



## **PLANT DEFENSES IN THE CLOUD FOREST**

**Trysta Wall, The New Teacher Project, Philadelphia, PA**

**Grade Level: 6-8<sup>th</sup>**

**Introduction:** Plants are an important part of every ecosystem on Earth and must defend themselves against herbivory by consumers within their ecosystem. In order to survive, grow, and replicate, plant species have evolved a tremendous variety of defenses. Through examination of local plants, as well as plants within the tropical montane cloud forest of Monteverde, Costa Rica, students will generate a new understanding of the necessity and usefulness of plant defense mechanisms.

**Major Themes:** Ecosystems, Defense, Adaptations

**Connections to the National Science Standards:** Structure and function in living systems, Populations and ecosystems, Diversity and adaptations of organisms, Scientific Inquiry

**Time:** 50-60 minutes (5 min for opening, 25+ minutes for directions and stations, 15 minutes for Defense Box discussions, 5 min for closing)

**Materials:** 1-4 computers with internet access. Panorama #1 hotspot #4 “Why Spines” and hotspot #6 “Science of Leaf Toughness”. Panorama #2 Canopy hotspot #4 “Fuzzy Leaves” (can be printed if fewer computers are available) and Media video “Tree Sap”. Additional pictures and examples of plants as needed. (See page 4 of student handout for additional plant ideas). Four boxes labeled with defense mechanisms. Student handouts included.

**Objectives:** Students will be able to 1) explain the defense mechanisms utilized by plants 2) identify defense mechanisms utilized by plants within the cloud forest 3) compare mechanisms to organisms in local ecosystem.

**Potential Misconceptions:** Students may have the following misconceptions:

- 1) Students may believe that only animals can engage in defense activities. They do not believe plants can evolve or respond to the environment.
- 2) Students may confuse plant structures used for other purposes, such as pollination or resource management, as defense mechanisms. Clarify that structures may be similar but may have different, or multiple, functions.

### **PROCEDURE**

**Opening:** Have students answer the question: What does ‘defense’ mean in ecosystems? Ask students to share their answers with the class and record key words and phrases that are mentioned on the board. These might include: protection, stay safe, stay alive, danger, etc. If students do not provide ideas of examples about plants, ask for their opinions regarding whether or not plants need defense in



an ecosystem. Tell students that plants are active members of an ecosystem, and they will be learning about methods used by plants to prevent or lessen herbivory. Plant specimens from the tropical montane cloud forest of Monteverde, Costa Rica, as well as local examples will be used.

**Development:** Prepare stations around the room with examples of plants using each of the four types of defense mechanisms. Include *Canopy in the Clouds* media depending on the number of computers available. Divide students into groups and allow 3-4 minutes at each station to examine the example. Ask students to fill out one slip (page 1 of student handout) at each station visited. While making observations on the plant example provided, students should determine a problem faced by the plant and how the plant is defending itself from this problem.

Once all stations have been visited, tell students that they must place each of their slips into one of the “Defense Boxes” provided. Name the boxes and indicate where they are located in the classroom, but do not explain or answer questions, as students will have to do this on their own. Label the boxes as follows:

Chemical Defense – chemical compounds

Mechanical Defense – physical structure

Thigmonasty – move in response to touch

Mimicry & Camouflage – acts or looks like another (may be separated if needed)

Give students two minutes to place each of their slips into the box that they believe is the best fit. Explain that they do not have to make the same choices as the individuals from their station group.

Re-group students and assign each group a box labeled with a defense mechanism. Students should work together to learn about the defense mechanism and the examples placed in their box. Ask each group to teach the class about the defense mechanism and use the slips in the box to help explain. Forewarn students that incorrect answers may have been placed in the boxes. Discussion amongst the group members with added help from the teacher should identify incorrect answers. Guide students to include the incorrect answers in their presentation to the class by using statements like, “We do not believe this is an example of chemical defense because....” or “This example would be a better fit for.....” Students can use page 2 of the student handout to help prepare their presentation.

Clarify any misconceptions or miscommunications about the different types of plant defense mechanisms. Reexamine or replay examples as needed.

Ask students to discuss the following questions as a class, or as an independent written closing:

- Why is it important for plants to defend themselves against consumers? Are there any other organisms that are a threat to plant survival?
- What mechanisms have plants developed to defend themselves? Can plants have more than one mechanism at a time?



- Which type of defense mechanism do you think is the most effective in ecosystems? The most widely used?

**Closing:** Ask students to think again about their ideas of defense in ecosystems. Refer back to the list created during the opening and ask students to include elements about plants now. Discuss answers to the questions above and provide feedback.

**Suggested Student Assessment:** Students can complete page 3 of the handout, *Student Assessment: Defense Mechanisms*. Students must list and define the defense mechanisms presented. Examples are given of a plant using a defense mechanism and students must apply the information learned to determine which type of mechanism is being represented. Finally, students are given an opportunity to create a defense mechanism, within the four categories, for a plant that is experiencing predation in the ecosystem.

**Extending the Lesson:** Locate an area in the local ecosystem that has a variety of plant species. Ask students to observe the plants, identify, and record examples of defense mechanisms. Have students predict why the plant needed to utilize a particular defense mechanism, in relationship to the surrounding ecosystem.

**Vocabulary:** defense, thigmonasty, mimicry, camouflage