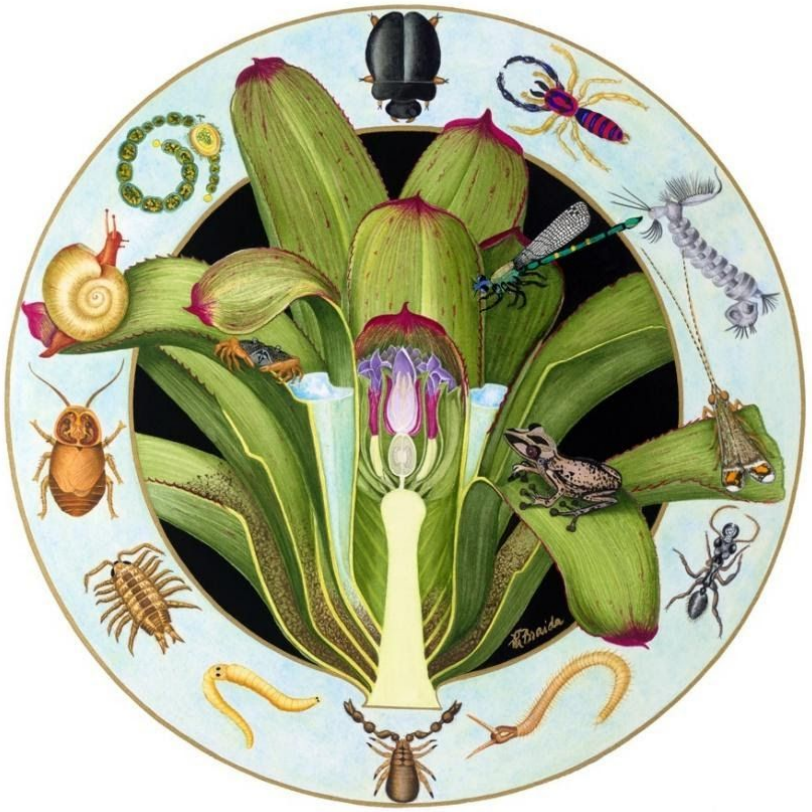
MARIE SELBY
BOTANICAL
GARDENS

Living the High Life: Epiphyte Curriculum

Grades 6-8



Curricular units designed and prepared by Tracy Calla and Julia Calderon

Living the High Life: Epiphyte Curriculum

Table of Contents

Standards:

Big Idea 6:

Over geologic time, internal and external sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's internal and external energy and material resources.

SC.7.E.6.6 Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.
Cognitive Complexity/Depth of Knowledge Rating: Moderate

Big Idea 15:

A. The scientific theory of evolution is the organizing principle of life science.
B. The scientific theory of evolution is supported by multiple forms of evidence.
C. Natural Selection is a primary mechanism leading to change over time in organisms.
SC.6.L.15.1 Analyze and describe how and why organisms are classified according to shared characteristics with emphasis on the Linnaean system combined with the concept of Domains.
Cognitive Complexity/Depth of Knowledge Rating: High
SC.7.L.15.1 Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species.
Cognitive Complexity/Depth of Knowledge Rating: Moderate
SC.7.L.15.2 Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to evolution by natural selection and diversity of organisms.
Cognitive Complexity/Depth of Knowledge Rating: High
SC.7.L.15.3 Explore the scientific theory of evolution by relating how the inability of a species to adapt within a changing environment may contribute to the extinction of that species.
Cognitive Complexity/Depth of Knowledge Rating: High

Big Idea 17:

A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.
B. Both human activities and natural events can have major impacts on the environment.
C. Energy flows from the sun through producers to consumers.
SC.7.L.17.1 Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.
Cognitive Complexity/Depth of Knowledge Rating: High
SC.7.L.17.2 Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.

Cognitive Complexity/Depth of Knowledge Rating: Moderate
SC.7.L.17.3 Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.
Cognitive Complexity/Depth of Knowledge Rating: High

Big Idea 18:

A. Living things all share basic needs for life.
B. Living organisms acquire the energy they need for life processes through various metabolic pathways (photosynthesis and cellular respiration).
C. Matter and energy are recycled through cycles such as the carbon cycle.
SC.8.L.18.1 Describe and investigate the process of photosynthesis, such as the roles of light, carbon dioxide, water and chlorophyll; production of food; release of oxygen.
Cognitive Complexity/Depth of Knowledge Rating: High
SC.8.L.18.2 Describe and investigate how cellular respiration breaks down food to provide energy and releases carbon dioxide.
Cognitive Complexity/Depth of Knowledge Rating: High
SC.8.L.18.3 Construct a scientific model of the carbon cycle to show how matter and energy are continuously transferred within and between organisms and their physical environment.
Cognitive Complexity/Depth of Knowledge Rating: High
SC.8.L.18.4 Cite evidence that living systems follow the Laws of Conservation of Mass and Energy.
Cognitive Complexity/Depth of Knowledge Rating: High

Unit Vocabulary:

Adaptation: a feature or trait of an organism that provides an improved ability to survive and reproduce in its environment.
Adventitious Roots: roots that grow from any part of a plant other than the root zone, for example, from stems or leaves.
Aroids: members of the A*raceae* family of plants also known as the arums, a mostly tropical family of non-woody plants, with very diverse forms and habits (vines, shrubs, floating, etc), many of which are epiphytic. Some very well-known houseplants (such as philodendrons and “elephant ear” plants) are aroids.
Biodiversity short for "biological diversity," biodiversity refers to the variety and variability of life on Earth. This includes the diversity of genes, species, and ecosystems. Biodiversity encompasses all living things and their relationships to each other. Biodiversity is richest in the tropics. Tropical forest ecosystems cover less than 10% of earth's surface, and contain about 90 percent of the world's species.
Bromeliad: A non-woody plant native to the New World tropics and subtropics, with short stems and a spiral arrangement (sometimes called a "rosette") of stiff or leathery, and often spiny, leaves. Most bromeliads are epiphytes.
Cactus: New World plants that have succulent stems and branches with spines or scales instead of leaves (or with very small or reduced leaves). Most cactus plants live in dry or desert areas, but some may live as epiphytes in rainforest-type environments.
Commensalism a relationship between two organisms in which one of the organisms benefits, while the other organism is unaffected.

("win-don't care")
Ecology: The study and scientific analysis of how organisms interact with one another and with their environment. It includes biology, chemistry, earth science and physics.
Ecosystem: A community of living organisms and their physical environment, interacting in a complex network or an interconnected system.
Endangered: A species that is very likely to become extinct in the near future.
Epiphyte: A plant that grows upon another plant (*Epi* = upon, *phyte* = plant), rather than in soil. Because epiphytes do not have roots in the ground, and derive their moisture and nutrients from the atmosphere, they are sometimes called "air plants." Epiphytes are harmless to the plants that host them; they are not parasites.
Evolution: the process of change in the characteristics of groups of organisms over the course of many generations, leading to the appearance of new forms.
Fern: an ancient group of plants that reproduce by spores rather than by flowers and seeds. About ⅛ of all ferns are epiphytes.
Functional Adaptation: An adaptation that helps an organism survive or reproduce by improving its ability to carry out important life functions, such as storage of water or absorption of nutrients.
Habitat: The place where an organism or a population of living things usually lives or occurs. A habitat includes all four necessities for an organism's survival – food, water, shelter and space.
Hammock: A term used in the southeastern United States for patches or "islands" of trees, usually hardwood, that grow within a contrasting ecosystem. Examples of hammocks are elevated areas (sometimes just a few inches of elevation) within a wetland, or stands of oaks on a slight depression or hill within a pine forest
Hemiepiphyte: A plant that lives as an epiphyte for some, but not all, of its life cycle.
Herbaceous: Plants that have soft or succulent (usually green) stems, rather than brown, woody stems.
Gesneriad: A family of plants, found in the Old and New Worlds that includes well-known houseplants such as African violet and gloxinia. Gesneriads are very diverse, but fuzzy leaves and brightly colored tubular flowers are shared characteristics. Many species grow as epiphytes or in depressions and crevices on rocks.
Mutualism: A symbiotic relationship between organisms in which each organism benefits from the relationship ("win-win")
Native: A species or organism originating naturally in, or born in, a particular place.
Neotropical: Belonging to or occurring in the tropical areas of the Western Hemisphere, also known as the New World (*neo* = new)
Niche: an organism's role or "place in this world." A niche includes an organism's habitat, the resources it requires, its activity patterns, its interaction with other organisms, and its adaptations.
Orchid: any one of a very large family (Orchidaceae, the orchid family) of plants that have fused male and female parts, and showy or bizarrely-shaped 3-petaled flowers, with the middle petal differing from the others in shape and/or color. Orchids occur worldwide, but are especially numerous in tropical forests, growing as epiphytes.
Pantropical: Belonging to or occurring in the tropical areas of all the major continents in both hemispheres (*pan* = all)
Parasitism: A symbiotic relationship between organisms in which one benefits and the other is harmed ("win-lose")
Photosynthesis: The process by which plants convert light energy into chemical energy or "food" that they can use to fuel their activities.

Phorophyte: a plant or tree that is the host to epiphytic plants.
Pineland: Also known as pine flatwoods, pinelands are the most common plant communities in Florida. As their name suggests, pinelands are woodlands dominated by pine trees. Understory plants commonly include saw palmettos, wildflowers, and ferns.
Pseudobulb: A thick, swollen, bulb-like stem found in many orchids, particularly tropical epiphytic ones. Pseudobulbs store water and nutrients.
Rhizome: a modified stem of a plant, from which both roots and new shoots grow. A rhizome is usually horizontal (or at least perpendicular to the force of gravity) and often underground.
Scrub: A unique natural plant community found only in Florida, easily recognized by the dominance of woody shrubs rather than trees, and frequent patches of bare, white sand. It is home to dozens of plant and animal species that occur nowhere else in the world. With more than two dozen threatened and endangered species dependent upon scrub, the entire community is itself endangered.
Structural Adaptation: An adaptation of an organism's physical features (such as shape, size, or color) that enable them to survive.
Symbiosis: Any type of close, long-term relationship or association between organisms. Symbioses could be commensal, mutualistic, or parasitic.
Succulent: Leaves, stems, or roots that are thick and fleshy, and capable of storing water. The word succulent is also used as a name for types of plants that have water-storing leaves or stems.
Tank: A structural feature of many bromeliads; the central part of the plant where the bases of their overlapping leaves meet and form a tight bowl or cup that holds water
Threatened: A species that is endangered or likely to become endangered (vulnerable) in the near future.
Trichomes: Hairlike or bristle-like growths on a plant's leaves or stems. On epiphytes, trichomes absorb water and minerals, reflect the sun's radiation, help maintain plant temperature, and reduce water loss. They also provide a defense against insects.
Velamen: a spongy, grey or white covering of the roots of some epiphytes, especially orchids. Velamen works like a sponge, it absorbs water quickly and dries slowly. It also adheres to surfaces, allowing an epiphyte to attach to its perch, and is thought to protect roots from sun damage.

Teacher Background Info: What is an Epiphyte?

An **epiphyte** is a plant that grows on the surface of another plant but does not harm the host plant. Epiphytes- mainly found in the tropics and subtropics- are specialist plants that have evolved away from growing in soil and have instead made their homes up in the tree canopy. They are sometimes known as "air plants"

- *Epi*- upon
- *Phyton*- plant

Some of the best-known epiphytes are ferns, orchids, and bromeliads, but epiphytes may be found in every major family in the plant kingdom. About 10% of all plant species worldwide are epiphytic.

There are several advantages to living high in the canopy. One obvious benefit is being out of reach of most herbivores. Much more sunlight is available in the limbs of trees than on the shady forest floor. Epiphytes do not have to expend energy to compete with much larger plants for sunlight or space. Many epiphytes also produce dust-like spores or tiny wind-borne seeds; air circulation up in the canopy transports their seeds from tree to tree. Animals are also important for plant pollination and seed distribution, and the canopy is the busiest place in a tropical forest, with thousands of bustling insects, and hundreds of birds and small animals.

Epiphytes are not parasites. Epiphytes and their host plants have a commensal relationship. Epiphytic plants derive only physical support from their host - normally a tree or another plant, but man-made structures may also be suitable depending on the epiphyte species. Since epiphytes do not have roots in the ground, and do not "tap into" their host, they have evolved to become very efficient in collecting water and nutrients. Epiphytes, like other plants, use photosynthesis for energy, and some epiphytes - many orchids, for example- have even developed photosynthetic stems and roots! Nutrients are taken from leaf litter, dust, and decaying organisms that surround or drop into the epiphyte. Epiphytes get their water from rain, damp air or moisture that condenses on the surface of their hosts. In some species, the roots have developed specialized tissue called velamen that acts like a sponge to quickly absorb and retain moisture. Many epiphytes have additional adaptations to enable them to survive periods of drought. Various orchid species are able to store water in thick stems, called pseudobulbs, and plants in the bromeliad family collect and hold water at the bases of their overlapping leaves. Some of these tank-forming bromeliads can hold up to two gallons of water!

Epiphytes are a significant component of the biodiversity in a tropical forest. Epiphytic plants can account for about ⅓ of all the plants in rainforests, and they also support a second layer of life. Epiphytes of all sorts are home for many arthropods including beetles, ants, wasps, and spiders. The pools of water collected between the leaves of tank-forming bromeliads are critical habitat for many unique species. Frogs, insect larvae, worms, snails, and even crustaceans are just some of the more than 200 species that can be found in a bromeliad's water tank. Almost 200 different bird species also depend on epiphytes. Epiphytes are an important source of nectar, fruit, insects and water, as well as nesting material for a variety of animals.

Introduction Activity: Life in a Bromeliad Matching Game

Duration: 10 minutes

Materials:

- Critter cards

Teacher Prep:

- Make copies and cut out one set of critter cards for each group.

Working in small groups:

Option 1:

1. Place the picture cards face up in front of you
2. Taking turns, match the larval or juvenile stage to the adult stage
3. Once all matches have been made, match the name card to the pair. Make adjustments to the pairs as needed
4. When finished compare answers with another team.
5. Teacher: go over answers with class when all students are done.

Option 2:

1. Place the picture cards face up in front of you
2. Stack the name cards
3. Select one name card and read it out loud to the group
4. As a team, find the larval or juvenile stage and the adult stage that matches the name
5. Next team member picks up and reads out loud the next name card and team mates find the matches
6. Continue until all cards are matched
7. When finished compare answers with another team
8. Teacher: go over answers with class when all students are done.

Extension: Try to identify the organisms depicted in the painting "Brazilian Bromeliad Dwellers" by O.M. Braida, and research their life cycles.

Introduction to bromeliads and their inhabitants: "Bromeliad Insects are Way Cool Because..." by Beaty Biodiversity Museum, University of British Columbia, Professor Diane Srivastava *https://www.youtube.com/watch?v=FjJnea0_pdk*

Brazilian Bromeliad Dwellers, 2016. O.M. Braida

		Jumping Spiders *(Psecas spp.)*
		Scavenger Beetle *(Lachnodacnum luederwaldtii)*

		Narrow-Winged Damselfly *(Leptagrion macrurum)*
		Trap-jaw Ant *(Odontomachus haematodus)*

		Caddisfly *(Macronema hagenii)*
		Mosquito (*Culex pilosus)*

Bromeliad Food Web, Energy Chain & Energy Pyramid

Create a food web using the organisms that are found in the Bromeliad as the starting point. Use the table below to list your organisms. Draw your food web in the space at the bottom of this page. Make sure your arrows point in the direction that the energy is flowing. Your food web should end with an apex predator. Use a separate sheet or the back of this page to draw an energy chain and an energy pyramid.

Organism	Eats	Is Eaten By

Bromeliads

Inflated Wild Pine or Reflexed Wild Pine *Tillandsia balbisiana* This Tillandsia is very distinctive, with its twisted leaves and inflated base. The bulbous base of the plant, formed by overlapping leaves, makes a home for ants or other small creatures, which provide the plant extra nutrients through their droppings or decomposing remains. In some cases, ants aggressively protect the plant from herbivores that might eat their home!	
Cardinal Airplant *Tillandsia fasciculata* In the southern half of Florida, this Tillandsia is one of the most conspicuous, especially for those who have visited the Everglades or Big Cypress National Preserve. It grows in dense clusters that resemble silver-green birds' nests, and produces bright red flower spikes that remain colorful for months. It can be found on cypress trees and oaks, and as well as on pines.	

Ball Moss *Tillandsia recurvata* Ball moss is extremely common in Florida. It is not a moss, but a bromeliad. It grows on the twigs and smaller branches of most hardwood trees and seems to be especially fond of live oak. It's also regularly found growing on telephone wires or fences. It is sometimes mistaken for a small clump of Spanish moss, but its clustering habit and long purple flower spikes distinguish it from Spanish moss, which has inconspicuous small green flowers	
Southern Needleleaf *Tillandsia setacea* Most of the Tillandsia species familiar to Floridians have curved leaves, but southern needleleaf has very straight fine leaves, resembling long pine needles. Southern needleleaf also also has beautiful delicate lavender flower spikes. It can be found in the southern ⅔ of Florida.	

Spanish Moss *Tillandsia usneoides* It seems everyone knows Spanish moss. Its long, silvery masses drooping from the limbs of old trees give the American South its iconic “look.” This unusual bromeliad is neither Spanish, nor moss! It is completely rootless, and is made up of hundreds of tiny individual plants, clinging together to make its recognizable long chains. It has nearly invisible green flowers. Historically, It has been used as stuffing for furniture and pillows, and woven to make blankets and mats. It is also an important source of shelter and nesting material for a variety of Florida animals.	
Giant Airplant *Tillandsia utriculata* The giant airplant is Florida’s largest native Tillandsia. It resembles the Cardinal airplant, but its leaves are generally broader and more curved, and its very tall flower spikes are light green. At one time, large populations of giant airplant were found frequently throughout much of Florida. It is now endangered as a result of attacks by the invasive Mexican bromeliad weevil, habitat destruction and illegal collecting.	

Ferns

Long Strap Fern *Campyloneurum phyllitidis* Long strap fern is found in moist, shady places, including cypress swamps and hammocks. It prefers to live close to the ground; a rock, a stump, a cypress knee, or a fallen log will do it just fine. Long, straight, leathery, light green fronds with slightly wavy edges make it easy to identify. Some of the fronds have rows of yellowish sori on the undersides.	
Golden polypody or Gold-foot Fern *Phlebodium aureum* This fern is found throughout Florida, most often seen growing in the boots of a cabbage palm. Its fronds can be two or three feet long. It usually grows in moist forests and swamps, in full sun or in partial shade. Gold-foot fern's large fuzzy golden-orange rhizome that wraps around its host is this plant's most distinctive characteristic, and how it got its name.	

Resurrection Fern *Pleopeltis polypodioides* This little fern is easy to miss, since it is small and doesn't look very "ferny" most of the time. It has an amazing super power, though. It is most often seen on the branches of oaks or on logs, brownish-grey and shriveled up. When the rain comes, resurrection fern will spring to life within a few hours, turning bright green and unfurling its fronds.	 
Shoestring Fern *Vittaria lineata* It is easy to see where the shoestring fern gets its name! Another native Florida fern usually found literally hanging out on cabbage palms, this fern has long, skinny fronds that resemble green shoestrings or long blades of grass. It can be found in pine flatwoods, hammocks, and moist swampy areas throughout Florida.	

Orchids

Butterfly Orchid *Encyclia tampensis* The butterfly orchid, first discovered in the Tampa Bay area (You can see "Tampa" in the second part of its scientific name) is found in most of Florida, from about Putnam County south. It is most often seen on live oak trees, but can grow on cypress, pop-ash, pond-apple, palm and pine trees. Its petals and sepals range from greenish yellow to bronzy, and its lip is white with a pink-to- purple spot. The State of Florida considers the butterfly orchid in need of protection from commercial exploitation.	
Green Fly Orchid *Epidendrum magnoliae* Spotting the green fly orchid can be challenging! It is quite small and very often grows on live oak trees among resurrection ferns, which are about the same height. Its flowers are small and yellowish-green, so even when blooming it's not much easier to see! It's perhaps easiest to see them when the weather has been dry and the resurrection fern shrivels up, making it easier to spot the orchid's shiny green grass-like leaves.	

Epiphyte Anatomy And Exploration

Materials:

- Magnifying glass- 1 per person
- Magiscope or microscope- 1 per group
- Epiphyte specimens* (Spanish Moss, ball moss, ferns, philodendrons, etc.)- at least 1 plant per group
- Scissors- 1 per group

Note: Epiphytes can be purchased from a garden shop, as many are popular houseplants. Dried Spanish moss can be found at craft stores, but try to avoid moss that has been dyed with color. Epiphytes may also be collected in your schoolyard or neighborhood or found locally in wooded areas (see field guide).* ***Before collecting wild specimens, be sure to get permission from the property owner or land manager. Do not wild-collect protected species.*

Teacher Prep:

- Obtain epiphyte specimens and magnification tools for the groups to use.

Directions:

- Divide students into pairs or groups of 3.
- Distribute epiphyte specimens among the groups.

1. Working in pairs or small groups, observe the physical characteristics of various epiphytes under magnification. Scissors may be used to remove plant parts for closer inspection, or to distribute leaves, flowers, etc. among the students.
2. Students record their observations on the worksheet below. When finished, teams share and compare observations with the class.
3. Teacher: circulate among groups as they work and provide help as needed. Go over answers with class when all students are done.

External features:
Leaves
Flowers
Sori (ferns)
Roots
Rhizomes
Seed Pods

Adaptations:
Structural
Functional
Reproductive
Defensive

Epiphyte Anatomy and Exploration - External Features

Name of Specimen or Plant Part	Drawing/ Sketch	Description of Characteristics	Plant type (fern, orchid, etc)

Epiphyte anatomy and exploration - Adaptations

Adaptation	Sketch	Description (How does it give the plant an advantage?)
Structural		
Functional		
Reproductive		
Defensive		

Selfie Scavenger Hunt

Duration: 30 minutes to 1 hour

Materials:

- Device with a digital camera, such as tablet/cellphone (1 per team)*If digital cameras are not available, students can sketch the answers using the provided sheet.
- Photo collage app (ex. Comic Maker, Diptic, etc) or Presentation software
- Selfie Scavenger Hunt Printouts (1 per team)

Teacher Prep:

- Make copies of Selfie Scavenger Hunt Printouts (1 per team). Make copies of sketch sheet if electronic devices will not be used
- Charge devices and ensure there is enough memory available
- Make sure all devices have a collage or slideshow app (many free apps are available)

Overview:

Students explore Selby Gardens (or a local ecosystem with epiphytes present). While exploring, students take pictures of themselves pointing to or in front of the answer to each question. Students then create a final presentation or slideshow that shows the specimens with labels.

Instructions:

- Divide students into teams of 2 or 3 students.
- If needed, remind students what an **epiphyte** is: *A plant that grows on another plant but is not parasitic.*

1. Read the list of clues
2. Staying in the designated area, find an example of the clue.
3. Take a selfie or group photo with the clue (or point to it), being careful not to disrupt it. You may also use the sheet provided to draw your finds if no electronic devices are available.
4. Continue until you have found ___ clues or time is up
5. Students will use a photo collage app or presentation app to create a final product such as a collage or slideshow that shows the pictures with labels explaining the picture.
6. When finished, collect collages by email, upload to a cloud-based system, Airdrop, etc.

Find the following:

1. A flowering epiphyte
2. An epiphyte that creates a fruit
3. How an epiphyte protects itself
4. An epiphyte that lives on or very near the ground
5. An epiphyte that does not live on the ground
6. An epiphyte that is grey or blends in
7. An epiphyte that is colorful
8. Something that relies on an epiphyte for its food
9. Something that lives in an epiphyte
10. Epiphyte seed capsule
11. A Bromeliad “tank”
12. Epiphyte roots adapted for holding on

SELFIE SCAVENGER HUNT
@ Marie Selby Botanical Gardens

RULES:

- Keep cameras/ cell phones/ tablets off the ground and away from water or anything else that could damage them.
- Photos must include at least 1 team member.
- Each team member needs to appear equally in the photos.
- The object you are photographing should be seen clearly in the background, or having a team member point to it.
- You must stay within the designated area, and on the trail or walkway.
- All pictures must be appropriate and follow school rules/code of conduct.

DIRECTIONS:

- Read the list of clues
- Staying in the designated area, find an example of the clue.
- Take a selfie or group photo with the clue (or point to it), being careful not to disrupt it.
- Continue until you have found ___ clues or until time is up.
- Once you have collected your clues, use a photo collage app or presentation app to create a final product such as a photo collage, comic strip or slideshow that shows the plants and labels explaining the picture.
- When finished, submit your final product to your teacher.

FIND THE FOLLOWING:

- A flowering epiphyte
- An epiphyte that creates a fruit
- How an epiphyte protects itself
- An epiphyte that lives on or very near the ground
- An epiphyte that does not live on the ground
- An epiphyte that is grey or blends in
- An epiphyte that is colorful
- Something that relies on an epiphyte for its food
- Something that lives in an epiphyte
- Epiphyte seed capsule
- A Bromeliad “tank”
- Epiphyte roots adapted for holding on

EPIPHYTE SCAVENGER HUNT
@ Marie Selby Botanical Gardens

Name:_____ Teacher:_____ Class:_____ Date:_____

Find and sketch the plants or plant parts matching the clues above. Include a label to describe which clue it is showing.

Adaptation Video Challenge

Pre-Activity: Plant Adaptation Presentation

Duration: 1 class period

Go over Plant Adaptation PowerPoint presentation with the class to familiarize them with the different types of adaptations

Field Activity: Video Challenge

Duration:

Pre-Field trip: 15 minutes

During Field trip: 1 hour

Materials:

- Epiphyte adaptation Video Challenge cards
- Digital video recorder (tablet/smartphone/digital camera)
- Adaptation PowerPoint (optional)
- Writing utensil (1/group)
- Time keeping device (recommended)

Teacher Prep:

- Print out video challenge cards (1 complete set for each group OR 1 card per group). Cut and fold in half to make a front and back
- Charge devices and ensure there is adequate memory
- Print out adaptation guides for chaperones (if needed)
- Optional: Set up devices to connect to Selby's free WiFi

Directions:

- Before going to Selby Botanical Gardens (or other field site):
  1. Prepare the materials needed for the activity.
  2. Decide how you will "collect" the videos when the students are finished: email their videos, upload to YouTube (or other video site), upload to a shared cloud storage location such as OneDrive, Airdrop, etc..
  3. Determine how much time students will have. 1st adaptation takes about 15 to 20 minutes; each additional adaptation takes about 10 to 15 minutes. All 4 adaptations should be able to be completed in less than one hour.
     a. Timing Guideline:
        i. 5 minutes to find epiphyte

ii. 5 minutes to fill out card (plan video)
iii. 5 minutes to film video
iv. 5 minutes to submit video (this may take more time depending on the method and size of the group) Allow extra time at the end, to help students submit their videos. Or have them submit the videos when they get back to class.

4. It is helpful to also review with the students how to use the recording devices, including filming, reviewing their videos and how you would like them to share their final video with you (Airdrop, email, etc).
5. (Optional): Pre-teach adaptations using the presentation provided.
6. (Optional): Meet with chaperones
    a. Hand out adaptation guides (if using)
    b. Explain basic premise of activity
    c. Explain how much help (give examples) they may provide the students. Encourage them to ask the students questions, instead of just giving answers.
7. (Optional): You may wish to go over the instructions for the Epiphyte Video Challenge while in the controlled environment of the classroom, so that students know what is expected when they get there and to maximize activity time.

- At the activity site:

8. Group students into pairs or groups of 3.
9. Read the directions to the groups:
    a. *You must create a **1 minute video presenting an epiphyte that clearly shows the adaptation** on the card.*
    b. *The video must be a "**single take**" (press play, record your video, press stop).*
    c. *You may redo your video as many times as you need to, however only the final submitted "single take" will be graded.*
    d. *Your video may not exceed 1 minute in length.*
    e. *Remember: You may NOT touch or pick any plants, unless instructed to*
10. Go over guidelines for activity:
    a. Stay in your group
    b. Do not touch, pick or harm any plants or animals *(include any other safety instructions)*
    c. Stay within the designated area
    d. *You will have _____ minutes to complete the activity. (Adjust time to students' levels and location)*
        i. *1 adaptation: 15 to 20 minutes*
        ii. *All 4 adaptations: 45 minutes to an hour*
    e. Use the back of the card to create your script for your video.
    f. Once you've planned your video, then start recording
    g. (If groups will be doing multiple adaptations): Each group member must appear equally in the group videos. (ex: if your team is

doing 4 videos, each group member must be in 3 (or at least 2) of the 4 team videos)

11. Explain how they will submit their video when finished.
12. If needed: remind students what an Epiphyte is.
    a. *A plant that grows on another plant but is not parasitic, such as the numerous ferns, bromeliads, air plants and orchids growing on tree trunks in tropical rainforests.*
13. Hand out the cards, depending on time, either 1 set per group OR randomly give each group one type of adaptation to find and film.
14. Set a timer for _____ minutes.
15. Disperse groups
16. Monitor groups and provide help as needed
17. When time is up, have students submit their final videos, via email, upload, Airdrop, or other preferred sharing method.

Post-Activity: Class Viewing

1. Prepare a queue of the students' videos to watch during class. Students love to see what their classmates did and to get their 5 minutes of fame!
2. (Optional) provide popcorn to enjoy while viewing.
3. (Optional) provide awards for "most creative," "most cinematic," "best acting," "best videography", "student's choice," etc…

Post-Activity: Peer Review

1. Make videos accessible to the students (OneDrive, YouTube, Blackboard, etc…)
2. Assign each group a set number of videos to watch that were created by other teams
    a. It may be helpful to have each team assess only 1 type of adaptation and the videos that go with that adaptation.
3. Give each member a rubric to critique the video by.
4. Each member should include one positive comment about each video at the bottom of each rubric.

Adaptation Video Challenge Cards

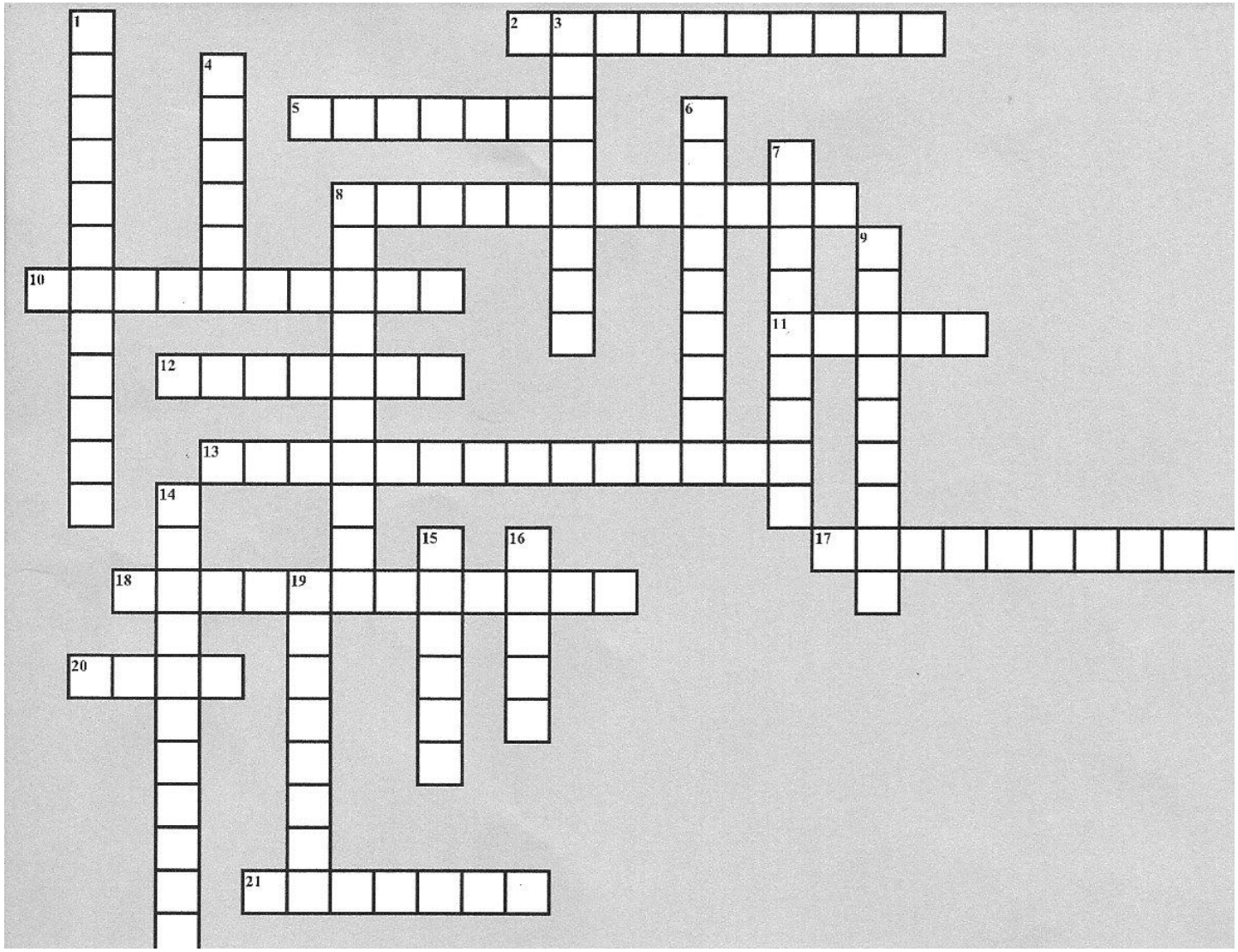
Adaptation to water availability	Epiphyte Name_____ Your Adaptation Presentation! _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
Supportive adaptation	Epiphyte Name_____ Your Adaptation Presentation! _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Defensive adaptation	Epiphyte Name_____ Your Adaptation Presentation! _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
Adaptation to sunlight availability	Epiphyte Name_____ Your Adaptation Presentation! _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Reproductive adaptation	Epiphyte Name_____ Your Adaptation Presentation! _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
Adaptation to nutrient availability	Epiphyte Name_____ Your Adaptation Presentation! _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Epiphyte Crossword Puzzle

Using the vocabulary words in this unit as clues, solve the crossword puzzle below.



Epiphyte Crossword Puzzle

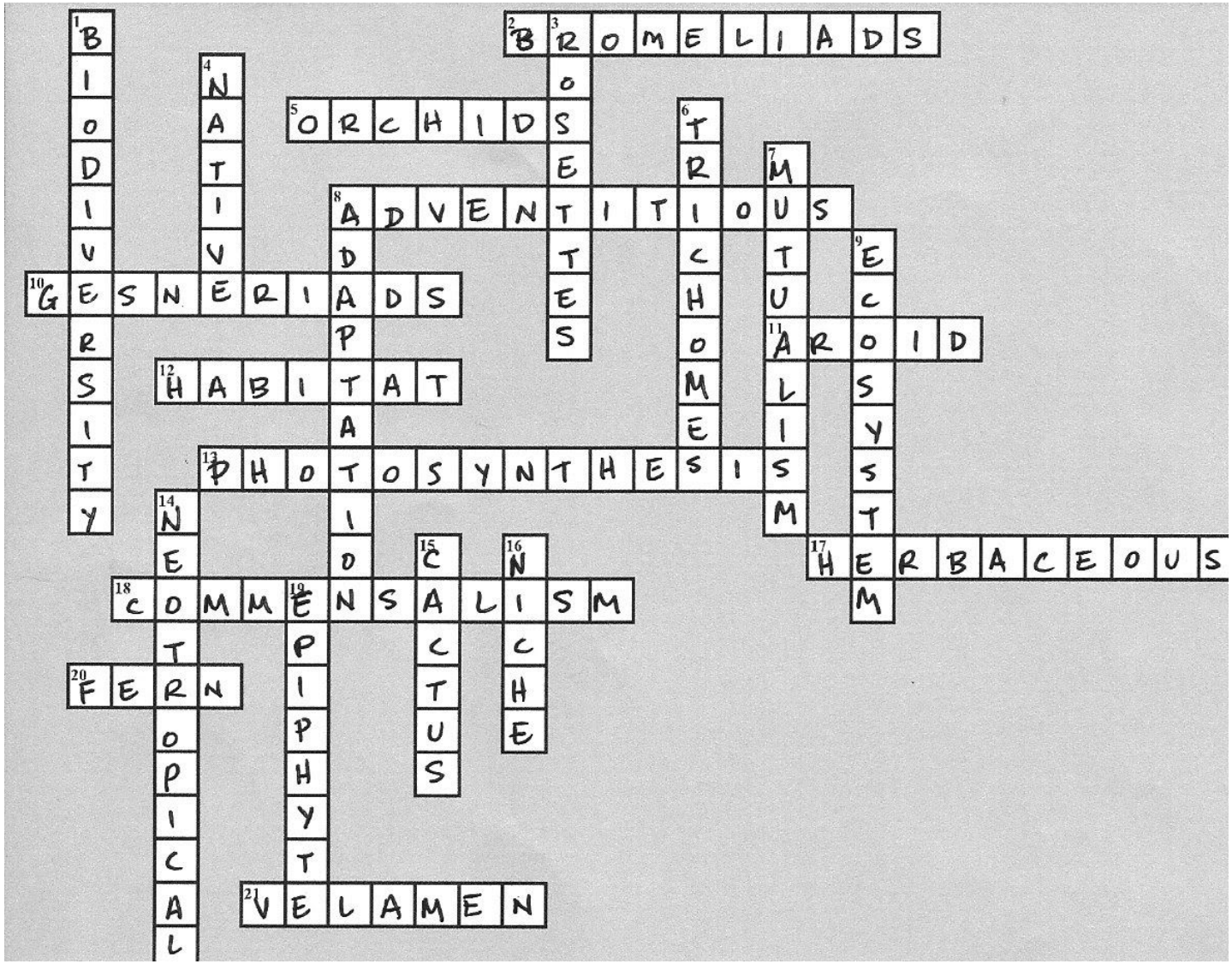
ACROSS

2 New World epiphytes with stiff leathery leaves arranged in rosettes
5 Epiphytic plants with showy or bizarre 3-petaled flowers
8 Roots that grow from a part of the plant other than the root area
10 Epiphytic plants form a diverse family that includes African violets
11 A member of the plant family *Araceae*
12 A place where an organism or a population usually lives
13 Process by which plants convert light energy into "food"
17 Plants that are soft or succulent rather than woody
18 A type of symbiosis where one organism benefits and the other is unaffected
20 One of a group of ancient plants that reproduce by spores
21 The spongy covering of the roots of many epiphytes

DOWN

1 Variety and variability of life on Earth
3 Spiral arrangement of overlapping leaves
4 An organism born in, or originating from, a particular place
6 Plant "hairs" that serve functions like water retention or sun reflection
7 A type of symbiosis where both organisms benefit from the relationship
8 A feature or trait that improves an organism's ability to survive
9 A community of organism AND their physical environment, interacting as a network
14 Belonging to or originating in tropical areas of the New World
15 New World plant with succulent stems and spines instead of leaves
16 An organism's role or place in the world
19 A plant that grows harmlessly upon another plant

Epiphyte Crossword Puzzle - Answer Key



Extension Activity: Epiphyte Art Contest

Students create a work of art (photograph, sketch, sculpture, etc...) to highlight a key feature of the epiphytes, based on the provided categories. Artwork is then to be displayed and voted on at school. Students can gather ideas and images while at Marie Selby Botanical Gardens or from their neighborhood or nature park.

Categories:

- Symbiotic relationships
- Epiphyte's Niche (role in the Florida ecosystem)
- Biodiversity
- Adaptations
- It's a plant's lifestyle