

Green Forever? Amazing Evergreens

Evergreen plants add color to our landscapes year-round, but they don't keep the same leaves indefinitely. Waiting to drop old leaves until new leaves are established is just one of the many special adaptations that help them survive in some of the toughest environments on the planet. In this lesson, students will explore some of the benefits plants can reap from being green 'forever.'



Grade Level/Range: 3- 5th Grade

Objective(s):

Students will:

- Use their senses to explore evergreen leaves.
- Investigate the benefits evergreen plant adaptations provide in different climates.
- Research common evergreen trees and shrubs in their area.

Time: 1 hour

Materials:

- Paper and pencils
- Sample evergreen leaves (needles from a local pine tree work well)
- Sample deciduous leaves (optional, if available depending on season)
- Leaf Exploration Worksheet
- Tree ID book or website

Background Information

Woody plants like trees and shrubs are broadly classified into two categories: deciduous and evergreen.

Deciduous plants drop their leaves annually as an adaptation to survive the winter. During the growing season, they store up water and energy in their branches, trunks, and roots. In the fall, most deciduous plants drop their leaves (although some may hold onto their withered leaves until spring), entering into a dormant state as an adaptation to survive the winter. In spring, they use their stored energy to sprout all new food-making factories (leaves).

Evergreen plants, in contrast, are covered in living foliage year-round. In northern regions, this allows them to begin photosynthesizing earlier in spring and continue later in fall than they could if they dropped their leaves. (In cold climates, evergreens slow their growth in winter but do not go fully dormant.) In tropical and subtropical climates, conditions allow for year-round growth, so evergreen plants hold onto their leaves to produce a constant source of energy.

Just because evergreens keep a foliage cover does not mean their leaves never drop. Evergreen plants do eventually lose older leaves; however, this occurs only after new leaves are established and ready to replace them. The lifespan of individual leaves varies depending on the type of plant. For example, the needles (leaves) on white pines live for two to three years before they turn yellow and drop.

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This cycling of leaves is just one of several adaptations that help evergreens survive in their ecosystems. Here are some common adaptations evergreen plants have evolved that allow them to thrive in challenging conditions:

Adaptations for short and long growing seasons. In cold climates, the growing season is short and plants may not have time to store up adequate energy to produce new leaves each spring. Holding onto their leaves gives evergreen plants additional time to photosynthesize in spring and fall, without expending the energy and time needed to grow an entirely new crop of leaves. In warm climates, conditions support year-round growth. This continuous growth means that plants need the ongoing supply of energy supplied through photosynthesis. There is no advantage for the plants to drop all their leaves at once.

Adaptions to dry conditions. Evergreen leaves tend to have a waxy coating which helps protect the cells inside and reduce moisture loss. This is especially true of evergreen trees that are native to cold climates, where the ground is frozen much of the year and the trees cannot take up water to replace that lost during photosynthesis.

Adaptations to cold conditions. Many evergreens have needle-shaped foliage; the needles are sturdy and have a relatively small surface area, so they tend to be more tolerant of extreme cold compared to deciduous plants (which tend to have broad, thin leaves that are easily damaged by freezing). The leaves of broadleaf evergreens, like rhododendrons, are relatively thick compared to deciduous leaves and usually have a protective, sometimes waxy coating. In addition, the foliage of some evergreens has internal temperature protection. The plants concentrate substances in their leaves that act as antifreeze to prevent ice from forming and damaging cells. Some of these chemicals are aromatic, giving trees like spruce and pine their signature scents. Learn more in [Winter Survival: A Tale of Plant Antifreeze and Exploding Trees](#).

Adaptations to snowy climates. The conical shape and narrow, needle-like foliage of many evergreens help prevent snow buildup which would otherwise result in considerable damage as accumulated snow strains and breaks branches.

Adaptions to limited nutrients. Since evergreens don't have to produce all new leaves each spring, they can get by with fewer nutrients. This gives them an advantage in areas with nutrient-poor soils that are unfavorable to deciduous plants. In cold-winter regions, for example, organic matter is slow to break down and release its nutrients into the surrounding soil. Rocky and sandy soils tend to be low in nutrients. In acidic soils, many of the nutrients are bound up in forms unavailable to plants; this gives evergreens like rhododendrons an advantage over nutrient-hungry deciduous plants that require soils with a more neutral pH.

Read [Staying Green: Adaptations of Evergreens](#) for additional background information about the biology of evergreen plants.

Advance Preparation

Collect an assortment of evergreen leaves from the garden for exploration. At minimum you need enough evergreen leaves for each student to have a sample. Bundles of pine needles work well. Other evergreen plants include boxwoods, rhododendrons, firs, yews, and arborvitae. (*Note that the needles on some evergreens, such as spruce, can be too sharp for young hands.)

Laying the Groundwork

On a blank sheet of paper, ask students to draw a picture of what trees look like during the winter months. If you are doing this lesson

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during late autumn or winter and have time and an accessible outdoor space, you can do this in conjunction with a nature walk.

Ask students to share their pictures. Begin your discussion by asking:
How many of your trees have leaves on them? Take a tally of the results.
Do all trees lose their leaves in the winter?
Can you think of any trees that still have leaves during the winter?
Why do you think some trees have leaves and others do not?
How do you think trees that keep their leaves might be different from the others?

Exploration

Provide each student or group of students with a copy of the Leaf Exploration Worksheet and one or more evergreen leaves to explore. Give students time to note observations, including the following:

- What is the shape of the leaf?
- What does the leaf feel like? Is it smooth or rough? Is it the same on both sides? Does it have a waxy coating?
- How thick is the leaf? Does it feel like it would tear easily?
- Crush the leaf in your hand. What does it smell like? Is the smell strong or weak?
- How do you think the traits you noticed might help the plant in extreme weather?

After students have had time to explore the evergreen samples on their own, as a group discuss your observations.

Use the Background Information provided to create a class list of the common adaptations of evergreen plants and discuss how these traits help them survive in extreme weather.

Depending on the season, you can follow up the observation of evergreen leaves by comparing them to deciduous leaves if available. Give each student or group a deciduous leaf to explore and a second Leaf Exploration Worksheet. Once finished, compare the two sets of observations.

Making Connections

Use the National Weather Service's Climate Tool to find the monthly average temperature and precipitation in your area. Start by selecting your region on the [NWS Weather Forecast Offices map](#). When you get to the tool, select the location closest to you and under "Product" select "Monthly Summarized Data." Next, under "Options," choose your desired year range and then use the tool to find data for the "Variables" of "Precipitation," "Average Temperature" and "Average Snowfall."

To complete your data, use the [Duration of Daylight/Darkness Table](#) from U.S. Navy website to find the average day length for the same time frame.

Enter your data into a chart that looks like the following:

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Month	Average Precipitation	Average Temperature	Average Snowfall	Average Day Length
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

As a class, discuss seasonal weather changes throughout the year. Ask students, since we know plants need water and sunlight for photosynthesis in order to make the food/energy they need to grow and be healthy, what does this information tell us about how seasonal changes may impact how well a plant can meet its needs? Why is it important for plants to adapt to the seasons? What do you think would happen if they could not adapt to the changes in the weather and sunlight availability?

Branching Out

Create a class guide of the 10 (or more) most common evergreens that grow in your area. Some local resources to help you create a list of evergreens to choose from include:

Your local [Native Plant Society Chapter](#)
 Your [local Extension Office](#)
 Your Local [State Park](#) or [National Park](#)
 Local garden centers or nurseries
 Local garden clubs

Explore the importance of evergreens for animals during winter months using the article [How Evergreens Provide a Winter Oasis for Wildlife by Project Learning Tree](#).

Connection to Standards

This lesson can be used to teach the following Next Generation Science Standards:

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment. [

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

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3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Leaf Exploration Worksheet

Sketch your leaf.	What is the shape of the leaf?	What does the leaf feel like? Is it smooth or rough? Is it the same on both sides? Does it have a waxy coating?	How thick is the leaf? Does it feel like it would tear easily?	Crush the leaf in your hand. What does it smell like? Is the smell strong or weak?	How do you think the traits you noticed might help the plant in extreme weather?

