Day 05 Why Do Plants Have Different-Shaped Leaves?			
Literacy Strategy: practice making connections across informational texts.		**Science Concept:** The fossil record provides evidence of how plants on Earth have made changes, or adaptations, in their structures to insure their survival in many different environments. The shape of a plant's leaf is one adaptation.	
Reading TEKS: 3.6(E)	**CCSS**: SL 3.2, W 3.7, W 3.8	**NGSS**: 3-LS2-1, 3-LS4-3	**Science TEKS:** 3(b)(2)(A) 3(b)(2)(B) 3(b)(10)(A)
Materials for Mini-lesson on Science-based Disciplinary Literacies (referred to as Mini-lesson): chart paper, markers, sample Inquiry chart, Making Connections across Informational Texts anchor chart.			
Materials for Science Inquiry Circles: team inquiry charts, pencils, variety of nonfiction texts for each group, access to websites and online books, access to all anchor charts already introduced.			
Materials for Guided Science Investigation: see instructions beginning on page 4.			
Content Vocabulary: **Observation**—the action or process of looking at something or someone carefully to gather information. **Hand lens**—a small magnifier used to see details more closely. **Data**—facts or information collected during an investigation (e.g., images, measurements, or words). **Plant adaptation**—a special feature or change that improves a plant's chances of living and growing in a specific environment. **Leaf morphology**—the size, shape, and structure of a leaf. **Leaf**—part of a plant that is specialized to capture sunlight and carry out photosynthesis (most leaves are broad and flat, but leaves have many forms, depending on characteristics of the environment). **Habitat**—the natural home or environment of living things. **Temperate zone**—the areas on Earth's surface found mainly between the tropics and the polar regions. **Deciduous**—description of a tree or shrub that loses most of its leaves at the same time every year. **Forest**—ecosystem or area covered with trees; trees require at least moderate amounts of rainfall to support their growth. **Grasslands**—areas where the primary vegetation is grass; many grasses can survive in conditions with relatively low amounts of rainfall. **Desert**—bare areas of land with very little rainfall and little vegetation.			
Science and Literacy Connection: scientists make connections between what is already known and new information that is collected through observations and investigations.			

Mini-lesson—15 minutes

OVERVIEW

Scientists are responsible for reading a lot of texts as they explore what other scientists have said about their topic. As they read, they can end up with a lot of unconnected or random information, some of it repetitive. Additionally, scientists have to be able to pull information together in concise, brief ways. To do this, they use a strategy called "making connections across informational texts."

This strategy is similar to one you may have used before—making self-to-text, self-to-self, and self-to-world connections, but that strategy (sometimes only called "making connections") is usually only used when reading fictional texts. The strategy we'll use today—"making connections across informational texts"—is used with nonfiction texts, such as scientific articles.

PROCEDURE

Each statement in quotation marks below contains suggested wording the teacher may choose to use for the lesson.

EXPLAIN THE STRATEGY

Tell what the strategy is (declarative knowledge)

- "The strategy we are using today is called "making connections across informational texts." This strategy is important for a few reasons:
    - It helps me determine if the author's claims and statements are reliable;
    - It helps me sort through repetitive information that I get when I read a lot of informational texts about a topic; and
    - It helps me pull all the information together into concise, or brief, statements."

Tell when and why to use the strategy (conditional knowledge)

- "I know to use the strategy when I'm reading more than one informational text about a topic, or when I find multiple claims being made about a specific question I'm asking. Sometimes I make connections within a single text, and other times I make connections across several informational texts."
- "I don't make connections the entire time I'm reading. I do it strategically, like when I come across information that I've been looking for, such as the information I'm going to enter on my inquiry chart."

Tell how to employ the strategy (procedural knowledge)

While you model the strategy, you might want to say something like this to the readers:

- "As I start to read, I first think about what I already know about a topic because accessing my prior knowledge is an important part of making connections within and across informational texts."
- "As I read, I realize that I'm reading something that is similar to (or different from) what I've read before. This is a connection."
- "If the connection is similar, I often don't need to do anything. However, if the connection is different, I need to stop and try to evaluate the claim or statement the author is making."
- "Something that helps me make connections while reading scientific texts is the way the ideas are sequenced, such as the way the author presents and justifies causes and effects, or the way the author compares (for similarities) and contrasts (for difference) facts and claims."

Science Inquiry Circles—30 minutes

OVERVIEW

Scientists often work in teams when conducting inquiry and investigations. Today, we will work in inquiry circles to investigate different questions about plant groups.

Prior to starting the inquiry circle work, be sure to have texts and technology available for your learners. You have been provided with a list of suggested books and websites titled Plant Resources in the Day 5 folder. These are suggestions, and you may use other resources. You may need to provide learners with specific instructions on how to access websites within your school district or you may want to create a click sheet of approved websites for learners to be distributed in your learning management system (Google Classroom, Schoology, etc.). As teams begin working, you may have some groups working online while others are working with traditional texts. This will depend on your access to technology and texts.

PROCEDURE

Each statement in quotation marks below contains suggested wording the teacher may choose to use for the lesson; teacher actions in parentheses.

Before Inquiry Circles

1. "It is time to get into our inquiry circles. You will be with the same team as yesterday, but we will rotate the scientific roles." (Assign roles at your discretion and have the Equipment Directors gather the inquiry chart for their team).
2. "You are already familiar with the inquiry chart and the inquiry questions. Today we will continue to look for answers to all of your questions."
3. "As you look for answers to your questions, you will practice your roles as scientists. You will do this because scientists have a special way of looking for answers. One way to look for answers is to do investigations. This means that they look at text (in books and on the computer) that might help them find information they can use."

During Inquiry Circles—20 minutes

4. "Today you will continue to investigate your plant group by using preselected websites on the computer (or tablet) and preselected texts." (The websites and texts are available on the Plant Resources document.)
5. "We have anchor charts to help guide your thinking. Do not forget to use them while working." (Refer to the Making Connections across Informational Texts anchor chart and the other anchor charts already introduced. Remind learners that each day they will practice the literacy mini-lesson during this inquiry circle time. Once you have taught several mini-lessons, they can use any of the reading strategies taught, not just the one for that day.)
6. "The Lead Scientist will guide all inquiries for the day by picking which question(s) will be answered. The Data Scientist will record all source information and the answers to your inquiry questions on the inquiry chart. Remember, it is important to record on your inquiry chart where you found the information (source) so that you do not plagiarize." (Point out to learners where sources are located on the inquiry chart and how one source may answer various questions. Remind your learners to record the title and author for texts and the URL for websites.) "The Lab Director and the Equipment Director must help find the answers to the questions online and in texts." (Be sure to model for learners where to record their source and where to record answers to specific questions. Explicitly show them how the inquiry chart will organize their progress.)
7. "My role is to help guide the inquiry circles, but I expect you to work as a scientific team to solve your problems together." (While teams are working together, walk around the room to facilitate as needed.)

After Inquiry Circles—10 minutes

8. "As we conclude our inquiry circles for today, each team will have a chance to share the questions they answered, what they accomplished, and what literacy strategies they used. The Lab Director will lead the discussion about today's results, and the Data Scientist will share your responses with the class. Discuss with your team, considering what you learned about your plant group. What problems did you encounter? How did you resolve those problems? Did you use a reading strategy? Which one, and how did it help you? What new questions do you have?" (After you have allowed the teams to gather their thoughts, have the Data Scientist share with the class.)
9. (After all learners have shared, thank them for their hard work, and point out any excellent behaviors that you observed. If you saw an outstanding example of using a reading strategy or collaborative work, explicitly point it out. If you notice any problems in the teams during the lessons, take a moment to point them out, and explain your expectations for all future inquiry circles. Collect all inquiry charts or have learners put them in their normal classroom place for ongoing work so they can easily access them.)

Guided Science Investigation—45 minutes

OVERVIEW

Today learners will be introduced to leaf morphology as they examine real leaves to consider why leaves have different shapes. After the exploration, they will view a slideshow to learn more about adaptations that enable plants to survive in different environments.

GUIDING QUESTIONS

Why are fossil plants important? What can plant fossils tell us about past environmental conditions on Earth? How do plants survive in different environments?

BACKGROUND INFORMATION

Fossils provide information about organisms that lived on Earth through time. Most children's early experiences with fossils focus on dinosaurs and other animals that once lived. However, we need to understand how all organisms interacted with each other and their environment and why some organisms survived while others did not. The fossil record gives us evidence of how plants changed through time and developed the structures that allowed them to live and grow in response to Earth's changing environments.

The variety of modern-day plants that populate Earth's numerous habitats have special features that enable them to live and grow in specific environments. These same special features, or adaptations, make it difficult for them to live in a different environment. Water is one of the most important aspects of the environment for plants. Some environments, such as a wet marsh, have too much water. Other environments, such as a desert, do not have very much available water most of the year. A plant that typically grows in a rainforest, where water is abundant, probably would not survive very long in the desert.

Plant leaves have many different shapes that are linked to the type of environment in which they live. By examining the morphology (the size, shape, and structure) of a leaf, we gain an understanding of how leaves interact with the other parts of a plant to ensure the plant's survival.

SAFETY

Children should wear safety goggles as they examine leaf samples. Children should also avoid touching their faces while handling the plants and should wash their hands after their work.

MATERIALS

Each team member will need:

- science notebook
- goggles

Each team will need:

- bag of 8 leaves (for a team of 4)
- hand lenses
- Leaf Morphology chart (paper copy or electronic access)
- Leaf Structure diagram (paper copy or electronic access)

Teacher will need:

- a sample leaf
- Day 5 Plant Leaf PPT
- Plant Adaptations PPT
- Leaf Morphology chart (paper copy or electronic access)
- Leaf Structure diagram (paper copy or electronic access)
- gallon zip-top bags or trays
- bag of assorted leaves

SETUP

- **Before the class**, the teacher will need to collect a variety of leaf samples for learners to examine. A mixture of both green and dried leaves is preferred, with some samples attached to a stem (if possible, give similar sets of leaves to each group).
- Organize a bag or tray for each team that contains different leaf samples (6 to 8 samples for each team to allow each team member to work with 2 leaf samples), a Leaf Morphology chart, the Leaf Structure diagram, hand lenses, and goggles.
- Make paper copies of the Leaf Morphology chart and the Leaf Structure diagram for each team, if needed, or provide access to an electronic version.
- Place all the materials in a central location for distribution.

DAILY OBSERVATIONS

Learners will examine leaf samples.

PROCEDURE

Engage

1. As you hold up a sample leaf so that for everyone can see it, ask, *Do you think all leaves look exactly like this one?* Accept responses (children will likely answer "no").
2. Confirm their ideas that there are indeed many different types of leaves. Then ask, *Why do you think plants have different shaped leaves?* Accept their responses and tell the class that today they will take a closer look at the structure of leaves and look for answers to this question.
3. Have the Equipment Directors collect the bag or tray of materials for their team.

Explore

4. Project the image of the green leaf from the Day 5 Plant Leaf PPT. Share that leaves do have some common features, even though they may look different. Ask the teams to find the Leaf Structure diagram in their bags or tray. As you point to the different parts on the projected leaf image, have them follow along and find it on their diagram.
5. Begin by pointing out the blade (lamina), which is the large, broad surface of the leaf that allows it absorb sunlight, water, and air. The surface of the blade may have different textures and colors, depending on the plant. Identify the tip, the base, and the petiole that connects the leaf to the stem of the plant.
6. Next, explain that the margin is the edge of the leaf.
7. Lastly, point out the veins that transport water and nutrients throughout the plant and also provide structural support for the leaf.
8. Add that the "arrangement " of leaves refers to how they are positiond or arranged on a stem; they will not record that today but it may be important for using during the plant observations.
9. Instruct them to use the Leaf Morphology chart in their materials as they make observations on the leaf samples you have provided. The Leaf Morphology chart identifies many different blade shapes, margins, and venation (the pattern of veins) of leaves. Each team member should make two different observations. They can decide which leaves they will observe.
10. Draw the chart below on the whiteboard and ask learners to copy it into their science notebooks, along with today's date. This is the information they need to make note of during the observations.

Leaf sketch	Shape of the leaf	Margin	Venation

11. Let the class know they have 15 minutes for their observations. As teams work, move between them to offer guidance as needed.
12. While teams are working, move between them to offer open-ended questions for consideration as they make their observations. (*Are you finidng the information you need? What are you noticing about the leaves?)*

Explain

13. When time is up, ask for volunteers from each team to describe one or two observations.
14. Then ask if there was anything that surprised them or stood out about the leaves they examined? Accept all responses.
15. Share that the place on Earth where plants live, rainfall amounts, and nutrients in the soil can all affect the shape of a leaf. The shape of a leaf is one adaptation plants have made over long periods of time to respond to the type of environment they live in.
16. Begin Plant Adaptations PPT.
    Slide 1: *Let's look at a few examples of adaptations that plants have made for surviving in their habitats, or natural environments.*
17. **Slide 2:** Read over the conditions found in a desert. Ask, *What do you think was the most important adaptation plants had to make to live in a desert habitat?* Accept all responses. If not brought up, share that a plant's ability to collect and store water is very important.

18. **Slides 3–4:** Read the information out loud. Point out that rainfall in a desert is very low, so plants need structures that can keep them alive. Explain that a waxy leaf can keep water from evaporating, and because it is shiny, it also reflects sunlight, helping to keep the plant cooler. Spines are modified leaves that keep animals (herbivores) from eating the plant. Spines also help to release heat from the stem during the day and collect water vapor during the night.
19. **Slide 5:** Point out the temperate regions on the world map to give children a sense of where temperate forests and temperate grasslands are found. Explain that temperate forests are found at mid-latitudes on Earth. In North America, that includes all of the United States and most of Canada. Add that the temperate regions have four distinct seasons.
20. **Slide 6:** Read the conditions found in a deciduous temperate forest. Explain that deciduous refers to trees that shed their leaves every year.
21. **Slides 7–8:** Read plant adaptations out loud. State that trees conserve water by shedding their leaves during the fall season. Ask, *How do you think that helps to conserve water?* Accept responses. Then, discuss how water and nutrients travel from the roots to the stem and leaves of a tree or plant. Tiny pores in the leaves, called stomata, return water back to the air in a process called transpiration. Transpiration occurs when water vapor is released, much like the water vapor you release when you breath. By shedding their leaves, trees can hold on to water they will need during the winter.
22. **Slide 9:** Read the conditions found in a temperate grassland. Explain that the soils in temperate grasslands are rich in nutrients due to the growth and decay of grass roots and provide a food source for living plants. For this reason, the grassland areas are used for farming (growing crops) and agriculture. Unfortunately, agriculture on the grasslands has affected many species that depend on the grassland for food, such as the migrating monarch butterfly whose populations are disappearing.
23. **Slides 10-11:** Read the descriptions of the leaves and roots of grassland plants, adding that the strong root system helps grass to grow back quickly, even after a fire!
24. End the slideshow by emphasizing these are only three examples of habitats, or environments, that plants have adapted to for survival.
25. Explain how studying information about modern-day plants helps scientists identify fossil plants. Leaves, stems, seeds, and other plant parts that have been fossilized give scientists clues about the environments they grew in. Plants found in animal poo (coprolites) and even in fossilized stomachs also give evidence of the animals that ate them. Unfortunately, some kinds of plants decompose faster than other organisms, making plant fossils rare compared to fossilized bones, teeth, and shells.

Elaborate

26. Challenge the class to look for information during inquiry circle time about which plant the leaves they examined today came from and the environment the plant lived in.
27. Tell the class they will be investigating more groups of plants in the coming classes. Each day they will develop questions to investigate as they make observations of the live plants.
28. Explain that their investigations in the coming week will help them understand the adaptations plants made over time to help them survive in changing environments, and prepare them for working with fossils on the last week of the unit!
29. Remind them again how important it is for all team members to contribute in gathering information. There is a lot to sift through, and it will be easier if they all do their part.

Evaluate

30. As teams conducted leaf observations, was there evidence that they were applying new knowledge about plant adaptations or morphology in their work, either written or verbal?
31. Did learners describe any similarities or differences between the leaves?
32. Was there evidence of collaborative work among the team members?
33. Did learners include new science vocabulary in their responses or explanations?

Expanded Standards
Reading TEKS: 3.6 Comprehension skills: listening, speaking, reading, writing, and thinking using multiple texts. The learner uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts. The learner is expected to (E) make connections to personal experiences, ideas in other texts, and society.
CCSS: SL.3.2 Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. W.3.7: Conduct short research projects that build knowledge about a topic. W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
NGSS: 3-LS2-1 Science and Engineering Practices): Construct an argument with evidence, data, and/or a model. 3-LS4-3 Disciplinary Core Ideas: For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.
Science TEKS: 3(b)(2)(A) Scientific investigation and reasoning. The learner uses scientific practices during laboratory and outdoor investigations. The learner is expected to plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world. 3(b)(2)(B) Scientific investigation and reasoning. The learner uses scientific practices during laboratory and outdoor investigations. The learner is expected to collect and record data by observing and measuring using the metric system and recognize differences. 3(b)(10)(A) Organisms and environments. The learner knows that organisms undergo similar life processes and have structures that help them survive within their environments. The learner is expected to explore how structures and functions of plants and animals allow them to survive in a particular environment.