

Photo Description



This photograph shows a wooden boardwalk extending over a lake during autumn. The trees surrounding the water display vibrant fall colors including orange, yellow, red, and brown leaves. Some trees appear to have lost many of their leaves already, showing the natural process of seasonal change in deciduous forests.

Scientific Phenomena

The anchoring phenomenon represented here is seasonal leaf color change and leaf drop in deciduous trees. This occurs because as daylight hours shorten and temperatures cool, trees stop producing chlorophyll (the green pigment that captures sunlight for photosynthesis). Without chlorophyll masking them, other pigments like carotenoids (yellows and oranges) and anthocyanins (reds and purples) become visible. Eventually, trees form an abscission layer at the base of each leaf stem, cutting off nutrients and water, causing leaves to fall. This is an adaptation that helps trees conserve energy and water during winter when photosynthesis would be inefficient.

Core Science Concepts

1. **Photosynthesis and Chlorophyll:** Trees use chlorophyll to capture sunlight and make food through photosynthesis. When chlorophyll breaks down in fall, other leaf pigments become visible.
2. **Plant Adaptations:** Deciduous trees have evolved to drop their leaves as a survival strategy for winter, reducing water loss and energy expenditure when sunlight is limited.
3. **Seasonal Patterns:** The timing of leaf color change and leaf drop follows predictable patterns based on environmental cues like temperature and daylight duration.
4. **Ecosystem Interactions:** Fallen leaves decompose and return nutrients to the soil, supporting the forest ecosystem and providing habitat for many organisms.

Pedagogical Tip:

Use a simple experiment with green leaves and rubbing alcohol to extract chlorophyll and reveal hidden pigments. This hands-on activity helps students visualize the concept that other pigments are always present but masked by chlorophyll.

UDL Suggestions:

Provide multiple ways for students to document observations by offering options like drawing, photographing, writing, or voice recording their observations of seasonal changes. Create a class phenology calendar where students can track and predict seasonal patterns using various representation methods.

Zoom In / Zoom Out

1. Zoom In: At the cellular level, specialized cells form the abscission layer where the leaf stem meets the branch. These cells create a barrier that blocks the flow of water and nutrients, eventually causing the leaf to detach cleanly without damaging the tree.
2. Zoom Out: This seasonal leaf drop is part of larger biogeochemical cycles. Decomposing leaves release carbon back into the atmosphere and soil, while nutrients like nitrogen and phosphorus enrich the soil for future plant growth, connecting to global carbon and nutrient cycles.

Discussion Questions

1. What evidence do you see that these trees are preparing for winter, and how might this help them survive? (Bloom's: Analyze | DOK: 3)
2. How do you think the fallen leaves will affect other living things in this ecosystem over the next few months? (Bloom's: Evaluate | DOK: 3)
3. What patterns do you notice in how different trees are changing colors, and what might cause these differences? (Bloom's: Analyze | DOK: 2)
4. If you returned to this same spot in winter and then again in spring, what changes would you predict and why? (Bloom's: Synthesize | DOK: 3)

Potential Student Misconceptions

1. Misconception: Trees "make" new colors in their leaves during fall.
Clarification: The yellow and orange pigments were always there but were hidden by the dominant green chlorophyll. Trees stop making chlorophyll, revealing the other colors.
2. Misconception: All trees lose their leaves because it gets cold.
Clarification: Only deciduous trees lose their leaves seasonally. Evergreen trees keep their leaves/needles year-round as an adaptation to their environment.
3. Misconception: Fallen leaves are just "tree trash" or waste.
Clarification: Fallen leaves are a vital part of the ecosystem, providing nutrients for soil, shelter for animals, and food for decomposers.

NGSS Connections

- Performance Expectation: 5-LS2-1 - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment
- Disciplinary Core Ideas: 5-LS1.C - Organization for Matter and Energy Flow in Organisms; 5-LS2.A - Interdependent Relationships in Ecosystems; 5-LS2.B - Cycles of Matter and Energy Transfer in Ecosystems
- Crosscutting Concepts: Patterns - Observable patterns in nature guide organization and classification; Systems and System Models - A system can be described in terms of its components and their interactions

Science Vocabulary

- * Deciduous: Trees and plants that lose their leaves seasonally as an adaptation to changing environmental conditions.

- * Chlorophyll: The green pigment in plants that captures sunlight energy for photosynthesis.
- * Abscission: The natural process by which trees shed their leaves by forming a separation layer at the leaf stem.
- * Photosynthesis: The process plants use to make food by combining sunlight, carbon dioxide, and water.
- * Adaptation: A special characteristic that helps a living thing survive in its environment.
- * Decomposition: The natural process where dead plant and animal materials break down and return nutrients to the soil.

External Resources

Children's Books:

- Why Do Leaves Change Color? by Betsy Maestro
- Red Leaf, Yellow Leaf by Lois Ehlert
- Fletcher and the Falling Leaves by Julia Rawlinson

YouTube Videos:

- "Why Do Leaves Change Colors?" by SciShow Kids - Simple explanation of leaf pigments and seasonal changes for elementary students (<https://www.youtube.com/watch?v=CpEzQMp58Cg>)
- "The Science of Fall Colors" by MinuteEarth - Animated explanation of the chemistry behind autumn leaf colors (<https://www.youtube.com/watch?v=aELJSMoKVF0>)