

Photo Description



This image shows a lawn completely covered with fallen autumn leaves in shades of red, yellow, orange, pink, and brown. Green grass peeks through the colorful blanket of leaves, and in the background you can see a house with a basketball hoop and trees. This is a classic example of what happens each fall when trees stop sending water and nutrients to their leaves.

Scientific Phenomena

Anchoring Phenomenon: Leaf color change and leaf fall (senescence)

Why It's Happening:

As temperatures drop and days get shorter in autumn, trees prepare for winter by stopping the flow of water and nutrients to their leaves. When this happens, the green chlorophyll (the pigment that helps trees make food) breaks down. This reveals other colors that were always in the leaves but hidden by the green—yellows, oranges, and reds. Eventually, trees drop their leaves entirely to conserve water and energy during the cold winter months when the ground freezes and water isn't available to the roots. This is a survival strategy that helps trees survive harsh winter conditions.

Core Science Concepts

- * **Seasonal Changes:** Earth's tilt and position in its orbit around the sun cause temperature and daylight length to change throughout the year, triggering different plant behaviors in each season.
- * **Plant Life Cycles and Adaptations:** Trees have adapted to survive winter by entering dormancy (a resting state) and shedding leaves, which is an inherited behavior that helps them survive in temperate climates.
- * **Photosynthesis and Chlorophyll:** Green leaves use chlorophyll and sunlight to make food for the plant. In fall, when photosynthesis slows, other pigments (carotenoids and anthocyanins) become visible, creating the colors we see.
- * **Energy and Resource Conservation:** By dropping leaves, trees reduce water loss through transpiration and conserve stored energy for survival during winter when growing conditions are poor.

Pedagogical Tip:

Help students connect leaf color change to a real-world experience they've had. Ask them to recall a time they noticed leaves changing color during a family outing or walk. This personal connection makes the phenomenon memorable and meaningful. You might also keep a leaf color journal throughout fall, collecting samples weekly to track the progression of changes in your own neighborhood.

UDL Suggestions:

To support multiple learners:

- **Representation:** Use photos, real leaf samples, and color charts to show leaf color changes. Create a visual "leaf progression timeline" on the classroom wall.
- **Action & Expression:** Allow students to show understanding through drawing, sorting leaves by color, creating a leaf collage, or writing about what they observe.
- **Engagement:** Connect to student interests by having them collect leaves from home, measure them, or press them for a classroom display. Make it a class treasure hunt!

Zoom In / Zoom Out

Zoom In: Cellular Level

Inside each leaf cell, there are tiny structures called chloroplasts that contain chlorophyll (the green pigment). When fall arrives and days get shorter, the tree stops sending water and nutrients to the leaves. Without these resources, the chloroplasts break down and stop making chlorophyll. As the green fades away, other pigments that were always there—like yellow carotenoids and red anthocyanins—become visible for the first time. It's like removing a green filter from a picture to reveal the colors underneath! This happens in millions of cells in each leaf simultaneously.

Zoom Out: Ecosystem and Seasonal Cycles

When leaves fall to the ground, they don't just disappear—they become part of a larger ecosystem cycle. The fallen leaves break down over time and return nutrients to the soil, which helps grass, plants, and trees grow in spring. Animals like earthworms, insects, and fungi all depend on these fallen leaves for food and shelter during winter. The leaf fall also signals to animals that it's time to migrate, hibernate, or prepare for cold weather. This autumn leaf drop is connected to temperature changes caused by Earth's tilt and position around the sun, which affects the entire Northern Hemisphere's ecosystems at the same time.

Discussion Questions

- * What causes the leaves to change color in the fall? (Bloom's: Understand | DOK: 1)
- * Why do you think trees drop their leaves in autumn instead of keeping them all year? (Bloom's: Analyze | DOK: 2)
- * If a tree didn't drop its leaves before winter, what problems might it face? (Bloom's: Evaluate | DOK: 3)
- * How would the life cycle of a tree be different if we lived in a place where it never got cold? (Bloom's: Create | DOK: 3)

Potential Student Misconceptions

Misconception 1: "Trees change leaf colors on purpose to be pretty for people."

Clarification: Trees don't change colors to look beautiful. Leaf color change is a survival strategy that happens automatically when days get shorter and temperatures drop. The colors were always in the leaf, hidden by green chlorophyll. When the tree stops sending nutrients to the leaves, the green fades and we finally see the other colors that were there all along.

Misconception 2: "Dead leaves fall because the tree killed them; the tree is sick."

Clarification: Leaf fall isn't a sign that the tree is sick—it's actually a healthy survival strategy! Trees intentionally drop their leaves to save water and energy during winter when it's cold and the ground is frozen. A healthy tree that drops all its leaves in fall will grow new leaves again in spring. Trees that don't drop their leaves (like evergreens) survive winter differently, but they're healthy too.

Misconception 3: "All leaves turn the same color in fall."

Clarification: Different types of trees have different pigments in their leaves, so they turn different colors. Some leaves turn yellow, others turn red or orange, and some turn brown. Even on the same tree, leaves might turn slightly different colors depending on how much sun they get. The specific color depends on what pigments are hiding under the green chlorophyll.

Extension Activities

Activity 1: Leaf Color Investigation

Collect 5-6 leaves of different fall colors from your school grounds or neighborhood. Have students measure the leaves, sort them by color, and create a bar graph showing which colors are most common. Students can predict which colors they'll see most and test their predictions. This connects to data collection and graphing skills while deepening observation of the phenomenon.

Activity 2: Paper Chromatography Leaf Pigments

Conduct a simple chromatography experiment using coffee filters, fallen leaves, and rubbing alcohol. Students will see the hidden pigments in leaves separate into distinct colors, making the science of color change visible and concrete. (Note: Adult supervision required for alcohol use; use only a small amount in sealed containers.)

Activity 3: Seasonal Tree Journal

Create a class or individual "Tree Through the Seasons" journal. Take photos of the same tree (or tree location) once a month throughout the school year. Have students record observations about color, leaf presence, temperature, and daylight hours. This long-term investigation helps students recognize patterns and understand that seasonal changes are predictable and cyclical.

Cross-Curricular Ideas

Math Connection: Leaf Counting and Data Graphing

Have students collect fallen leaves from the school playground and sort them by color (red, yellow, orange, brown, etc.). Students can create a tally chart to count how many leaves are in each color group, then make a bar graph showing their results. This connects to data collection, organization, and graphing skills while deepening their observation of the phenomenon in the photo.

ELA Connection: Descriptive Writing and Seasonal Poetry

Ask students to write descriptive paragraphs or acrostic poems about autumn using sensory words (crispy, colorful, cool, crunchy). Have them use the photo as inspiration and include at least five adjectives describing what they see, hear, or feel during fall. Students could also write from a tree's perspective: "What would a tree say about losing its leaves?" This builds vocabulary and writing skills while exploring the phenomenon creatively.

Social Studies Connection: Cultural Celebrations and Seasonal Traditions

Connect autumn leaf changes to fall holidays and cultural celebrations around the world. Discuss how different cultures celebrate harvest time and the changing seasons (Thanksgiving, Sukkot, Mid-Autumn Festival, Día de Muertos). Have students research how people in different regions prepare for winter based on seasonal changes in their environment. This builds global awareness and helps students understand that seasonal cycles affect human communities and traditions.

Art Connection: Fall Leaf Art and Nature Collage

Students can create artwork inspired by the photo using real fallen leaves, watercolor paints, or colored paper torn into leaf shapes. They might make leaf rubbings, press leaves between wax paper and iron them (with adult help), or create a classroom mosaic or mural showing the progression of fall colors. Students could also photograph leaves in different lighting to explore how colors appear different in sunlight versus shade, connecting art to light and observation skills.

STEM Career Connection

Botanist (Plant Scientist) – Average Annual Salary: \$63,000

Botanists study how plants grow, change, and survive in different environments. A botanist might spend their fall studying why leaves change color, how different tree species prepare for winter, or how climate change affects when leaves fall. They work outdoors collecting samples and in laboratories conducting experiments. If you love plants and asking "why?" questions, this could be your career!

Meteorologist (Weather Scientist) – Average Annual Salary: \$62,000

Meteorologists study weather and climate patterns, including the temperature and daylight changes that trigger leaf color change. They track seasonal patterns, predict frost dates, and understand how Earth's position around the sun affects weather in different regions. A meteorologist might explain why fall comes earlier or later in different years. If you enjoy weather watching and making predictions, meteorology could be for you!

Arborist (Tree Care Specialist) – Average Annual Salary: \$58,000

Arborists are experts who care for trees in neighborhoods, parks, and forests. They understand tree health, including what happens to trees during each season. An arborist might help remove fallen branches, prune trees so they stay healthy, or plant new trees and care for them through their first fall. If you like working outdoors with trees and solving problems about plant health, this job combines science with hands-on work!

NGSS Connections

Performance Expectation:

4-LS1-1: Use a model to describe that animals receive different types of information through their senses, process that information in their brain, and respond to the information in different ways.

4-ESS2-1: Make observations and measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Relevant Disciplinary Core Ideas:

- 4-ESS1.A The Universe and its Stars
- 4-ESS2.E Dynamics of Earth's Systems
- 3-LS4.B Natural Selection

Crosscutting Concepts:

- Patterns - Seasonal patterns repeat each year
- Systems and System Models - Trees are part of a larger ecosystem system affected by seasonal changes
- Cause and Effect - Shorter days and colder temperatures cause leaves to change color and fall

Science Vocabulary

- * Chlorophyll: The green pigment in leaves that helps plants capture sunlight and make their own food.
- * Photosynthesis: The process plants use to turn sunlight, water, and air into food and energy for growing.
- * Dormancy: A deep sleep-like state that plants enter to survive harsh winter weather.
- * Senescence: The scientific term for the aging process in plants, including the yellowing and falling of leaves in autumn.
- * Transpiration: The process where water absorbed by plant roots evaporates from the leaves into the air.

External Resources

Children's Books:

Leaf Man* by Lois Ehlert – A colorful picture book that uses real leaves to tell a story and celebrate autumn leaves

Why Do Leaves Change Color?* by Betsy Maestro – A clear, illustrated explanation of leaf color change designed for elementary readers

Come On, Rain!* by Karen Hesse – A poetic picture book capturing the feeling of seasonal change and weather patterns