**A 5E Lesson Plan: Bursting Buds!**

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**Essential Questions:** How does a leaf form? How does it change over time?

**Overview:** By the time a tree drops its leaves in the fall, the ones for the next spring have already formed. Tiny leaves, stems, and sometimes flowers, are located in packages called buds. They remain small and close to the plant with a protective covering of tough scales that form a waterproof case. In spring, sap rises from the roots to the branches; the bud begins to swell noticeably, and the scales fall off the buds; and the tree’s leaves, stems, and flowers unfurl and grow. In the summer, the tree begins to develop new buds for the following year. Did you know there is a whole field of science devoted to the timing of biological events like flowering, leafing, migration, and hibernation? It is called phenology, and it is a very valuable way for us to understand how changes in our environment affect the plants, animals and ultimately us!

**Materials Needed:** Tree buds, magnifying glasses, razor knife or other sharp tool to cut the buds in half

**Engage:** As the anchoring phenomena, have students observe a variety of buds that have been collected prior to the lesson. *What are they? What do they do?* Read *Goodbye Winter, Hello Spring* by Kenard Pak. Discuss what is happening to the plants and animals throughout the book.

**Exploration:** Divide students into teams of 2 or 3, providing each group with magnifying glasses, 1 unopened tree bud and 1 tree bud that has been gently split in half. Have them sketch their observations.

**Explanation/Evaluation:** Whole group discussion: *Did you notice the different parts of the bud? What colors did you observe? What do you think is packed into the bud? Do you think this bud will be a leaf or a flower? Why? What is the white, cottony material?* *How many days do you think it will take the bud to completely open? Why is a tree bud important?**What other animals are dependent on this plant? (Research and find out!) How does a plant’s life cycle affect the life cycles of birds and insects?*

**Elaboration:** A great way to study phenology as connected to plants is to observe the buds on trees and shrubs in the late winter and early spring. If you are able to take your students outdoors to observe a tree, have them closely exam the twigs and branches. Have them describe what they observe. Explain that tree twigs have different identifiable parts: terminal bud, lateral bud, girdle scar, leaf scar, lenticel, old and new wood.

Integrate these observations into your curriculum by having students write about them. Students can incorporate descriptive vocabulary, create a story about the wildlife and people that interact with the plant, or write a letter to a friend who lives in a different area about the seasonal changes to the local environment.

Additionally, students can measure the length of different buds, finding averages, mean, median, mode, and range. Graph results over time. Measure temperature and record it each time you observe. Research day length and keep track of that along with the bud observations. Correlate the observations of when buds open with temperature and amount of daylight.

Lastly, these observations can be digitally shared with Project Budburst, a citizen science phenology project at www.budburst.org. Spring, summer, fall, and winter phases are all valuable. These observations are used to better understand how plant species and ecosystems respond to changes in climate locally, regionally, and nationally.