AG-SEEDLINGS, K-5

Index of Lessons

Overview of lessons

1. Bee-Healthy Farms

Overview: In this lesson, students will learn the importance of a healthy diet for living organisms. Students will learn about the importance of agriculture and how humans can affect food crops. Students will learn that the key role to healthy agriculture is having a thriving population of pollinators. The class will hear stories about STEM-related careers in the agricultural industry and the importance of pollinators for our crops. Students will take gained knowledge and design their own pollinator garden. Students will choose diverse types of plants based on native and non-native species, color, and growing season. Students will use math to measure their garden bed and will use formulas to find the area/perimeter of their garden bed. Students will be able to share the similarities and differences between their pollinator garden beds.

3-5ELS1-3: Analyze how living organisms, including humans, affect the environment in which they live, and how their environment affects them.
3-5ELS1-4: Make a claim about the environmental and social impacts of design solutions and civic actions, including their own actions.

2. Darwin's Orchid

Overview: Students will learn about the importance of plant structures to understand how they grow. Students will learn the study of plants and ***Botany***. The class will learn about the naturalist and scientist, Charles Darwin, and his study of the Star Orchid. They will learn that Darwin determined that the only pollinator able to drink nectar from this plant was the Wallace's Sphinx Moth, known for its long tongue. Darwin was able to predict this pollinator by investigating a flower dissection of the Star Orchid. Students will model similar practices of a botanist by investigating in their own flower dissection. In a science journal, students will illustrate, label, and describe their given flower. Students will also predict what pollinator(s) would visit their flower based on the plant's internal and external structures like Charles Darwin's work.

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

3. D.I.Y. Plant Fossils

Overview: Students will learn about the study of fossils and ***Paleontology***. Students will learn how analyzing fossils helps scientist understand what Earth was like thousands of years ago, including plant life. Students will then study fossils using real plant trace fossils from the Penn State Fossil and Rock Museum. The teacher will then guide students outside and they will have to choose a native plant and make a trace fossil using a guided recipe. Students will use a science journal to illustrate and write scientific descriptions of fossils based on the trace fossils created from their peers. The class will analyze the fossils to provide evidence of their local environment.

3-LS4-1: Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

4. From Bee to Pie

Overview: In this lesson, students will learn about the importance of agriculture in Pennsylvania. They will learn about apple orchards and the key role pollinators play in apple production. Students will learn the process from apple blossom to fruit to harvest to distribution to table. The class will demonstrate and explain the farming process to the table. Students will then get to make their own apple pie cup using math fractions to demonstrate measurement skills. Finally, Students will get to enjoy their delicious treat while learning about the human impact in agriculture.

K-2 ELS 1-2: Categorize ways people harvest, re-distribute, and use natural resources.

5. Match That Pollinator

Overview: Students will learn about the plant-pollinator relationship and the physical traits that make certain plants and pollinators good pairs. Students will review how plant growth is dependent on visiting animals and insects such as bees, beetles, hummingbirds, butterflies, etc. to pollinate. But just like humans, pollinators do enjoy the nectar from certain types of plants. Students will investigate and measure different pollinator's structures to predict what types of plants they collect nectar and pollen from. During the activity, students will model similar roles of an ***Entomologist***. Scientists who study insects and the importance of pollination for species to continuously thrive. Overall, students will gain knowledge of how both plants and animals need each other to survive regarding food and reproduction.

3-LS4-2: Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

6. Pollinator Relay

Overview: In this lesson, students will learn how honeybees pollinate flowers. Students will also learn how diverse types of flowers have unique blends of pollen nutrition. Pollen and nectar provide bees with a blend of protein and lipids. Just like humans, our food sources are full of nutrients and give us energy throughout the day. Students will show

their understanding of bee pollination by embodying pollen collection. The teacher will guide students outside to model bee pollination by playing the game, Pollinator Bee Relay. Students will act as bees in a beehive. There will be flower buckets full of pollen balls located around the beehive. One bee at a time will leave the hive to collect pollen. The goal is for students to work together and to collect as much pollen as possible. Students will also receive “extra pollen points” when collecting diverse types of pollen that are enriched in high protein and high lipids.

2-LS2-2: Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

7. Pollinator Symmetry

Overview: In this lesson, students will learn about the key role of **bilateral symmetry** in pollinators and flowers. Research scientists have observed the phenomenon of pollinator attraction to the color and to symmetrical appearance of plants. In fact, many animals and insects are symmetrical. This symmetry is important to the reproduction and survival of plants. Students will then take the knowledge given and create bilateral symmetrical pollinators. Students will have to draw mirror images using mathematical shapes and lines. Students will then use a method of painting and folding to create a symmetrical insect and/or flower.

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

8. Shape of Wings

Overview: Students will learn about the Monarch Butterfly and their amazing wings. This species uses its wings to travel and protect itself from predators. The bright orange and district black shapes on the wings are to warn predators not to “eat me.” These wings are poisonous to digest and even though they have a beautiful appearance, they are a physical attribute to warn others. The most important key role of these wings is the natural engineering design for the ability to travel far. Given the ability to fly thousands of miles to migrate, the Monarch’s large and flexible wings give them a burst of propulsion. Students will learn how research scientists have discovered that these wings "clap" together, squeezing out the air between with such **force** that it thrusts them forward. Students will gain knowledge of these wings and create their own Monarch butterfly model. Students will design their wings using shapes and color. Then students will take their designed wings and tape them onto a balloon. Students will model the “clapping” motion by pushing down on the top center of the balloon, between the wings. Students will observe their designed wings “clapping” back and forth, like the Monarch when flying. Finally, students will learn that humans have studied structures of animals to mimic similar movement in many manufactured inventions such as cars, airplanes, and boats.

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.

9. The Emerald Trap

Overview: Students will learn about the **invasive** species, the Emerald Ash Borer. Students will learn how this invasive species is responsible for the deconstruction of millions of ash trees, a key plant in Pennsylvania's ecosystem. Students will learn diverse ways to protect our ecosystem from this invasive species. Students will then make an Emerald Ash Borer decoy and design a trap to collect this specimen. Students will observe and collect data on their traps. Finally, the class will discuss variables and solutions to control this science experiment for future testing. **(**For best results, a prism trap located up in the tree is the common method.) However, the goal of this activity is not to collect the most E.A.B. but rather having students critically think of solutions, practice by making designs, and finding innovative solutions. Students should be given the opportunity to discuss and make their own "ideal" trap. These scientific common practices are like the role of **entomologist** who study solutions to problems such as invasive species.

K-2ELS2-2: Plan and carry out an investigation to address an issue in their local environment and community.

10. The Flight of The Monarch Butterfly

Overview: Students will learn about the Monarch Butterfly great winter **migration** to central Mexico. Scientists have studied over the years the phenomenon of these amazing pollinators migrating to the same location every year. It takes two to three generations of monarch butterflies to migrate north from Mexico through the U.S. up to Canada. When returning later in the year, the monarchs develop a 'Super Generation' to make the longest leg of the journey southward, for the winter migration. Students will learn how Monarch Butterflies can migrate south not due to parent trait but rather a natural compass internal within their body. Students will design a monarch butterfly model with an inserted compass. The class will learn what a compass is and how to use one to navigate. The teacher will then guide students outside to model as the butterfly, navigating south and then north. Students will use the compass to direct its Monarch butterfly to migrate. Overall, the class will move in the same direction as Monarch butterflies do when migrating.

1-LS3-1: Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
K-2 ELS 1-1: Examine how people from different cultures and communities, including one's own, interact and express their beliefs about nature.

11. The Million Dollar Fly

Overview: Students will learn about the term ***invasive*** and ***endangered*** species. Students will learn about The Spotted Lanternfly, an invasive species that is destroying Pennsylvania's agriculture and ecosystem. The class will gain knowledge on the negative impacts this species has caused to Pennsylvania agriculture in grapes, apples, and the hardwood industries. Students will also learn why it is crucial for STEM-related careers in agriculture to create solutions to control this state environmental issue. Students will study and design "Wanted Bug" flyers to promote

awareness to the community. Students will also plant milkweed within their community as a natural way to control the spread of the Spotted Lanternfly but also promote growth with the endangered species, the Monarch Butterfly. Students will see the importance of having a balanced ecosystem.

5-ESS3-2: Generate and design possible solutions to a current environmental issue, threat, or concern.
3-5ELS2-4: Develop a model to demonstrate how local environmental issues are connected to the larger local environment and human systems.

12. The Waggle Dance

Overview: Students will learn about the importance of communication among species, focusing on the dwarf honeybee species, Apis florea. Students will learn about the **Waggle Dance**, a way for bees to inform and receive information about new food sources. Students will also learn about the importance of collecting pollen and nectar as a food source for the whole hive. Students will participate in modeling this process through embodiment. As teams, students will act as worker bees in a hive. Students will have to work together and dance as a form of communication to explain where the local food sources are. Students will model similar movements bees use when demonstrating the Waggle Dance. Students will also receive time to discuss and reflect on ways to improve communication within their own hive.

3-LS4-2: Use evidence to support the explanation that traits can be influenced by the environment.

4-LS1-1: 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.

13. Where in the World is R.T. Hummingbird?

Overview: In this lesson, students will learn about the Pennsylvania state hummingbird, The Ruby-Throated (R.T.) Hummingbird. Students will learn how this special hummingbird is a natural pollinator and it's amazing annual journey through the United States. Students will work together to discover this pollinator's **migration** route from southern part of the United States to Canada. Students will receive 5 diary passengers written from the R.T. Hummingbird who is migrating north for the summer months. Each diary passage has geological context clues. Students will use the clues and a physical region map as a key to help guide them into finding the correct 5 locations. Students will then connect the 5 location spots to observe the northern migration route of the R.T. Hummingbird.

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

14. I am a Citizen Scientist!

Overview: In this lesson, students will learn about open-source data and what it means to be a citizen scientist. Students will use the app, Seek by iNaturalist to collect data at the school's local ecosystem. Students can take and upload photos of plants and insects found outside then collaborate with other citizen scientists to determine what type of species they found. Students can also find the migration patterns of these insects and species from other collected sources of data. Students will learn the importance of using technology as a tool and as a form of communication with other informal scientists from around the world.

K-2 Grade Band: 3.4.K-2. B Examine how people from different cultures and communities, including one's own, interact and express their beliefs about nature.

3-5 Grade Band: 3.4.3-5.C Examine ways you influence your local environment and community by collecting and displaying data.