds, and harvesting vegetables.

The curriculum is designed around the ECO-Cycle. Once it is assembled and running (see assembly instructions included with the kit), the following lessons may be implemented.

Grades 3 - 5 Lesson Plans

Teacher Background

LIFE SCIENCE: Structures for survival in a healthy ecosystem.

Students learn that plant's adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:

- Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.
- Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.
- Students know living things cause changes in the environment in which they live: some of these changes are detrimental to the organism or other organisms, and some are beneficial.
- Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations. Create three different settings to grow chard. Plant seeds in unhealthy soil, healthy soil, and substrate in the ECO-Cycle. Study growth and health rates of plants.
- Students know that some organisms that once lived on Earth have completely disappeared and that some of those resembled others that are alive today.
- Students can understand the mutual importance of living things such as fish in the environment and how they benefit the growth of plants. Students can learn that plants in the wrong environment will not survive; such as unhealthy soil, or without light, but in a healthy environment may survive and thrive.

ACTIVITY #1: THE AQUAPONIC BRACELET

NGSS: 5-LS2-1 :

OBJECTIVE:
Students will use aquaponic vocabulary combined with art to replicate the action of the ECO-Cycle.

MATERIALS:

- Leather or nylon string
- 14 plastic beads per student in the following colors: yellow, green, blue, white, black, brown, and orange

ACTION:
Students will place the beads on a string in the order of action that occurs in the ECO-Cycle: yellow, green, blue, white, black, brown, and orange. The order of the beads are important. The yellow bead represents the sun shining down onto the growing plants. Green representing the plants in the water that use the sun for food. Blue represents the water in the system. White represents the oxygen produced by the plants. Black represents the fish which use the oxygen to both breathe and grow. Brown represents the waste produced by the fish. Finally, orange represents the bacteria which helps convert the waste to nitrogen that the plants can use.

The beads can go all around the bracelet to repeat the cycle twice. This is a non gender specific, environmental bracelet.

FURTHER DISCUSSION:
What do you think would happen if you decided to change the sequence of colors on your bracelet? Would this adversely change how the ECO-Cycle works? What would happen if we removed a color in the bracelet? How would that change the action in your ECO-Cycle?

CLASS DISCUSSION:
Have the students reflect on food webs and what has been learned so far with the ECO-Cycle Aquaponic Kit. Students should write a paragraph on how important the symbiotic relationship is between fish, plants, water, food and light.

SWIMMING DEEPER:
John Muir the famous naturalist once said, “When we try to pick out anything by itself we find it hitched to everything else in the universe.”

- What does this mean to the class?
- Ask the students to write a paragraph explaining their understandings.

ACTIVITY #2: WHAT DO PLANTS NEED TO LIVE?

NGSS: 3-LS4-3

OBJECTIVE:
Students will learn about different elements (substrates) that plants can grow in. Students will understand that in the ECO-Cycle plants are grown in a different substrate such as gravel, clay pellets, or peat and coco based plugs. Students already know and understand that plants typically grow in healthy soil.

MATERIALS:

- Five bean seeds/plants
- Paper towels
- Ziplock bags
- Clear plastic cups
- Potting soil
- Sand
- Two cups of water
- Scissors

ACTION:
Start seeds on a wet paper towel - cut paper towel into narrow strips about four inches wide and place inside a ziplock bag. Students can watch the whole sprouting process. Seed should also be germinated in the ECO-Cycle. Once the seeds sprouted, transplant the sprouts to clear plastic cups, positioning them against the sides so you can see the root formation as they grow.. Grow four in potting soil and one in the ECO-Cycle.

Label the five identical plants:
Light and Water
Light and No Water
Water and No Light
No Light and No Water
Light, Water, and No Soil

Deprive each cup of one thing a plant needs to grow:
One gets light, water, and soil
One gets light, soil, but no water
One gets water and soil, but no light
One gets soil, but no light and no water
One gets light, water, but no soil

FURTHER DISCUSSION:
Have students create a prediction of what will happen to each cup. Students will collect data and complete the chart on the next page.

WHAT DO PLANTS NEED TO LIVE?

Write a Prediction :

Observe: How do the plants look? Record your observations in a chart.

PLANTS	Day 1	Day 2	Day 3	Day 4	Day 8	Day 12
Light, Water, and Soil						
Light, Soil, No Water						
Soil, Water, No Light						
Soil, No Water, No Light						
Water, Light, No Soil						

Predict: What do you think will happen to each plant?

Collect Data: Look at the plants every few days. Record your observations in your chart.

Analyze Data: Which plant grew the most after two weeks? Which plant looks the healthiest?

What do plants need to live?

Is this what you expected?

ACTIVITY #3: FLOWER ANATOMY & DISSECTION

NGSS: 4-LS1-1

OBJECTIVE:
Students will investigate and understand basic plant anatomy and life processes. Key concepts include: structures of typical plants (leaves, stems, roots, and flowers).

MATERIALS:

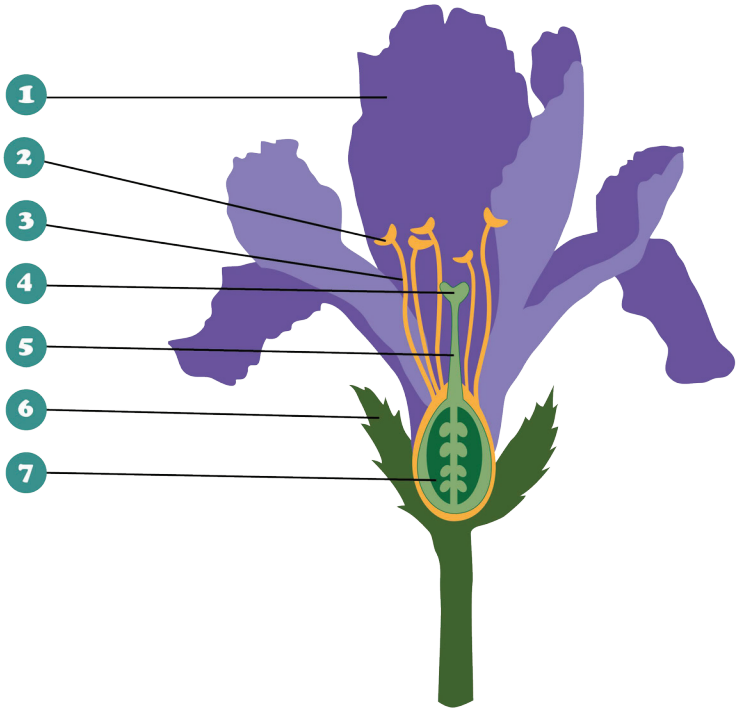
- Hibiscus flower
- Small plant
- Paper towel
- White drawing paper
- Pencils
- Tweezers

ACTION:
Student led observations. Pass out flower and plant diagram worksheets. Pass out flower, small plant, tweezers, and paper towel to students.

Using tweezers, students will dissect (with teacher modeling) their plant identifying the basic parts including the leaves, stems, roots, and flowers.

Students will draw, label, color parts of a plant on drawing paper, and write what each structure does.

FURTHER DISCUSSION:
Ask the students if they can find the same anatomy on flowering plants such as daffodils, amaryllis, or other bulbs.



1. PETAL
2. ANTHER
3. FILAMENT
4. STIGMA
5. STYLE
6. SEPAL
7. OVARY

ACTIVITY #4: PLANTS AND LIGHT

NGSS: 3-LS3-2

OBJECTIVE:
Students learn early on that all plants need the sun in order to grow and produce their own food. In this lesson, students will gain an understanding of the how grow lights in the ECO-Cycle take place of the sun. Since these lamps act in a similar fashion of the sun, the students will observe that plants grow towards light.

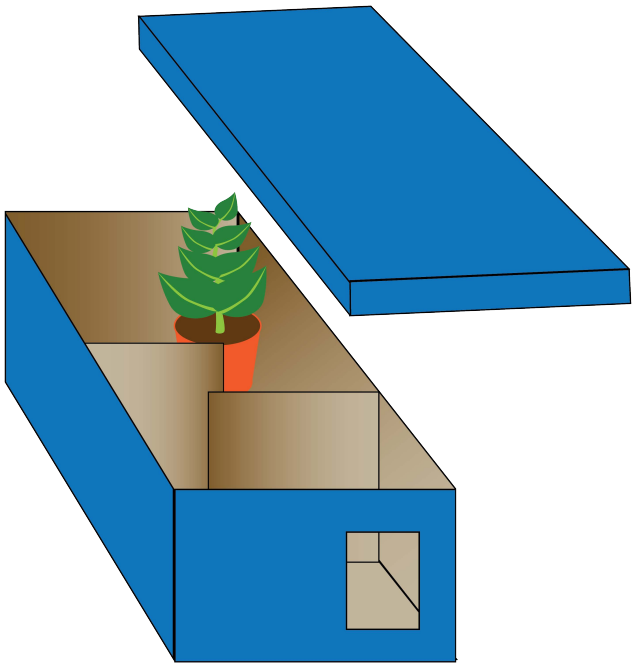
MATERIALS NEEDED:

- Scissors
- Large shoebox
- Heavy cardboard box
- Masking tape
- Small potted ivy plant

FURTHER DISCUSSION:
Plants need sunlight to survive. If something is blocking the light, how will a plant respond?

ACTION:
Cut a hole in one end of a shoebox. Cut two dividers from the cardboard as tall as the shoebox but an inch shorter than its width. Tape the dividers upright along the inside of the box. The first divider should be attached to the same side as the hole that was cut into the box in step 1.

The other divider should be on the other side. Put your plant in the end of the box opposite the hole. Put the lid on the box and turn the hole toward bright sunlight.



OBSERVE:
Every three or four days, remove the lid to water your plant and observe its growth. Do this for several weeks.

WRAP UP:

- How does the plant change after a few weeks?
- How does it get the light it needs
- How might this be similar to what happens on a forest floor?

ACTIVITY #5: CLASSIFY LEAVES

NGSS: 3-LS3-2

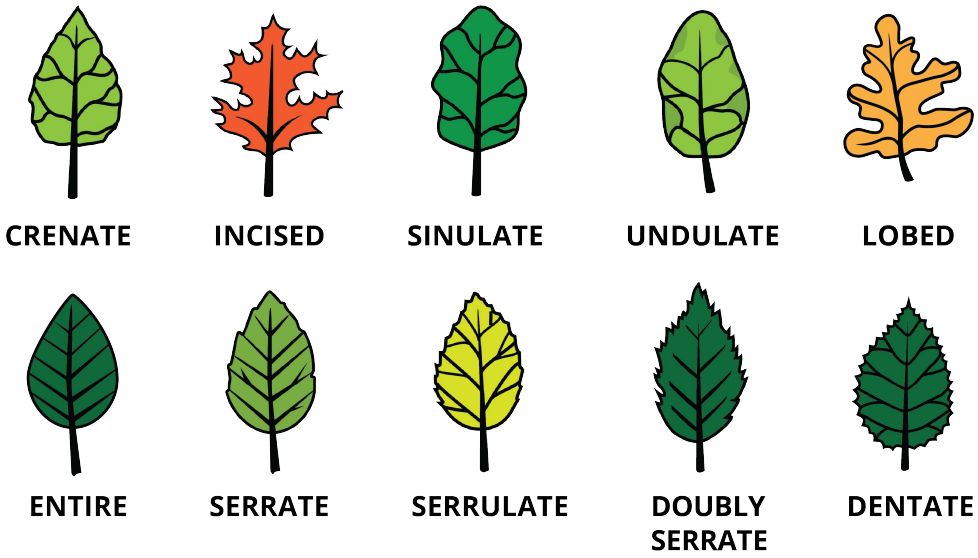
TEACHER BACKGROUND:
When scientists classify, they place things that share traits or characteristics into groups. In order to classify, scientists need to compare and contrast. To compare you look for how things are alike or similar. In order to contrast, you must look for how they are different. When looking at leaves we may notice many similarities and differences.

OBJECTIVE:
Students will learn the defining characteristics of leaves either in the ECO-Cycle or in the schoolyard.

CLASS DISCUSSION:
Classifying is a useful tool for organizing and analyzing things. When you classify, you can learn the characteristics of millions of things without actually having to learn about each one. For example, you may not know all the different kinds of bicycles there are in the world, but you know something about all bicycles: Bicycles have two wheels.

It is a good idea to keep notes of the criteria or rules you use to classify things. An example of a criterion is the number of wheels something has. If you decide to classify things by the number of wheels they have, cars, pickup trucks, and carts would be in the same group because they all have four wheels. Motorcycles and bicycles would be in the same group because they have two wheels.

One way to classify things is by their shape. You can classify leaves by the shape of their edges. Here are some examples of the different types of leaf edges:



ACTION:

Find ten leaves of different kinds, shapes, and sizes. Examine each of your ten leaves one at a time. Draw your leaves on a chart similar to the one shown. Write a description of each leaf next to the picture.

Classify your leaves according to the type of edge each has. Use the leaves from above as a guideline. Record the type of edge on your chart.

Identify any of the similar leaves from above with anything you may be growing in your ECO-Cycle at this time.

Leaf Classification

Leaf	What It Looks Like	Description	Classification
1.		veins smooth edges	smooth
2.			

SWIMMING DEEPER:

Ask students to collect leaves from all over campus and home. They should note where they found the leave and what kind of plant it came from. Have students do a rubbing of each of their leaves on a separate paper and identify parts. Suggestions for items to identify: venation, shape, margin, arrangement, monocot, dicot, modified, stem attachment or base shape. Leaf rubbing should be saved in a binder for the academic year.

LEAF RUB ACTIVITY

STEP 1: Be sure your leaf is fairly dry. If you have a moist leaf, like lettuce, set it out fora day or two and let it dry out just a little.

STEP 2: Place your leaf under a piece of white paper.

STEP 3: Hold the paper flat and tight over the leaf. Using the side of the tip of the colored pencil, rub the pencil back and forth using wide strokes over the paper. The an image of the leaf will begin to show up on the paper. Be sure to rub firmly and on the edges and stem of the leaf as well.

STEP 4: Once your rubbing is complete, label all the parts of the leaf and identify the type of venation, shape, margin, arrangement, monocot, dicot, modified, stem attachment or base shape.

ACTIVITY #6: HOW DOES WATER MOVE IN A PLANT?

NGSS: 4-LS1-1

TEACHER BACKGROUND:
When you cut a thin slice of a plant stem or root and look at it under a microscope, you can see the tissues that form the transport system.

MATERIALS:

- Magnifying glass
- Celery stalk
- Food coloring
- Colored pencils or crayons
- Water
- Mason jar
- Spoon
- Knife

MAKE A PREDICTION:
What will happen if you leave a celery stalk in colored water? Create a hypothesis.

ACTION:
Grow celery in your ECO-Cycle or purchase at the store.

Observe – Use a magnifying glass to look at the celery stalk.

Cut the end of the celery stalk and place the celery stalk in a container with water.

Put five drops of food coloring into the container. The best food coloring to use is a blue or red. Stir the water until the food coloring is thoroughly mixed.

Record Data – Use colored pencils to draw a picture of the celery stalk. Record the date and time.

Observe – On the following day; use the magnifying glass to look at the celery stalk. Note any changes

Record Data – Use colored pencils to draw a picture of the celery stalk. Record the date and time.

FURTHER DISCUSSION:
What can you conclude about how water moves in a plant? Communicate – Write a report of your investigation. Describe any differences between your results and those of your classmates. Have the students each bring in a straw from home and a healthy beverage and have them drink the beverage correlating the drinking of the beverage to the action of the plant.

SWIMMING DEEPER:

For a fun twist, try this activity with white carnations and assorted food coloring. Students can make colorful flowers that double as a nice take-home gift.

ACTIVITY #7: SEED PACK BOOKMARK

NGSS: 3-LS4-3

OBJECTIVE:
To teach the students how to read a seed packet and have a clear understanding of the difference in how we would plant seeds in a soil garden verses the way we plant seeds in an ECO-Cycle.

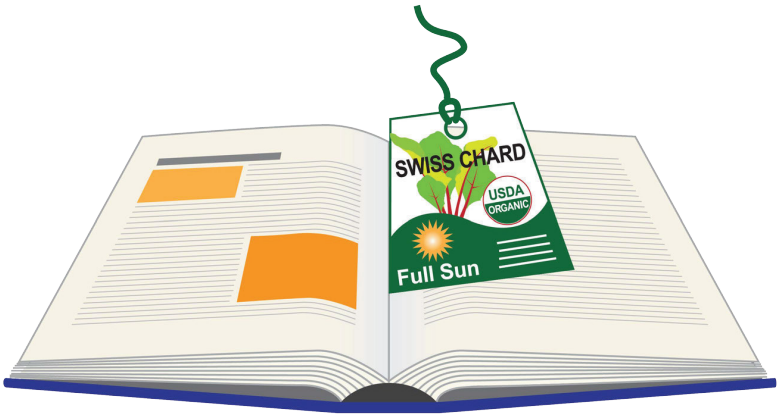
QUESTIONS FOR DISCUSSION:
What are the main differences we see when we look at planting seeds in the ECO-Cycle verses planting in a garden bed? As we read a seed packet what are some of the most important things we see on the back of the packet? Seeds need spacing, proper depth for planting, days to harvest and finally time of year to plant the seeds. In a closed ECO-Cycle system like ours do we need to follow the same parameters as we would if were planting or sowing seeds in a garden bed?

MATERIALS:

- Construction paper
- Crayons or markers
- Scissors
- Photo copies of seeds packs

BUILDING BACKGROUND:
Explain to the students that it does not matter what time of year to plant in the ECO-Cycle. This is very important in places where we have long harsh winters where in typical farming you have to wait until the last frost before sowing seeds or may even have to start seeds indoors before we bring them into our garden beds.

ACTION:
Have the children create a memorable bookmark they will use with all there reading materials throughout the school year. Have the children draw a picture of the seed pack they have been given with the following information on the bookmark.



NAME OF SEEDS	DAYS TO GERMINATE	DAYS TO HARVEST	SPACING	COLOR OF VEGETABLE	SUGGESTIONS	HAVE YOU TASTED?

SWIMMING DEEPER:

There are many ways to make agriculture more sustainable and efficient and no matter where you are in the world there are ways to include the ECO-Cycle Aquaponics Kit.

- How could we farm more efficiently in our current agriculture system and use less land space?
- What are the benefits of growing produce all year long?

ACTIVITY # 8: CAN A PLANT GROW IN THIS?

NGSS: 5-LS1-1

OBJECTIVE:
To show students how plant roots can grow around objects as they would in soil. Teach students that in the ECO-Cycle we do not necessarily need to grow our seeds in soil and we use a different substrate such as a lava rock or other rock material. This will demonstrate that plants have the ability to grow in other settings.

QUESTION FOR DISCUSSION:
Since everyone typically starts seeds directly in soil or in a seed table, how is it possible for us to start seeds in a different setting? Can plant roots grow around objects in order to get the nutrients the plant needs?

MATERIALS:

- 16 oz. clear plastic cup
- Black sharpie
- Soil
- Bean pole seeds
- 2.5” block of wood
- Rock approx. 2.5"
- Watering can
- Paper
- Pencil

BUILDING BACKGROUND:
Students understand the role of roots in the plant system acting as an anchor for the plant, absorbing water, minerals and nutrients, and also as a storage facility for food for the plant.

ACTION:
In groups of two students- take a 16oz clear plastic cup, write their names on the cup and fill the cup ¾ of the way with potting soil. The A group will place a small 2.5” block of wood onto the soil then cover the rest to the surface of the cup with potting soil.

Measuring just below the fingernail of the students' pinky finger, the group will plant a single pole bean seed and lightly cover the seed with soil.

Take the watering can and soak the soil enough to get everything wet but be sure not to drown the seed.

Group B will repeat the same actions as the other group but instead use a flat beach rock that fits the same way into the cup. Group C will plant in the ECO-Cycle.

WRAP UP:
Ask the students to predict which seed in which cup will be able to grow the best? If something is blocking the seed what will the roots do? Do all seeds need to grow in soil or can you substitute something other than soil to grow your plants in?

SWIMMING DEEPER:
Have the students take a walk outside and see if they find any weeds growing in between cracks in the sidewalk.

- Students may find weeds growing out of a curb as well.
- This will show another great example of how plants and roots grow.

ACTIVITY #9: ENERGY IS ALL AROUND US

NGSS: 5-PS3-1

OBJECTIVE:
As we all know, the largest and most abundant source of energy we have is the sun and it is needed for the growth of all plants. However, the students will see energy used in a different way through the ECO-Cycle in the form of grow lamps which substitute for the power of the sun to help plants grow.

ACTION:
What are forms of energy sources that we know of and how many can you name off the top of your head?

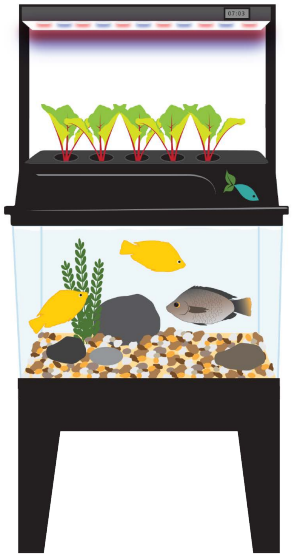
Draw a model of the how energy is being cycled through your ECO-Cycle. Explain how the parts work together and how they are related to one another. Students write and share explanations using whatever words are comfortable.

ACTIVITY #10: IT'S NOT A HABIT, BUT A HABITAT!

NGSS: 3-LS4-3

OBJECTIVE:
Students will learn about food chains and habitats. The ECO-Cycle shows an excellent example of a habitat in a closed system. Students learn the importance of co-existence and gain a better understanding of how each component is vital for the existence of another. Outside in your garden or schoolyard, students can observe and learn the interrelationships of living organisms in the open environment.

QUESTIONS FOR DISCUSSION:
What is a habitat? What do plants in our garden need in order to survive? What do we need in order to survive? Can plants grow anywhere? What would happen if all animals or plants were gone? How can plants in the garden be part of the habitat for everything in the garden or in the ECO-Cycle Kit?



MATERIALS:

- Plain construction paper
- Magnifying glasses
- Outside environment
- ECO-Cycle
- Pencils

ACTION:
Have students observe for three minutes what is happening in the ECO-Cycle between the fish in the tank, and then have them observe the plants.

Have students step outside into the natural environment, like a garden or park. Observe a specific plant or plants in one area. Look under the plants outside and in the soil around the plants. Have students try to find three different insects. Have them do the same with the ECO-Cycle Kit. Students draw their findings into their own habitat.

Have students investigate and observe the same two habitats for several weeks and ask the students to record and draw the changes that appear.

SWIMMING DEEPER:

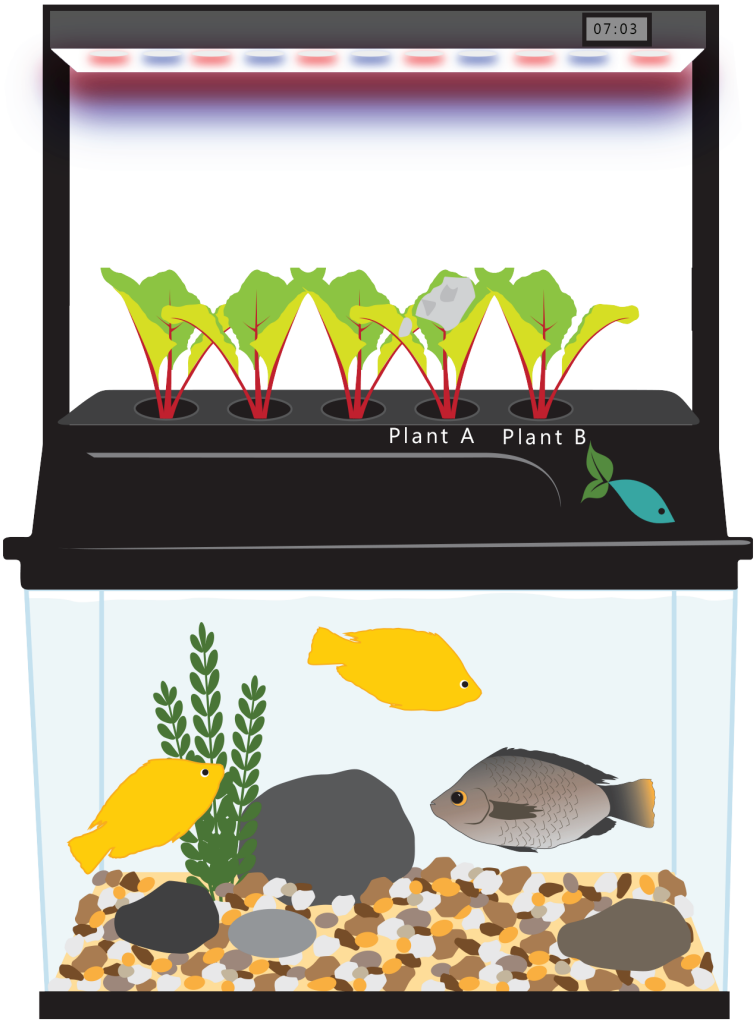
- What were the biggest changes noted?
- How did plants, fish, insects, and everything else play an important role in the habitat?
- What do you think would have happened if we removed one part of the habitat?

ACTIVITY #11: LET THERE BE LIGHT!

NGSS: 5-PS3-1

MATERIALS:

- Two mature plants
- Tin foil
- Water
- ECO-Cycle



ACTION:
Label two identical plants "Plant A" and "Plant B". Wrap each leaf of Plant A with aluminum foil. Keep the leaves of Plant B uncovered. Each plant should receive the same amount of light and water.

PREDICT:
What do you think will happen to each plant?

OBSERVE:
Uncover Plant A after four days. Record your observations about each plant in a chart.

INFER:
Why do Plant A and Plant B differ after four days?

DRAW CONCLUSIONS:
How can you tell plants need light to grow?

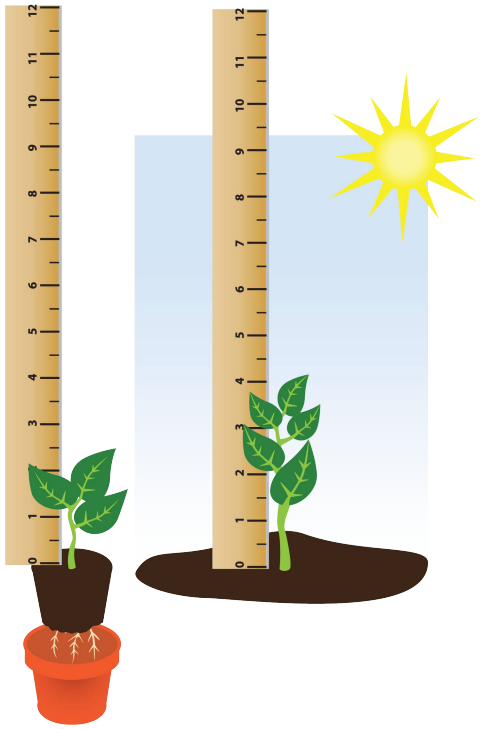
SWIMMING DEEPER:

- Have students use different plants, different locations, both indoors and out with various materials to cover leaves (copy paper, newspaper, magazine pages, card stock paper, wax paper, parchment paper, etc.
- Group students and fill the entire ECO-Cycle with a variety of plants. Ask students to compare and discuss why some plants might need more light then others.
- Students discuss the variations in what they observe at the conclusion of the experiment time and why they observed those variations, if any.

ACTIVITY #12: TIME TO GO AND GROW

NGSS: 3-LS-1

DESCRIPTION:
Students learn how to transplant seedlings from seed start trays. Students will plant seedlings in both the ECO-Cycle and soil.



OBJECTIVE:
To learn how to transplant seedlings and plant in both soil and the substrate clay rock and properly handle these delicate seedlings.

BUILDING BACKGROUND:
It is very important that students learn and understand the proper way of handling such a delicate plant when transplanting. The roots are very fragile and the plants need to be handled carefully and by the stem. Students will learn about spacing in a garden setting and how to plant in our grow cups found in the ECO-Cycle. It is ***very*** important that the dirt has been removed from the roots of the seedlings before placed into the net cups to prevent from dirtying up the water and fish tank.

MATERIALS:

- Trowels
- Seedlings ready for transplant
- Paper
- Pencils

CLASS DISCUSSION:
Have the students observe and look at the seedlings in our seed start tray. Observe how the plants began growing closely together. It is imperative that the plants are handled carefully and given space so when they are fully grown, they have plenty of room.

ACTION:
In groups of two, have the students work together carefully removing the seedling from the start tray using a hand trowel.

Have students dig a hole twice the size of the root ball in the soil for the outside garden bed. For the fire clay rocks tell the students to remove all dirt from the seedling so the dirt does not cloud the water in the fish tank.

Have the students plant the seedlings and press the soil firmly around the plant. In the ECO-Cycle Aquaponics Kit, make sure the fire rock clay covers the roots in the grow basket. Have the students record the transplants size and start date for growth.

SWIMMING DEEPER:
Students study the rate of growth between both transplants. This is a great way for the students to see which plants grow the fastest. Students can also measure how much water was used over a period of time to grow the transplants into full mature plants in the garden and the ECO-Cycle.

- Why was it necessary to transplant seedlings?
- Ask the students about spacing between both the plants in the ECO-Cycle and a traditional garden.
- Ask the students to explain why it is important to have the proper spacing in order for the plants to grow.

ACTIVITY #13: WE SEA (Created by Haley Stelzl, 5th Grader)

NGSS: 5-LS2-1

OBJECTIVE:
Through observation the students will study the growth of both fish and plants in the ECO-Cycle over a ten week period. The students will create a prediction that if you add or subtract fish, the plants will adapt to their rate of growth from the amounts of fertilizer created by the fish waste. Students will chart the growth of both plants and fish weekly and after three months report their findings.

MATERIALS:

- ECO-Cycle Aquaponics Kit
- Six small leafy green transplants (chard preferred)
- Seeds (basil or lettuce)
- Ruler
- Paper
- Pencils

BUILDING BACKGROUND:
Through the study in the garden, students understand by adding compost to the soil it helps with the growth of the plants from fertilizers. Students have learned the importance of healthy soil, air, sun and water and that they all have a direct correlation with the growth of the plant.

ACTION:

Student led planning. The students will use both seeds and early transplants placed in the grow cups that rest above the fish tank. The seeds will be placed on a strip of paper towel which acts as a wick to keep the seeds in place and absorb the nutrients needed for growth. The students then can record weekly the rate of growth from both seed starts and the transplants.

GROWTH CHART PLANTS VS. FISH					
WEEK	**DATE**	**PLANTS**	**SEEDS**	**FISH**	**NOTES**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Haley's Question:

If the students were to add or subtract food amounts, would that help increase fish waste in order to help with growth of plants or would it damage the cycle?

ACTIVITY #14: AN EDIBLE LESSON

NGSS: 3-LS4-3

OBJECTIVE:
To cook something nutritious and flavorful, growing in our ECO-Cycle Aquaponics Kit. Teacher Background: Rainbow Swiss chard is known for its bouquet of colorful leaves with bright stems. Swiss chard has earthy flavors and a bit of saltiness. Chard is packed with high levels of vitamins C, K, E, beta-carotene and the minerals manganese and zinc.

GEOGRAPHY AND HISTORY:
All chard varieties are descendants of the sea beet . They can be found growing in the Mediterranean and Atlantic coasts of Europe and North Africa.

GROWING NOTES:
Rainbow Swiss chard plants thrive in cool summer temperatures, but are tolerant of heat and humidity making it a very easy plant to grow and available all year round. It makes a great plant to grow in our ECO-Cycle and is a very low maintenance plant for students to grow.

INGREDIENTS:

- 8 oz. of fresh Rainbow Swiss chard harvested from your ECO-Cycle
- ½ medium yellow onion finely chopped
- ½ small Maui sweet onion finely chopped
- 1 tsp minced garlic
- Handful of golden raisins
- 1 medium lemon
- ¼ cup of water (H2O)
- Olive oil
- Salt and pepper

In a saucepan heat up a tablespoon of olive oil and brown the onions using a 2-to-1 ratio of Maui red onion to yellow onion.

Add your chopped Rainbow Swiss Chard to the onions and allow sauté for a few minutes. Add garlic and raisins. Seasoned with salt and pepper.

After another minute add water, cover and allow to simmer for two minutes.

Turn off heat. Squeeze half of lemon over the dish and serve. Enjoy!

Glossary

Aquaponics –The system or the development of a system that is beneficial to both plants and aquatic animals and bacteria in a recirculating environment where all can thrive and grow; a sustainable food production system that combines a traditional aquaculture (raising aquatic animals such as fish in tanks) with hydroponics (growing plants in water) in a symbiotic environment

Bacteria – Any of the smallest kinds of microorganisms; one-celled living things that do not have a nucleus

Biome – A place with certain kinds of living and nonliving things

Cell – The smallest part of a living thing that can carry out processes of life

Consumer – A living thing that eats other living things

Decomposer – A living thing that breaks down dead plants and animals

Ecosystem – All the living and nonliving things working together in an area

Environment – All the living things and nonliving things in a place

Fresh water – An environment that has water with little or no salt in it

Germination – The development of a plant from a seed or spore after a period of dormancy

Habitat – The place where a living thing makes its home

Non-vascular – Any plant that soaks up water from the ground directly into its cells

Pollen – A powdery material that flowers need to make seeds

Pollination – The movement of pollen to the seed-making part of a flower

Producer – Any living thing that makes, or produces, its own food

Respiration (in cells) – The release of energy from food

Seed – An undeveloped plant with stored food inside a protective coat

Symbiotic – A mutually beneficial relationship of animals and plants

Next Generation Science Standards:

3-LS-1 : Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS3-2 : Use evidence to support the explanation that traits can be influenced by the environment.

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.

4-LS1-1 : Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

5-PS3-1 : Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.

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.

5-ESS2-1 : Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

MATH

Differentiate between, and use appropriate units of measures for, two- and three-dimensional objects (i.e. find the perimeter, area, surface area, volume)

WRITING

All standards across all grade levels