

DOUGLAS FIR

The Douglas fir tree is a model of adaptability. It thrives in diverse places, from shady forests to sunny clearings, mountain slopes to coastal bluffs. It can take the form of a scraggly bonsai tree shaped by harsh weather, or a massive 1,000-year-old giant with a thick trunk and a 300-foot crown. Douglas fir helps people to be adaptable by providing lumber, fuel, food, medicine, and many other gifts.



Other Names: *Pseudotsuga menziesii*, common Douglas, sčəbidac (Northern Lushootseed)

Identifying Douglas Fir: Douglas fir is the most common evergreen tree in the Pacific Northwest and southern British Columbia. Young bark is gray and smooth with resin blisters, but when it grows over a foot thick, it begins to turn corky, reddish-brown, and deeply furrowed, making it the "grooviest" tree in the forest. Needles are pointed, but not sharp, are all the same length, and are spirally arranged around the branch like a bottlebrush. They smell like citrus and pine when crushed. Male cones are small (2cm long) and produce a massive amount of golden pollen that is carried in the wind. Once pollen is released, male cones quickly wither and fall off the tree. Woody female cones are on the same tree and hang down. Pairs of seeds can be found between each scale of the cone and have wings. Each scale has an attachment, called a three-pronged bract, that resembles the tail and rear feet of a mouse. In a common Salish story, it is said that a long time ago, mice were running from a fire and climbed into Douglas fir trees to find refuge. They hid in Douglas fir cones and are still stuck there today. The oldest known Douglas fir is 1,400 years old with a 393-foot crown and a 17-foot-wide trunk. Before logging, Douglas fir may have been the tallest tree in the world.

Where it Grows: Douglas fir thrives in many environments including partial shade and full sun, wet forests, and dry open parklands. Two varieties are recognized: Coastal Douglas fir (*Pseudotsuga menziesii* var. *menziesii*) grows west of the Sierra, in the Cascade Mountains, and in the British Columbia Coast Range, while *T. menziesii* var. *glauca* (Rocky Mountain or inland Douglas fir) grows in dry montane areas on the east side of the mountains from northern Mexico up to central British Columbia and Alberta, Canada.

Season: Harvest lime-green branch tips in April through mid summer depending on elevation. Mature needles and pitch can be gathered during any season.

How to Harvest: Tender spring tips are easy to pinch off or cut with scissors, but remember that you are pruning the new growth. Harvest from side branches instead of the lead branch and do not take too much from any one part of the tree. You can also use mature needles for tea and medicine making. Gather recent windfall or prune branches, then hang them in bundles or dry in baskets. Once dry, run your fingers along the stems to remove needles or cut them off with scissors. Doing this in a paper bag or large bowl helps contain the needles. You can harvest Douglas fir pitch whether it is still soft or hardened. Store in a plastic bag, small jar, or wrap in a large leaf like big leaf maple or thimbleberry. To remove pitch from your hands, use oil or alcohol.

Eating Douglas Fir: In springtime, Douglas fir tips are tender and delicious. They are high in vitamin C and electrolytes, and are sometimes called the original energy drink or "Nature's Gatorade." For generations, Coast Salish People have valued them for warding off hunger and thirst during intense physical activity or travel. You can eat them fresh, freeze them, or dry them. Both hot tea and sun tea are tasty. Needles can be infused in honey or vinegar. They are also used for flavoring liquors, syrups, and desserts including ice cream. You can also add them to gummy treats.



Medicine: Like other evergreen conifers, Douglas fir needles and pitch are high in aromatic resins that fight infection and stimulate immunity. Tea made from fresh young needles or dried older needles is useful for fighting colds and boosting energy. Douglas fir also supports skin health through inhibiting microbes, providing vitamin C, and acting as a gentle astringent. The dried needles make a nice aromatic bath. Wilted and finely chopped needles are infused in oil to make a body oil, lotion, or salve. Soft pitch is used directly on wounds or can be added to salve.

Traditional Technologies: Native People historically used resin for waterproofing canoes, tools, and implements. The bark is an excellent fuel for cooking fires, and pieces of the rotten wood (punk) from stumps or fallen trees make good fire starters when dry. John and Linda Elliot from Tsartlip First Nation were taught to use Douglas fir firewood in summertime because it burns hot and clean, but does not spark. This reduces the chance of starting a damaging fire. If kept in a closed clamshell, the burning coal would last quite a while. People could travel with fire this way.

Douglas fir wood is hard and resilient for a conifer, and boasts one of the highest strength to weight ratios of any tree in western North America. Timber companies often plant it because it is adaptable in many environmental conditions and it yields the highest amount of timber of all trees in North America. It is used for lumber, plywood, pilings, marine structures, railroad ties, flooring, furniture, pulp, and many other things.

Ecological Relationships: Old growth Douglas fir trees have massive canopies with millions of needles. About a third of the needles fall off each year and land in the tree's broad, upper branches. These build up into mats up to 12 inches thick. Decomposers, including plants, fungi, bacteria, millipedes, and insects such as spiders and mites move in, turning the needles into rich soil. Lichens thrive in the treetop gardens and fix nitrogen from the air into their bodies. When they fall to the forest floor they provide rich nutrients that amend the typically acidic soil. Forest ecologists are discovering a diversity of species in these forest canopies.

Nalini Nadkarni, a forest ecologist and professor at the Evergreen State College, is called the "Queen of canopy research" and has devoted her career to exploring the rich, vital world found in the tops of trees. To learn more, listen to her TED talk at https://www.ted.com/talks/nalini_nadkarni_on_conserving_the_canopy. See her *Tree Top Barbies, Sustainable Prisons, and Sound Scientist* projects, which engage people with science and nature.

Douglas fir seeds are packed with nutrients that mice, chipmunks, and birds, including juncos, pine siskins, song sparrows, golden-throated sparrows, red crossbills, and purple finches feed on. Birds help to



extend the range of Douglas fir as they migrate. Native Douglas squirrels cache away large amounts of cones in a single location and peel away the scales to get to the seeds. You may see a large pile of scales at the base of their larder. They also eat Douglas fir spring tips and the young inner bark.

Douglas fir populations were historically kept in balance by fire. Young saplings will quickly establish themselves in open areas including camas prairies and disturbed sites. Fires, both natural and burns carefully planned by Coastal Salish ancestors, helped control Douglas fir growth and maintained diverse landscapes by killing younger saplings and allowing older trees to survive. Older trees can develop bark 12 inches thick and are unharmed by fast burning ground fires. You can see burn marks on old trees that survived fires several hundred years ago.

Additional Resources:

Douglas Fir Video with Cinnamon Bear: <https://vimeo.com/571848197>

Green Giants. Sneed Collard III.

Northwest Trees. Arno and Hammerly

Tree: A Life Story. David Suzuki and Wayne Grady.

Coloring page: <http://www.supercoloring.com/coloring-pages/douglas-fir>

Forest Fast Break video on fire

<https://www.youtube.com/watch?v=1FiYBeuO6cl>

Douglas Fir: A Wildlife Hero. Us Fish and Wildlife.

<https://www.fws.gov/news/blog/index.cfm/2015/12/16/Douglas-Fir-A-Wildlife-Hero>



References

Interview with Linda and John Elliot. Tsartlip First Nation, May 2017.

Arno, Stephen. and Hammerly, R. (2007). *Northwest Trees*. The Mountaineers Books.

Pielou, E.C. (1988). *The World of Northern Evergreens*. Cornell University Press.

Suzuki, David. and Grady. W. (2004). *Tree: A Life Story*. Greystone Books Ltd.

Turner, Nancy. and Hebda, R. (2012). *Saanich Ethnobotany*. Royal BC Museum Publishing.

Wohlleben, Peter. (2015). *The Hidden Life of Trees*. Greystone Books Ltd.

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MEET DOUGLAS FIR

Time: 30 minutes
Season: Any season
Age: Grades K-5
Setting: Indoor or Outdoor



Overview: Students learn how to identify the Douglas fir tree through working in pairs and investigating samples. In a group discussion, students explore qualities that make Douglas fir adaptable, and then relate them to human adaptability.

Student Wondering: *How do I identify Douglas fir? What qualities make it adaptable?*

Learning Objectives	
Understandings	Knowledge and Skills
<p><i>Student will understand that...</i></p> <ul style="list-style-type: none">plants develop characteristics that help them to adapt to different environments and conditions.plants help humans to be more adaptable.through observing plants, we can learn ways to be more adaptable.	<p><i>Student will be able to...</i></p> <ul style="list-style-type: none">identify Douglas fir based on looking at leaves, cones, and bark.understand three ways Douglas fir shows adaptable characteristics.name two traits that help humans to be more adaptable.

NGS Standards: Performance Expectations		
Scientific and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none">4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.	<ul style="list-style-type: none">LS1.A: Structure and Function	<ul style="list-style-type: none">Systems and System Models

Vocabulary: evergreen, conifer, trunk, crown, cone, scale, bract, pitch

Background: Douglas fir is the most common evergreen conifer and the most important timber tree in the Pacific Northwest, producing more board feet than any other evergreen conifer. It thrives in many environments including high and low elevations and wet or dry sites. There are many qualities that make Douglas fir adaptable. These include needle-shaped leaves that are waxy, the overall shape of the tree that can withstand wind and snow, thick bark, resin that is antimicrobial, healing, and insect repelling, and other traits. Douglas fir

is an important tree to many species including humans. It provides food, medicine, shelter, and other gifts. (For more information on qualities that make evergreen conifers resilient, see the *Evergreen Conifer Tree Overview*.)

Materials

- For inside lesson: Samples of Douglas fir small branches, cones, bark, and sap (place sap in a plastic container or bag to avoid a sticky mess). You can also project or print out the Douglas Fir Lifecycle Page (see end of document).
- Grades K–1: <http://www.supercoloring.com/coloring-pages/douglas-fir> for each student.
- Grades 2–5: *Getting to Know Douglas Fir* questionnaire for each student.

Preparation: Read the *Douglas Fir Overview*. Print coloring sheet or questionnaire for each student.

Inside: Gather samples of Douglas fir cones and branches ahead of time so there are enough for each pair of students. If possible, bring in a few samples of Douglas fir bark and pitch so students can see the color and texture. You may be able to pull bark off of a fallen tree. Place pitch in a few plastic containers or bags. You can pass these between groups if you don't have enough for each group. Find a picture of a Douglas fir tree to project on a screen, or project or print the Douglas fir photo sheet so students can see the overall form of the tree.

Outside: Choose a Douglas fir tree that is large enough so that students can see leaves and woody cones. Older trees have characteristic "groovy" reddish bark.

LESSON: MEET DOUGLAS FIR

INTRODUCTION

10 MINUTES

Begin by either projecting a picture of Douglas fir on a screen, passing out photos of Douglas fir, or gathering around a Douglas fir tree outside.

Share: Today we are going to learn about the amazing Douglas fir.

- Douglas fir is an **evergreen conifer**, meaning that it has needles that stay green all year long and it has cones. It is the most common evergreen conifer in our region.
- Douglas fir is the second tallest tree in the world after the California redwood. Before humans started logging it may have been the tallest. The biggest living tree is 393 feet tall, which is more than the length of a football field, and over 1,400 years old—18 times longer than the average human life in America!
- Douglas fir wood is strong, flexible, and lightweight. Imagine how tall and straight the **trunk** is. It can bend in the wind and not snap. Water and food for the tree are carried all the way from the roots to the **crown**.

Ask: *What things do people make from wood?* Give students a chance to respond. Examples include lumber to build homes, tools, picture frames, skateboards, paper, toilet paper, etc. Humans have not been able to invent a better building material than wood.

Share: Douglas fir can live in a lot of places. It can grow high in the mountains and on the coast of the Pacific Ocean. It can grow in dry conditions and very wet conditions. It can even survive in intense heat and extreme cold. It is **adaptable**.

Ask: *What does it mean to be adaptable?* Give students a chance to respond. Fill in missing information including, "Being adaptable means that you are able to adjust to many different conditions. Douglas fir has many qualities that make it adaptable. You are going to explore these qualities by getting to know Douglas fir up close."

HANDS-ON ACTIVITY

15-20 MINUTES

Have students work in pairs. Pass out questionnaires and samples of leaves, cones, bark, and pitch to each group. Give them about 10 minutes to answer the questions and draw pictures. Encourage them to use all their senses including "scratch and sniffing" the needles, dissecting the cones to look for seeds, and feeling the bark.

K-2 Students: Break students into groups and pass out samples. Verbally ask questions on the questionnaire, grouping them into questions about the needles, cones, bark, pitch, and overall form. Give them a few minutes to explore each part and discuss answers. Pass out blank paper and drawing utensils or a coloring sheet for students to color.

Group Discussion: Go through questions in questionnaire below and either ask for volunteers or call on pairs of students. Fill in answers and knowledge as needed including:

- Leaves are shaped like needles, are pointed at the tip and are not sharp to touch.
- The top of the needle is dark green and the bottom has two white lines, making it look gray. These are tiny stomata that breathe in carbon dioxide and breathe out oxygen.
- Needles grow in a spiral arrangement around the branch like a bottlebrush.
- Needles smell like citrus and pine when you scratch or crush them.
- Female cones are made of many scales attached to a central axis. The seeds are hidden between the scales. They come in pairs and are shaped like a wing to help them fly in the wind.
- Female cones hang down, which helps to release the seeds.
- Each scale on the cone has a "3-pronged bract" attached.
- Story Connection: Tell the story of how Mice Got in Douglas Fir Cones:
 - *A long time ago there was a great forest fire that swept through this area. All of the animals were running to escape. The poor little mice could not run fast enough so they asked the strong and tall Douglas fir for help. Douglas fir invited the mice to climb up its trunk and hide in its cones. Douglas fir has thick bark, and it was able to survive the heat of the flames. The mice are still in the cones. Can you see their little hind feet and tails sticking out from beneath the scales?*
- Bark is smooth when young and becomes grooved as it gets older. People say it is the "grooviest tree in the forest." The color is grey to reddish brown and it can get 12 inches thick!

- Pitch is made by trees to help fight infection, to heal from injury, and to repel insects and diseases. People use pitch to heal wounds.
- Overall shape – the very top of the tree points straight up and is triangular-shaped, which helps to shed snow. The upper branches look like arms reaching up toward the sky in a U shape.

TYING IT TOGETHER

5-10 MINUTES

Ask: *Based on what we have learned, what makes Douglas fir adaptable?*

Group Discussion: You may need to give hints like: How does Douglas fir survive insect attacks or lightning strikes? (thick bark) Fill in knowledge as needed including:

- Needle-shaped leaves are very narrow and do not catch wind or snow like large leaved trees.
- Needles are waxy and tough. They are waterproof in wet conditions. When it is hot and dry, the waxy coating helps them hold onto water.
- Seeds have a wing that helps them fly in the wind.
- Bark is thick and can withstand heat (trees with thin bark can get sunburned), fire, being scraped, insect invasion, etc. It is “thick-skinned.”
- Douglas fir makes its own medicine in the form of pitch.

Ask: *What helps you to be adaptable?* Have students answer in a circle, popcorn style, or do reflective writing.

Possible answers include:

- The appropriate clothing for the weather including a raincoat during a downpour, warm clothes in winter, and cool clothes and sunblock in summer.
- Learning skills that help you adapt to different or new situations.
- Being “thick-skinned” and not letting mean things get you down.

DIGGING DEEPER

Watch a Video on Douglas Fir: Featuring Cinnamon Bear <https://vimeo.com/571848197>

Douglas Fir Poster: Have students make a poster or do a nature journal entry on Douglas fir with a drawing.

Research Douglas Fir: Have students do a report about Douglas fir. Have them look in books in the library and look for local Douglas fir trees. Interview local tribal elders, foresters, and other experts.

Teach the *Douglas Fir: Food and Medicine* lesson.

GETTING TO KNOW DOUGLAS FIR

What are Douglas fir leaves shaped like?

Are they pointed at the tip?

Are they sharp to touch?

What color are they on the top and bottom?

Drawing of Leaves

Do they grow flat (horizontally) on the branch or all around the branch (spiraled)?

Drawing of Cone

When you scratch them, what do they smell like?

Can you find any seeds in the cone?

What is the shape of each seed?

Do the cones hang down or point upward on the tree?

Each scale on the cone has an attachment called a bract. What does it look like?

What texture and color is the bark?

Why do you think Douglas fir makes pitch?

What else do you notice?

THE LIFECYCLE OF DOUGLAS FIR

Time: 50 minutes
Season: Any season
Age: Grades 6-12
Setting: Indoor or Outdoor



Overview: Students learn about the physical characteristics and life cycle of Douglas fir through discussion and observation, working in collaborative groups. In a class discussion, students explore qualities that help Douglas fir to be adaptable, and relate this knowledge to human adaptability.

Student Wondering: *What is the lifecycle of a Douglas fir tree? What makes it so adaptable and what can it teach me about being more adaptable?*

Learning Objectives	
Understandings	Knowledge and Skills
<p><i>Student will understand that...</i></p> <ul style="list-style-type: none">• trees have a distinctive life cycle that is similar to the human lifecycle.• trees are more resilient if they develop beneficial relationships.• Douglas fir is a powerful player in our environment	<p><i>Student will be able to...</i></p> <ul style="list-style-type: none">• identify Douglas fir.• understand the different stages of a Douglas fir life cycle including seed, sapling, adult tree, pollen cones, seed cones, and nurse log.

NGS Standards: Performance Expectations		
Scientific and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none">• MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.	<ul style="list-style-type: none">• LS1.B: Growth and Development of Organisms	<ul style="list-style-type: none">• Cause and Effect

Vocabulary: Evergreen, conifer, adaptable, stamen, germinate, fertilize, photosynthesize, symbiotic, snag, decompose, nurse log, aril, monoculture

Background: Douglas fir is one of the most common trees in our region and many students are familiar with it. This lesson helps students to understand the lifecycle of Douglas fir from seed to nurse log, as well as why it is so successful at growing in many different environments.

Materials

- Outside: Find a Douglas fir tree that is large enough for students to see typical characteristics including leaves, woody cones, and furrowed bark.
- Inside: Bring in enough samples of Douglas fir branches and woody cones for each group to look at. If possible, also bring a few samples of pollen cones (spring only), bark, and pitch to pass between groups. Project a picture of Douglas fir on a screen or pass out photos of the tree so that students can see the overall shape.
- *Douglas Fir Lifecycle Cards*
- *Getting to Know Douglas Fir Questionnaire*

Preparation: Read the *Douglas Fir Overview*. Print *Getting to Know Douglas Fir Questionnaire* and *Douglas Fir Lifecycle Cards* so that each group of four to six students has a set. Cut out cards for each group. If you are teaching inside, gather Douglas fir samples for each group and have a picture of Douglas fir ready to project on a screen or print copies for students to look at.

LESSON: THE LIFECYCLE OF DOUGLAS FIR

INTRODUCTION

5-10 MINUTES

Share: We are going to explore the life of a Douglas fir tree from pollination to decomposition. (Choose information from the *Douglas fir Overview* that fits your students' knowledge level including:)

- Douglas fir is an **evergreen conifer**, meaning that it has needles that stay green all year long and it has cones. It is the most common evergreen conifer in our region.
- Douglas fir is the second tallest tree in the world after the California redwood. Before humans started logging it may have been the tallest. The biggest tree is 393 feet tall, which is more than the length of a football field, and over 1,400 years old – 18 times longer than the average human life in America!
- Douglas fir wood is strong, flexible, and lightweight. Imagine how tall and straight the trunk is. It can bend in the wind and not snap. Water and food for the tree are carried all the way from the roots to the crown. Humans have not been able to invent a better building material than wood.
- Douglas fir is **adaptable**. It can grow and survive in many conditions including the wet, windy Pacific Coast, the cold, snowy mountains, wet rainforests, and dry, open prairies. Ancient Douglas firs in the central Cascade Mountains have survived many environmental changes. These trees sprouted perhaps 1,000 years ago, during a warming period called the "Medieval Optimum." Even though it is too cold now for baby Douglas-fir trees to survive, the older trees have continued to live.
- Being adaptable means that you are able to adjust to many different conditions.

BOTANICAL NAMES

5-10 MINUTES

What's in a botanical name, and why do scientists use them?

Most of us know plants by their English common names, such as Douglas fir, which is named after 17th Century Scottish **botanist** David Douglas. However, Douglas fir is just one of many names for this plant. In the Lushootseed language spoken by Coast Salish people of the Puget Sound basin, Douglas fir trees are called č̥alc, or sč̥əbidac. č̥alc means "easy to split," and comes from the root word č̥əx, "to split." Each one of these common names tells us something about the plant and its natural and cultural histories.

Another type of plant name is the **botanical name**. Botanical names are helpful because they are a common language understood by botanists all over the world. Using a botanical name lets us know that we are referring to the same plant regardless of the many common names a plant might have. Botanical names follow a tree-like pattern of classification that also helps us to understand the natural and cultural histories of the plants we are working with. The most important classifications, or "clades," for beginning botanists are the **plant family, genus, and species**.

Plant Families: Like most conifers of the Pacific Northwest, Douglas fir is a member of the Pinaceae family. In addition to Doug fir, pines, hemlocks, true firs, and spruce are also all members of this family. One easy way to know that a native tree is a member of the Pinaceae family is that all of these trees have needles (as opposed to scales, as in western red cedar), and dry, scaly cones (as opposed to arils, as in Pacific yew).

Genus and Species: Each and every plant in the world has been given a unique two-part botanical name. This is called the **binomial system of nomenclature**, and was brought into common usage in the 1700's by Swedish botanist Carol Linnaeus. The first part of the botanical name is the genus and the second is the species. For example, Douglas fir's botanical name is genus: *Pseudotsuga*, species: *menziesii*. Most botanical names derive from Latin. In Latin, Pseudo means false. The second half of the genus name -tsuga, refers to the genus hemlock. So, the word *Pseudotsuga* means false hemlock, presumably because it was mistaken for hemlock at some point in time in the past. However, Douglas fir's common name is also misleading, as Douglas fir is not technically a fir at all. "True" firs are members of the genus *Abies*, which Douglas fir does not belong to. *Menziesii* is the species, and it is named after the surgeon/naturalist Archibald Menzies, who explored the Salish Sea in 1791 on Captain Vancouver's expedition around Vancouver Island. Until very recently, most physicians like Menzies were also highly skilled botanists, as plants played a central role in medical practice.

HANDS-ON ACTIVITY

20 MINUTES

Breakout Groups: Break students into groups of four to six. Give each group samples of Douglas fir needles, cones, bark, and sap and one *Getting to Know Douglas Fir Questionnaire*. Have students work together to look at samples and fill out the questionnaire (5 minutes).

All-Group Discussion: Have students share answers to the questionnaire. Either call on groups or ask for volunteers to answer each question. Answers include:

- Needles – are all the same length, pointed but not sharp at the tip, and spirally arranged around the branch like a bottlebrush. They smell like citrus and pine when crushed.
- Cones – male cones are small and produce a massive amount of golden pollen that is carried in the wind. Larger female cones are on the same tree, hang down, look woody, and have 3-pronged bracts that resemble the tail and rear feet of a mouse. Story Connection: Tell the story of how Douglas fir cones got mice stuck in the cones from the *Douglas Fir Overview*.
- Bark – young bark is grey and smooth with resin blisters, but when the tree trunks grow over a foot in diameter, the bark begins to turn corky, reddish-brown and becomes deeply furrowed, making it the “grooviest” tree in the forest.
- Pitch – can be liquid or get hard over time. It has a strong smell resembling pine and citrus. It is very sticky. Pitch is the medicine of the tree and helps to heal wounds, fight infection, and repel insects.
- Overall tree shape – the lead branch at the top sticks straight up and upper branches swoop up toward the sky like arms lifting skyward in a U shape.

Lifecycle Activity: Pass out lifecycle cards to groups. Have each student read a card to the group. Their challenge is to guess the correct order of the Douglas fir lifecycle. Have them line the cards up or have the students line up in the correct order.

TYING IT TOGETHER

15-25 MINUTES

Act it Out: Have each group create a short play, song, poem, or other rendition of the lifecycle of Douglas fir that is a maximum of two to three minutes. Students can plan for 5-10 minutes and then share with the class.

Reflection: Have students do a group reflection, answer popcorn style, or do reflective writing.

Ask: *How is my life like Douglas fir? How is it different?*

DIGGING DEEPER

Explore Wind Pollination: Conifers developed wind pollination far before the evolution of flying insects. While scientists consider this to be a “primitive” form of reproduction, it serves conifers well. There is almost always wind over a forest. They do not have to expend large amounts of energy making showy, fragrant, and nectar-filled flowers to attract pollinating insects or birds.

Douglas fir male cones grow in greater profusion on the lower half of the tree so that they are likely to blow pollen to the cones of a different tree, thus promoting genetic diversity and creating trees that are more likely to adapt to environmental changes.

Female cones turn upward during pollination and the shape acts like a wind turbine specifically engineered to funnel male pollen toward their ovules. Once fertilized, the seeds mature and develop a wing that helps them to fly a distance from the mother tree.

Explore Forest Diversity versus Tree Monoculture: Douglas fir plantations are frequently planted for timber. What is the difference between a Douglas fir forest and monoculture? These notes are adapted from the book *Tree: A Life Story* by David Suzuki and Wayne Grady:

Diversity offers resilience and adaptability. There is individual gene diversity within each species, many different kinds of species within habitats, habitat variety within ecosystems, and a great array of different ecosystems around the planet. This diversity has given life its resilience within the biosphere. Monoculture, the spreading of a single species or genetic strain over a wide area to the exclusion of other strains or species, is the antithesis of diversity and makes a species or an ecosystem vulnerable to changing climatic conditions, predators, pests, or diseases – as we have learned at great cost through the experience of agriculture, fisheries, and forestry. Also see the book *The Hidden Life of Trees* for differences between trees in a forest and trees that do not develop relationships with other trees and fungi.

Douglas Fir Art Project: Have students make a poster about the lifecycle of Douglas fir. They can either draw or make a collage.

POLLEN CONES

Pollen cones are the male flowers of a plant. They are small, gold-colored, and can be so numerous that the entire tree looks gold. Each pollen cone has a central spine covered in **stamens** with tiny sacs full of pollen on the tip. These burst open and catch a ride on the wind. The shape of the pollen helps them fly into female Douglas fir cones. Once the pollen is shed, the cones wither and fall from the tree.



SEED CONES

Seed cones are the equivalent of female flowers on a conifer tree. Instead of having petals, they have scales that are spirally arranged around a central spine. Each cone carries ovules with eggs. Once **fertilized** by pollen, they turn into seeds. The cones become sealed with wax and resin to protect the growing seeds - shedding water in springtime and retaining water during the dry summer months. When the seeds are fully developed in autumn, the scales open and the seeds fly in the wind.



SEEDS

Seeds are nestled within the scales of the female cones. Each has a wing to help it fly a distance from the mother tree. Hungry birds, squirrels, and other animals also help scatter seeds. Each seed contains everything it needs to get a good start on life – a small root, a stem, and five to seven leaves, plus enough food to nourish its growth until it can make its own food. Douglas fir seeds can lie dormant for years until the right amount of nutrients, water, and sunlight are available for germination.



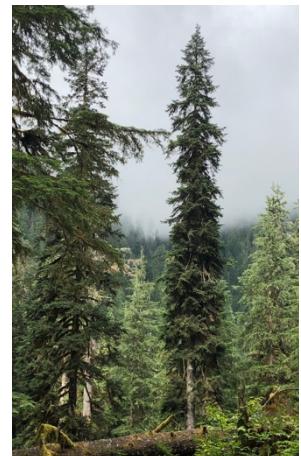
SAPLING

A tiny Douglas fir tree uses water, nutrients, and energy from the sun to make sugars for food in order to grow. Larger trees including the mother can connect to the sapling's roots and share their nutrients to help it grow. The sapling will better survive if it builds **symbiotic** (mutually supportive) relationships with fungi and other trees. Through root connections, the sapling shares its sugars with fungi, and fungi help the sapling stretch out its roots so it can get more water and nutrients from the soil.



ADULT TREE

A fully-grown Douglas fir has an extensive root system, a tall trunk, and a massive canopy. Roots break up soil, release minerals and nutrients, and feed soil organisms. They suck water up from the soil through hundreds of feet of trunk, purify it, and then release it into the air—helping to form clouds. During the day, needles breathe in carbon dioxide and breathe out oxygen, reducing greenhouse gases. About a third of the needles fall off each year and become nutritious soil, which houses and feeds many plants, fungi, and invertebrates including spiders, mites, and millipedes. Douglas fir grows a *lot* of seed cones each year, which feed birds, squirrels, chipmunks, voles, and other creatures. Only a tiny number of those seeds will grow into baby trees.



NURSE LOG

Even when a tree dies, its life is far from over because it gives back those nutrients it's gathered over its lifetime and helps other organisms to live and grow! Standing **snags** become home to wood-eating insects, bacteria, fungi, and plants that break down the wood. Woodpeckers and other birds eat insects and create little holes in the tree where other animals make homes. When Douglas fir trees fall down, they can take hundreds of years to **decompose**. These "**nurse logs**" become a home for moss, lichens, fungi, red huckleberry, and hemlock and cedar trees.



DOUGLAS FIR: FOOD AND MEDICINE

Time: 50 minutes
Season: Any season
Age: Grades 4-12
Setting: Indoor or Outdoor



Overview: Students learn about how Douglas fir is used for food, medicine, and traditional technologies. In a hands-on activity, they make and sample either tea or lip balm.

Student Wondering: *How can I use Douglas fir for food and medicine?*

Learning Objectives	
Understandings	Knowledge and Skills
<p><i>Student will understand that...</i></p> <ul style="list-style-type: none">plants develop characteristics that help them to adapt to different environments and weather conditions.plants and humans are adaptable.	<p><i>Student will be able to...</i></p> <ul style="list-style-type: none">identify Douglas fir.understand three ways Douglas fir shows adaptable characteristics.understand the different stages of a Douglas fir lifecycle including seed, sapling, adult tree, pollen cones, seed cones, and nurse log.

NGS Standards: Performance Expectations		
Scientific and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none">MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.	<ul style="list-style-type: none">LS1.B: Growth and Development of Organisms	<ul style="list-style-type: none">Cause and Effect

Vocabulary: Evergreen, conifer, adaptable, nutrients, electrolytes, topical, aerosols, terpenes

Background: Douglas fir is a common tree that is valued for many purposes. The young tender needles are harvested for food and for tea in the springtime. Older needles can also be used for tea. The needles and pitch are used as a topical medicine because they fight infection and are high in compounds that stimulate healing.

Materials: See recipes for materials. If you are doing this lesson indoors, gather samples of Douglas fir including branches, cones, bark, and pitch for students to learn identification characteristics. You can also project or print the Douglas Fir Lifecycle Page (see the end of this document).

Preparation: Review the *Douglas Fir Overview*. Choose a hands-on activity that fits the season, supplies at hand and your students' interest. Possibilities include making a Douglas fir tea or making a lip balm.

LESSON: DOUGLAS FIR - FOOD AND MEDICINE

INTRODUCTION

5 MINUTES

Begin by showing students an image or a sample of Douglas fir. **Ask:** What do you know about Douglas fir? Give students a chance to respond. Fill in information. For example:

- Douglas fir is the second tallest tree in the world and it can live to be over 1,000 years old!
- *How do we identify Douglas fir?*
 - Needles are dark green on top and have two white lines on the underside. They are spirally arranged around the branch like a bottlebrush and are pointed, but are not sharp to touch.
 - Male cones have pollen, are small, and come out in springtime.
 - Female cones are larger than male cones, are woody and have seeds. Each scale has a 3-pronged bract that looks like a mouse's tail and back feet. (Have a student tell the story of how mice got stuck in cones, or tell it yourself if they have not heard it).
 - Bark is reddish-brown and deeply grooved, making it the "grooviest tree in the forest." It can grow to be 12 inches thick!
 - The top of the tree points straight up.
 - The upper branches look like arms reaching toward the sky in a U-shape.

(You can project or print the Douglas Fir Lifecycle Page)

- Douglas fir is **adaptable**. It can grow and survive in many environments, including the high mountains, the beach, dry, open sites, and wet, shady forests. It has waxy evergreen leaves that retain water on hot summer days and repel water on wet days. Because its leaves are evergreen, Douglas fir continues to photosynthesize and grow during the winter. Douglas fir can also withstand extremely cold temperatures without freezing. Through a process called supercooling, liquid inside the cells stays a liquid instead of forming ice crystals. By not having any minute particles inside the cell or having any rough surfaces on the cell walls, ice is not able to crystallize because there is nothing to adhere to. This capacity allows Douglas fir to survive in higher elevation habitats, where many lowland conifers cannot. Mature Douglas fir is known as a fire "resister," because its thick bark allows the trees to survive low to medium severity fires. Like many conifers, Douglas fir can also change its surrounding environment to meet its own needs. During hot, dry weather, the trees emit **aerosols** (small airborne particles) called **terpenes** from their needles. This process is known as "cloud seeding," and facilitates moisture and sometimes even rain in the forest canopy.

Douglas Fir Uses: **Share:** Douglas fir supports people in being adaptable to their environment in many ways, including providing lumber, food, medicine, pitch, oxygen to breathe, shelter and much more.

- Wood: Douglas fir wood is strong, hard, and resilient. It yields the highest amount of timber of all trees in North America. It is used for lumber, plywood, pilings, marine structures, railroad ties, flooring, furniture, pulp, and many other things. The wood and bark make excellent fuel for fires.
- Needles: In late spring, tiny, brown buds at the tips of evergreen tree branches swell and open into tender limey-green needles. They have a refreshing lemony flavor and are energizing because they are high in nutrients including vitamin C and electrolytes. Tips can be eaten straight as a trail snack, put into salads or sauces, added to baked goods, or brewed for tea. Some people call the tea the original energy drink, or "Nature's Gatorade." People use Douglas fir needles topically because they contain vitamins and other nutrients that support immune function and promote healing. The needles are finely chopped and infused in oil that can be made into body oil, lotion, lip balm, or salve. They are also used in baths.
- Pitch: Douglas fir produces large amounts of fragrant resin, or pitch. You may notice it where the trees have been injured from lightning, lost branches, been scraped, or attacked by insects. It is a honey consistency at first and becomes very hard as it ages. The liquid pitch can be placed directly on wounds or insect bites to speed healing. Pitch is also used as a fire starter, incense, and waterproofing.

HANDS-ON ACTIVITY (*choose one*)

Douglas Fir Tip Tea

10-20 MINUTES + sipping time

You will need: A strainer, a pot or jar with water, tree tips, and paper cups. Make sure you have hot cups if you are serving a warm tea.

Harvest young Douglas fir tips when they are limey-green and tender - usually April-June. You can do this ahead of time with students. Remind harvesters that they are pruning the tree and to only take a little bit from each branch. Tips can be preserved in the refrigerator for several days or in the freezer for several months. You can also dry them in a basket or a food dehydrator. If you missed harvesting spring tips, try drying older needles for tea. They are tasty, refreshing, and have a slightly more astringent flavor. Have students help you make the beverage and then do a tasting.

- Sun Tea: Rinse the tips to remove any dirt or insects and place in a large jar to make tree tip-flavored water. Add a large handful of evergreen tree tips per each quart of water to a glass container with a lid. Let the tips infuse in the water for several hours to overnight. Show students the tea and strain it out with them so they can see the whole process.
- Hot Tea: This tea tastes stronger and is more astringent than sun tea. Gather and dry branch tips with mature needles in any season and make a hot tea by using about 1 tablespoon of crushed needles per cup of hot water and steeping it for 15 minutes. Cover with a lid to retain aromatic oils. If you are short on time, make the tea ahead of time and serve to students.

- Tree Tip Lemonade: Place one to two cups of tips in a large jar or pitcher with six cups of water. Cover and let steep in the sun or a warm place for 4-6 hours. Strain. Add the juice of three lemons or about $\frac{1}{4}$ cup of lemon juice and two to three tablespoons of honey (dissolved in hot water.) Mix and serve over ice.
- Winter Tree Tea: Mix equal parts dried Douglas fir needles with rose hips. You can harvest the Douglas fir needles any time of year. Spruce and true fir needles will also work. Steep 10-15 minutes. This tea is a favorite around the holidays and helps to fight off colds.

Discuss the differences between sugary energy drinks and Douglas fir tea. Ask why Douglas fir is called "nature's Gatorade" and "the original energy drink".

Douglas Fir Oil and Lip Balm

This is a two-part activity. Either make the tree infused oil ahead of time and have students strain it, or make the oil in class one day and then follow up by turning it into lip balm another day. Have students participate in as much of the process as possible. For example, they can chop the tree leaves, press out the oil, measure, stir and pour the lip balm, and make their own labels.

Infused Oil:

SEVERAL HOURS

You will need: Fresh Douglas fir needles, extra virgin olive oil, scissors, a blender or food processor, a double boiler, a burner, muslin cloth, a glass container (canning jar).

1. Harvest clean and healthy looking branches from Douglas fir trees.
2. Have students pull needles off branches. Either finely cut needles with scissors, or place them in a food processor or blender to finely chop them. This will help open cell walls in the plant and extract the scent and medicine more readily.
3. Place the chopped leaves or needles in a double boiler. Cover with oil so the oil is about $\frac{1}{4}$ to $\frac{1}{2}$ inch above the plant material. Heat very gently to hasten extraction and help remove water from the plant material. Keep the temperature low so it does not boil. You can turn the double boiler on and off as needed. The oil should take on a green color and strong smell. Allow the oil to infuse for several hours. You can leave it for several days, occasionally bringing the oil to a warm temperature and stirring it.
4. Strain the oil with muslin cloth and allow it to sit for an hour or more. If there is sediment or water remaining in the oil, it will fall to the bottom.
5. Pour the oil into a glass storage container, leaving water and sediment behind. Label and store in a cool dark place for up to a year.

Lip Balm:

30 MINUTES

You will need: a Pyrex measuring cup (8 or 16 oz.), a 1 pound scale that measures ounces, beeswax, essential oil, lip balm or salve tins, and labels.

1. Measure ingredients. Use 1 part beeswax by weight to 4 parts Douglas fir infused oil by volume. One half cup of oil and one ounce of beeswax will make about 25 - 1/16 ounce roll up tubes.
2. Gently heat the oil and beeswax in a double boiler until the beeswax is just melted.

3. Turn off heat and add 10 to 15 drops of pure essential oil per 4 ounces of oil. Nice options include Douglas fir, fir needle, grapefruit, sweet orange, and lavender.
4. Pour the lip balm into the tubes and allow it to cool before placing the caps on.
5. Label. Standard address labels work well for lip balm tubes if you cut off about 1/4 of the length of the label. Students can make their own, or you can print them ahead of time.

TYING IT TOGETHER

Have each student share one thing that they will remember about Douglas fir with a partner, a small group, or in reflective writing time. For homework, ask students to identify a Douglas fir tree in their neighborhood. Can they find the tips, male and female cones, and pitch? Have them teach a friend or family member what they have learned.

DIGGING DEEPER

[Make Evergreen Bath Salts](#): See *Evergreen Conifer Overview* and lessons.

[Ethnobotany Research Project](#): Research people's relationships with Douglas fir. Research might include a study of traditional uses, the timber economy, Douglas fir as invasive species, etc.