Leaf Exploration

Science and Engineering Practices (SEP) – *Constructing Explanations and Designing Solutions*

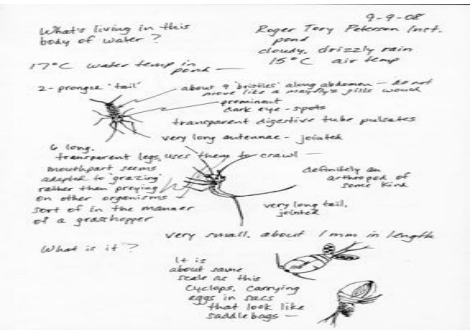
Disciplinary Core Ideas (DCI) – *Biological Evolution: Unity and Diversity: Adaptation, Biodiversity & Humans*

Use the boxes as guidelines to arrive at the NGSS standards which are written in **bold**

This activity requires the facilitator to gather enough leaves from trees for everyone in the class to have one.

Objective: Students investigate plant adaptations, and practice the art of observing nature and recording details by carefully studying and drawing a leaf.

Background: A traditional page in a nature journal may consist of quick studies of plant and animal life sketched out as rudimentary line drawings and used as an inventory of an ecosystem.



Naturalists approach their study by using the process of **inquiry**, which is more systematic than simply asking questions. The **inquiry** process begins with observation and asking questions, and ends with asking more questions!

Your own backyard contains many varieties of plants, each with their own story to tell: some are ancient residents of your region whose ancestors evolved there; others are immigrants with a more recent past history of living in this habitat. The old-timers are called **native species**; the newer arrivals are called **non-native** species.

Activity:

1) Before passing out leaves, ask students to first draw in their journal pictures of leaves that they can remember seeing at their homes, or around the community. How many details can students recall?

This awakens student's prior knowledge, connecting them to what they already know and constructing an explanation of observed relationships.

Describe the environment where you saw the leaves.
Were there other plants growing nearby? Was it a shady area? Was is near water?
What can a leaf tell you about the environment that the tree came from? Think about the availability of water, sunlight, space etc.

2) Pass out leaves and hand lenses

3) Ask students to make a scientific drawing of their leaf in fine detail, including labels and written descriptions of the leaf's characteristics. Start by drawing the shape and proportions. Once this is finished, turn your attention to detail.

Encourage detailed observation

What is the size of the leaf? What is the shape?
What features do you notice? Is there an area where an insect may have taken a nibble? How about any mildew or fungus growing on your leaf? What is the color like? Is it all one color or many?
How does the leaf feel? Waxy? Bumpy? Fuzzy?
Does your leaf curl in a certain direction? Does it lay flat?

4) After they've completed their scientific drawings, pass out crayons for students to make leaf rubbings with.
To make a leaf rubbing, place the leaf underneath a sheet of paper and gently rub the flat side of the crayon across the top. The texture of the leaf allows its image to show through.

5) Review the "Plant Adaptation Fact Sheet" with students and brainstorm how different leaf shapes/features could help the tree survive in its habitat.

For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

Help your students imagine a situation in which a leaf changes.

For example: sycamore leaves may become bigger or smaller, they may lose their fuzzy surface, they may become waxy or spined, etc. If this happened, what do you wonder would happen?

How would this impact the tree?
How would this change where the tree thrives?
How would this impact the animals that are able to use the tree?
Would this help or hurt the tree? How?

Encourage students to think about the type of habitat that their tree would survive in based on its adaptations.
Have them write down their **hypothesis** and **supporting evidence**.

What features of the leaf make you think it would do well in that environment?

Once students are asking questions about changes to leaf structure, direct them back to asking questions about the leaves as they are.

Why do sycamores have fuzzy leaves?
Why do sycamores grow near rivers?
What sort of animals use sycamore trees for food or shelter?
Do sycamores like having squirrels live in them?
Are sycamores sad during a drought?

Identify scientific (testable) and non-scientific (non-testable) questions

Guide students into dividing their questions into two categories: **testable** and **non-testable**.
Students can try to modify non-testable questions to make them testable:

"Are sycamores sad during a drought?" could become *"Do sycamores face problems during a drought?"* or *"Do more sycamores die during a drought?"*

Construct an explanation of observed relationships.

Compare and contrast your leaf with a classmate who has a different leaf and share drawings and details.

Do you think the leaves would survive well in the same environment? Why or why not?

Optional observational game: Have students return all leaves to a central table, mix them up, and then give students a chance to try and identify their original leaf.

Go outside: Provide leaf charts and ID booklets for class study. See if students can identify their leaf, then see if they can find it on their schoolyard!

Have students use the leaf charts and ID booklets to identify the evidence that supports their hypotheses

What are some characteristics of your schoolyard environment?
What features of the leaf allow it to live there?
Think about shape, size, texture, grouping, availability of light, etc.

6) Come back into the classroom and have students share which trees they identified. Use the resources in the folder to learn more about riparian trees.

Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

What leaf adaptations would prepare a tree or plant for a drier climate? A wetter one? A hotter one? A cooler one?

Have students apply scientific ideas to solve a design challenge: Imagine you are an engineer tasked with designing a plant that will thrive on Mars. Use what you know about leaf adaptations and their environments to create a plant that will fit these Martian environmental constraints:

- **high winds**
- **extreme temperatures**
- **water in the form of ice and frost**
- **an abundance of carbon dioxide in the atmosphere**
- **rocky, low nutrient soil.**

What would the leaves of this tree look like?
What would the root system look like?
Would this tree grow to be tall or short?
What other features should you include on your tree for it to survive on Mars?

Make a scientific drawing of your imaginary leaf including labels and written descriptions of the leaf's characteristics.

Leaf Exploration kit materials:

Leaf collection zip lock bag
30 + rulers
30 + hand lenses
30 + crayons
10 Leaf Keys to the Riparian Trees of SCC
14 Creek trees guides
2 large magnifiers

Resources in folder:
Native Riparian Trees with Photos
12 Leaf shape guides
"Plant Adaptation Fact Sheet"
"Ecological Relationships:
The Riparian Trees of California"
"Native Trees for Upland Planting"
"Types of Leaves"