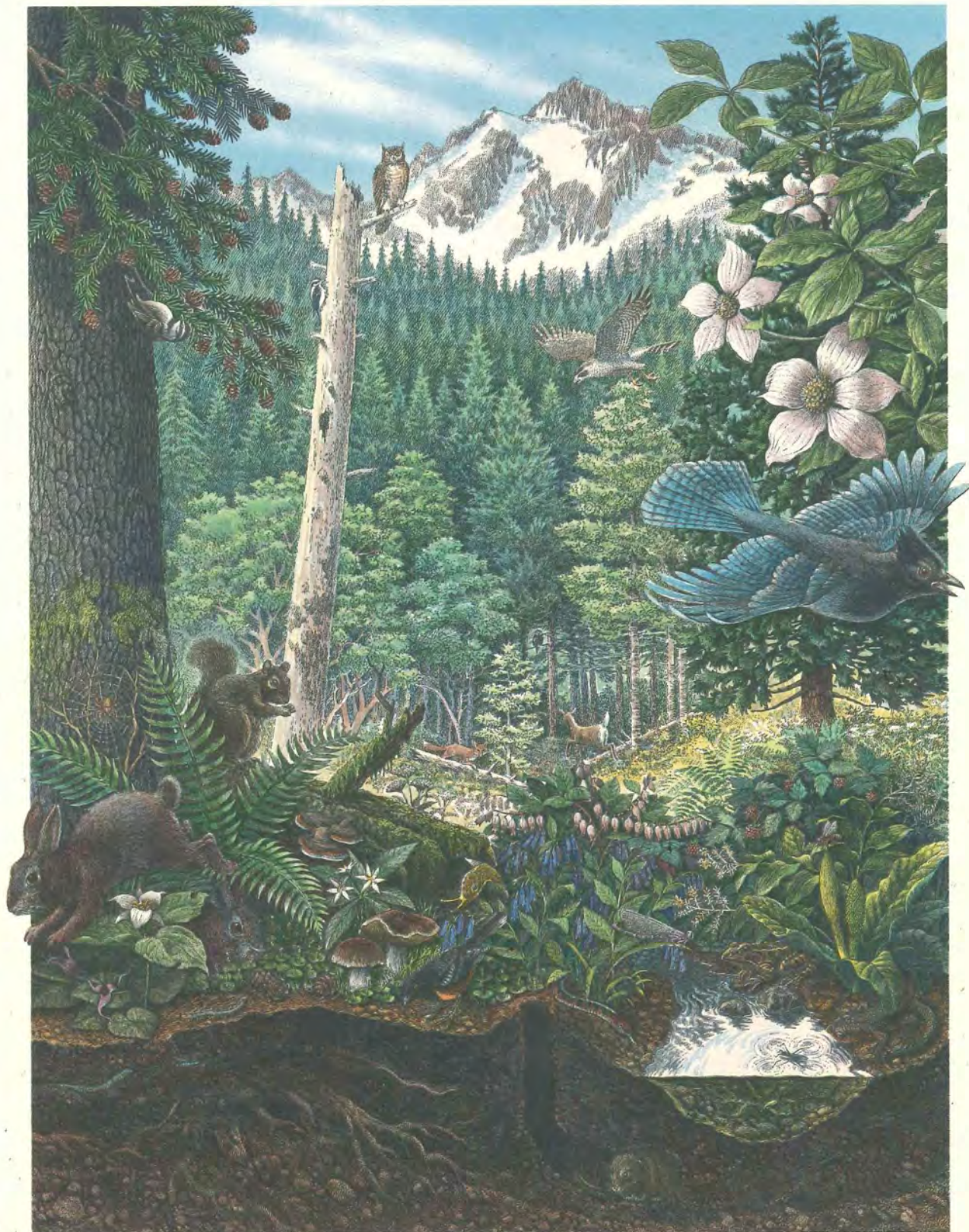


Forests of Washington

Forest Ecosystems and People



Activity Guide Grades 4-9

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Activity Guide Grades 4-9



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Preface

Ask any Washingtonian where in the world they would most like to live, and invariably the answer will be “Washington state.” We have it all — ocean beaches, breathtakingly beautiful mountains, desert landscapes, lakes, rivers and farms. Woven through and around it all, we have forests — miles and miles of rich, life-giving bountiful forests. People of Washington have basic understandings of the complex relationships between people and our forests. We know that we depend on the forests for recreation, wildlife habitat, clean air and water, jobs and products. We know that our state relies heavily on a forest-based economy.

However, projections indicate that by the year 2010 our state's population will grow from about 4½ million to somewhere around 6 million, an increase of 30 percent. Some of these 1½ million people will be born here, but many will move here from other places around the globe. What will newcomers think of our forests? And what decisions will they demand be made on behalf of our forests?

Traditionally, people have differed about the appropriate uses of natural resources. Accordingly, the issues surrounding forests are more involved than simply preservation versus harvest. Rather than ignore these differences and the difficulties involved, our young people, as policy and decision-makers of the future, need to be equipped with the knowledge and skills to tackle real life issues. **Forests of Washington** offers students opportunities to gain in-depth knowledge about our forests and helps them refine critical-thinking and decision-making skills.

The learner enters **Forests of Washington** as he or she would enter the forest — with eyes and minds open to experience the rich diversity of life that exists there. Proceeding further, the learner comes to understand the ways in which our lives are affected by the existence of our different forests and how our lives, in turn, affect the forests. The learner leaves **Forests of Washington** with a clearer idea of each individual's and society's obligation to make intelligent decisions and take appropriate actions.

Young people need experiences that will help create within them a sense of place — experiences that foster a connectedness to the land and all our resources. As educators we can give students a gift — a gift of wonder, involvement and learning experiences preparing them for a world beyond the classroom, ready to meet the challenges of today, as well as the future.



Douglas Fir

Introduction

Since the 1970s, **Environmental Education ABOUT FORESTS** has offered Project Learning Tree workshops to thousands of Washington teachers. These workshops have been enthusiastically received, but many teachers have expressed a desire for information specifically related to Washington forests. In the early 1990s, teams of classroom teachers, environmental educators, resource management personnel and school administrators worked together to produce **Forests of Washington**, comprehensive environmental education resource guides with an emphasis on the trees, wildlife, forest regions and issues relevant to our part of the country.

Also in the early 1990s, Washington public schools were mandated to incorporate environmental education into all subject areas. **Forests of Washington** enables teachers to meet the mandate through the use of lessons integrating social studies, language arts, science, art, physical education, music and math.

Environmental education is more than the mechanics of integrating subject areas. Good environmental education is student-centered, requiring the teacher to step out of the traditional role of content specialist and into the role of facilitator — teaching students how to learn, rather than what to think. Environmental education gets young people out of their seats and into the community, helping them discover a world of beauty, relevance and intricate relationships. Environmental education does not necessarily spur us to political action; rather, it helps a student wonder, care, make responsible decisions and work to make the Earth a better place to live.

The challenge in creating quality environmental education materials requires that we set our personal biases aside. Activities need to encourage students to investigate, explore, think and come to their own conclusions. For guidance, **Forests of Washington** uses the Superintendent of Public Instruction's (SPI) Environmental Education Guidelines for Washington Schools as a basic framework.

The Environmental Education Guidelines for Washington Schools and the **Forests of Washington** activity guides incorporate the following goals:

1. Students will develop knowledge of the components of the environment and their interactions.
2. Students will value the environment as the basis of our physical lives, economy and emotional well-being.
3. Students will apply personal decision-making skills to enhance environmental quality.
4. Students will develop and utilize the knowledge and skills necessary for cooperative action on behalf of the environment.

Lessons and activities are divided into four units, each corresponding with one of the four goals. By using **Forests of Washington**, teachers guide students through a learning process in which they develop a knowledge of ecosystems and an awareness of the connections between humans and the environment. Students also develop better decision-making skills and identify, plan and implement community-based projects. This learning process is applied to the specific content of Washington's forests: the trees, wildlife, forest regions, watersheds and issues unique to our state. A video and poster accompany the activity guides, and suggestions for their use are found in several activities.

The lessons in **Forests of Washington** are designed to be used sequentially or as stand-alones. Sequential lessons will form a unified study unit, yet each lesson is self-contained and can be incorporated into the regular curriculum.

The resource materials have been extensively field tested by individual classroom teachers, and have been utilized at a number of teacher education workshops. Comments, suggestions and ideas have been systematically incorporated into the activities. The materials have also been analyzed by resource management personnel, forest industry representatives, environmental educators and school administrators. This scrutiny proves **Forests of Washington** to be comprehensive, value-fair, high quality environmental education learning resources.

The most effective environmental education programs emphasize student interaction with the natural and social environment. **Forests of Washington** encourages you to use the out of doors, and to utilize your local social processes, such as government, law, economics and communications. Our local communities provide educators and students with the most relevant learning resources. We hope that you will find these materials worthwhile and exciting to use on your quest to learn more about our environment.

Lynne Ferguson
Director, Environmental Education ABOUT FORESTS
Washington Forest Protection Association

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Opening Activity

Learning Outcome

Students will be prepared to learn about Washington's forests.

Learning Procedure

Use the introductory video *About Forests: Forest Ecosystems and People* that comes with this activity guide. The video is an overview of some of the things students will learn as they study the forests of Washington.

Ask students what they think topics for study will be or what they would like to learn about forests. (Either list their ideas on the board or have them write their expectations on a piece of notebook paper.) Have students draw pictures of forests.

What Does the Video Tell Us? View the video and discuss with students its contents compared to the list they generated prior to seeing the video. Which of the students' predicted topics were covered? Add to the list points of information in the video students did not predict. What more would they like to learn?

What Do We Want to Know? Watch the video again, this time asking students to write questions that come to mind as the information is presented. (Encourage all types of questions: "Why, where, when, which, who, what, what if....") Post students' questions in the room and refer to them as the weeks go by. See how many questions are answered by using the **Forests of Washington** activity guides. (If some questions are not answered, discuss how to find the information from another source, and follow up with library research or letter-writing.)



Skills

Prediction, observation

Subject Areas

Language arts, social studies, science, art

Materials

Video*

Paper

Drawing supplies

* Provided



Big Leaf Maple

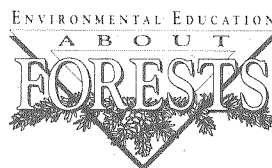
Unit I

Washington Forest Ecosystems

Washington State Environmental Education Goal 1:

The student will develop knowledge of the environment's components and their interactions.

1	There's No Place Like Home.....	4
	A look at soils, climate and topography	
2	Getting to Know Trees of Washington.....	12
	Tree species identification	
3	Here's Looking at Yew.....	22
	Diversity and the Pacific yew	
4	Forest Homes	28
	Habitat layers and wildlife in Washington	
	Wildlife: Beaver and Eagle Activity	
5	Come Grow With Us.....	54
	Forest regions of Washington	
6	Washington Forest Eco-Connections.....	62
	Understanding forest webs	



There's No Place Like Home

Background Information for Teachers

It is no coincidence that Washington is called the Evergreen State: green forests dominate much of the landscape. The types and sizes of trees in Washington's forests differ from one part of the state to another. Many factors such as soil type, climate and topography contribute to these differences. The following outlines some of these influences on Washington trees:

Skills

Cooperative learning, discussion, observation

If **More Ideas** section is used:
compare/contrast, cooperative action

Subject Areas

Science, geography, drama, language arts

Materials

Physical map of Washington*
(student copies & transparency)

Picture of sub-alpine fir*
(for evaluation)

* Provided

Soil: The structure of soil determines its water-holding capacity. Sandy soil dries out quickly, though it allows good air flow. Clay soil retains water but allows little air flow, and when dry, is hard and difficult for roots to penetrate. Most soils occur in combinations along with varying amounts of humus (decayed organic matter), bacteria, fungi, invertebrates and rocks. Washington cannot be divided into "soil zones" because all types of soils occur in every part of the state. However, it can be said that the higher the elevation, the shallower the soil becomes. At the timber line soils are still primarily glacial drift (sandy and gravelly). In some locations in the Puget Sound region glacial drift from the Ice Age can be found near the surface. Soils on forest floors have much more humus than soils in other places. In river valleys soils usually are deeper due to alluvial action.

Water: Rainfall in Washington forms a pattern. The coast and coastal mountains receive the most rain (except for a rainshadow effect on the north and east sides of the Olympics). The Puget Sound lowlands and western Cascades have a fair amount of rain while eastern Washington receives very little because of the rainshadow effect of the Cascades. Rainfall is a major factor determining where trees grow in Washington.

Air: At first glance, it makes sense to say the air over Washington is the same everywhere. However, because of topography, population and climate, the air in such areas as Puget Sound and Spokane is usually more polluted than the air in rural locations. Pollution creates problems for urban forests on both sides of the Cascade Mountains.

Temperature: Temperatures in Washington also form a pattern. The least variation in temperatures occurs on the coast. The maritime climate remains cool and moist except for periods in summer. Puget Sound lowlands are cooler in winter and warmer in summer than the coast, but the climate still is mild. Eastern Washington experiences a huge swing in temperatures. The summers are hot and dry; winters are cold and dry overall, though there is snow (a valuable source of soil moisture). Freezing nighttime temperatures are not uncommon in eastern Washington from October to May. Northern Washington temperatures are slightly lower than those in southern Washington.

There are variations to the temperature patterns of Washington. A gain in elevation leads to colder temperatures; snow rather than rain dominates the upper slopes of the Olympics and the Cascades. Exposure also affects temperature. For example, an unprotected hilltop is cooler than a south-facing canyon. Forests create their own microclimates by providing shade and windbreaks.

Learning Outcome

Students will understand the effects of soil, climate and topography in determining tree species in Washington.

Learning Procedure

What Helps a Tree Grow? Draw an outline on the board of two trees of the same species, one bigger than the other, and explain that both trees are the same age. Pair students and have them brainstorm to record as many reasons as possible why the two trees are different in size. Have teams share their thoughts with the class and note their ideas on the board. Ideas may include "different amounts of water," or "different amounts of sunshine." Conclude by listing factors that influence the growth of trees: **light, temperature, water, soil, air and genetics.**

Distribute physical maps of Washington to students and together identify and label the mountain and lowland regions. Consider each growth factor listed on the board. For example, ask students if the amount of **light** trees receive would be the same in all parts of the state. Point out that coastal areas where it's foggy or cloudy much of the time would receive less light than eastern Washington. (Refer to background information for discussion of differences in temperature, water, etc., throughout Washington.) Discuss

the ways trees adapt to different growing conditions. Talk about the varied conditions in Washington state and the numerous species growing here.

Demonstrate a Rainshadow: To set up a demonstration showing the rainshadow effect in Washington, take students to a dirt-covered or asphalt play area. Using sticks in the dirt or chalk on the asphalt, have students create an outline of Washington. (Before conducting this activity it might be helpful to have students look at a map so they know the state's general shape and approximately where its mountain ranges are located.)

Have a few students crouch along the coast to represent the lowland hills; have other students stand to represent the Olympics, the Cascades and the Blue Mountains. The remaining students are to represent clouds: each of them will have a saturated sponge and begin their journey above the Pacific Ocean. As they approach the lowland hills, they begin to "lose" some of their water by slightly squeezing the sponges. As they encounter the Olympic Mountains they lose additional water, more as they approach the Cascades and yet more as they reach the Blue Mountains. (No doubt you've already cautioned students not to squeeze the sponges directly over the "mountains!") Observe the moisture on the "west" side of the mountains and the dryness on the "east." If the clouds continue toward the Rocky Mountains, will the sponges become completely dry, or will there still be "moisture in the air?" Discuss why this is so.

Take a Close Look at Soil: Ask each student to bring from home a soil sample in a clear plastic container with a lid. Add water to the jars, shake and let them settle. Examine the layers. Usually there will be varying layers of sand, silt and clay, with organic material (humus) floating on top. Discuss why samples differ.

Have students write to schools in different parts of the state to exchange soil samples for further investigation.

More Ideas

1. Demonstrate the water-holding capacity of different soils by doing the following: Fill a large plastic pop bottle half full with sand. Fill another one with the same amount of clayish soil, and a third with humus (or compost or peat moss). Add to each bottle an equal portion of water. (Measure the water before pouring.) Cover each opening with several layers of cheesecloth secured with rubber bands and turn each bottle upside down, one at a time, over three separate containers. Let stand overnight. Measure the water you collect from each bottle and compare. Discuss why the amounts of

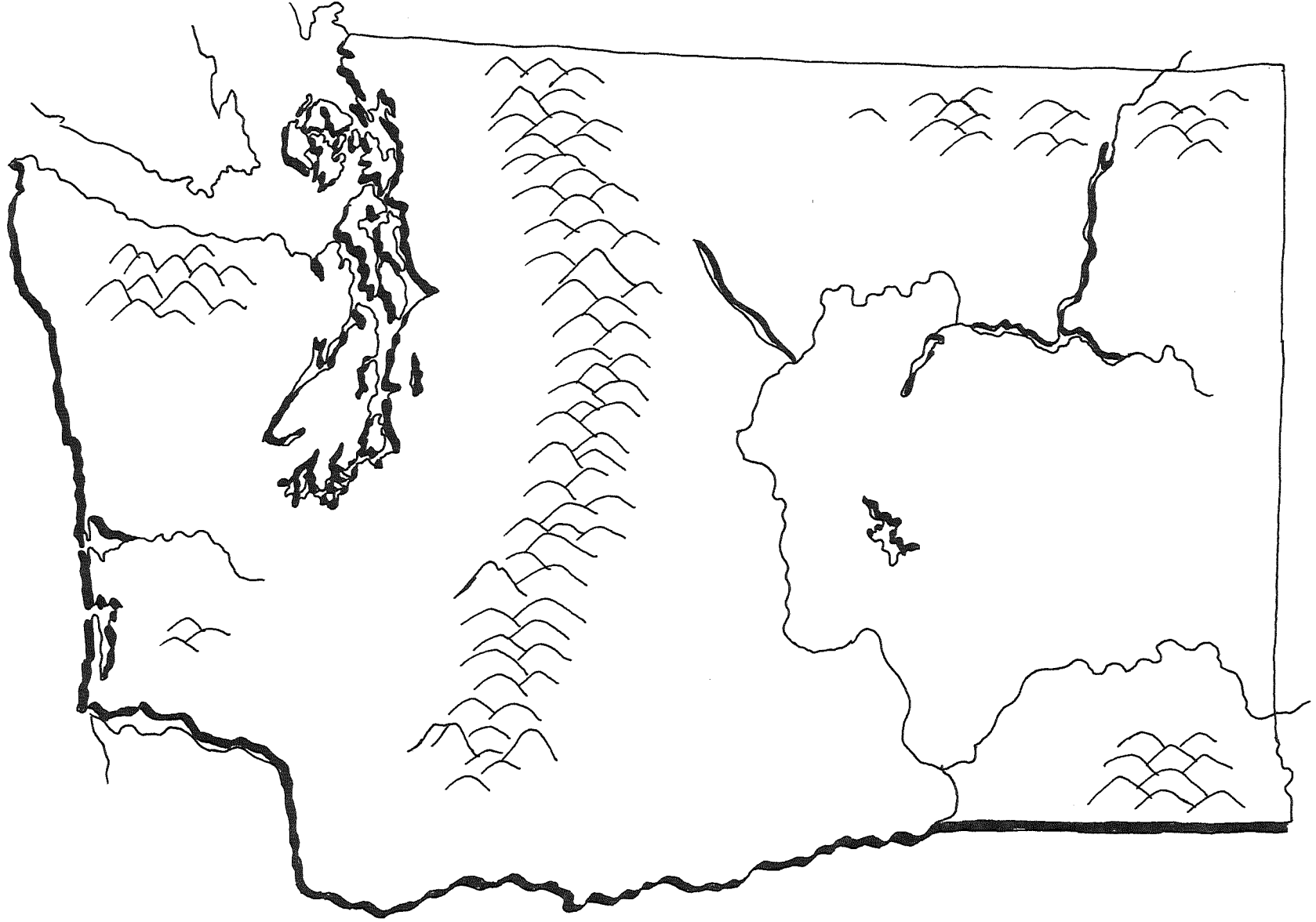
water were different and what implications this demonstration has for trees of Washington.

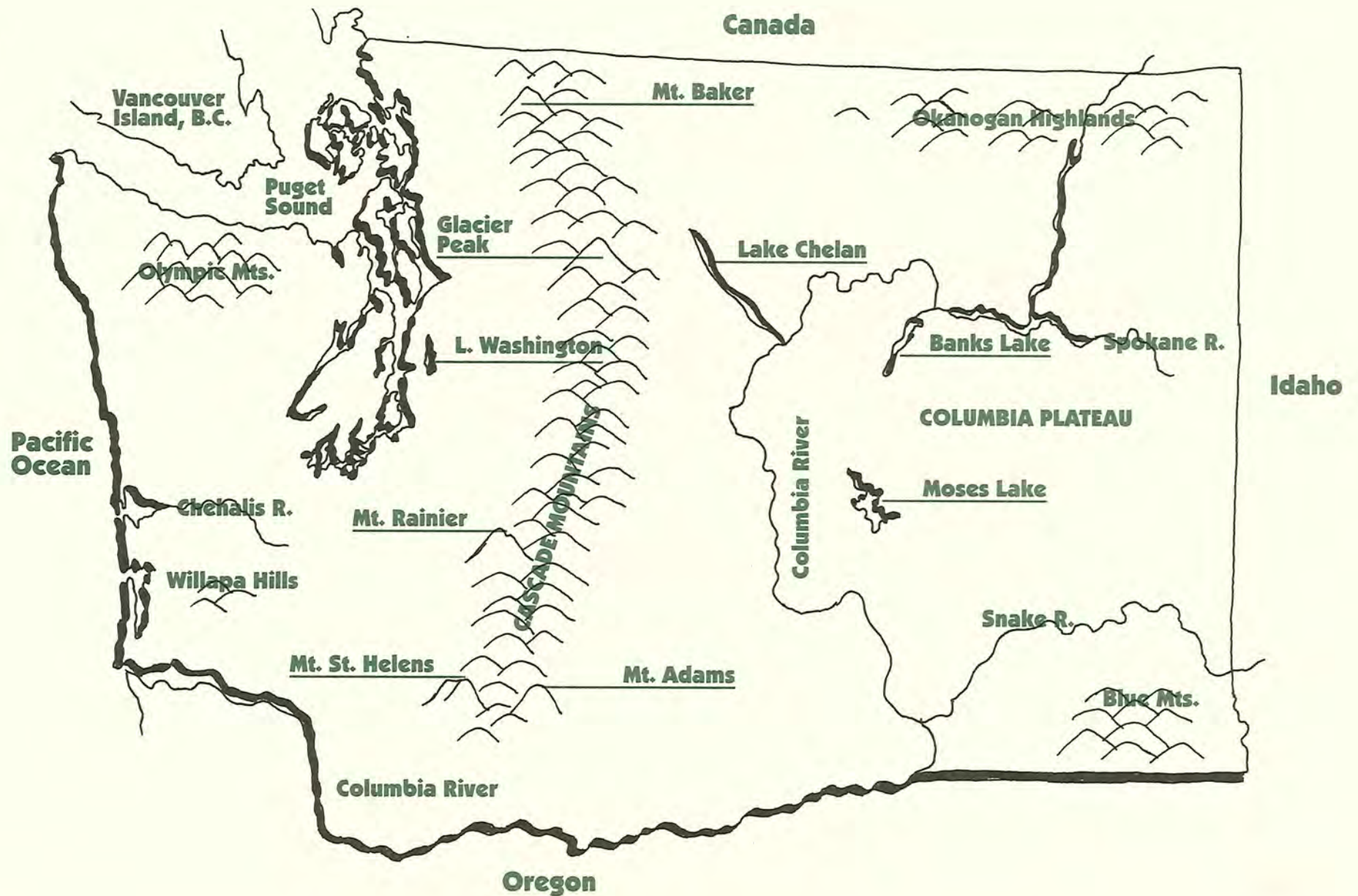
2. Determine the predominant type of soil in your community, then plant appropriate trees and small plants around the school, in a local park or in an area that needs vegetation.

Assessment: What Did We Learn?

Show students the picture of a subalpine fir. Explain how this tree grows at the tree line in the Olympic and Cascade Mountains where soil is shallow and rocky with rapid drainage. Note the winter temperatures are extremely cold. Tell students to write a paragraph explaining why subalpine trees do not grow alongside western red cedars that grow in the lowland forests of western Washington.

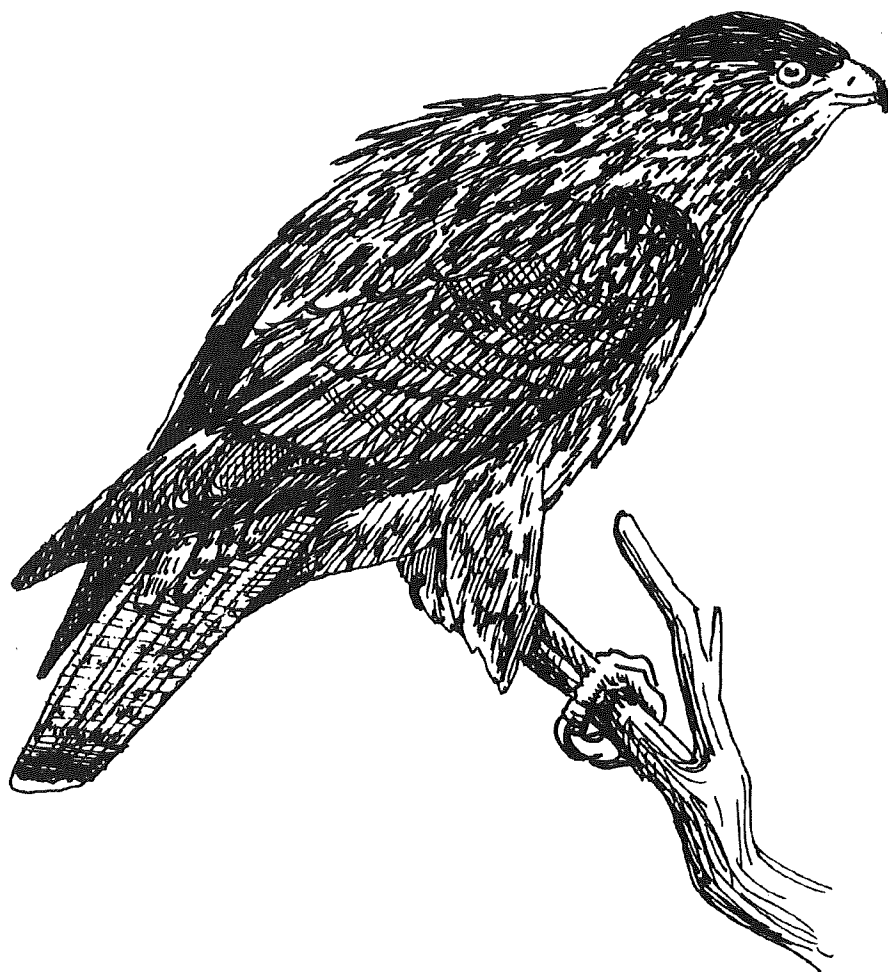






**Sub-alpine fir:**

This tree grows at the tree line in the Olympic and Cascade Mountains where soil is shallow and rocky with rapid drainage. The winter temperatures are extremely cold. Write a paragraph explaining why subalpine trees do not grow alongside western red cedars that grow in the lowland forests of western Washington.



Red-tailed Hawk:

Getting to Know Trees of Washington State

Background Information for Teachers

Skills

Discussion, cooperative learning, oral presentation, observation, tree identification, sketching, investigation, video technology (optional)

If More Ideas section is used:
Graphing, compare/contrast, taxonomic key, creative writing

Subject Areas

Speech, drama, art, language arts, science, geography

If More Ideas section is used:
Math

Materials

Leaves, cones and small branches from as many as possible of the eleven trees listed on the *Washington Trees* information cards

Paper for sketches, rubbings and story illustrations

Washington Trees information cards*

Paper for riddle books

* Provided

Washington is home to a wide range of native tree species. Trees, like all other living things, are adapted to their environment. The state's varied terrain and climate exert strong influences on what tree species are found in various regions of Washington.

Characteristics of Washington trees differ greatly. Hands-on observations of trees, their leaves, cones and bark will make tree identification an easier and more enjoyable task. Several tree terms, however, can be confusing. People often misconstrue the words "evergreen" and "conifer," thinking they are synonymous. They are not. A conifer is a cone-producing, needle-leaf tree. Most conifers are evergreens (trees that do not lose their leaves in the fall), but not all. For example, the western larch, which grows in the eastern Cascades and the intermountain region, has needles which drop each fall and renew each spring. The western larch is, therefore, a "deciduous" conifer. (Deciduous trees drop their leaves each fall.)

Similarly, people often equate "broadleaf" with "deciduous," but some broadleaf trees do not drop their leaves in the fall. For example, holly trees and Pacific madronas both keep their leaves all winter. They are, then, "broadleaf evergreens." The opposite of "evergreen" is "deciduous," and the opposite of "conifer" is "broadleaf." (Biologists define conifers as "gymnosperms" because their seeds are produced by cones. Broadleaf trees are "angiosperms" because their seeds are produced by flowers.)

Learning Outcome

Students will be able to identify eleven native tree species of Washington and recall one distinguishing feature of each tree.

Learning Procedure

Getting to Know Washington's Trees: Hold up pictures one at a time of the eleven trees on the Washington tree information cards. Ask students what they know about each tree. Have they ever seen that species? Where?

Assign students to eleven teams and give each team the task of reading one information card and reporting to the class about that tree.



Presentations can be simple oral reports with posters as visual aids or creative reports such as rap songs. Videotapings of students examining a living tree of that species or interviewing another student acting the part of a "talking tree" would also be interesting techniques.

Provide leaves, small branches of conifers and cones of as many as possible of the eleven trees and have students make sketches and/or do rubbings. If some of the trees can be found on school grounds or in nearby neighborhoods, visit the sites for observation and sketching.

Where Do Trees Grow? Create a bulletin board of Washington's trees by placing a map of the state in the middle and pinning up leaves, small branches, sketches, pictures, etc., of the eleven trees in a circle around the map. Put trees found in eastern Washington on the right side, trees of western Washington on the left and trees found in both parts of the state at the top or bottom of the bulletin board. Refer to the bulletin board once or twice a day to review what students have learned about the characteristics of the eleven trees.

Make a Riddle Book: Divide class into ten teams. Distribute one of the Washington Trees information cards to each team and have them read it together. Keep the card on western red cedars for an example. Explain the class will produce a riddle book about Washington trees, including the soil, climate and topographic factors that influence their growth. Each team will create one page which gives four clues about their tree on one side of the page and the answer with illustration on the back side. Two clues should be taken from the "growth requirements" section and two from the "characteristics and uses" section of the information card. (Recommend tree height not be used as a clue.) Do one example together:

1. I like wet soils.
2. I live in lowlands and on mountainsides of western Washington but not at high elevations.
3. Native Americans used my inner bark for weaving.
4. My heartwood is resistant to rot.

Who am I?

Answer: Western red cedar

Have teams share their riddle pages with the class, then bind the book. Read the book aloud once a day for a week, but each day change the order in which you read the pages. By the end of the week most students will be able to answer all eleven riddles.

More Ideas

1. Using information from the Washington Trees information cards, create a graph of average tree heights. See if any patterns exist. (Do trees on the west side of the state grow taller than those on the east side?) Discuss reasons for patterns.
2. Exchange pressed leaves or conifer cones and small branches with a class from another part of the state. Include photographs or videos of trees in your area. A video of your students examining and describing native trees from your part of the state would be a great teaching tool for teachers in different regions. (Note: Western hemlock branches can be preserved by laminating. Otherwise, the needles fall off within a day or two.)
3. Play a game in which each student has the name of a tree taped to her/his back. The student won't know the identity of the tree and must go around and ask other students "yes" or "no" questions such as, "Do I live in western Washington?" to determine the species. When the student guesses correctly, she or he is allowed to sit.
4. Have students compile a classification booklet for younger students with a simple key* for identifying the eleven native tree species. Pair your students with younger "buddies" to show them how to use the classification booklet.
5. Take students on a field trip to a forest, park or school grounds to find examples of tree species studied. Or, hike through the forest and identify trees by using the riddle clues.
6. Read a short legend about how something in nature came to be. (Use Rudyard Kipling's *Just So* stories as an introduction to legends.) Discuss what features are common to legends such as talking animals and the opening sentence, "Long, long ago." Explain that each student will write a legend about one of the eleven trees of Washington. Brainstorm about possible legend ideas to explain the following:
 - Why western red cedars resist rot
 - Why western hemlocks have droopy tops
 - Why Douglas fir cones have bracts (little "tongues" that stick out between the scales)

* The Washington State University Cooperative Extension publishes a guide, *Trees of Washington*, that contains an easy-to-use taxonomic key to Washington's native tree species. To obtain write: Bulletin Office, Cooperative Extension, Cooper Publications Building, Washington State University, Pullman, WA 99164-5912 and request Publication #EB0440.

Why Sitka spruce live in wet places

Why Pacific madronas have peeling bark

Why Pacific silver firs look silver

Why lodgepole pine cones open only when heated
by forest fires

Why big leaf maples have the biggest leaves
of any maple

Why red alder grow by rivers

Why ponderosa pines have the longest needles

Why western larch lose their needles each fall

Tell each student to write a legend and share her/his first draft with the class for feedback. After revision and editing, have students rewrite and publish their legends in bound books with cover illustrations.

Assessment: What Did We Learn?

For each picture of a tree the teacher holds up (or indicates on the bulletin board, or points out on a walk around the school grounds or neighborhood), students write the name and one distinguishing characteristic.



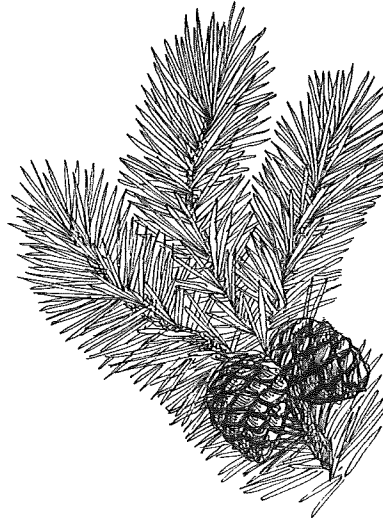
Washington Trees Information Cards



1. Western Hemlock *Tsuga heterophylla*:

- a. **Growth requirements:** The western hemlock grows throughout Washington where soils are generally moist, but not saturated (not wet soils). It prefers mild temperatures and germinates in shady places, particularly on nurse logs in forests. This tree generally grows in the lowlands and in lower mountain elevations.
- b. **Characteristics and uses:** The needles of the western hemlock are short and rounded, and its cones are small. This tree averages 125 to 175 feet in height and is identified easily by its graceful, lacy branches and drooping top. The wood is used for both lumber and pulp. In 1947, the western hemlock was named the Washington State Tree.

Washington Trees Information Cards



2. Lodgepole Pine *Pinus contorta*:

- a. **Growth requirements:** The lodgepole pine is unusual because it has adapted to two different environments. It is found on the Washington coast in wet soils where it grows to only 25 or 30 feet. There this pine enjoys mild temperatures. (This tree got its start during and immediately after the last Ice Age, more than 10,000 years ago, and has managed to adapt to warming conditions.) The lodgepole pine also grows in the mountains of eastern Washington at high and mid-elevations, in sandy soil. There it grows between 75 and 80 feet tall and endures very cold temperatures in winter.
- b. **Characteristics and uses:** A lodgepole pine's needles are 1 to 3 inches long, growing in bundles of two. The scales on the cones remain closed for years until heated by forest fire. (Areas destroyed by fire are often reseeded quickly with lodgepole pines.) The lodgepole pine is used for poles (not surprising when you consider its name), lumber and pulp and is cultivated for use as a Christmas tree.

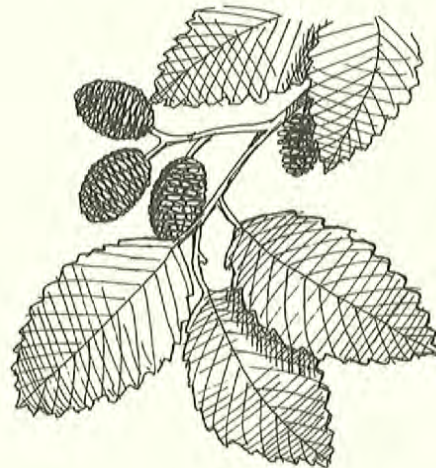
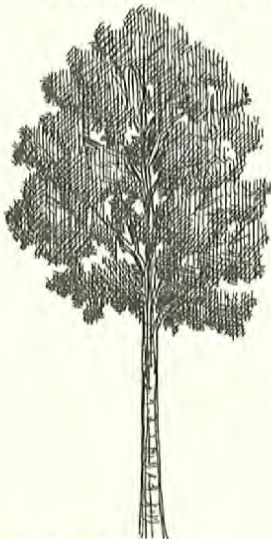
Washington Trees Information Cards



3. Pacific Madrone *Arbutus menziesii*:

- a. **Growth requirements:** The Pacific madrone requires well-drained soil and very mild temperatures. It grows in western Washington at lower elevations, especially along the Pacific coast, Puget Sound and the Strait of Juan de Fuca.
- b. **Characteristics and uses:** The dark green, leathery leaves of the Pacific madrone do not drop off in autumn. (It is, therefore, an evergreen, even though it is not a conifer or needle-leaf tree.) Its tiny white flowers turn into orange berries. This tree's smooth, reddish bark curls and peels periodically. This plant can grow as tall as 100 feet. The Pacific madrone sometimes is used as an ornamental tree.

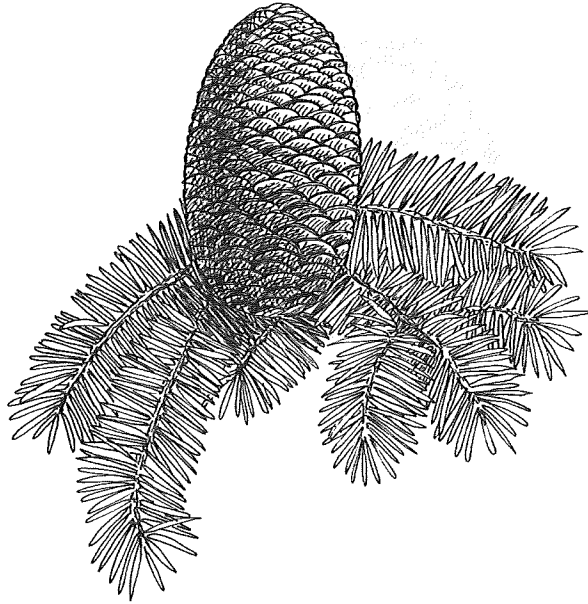
Washington Trees Information Cards



4. Red Alder *Alnus rubra*:

- a. **Growth requirements:** The red alder is able to grow in rocky places but is frequently seen on the sides of streams and other moist areas. It grows in mild climates throughout western Washington, especially on disturbed sites (those that have been burned or harvested). The red alder is not usually found at mid or higher elevations.
- b. **Characteristics and uses:** This tree can grow 30 to 60 feet tall. It has 5-inch long, toothed leaves and seeds are formed in catkins, dense flower clusters. The red alder is valuable because it adds nitrogen to the soil, helping other plants grow. Also, its wood makes good fuel because it gives off few sparks. Alder wood also is used for furniture, veneers and pulp.

Washington Trees Information Cards



5. Pacific Silver Fir *Abies amabilis*:

- a. **Growth requirements:** The Pacific silver fir grows in mountain regions that receive a lot of rain and snow. It can be found in the Olympic mountains and the Cascades, as high as 6,000 feet. This tree needs moist but not saturated (extremely wet) soil and can withstand fairly cold temperatures.
- b. **Characteristics and uses:** This tree's flat needles are a little over an inch long. Its cones are purple and barrel-shaped. The Pacific silver fir can grow between 100 and 150 feet tall. Its wood is used for lumber and pulp.

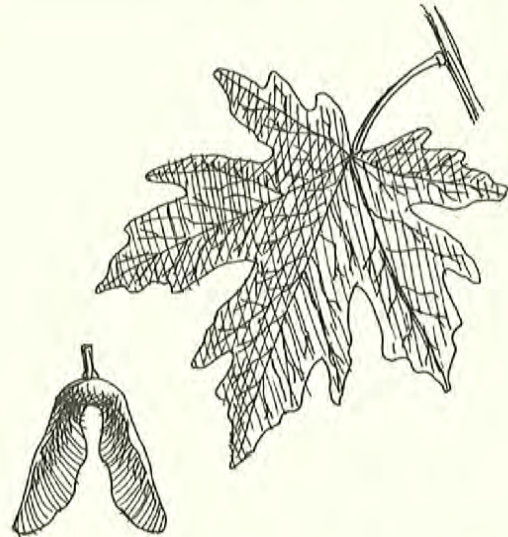
Washington Trees Information Cards



6. Western Larch *Larix occidentalis*:

- a. **Growth requirements:** The western larch grows in Eastern Washington (and into Montana). It thrives in moist, well-drained soil and can withstand very cold temperatures.
- b. **Characteristics and uses:** This tree has 1½-inch needles that grow in clusters. The needles fall off in the fall and re-appear in the spring, making this one of the few deciduous conifers (a needle-leaf tree that loses its leaves and therefore is not an evergreen). The western larch can be identified easily in the spring because of its bright, "spring-green" color against the darker green of other conifers. In autumn, its needles turn golden before dropping. The wood of the western larch is used for lumber.

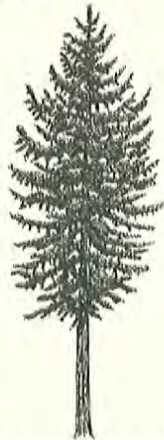
Washington Trees Information Cards



7. Big Leaf Maple *Acer macrophyllum*:

- a. **Growth requirements:** This maple grows at lower elevations in western Washington. It prefers nutrient-rich, moist (but not thoroughly wet) soil and mild temperatures.
- b. **Characteristics and uses:** The big leaf maple deserves the name! The leaves are 12 inches in diameter, larger than any other maple. This tree can grow to 100 feet. Each fall it sends "helicopter" seeds to the ground, seeds which look like they have propeller blades. With the big leaf maple's spreading branches and huge leaves, it's no wonder it is used as a shade tree. The wood of this maple is useful as furniture and firewood.

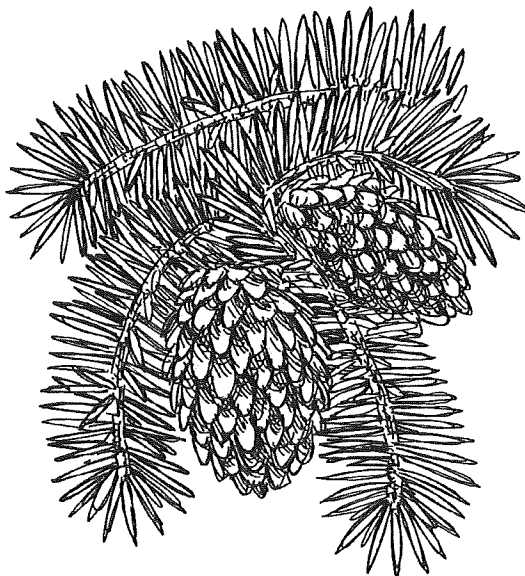
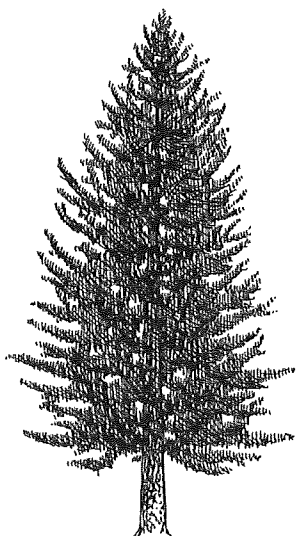
Washington Trees Information Cards



8. Douglas Fir *Pseudotsuga menziesii*:

- a. **Growth requirements:** This fir prefers moist, well-drained soil and can be found throughout western Washington up to the mid-elevation slopes of the western Cascades. It also grows on the mid and lower level slopes of the eastern Cascades and in the Okanogan Highlands. This tree withstands a wide range of rainfall amounts and temperatures. The Douglas fir is not tolerant of shade and requires a lot of sunlight to grow.
- b. **Characteristics and uses:** The Douglas fir averages 100 to 130 feet in height in eastern Washington and up to 200 feet in the moist Pacific forests. Its needles are a little over 1 inch long and cones are 3 to 4 inches long. Cones have distinctive leaf-like "bracts" which stick out between the cones' scales. Douglas fir is the most important species to the timber industry because its wood is strong and durable. This wood is used for many things including home-construction. The tree itself is useful for landscaping along freeways and as a Christmas tree.

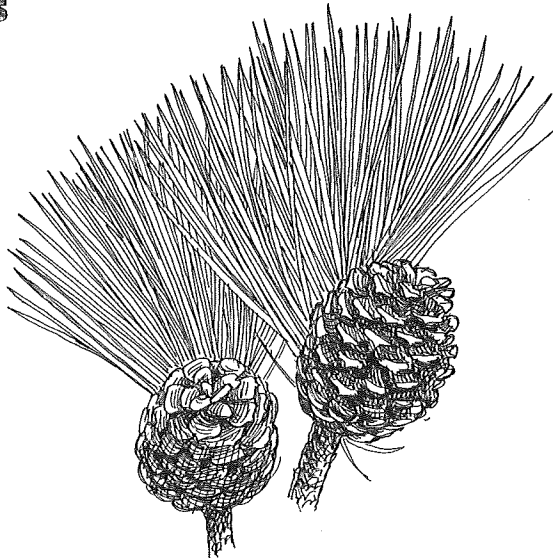
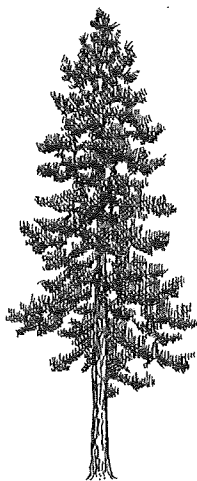
Washington Trees Information Cards



9. Sitka Spruce *Picea sitchensis*:

- a. **Growth requirements:** Sitka spruce grows well in wet soils, even bogs. It needs very wet, mild winters and therefore grows only along the Pacific coast at low elevations. This tree thrives in the moisture-laden summer fogs that are frequent along the coast.
- b. **Characteristics and uses:** Needles are about an inch long and extremely prickly. The Sitka spruce's height reaches 150 to 200 feet. Its wood is used for lumber, veneer and pulp.

Washington Trees Information Cards



10. Ponderosa Pine *Pinus ponderosa*:

- a. **Growth requirements:** The ponderosa pine can withstand very hot and very cold temperatures. It grows on the eastern slopes of the Cascades, as high as mid-elevation. This tree also grows in other eastern Washington forests, those in the Blue Mountains and the Okanogan Highlands. The ponderosa pine likes well-drained, sandy soils and does not require large amounts of rain or snow to survive.
- b. **Characteristics and uses:** This pine is very resistant to fire and drought. It has the longest needles of any tree in Washington: 5 to 10 inches. The ponderosa pine reaches 150 to 180 feet in height. Wood from this tree is used for cabinets, furniture and toys.

Washington Trees Information Cards



11. Western Red Cedar *Thuja plicata*:

- a. **Growth requirements:** The western red cedar requires wet soils and thrives throughout Washington. It is found extensively up to mid-elevation on the west side of the Cascades. It prefers relatively mild temperatures and plenty of moisture.
- b. **Characteristics and uses:** This cedar has scaled leaves with drooping branches overlapping each other. Its reddish-gray bark is fibrous, one reason Native Americans used the inner bark for weaving clothes. They also hollowed out these trees to make canoes and carved their trunks for totem poles. The western red cedar reaches an average height of 150 to 200 feet. Because its heartwood is resistant to rot, cedar is used for outdoor furniture, decks, fenceposts, shingles and siding.

Here's Looking at Yew

Background Information for Teachers

Biological diversity, or biodiversity, refers to the different kinds of plants and animals in an ecosystem. Much has been said about the biodiversity of tropical rainforests and the thousands of plant and animal species that live there. The ecosystems of Washington's forests are also richly diverse. Forest diversity is important for many reasons. Among them:

1. There are thousands of plant and animal species that may contain chemical compounds of great value for pharmaceuticals, natural pesticides or new strains of disease-resistant crops.
2. Biodiversity provides an enormous gene pool that helps ensure species survival. This large and diverse gene pool contributes to a healthy, balanced ecosystem. By drawing on the gene pool, species are able to adapt and respond to environmental pressures such as climate change and disease.
3. All species are bound together by a complex web of relationships and interdependencies. Every plant and animal provides something (shelter, food, pollination), and a change in one species may be felt throughout the ecosystem.

In the Pacific Northwest the changing value of a species has taken the foreground as scientists have discovered the cancer-curing properties of Pacific yew trees. The drug taxol is extracted from the tree and has been shown to cure various kinds of cancer, including ovarian cancer (a disease that kills 12,000 women annually in the United States). Until a few years ago, the Pacific yew had little recognized value although at one time Northwest Coast tribes prized its strong, dense wood for poles and harpoon shafts. This scraggly inhabitant of forests has become a "miracle tree" in the fight against cancer. What other important discoveries await us? The answer is that we have no way of knowing which of the thousands of species of plants and animals, both vertebrate and invertebrate, will be found to have critical economic or ecologic importance.

The U.S.D.A. Forest Service, Federal Bureau of Land Management and National Cancer Institute are now struggling to figure out how we can use the Pacific yew while we ensure protection of it. Many private and government researchers are working hard to answer many questions and replicate taxol in the laboratory. They also are studying the overall role of biological diversity and the possible contributions of various species.

Skills

Classification, observation, graphing, discussion, creative writing

If More Ideas section is used:
Research

Subject Areas

Math, science, language arts

If More Ideas section is used:
Art

Materials

Watercolor supplies
(or colored chalk)

Picture of Pacific yew*

Bar graph* (make transparency)

* Provided



Learning Outcome

By studying the Pacific yew tree of Washington, students will gain an understanding of the concept of diversity.

Learning Procedure

How Many Plant Types Do We Have? Take the class on a walk through the local neighborhood and to different areas of the school grounds (field, playground, forest, near buildings, yards, lawn, near driveways). Assign groups of students to different areas to count the number of different species (different kinds of plants). Discuss the importance of including various **kinds** of mosses, grasses, lichens, “weeds” and algae (if present) in addition to ornamentals, annuals and perennials. It is not necessary to know the name of each plant: a simple record sheet can include a leaf sample or sketch of each species rather than the name. (Be sure to alert the students about the potential presence of poisonous plants before they begin.)

When assignments are completed, pool data by graphing students’ findings. To do this, create a bar graph showing the number of species of plants in each group’s assigned area. Use a transparency of the chart provided in this lesson.

What is Diversity, Anyway? Explain the concept of “diversity,” noting the different species in one area. Ask which group’s area has the greatest diversity. What might be some advantages of greater diversity in a front yard, a forest, or a human population? (Refer to background information.)

Point out examples where diversity is lacking and consider reasons for reduced diversity.

Discuss the concept of “weed.” What is a weed? Who decides? How does using that classification influence our perception of a plant’s value? (In eastern Washington, Baby’s-breath was considered a weed until people realized its commercial value to the floral industry.)

Understanding the Pacific Yew: Explain that people have not always understood the value of diversity. Show the picture of the Pacific yew and discuss how people have valued this species over time (from tribal uses to little use to intense research and a life-saving drug).

Have students write poems about the Pacific yew and illustrate them with watercolor or colored chalk. Poems might follow this pattern:

Pacific Yew	
_____ and _____,	(two adjectives)
_____ing, _____ing, _____ing,	(three "ing" verbs)
_____?	(a question)
Example:	
Pacific Yew	
needled and rosy-barked	
breathing, shading, slow-growing,	
Who knew the secrets of your bark?	

More Ideas

1. Assign each pair of students an animal or plant category such as birds, fish, reptiles, amphibians, mammals, mollusks, insects, spiders, micro-organisms, trees, flowers, vegetables, fruits and water plants. Have each pair create a magazine picture collage of all the different kinds of animals or plants in their category. Bind collages together as a book titled *Diversity on Planet Earth*. Or, students can collect magazine pictures of their category and make a class poster on which they label diverse uses and needs for specific species.
2. Have students research the ways in which Native Americans used the plants of Washington's forests for medicinal purposes, food and materials. (Look for books on ethnobotany in the library. Also, Washington State Department of Ecology's *Discover Wetlands* curriculum has a section on native plant use in Washington.)

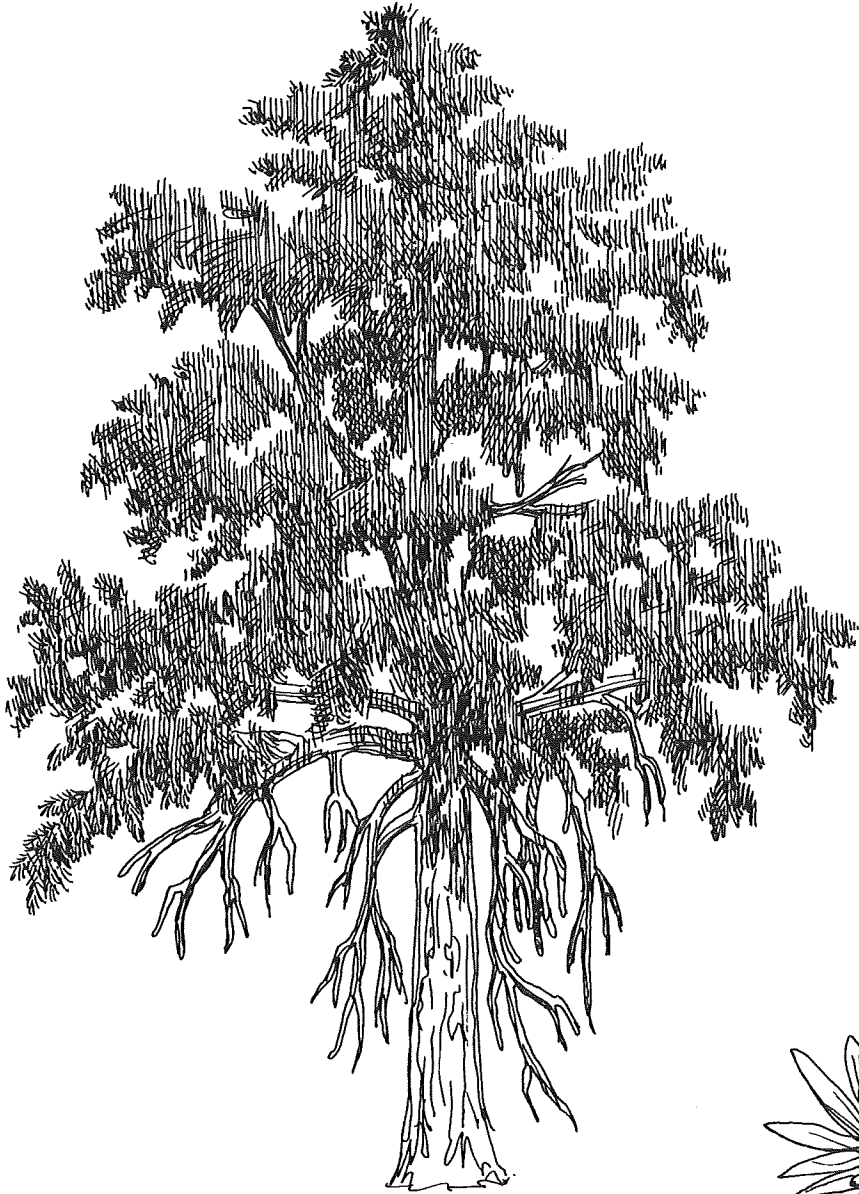
Washington Department of Ecology
Wetlands Section
P.O. Box 47600
Olympia, WA 98504-7600
3. Take hula-hoops out to the playground. Place one on a grassy spot and ask two students to look at the kinds of plants inside the hoop. How many different kinds of plants are there? Assign students the

task of finding a spot where a hoop can be placed that represents the greatest diversity in the schoolyard. Remind students of the possibility of plants they can't see, for example, soil fungi which are present even when their "mushrooms" are not.

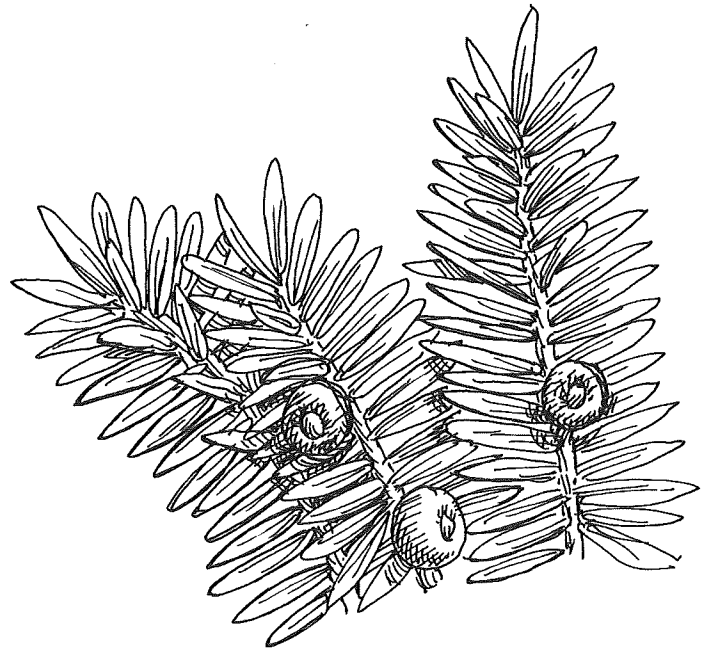
Assessment: What Did We Learn?

Have each student write a letter to a friend or relative relating the story of the Pacific yew. Review important points beforehand, such as where the tree grows, what happened to it historically and why it is currently viewed as valuable.





Pacific yew



27

Forest Homes

Background Information for Teachers

When studying forest habitats, the concept of layers is often used. For the purposes of the **Forests of Washington** activity guides, four layers are identified and discussed:

Skills

Discussion, artistic representation, observation, creative writing

If **More Ideas** section is used:
Research, listening, computer technology, compare/contrast

Subject Areas

Art, language arts, science

Materials

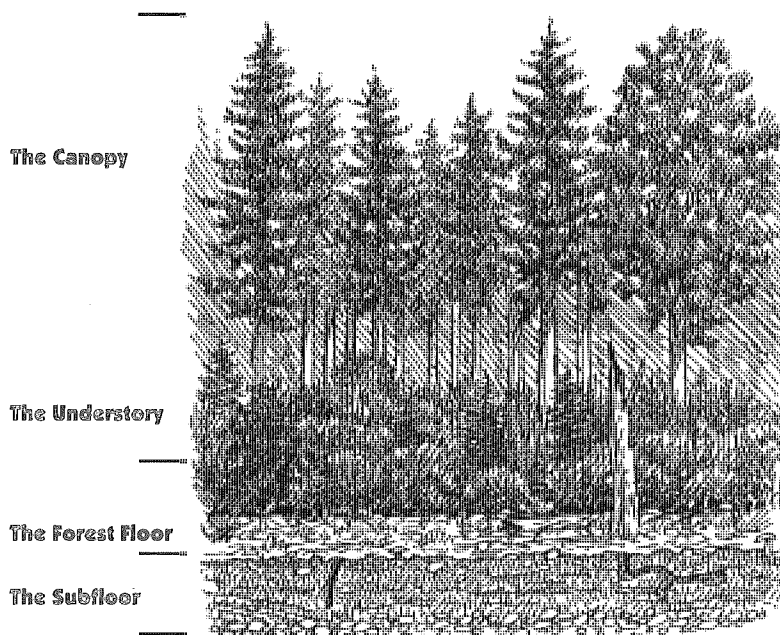
Butcher paper

3" x 5" cards (optional)

Colored chalk, crayons or collage materials

Washington Animals
information cards*

* Provided



1. **The canopy:** This layer comprises tree tops and overlapping branches of large trees.
2. **The understory:** This layer is made up of smaller trees, shrubs, bushes, snags — in short, everything between the canopy and the floor.
3. **The forest floor:** The floor includes leaf litter, stones, fallen logs, groundcover plants, stumps, etc.
4. **The subfloor:** The subfloor comprises soil, rocks, roots, fungi, invertebrates and tunnels — everything under the ground.

Washington forest animals usually inhabit one of these layers, although some animals use more than one. They may raise their young and find shelter in the canopy and forage the understory, forest floor and even the soil for food.

When studying forest animals, remember to include all forms of wildlife (fish, insects, slugs and spiders, for example), not just mammals and birds.

Learning Outcome

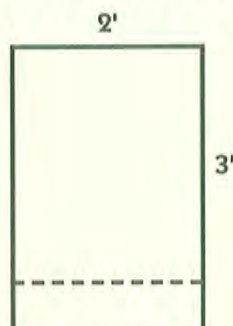
Students will be able to describe the four general habitat layers of a Washington forest and identify some of the animals which inhabit each layer.

Learning Procedure

What Makes a Forest? Brainstorm together and list on the board as many components of a forest (excluding animals) as students can name. The list will probably include many of the following:

- large trees (species depends on location)
- groundcover plants, grasses
- small trees
- leaf litter (fallen needles & leaves)
- snags (standing dead trees)
- fungi (both aboveground fruiting bodies — mushrooms, etc., — and underground mycelia)
- fallen logs
- stones
- bushes
- streams (from small creeks to major rivers)
- flowers
- roots and burrows
- ferns, liverworts, lichens and mosses
- soil

Make a Forest Mural: Create a class mural of an eastern or western Washington forest using butcher paper, colored chalk, crayons or collage materials. Divide students into groups of two or three, and give each group a strip of butcher paper about two feet wide and three feet tall. Have students pencil a horizontal line six inches from the bottom of their strip to represent the level of the forest floor. Strips will look like this:



Each team's task is to design the layers of the forest, from below ground level to the tallest trees, including as many of the ideas listed on the board as possible. When finished, connect the strips together to form one large mural and have each team describe its section. Discuss any additions or changes that need to be made.

Outdoor Variation: In a forested area (or patch of trees if need be), divide students into four groups. Each team is assigned a forest layer and given a 3" x 5" card. Instruct each group to investigate its layer (being careful not to disturb plants and animals) and write significant characteristics on the card. Back inside, or using picnic tables, give each group a large piece of butcher paper and have students recreate their forest layer. When all groups are finished, display the pieces of paper together as one large mural of the forest.

Who Lives in the Forest? Using the mural, introduce the names of the four layers of a forest. (See background information.) Explain that animals usually live within one of these layers.

Distribute *Washington Animals* information cards. (Several students will have the same animal.) Every student is to read the information and cut out the picture. For each animal, students share what they have learned and discuss where to glue the animal pictures on the mural.

Describe Where Forest Animals Live: Look at the Washington Forest Poster provided with this activity guide. With students, identify animals and forest habitat layers where they seem to be foraging. Write this starter sentence on the board: "A Steller's jay flew." Encourage students to practice their powers of observation and description by expanding the sentence with descriptive phrases based on the poster. (In this activity, only one "and" may be added to the sentence.) Combine several sentences, then tell students to expand one on their own and perhaps illustrate it.

Example of starter sentence:

"A Steller's jay flew."

Example of expanded sentence:

"A bright blue Steller's jay flew swiftly, like a colorful streak, through the understory in search of fat seeds and startled a furry, brown rabbit who had stopped to nibble a juicy fern on the quiet forest floor."

More Ideas

1. Instruct students to do individual research reports on their favorite forest animals and make clay models or dioramas.
2. Invite a person from a nearby wildlife care center to speak to the class. Speakers usually bring birds of prey or other animals which have been injured and cannot return to the forest.
3. Do an in-depth study of beavers or eagles by using the accompanying reading material with your students. Tell them to write a first-person story about a baby beaver, or have them practice listening skills by imagining they are eagles as you read the *Imagination Field Trip* found in this lesson.
4. Have students investigate their school grounds or yards, or go on a forest field trip to see if they can identify habitat layers. Discuss what kinds of wildlife might use each identified layer. Go on a "wildlife safari" from the soil to the treetops.
5. Use a computer drawing program such as MacPaint or MacDraw. Have students create pictorial representations of forest layers. They could create a key with symbols representing forest components such as conifers, broadleaved trees, fallen logs, snags (dead, standing trees), etc.
6. Use a word processing program to create a Washington Forest newspaper written by forest animals reporting on forest events. Examples of articles might be: "Snag Falls to Forest Floor: Eagle Loses Home" or "New Insect Recipes for Woodpeckers."
7. Compare forest animals' adaptations to winter and summer. Are there differences? Research and chart your findings.
8. Make animal "crazy" books. Have students draw and label four animals, one on each page. Bind the book and cut pages in half. When students turn the page they will see the bottom half of one animal and the top half of another.

9. Create a mini-subfloor and forest floor habitat by cutting the top off a plastic 2-liter bottle. Add soil and stones, make mock burrows, then add needles, decomposed plants, fungus, etc. Materials can be gathered from different places and bottles compared for observing differences.
10. Instruct students to make mobiles showing the layers and habitats of a Washington forest. Use labels to identify animals and types of vegetation.

Assessment: What Did We Learn?

Each student is to write a descriptive sentence for every one of the four habitat layers. Next to each sentence, ask the student to list two animals found in that layer.



Wildlife: The Beaver — Nature's Engineer

The beaver, a member of the rodent family, is a unique animal capable of drastically changing the landscape to suit its needs. When people and beavers live in the same environment, people often do not like what the beaver does.

What does the beaver look like?

The prehistoric ancestor of the beaver lived more than a million years

ago. These

creatures grew to

be 8 feet in

length and

weighed 700

pounds or

more. Today

beavers

average 40 to

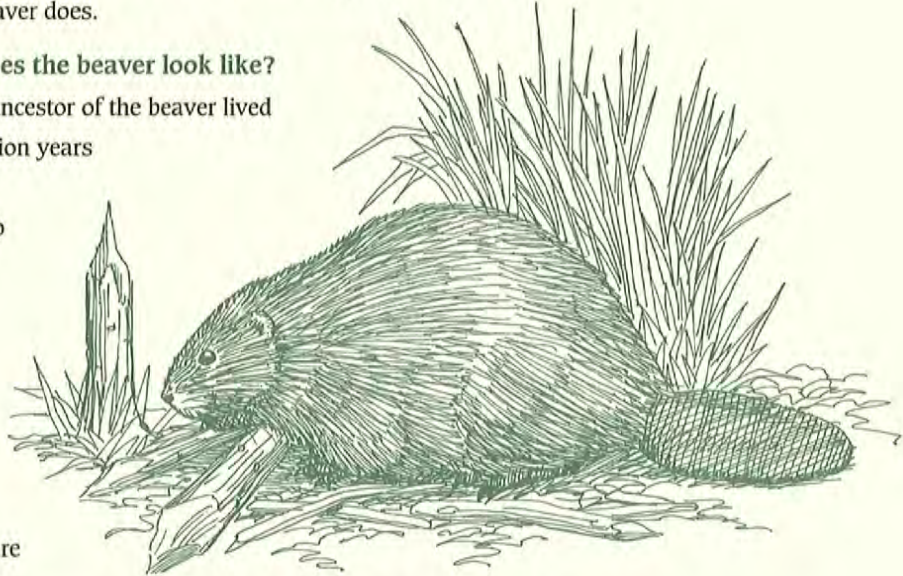
50 pounds and are

4 to 5 feet long,

including their tails. Many years ago a few beavers weighing almost 100

pounds were caught by trappers. The beaver usually lives about 12 years. It

has soft, dense fur which is waterproof because of its oil content.



What adaptations do beavers have? Specific adaptations help an animal to be well suited to its place (niche) in the forest. Beavers have ear and nose valves which close when they swim underwater. They have large, broad tails which help them swim. They can also slap their tails against the water to warn other beavers of danger or to frighten other animals. Beavers' back feet are webbed for swimming or supporting their heavy bodies in soft river mud. The front feet — like little hands — hold food or logs used in building their dams. Using their back feet, they spread oil from glands located on their abdomen over their fur.

Internally, the beaver has large lungs to hold oxygen. This characteristic lets them stay underwater up to 15 minutes. Beavers have chisel-like teeth and strong jaws which can gnaw through a 6-inch tree in 15 minutes! Their front teeth continue growing throughout their lives. These creatures must chew on trees to keep their teeth from growing too long. The tree-chewing action wears down the teeth.

Beavers make many sounds like churrs, mumbles, snorts and hisses to get the attention of other beavers.

How does the beaver build a dam and its lodge? It is fortunate for beavers that many trees along the water's edge often slant toward the water. As they chew through the trunks, these trees fall into the water and the dam is begun. The beaver works all night and sleeps during the day.

The dams can be very large — up to 2,000 feet long (almost half a mile!). Beavers make the dams by pushing sticks into the river bottom mud, then covering them with mud. Next they weave branches in and out of trees they have cut down, adding stones and plants until the dam is very strong.

The beaver's home is called a lodge. It is built with sticks and mud piled together. Often the lodge has an underwater door for protection. It may have several rooms if the beaver colony is large. Usually a lodge will have a small opening at the top for fresh air.

How do beavers live? Beavers eat the bark and twigs of cottonwood, alder, willow and poplar trees. In winter they stay underwater most of the time. Kits are born in May or June. The litter may be 3-9 kits. Very few animals prey on beavers because beavers live mostly in water. Coyotes, bears, wolves and foxes may eat them if they go too far from their home pond.

How do beavers and humans interact? The beaver population can multiply quickly so it is controlled through trapping and by attrition. Sometimes human and beaver interests conflict. Beaver dams create ponds which can ruin trout streams and flood pastures, meadows and stands of trees. Also, beavers often gnaw valuable trees.

Certainly not everything beavers do crosses purposes with human plans. The ponds beavers create provide homes for many fish and water birds while helping to control spring runoff and prevent flooding. The ponds also serve as reservoirs to collect water. When an old beaver dam breaks, the area becomes a lush, grassy meadow. Beavers truly are nature's engineers.

Wildlife: The Bald Eagle – America's Symbol

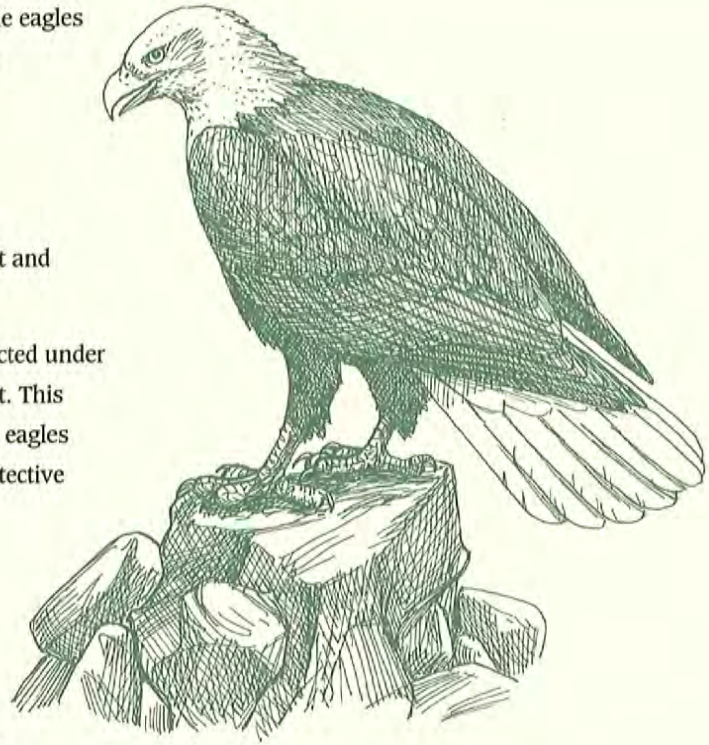
As the symbol of the United States, the majestic bald eagle represents freedom, strength and power. In our ancestors' day it was counted in the thousands, but today there are fewer than 5,000 in the contiguous 48 states. Washington's nesting population has about 400 pairs, ranking it among the largest in the nation.

Why is the bald eagle an endangered species? During the 19th century, egg collecting, shooting and trapping were popular, and bounties were offered for eagles. In the 20th century DDT, a pesticide used by farmers, washed into streams and poisoned fish. The DDT was transferred to the

eagles when they ate the fish. DDT made eagles' eggshells so soft that female eagles crushed the eggs while incubating them, dooming their offspring before they could hatch.

DDT is banned today, and the government is working to protect eagle habitats so the birds can nest and hatch young.

Today bald eagles are protected under the federal Endangered Species Act. This legislation makes it illegal to harm eagles in any way and provides other protective measures. Because the human population of the U.S. is much larger than in the past, it is of great importance that we protect the eagles' habitat from interference by people.



How does the bald eagle live? Eagles require an enormous amount of space to exist. They use this territory to forage and nest. Eagles prefer very tall old-growth and mature second-growth coniferous trees and snags for perching and nesting. These tall trees in the interior of the forest allow eagles to watch for prey easily, giving them a clear view from the trees' stout branches high above the ground. In western Washington bald eagles usually prefer Douglas fir, whereas in eastern Washington they often choose ponderosa pine. Most of the trees they use as perches and nests are along shorelines so they readily can find fish. Shoreline property also is in great demand by humans for development.

Bald eagles mate for life and usually construct more than one nest, or aerie, in a territory. They use their nests over and over throughout their lives. A nest is usually near the top of a tree and is very large, often 5 feet in diameter. Eagle pairs are very sensitive to human activity near their aerie. The presence of people could provoke the female eagle to leave her nest and eggs unattended.

Just as bald eagles keep the same nests year after year, they also return to the same roosting sites in coniferous trees. Eagles often roost in large groups during the night and sometimes during the day, especially in bad weather. The trees give eagles protection from the elements as they roost.

Imagination Field Trip

Close your eyes and imagine you are a bald eagle. Put yourself into the eagle's body. Picture your beautiful snowy white head. Feel your strong, curved beak. Imagine your powerful feet with long, sharp talons that hold you solidly on a perch high in the tallest evergreen. Look around and notice what you see. Is it a river or a large body of water like Puget Sound? Look above your head. What do you see? How does the wind feel against your feathers? What sounds do you hear?

Think about your eaglets in their nest. How many are there? Look at their brown, fuzzy bodies. Think about how hungry they are. What are they doing?

Now, look again at the water before you — is that a fish in the water? Look at its glistening silver body. Notice the way it darts and glides through the water. Feel the muscles in your legs tensing as you get ready to take off into the air. Spread your wings and push your feet hard against the tree limb.

Now you are flying! Feel how light you are as you slowly flap your wide wings. How free you feel! With your strong eyes you can see the fish swimming in the water. Tuck your legs under your body — lower your head as you begin to dive — you are going faster and faster — your eyes fix on the fish — feel the rush of air around your body — it flattens the feathers on your head — down, down, down you go — straight toward the swimming fish.

A split second before you hit the water you lower your feet and open your wings all the way. Your strong talons slide through the water and grasp the fish. It tries to get away but you hold it tightly. Notice how you feel as you swoop up into the air. Flapping your wings hard, you start climbing upward. It takes a lot of energy to climb so far and so fast as you clutch the fish.

As you fly back to your nest, look around and see the tops of the trees. How do they look? The sun feels warm on your back as it dries your feathers. You smell the evergreens and see your aerie in front of you. You land carefully on its edge and offer the silver fish to your eaglets. They hungrily and noisily eat the fish.

Fly to your perch in a nearby tree and rest. Your eaglets will be hungry again soon.

Now come back and land in your seat in your room, slowly opening your eyes.

Eastern Washington Animal



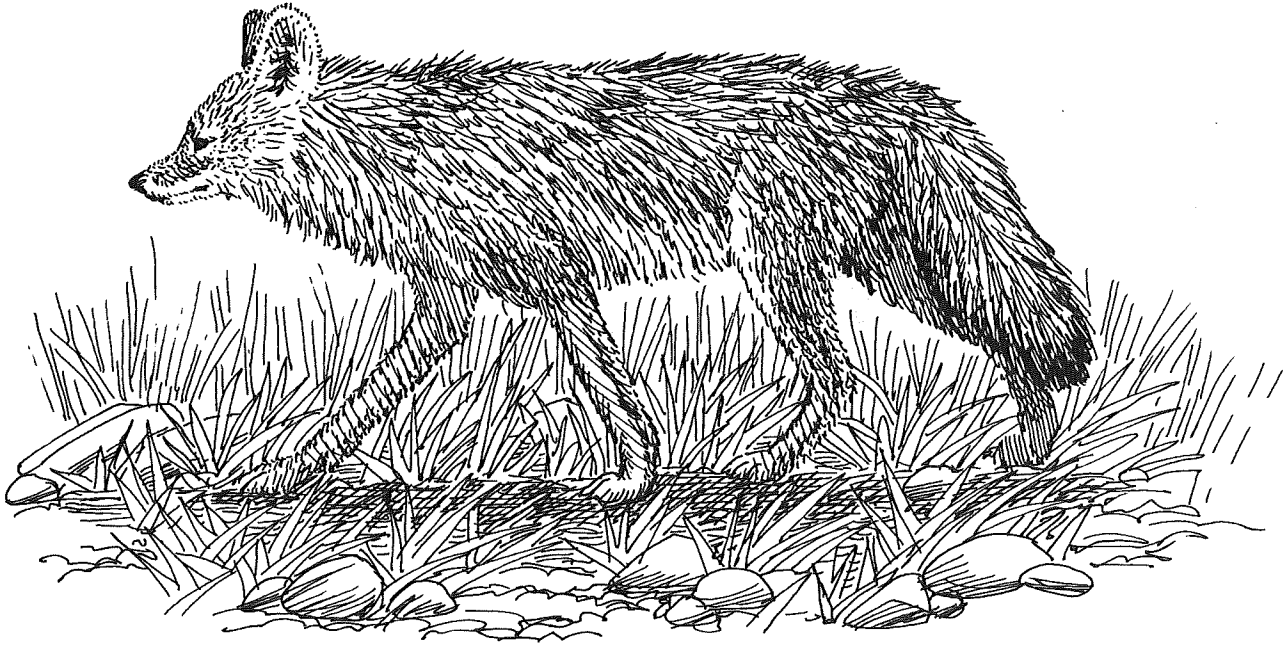
Mule Deer: The mule deer gets its name from its large ears that resemble those of a mule. It browses on the forest floor, eating shrubs and twigs. The mule deer browses at upper elevations in summer and comes down to lower elevations in winter. At full height, the male is $3\frac{1}{2}$ feet tall at the shoulders.

Eastern Washington Animal



Elk: Except for the moose (an occasional visitor to Washington), the elk is the largest member of the deer family, averaging five feet tall at the shoulders. The huge antlers of the bull are shed each year, but by fall, new ones take their place. Baby elk are born in May or June. The elk's camouflaged coloring and habit of "freezing" in position protects it from coyotes and bears. This animal, like the mule deer, is a forest floor browser and also found in western Washington.

Eastern Washington Animal



Coyote: This four-legged creature, similar in size to a large dog, hunts rodents and ground birds on the forest floor. The coyote lives in a cave or den that it has dug into the ground. Pups, born in April or May, are as big when six months old as their parents and can hunt on their own. This animal often hunts with other coyotes, using teamwork.

Eastern Washington Animal



Golden Mantled Ground Squirrel: This rodent is often mistaken for a chipmunk, but its stripes stop at its shoulders. (The chipmunk's stripes go clear to its nose.) The ground squirrel burrows into the earth and eats seeds and nuts, often filling its cheek pouches with them. When winter comes, the ground squirrel hibernates.

Eastern Washington Animal



Deer Mouse: The deer mouse feeds at night. So do some of its predators, such as owls, so this mouse must keep a careful watch while looking for food. The deer mouse is sometimes called the white-footed mouse. It occasionally digs a tunnel for its home, but usually uses a hollow log or stump. This rodent eats berries, seeds, leaves and insects on the forest floor.

Eastern Washington Animal



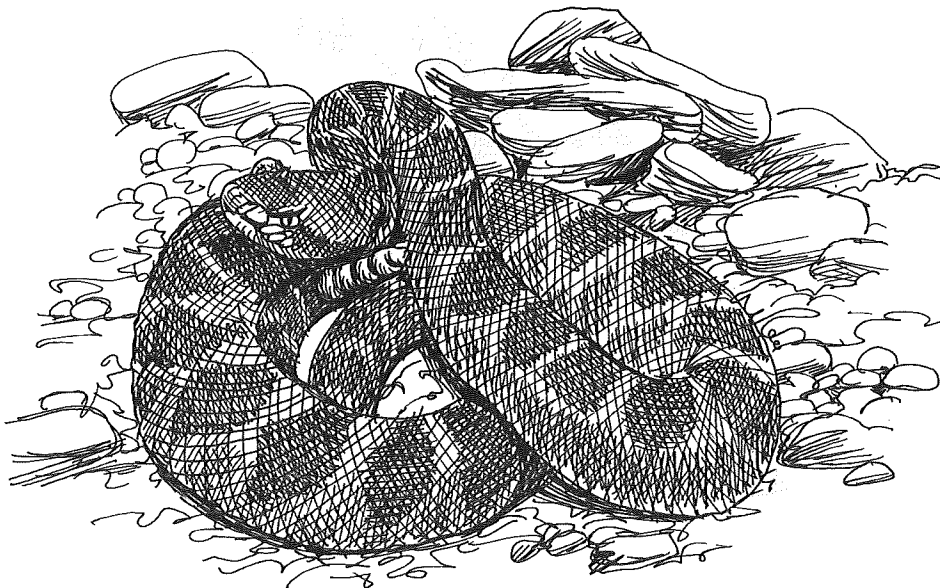
Red-tailed Hawk: The red-tailed hawk nests in the forest canopy, although you might see it perched atop a telephone pole or fence post. It can sit there for hours, then suddenly swoop down to surprise its prey. The red-tailed hawk uses its talons (claws) to capture small animals such as snakes, rodents and frogs, and tears the meat with its strong beak. This hawk is also found in western Washington.

Eastern Washington Animal



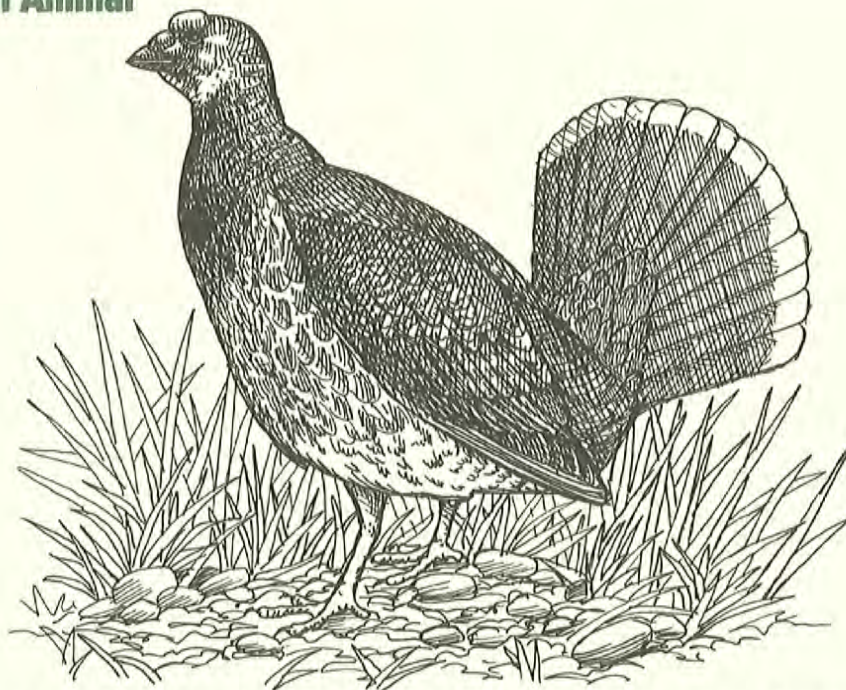
Great Horned Owl: This bird of prey nests high in trees or on cliffs, at times using an old nest abandoned by herons or hawks. The great horned owl often uses the same nest year after year. This is the largest common owl. As is true of other owls, its feathers are soft so its flight is silent. This owl has a deep hooting call. Its large facial discs help it hear, and its eyesight is extremely sharp. The great horned owl preys on small mammals such as rabbits and rodents.

Eastern Washington Animal



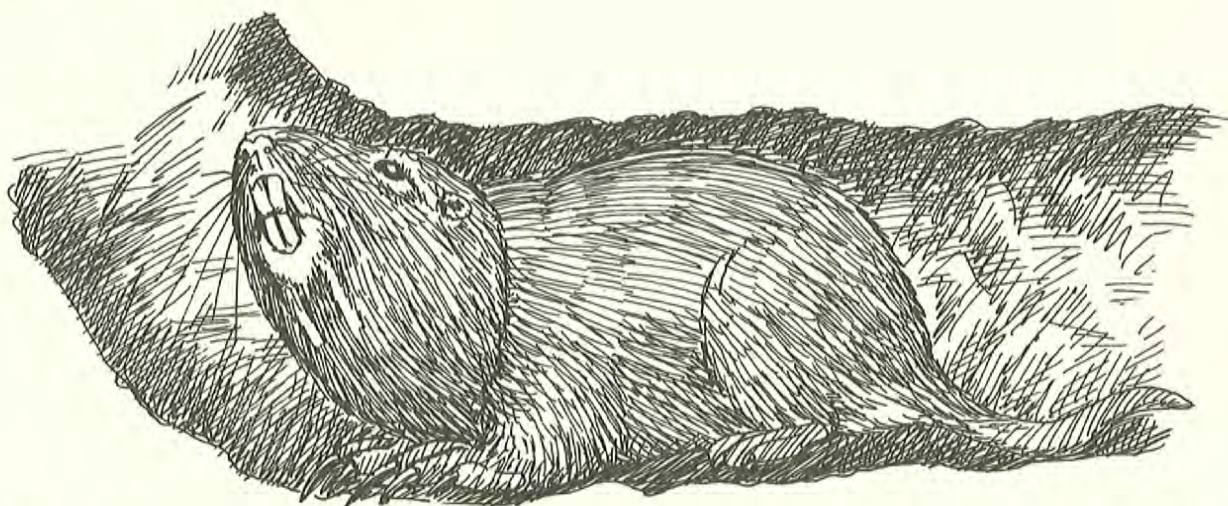
Western Rattlesnake: This snake finds shelter under rocks and within burrows in the ground. It hunts on the forest floor for rodents. As you probably know, this snake's bite is poisonous; venom is sent from glands through holes in the two fangs, then into its victims. The western rattlesnake gives birth to live snakes instead of laying eggs like most reptiles. Have you heard that you can tell the age of a rattlesnake by counting the "rattles" on its tail? This isn't true. Tail segments are added each time the snake sheds its skin, which can be several times a year.

Eastern Washington Animal



Blue Grouse: This bird nests in a hidden place on the forest floor. It also searches there for insects, seeds and berries to eat in summer, but in winter it eats only pine needles. The grouse sounds like nothing else! Its deep, deep bass call is made by inflating and deflating pouches on each side of its neck. The blue grouse's 10 to 15 babies leave the nest soon after they hatch, but if danger is near, the mother gives a sharp call to bring them back. The blue grouse is also found in western Washington.

Eastern Washington Animal



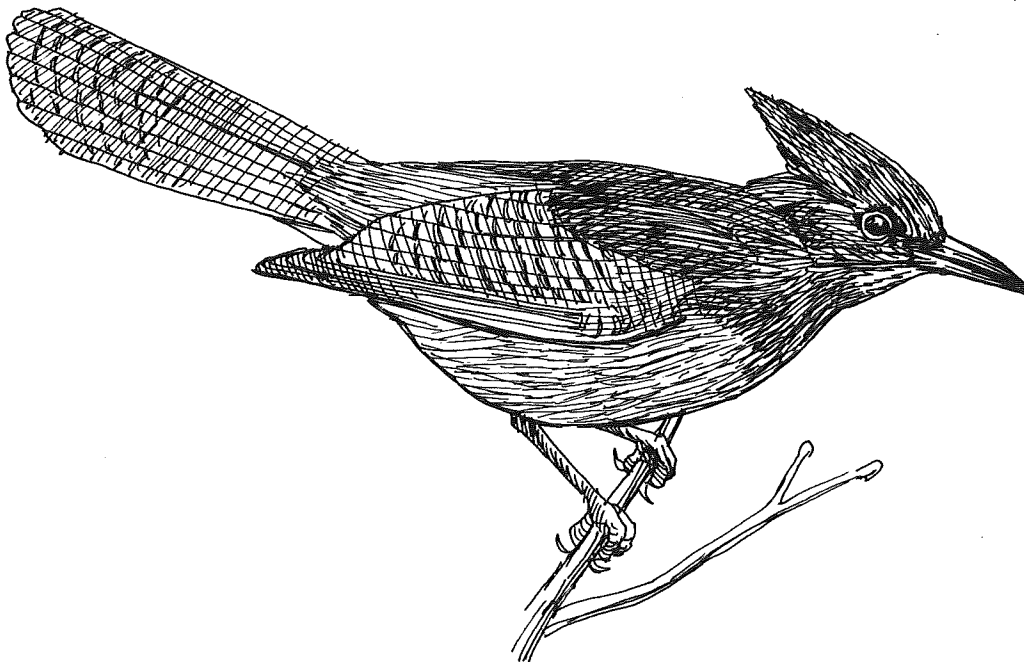
Northern Pocket Gopher: The northern pocket gopher spends its whole life underground and is well-suited to that environment. This animal has strong front feet for digging, and its lips close behind its teeth so that dirt doesn't get in its mouth as it chews into roots. The northern pocket gopher carries the plant roots it gnaws in pouches on either side of its mouth. In the winter, it tunnels through the snow and fills the tunnels with dirt from its burrows. When the snow melts, you can see the mounded rows on the ground.

Eastern Washington Animal



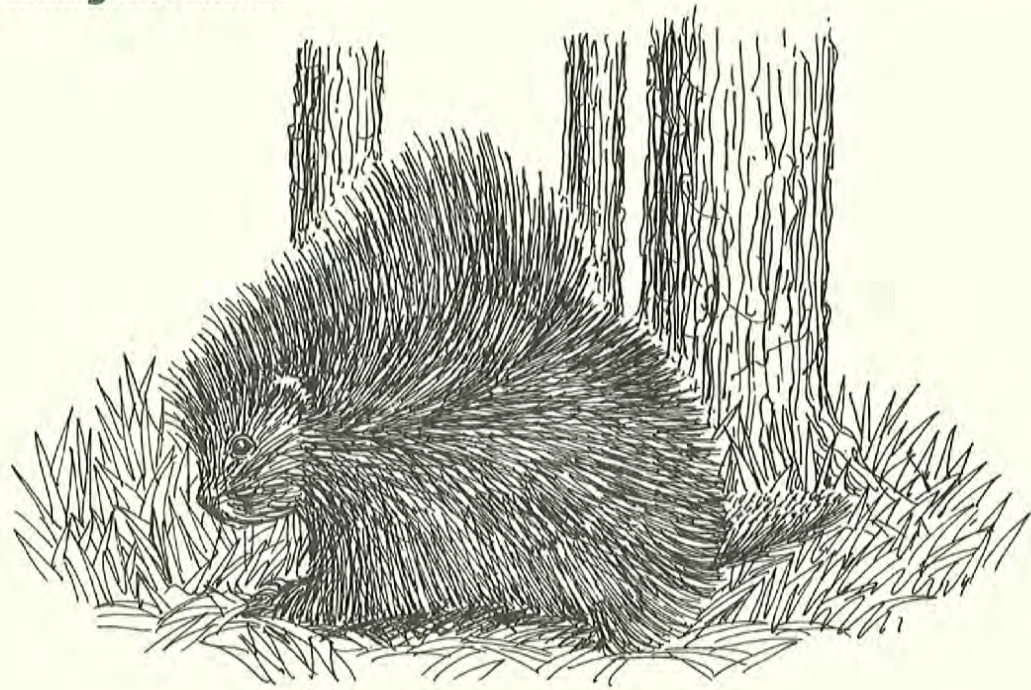
Hoary Bat: This is the largest bat in North America, with a wingspan of 16 inches. It is active at night, catching insects while flying in the air. The hoary bat lives alone in trees, sleeping high in the canopy. It migrates south for the winter.

Eastern Washington Animal



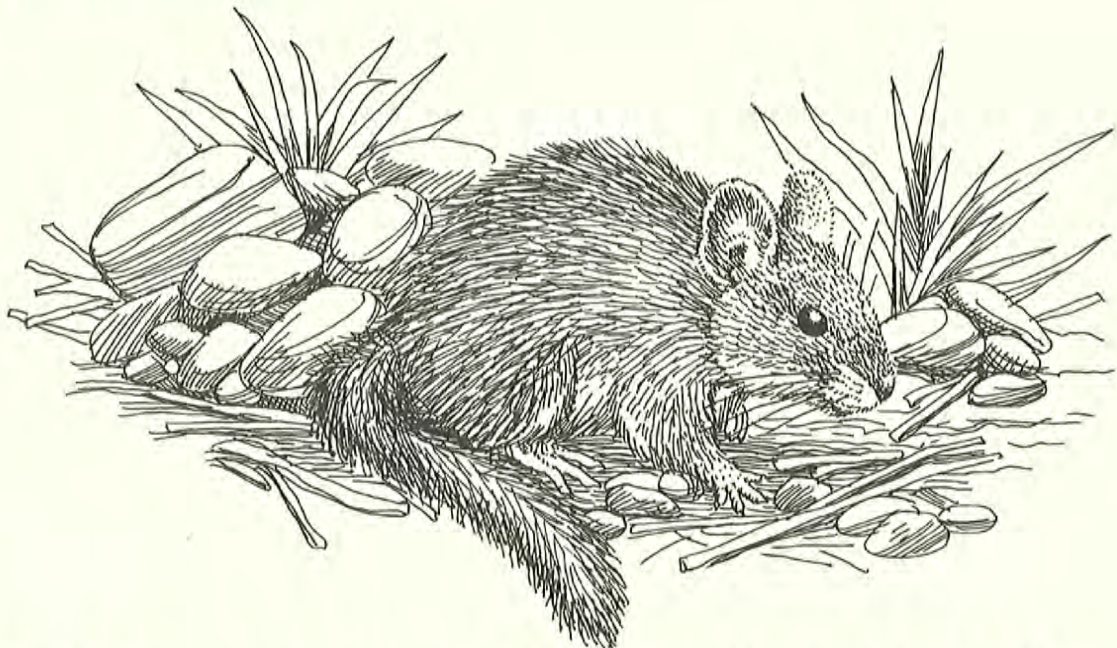
Steller's Jay: This noisy bird is best known for its shiny blue-black color and crest. It nests in the canopy but often finds seeds, berries and insects to eat on the ground. This bird was named for a German naturalist, George Wilhelm Steller.

Eastern Washington Animal



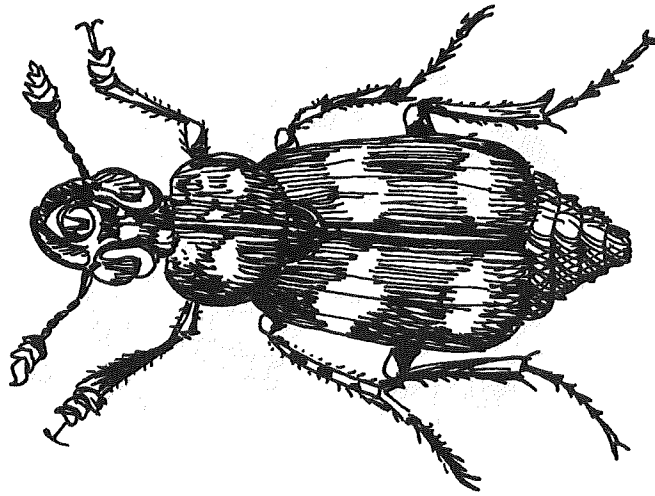
Porcupine: When threatened, the porcupine lashes its tail back and forth. Any would-be predator who gets in the way will receive a snoutful of barbed quills! The porcupine lives on the forest floor, usually in a hollow log. It eats plants, often killing trees when it eats the inner bark. This member of the rodent family is active both day and night, summer and winter.

Eastern Washington Animal



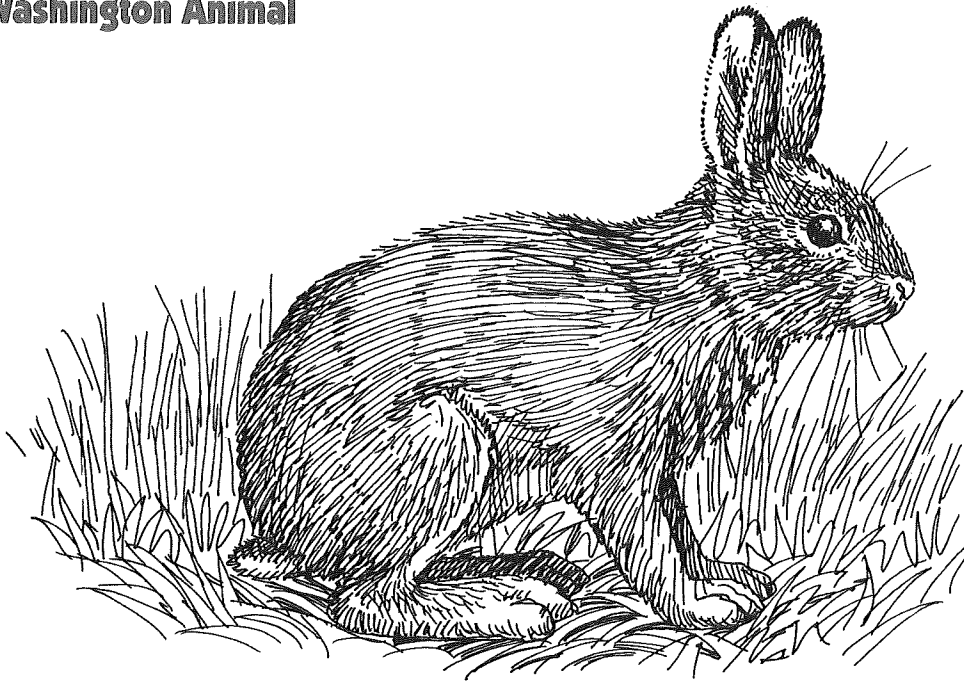
Woodrat: This bushy-tailed rat is also called a "pack rat" or "trade rat" because it often carries off shiny items belonging to humans. It hunts at night. The woodrat makes its grassy nest among rocks or brush on the forest floor. This rodent adds sticks and other treasures to its nest constantly, so its home soon becomes a fortress, offering good protection.

Eastern Washington Animal



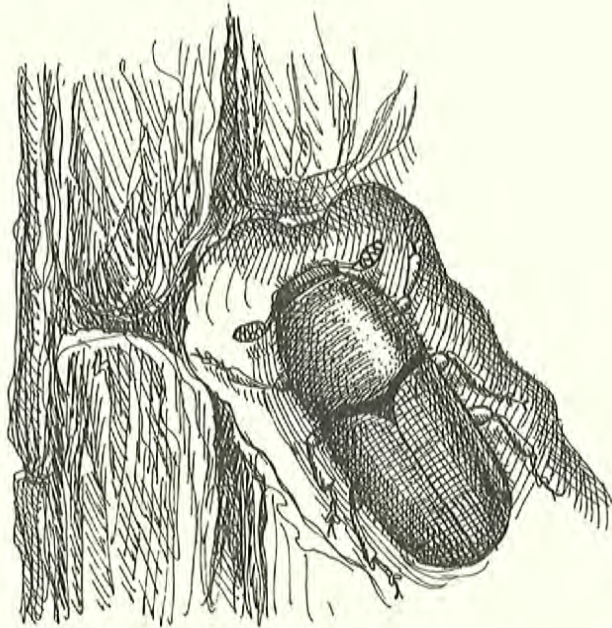
Carrion Beetle: There are over 1,000 species of carrion beetles, many living in forests. This insect is a scavenger, feeding on decaying animal matter on the forest floor. In doing so, the carrion beetle plays an important recycling role, turning dead plants and animals into inorganic matter that enriches the soil.

Eastern Washington Animal



Snowshoe Hare: This animal lives on the forest floor, in a grassy hollow sheltered by rocks or bushes (unlike its cousin, the rabbit, which burrows into the ground). The snowshoe hare is brown in summer but, in this part of the state, turns white when winter arrives, blending into the snowy landscape as protection against predators. Its large, furry feet allow it to run over deep snow without sinking in. This creature is nocturnal and eats plants.

Eastern Washington Animal



Mountain Pine Beetle: The pine beetle lives in the understory on the trunks of large lodgepole pines. The female burrows into the trunk to lay her eggs. When eggs hatch, hundreds of larvae begin tunneling through and eating the wood, killing the tree. If restricted to older growth, the activity of the pine beetle can be helpful to the forest ecosystem by removing large trees that fall and decay on the forest floor, providing nutrients to the soil. Heavy infestations, however, threaten younger trees.

Eastern Washington Animal



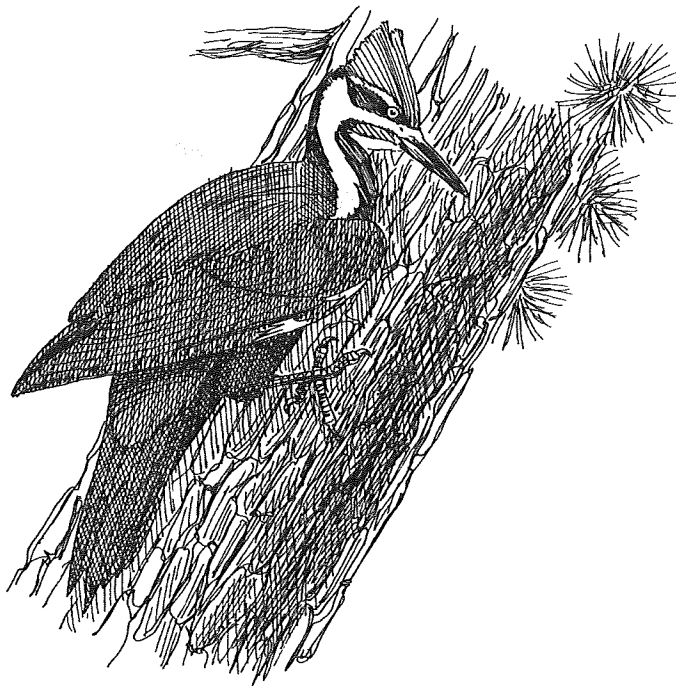
Nuthatch: The nuthatch is unique in that it can walk up and down tree trunks and hang upside down on branches, looking for insects to eat. This social, non-migrating bird lives in the canopy but often forages on tree trunks in the understory.

Western Washington Animal



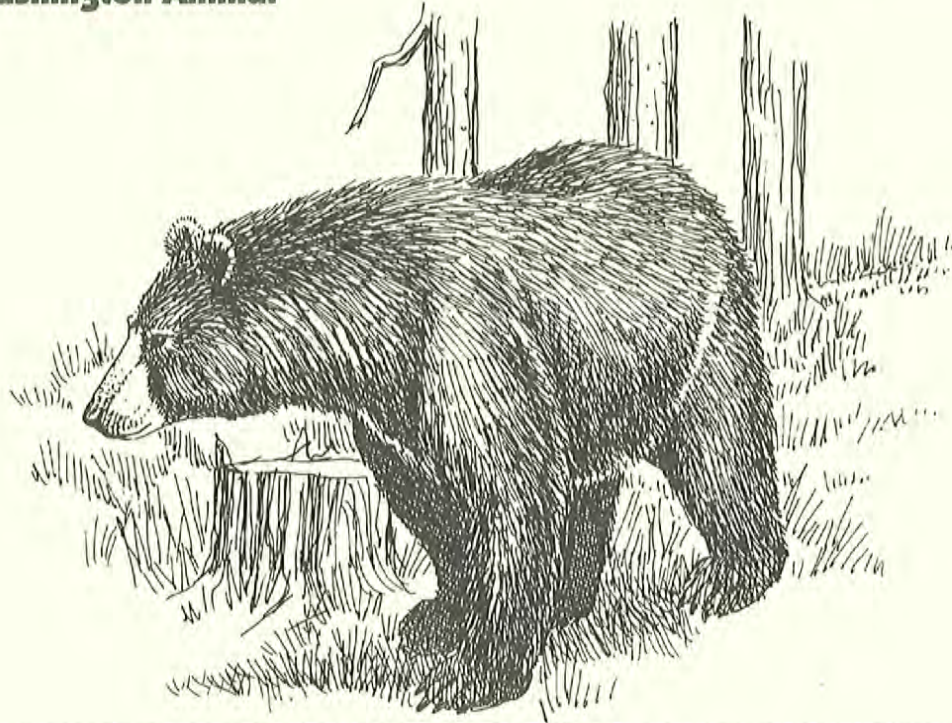
Douglas' Squirrel: Named by a Scottish botanist, David Douglas, this squirrel builds nests (often more than one) in hollow limbs or snags, usually in the canopy. It forages on many levels, eating nuts, seeds, insects, mushrooms and bird eggs. The Douglas squirrel does not hibernate but stores seeds for the winter in its nests and in the ground. Another name for this squirrel is "chickaree."

Western Washington Animal



Pileated Woodpecker: This bird nests in trunk cavities and loudly drills for insects on tree trunks in the understory. Its special tongue is long, barbed and coated with sticky saliva to help it spear insects. The pileated woodpecker's coloring is distinctive: black and white with a red crest. Its toes, two facing forward, and two backward, help it grip the trunks of trees.

Western Washington Animal



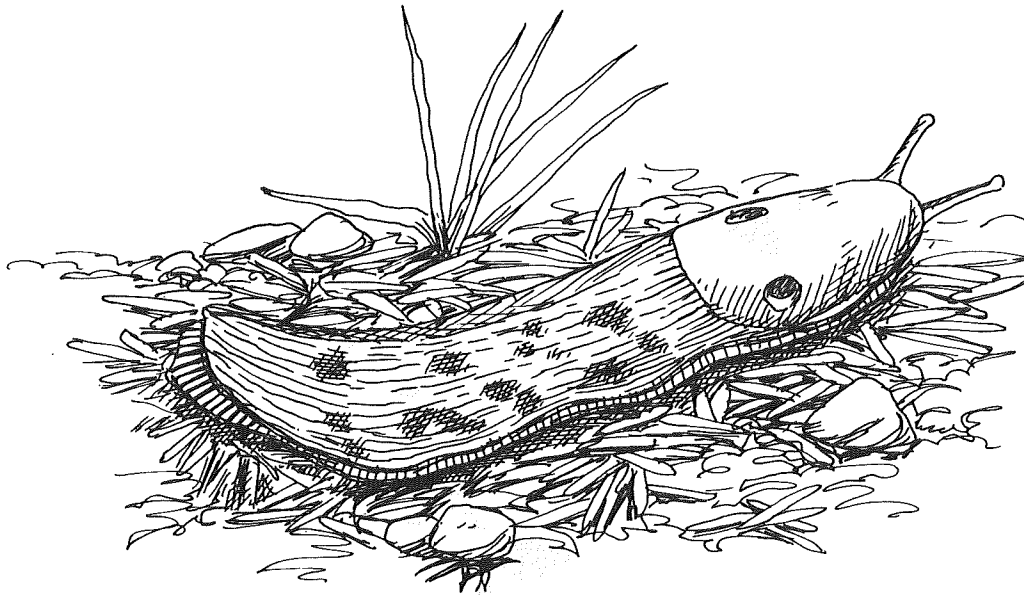
Black Bear: The black bear sleeps in caves, hollow trees or rocky crevices. It eats almost anything including insects, mushrooms, berries and small animals. The black bear doesn't hibernate, but it does sleep through the worst part of the winter. The mother bear spends 18 months raising her cubs.

Western Washington Animal



Black-tailed Deer: The black-tailed deer is a variety of mule deer and is named for its black tail. It browses on the forest floor, eating shrubs and twigs. The black-tailed deer, like other mule deer, browses at upper elevations in the summer and comes down to lower elevations in the winter.

Western Washington Animal



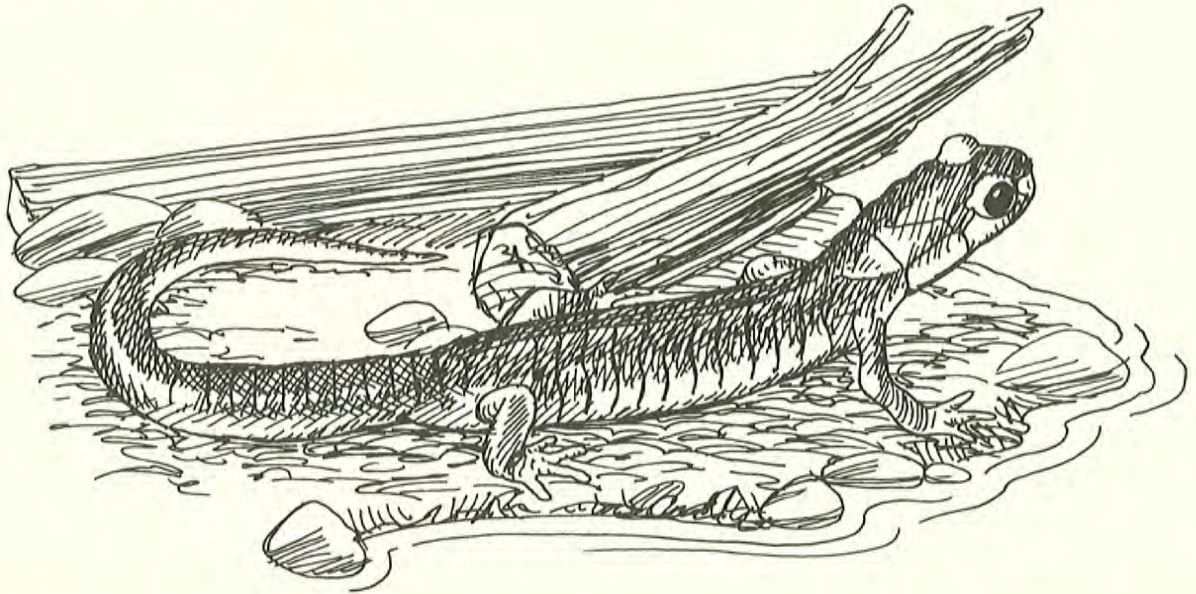
Banana Slug: The yellowish-green banana slug grows several inches long. It inhabits the forest floor, living under leaf litter, logs and stones. This banana-shaped creature feeds on leaves and helps process decaying matter into humus. It has two pairs of tentacles with eyes on the longer pair.

Western Washington Animal



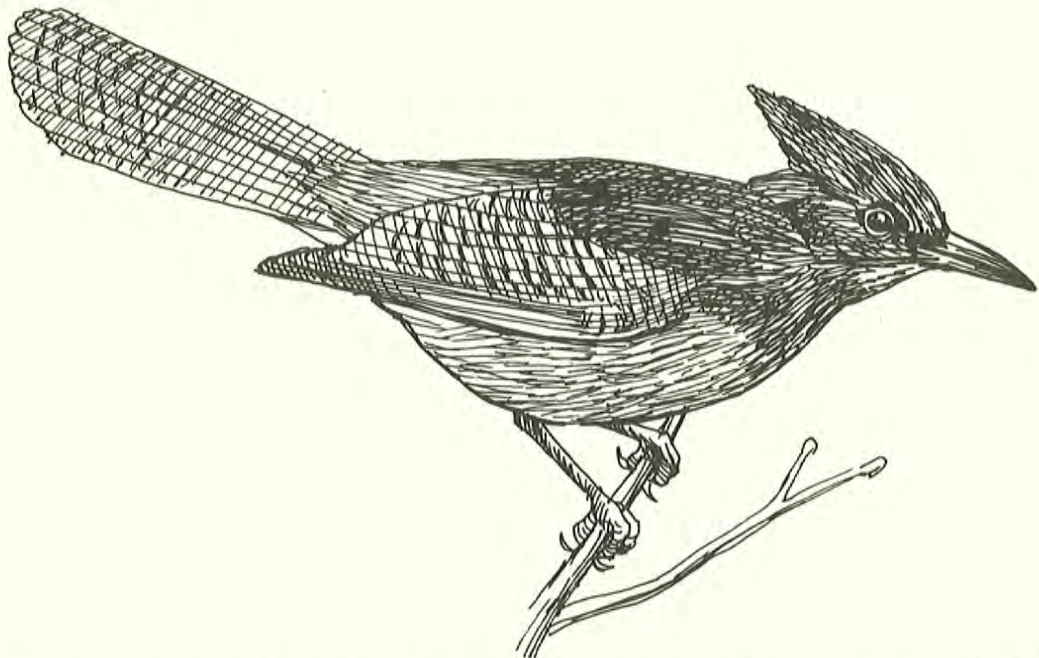
Northern Flying Squirrel: The flying squirrel doesn't really fly; it glides, using the skin stretched between its arms and legs to sail from a tall branch to another tree's trunk. Its tail acts to balance and steer it in "flight." This squirrel often uses old woodpecker holes for nests and is active at night. The owl is its worst enemy. The flying squirrel eats lichens, seeds, berries and truffles (root fungi).

Western Washington Animal



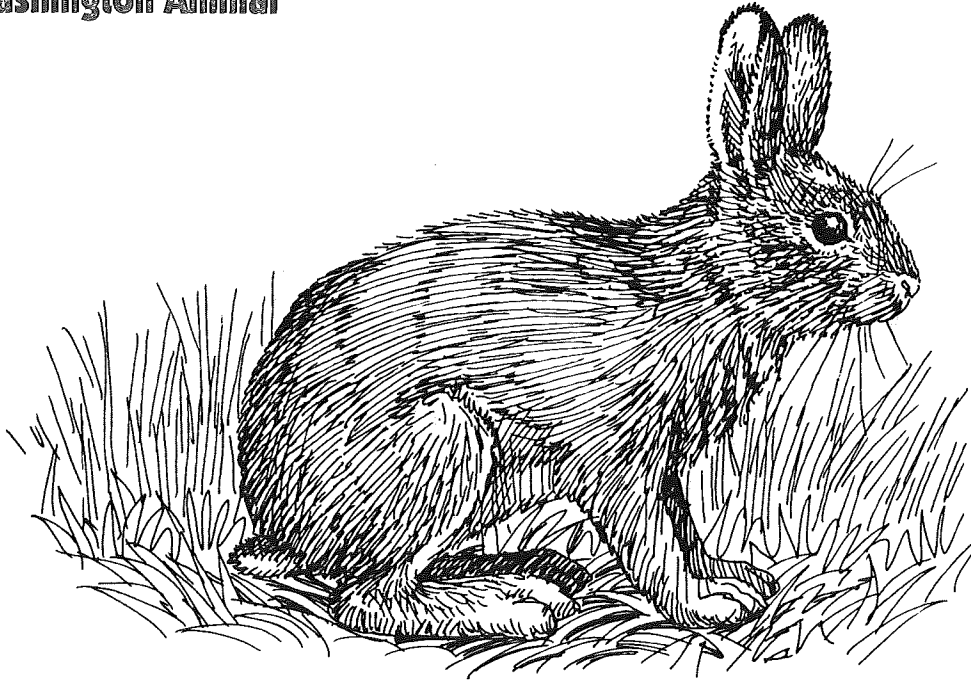
Salamander: This forest amphibian can be found in any moist, dark place — under rocks and logs, under bark, even under leaf litter. It must have moisture to survive. When first born, the salamander, like the frog, goes through a “polliwog” stage, needing water to breathe until it goes through metamorphosis and is able to breathe air. The salamander captures insects with its sticky tongue.

Western Washington Animal



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Western Washington Animal



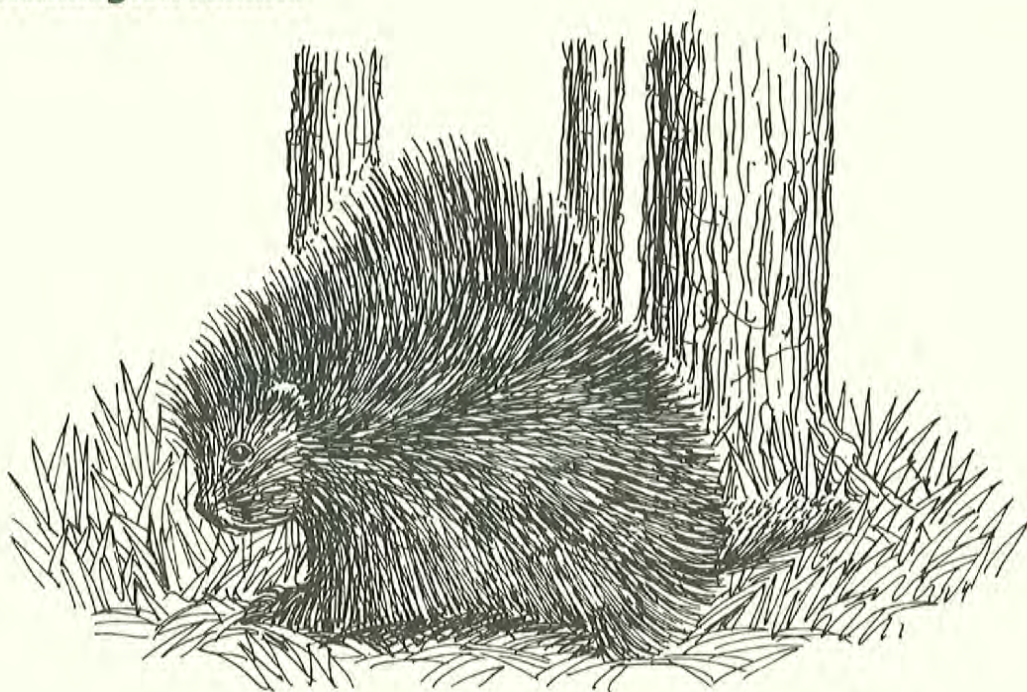
Snowshoe Hare: This animal lives on the forest floor, in a grassy hollow sheltered by rocks or bushes (unlike its cousin, the rabbit, which burrows into the ground). The snowshoe hare is nocturnal and lives on plants. As a protective feature, this furry creature turns white in winter where there is frequent snow, but in areas of western Washington where winters are mild, it remains brown.

Western Washington Animal



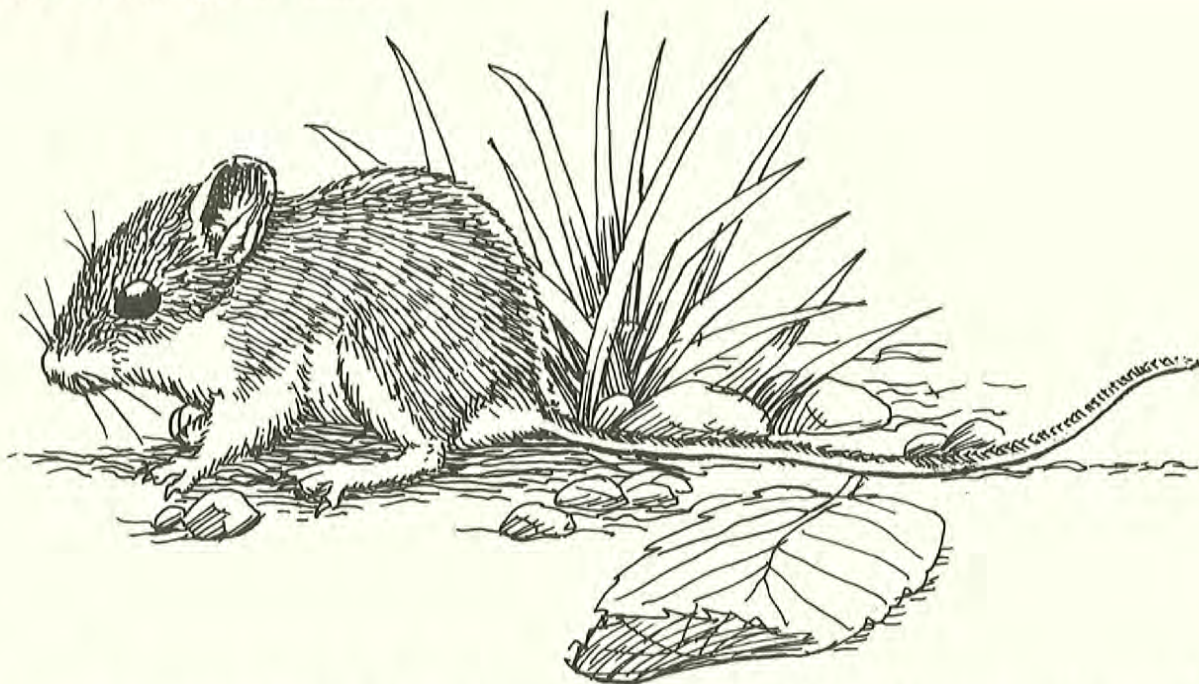
Great Horned Owl: This bird of prey nests high in trees or on cliffs, at times using an old nest abandoned by herons or hawks. The great horned owl often uses the same nest year after year. This is the largest common owl. As is true of other owls, its feathers are soft so its flight is silent. This owl has a deep hooting call. Its large facial discs help it hear, and its eyesight is extremely sharp. The great horned owl preys on small mammals such as rabbits and rodents.

Western Washington Animal



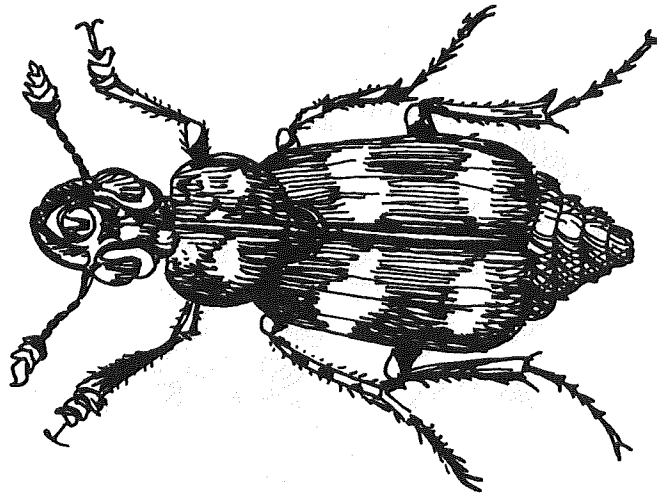
Porcupine: When threatened, the porcupine lashes its tail back and forth. Any would-be predator who gets in the way will receive a snoutful of barbed quills! The porcupine lives on the forest floor, usually in a hollow log. It eats plants, often killing trees when it eats the inner bark. This member of the rodent family is active both day and night, summer and winter.

Western Washington Animal



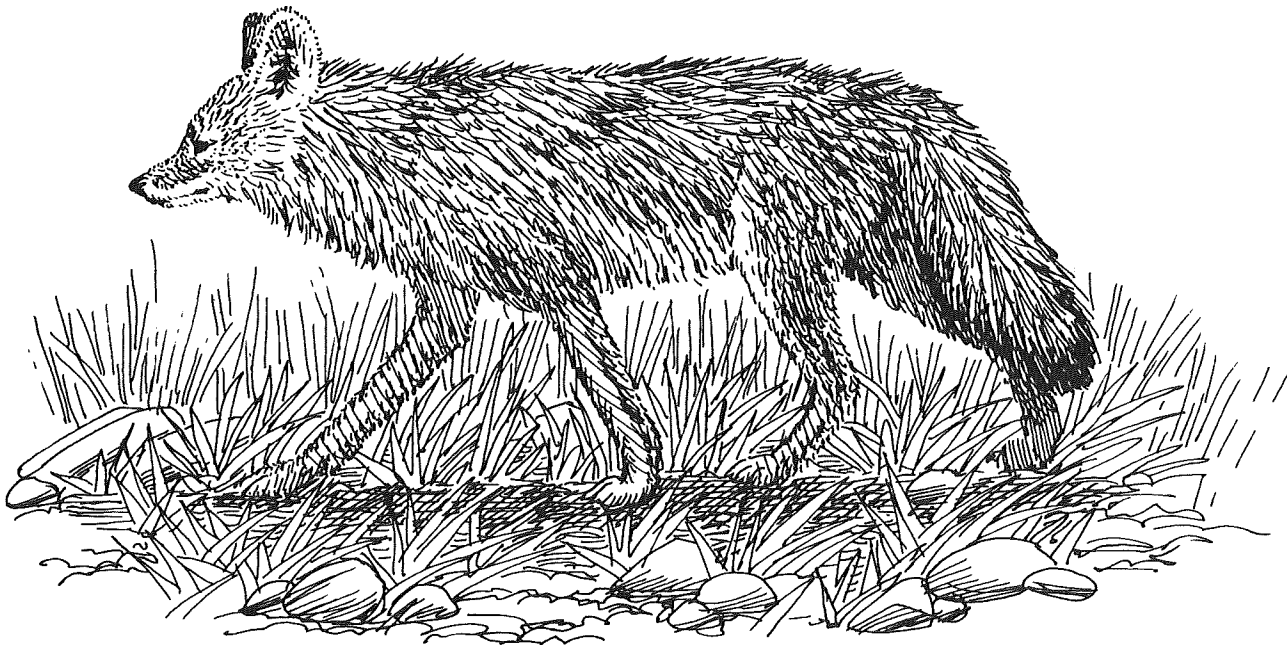
Deer Mouse: The deer mouse hunts at night. So do some of its predators, such as owls, so this mouse must keep a careful watch while looking for food. The deer mouse is sometimes called the white-footed mouse. It occasionally digs a tunnel for its home, but usually uses a hollow log or stump. This rodent eats berries, seeds, leaves and insects on the forest floor.

Western Washington Animal



Carrion Beetle: There are over 1,000 species of carrion beetles, many living in forests. This insect is a scavenger, feeding on decaying animal matter on the forest floor. In doing so, the carrion beetle plays an important recycling role, turning dead plants and animals into inorganic matter that enriches the soil.

Western Washington Animal



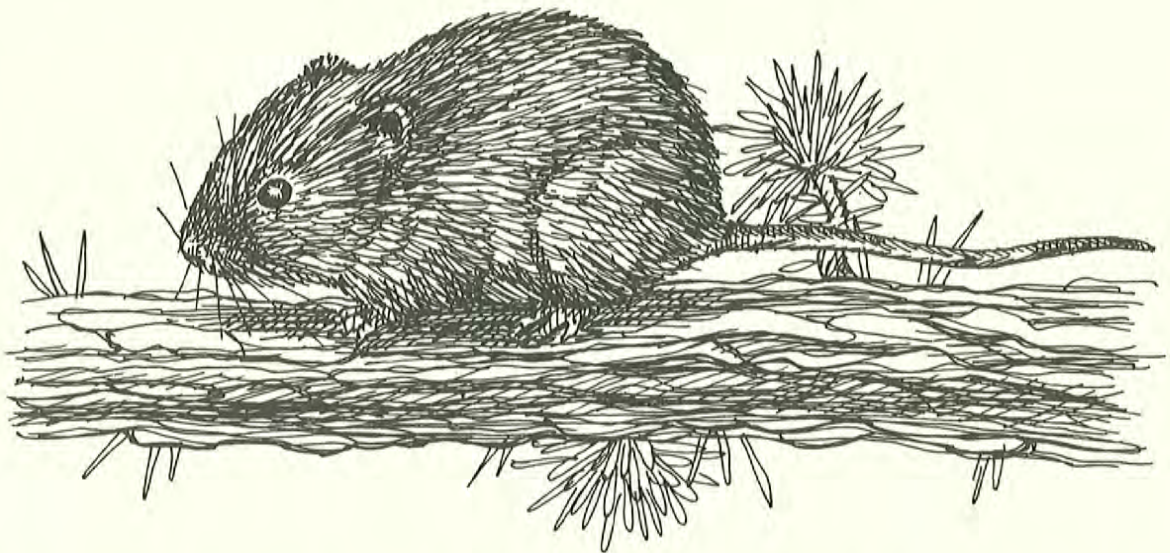
Coyote: This four-legged creature, similar in size to a large dog, hunts rodents and ground birds on the forest floor. The coyote lives in a cave or den that it has dug into the ground. Pups, born in April or May, are as big when six months old as their parents and can hunt on their own. This animal often hunts with other coyotes, using teamwork.

Western Washington Animal



Nuthatch: The nuthatch is unique in that it can walk up and down tree trunks and hang upside down on branches, looking for insects to eat. This social, non-migrating bird lives in the canopy but often forages on tree trunks in the understory.

Western Washington Animal



Vole: The vole is a mouse-like rodent. It burrows in the ground and eats truffles (root fungi), insects and seeds on the forest floor. It has many predators including the owl and weasel. The red tree vole is unique because it nests in the branches of Douglas fir trees and rarely leaves the canopy.

Come Grow With Us

Background Information for Teachers

Skills

Mapping, prediction, cooperative learning, creative writing, persuasive writing

If **More Ideas** section is used:
Video technology, presentations

Subject Areas

Geography, art, language arts

If **More Ideas** section is used:
Communications media

Materials

Washington state physical map
(wall map or copy of map from
There's No Place Like Home lesson)

Washington forest regions
map* (student copies +
transparency + key)

Chalk (or sand pile) for
outdoor activity

Construction paper, magazines

Student Cards of 4 forest regions*

* Provided

Washington's forests are as diverse as its topography and climate. The Cascade Curtain is not only a political division! These mountains create two climate zones for our state: The west side receives more precipitation and experiences milder temperatures than the east side. These variables strongly influence which species of trees grow in our state. In addition, forests change with elevation. Low elevation forests have different species of plants and animals than high elevation forests, no matter where in the state they are. Temperature, wind and precipitation are more extreme at high elevations. The growing season is shorter, with winters arriving earlier and lasting longer. Winds and lower temperatures prevail, and only certain tree species have adapted to these conditions. Considering the interplay of climate and topography, Washington's forests can be grouped into four regions (see Student Cards).

Learning Outcome

Students will be able to identify the four forest regions of Washington and describe the climate, topography and one tree species adapted to each region.

Learning Procedure

Where Are Washington's Forests, Anyway? Using the student physical map provided in Lesson 1: *There's No Place Like Home*, (or a wall map) review Washington geography and the climate and topography variations throughout the state. (Also see Student Cards at the end of this lesson.) Ask students if they think forests grow in all parts of Washington and why or why not. Are the forests the same? Why or why not? Have they ever visited another part of Washington? How was it the same or different? Summarize by explaining that because the climate and topography vary so much, the kinds of trees and forests that grow in Washington also vary.

Tell students to predict where they think forests might grow. Next, hand out the Washington forest regions map and discuss the four forest regions using the Student Cards. Color-code the key for the name of each region and have students color the map accordingly. Also, beside each tree, color the box(es) which represent the region(s) in which that tree grows. (See teacher's key.) Discuss why certain trees grow in specific regions. Which trees grow in more than one region? What could be some reasons



for that? (Refer to *Washington Trees* information cards in Lesson 2: *Getting to Know Trees of Washington*.) Indicate your town on the map and note which forest region you are in or near.

Go Outside: Take students outside and assign them to work in pairs to create chalk maps of Washington and its forest regions. (Other options include creating 3-D models in a sand box or a table map out of clay or salt dough. Use colored toothpicks for trees: different colored toothpicks can represent different tree species.)

Make a Brochure: Obtain a variety of travel brochures from a local travel agency. Show them to the students and discuss the persuasive styles of writing and colorful pictures used to entice people to visit different places.

Instruct students to create brochures inviting people to visit each forest region. Hand out the Student Cards. With input from students, list on the board the positive attributes of each region's natural features and some of its recreational opportunities. Make magazines available for cutting out letters and pictures. Post brochures on a bulletin board and ask students to give each other positive feedback about their achievements.

More Ideas

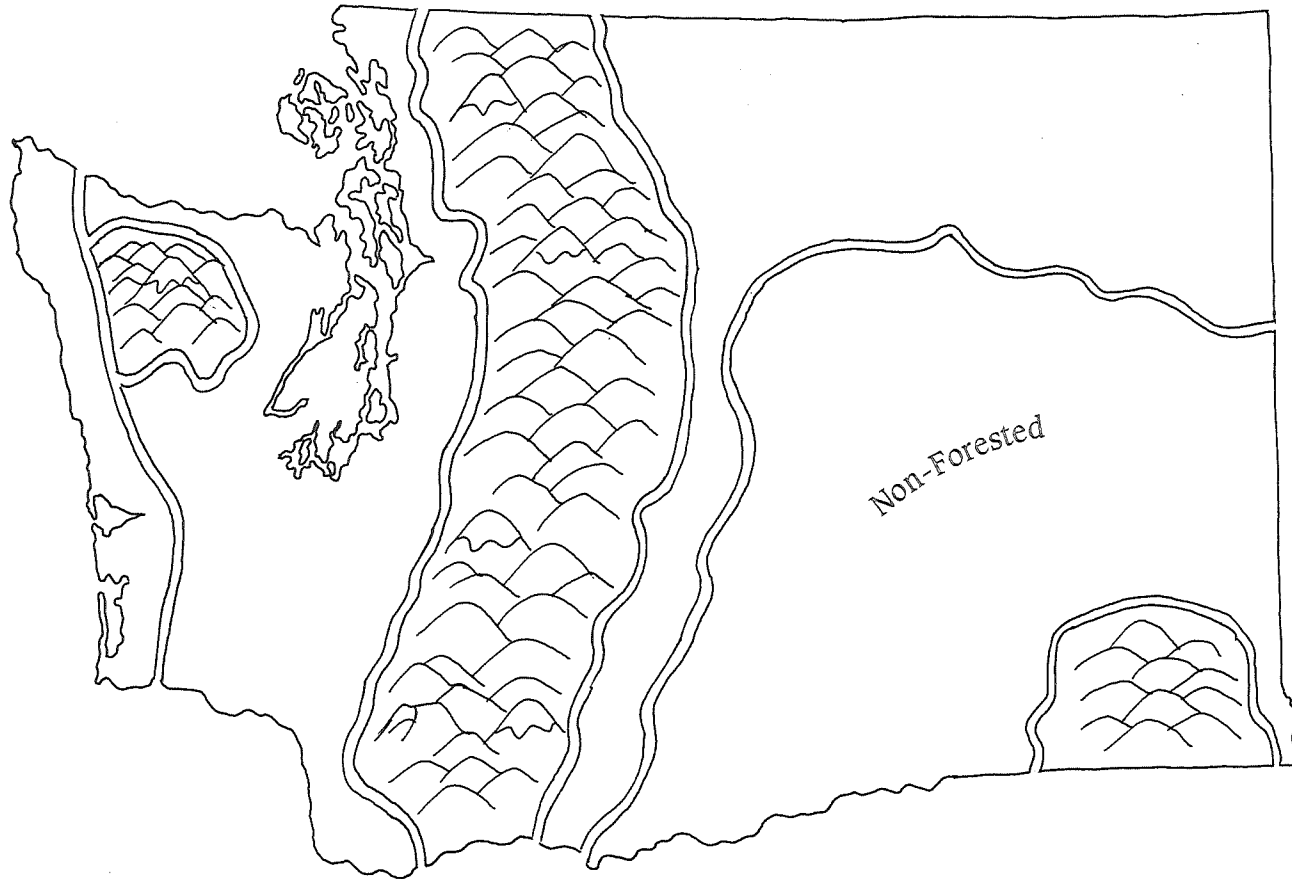
1. Ask all the students who made brochures for one forest region to form a team and create a television "commercial" to attract tourists to their region. Do the same for the other three regions and videotape the four commercials to present at a PTA meeting or to show to other classes.
2. Tell students to create their brochures from the tree's point of view. Instead of inviting people to visit the region, brochures would invite other plants, mammals, birds and fish to come and live there and would describe the ideal conditions available.
3. Instruct students to work in small groups to create bumper stickers, television and radio ads, or posters about their assigned forest region. Upon completion, each group will present their creation to the class.
4. Invite a cartographer to speak to the class about map-making and map reading.

Assessment: What Did We Learn?

Ask students to identify the four forest regions of Washington on a map and write two sentences about each one, describing the regional attributes (including one tree species per region).



Forest Regions of Washington State



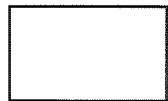
56



Coastal



Mountain



Lowland



Intermountain

Sitka Spruce

Pacific Madrone

Douglas Fir

Western Red Cedar

Western Hemlock

Big Leaf Maple

Pacific Silver Fir

Subalpine Fir

Mountain Hemlock

Western Larch

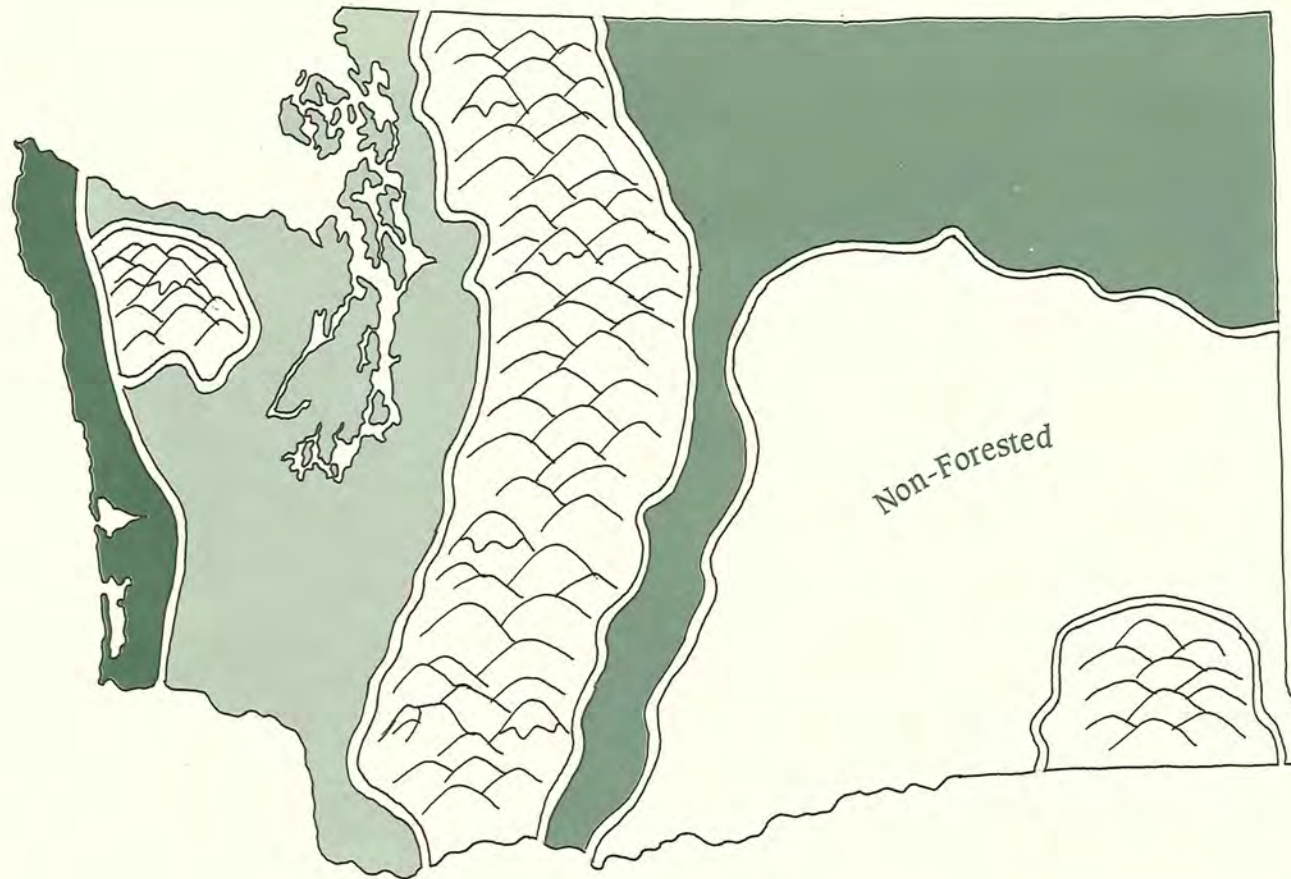
Ponderosa Pine

Lodgepole Pine

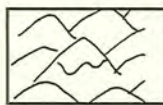
	Coastal	Lowland	Mountain	Intermountain
Sitka Spruce				
Pacific Madrone				
Douglas Fir				
Western Red Cedar				
Western Hemlock				
Big Leaf Maple				
Pacific Silver Fir				
Subalpine Fir				
Mountain Hemlock				
Western Larch				
Ponderosa Pine				
Lodgepole Pine				

Forest Regions of Washington State

(Teacher's Key)



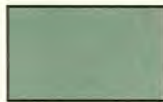
Coastal



Mountain



Lowland



Intermountain

Sitka Spruce

X

Pacific Madrone

X

X

Douglas Fir

X

X

X

X

Western Red Cedar

X

X

X

Western Hemlock

X

X

X

Big Leaf Maple

X

Pacific Silver Fir

X

Subalpine Fir

X

Mountain Hemlock

X

Western Larch

X

X

Ponderosa Pine

X

X

Lodgepole Pine

X

X

X

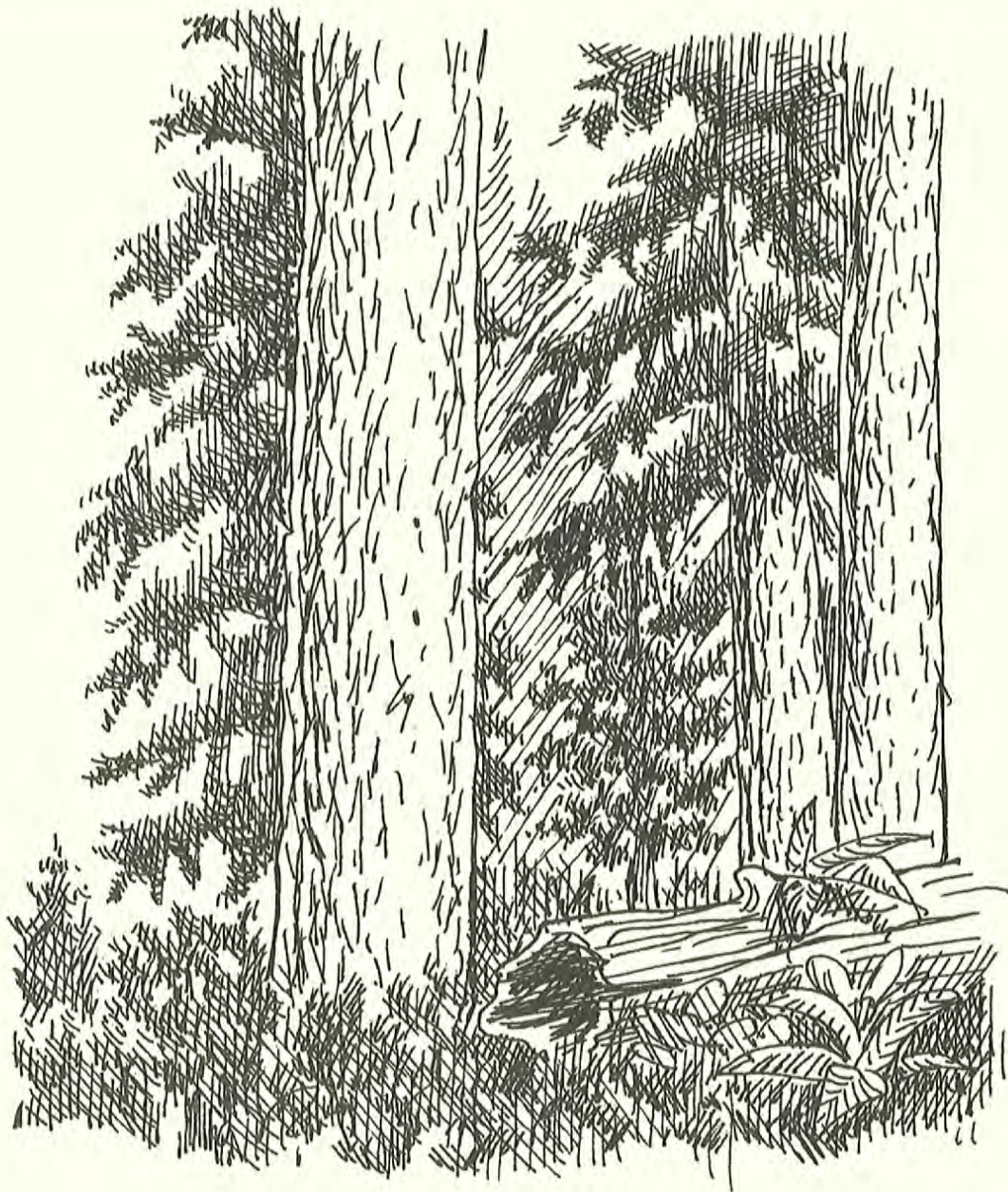
	Coastal	Lowland	Mountain	Intermountain
Sitka Spruce	X			
Pacific Madrone	X	X		
Douglas Fir	X	X	X	X
Western Red Cedar	X	X	X	
Western Hemlock	X	X	X	
Big Leaf Maple		X		
Pacific Silver Fir			X	
Subalpine Fir			X	
Mountain Hemlock			X	
Western Larch			X	X
Ponderosa Pine			X	X
Lodgepole Pine	X		X	X



Coastal Forests

These are low elevation forests bounded by the reach of ocean fog. They characterize a long, narrow region which stretches the length of Washington's coast (and, in fact, extends north into Alaska and south as far as northern California). An important characteristic of the coastal region is the frequent summer fog that rolls in off the ocean, ensuring moisture is available, even during the relatively rain-free summers. This is the mildest region (with temperatures neither very hot or very cold) and receives the most rain (133" per year) compared to other regions in Washington. Sitka spruce, western red cedar and western hemlock are the most common types of trees, though Douglas fir is abundant in places. Along coastal cliffs and other rocky areas the Pacific madrone beautifies the region with its smooth red bark and broad, evergreen leaves. The lodgepole pine also can be found, but this species does not grow as tall or as extensively as it does east of the mountains.

Within this region is a temperate-zone rain forest, one of only four or five in the world (and by far the largest). Thick clouds blanket the sky most of the time. Mist envelops the trees, which are huge, and water drips from branches that are covered with lichen, ferns and mosses. This forest receives up to 20 feet (240") of rain each year! Summers are relatively dry, although fog often condenses on the needles of trees and drips to the ground. "Fog drip" adds up to 4 feet of moisture per year to the forest valleys on the west side of the Olympic Peninsula. Rotting debris, nurse logs, mosses, ferns, herbs and shrubs cover the forest floor. Giant trees loom everywhere, some 300 feet tall, 60 feet around and more than 1,000 years old. Fifteen hundred organisms may live in a single tree in a web of relationships we have only begun to understand.



Lowland Forests

This region between the coastal zone and the Cascade Mountains (excluding the Olympic Mountains) is sometimes called the Puget Sound Lowlands. It is the largest forested zone in Washington and probably the most important for timber production because its mild temperatures and abundant rain (70" per year) provide excellent growing conditions. Much of the region has been logged in the past 150 years. As a result, the present forest consists primarily of stands of second- and third-growth Douglas fir, along with western hemlock and western red cedar. These last two species re-seed readily within the shade of a forest. (These forests are often referred to as "Western Hemlock Climax Forests" because, if left alone, Douglas fir, even if currently dominant, will eventually die and be unable to re-seed in the shade of hemlocks and cedars.) Big leaf maples also grow here, particularly noticeable in autumn when their huge, golden leaves blanket the forest floor.

Expanding urban areas are encroaching upon many parts of the lowland forest. These forests, which have grown trees for thousands of years, are becoming sites for shopping malls and housing tracts. Retaining forested areas as "urban forests" (greenbelts and parks) is a significant consideration for planners and managers. Just think of what urban forests give us: clean air, soil erosion control, clean run-off water, shade and temperature control, wind protection, beauty, privacy, homes for wildlife, barriers to noise pollution.



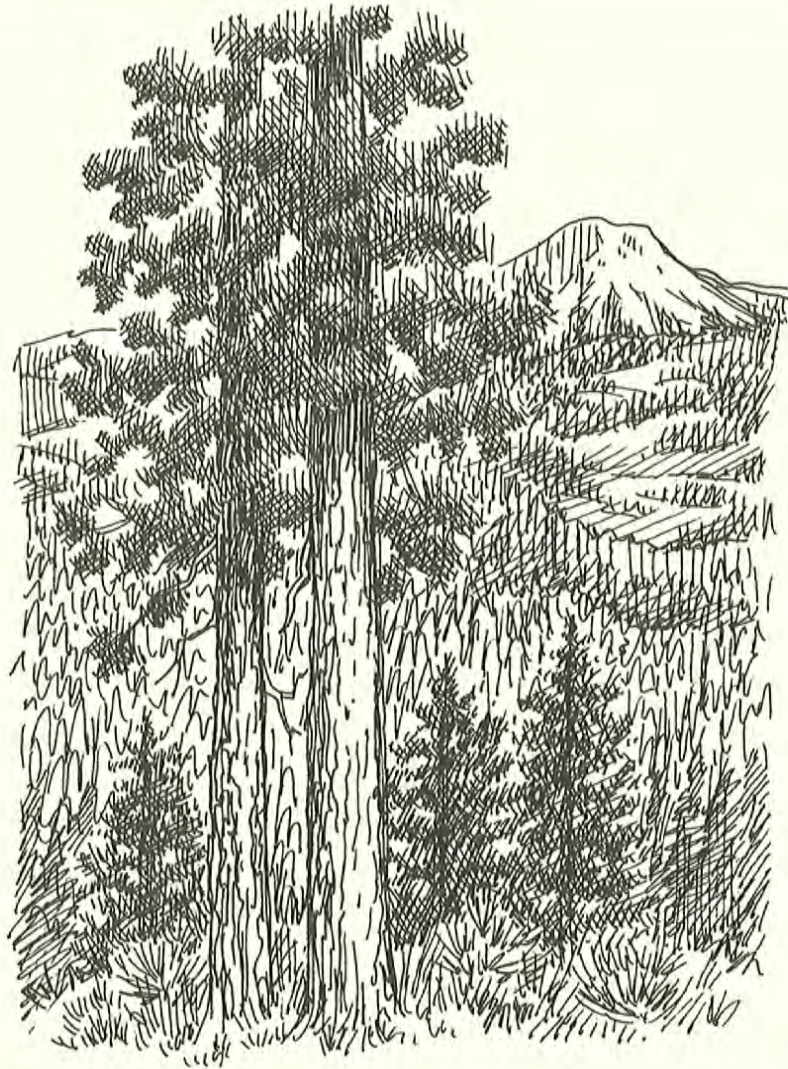
Mountain Region

The mountain regions of Washington are difficult to characterize because westside mountains differ from eastside mountains, plus conditions vary greatly from mountaintops to lower elevations. The best generalization would be that tree species in mountain forests of Washington change depending upon elevation and precipitation.

For our purposes in this lesson let's consider the mid-elevations of the Olympics and Cascades to be mountain regions. With their short, cool growing seasons and substantial snowpack, they are wetter and cooler than the lowland forests. Douglas fir, western hemlock, western red cedar and Pacific silver fir thrive here.

On the mid-elevation slopes of the eastern Cascades, Douglas fir is joined by lodgepole pine, ponderosa pine, grand fir and western larch as the dominant species.

Above the mid-elevations of the mountain region, snowpack can be 25 feet deep and last 6 to 8 months. There subalpine firs survive, often growing only one fraction of an inch per year, pruned by snow loads and winds. (Old growth doesn't have to be huge, does it?) Mountain hemlocks and Alaska yellow cedar also survive at this high elevation. All three tree species grow well on both the east and west sides of the mountains, joined on the east by larch and Engelmann spruce. These timberline trees form their own support groups, growing in clumps for protection, with "tundra" meadow plants and wildflowers covering the slopes between.



Intermountain Region

The lower eastside of the Cascades, the Okanogan Highlands and the Blue Mountains of southeastern Washington are all part of the intermountain range. This is a dry region with temperature extremes. It usually freezes at night from October through May. Summer daytime maximums commonly reach 90-100 degrees (F). Generally these forests are dominated by ponderosa pine, a tree which is very drought-resistant. Because this region receives an average of only 20" of precipitation per year, plant growth is not as dense as in other forested regions of Washington. Ponderosa forests typically are open, interspersed with sagebrush and grassland. Lodgepole pine also thrives in this region, often in large stands. This tree is brought to life by fire; the heat of flames causes its cones to open and disperse seeds, making wildfire an important factor within the ecosystem. Douglas fir, western larch and western white pine are found here too. Western larch trees enliven this region with color. They create a golden shower in the fall when their needles begin to drop; in spring they sport vivid lime green foliage as new needles unfold.

All of Washington's forest regions provide great diversity of wildlife habitat, but several unique wildlife areas exist in the intermountain region. One, in the Okanogan National Forest, is an area managed for lynx habitat. This forest may have the largest lynx population in the contiguous United States. Lynx depend on snowshoe hares for food, so the populations of the two species rise and fall together. The U.S.D.A. Forest Service manages timber cutting in a manner that encourages dense stands of young lodgepole pines to replace small clearcut areas, thus providing the food (inner bark) and cover snowshoe hares require. A mosaic of young lodgepole pines and older growth (for lynx dens) creates a lynx habitat.

In the Colville National Forest two species of animals are threatened: the bald eagle and grizzly bear. Three are endangered: the woodland caribou, wolf and peregrine falcon. The caribou herd found in this region is the only one left in the contiguous U.S. A recovery program is underway for caribou in the Colville Forest, and curbs are put on timber cutting and recreation in caribou habitat areas.

Washington Forest Eco-Connections

Background Information For Teachers

Skills

Cooperative learning,
discussion, critical thinking

Subject Areas

Science, art, drama

Materials

Eco-Connection cards*

* Provided

Washington forests are full of connections. Every organism is connected to other living things and non-living things as well. Their relationships are often thought of as a web, woven together in an intricate pattern and with a delicate balance humans often find difficult to understand. We can begin to understand by remembering the "LAWS" of the forest ecosystem — **Light Air Water Soil** (including rocks). These form the basis of our ecosystem, and without them there would be no life. The following statements illustrate some of the connections in a forest ecosystem:

1. **Sunlight** provides energy to help green plants produce carbohydrates ("photosynthesis").
2. **Sunlight** raises the forest temperature so creatures don't have to use as much of their own energy to stay warm. Reptiles and amphibians need warmth to speed up their metabolism.
3. **Sunlight** causes evaporation that fuels the water cycle, bringing more moisture to forest plants and animals.
4. **Air** provides oxygen and carbon dioxide for plants and animals to breathe.
5. Moving **air**, or wind, is an important component of the water cycle.
6. Moving **air** aids in pollination.
7. **Water** is needed by plants and animals to survive.
8. **Water**, as it freezes in cracks, helps rocks break up into smaller pieces, eventually becoming soil.
9. **Water**, through rain, washes plant leaves, allowing for better photosynthesis.
10. **Soil** provides food for plants.
11. **Soil** filters, cleans and stores water and provides a place for plants to grow.
12. **Soil** and rocks provide homes for animals, fungi and bacteria.
13. **Plants** provide food and homes for animals. Some **animals** provide food for other animals.
14. Decaying **plants** (example: rotting logs) and **animals** provide nutrients for soil (as do animal droppings).

Learning Outcome

Students will understand some of the connections among living and non-living components of Washington forest ecosystems.

Learning Procedure

What Is a Forest Ecosystem? Describe the difference between living and non-living components of the environment. Ask students to name all the living and non-living things they can think of which would be found in a Washington forest. Discuss some of the relationships among non-living things, plants and animals in a forest. (See background information.) Illustrate the relationships by showing students the connections between living and non-living components portrayed on the Eco-connection cards. Explain that the word "ecosystem" refers to all those connections. An ecosystem can be described as all living things and their environment in an area of any size, all linked together by energy and nutrient flow. Explain to students that people are just beginning to understand how many connections there are and how they function.

Forest Ecosystem Demonstration: Photocopy and cut out the Eco-connection cards. Divide the class into teams of two or three and distribute Eco-connection cards to each team. Be sure each team receives a mix of wildlife, plants and non-living component cards. Several teams will have the same pictures. (Choose either the western or eastern Washington Eco-connection cards.) Explain that their task is to decide what the connections are among the pictures on the cards and to devise a way to illustrate or demonstrate those connections to the class. Students may use art materials for posters or mobiles, or may choose to use drama (perhaps puppets) to demonstrate their eco-connections.

More Ideas

1. Play a game in which each student represents one component of a Washington forest. (Assign each student one component from the Eco-connection cards. For example, one student will be the sun, one will be the soil, one an owl, etc.) Give each student seven identical cards naming the component that student represents. To play, students must trade cards with six other students. (They should end up with six other cards + one of their own cards.) When finished trading, students should arrange their cards in a way that helps them explain the possible relationships between cards. Have students share their explanations in teams of two or three.

2. Create a Washington forest food web on the board (or on poster paper) by asking students to name the “producers” (green plants) that grow in forests found in your part of the state. Next, ask them which “consumers” (animals) would eat each of the producers. List the animal’s name above the plant it feeds on and draw an arrow from the plant to the animal. The arrow indicates that the plant “provides energy for” the animal. Ask what other animals consume the animals already listed on the board. Continue to add animal names and arrows. Look to see if some of the consumers listed eat more than just one thing. Draw additional arrows: For example, if you have shown that an owl eats a mouse and a nuthatch eats an insect, you also need to draw an arrow from the nuthatch to the owl since owls often eat small birds. When finished, you will have created a Washington Forest Food Web. Have students choose one of the “top” consumers and create a poster or mobile to illustrate its food web.
3. Instruct students to cut pictures out of magazines to make a collage of the forest ecosystem. You can also use illustrations from the provided Eco-connection cards for this exercise.

Assessment: What Did We Learn?

Use the activity in *Forest Ecosystem Demonstration* for evaluation purposes.



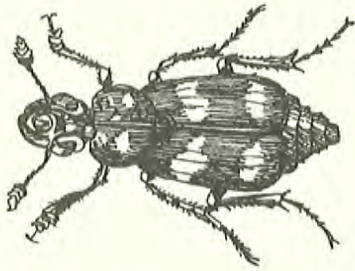
Eastern Washington



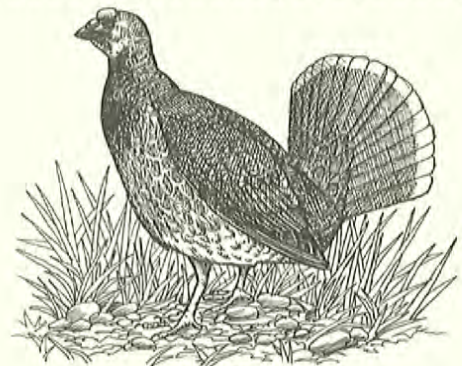
Mule Deer



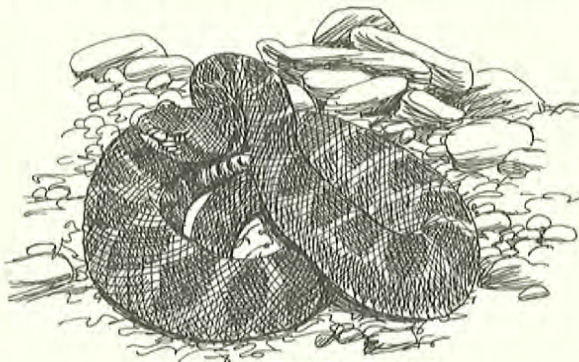
Shrub



Carrion Beetle



Blue Grouse



Western Rattlesnake



Deer Mouse

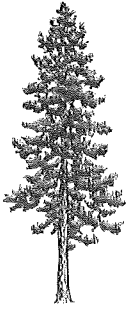


Douglas Fir

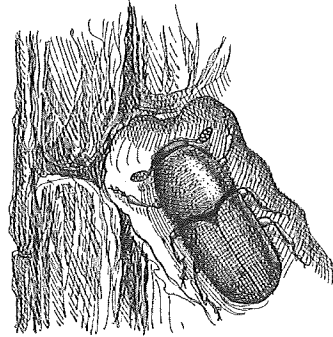
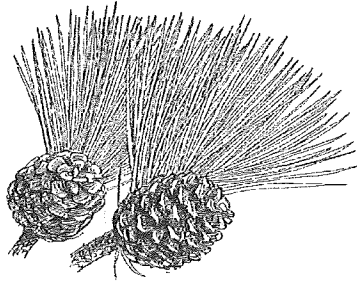


Nuthatch

Eastern Washington



Ponderosa Pine



Pine Beetle



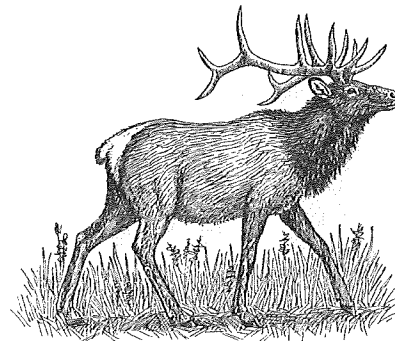
Golden Mantled Ground Squirrel



Great Horned Owl



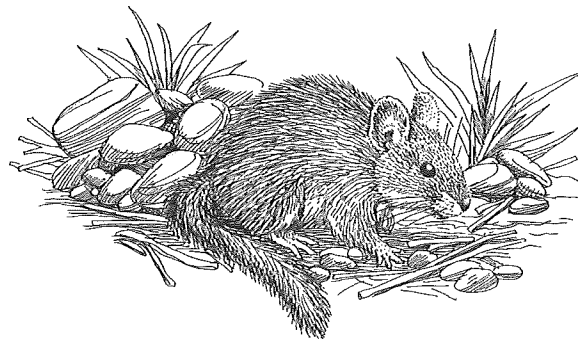
Grass



Elk

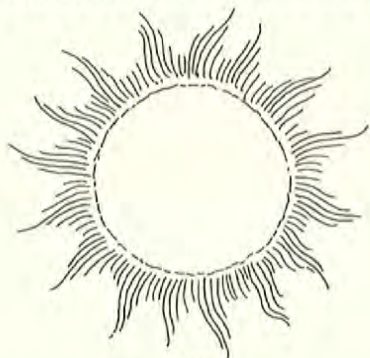


Red-tailed Hawk

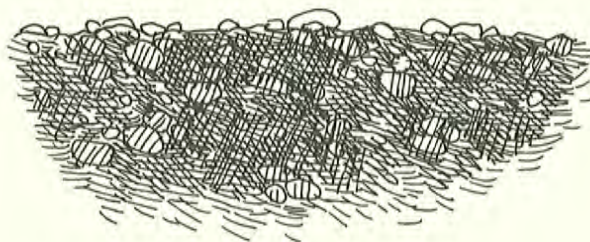


Woodrat

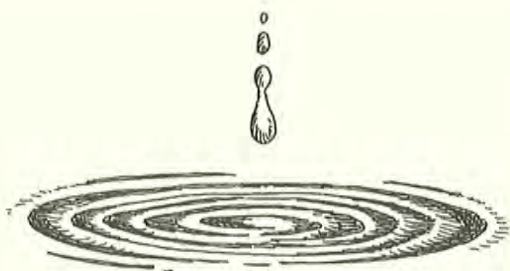
Eastern & Western Washington



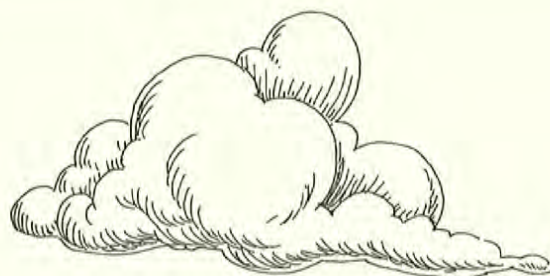
Sun



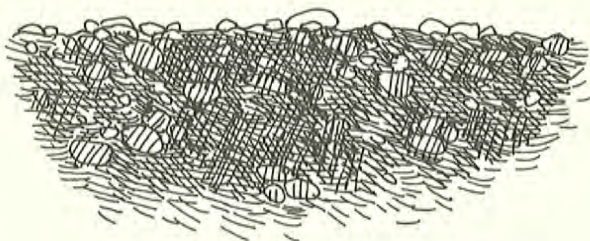
Soil



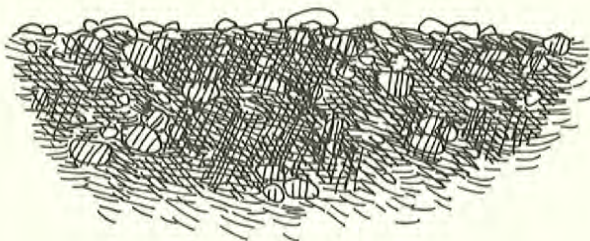
Water



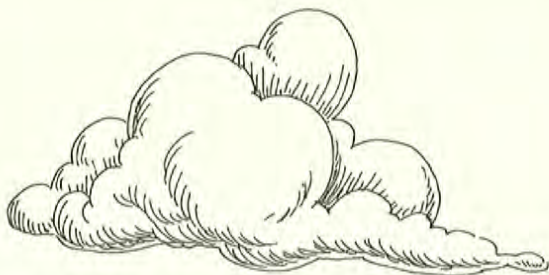
Air



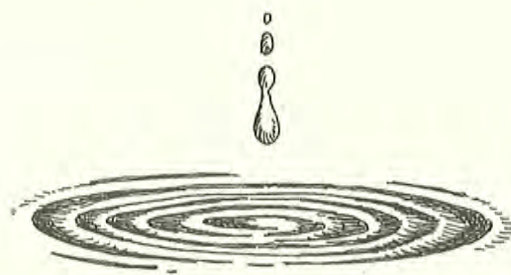
Soil



Soil



Air

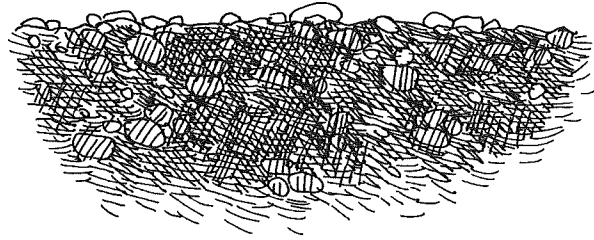


Water

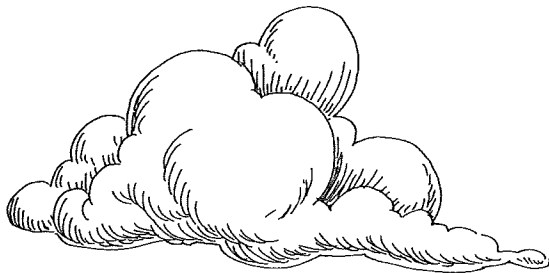
Eastern & Western Washington



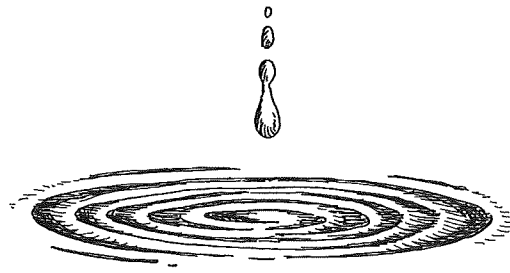
Air



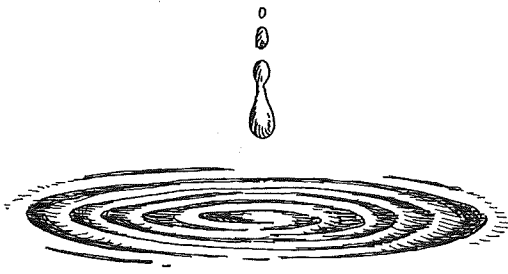
Soil



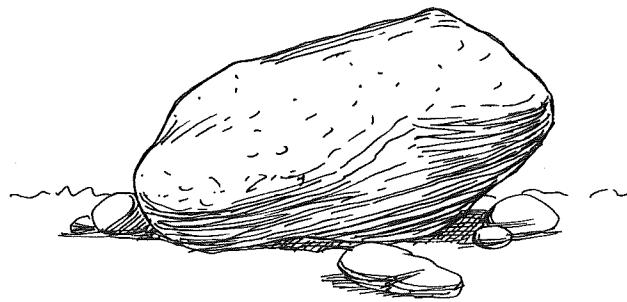
Air



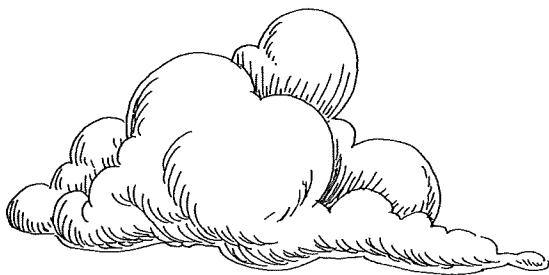
Water



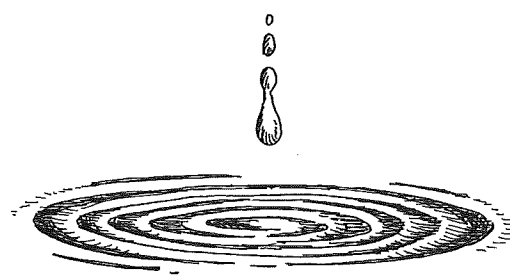
Water



Rock



Air

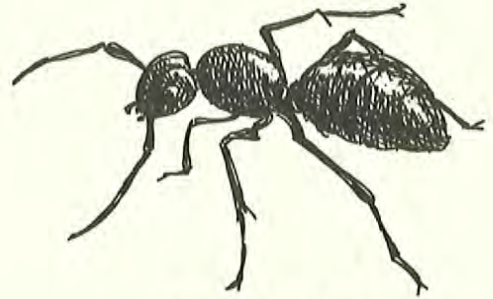


Water

Western Washington



Douglas Fir



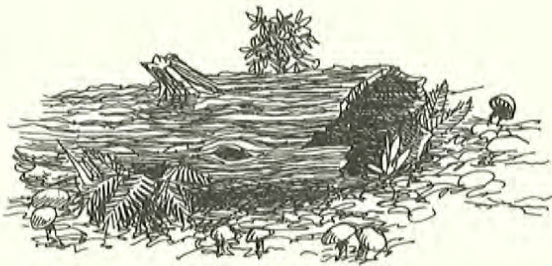
Carpenter Ant



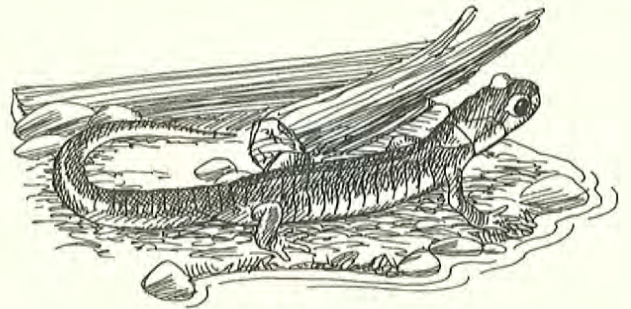
Pileated Woodpecker



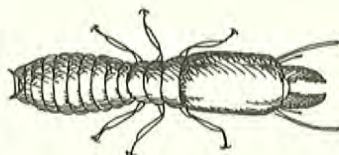
Douglas' Squirrel



Fallen Log



Salamander

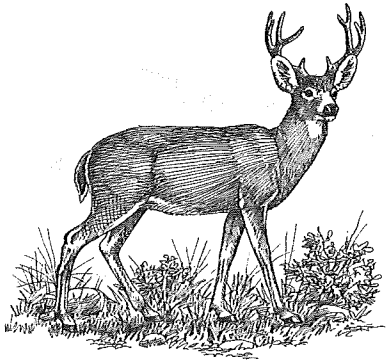


Termite



Bear

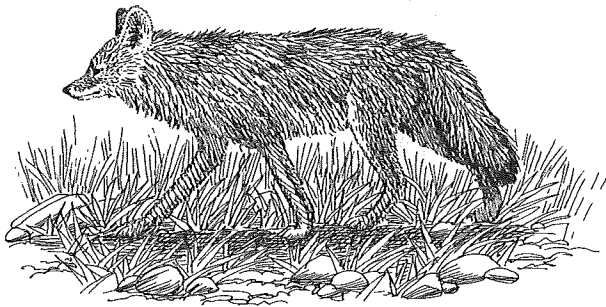
Western Washington



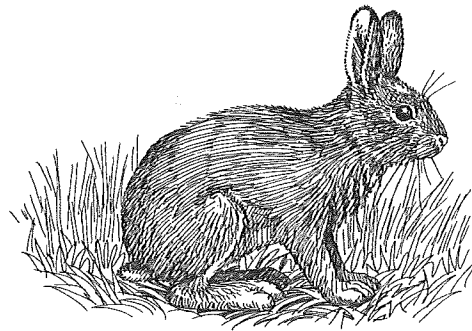
Black-tailed Deer



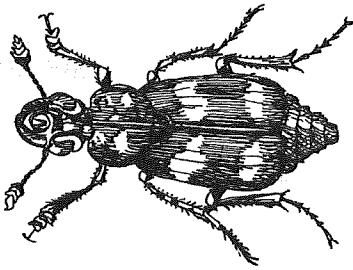
Blackberries



Coyote



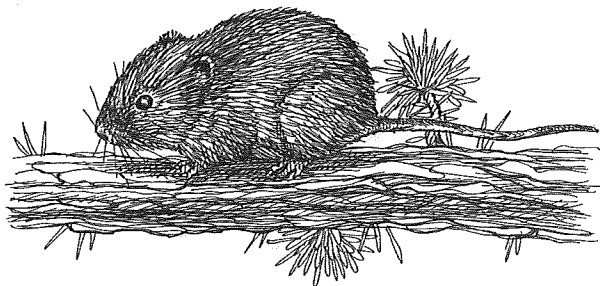
Snowshoe Hare



Carrion Beetle



Grass



Vole



Great Horned Owl

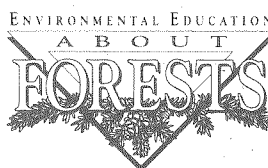
Unit II

Human Interdependence on Washington Forests

Washington State Environmental Education Goal II:

The student will value the environment as the basis
of our physical lives, economy and emotional well-being.

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Fire: Friend or Foe

Background Information for Teachers

Throughout history humans have had a love/hate relationship with fire. The ability to purposely light fire enabled people to stay warm, cook food and have light at night. But people weren't always able to control fire — sometimes fire got out of control and wreaked havoc with the surrounding environment. Or did it? Forest fires seem to bring down the curtain, but sometimes they really are the opening act in nature's play. Fire presents opportunities for new life to begin; nearly every ecosystem in North America depends on fire. Our challenge is to try to understand its place in nature and reconcile our relationship to the mighty force that both gives and takes away life.

Some Native Americans referred to fire as "Grandfather Fire" because it was a force they couldn't always control, but one they must always protect. Fire was sometimes used as a hunting tool by many Native Americans. They often used fire to encourage growth of plants that were eaten by animals they hunted. For example, controlled burns kept the grasslands fertile so buffalo would be attracted to the area. In western Washington, Native Americans used fire to keep conifers from invading prairies (scattered areas of grass and oaks growing on coarse, gravelly soils). These fires encouraged the growth of camas, valued as a root crop, and maintained open grazing conditions favored by deer. Fire also was used to drive animals into places where Native Americans could hunt them more easily. Early white settlers imitated the native people's use of fire.

Fire has many natural benefits, as well as being useful to people. As areas are burned, grasslands are created instead of forests. Some trees, such as the lodgepole pine, giant sequoia, longleaf pine, ponderosa pine and Douglas fir, need sunlight to grow and are therefore helped by ground fires which clear out dense forest growth. The lodgepole pine needs the heat from a fire to open its cones and release its seeds. As forests burn, fire releases minerals from wood and grasses, breaking them down and returning them to the soil so plant roots can absorb them and grow more rapidly. The result is new growth that provides food for many animals.

Some animals use fire to their advantage. For example, the firehawk flies to a fire, picks up a smoldering branch or twig and drops it onto unburned grass. It then waits for a feast as mice, chipmunks and snakes run out of the way of the new fire. The Kirtland's warbler lives only in recently burned jack pine forests. The Steller's jay and pronghorn antelope look for food in both burned and unburned areas.

Skills

Discussion, cooperative learning, critical thinking

If **More Ideas** section is used:
Graphing, computer technology, persuasive writing

Subject Areas

Science, physical education

If **More Ideas** section is used:
Math, language arts

Materials

Paper

Drawing supplies

Scissors

Safety pins

Huge forest fires are phenomenal forces; they have been known to create their own weather. As heat and moisture rise in the air, towering cumulus clouds form. They can cause lightning and start other fires. As oxygen is sucked into the fire, winds are created which fan the fire to burn brighter and faster.

Opinions on fire constantly change as people seek to control its use and spread. Whether naturally occurring or human-caused, fire needs three things to burn: fuel, oxygen and heat. In the early part of this century controlled fires were used to rid the forests of dry, dead tinder. After World War II, new technology and techniques were used to control forest fires. Smokey the Bear reminded people that only they could prevent forest fires. Today, we know that people can't prevent all forest fires, and many people believe that we shouldn't even attempt to control wild fires. Still, some land managers promote the return of controlled burns, with the argument that if controlled burns are permitted they reduce the chance of larger, more destructive fires. They also open up an area to sunlight and help to control insects and tree diseases. On the other hand, repeated use of fire may endanger watersheds through erosion and could harm soils, reduce the natural beauty of an area, create air pollution and decrease the timber supply.

The National Park Service, the U.S.D.A. Forest Service, the Washington State Department of Natural Resources and private landowners are exploring their fire and land protection policies. As scientists continue to study fire's effects on ecosystems, forest managers will continue to revise fire policies. It will be interesting to see what those changes will bring.

Learning Outcome

Students will understand the natural role of fire and learn that the effects of forest fires can be both positive and negative.

Learning Procedure

Is Fire Positive or Negative? Instruct students to work in groups of four to generate two lists: one list for positive effects of fire, a second list for negative effects of fire. (The idea is to encourage students to think of fire as a positive as well as negative force. Most students tend to think of forest fires as having only negative impacts.) As a class, compile the lists on the board. Using the background information as a reference, conduct a class discussion of the pros and cons of fire.

Play Forest Fire Tag: Review with students the fire triangle (components necessary for fire): **heat, oxygen and fuel.**

Either outside or in the gym, play a tag game to simulate the pros and cons of fire. Prior to leaving the classroom, designate four students as fire, two others as firefighters. Have remaining students count off by threes. The “one’s” represent lodgepole pine seeds, “two’s” are houses and “three’s” are oxygen. Students are to make pictorial name tags to pin on the fronts of their clothes. As examples, firefighters might draw hoses or shovels, and fire could be illustrated as flames.

When outside or in the gym, designate boundaries for two circles: an inner circle and an outer circle. The fire and firefighter students stand in the center of the inner circle, and the remaining students form the outer circle. At your signal the fire students try to tag students in the outer circle, and the firefighter students try to tag the fire students. Fire students can enter the outer circle, but not the firefighters. Fire must leave the game when tagged by firefighters. When the lodgepole pine seeds are tagged by fire they become trees and “freeze” with their arms outstretched. When the houses are tagged they become ashes and sit down where they were tagged. When oxygen students are tagged they become fire and join the other fires in trying to tag houses and pine seeds. When all the houses and pine seeds have turned to ashes and trees, the fires must return to the inner circle (because all the “fuel” is gone). The game is over when there are no students left to tag.

Help students process their learning by asking questions about the game, such as: How was this game like a real fire? How was it different? In a real fire, what are some positive effects that happen? What are some negative effects? (see Background Information for more ideas) Alternatively, divide students into groups and have each group draft answers to the questions and present their thoughts.

More Ideas

1. Have students use a word processor to create fire stories from various perspectives: that of a Native American in the times before pioneer settlement, a Douglas fir tree in the coastal forest “waiting” for an opening in the canopy to give it a chance to grow, a firefighter, a wilderness ranger, a deer, a homeowner, or any perspective of their choice. Stories could be illustrated and bound as a class book.
2. Invite guest speakers to talk to the class about fire management. Guests might be firefighters with the Washington State Department

of Natural Resources, land managers with the U.S.D.A. Forest Service, or private forest managers.

3. Instruct students to write "letters to the editor" stating their opinions, based on facts, about the positive and/or negative roles of fire.
4. Use the chart below to graph the number of forested acres burned each year in Washington. Discuss possible reasons for variations in numbers of acres burned/year.

Year	Number Acres Burned
1990	11,000
1989	8,500
1988	27,000
1987	9,500
1986	2,500
1985	42,000
1984	4,000
1983	2,000
1982	4,000
1981	4,000
1980	2,000
1979	15,000
1978	4,000
1977	7,500
1976	9,000
1975	2,000
1974	6,000
1973	10,000
1972	2,500
1971	1,000
1970	61,000

Assessment: What Did We Learn?

Students can demonstrate what they've learned by creating posters to illustrate pros and cons of forest fire. (They can use lists generated in *Is Fire Positive or Negative?*)



The Forest Flu

Background Information for Teachers

Typically, we think of a diseased tree negatively. When a beautiful tree that is part of our landscape becomes damaged or diseased and dies, we are sad to see it go. When East Coast towns suffered an outbreak of Dutch elm disease the local landscape was severely altered. Tronsen Creek campground on Washington's Blewett Pass has been temporarily closed because many seemingly healthy trees have a serious root disease. When tree roots become infected they can no longer efficiently draw up water and nutrients, and the tree eventually dies. The next windstorm can cause considerable damage as weakened trees fall to the forest floor. These are not favorable conditions for a family camping trip!

The landowner managing a forest for timber production does not welcome disease. Many U.S.D.A. Forest Service lands in eastern Washington and Oregon are now considered not suitable for timber production because of widespread disease and insect infestation. Some possible causes could be an abundance of a single tree species or policies that dictated suppression of wildfires and allowed limited use of controlled burns.

From a human perspective forest diseases are not very desirable. But sometimes insects and disease have beneficial roles in the forest ecosystem. Disease and insects, along with fire, lightning and wind, help create snags that provide important wildlife habitat. Diseased trees die and fall and allow sunlight to reach shade-intolerant seedlings. The fallen logs, in turn, create new habitat for many plants and animals and return nutrients to the soil as they decay.

Learning Outcome

Students will gain an understanding of the positive and negative roles disease plays in the forest regeneration cycle.

Learning Procedure

Go Outside: Take the class on a field trip around the school grounds or surrounding neighborhood. Have students look for evidence of diseased trees (brown, crisp branches; scars; curling leaves). Ask students to visually and verbally compare diseased trees with healthy trees. (If there are no trees in your area, look at bushes or other vegetation.)

Let's Play Tree Doctor: Either outside or back in the classroom use the background information to conduct a discussion on what evidence

Skills

Observation, compare and contrast, drawing, discussion, cooperative learning, critical thinking

Subject Areas

Science, art, drama (activity variation)

Materials

3" x 5" cards

Poster or butcher paper

Drawing supplies



indicated a tree might be diseased. (Make comparisons to the ways people show evidence of injury and disease, i.e., scabs, scars, fever, rashes). Ask students what they do to prevent and control disease and infection in their bodies. Ask them what could be done to prevent and control disease in a forest.

Forest managers sometimes use pesticides and fungicides to control disease and insects. They also use biological methods, such as release of bacteria that specifically attack forest damaging insects or release of sterilized female insects for population control. Some forest managers plant a variety of tree species and stagger their harvest schedule to create a mixed-age forest. Variety and staged development decrease the likelihood of an entire stand of trees being wiped out by infection or insect infestation.

If possible, have students look closely at a fallen log to find evidence of insects, fungi and decay, and discuss the role of disease in the recycling of soil nutrients.

Disease and the Forest Cycle: Copy the 7 statements below and cut into 7 strips or cards. Divide students into 7 groups and give each group one card:

Card #1 You are a forester planting a tree seedling in the forest soil.

Card #2 You are a young tree growing among many big and small trees.

Card #3 You are a tree with many leaves eaten by insects.

Card #4 You are a tree who is dying from lack of water and nutrients because your roots are diseased and can't do their job.

Card #5 You are a big windstorm that knocks down a diseased tree.

Card #6 You are a new log lying on the forest floor, and many plants, insects and animals are using you for shelter and nourishment.

Card #7 You are a very decayed log in the forest, turning into soil.

Instruct each group to draw a picture of what their card tells them they are. When all the groups have finished, display the pictures either in a line or a circle on the floor or wall. Discuss with students the natural cycle and the role disease plays in forest regeneration.

Variation: Divide students into seven groups, give each group one of the situation cards and have them make props to dramatize the forest regeneration cycle.

More Ideas

1. Invite a forester to your classroom to discuss the negative and positive aspects of forest disease and insects.
2. Take a field trip to a local tree farm to see how it is managed for timber production, wildlife, recreation and water quality. See what a tree farmer does to prevent and control tree disease.
3. Students contact a forester, tree farmer, wildlife biologist, nursery professional, garden club member, city arborist, or tree surgeon to compare how different professionals prevent and control disease and insect infestation.
4. Instruct the class to draw a mural of the forest regeneration cycle and label its stages and phases.

Assessment: What Did We Learn?

Students list two detrimental and two positive aspects of tree disease.





Western Red Cedar

Weather Waltzes With the Forest

Background Information for Teachers

Skills

Artistic interpretation, oration, creative writing, discussion, cooperative learning, critical thinking

Subject Areas

Communications media, music, language arts

Materials

A variety of musical instruments and objects to create sound effects

Tape recorder

Blank tape

No doubt you've heard the comment, "If you don't like the weather in Washington, just wait a few minutes, it will change." The topographic layout of the state, from the ocean to the mountains to the desert, allows us to enjoy a unique variety of weather patterns. The weather, acting in concert with the topography, affects the location and variety of trees and vegetation. But other than determining where trees grow and what type of trees grow in different places, what does weather have to do with Washington's forests?

It is not unusual for us to experience summer droughts — even in typically wet western Washington. For the most part, trees are adapted to particular weather patterns. For example, Douglas fir is genetically programmed to survive anywhere in the state but especially in western Washington's cold, damp winter and warm, dry summer. But even trees adapted to drought situations are susceptible to drought-induced risks. For instance, the likelihood of forest fire, both natural and human-caused, is higher during times of prolonged drought. Also, if trees are deprived of water for unusually long periods of time they can become stressed and possibly die.

Forests are not just affected by weather; they aid in protecting other species from certain weather conditions. Forests act to regulate temperature, providing beneficial protection to many animals. In winter, forests are warmer than surrounding open space and offer shelter from wind and deep snow. In summer, forests are cooler than surrounding open spaces and are very inviting to hikers, campers and certain wildlife species.

Forests play an important function in flood control for many communities. Heavy rains are slowed when they hit the dense forest canopy, and tree roots help keep soil from being washed away. Of course, summer thunder and lightning storms have the potential to create forest fires. Fire plays an important role in the forest ecosystem by cleaning out accumulated woody debris, opening space for sunlight to reach shade-intolerant species and providing the catalyst for some species to germinate (see Lesson 7: *Fire: Friend or Foe?*). On the other hand, forest fires can destroy homes and other personal property, take lives and wipe out commercial forests.

The dance performed by forests and weather is complex and intricate. Weather has significant impacts on forests, yet forests in turn modify the effects of weather.



Learning Outcome

Students will identify ways forests are affected by weather and ways forests provide protection from weather.

Learning Procedure

Write a Radio Show Script: Students will create a “radio show” about the interactions of the forest ecosystem and the weather. To begin, use the background information and lead a discussion on the interplay between Washington’s forests and the weather. Divide students into four groups to represent the seasons. Let the groups decide who in each team will provide sound effects, who will represent forest plants and animals and who will portray people visiting or living near the forest. Then, each group prepares a short script for their seasonal segment of the radio show.

Imagine the Weather through Music: Using a tape recorder, each team takes a turn recording the sounds and experiences of their assigned season. Help them decide what objects and musical instruments can portray different weather sounds. (For example, wind instruments and whistles can represent wind; drums and clapping can sound like thunder; small bells can represent snow; sandblocks rubbed together can sound like rain.) Encourage students to be creative in finding ways to portray weather sound effects. Interspersed among the weather sounds, the other students will tell their experiences, from the perspectives of their chosen characters, of the forest and the weather. A deer or elk may be grateful to have the forest as shelter from the deep snow in the fields. A homeowner in the valley may be glad that the forest keeps the spring rains from flooding her/his home. (The class may need to do some group brainstorming to come up with ideas for weather sounds and character ideas.)

More Ideas

Students write haiku about the interactions of forests and weather. Haiku is a Japanese form of poetry that usually has nature as its topic and consists of three lines: 5 syllables, 7 syllables and 5 syllables. Example:

<p>Clouds gather quickly. (5 syllables)</p> <p>Tree tops shed the streaming rain. (7)</p> <p>The twin fawns are dry. (5)</p>
--

With Vivaldi’s *Four Seasons* as background music, students record their poems onto a class tape.

Assessment: What Did We Learn?

To demonstrate knowledge gained, have each student draw a picture representing ways forests provide protection from the weather and write a short paragraph explaining the picture.





3. Pacific Madrone

Finding Out About Watersheds

Learning Outcome

The student will be able to define the term “watershed” and identify the natural and human components of a typical watershed.

Learning Procedure

What Is a Watershed, Anyway? Introduce watersheds by explaining that Washington forests are part of something bigger, i.e., they don't exist in isolation. That larger picture is called a watershed. We might not live in a forest, but we all live in a watershed. By studying one we can learn what the natural and human parts of a watershed are and how important and valuable all the resources, including forests, are to us.

Build a Watershed: Use a large plastic garbage bag and drape it over some loosely crumpled newspaper. (Use a slope outside your room or slightly slanted board inside.) The idea is to create a hilly contour with a valley in the middle, sloping “to the sea.” Using a spray bottle, spray “rain” on the mountains to observe how the water forms streams and tributaries and flows downhill. (If you're doing this inside, use a towel to catch the runoff!) Many “lakes” will be formed along the way to the sea. Explain that the region that drains into a body of water is the watershed for that body of water. Discuss what another source of water might be, i.e., snow, and how, in a real watershed, the ground is permeable, causing much of the water to seep down and flow underground. This is the source of well water and springs. (Try using layers of paper napkins or tissues to simulate absorption.) Rivers, wetlands and lakes also are connected to the groundwater.

What Do We Find in a Watershed? In the classroom, divide students into pairs. Photocopy and enlarge the watershed illustration (with this lesson) and give a copy to each pair. Re-define and discuss the term “watershed” (the region that drains into a body of water). The illustration depicts a watershed for a river. If the river were named Crooked River, this would be the Crooked River watershed.

Skills

Discussion, cooperative learning, mapping, critical thinking

If More Ideas section is used:
Compare/contrast, research

Subject Areas

Science, social studies, geography

Materials

Large plastic garbage bag, spray bottle, 2' x 3' board (optional), newspaper

Watershed Illustration *

Drawing supplies

Butcher paper (optional)

3" x 5" cards (variation option)

* Provided



On the watershed illustrations, locate and discuss some of the elements of a typical watershed. Use the following terms:

forest (a group of trees that includes all plants and animals above and below ground)

river (a large body of water that runs into a lake, ocean or other river)

glacier (a large body of slow moving ice that melts, thereby feeding creeks and rivers)

tributary (a stream which joins a larger body of water)

spring (groundwater that comes to the surface)

wetland (low area covered by shallow water most of the time, where plants that "like to have their feet wet" grow)

marsh (a wetland where mostly grass-like plants grow, i.e., cattails)

saltmarsh (a marsh in an estuary, inundated by tides twice a day)

swamp (a wetland where mostly trees and shrubs grow, i.e., willows)

estuary (the mouth of the river where freshwater meets saltwater)

Variation: Print the watershed elements on 3" x 5" cards and have students place the cards on the watershed they created in the *Build a Watershed* activity.

What Are Some Human and Ecosystem Interactions?

Ask students to think about the functions and interactions of a watershed's natural environment. List their ideas on the board or on butcher paper.

Possible ideas include:

1. Trees and other plants stabilize the soil with their roots.
2. Trees and other plants provide oxygen.
3. Trees and other plants help clean the air by absorbing polluted air through their leaves and releasing clean air.
4. Forests filter and clean run-off water so tributaries are clear.
5. Forests provide havens of beauty and tranquility.
6. Trees on streambanks keep water cool and healthy for fish.
7. Forests provide habitat for wildlife.

8. Wetlands and forests prevent flooding by soaking up extra water.
9. Wetland plants filter sediments and pollution, keeping rivers clean.
10. Estuaries/saltmarshes produce a huge amount of food (because of their shallow, warm, high-nutrient conditions) and provide “nurseries” for the young of many species. Much of our food (clams, crabs, salmon and other fish) depends on estuary food webs.

Next, ask them to brainstorm human activities that take place in a watershed (how do people use forests, springs, wetlands, flat land, estuaries?) Possible ideas include:

Camping	Skiing
Logging	Farming
Dam-building	Shipping
Fishing	Working in factories
Building towns (stores, houses and roads)	

Instruct students to draw elements of human civilization on their watershed illustrations. Discuss ideas for pictures: for example, logging trucks and campers on the mountains; a hydroelectric dam on the main river; barges in the estuary; paper mills and factories on the shores; farms inland, homes. Partners will need to plan their watershed together. When finished, students can share their illustrations with the class.

More Ideas

1. Use a local map to identify some of the towns, rivers, lakes, mountains, glaciers, dams, etc., in your watershed. Compare and contrast your watershed to the watershed illustration, discussing how your watershed is the same as and/or different from the typical watershed portrayed on the student illustration. Are there forests in your watershed? Is there a dam? Are there farms, ranches or orchards? Does your river flow directly into the sea? Is logging or shipping done in your watershed?

Divide the class into five groups to do homework research on the topics below, one topic per group. After information is gathered, each team is to create a visual aid (a map of the watershed illustrating the researched topic) and give a group oral report. Subjects are:

- a. Farms, ranches, orchards, dairies: How many? What products? How many acres? Where located? What markets?
 - b. Timber operations: What companies? What type of operations (sawmill, harvesting, recreation, etc.)? How many acres? Where located? Destination of products?
 - c. Recreation: What activities? What lands are used? How many sporting goods/outdoor stores? How many tourists?
 - d. Industries: What kinds? Where located? Where/how products are transported? Waste products? (If any, how eliminated or recycled?) Number of people employed?
 - e. Population: How many people? Where located? What growth trends? What problems because of growth? (i.e., utilities? schools?)
2. Create a classroom 3-D model of your watershed. Use wet dirt or sand to build the land forms. Cover the forms with strips of papier-mache. When dry, students take turns painting the watershed. Instruct them to add 3-D houses, factories, farms, campgrounds, logging operations, dams, marinas (whatever they have learned through their research).
 3. Outside, find a small slope covered with vegetation and another that is relatively free of plants. Slowly pour a bucket of water from the top of each slope. Tell students to observe how long it takes the water to reach the bottom and to look for signs of pooling, erosion, etc. Discuss observed differences between the two slopes.

4. Investigate dams and fish ladders on the Columbia river.

Call Bonneville Power Administration's publication division, 1-800-622-4520, and give your name, street address and the publication you would like. Publications (including class sets) are free. The following are suggested:

DOE/BP 700 *The Magnificent Journey* (story of salmon migration and threats)

DOE/BP 249 *Enhancing Our Fish and Wildlife Resources* (history of salmon population decline on the Columbia, the 1980 Conservation Act and results)

DOE/BP 1721 map of power plants and dams on the Columbia

DOE/BP 1731 map of Columbia River watershed and multiple uses of river

DOE/BP 954 Yakima and Klickitat watersheds: salmon and steelhead problems

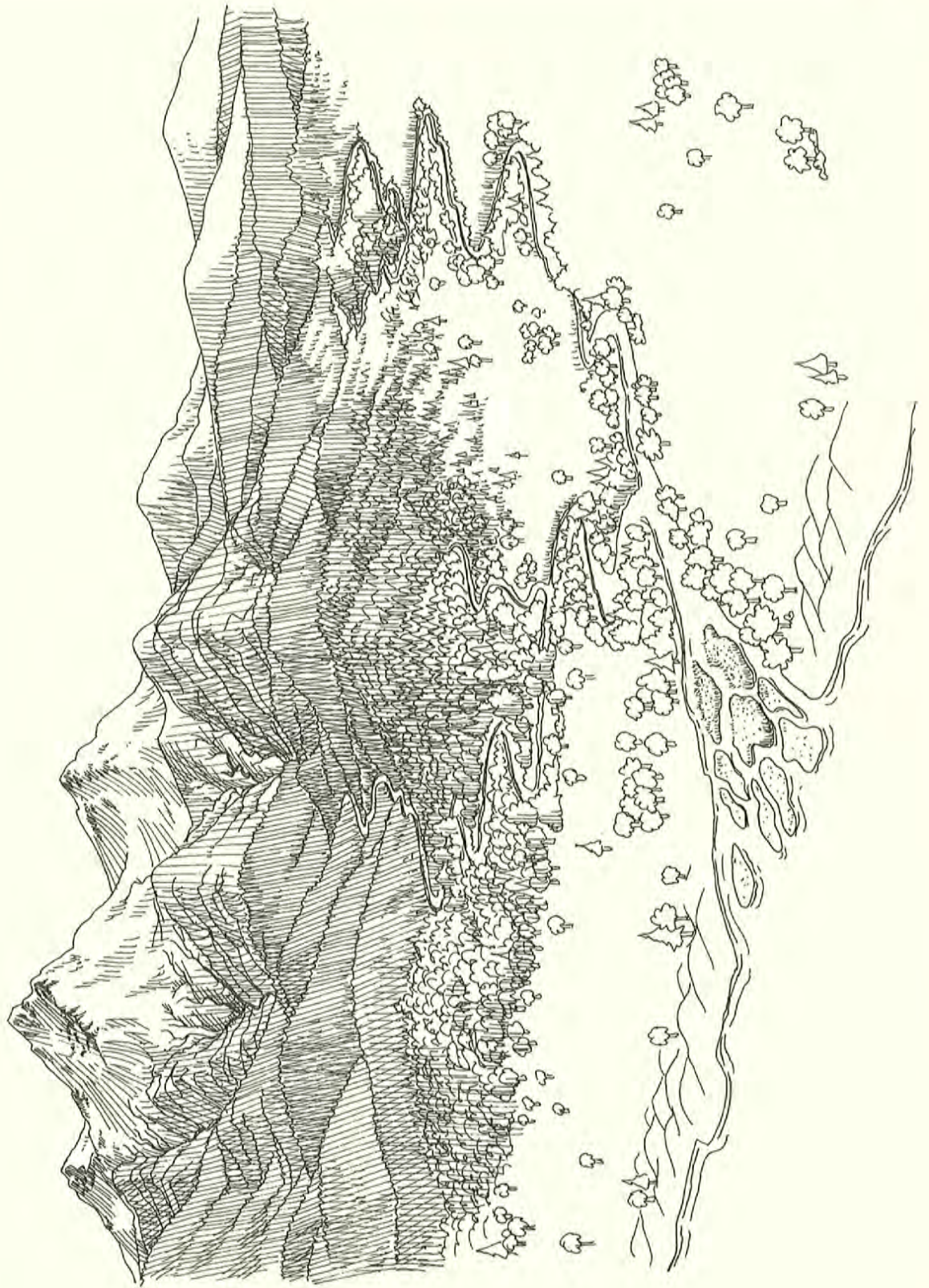
Contact the Washington Forest Protection Association for a copy of *The Impact of Environmental and Management Factors on Washington's Wild Anadromous Salmon and Trout*.

Also contact the Washington Department of Fisheries for salmon education materials (see resource section).

Assessment: What Did We Learn?

Instruct each pair of students to share with the class three examples on their watershed map depicting interactions between humans and the natural environment.





Watershed Benefits

Learning Outcome

Students will become aware of the great number of jobs, products, natural benefits and recreation opportunities that are dependent on the resources provided by a watershed.

Skills

Cooperative learning, discussion, creative writing, artistic representation, critical thinking

Subject Areas

Art, social studies, drama

Materials

The Game of Watershed Benefits cards*

Tag board and yarn or string

Timer or stop watch

Dice

* Provided

Learning Procedure

What Watersheds Provide: Discuss the term "watershed" (the region that drains into a body of water) and what kinds of natural resources are found in most Washington watersheds (i.e., forests, streams, lakes, groundwater). (See Lesson 10: *Finding Out About Watersheds*.) Write these words on the board: **products jobs recreation natural benefits** Ask students for a few examples of products that are dependent on watershed resources. Do the same for the other three categories. Tell them there are many benefits provided by watershed resources and that the following game will help make them more aware of those benefits.

Play a Watershed Resources Game: Divide the class into four teams. One team member at a time comes to the front of the class and rolls a die. Depending on the number rolled, a card is chosen from one of four categories (Cards need to be stacked in four piles, one for each category.):

Number on die = Category

1 or 6 = Product

2 or 5 = Job

3 = Recreation Activity

4 = Natural Benefit

After a card is chosen, that team member must either draw or act out (or both) the word(s) on the card. The rest of the team has one minute to try to guess that watershed resource.

The team member drawing (and/or acting) may not speak or write any words on the board, only pictures. (Before the game begins, the class may want to agree on some charade signals, i.e., "sounds like.")

If a team guesses correctly within one minute, it earns a point.

Each student should have at least one turn to choose a card. Some may have to do so twice in order to balance the teams. The group with the highest score wins.



If time permits, allow each student several turns so the class will begin to understand the number of jobs, products, etc., dependent on watershed resources. If time is short, be sure to play the game several more times in the coming weeks.

Underscore students' understanding by telling them to compare their levels of awareness about watersheds before and after the game was played.

Make a Mobile: Students choose two uses of resources in a watershed and illustrate them, one on each side of a waterdrop-shape cut from tag board. These two-sided mobiles may be hung in the library with a display title such as "How Do We Use Our Watershed?" (Encourage as many different combinations as possible.)

More Ideas

1. Divide students into groups of four or five. Shuffle the *Job* cards and *Recreation* cards from the Game of Watershed Benefits. Pass out two cards to each student. Have each student make a statement about how he/she wants to use the watershed, based on one of the cards held. (Example: "I want trees harvested in the watershed because I'm a log truck driver and society needs products provided by trees." or "I want to cross-country ski in the watershed because my family likes being in the forest together, enjoying the beauty and getting exercise.")

When each student has made two statements, ask the groups to discuss what happens when many people are doing different types of activities in a watershed. What effects do they think there would be?

2. Make a collage of Washington's watershed benefits by first drawing a large map of the state on tag board and cutting it out. On the map, make a collage of magazine pictures showing products, jobs and recreation opportunities provided by our state's watershed resources. After the collage has dried, trim the map's borders so the collage will be shaped like our state. (A giant one on butcher paper would make an impressive piece of art to display at the school district office.)
3. Have students list three watershed benefits under each category (products, jobs, recreation, natural benefits) and make a class chart.
4. Play the Project Wild-Aquatic game, "Migration Headache." Discuss how the increase in human population and our activities

in a watershed impact wetlands and migrating bird populations. (For more information on Project Wild and Project Wild-Aquatic, contact Washington Department of Wildlife — see resource section.)

5. View the 3-2-1-Contact video, *Down the Drain*, an entertaining discussion of the water cycle and watershed issues (available through most ESD AV centers or order from the video collection, Seventh Generation, 1-800-456-1177).

Assessment: What Did We Learn?













Tell students to list three watershed benefits under each of the four categories: products, jobs, recreation, natural benefits. After this exercise they are to explain orally or in writing what their waterdrop mobile is all about.


















Jobs

<p>FORESTER (studies forests and recommends ways to use and protect the forest for recreation, timber harvesting, etc.)</p> 	<p>WILDLIFE BIOLOGIST (studies animal populations and advises foresters about habitat needs and locations of endangered species)</p> 	<p>FOREST FIRE FIGHTER</p> 
<p>SAWMILL WORKER (works in mill where logs are sawed into boards, collects bark, chips and sawdust for other uses)</p> 	<p>LOG-TRUCK DRIVER</p> 	<p>LOGGER (harvests timber and loads logs onto trucks, using equipment such as chainsaws and cranes)</p> 
<p>LUMBER STORE OWNER (buys lumber from mills and sells it to customers who need lumber to build houses, furniture, shelves, etc.)</p> 	<p>PAPERMILL WORKER (operates machinery that grinds logs into pulp, adds chemicals and makes paper products)</p> 	<p>DAIRY FARMER</p> 
<p>RIVER RAFTING GUIDE (leads groups on rafting trips down rivers, teaches about safety and nature)</p> 	<p>SKI RESORT CHAIR-LIFT OPERATOR (helps people onto chair-lifts, operates machinery that carries skiers up the mountain)</p> 	<p>PARK RANGER (oversees state or national parks, supervises staff to ensure visitor comfort and safety, provides information on natural history, protects area as a natural resource)</p> 
<p>FISHERIES BIOLOGIST (studies fish populations, oversees work of fish hatcheries, helps decide how many fish may be caught each year)</p> 	<p>MARINA OWNER (rents space in marina to boat owners, maintains piers, enforces rules, usually provides fuel, showers and groceries)</p> 	<p>COMMERCIAL FISHERMAN</p> 
















Jobs

CROP DUSTER (flies airplane that sprays pesticides onto fields and orchards)	WATERWELL DRILLER	WHEAT FARMER
		
FERRY WORKER (helps load cars onto ferries, or helps serve food, or maintains cleanliness of ferries or works in engine room)	BARGE CAPTAIN (pilots the tugboat that pulls or pushes barges — large, floating platforms used to carry goods over water)	ORCHARDIST (oversees planting, fertilizing, pruning, mowing and harvesting in orchards)
		
MEMBER OF ARMY CORPS OF ENGINEERS (plans and constructs dams and bridges)	BRUSH PICKER (picks berries, mushrooms, baby's breath or other brush used for commercial purposes)	RANCHER (oversees buying, raising and selling of cattle, sheep or horses)
		
HYDROELECTRIC PLANT OPERATOR (helps produce electricity by maintaining machinery in dams or operating computers)	OYSTER FARMER (raises oysters in an estuary)	CARPENTER
		








Products

SPINACH 	SALMON 	CLAMS 
CRABS 	OYSTERS 	SHRIMP 
MILK 	ELECTRICITY 	DEER MEAT 
CHEESE 	EGGS 	BEEF 
DOORS 	CABINETS 	TABLES 
















Products

CANDY BOXES 	REPORT CARDS 	FOLDERS 
GUITARS 	WRAPPING PAPER 	NOTEBOOK PAPER 
DRUMS 	SLEDS 	BASKETBALL COURTS 
TOOTHPICKS 	CRIBS 	HOCKEY STICKS 
HAMMER HANDLES 	FENCES 	TOILET PAPER 
















Products

CHURCH PEWS 	PLYWOOD 	CHARCOAL 
DISPOSABLE DIAPERS 	RAKE HANDLES 	SWINGS 
SKIS 	TENNIS RACKETS 	APPLE CRATES 
CEDAR WOOD PENCILS 	CEDAR ROOF SHINGLES 	PIANOS 
BOOKS 	NEWSPAPERS 	WOOD HEAT 
















Products

TULIPS 	WHEAT 	CHERRIES 
GROCERY SACKS 	MILK CARTONS 	APPLES 
CHAIRS 	SCHOOL DESKS 	ROLLING PINS 
SEESAWS 	POPSICLE STICKS 	LADDERS 
MAPS 	FILBERTS (HAZELNUTS) 	BLUEBERRIES 

Recreation

CLAMMING 	INSECT COLLECTING 	SCUBA-DIVING 
CRABBING 	CANOEING 	PICNICKING 
SLEDDING 	SNOWBOARDING 	ROCK COLLECTING 
SIGHTSEEING 	BIRDWATCHING 	PHOTOGRAPHY 
SAILING 	MOUNTAIN BIKING 	FOUR-WHEELING 

Recreation

WATER-SKIING 	SNOW-SKIING 	SWIMMING 
HORSEBACK RIDING 	SNOWSHOEING 	PLEASURE BOATING 
HUNTING 	FISHING 	SNOW-MOBILING 
WIND SURFING 	MOUNTAIN CLIMBING 	HIKING 
RIVER RAFTING 	CAMPING 	JET SKIING 

Natural Benefits

CLEAN AIR (trees trap air pollution in their leaves)	CLEAN GROUNDWATER (gravel and soils act as filters to trap pollutants)	CLEAN STREAMS (the debris on a forest floor and wetland plants filter and clean run-off water flowing to streams)
		
WILDLIFE	SOIL STABILITY (plants hold soils in place, preventing erosion)	OXYGEN (plants give off oxygen)
		
QUIET	BEAUTY	SHADE
		
WIND BUFFERING (trees provide wind breaks)	HABITAT (plants, soil and rocks provide places for animals to live)	FLOOD CONTROL (wetlands, like giant sponges, absorb flood waters; forests and other habitats absorb water into the ground)
		
GLOBAL TEMPERATURE CONTROL (trees absorb carbon dioxide from the atmosphere and convert it to organic carbon, thus reducing greenhouse gases thought to cause global warming)	HOME TEMPERATURE CONTROL (deciduous trees around a house provide shade in the summer yet allow sun to warm the house in the winter)	NOISE CONTROL (urban trees help reduce noise pollution by blocking noise)
		

Raindrops Keep Fallin' On My (Water)Shed

Background Information For Teachers

Skills

Experimenting, discussion, cooperative learning, observation, critical thinking, creative writing, illustrating, investigation

If **More Ideas** section is used:
Video technology

Subject Areas

Science, language arts, art

If **More Ideas** section is used:
Drama

Materials

Baggies (one per student)

Small paper cups (one per student)

Tape

Writing and illustration paper

The water in a watershed is always being recycled. It has made this journey through forests, down the hills and under the ground before and it will make it again many times. This is, of course, due to the cycle of evaporation, condensation and precipitation we call the water cycle. As the sun heats the ocean surface, water evaporates. Winds carry the water vapor toward the land. On the way, the vapor cools enough for tiny droplets to condense into clouds. When the clouds bump into mountains and are forced to rise higher, more cooling occurs. The cooled water droplets now form true drops and fall as rain or turn into snow crystals. This precipitation falls on watersheds everywhere, and the water begins its journey back to the ocean. Along the way, a water droplet may encounter any number of events. It may be absorbed by a tree root, a natural occurrence, or be used to wash dishes, a human-caused event. By developing their own stories of a water drop's journey through a watershed, students will be led to consider the complex interactions between people and watersheds.

Learning Outcome

Students will demonstrate an understanding of the complex interaction between people and watersheds.

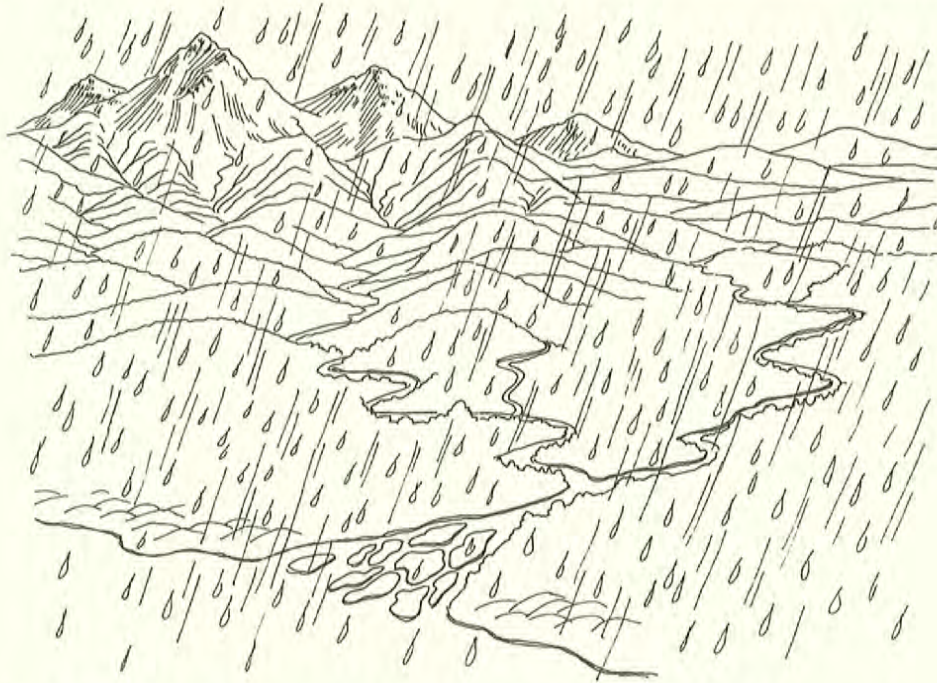
Learning Procedure

The Water Cycle: Explain that the class will be talking about the water cycle, but first you want them to perform an experiment. Hand one baggie and one cup to each student. Students are to put about 2 oz. of water in each cup, mark the waterline, tape or staple the cup inside the baggie so it won't spill and seal the baggie. Tape baggies to classroom windows and observe what takes place over the next few days.

Discuss observations based on the baggie-cup experiment. Review the water cycle and point out that the water evaporated from the cups just as it does from the oceans. It condensed on the sides of the baggie similarly to the way it condenses in clouds. The water flowed down the sides and accumulated in the bottom of the bag in the same way it flows down hillsides into lakes (and under the ground.)

Write a Water Cycle Story: Explain that students will be writing stories describing the journey of a water particle from the time it evaporates





from the surface of the ocean until it arrives back in the ocean. Their stories will be bound in a book with opening and closing paragraphs to complete the description of the water cycle. (See opening and closing paragraphs provided at the end of this activity.) Brainstorm with the class to think of things the water particle might encounter on its journey. What might happen in mountains and forests? What might happen in a stream or lake? What might happen as the stream passes a farm? As it passes a city? (When you have completed Lesson 10: *Finding Out About Watersheds* use the ideas recorded on butcher paper or blackboard to help students think about this process.)

Divide students into groups of three. Each student will be responsible for writing one paragraph of a three-paragraph story. To begin, they jot down or sketch their ideas using the following guidelines:

Paragraph 1: Tell where the water drop landed in a forest and what happened to it there. (For example: Does it fall onto a leaf and slide off onto an animal's back? Does it hit the ground, sink into the soil and flow underground into a spring? What does it see along its journey through the forest?) All raindrops must end up in a stream by the end of this paragraph.

Paragraph 2: Tell about three things that happen to the drop as it travels downstream. (Perhaps it passes a farm and is polluted by run-off fertilizer. Perhaps it passes through wetland grasses and gets clean again.)

Paragraph 3: Think of one last adventure for the water drop before it flows back to the ocean. (Perhaps it arrives at a dam and passes through the turbines. Maybe it gets diverted into an irrigation ditch. Perhaps it gets soaked up in the clothing of people wading in the stream, goes through a washing machine, passes through a sewage treatment facility and lands back in a river. Or, it might be used by a plant and released through transpiration back into the air.)

After teams have outlined their three paragraphs, instruct them to write and illustrate their water drops' journeys. Bind stories into a class book with the provided opening and closing paragraphs. Keep the book in the school library so other students can learn what happens in a watershed.

Where Does Your Rainwater Go? Take students outside to investigate what happens to water after it hits the school roof. Tell them to locate gutters, drainpipes, drainage and catch basins, etc. Does the water go into a storm drain or does it go into the ground? Have students investigate where the water goes after it enters the storm drain or the ground. Pupils could write a group letter asking someone from the public utilities department (or whatever agency is responsible for managing drainage in your community) to speak to the class. Or, the class could take a field trip to the facility.

Discuss what would happen to a raindrop falling on the roof of your school. What kind of journey would it have? How would that be different from or similar to the journeys created in class?

Opening Paragraphs: One sunny day a drop of water was swimming in the ocean. As the day got warmer and warmer, the drop of water started to evaporate. Invisible to the human eye, the water vapor rose through the air until it encountered a layer of much colder air. Then the water drop joined with many other water drops to form a cloud.

Later that afternoon, a big wind started to blow over the ocean toward the distant hills, cooling the land. The cloud of water drops was caught in the mighty wind's power and pushed faster and faster toward the land. Suddenly a big hill loomed in front of the cloud, and the cloud either had to crash into the hill or rise and go over it. As the cloud was pushed over the hill by the rush of air behind it, it encountered an even colder layer of air. This freezing cold layer caused the cloud to contract, forcing the water drops to fall to the forest below.

Closing Paragraph: The drop of water finally made it back to the ocean. What an adventure! As the drop moved through the salty water, the sun rose higher in the sky, causing the air to become warmer and warmer. It began to evaporate once again. The water drop invisibly rose into the air off on another adventure!

More Ideas

1. Students dramatize their journeys for the rest of the class. The teacher, parent helper or students videotape dramas. The video will be a "live" version of the class book. Have a student read the opening paragraphs at the beginning of the video and the closing one at the end. Share the video with other classes in your school.
2. Perform the same baggie-cup experiment with salt water. Discuss desalination. Try it again with colored water. Imagine that the food coloring is a pollutant. What happens to pollutants during the water cycle?
3. Design a cartoon strip explaining the journey of the raindrop.

Assessment: What Did We Learn?

Students will demonstrate their levels of understanding through writing their water drop journeys.



Who Manages Washington's Forests?

Background Information for Teachers

Skills

Drawing, discussion, research, mapping, oral presentation, compare/contrast

Subject Areas

Art, social studies, geography, language arts

Materials

Drawing paper

Map of your county

Four *Who Manages Washington's Forests* picture cards*

* Provided

Half of Washington is covered with forests that provide natural benefits to people and wildlife. Whether or not a forest provides other benefits such as recreational opportunities, jobs, and/or wood products depends on who owns and/or manages that particular forest. Washington forests are managed by several public and private groups, each with a different purpose or management strategy, as shown in the following chart:

Owner	Management Strategy
Public	
U.S.D.A. Forest Service	
Colville National Forest	Multiple use — recreation, timber, grazing, protection of wilderness, range, wildlife habitat, watershed protection
Umatilla N.F.	
Wenatchee N.F.	
Gifford-Pinchot N.F.	
Mt. Baker-Snoqualmie N.F.	
Olympic N.F.	
National Parks	Preservation of outstanding natural and historic areas for the education, enjoyment and inspiration of all people
Mount Rainier National Park	
North Cascades N.P.	
Olympic N.P.	
Native American Tribes	Multiple use
Washington Department of Natural Resources	Timber harvesting to provide state revenue (also wildlife and recreation)
Washington Parks and Recreation Areas	Recreation and wildlife habitat
County and City (urban forests)	Recreation and wildlife habitat, watershed protection
Private	
Private Industrial Forests	Timber harvesting, recreation, wildlife habitat
Private Individuals	Individual's choice



Learning Outcome

Students will understand that the forests of Washington are owned and/or managed by a number of different groups and individuals, private and public and that forests are managed for various purposes.

Learning Procedure

Forest Fun: Lead a class discussion about what students like to do in the forest. Then, ask each student to draw a picture of that activity and the surrounding forest. (Maybe one student will want to go hunting in a forest clearing. Perhaps another wants to go camping where there are no cars or roads. Yet another might like to look for signs of wildlife in a heavily forested area. Or, a student might prefer to go downhill skiing on an open slope.) Students share their pictures and discuss the differences in types of forests required for each activity.

Who Takes Care of Washington's Forests? Discuss the fact that many different groups, both private and public, manage Washington's forests. Show students one *Who Manages Washington's Forests* picture card at a time and explain who the manager is and how the forest is managed. (Information on back of picture.) Ask students which forests would best suit the activities they drew in *Forest Fun*. Conclude by instructing students to write captions for their pictures. Examples: "I could go hunting in a national forest or in a private forest," or "I could go on a picnic in a national park and see spectacular scenery," or "I could go skiing at a resort that leases land from the U.S.D.A. Forest Service."

Using a map of your county, tell students to find forested areas and identify the managers. They might need to contact city, county, state and federal agencies or private landowners for information and brochures. (Explain there are more than the four types of managers represented in the picture cards. See *Background Information*.) On the bulletin board, create a map of your county and the forested areas, labeled according to ownership/management. Devise a key with symbols for timber harvesting, recreation, preservation, wildlife habitat and cattle grazing. Draw appropriate symbols on each forested section of the map.

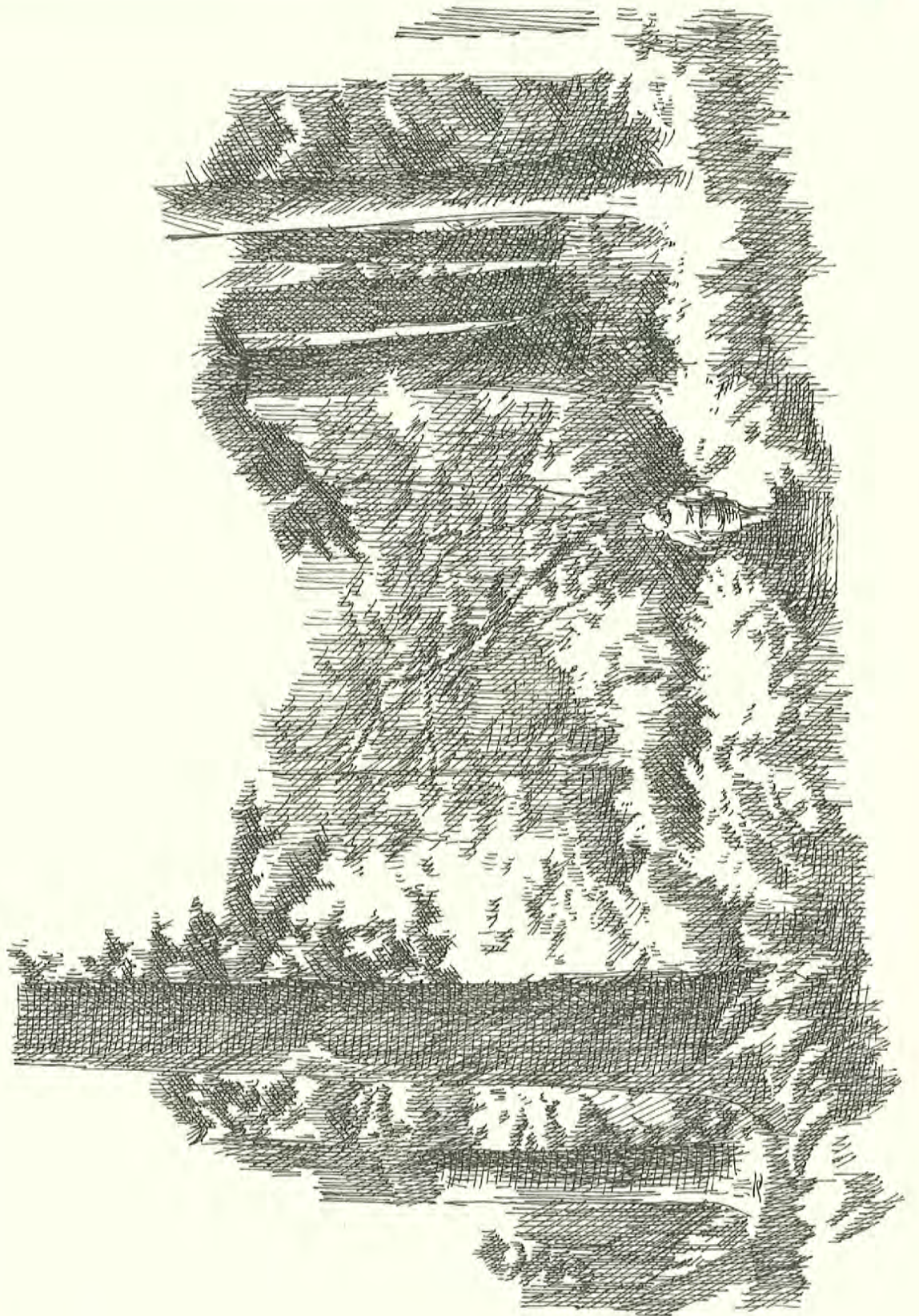
More Ideas

1. Take a field trip to two different forested areas in your county, perhaps a county park and a private tree farm. Compare the two areas and discuss how they are managed for different purposes. How do they look different from each other? How do the jobs of the people who work in these locations differ from each other? Compare what each area provides for the county's residents.
2. Divide students into groups to research particular types of forest. Each group will teach the rest of the class about the forest type they studied. (Students can use *Who Manages Washington's Forests* picture cards for research.)
3. Students are to pretend they are owners or managers of a forest and develop a master plan for its use.

Assessment: What Did We Learn?

Ask students to list three groups that manage forests in Washington and name one way each manages the forest.

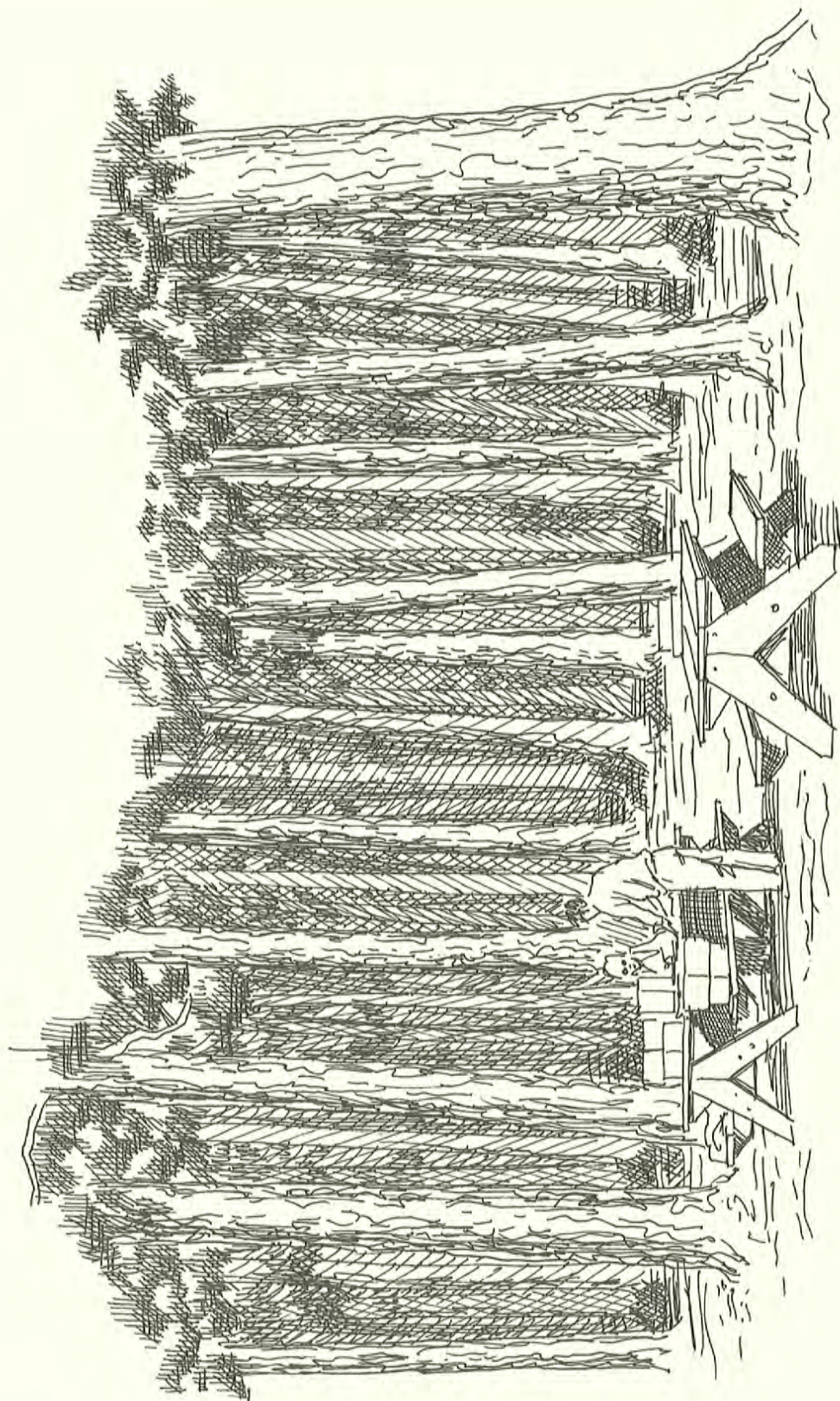




Who Manages Washington's Forests

1. People visit Mt. Rainier National Park:

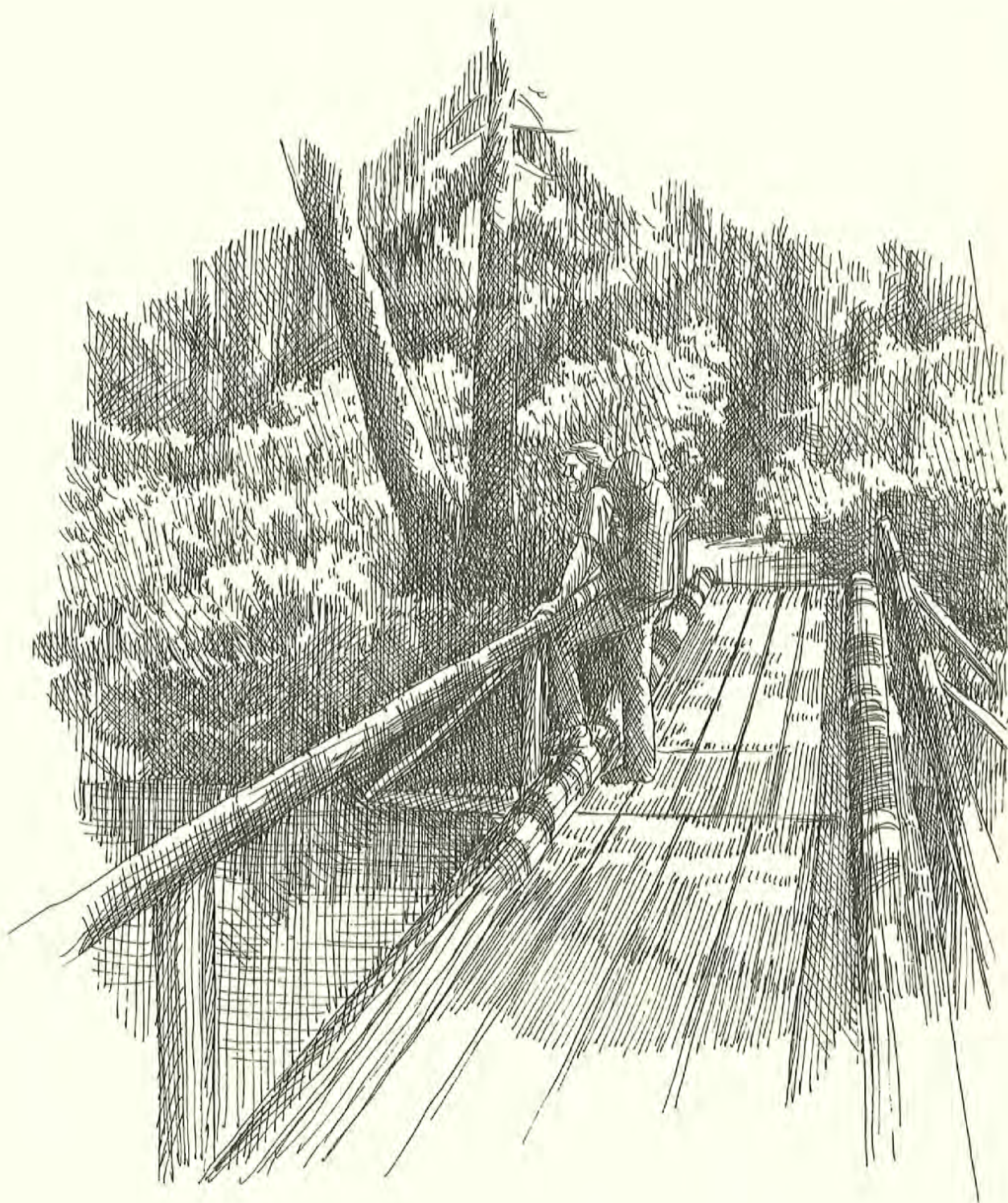
National parks and monuments are owned by the public and managed by the U.S. government. These areas are preserved because of their outstanding beauty and/or educational value. We have three national parks in Washington state: Mt. Rainier, North Cascades and Olympic National Park, and one national monument: Mt. St. Helens. These are for people to visit and enjoy. Hiking, picnicking and river-floating are allowed and, within limits, camping and horseback riding. However, hunting, collecting and resource harvesting are not allowed.



Who Manages Washington's Forests

2. People picnic, camp and fish in a national forest:

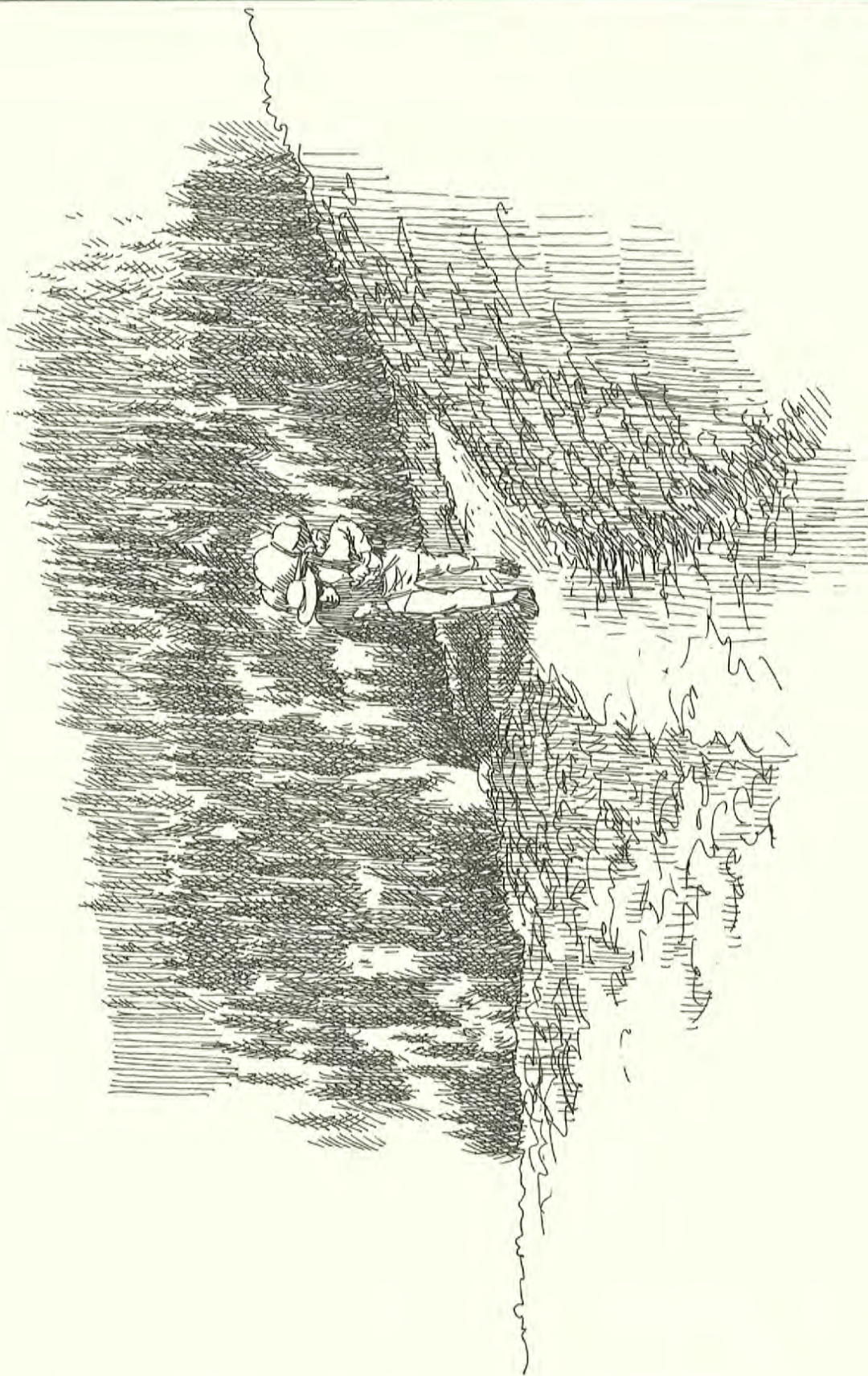
The national forests in Washington are owned by the public and managed by the U.S. government. These lands constitute 28 percent of the commercial forests in the state. They are areas set aside for multiple uses such as recreation, wildlife, timber and grazing. These forests also include designated wilderness areas — preserved lands allowing minimum access to low-impact hikers and campers. (No roads or cars are allowed in wilderness areas.) Washington state has six national forests: Colville, Umatilla, Wenatchee, Mt. Baker-Snoqualmie, Gifford Pinchot and Olympic. Recreational opportunities include hiking, camping, hunting, fishing, boating, skiing, swimming and picnicking. The U.S.D.A. Forest Service (under the Department of Agriculture) issues permits to ranchers, ski resort owners, RV campgrounds, etc.



Who Manages Washington's Forests

3. People hike on DNR land:

Washington State Department of Natural Resources (DNR) owns 11.8 percent of the commercial forests in our state. Revenues from timber harvesting are used by the state for funding school buildings and other public facilities known as the trust mandate. Lands are also managed for multiple-use activities such as hunting, camping, biking, hiking, horseback riding, grazing, etc.



Who Manages Washington's Forests

4. People hike in a privately-owned forest:

Private industries own 24 percent of the commercial forested land in Washington state. Private individuals own another 25 percent. Generally, the main activity is timber production, providing the wood for the thousands of products we use daily. However, while trees are being re-grown on private land, it is used by wildlife. (Deer, elk and birds of prey use the newly opened areas for foraging and hunting.) People also use private industrial forests for recreation. Hunting and cross-country skiing are two sports commonly enjoyed in these forests.

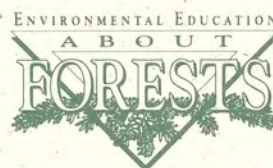
Unit III

Decision-Making & Washington Forests

Washington State Environmental Education Goal III:

The student will apply personal decision-making skills to enhance environmental quality.

14	Where There's A Will, There's A Way	118
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Where There's A Will, There's A Way

Learning Outcome

Students will be able to recognize and use techniques of propaganda and persuasion to influence a land-use management decision.

Learning Procedure

Fact or Opinion? Bring to class several *Letters to the Editor* sections of the newspaper. Discuss styles of persuasive writing, and the use of fact and opinion. Have students work in groups of three or four. Instruct them to read the newspaper letters, looking for words of persuasion, identifying facts and opinions and other propaganda techniques such as stating some facts and ignoring others.

Set the Stage. Read the provided scenario to the class then divide the class into four groups. Give each group a copy of the scenario so they can refer back to it. Also give each group the management goals and background information cards from one of the four following interested parties: the National Park Service, the U.S.D.A. Forest Service, The Nature Conservancy and a tree farmer.

The Interested Parties

Some Management Goals of the U.S.D.A. Forest Service:

National Forests are owned by the public and managed by the United States Department of Agriculture. They are set aside for multiple uses such as recreation, wildlife, timber and grazing. They also include wilderness areas — preserved lands allowing minimum access to low-impact hikers and campers (no roads or cars are allowed in wilderness areas). Recreational opportunities include hiking, camping, hunting, fishing, boating, skiing, swimming and picnicking. The U.S.D.A. Forest Service issues permits to ranchers, ski resort owners, recreational campgrounds, mining and logging companies.

Skills

Critical thinking,
written communication,
research (optional),
cooperative learning

Subject Areas

Language Arts, Social Studies,
Journalism

Materials

Newspaper articles

Scenario card *

Background information cards *

* Provided

Some Management Goals of the National Park Service:

National Parks are owned by the public and managed by the United States Department of the Interior. These areas are preserved because of their outstanding beauty and/or educational value. People are allowed to visit and enjoy the parks. They can hike, picnic, river-float and, within limits, camp and horseback ride. Hunting, collecting and resource harvesting are not allowed.

Some Management Goals of The Nature Conservancy:

The Nature Conservancy is a non-profit membership organization that buys critical habitat property that is under pressure from development. They are particularly interested in buying land that provides nesting ground for a variety of species. The land is then protected indefinitely. People are allowed to visit Nature Conservancy preserves, but sometimes access is limited to protect animals during certain times, such as nesting.

Some Management Goals of a Tree Farm:

Tree farms are privately owned by individuals or companies. Generally, the main activity is timber production, providing wood and fiber for the thousands of products we use daily. Tree farms provide land for wildlife. People use private forests for educational field trips and for recreation, such as hiking, hunting and cross-country skiing.

Note: To help your students better understand the goals of each of these "ownerships" encourage them to do library research and also to interview a local representative of each of the four groups. See Resource section for addresses and phone numbers.

Draft a Letter. After each group receives their pertinent background information they should brainstorm all the reasons why the heirs should sell them the property (keeping in mind the deceased landowner's stipulation). Instruct all four groups to take into account the growing impact of population growth and the increasing consumption of natural resources. When they have written down all the reasons they can think of, they are ready to develop an outline for the persuasive letter they will send to the heirs, using the following format:

1. Opening sentence: We want to buy the land because...
2. Explanation of interest group (who we are)
3. The plan for the land (what we would do with the land)
4. Why we are the best choice for purchasing for the land (how we would provide the greatest overall good for the greatest number)

Persuade the Heirs. When each group is satisfied with their draft letters have them write a convincing letter to the heirs to influence them to choose their group to buy the land. The letters should contain value-laden words or phrases which the students believe will contribute to the effectiveness of their argument. Other propaganda techniques such as stating some facts and ignoring others may be used, but the students may not say anything which is untrue.

After the letters to the heirs are completed have the class share them to determine how the choice of words, selection of facts and other techniques were used to build a case for one viewpoint or another.

The Final Decision. After hearing the four letters have the class vote to decide which group produced the "best plan to provide the greatest overall good for the greatest number of people" as stipulated in the will. Have the class discuss their reasons for voting for a particular group. Through this discussion, try to get the class to come to a consensus on who should be awarded the right to buy the property. Alternatively, the letters could be read to an impartial audience, such as another class, a group of people from the community (invite representatives from the four interest groups!), or a panel of teachers and/or parents, and they would decide who gets to buy the property.

More Ideas

1. After writing the persuasive letters from the perspective of a particular interest group, research and discuss the following:

How do the management goals of the four groups differ?

What other groups might recommend different management goals for the land? For example, consider the view of groups such as the Sierra Club, the Chamber of Commerce or a Native American tribe.

What forces (such as history, economics, aesthetics, culture) may determine the values each group attaches to the forest? How are they reflected in the management of their lands?

What are the differences and similarities between publicly and privately managed land?

Do public and private land management influence each other?

What are the effects and pressures of each on the other?

2. Have each group make a mural, map or poster depicting their plan for the parcel of land.

Assessment: What Did We Learn?

The persuasive letters to the heirs will serve as assessment tools to determine how well the students can construct a compelling argument from a particular point of view.

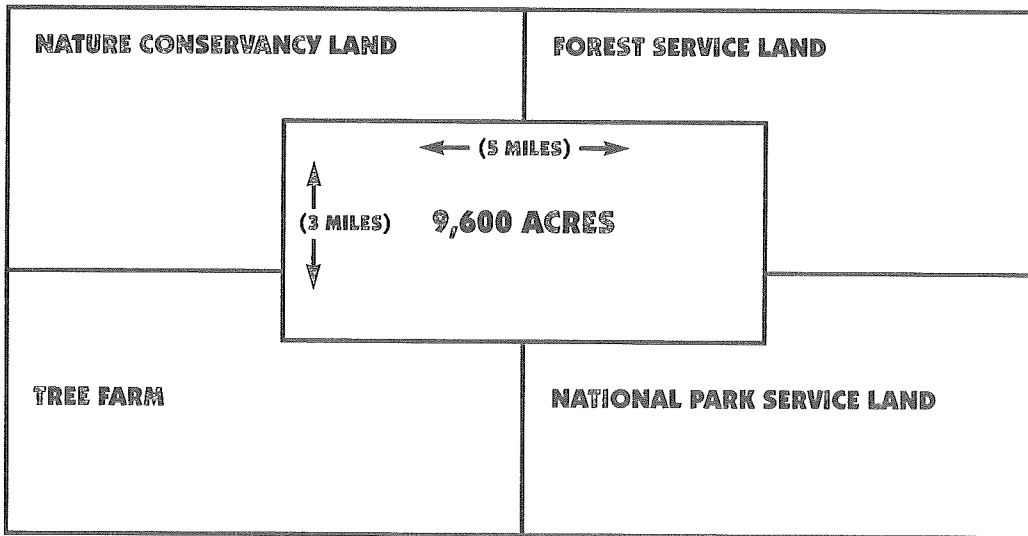


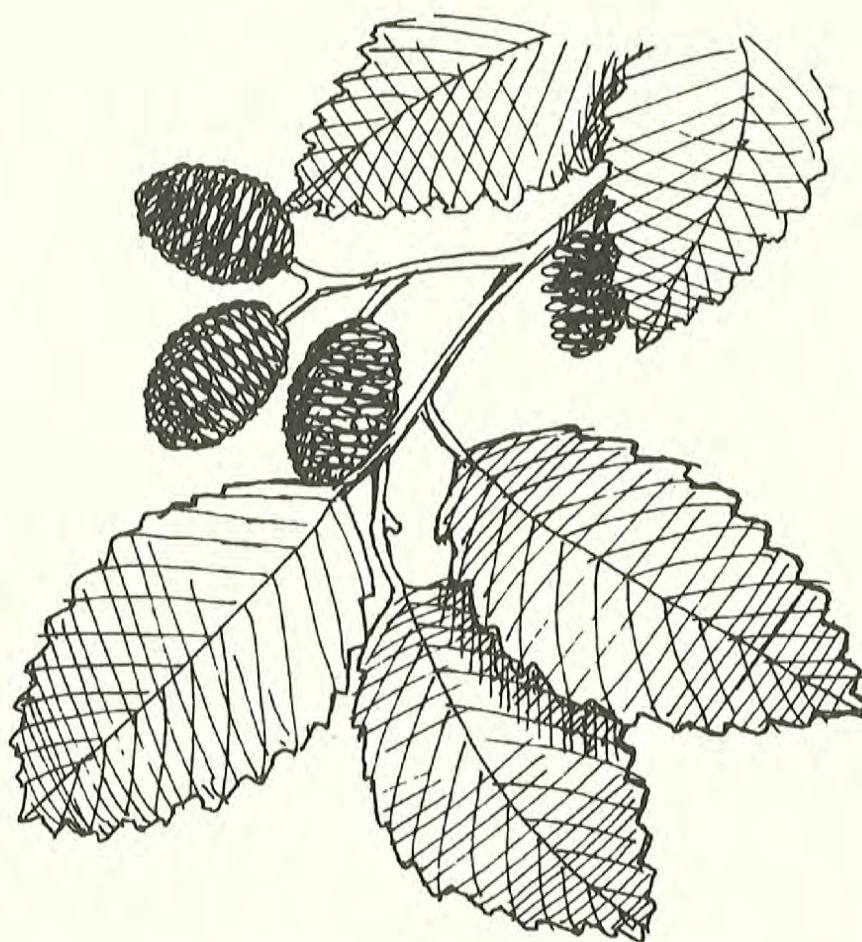
The Scenario

Imagine there are 9,600 acres (15 square miles) of old growth forest surrounded by other forest land which currently is managed by several different groups. Some of the surrounding forest is managed by the National Park Service, part is managed by the U.S.D.A. Forest Service, another portion is owned by The Nature Conservancy and the last part is privately operated as a tree farm. The owner of the 9,600 acres has just died and left a will stating that:

"This property should be sold to the group which produces the best plan to provide the greatest overall good for the greatest number of people."

The heirs to the land wish to sell the property quickly. All of the surrounding landowners are interested in purchasing the property. What should the heirs do?





Red Alder

Less Is More

Background Information For Teachers

Over the last three decades we have become a throw-away society. Those of us affected by the Great Depression and World War II learned how to conserve and do with less. But the economic well-being of the 1950s and 1960s led many of us to feel that we live in the land of plenty, that we can always buy more. Built-in obsolescence has become the American way of life — we saw the advent of disposable razors, pens and cameras. This marketing and lifestyle attitude has created challenges. Many Washington communities are facing difficult decisions as landfills reach full capacity. Garbage rates rise, illegal garbage dumping creates health hazards and ugly vistas and alternative landfill space is scarce or nonexistent, often requiring that municipal garbage be hauled to other towns, counties, or states.

Approximately 60-70 percent of our general waste stream is composed of materials that are forest products. This percentage is even higher in a typical school setting. Fortunately, the majority of this “waste” has tremendous potential to be reused, reduced and recycled. For example, basic paper fibers can be reprocessed three to four times before their usefulness is depleted, at which time most can be composted. The same is true for many construction materials. Often, leftover building materials and scraps can be used for other purposes or recycled into other products so they don’t have to take up space in a landfill.

Washington’s forests provide valuable resources. There are many ways individuals and communities can conserve forest products, while at the same time delay the filling and closure of local landfills. Consumer decisions constitute perhaps one of the most important drivers for resource conservation. For example, unnecessary packaging is one of the biggest contributors to the general waste stream. We can choose to buy in bulk, buy products with recycled and recyclable packaging, reuse bags for shopping, use cloth napkins, give gifts in reusable bags and boxes, bring our lunches instead of going to fast food outlets (and carry these meals in reusable containers). With creativity and effort, we can all find ways to reduce our consumption and our garbage, find new uses for old items and recycle what we can no longer use.

Skills

Compare and contrast, estimating, graphing, data gathering, discussion

If **More Ideas** section is used:
Computer technology, video technology

Subject Areas

Math, science

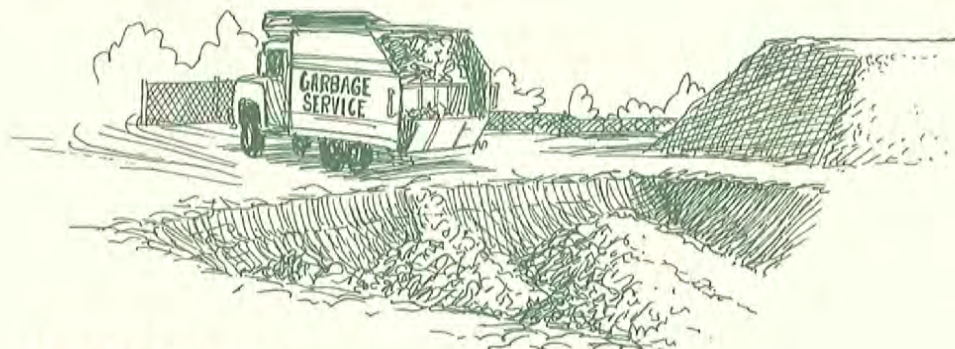
Materials

Bathroom or other type of scale

Sorting containers

Chart and graph paper





Learning Outcome

Students will identify ways people can reduce, reuse and recycle processed forest products.

Learning Procedure

Trash Totals: Conduct a class discussion about recycling in your community. Who has curbside recycling available where they live? Who has to drive somewhere to drop off recyclables? What are some ways we can reduce the amount of garbage we create?

Conduct a waste audit in the classroom, at school and/or at home.

To begin:

1. Save trash for four days. On day five, sort into piles of paper, metals, glass, food and other. Use a bathroom scale to weigh the amount of material in each category and record the information. (If students are conducting a home audit, be sure to give the parents advance information regarding this assignment and encourage their support and cooperation.)
2. Determine how many total pounds of forest product waste (paper, cardboard, wood products, etc.) were collected and divide that total by the number of students to get a pound/per student ratio. Multiply this by the number of students in your school to get a total school estimate. You might want to factor in office and specialty areas (cafeteria, janitorial services, art room, etc.).
3. Record the information on a bar or other graph. If applicable, compare graphs for home, classroom and school for one week, one month, one school year.
4. Contact your local Washington State Department of Ecology office and ask staff to prepare equivalence information for your statistics. They will tell you how many trees, how much water, electricity, oil, etc., would be saved by recycling the forest products you have collected.

Trash Truth – Less is Best: Based on provided background information and the activity in *"Trash Totals,"* lead a class discussion using the following suggestions and questions:

1. Determine what product(s) caused the greatest amount of waste and discuss why the collected materials were discarded.
2. Identify ways this waste could be reduced or reused.
3. How much of the overall waste is recyclable in your community? (Call the Washington State Department of Ecology's Recycling Hotline, 800-732-9253, for recycling opportunities in your area.)
4. Who makes the decision to buy products for your school? Could they buy less, buy recycled products, etc.? Who makes the decision to buy products for your home? Could they buy less, buy recycled products, etc.?
5. What waste-causing products could the school and family eliminate? Could less wasteful products be used instead?
6. How much of the garbage is packaging? Are there ways the amount of packaging could be reduced or reused?

More Ideas

1. Create "pen pal" relationships with students at other schools to compare actions and results. Take advantage of Eco-Net, a computer network for national and international connections, if it is available at your school.
2. Sponsor a recycling competition within your school or with another school. Ask parent groups or a local recycling company to provide awards and giveaways.
3. Conduct a field trip to a local landfill, transfer station, recycling center or composting demonstration site.
4. Invite guest speakers from such places as the county solid waste division, recycling companies, Washington Energy Extension Service and the forest products industry.

5. Assign a video or photo montage of the entire project. Share with city and school personnel, especially if there are no recycling options in the area. Contact the news media.
6. Challenge students to a "no garbage can week" where cans are put away and all throwaways have to be processed in some other way.
7. View the 3-2-1-Contact video *The Rotten Truth* (available through most ESD AV centers, or order from the video collection, Seventh Generation, 1-800-456-1177).

Assessment: What Did We Learn?

Prior to conducting the activity, ask students to estimate the amount of waste they feel they generate in one week and compare projected and actual results. Ask students to list a given number of ways they can reduce, reuse and recycle, especially forest related products. Conduct this same activity after three to five months to see if the amount of waste has been reduced at home and/or at school. Ask students to write or dictate a statement as regards the value and meaning of the results generated by this activity.



Tree Gifts

Background Information for Teacher

Read *Splinters Don't Count* and *Things Made from Pulp, Paper and Chemicals: Co-Products of the Pulping Process* handouts.

Skills

Brainstorming, cooperative learning, problem-solving, categorizing

If More Ideas used:
Interviewing

Subject Areas

Language arts, science, art

Materials

Splinters Don't Count handout *

Things Made From Pulp, Paper and Chemicals handout*

Butcher Paper or Tag Board

Examples of wood products (optional)

Magazines

Drawing supplies, scissors, glue

* Provided

Learning Outcome

Students will understand the important role Washington's forests play in providing products we depend on.

Learning Procedure

Gifts From Trees: Ask the class to think about the products we get from trees. Write their answers on the board for all to see. Divide students into small groups and ask them to work together on the following assignment: Starting from the time they were born, identify items from trees used at each stage of their lives. (They may use the brainstormed list for ideas.) Using the lists from all the groups, create a class chart portraying the most important forest products at various stages of students' lives.

That Comes From Trees!?! You may want to bring to class some illustrative examples of common and uncommon forest products such as:

ethyl alcohol products — artificial vanilla and vinegar

tissue products — disposable diaper, toilet paper and paper towels

pulp products — football helmet, ping pong balls, puzzle, book

lignin products — gummed tape, linoleum, medicated poultry feed

lumber products — plywood, rolling pin, pencils

Have students read, or explain to them the major concepts of, the *Splinters Don't Count* handout.

Tree Collage: Divide class into groups of four or five, and distribute the *Things Made from Pulp, Paper and Chemicals: Co-Products of the Pulping Process* handout. Using the handout as a guide, students can cut pictures of products from magazines or draw pictures. Glue pictures on a piece of butcher paper or tag board to make a large mural showing the diversity of wood products important to our daily lives. Use the murals to create a display for the whole school to see.

What Could We Use Instead? Ask students to tell you what they think the terms "renewable" and "non-renewable" mean. Explain that



wood products come from trees, a renewable resource. Using the list tracing important forest products in students' lives, ask students to work in small groups to think of alternative resources we could use instead of forest products. After each alternative resource, have students describe whether it is renewable or not.

More Ideas

1. Give each student a large piece of butcher paper. Instruct them to draw a vertical line down the center of the paper. On one side have them draw a picture of a room in a house or school. On the other side of the paper have them draw a picture of the same room without anything in it made from trees. Have them share their pictures, and discuss how life would be different if we had no trees.
2. Contact a lumber store near you, and invite a representative to visit your class. Have students prepare questions ahead of time, such as where do they get their wood, what happens to it and where do the products go. If possible, arrange to take a field trip to the lumber store.
3. After students have completed their tree collages take a field trip to a local hardware, grocery, department or other retail store. Use the *Things Made From Pulp, Paper and Chemicals* handout as a checklist for conducting a scavenger hunt.

Assessment: What Did We Learn?

Each student will choose three forest products and write a paragraph about the importance of each product to the student's life.



Splinters Don't Count

How Many Forests Products Can You Name?

*Adapted from Puget Parade,
Volume 1, Number 1*

Just for fun, name 2500 products that come from trees. But don't count lumber, plywood, paper — or splinters.

Before you get started, here's another challenge: What do beekeepers, Maine lobstermen, chicken ranchers, photographers, and Texas wildcatters all have in common?

The work they do, the products they sell, all depend on co-products from trees.

Now before you settle down to make your list of those products, remember trees are renewable. There are no "dry holes," no "exhausted veins," no "bottom of the barrel" in a forest — if we practice good forest management.

But for centuries people saw trees only as lumber, or firewood.

In the process of making lumber, however, there was a tremendous amount of waste. Sawdust, bark, and wood scraps all had to be hauled away or burned — and that created more complications.

Finally, scientists came along and peered into the very structure of trees. They found a brew of chemicals. The stuff of energy. And new ways of taking a tree apart, and shaping it into human needs.

They perceived, in short, that the molecular lattice-work of a tree had a potential beyond their wildest dreams. The lights burned late at research centers all over the country.

The story of how the forest industry used this research to create new products, new markets, new ways of doing things and even new energy, is too big of a story to be told here. But to help with that incredible list you'll be working on, we'll outline some of the products that depend on the exotic chemistry of a tree. We'll start with:

Bark

Up to 21 percent of a cord of wood may be bark. Much of it is used as fuel in forest industry mills. It is also a source of chemicals, resins, waxes, vitamins, plywood adhesives, plastic fillers,

lacquers, and oil-spill control agents. Bark is also used for mulches and soil conditioners.

Wood Flour, Resins

Wood flour and melamine resins using cellulose filler are principal components of dinnerware, electrical receptacles and parts, toys, handles for cooking utensils, telephone housings, camera cases, and appliance housings.

Cellulose

Ethyl cellulose and other chemical based cellulose are used in making tool handles, photographic films, sausage casings, and football helmets. Acetate filament yarns make textile products such as clothing, drapes, and rugs. Nitrocellulose is used in making solid rocket propellants and other explosives.

Alcohol And Yeast

Alcohol and yeast are co-products of the fermentation of natural wood sugars. The alcohol produced in Bellingham is of extremely high purity and has many uses such as vinegar, cosmetics, solvents, and food carriers.

There is more than one kind of yeast. One kind of yeast from wood sugar is used in baby food and cereals. Another type is used in food supplements for cattle, fish, and chickens. A third type goes into pet foods. Wood sugar yeast has been found to make bees and lobsters grow faster!

Turpentine, Tall Oil

Turpentine and tall oil are important ingredients in paint, varnish, adhesives, asphalt, printing inks, rubber products, soaps, and polishes. Synthesized essential oils are used in chewing gum, toothpaste, menthol cigarettes, detergents, and shampoos.

Spent Pulping Liquids

Products from spent pulping liquids are used in vanilla flavoring, cement, ceramics, fertilizers, oil well drilling compounds, cosmetics, gummed tape, and certain drugs for hypertension and Parkinson's disease. These co-products come from a Bellingham facility.

Energy

Bark, ground wood, and spent pulping liquids are used by the pulp and paper industry for energy. Nationally, half the energy used to make pulp and

paper is created from bark, ground wood and these liquids.

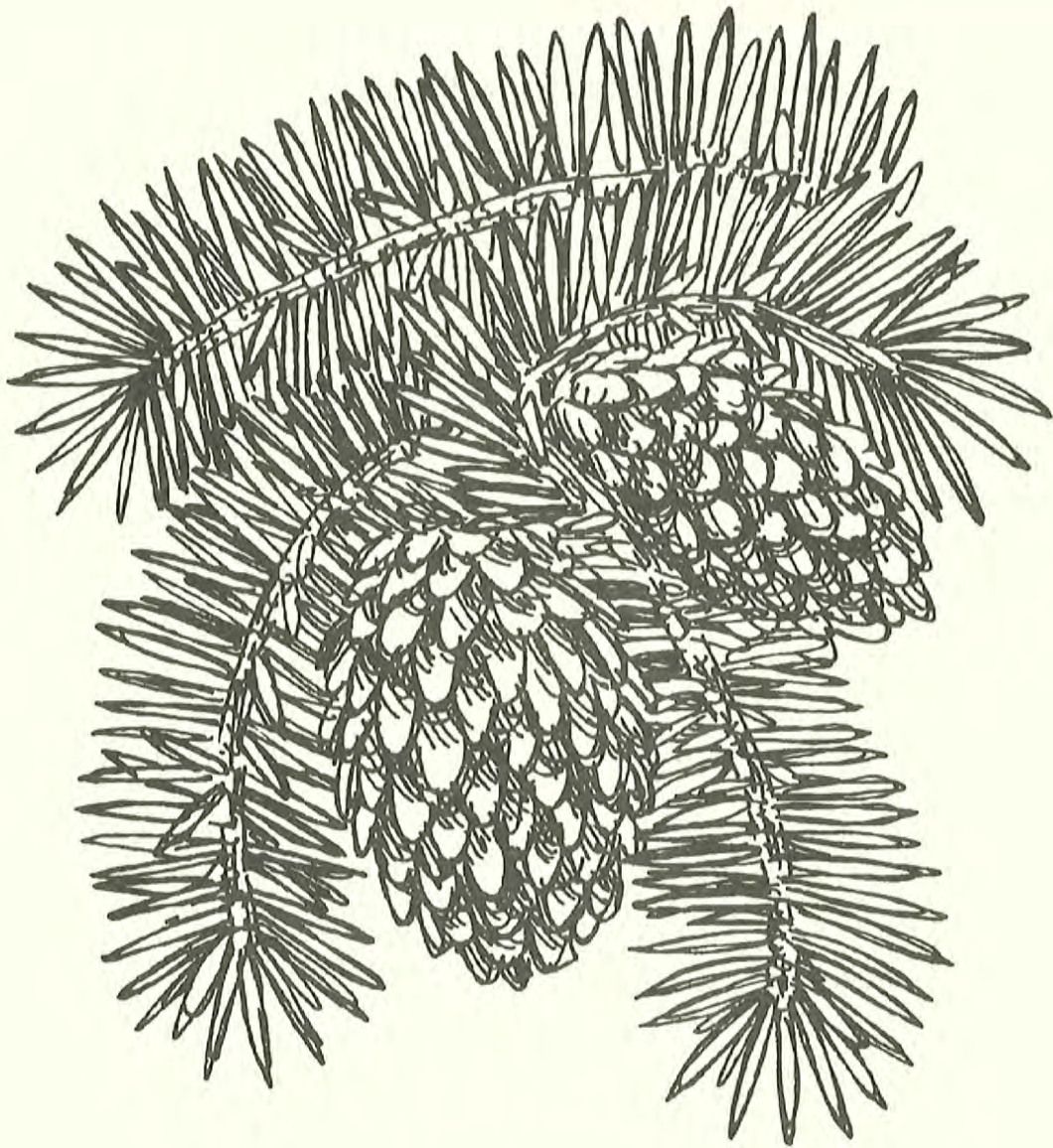
Lobsters and bees grow faster, chickens prosper, photographers have film for their cameras, and mud additives make drilling easier for Texas oil-men — all because of chemicals and co-products from trees.

Now that you have a hint, get busy on that list of tree products. Here's a suggestion that might help: Inventory just about everything in sight, in the next room and out on the street. That'll give you a good start — but remember, splinters don't count.

Things made from Pulp, Paper, and Chemicals: "Co-Products of the Pulping Process."

*Adapted from Puget Parade,
Volume 1, Number 1*

rayon	highway surface	magazines
cellophane	oil and gas wells	photographic slides
photographic film	liquid soap	automobile instrument panels
newspaper	shelf paper	draperies and bedspreads
alcohol	vacuum cleaner bags	stadium seats
space craft reentry shields	flypaper	trailers and mobile homes
book paper	glasses frames	puzzles
telephone casings	corks	toys
football helmets	guitars	mirror backs
roofs	name tags	signs
piano keys	gift boxes	stereo cabinets and speakers
ping pong balls	movies	can labels
fishing floats and tackle	decoys	posters
flashlight cases	snowshoes	venetian blinds
camera cases	fence posts and fencing	fine printing papers
artificial snow	heels for shoes	missile and radar domes
toilet seats	facial and bath tissues	crepe paper
artificial vanilla flavoring	paper towels	confetti
vinegar	hair spray	salad sets
cosmetics	nail polish	salt and pepper cellars
fertilizer	laxatives	golf tees
gummed tape	linoleum	hand cleaners
ceramics	tires	lubricants
sausage casings	atlases and maps	printing ink
diapers	popsicle sticks	waterproofing
clock cases	umbrella handles	roofing compound
rubber tires	flooring	paint
foam rubber	kitchen cabinets	telephone books
bread wrapping	knife handles	masking tape
price tags	grocery sacks	
tax forms	milk cartons	
diplomas	egg cartons	
varnish	buttons	



Sitka Spruce

Wood You Make a Difference?

Background Information For Teachers

Skills

Investigation, experiment, compare and contrast, critical thinking, persuasive writing (assessment)

Subject Areas

Science, health, language arts (assessment)

If **More Ideas** section is used:
Math

Materials

Two metal coffee cans, can opener, paper and matches

Two large glass jars with lids

Petroleum jelly

Coffee filter

Vacuum cleaner and coffee filter

Firewood

The energy crisis in the early 1970s spawned a popular bumper sticker stating "Split Wood, Not Atoms." Heating your home with a wood-burning stove became the environmentally and economically correct thing to do. A decade later, however, studies emerged showing a connection between air pollution, wood stoves and human health. It began to appear that by making the personal decision to heat your home with wood, you were putting the community's air and health at risk. The irony is that most of us wanted to believe that business is the cause of air pollution. Now we realize that we are all part of the problem. What makes it particularly worrisome is that the pollution we create with our woodstoves affects us where we spend the most time — in our homes. And the people most adversely affected by woodsmoke pollution are the elderly, the very young and those with asthma and cardio-respiratory problems. These are the very people who are home most often.

In the days when fewer people lived in this state there probably was minimal health risk in heating with wood. People now who live in relatively isolated areas don't create much of an impact. But in densely populated urban and suburban areas it is difficult to avoid polluting your neighbor's air space. There are communities in Washington where air pollution is compounded by the local topography, such as Spokane, Yakima, the Methow Valley and the greater Puget Sound trough. In winter, these areas experience air inversions in which a layer of warm air is trapped by an overlying layer of cold, dense air. Air inversions occur when there is an absence of wind and rain. We are then forced to breathe the stale, polluted air we created.

Regional air pollution control agencies and the Washington Department of Ecology have regulations governing the use of wood-burning stoves. When air is very stagnant, the state or local authority will issue a burning ban prohibiting the use of most woodstoves and fireplaces. These regulations have become stricter over the years, and some people are pushing for a total ban on the burning of wood for home heating.

On the other hand, new wood-burning stoves are much more efficient and burn cleaner than their early counterparts. Some people argue that wood is a plentiful, renewable resource. The U.S.D.A. Forest Service sells inexpensive permits for people to gather firewood in timber-harvest areas. This helps eliminate small, woody debris that could become forest



fire fuel. For some people, wood is an inexpensive fuel alternative. Also, the use of wood lessens our dependence on fossil fuels, nuclear power and hydroelectric power.

Heating a home with wood remains a personal choice, but one increasingly governed by specific laws and regulations. Dry, seasoned wood is the only fuel allowed to be burned in a woodstove, and the smoke emitted from the chimney must not exceed state opacity standards. For specific information, contact the local air pollution control authority or the nearest state Department of Ecology regional office.

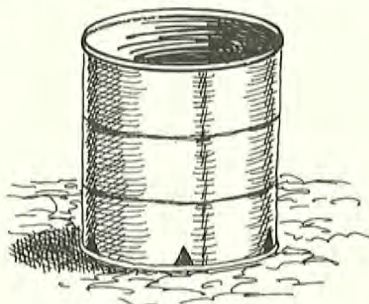
Learning Outcome

Students comprehend that personal choices and actions have positive and negative impacts on the environment.

Learning Procedure

See for Yourself: Use the following activities to help students understand the interactions of fuel combustion, weather and pollution:

Combustion — Obtain two coffee cans or similarly-sized metal cans. Use a can opener to make five holes around the sides near the bottom of one can (see illustration). Place a burning piece of paper in the bottom of each can and note the time it takes each piece of paper to burn. Note, too, how completely each piece burns. This activity demonstrates that in order to burn efficiently, fire needs oxygen. When homeowners close the damper on their woodstoves to conserve fuel, they reduce oxygen going to the fire. (Rapid, efficient burning produces a very hot fire that is short-lived. A “smoldering” fire produces even, longer-lasting heat.) When fuel is burned inefficiently, more particulate matter (one of the polluting components of wood-smoke) is released into the atmosphere, contributing to increased air pollution. Discuss why people often shut the damper on their woodstoves and what effect this has on our air quality.



Air Inversions — Using two large glass jars with lids, place one in a refrigerator and the other on top of a heater. When the jars are cold and warm, respectively, put them on a table in front of the room. Place a burning piece of paper in the bottom of each and quickly replace the lids. Notice if the smoke rises, or if it gets trapped near the bottom. This activity simulates what happens when there is a winter air inversion — normally warm air rises, but during an inversion the warm air is trapped by a layer of cold, dense air and pollutants are trapped in the warm air layer near the ground. If you live in a valley, observe the air quality on a still, dry winter day and discuss inversions.

Particulates in the Air — At various times over the course of the school year, smear petroleum jelly on a white piece of paper and place it on a windowsill or in a dry place outside. Secure the corners of the paper so it will not blow away. Compare the paper over time, looking for evidence of particulate matter. Conduct this test under a variety of weather conditions. Discuss why the white paper traps more air-pollution particles on some days than others. This activity should give an indication of particulate matter in the air and will show that during winter months, on still, cold days, there is a higher incidence of air pollution. This is partially due to woodburning stoves.

Variation: Place a coffee filter over the mouth of a vacuum cleaner hose, stick the hose out the window and turn on the vacuum cleaner to suck in air. Note any dirt on the filter.

Fuel Efficiency — In a safe place in the school yard, demonstrate the difference in burning rates and efficiency by using a variety of dry and wet sticks of wood and a variety of types of wood. This activity demonstrates that dry, seasoned wood burns more cleanly and completely than wet or unseasoned wood.

Note: Have students summarize what they have learned about air pollution and wood-burning stoves in these four experiments.

More Ideas

1. Contact the American Lung Association's local chapter for information on the effects of smoke on human health. Ask if staff has access to equipment that measures lung capacity and if it can be brought to your school. If possible, measure students' lung capacity at the beginning of the school year and again in the middle of winter. Compare any differences.
2. Students conduct polls in their neighborhoods to see how many people have woodstoves and how often they are used to heat homes. Compile the class's information and find the percentage of woodstoves compared to the number of homes polled. Extrapolate this information to the number of people who live in your community to estimate the number of woodstoves and woodstove use in your community.
3. Invite an inspector or public information officer from the local air pollution control agency to make a presentation to the class. On another day, invite a local woodstove manufacturer or dealer.

Variation: Instruct students to write to the local air pollution control agency for information on woodsmoke and pollution and also write to a woodstove manufacturer or retailer for the same information. Students compare the information from each source.

Assessment: What Did We Learn?

After conducting the experiments and summary discussion, tell students to write a short paragraph on whether they would use wood to heat their homes, specifying why or why not.



Let's Make a New Deal

Background Information for Teachers

Skills

Discussion, role-playing, cooperative learning, consensus-building, debate, critical thinking

Subject Areas

Social studies, drama, language arts

Materials

TFW cards*
(one deck = 40 cards)
Play equipment
(or pictures of play equipment)

* Provided

Washington boasts one of the most innovative procedures for cooperatively protecting natural resources — the Timber, Fish and Wildlife Agreement (TFW). The 1970s were full of adversarial court battles, with environmental groups filing suit and winning a case (called the “Classic U”) that drastically changed the way the Department of Natural Resources regulated timber sales. At the same time, Native American tribes were fighting in the courts over their treaty rights and the number of fish they were entitled to harvest. In 1974, The Boldt Decision confirmed the tribes’ rights to harvest half the fish and made the tribes co-managers of the resource. A later court decision decreed that state and federal governments must not degrade fish habitat.

Also in 1974 the Forest Practices Act was adopted. The intention of the Act was to create a comprehensive regulatory program governing forest practices. The Forest Practices Board (created as part of the change) is responsible for overseeing the Act and protecting public resources. The original Act contained broad water protection rules. In this regard, the Act was ahead of its time. However, over time there was a realization that the Act needed to be more broad-based and needed to address other concerns in addition to water quality. The Act also needed to be based more firmly in good science. The problem was, many of the interested parties disagreed with what constituted “good science.” A symptom of this disagreement was that the timber industry, environmental groups and tribes spent a lot of time, money and energy trying to get the Board and state legislature to alter practices to each group’s satisfaction.

Not surprisingly, all interested parties were frustrated. In the summer of 1986 the Northwest Renewable Resources Center held a meeting between representatives of state agencies, Native American tribes, the timber industry and environmental groups to search for a better way to cooperatively manage timber, fisheries, wildlife and water resources. Working groups were formed, “consensus decision-making rules” were agreed upon and, after sixty meetings in a five-month period, a final agreement was reached in February 1987. No representatives at the bargaining table walked away with everything they wanted, but all walked away with something they needed, under conditions they could tolerate.



According to a TFW introductory booklet, The Timber, Fish and Wildlife (TFW) Agreement is a fluid, changeable, “living” document designed to reshape the way we manage our forest-based natural resources in Washington state. It is not a legal agreement. It is an agreement of commitment by all parties to work together to reach consensus, encouraged by peer pressure.

“The TFW process recognizes that many different interest groups and governmental agencies must be involved, together, in order for the best decisions to be made. The decisions must take into account the need for a viable timber industry as well as a need for healthy fish and wildlife habitats, the protection of water quality and respect for tribal archaeological and cultural heritage.”

Learning Outcome

Students understand how cooperation among environmental groups, businesses, government agencies and native tribes has had a positive impact on environmental quality.

Learning Procedure

Play the Timber, Fish and Wildlife Game: Divide students into groups of four. Give each group a full deck of TFW cards (there are eight cards each of wildlife, fisheries, archaeology/cultural, water quality and timber in each deck). Discuss appropriate symbols for each of the five categories, then tell students to draw simple illustrations of the symbols on each card in a category.

Discuss how a forested area might be important to each of the five concerns and how one concern might conflict with another. Then, students play a card game following these rules:

1. The object is to get one card from each of the five categories (i.e., one wildlife card, one fisheries card, etc.).
2. The dealer shuffles the cards and deals out five cards to each player.
3. The remainder of the cards are put face down in the middle of the table. This is the “draw” pile.
4. The first player draws a card, and must “throw one away” in a pile (face down) next to the “draw” pile.
5. Each player continues in turn to draw and discard.
6. The first player to get each of the five TFW cards (with one left over to discard) is the winner of the hand.

When all groups have finished the game, explain to the students that in Washington we have a variety of interest groups involved in managing our natural resources. By playing the card game, students become familiar with five of those groups. Each has different management objectives, therefore they all had to find a way to work together to protect resources while still providing products and livelihoods. The timber industry is interested in growing and harvesting trees; government agencies are charged with protecting fish, wildlife, air and water quality and ensuring that rules and regulations are followed; environmentalists want to affect decisions about forests; native tribes want to be certain they will have access to their treaty-promised resources and protection for their cultural heritage.

How Do You Solve Problems? Ask students to identify ways they solve differences, for instance, by majority vote, by fighting, by flipping a coin. Then, using the provided background information, explain the development and process of TFW, how different factions worked together to resolve differences in natural resource management.

How Do We Reach Consensus? Pupils will participate in a consensus-building activity to help them better understand the TFW process. First, explain that the only way any cooperative agreement can work is if there are clear ground rules. Parties involved in TFW traditionally had been adversaries; to effectively communicate, each group had to understand and agree to play by the same rules. Before starting the following activity, explain the rules the students will adhere to:

1. Participants must leave their positions “at the door” in order to listen to the other parties with an open mind and to work at solving others’ problems instead of just their own.
2. Participants must truly listen in order to find a solution to the problem instead of trying to prove a point. They must ask questions in order to understand and make statements to explain or educate.
3. Participants are free to walk away from the bargaining table at any time but must tell why they are leaving. This gives others a chance to see if they can help resolve the issue.
4. A commitment must be made to attempt to reach consensus.
(Explain how consensus is different from majority vote: with consensus, all participants get something they want but may have to give up some things in return.)

Take the students out to the playground and choose an area to use for your simulation (either the play shed, the asphalt play area or the play field). Instruct students to look closely at the area. Tell them they will decide who hypothetically will get to use the area at recess and for what purposes it will be used. Return to the classroom and draw a rough outline of the play area on the chalkboard. Students will use this outline for filling in their play use plan as it is developed.

Pupils are to suggest their favorite activities in the chosen play area and agree on a maximum of four that will be used in the simulation. For example, the class may choose basketball, four-square, jump-roping and hopscotch as their favorite activities in the play shed. Have students choose which activity group they would like to represent. These will be the four teams. Each team will pick a spokesperson to represent them at the bargaining table.

Before coming to the bargaining table, the four spokespeople symbolically set down play equipment (or pictures of the play equipment) that represents their chosen activity. They are coming to the bargaining table to cooperatively agree on a schedule or method of using the play area that will please all parties. If a spokesperson needs ideas or encouragement, he/she may call time out and confer with teammates. If other team members would like to make a point, they must also call time out to confer with their spokesperson. Team members not at the table cannot shout out comments or ideas; only the designated spokesperson may speak at the bargaining table. (You may want to act as moderator to be sure rules are followed.) The game is over when a plan has been developed that all four teams can agree on.

More Ideas

Each student writes down events, feelings and experiences of the character they played in the simulation.

Assessment: What Did We Learn?

To demonstrate knowledge, pupils write a paragraph explaining what they learned about the TFW process.



TFW Cards

FISHERIES

FISHERIES

FISHERIES

FISHERIES

FISHERIES

FISHERIES

FISHERIES

FISHERIES

TFW Cards

<div>WILDLIFE</div>	<div>WILDLIFE</div>
<div>WILDLIFE</div>	<div>WILDLIFE</div>
<div>WILDLIFE</div>	<div>WILDLIFE</div>
<div>WILDLIFE</div>	<div>WILDLIFE</div>

TFW Cards

TIMBER

TIMBER

TIMBER

TIMBER

TIMBER

TIMBER

TIMBER

TIMBER

TFW Cards

WATER QUALITY	WATER QUALITY
WATER QUALITY	WATER QUALITY
WATER QUALITY	WATER QUALITY
WATER QUALITY	WATER QUALITY

TFW Cards

ARCHAEOLOGY / CULTURAL

ARCHAEOLOGY / CULTURAL

ARCHAEOLOGY / CULTURAL

ARCHAEOLOGY / CULTURAL

ARCHAEOLOGY / CULTURAL

ARCHAEOLOGY / CULTURAL

ARCHAEOLOGY / CULTURAL

ARCHAEOLOGY / CULTURAL

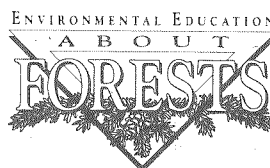
Unit IV

Cooperative Action

Washington State Environmental Education Goal IV:

The student will develop and utilize the knowledge and skills necessary for cooperative action on behalf of the environment.

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Town Trees

Background Information for Teachers

When asked to think about forests, most students tend to picture vast, remote forests that can only be reached by taking a long ride in the car. Few of us realize that the trees, plants and wildlife in our towns and neighborhoods are part of a forest ecosystem. We can learn a lot about those more remote forests by studying our local forest environment.

Neighborhood forests provide many important benefits. They provide wildlife habitat, shade from the summer sun, cleaner air, soil erosion control, noise and wind buffers, and of course they add beauty to our surroundings. Neighborhood forests can also serve as an environmental education resource where students can see and learn about the connections between our lives and the natural world.

Learning Outcome

Students will understand the value of neighborhood trees.

Learning Procedure

Where are the Trees in Your Neighborhood? Ask students to read *Neighborhood Forests: What Are They?* Discuss. Help students learn about your neighborhood trees by taking a walking tour of the area around your school. Ask parents to join your class in creating a baseline map of the trees in the neighborhood. Using the *Components of a Neighborhood Forest* worksheet, students will work in small groups, each with an adult, to make a simple map of your neighborhood trees and significant green spaces (i.e., parks, fields).

Alternatively, you can contact the Washington Department of Natural Resources or Washington Department of Transportation for a color aerial photo of your town. Draw a square around the part of the photo that you think would be your "neighborhood forest." Using the aerial map, have students work in small groups to complete the *Components of a Neighborhood Forest* worksheet. The worksheet will help them identify the green areas within the square on the photo. Keep in mind that you will need to take students on a walking tour of your neighborhood in order for them to complete the data sheet.

Skills

Mapping, investigation, research, observation, project planning, cooperative learning

Subject Areas

Social studies, language arts, science

Materials

Neighborhood Forests: What Are They? Background Sheet *

Components of a Neighborhood Forest Worksheet *

Wildlife Observations Worksheet *

Aerial photograph (optional)

City map (optional)

Paper, pencils and clipboards for map-making

* Provided



The Value of Trees. After completing the *Where are the Trees in Your Neighborhood* activity, ask students to think about the value of its trees. For instance, neighborhood trees provide beauty and privacy. Trees also provide protection from weather extremes, offering protection from wind in the winter and offering shade in the summer. They absorb carbon dioxide from the air, thus protecting us from some pollutants by cleansing the air we breathe. Neighborhood forests also provide homes and food for a wide array of animals.

Homes for Wildlife. In any forest ecosystem, we often talk about “habitat layers” when describing wildlife homes and foraging habitats. The top layer of a forest is called the “canopy” and consists of the upper branches of the tall trees. The next layer, the “understory,” consists of middle-level trees and shrubs. The third layer, the “forest floor,” is made up of whatever is found on the ground: perhaps ferns, dead needles, stones, logs, or wildflowers. The last layer, the “sub-floor,” consists of the soil, rocks, roots and tunnels underground. Neighborhood forests have these same layers, but tall buildings may be part of the “canopy” and sidewalks may be part of the “forest floor.”

Students are to use the *Wildlife Observations* worksheet to see how wildlife uses the layers of your neighborhood forest, especially the trees. (Remind students that trees are only one component of a neighborhood forest. Other plants provide many of the same benefits that trees do, and a diversity of plant species is important to the health of any ecosystem.) This investigation can be done as a whole class walking trip, an assignment for each student to do with their families or students can be divided into three teams, with different teams observing different areas. (For instance, have one team observe a park, another a commercial district and another a neighborhood with houses.) Whichever method you choose, have everyone share their recorded observations. Possible discussion questions include:

What are your conclusions about forest wildlife and neighborhood trees?

What types of wildlife seem to need trees for habitat (shelter and food)?

What types of wildlife have adapted to human structures and human food?

How important do you think it is for neighborhood areas to provide habitat for wildlife?

You might want to repeat this activity in the fall, winter and spring to compare wildlife observations at different times of the year.

Provide for Wildlife. Now that you are more familiar with your neighborhood forest, look for areas that need more trees and plants, or areas that could provide for wildlife if they had just a little help. Tour the area you have in mind and have each student illustrate, on a simple map, the landscaping details. Note the sizes, placement and species of plants that exist. Discuss the benefits provided by these plants — beauty? shade? erosion-control? wildlife habitat? Envision an area where a neighborhood forest, a small stand of trees, could be planted along with other plants of varying heights (including ground-cover, wildflowers, large stones and logs). Discuss what would be the additional benefits of such an area. If the class decides to implement the project, see Lesson 20: *Earthkeepers: From Schoolyard to Planet* for planning information.

More Ideas

1. Carry out a planting project in an area of the schoolyard where erosion-control is needed. Discuss the negative impacts of erosion (siltation in nearby streams, loss of topsoil) and design a project which will eliminate an erosion problem on your schoolgrounds.
2. Establish a “buddy” system whereby each of your students has a “buddy” from a lower grade level. Instruct students to teach their buddies about the value of neighborhood forests and the need to protect the newly-enhanced part of the playground. (Or, perhaps buddies could help with tree plantings.)
3. Create an all-school “ownership” in the newly-enhanced area. Give classroom tours and have your students explain to other classes the reasons why the project was undertaken, the names of the plants and the provisions for wildlife. Hold a schoolwide contest to name the new area. Establish a display in the library to teach the names of common birds in the area. One part of the display can include a reporting sheet where any student can report a bird sighting.
4. Create a class book documenting the project. Make different students responsible for different pages. Include photos or student illustrations and an identification section naming the new plants.
5. Nominate your project for an Arbor Day award. (See resources below.)
6. Students research, write and present reports on one native and one non-native plant species. Then, as a class, decide whether or not your project will include non-native species.

Assessment: What Did We Learn?

Students write a paragraph explaining the value or benefits of a neighborhood forest.

Resources:

Arbor Day Council
Keep Washington Green
Anderson Hall
University of Washington
Seattle, WA 98195
206-543-2750

Washington Community and Urban Forestry Council
Department of Natural Resources
P.O. Box 47046
Olympia, WA 98504-7046

WA Department of Wildlife
Backyard Wildlife Sanctuary Program
16018 Mill Creek Boulevard
Mill Creek, WA 98012
206-775-1311



Background Information for Students

Neighborhood Forests: What Are They?

Neighborhood forests? How can there be a “forest” where buildings and roads cover most of the space? The answer lies in our definition of forest: A forest is an ecosystem where the dominant plants are trees and shrubs. But a forest ecosystem is much more than trees. It includes ferns, grasses, flowers, moss, mammals, birds, fish, insects, soil, water, stones, air and often humans. Because it’s an ecosystem, all the components of a forest are connected in many, many ways. (Animals eat plants, plants and animals die and decay, enriching the soil, soil provides food for plants and homes for some animals, etc.).

A neighborhood forest is also a forest ecosystem in which all of the parts are connected — it’s just that many of the parts happen to be buildings, cars and lots of people! Neighborhood forests are found wherever people live together in communities, large and small. The Components of a Neighborhood Forest worksheet will help you find out about the neighborhood forest you live in.

Components of a Neighborhood Forest Worksheet

1. List the names of all the parks in your general area.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

2. List the names of other public "greenspaces" such as golf courses, playing fields, cemeteries, etc.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

3. If using an aerial photo, list the other kinds of places which are green. (For example, people's yards, trees planted along downtown streets, etc.)

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

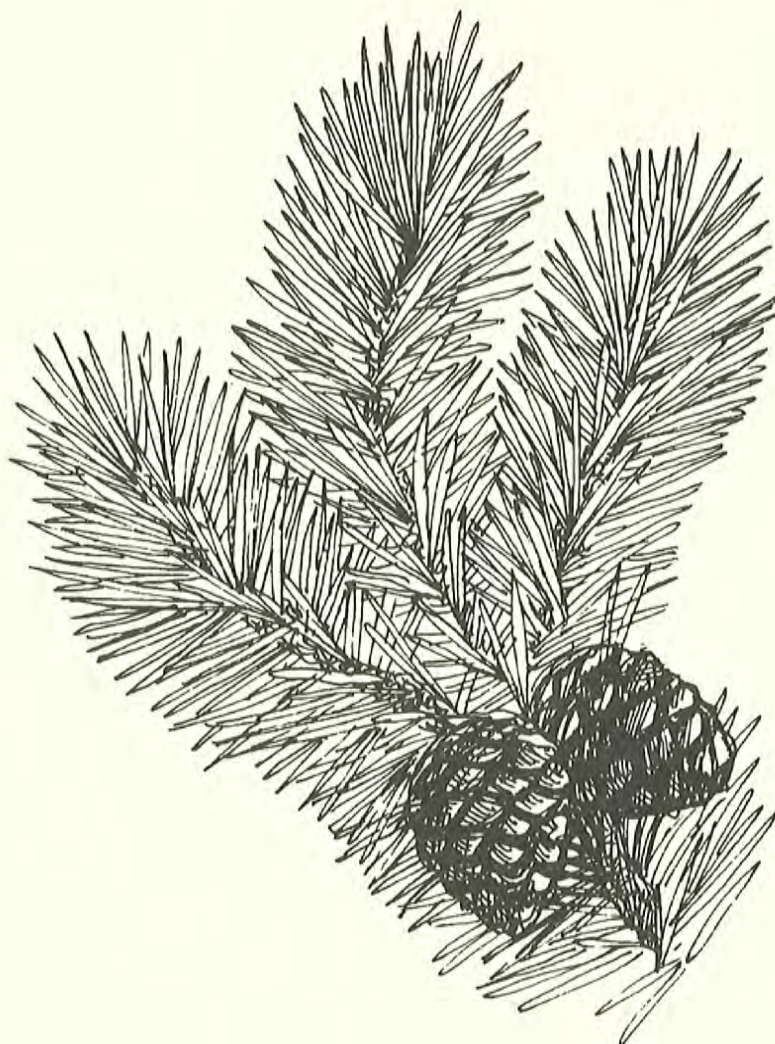
4. Tour your neighborhood and list some of the wildlife you observe. (Don't forget to include insects, too!)

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Wildlife Observations Worksheet

Area Observed: Neighborhood ☐ Commercial ☐ Park ☐

Animal Observed (or signs of animal)	Where
Canopy: Example: Pigeons	Rooftop of bank
Understory: Example: Butterfly	Rhododendron bush
Forest Floor: Example: Ants	Sidewalk cracks
Sub-Floor: Example: Mole hills	Courthouse lawn



Lodgepole Pine

Earthkeepers: From Schoolyard to Planet

Background Information for Teachers

Skills

Decision-making, cooperative learning, planning, investigation

Subject Areas

Civics/social studies

Materials

Local phone book

How Communities Are Organized Worksheet *

Project Description Worksheet *

Butcher paper

Final Checklist *

* Provided

Many teachers and school administrators express the need for students to be involved in environmental, community-based projects. Project options abound, but sometimes teachers and students need guidance on how to proceed with a chosen project.

The most successful projects are those in which students feel personally invested. Undertaking an environmental project allows your students to become involved in real-life problem-solving. They learn how to make community contacts and organize an event, and they gain skills necessary for cooperative action. Students will improve not only their local environment, but their self-esteem as well.

Learning Outcome

Students will be able to plan, organize and implement a community-based, forest-related project.

Learning Procedure

How Communities Are Organized. You and your class have decided you want to be involved in a community project, but you aren't sure where to start. Regardless of the nature of the project you choose, you may want to make many community contacts . . . contacts for advice, donations and other kinds of support. Community agencies can seem like a maze of overlapping bureaus, departments and services. Before defining your project, ask students to take a little time to learn about how your community is organized so that they'll understand who can help with what.

The *How Communities Are Organized* Worksheet shows how neighborhoods group together to form a town (or city). Towns that are close to each other form a county; all the counties together make up a state; all 50 states form the nation (or federal level of government). Each level performs certain functions or helps us meet certain needs. Those services are shown on the worksheet. (For example, cities usually provide fire protection; state government usually provides state highways and money for schools.)



Using a local phone book, students find out what services are provided by your town and county, and record the findings on the worksheet. The natural resource services provided by Washington State and the U.S. Government (along with addresses and phone numbers) are listed for your information.

Choosing a Project. Perhaps through previous investigations you and your students have seen a place in your community where more trees are needed or where a greenspace needs cleaning or re-vegetation. You have decided to do something about it! As a class, list as many project ideas as you can. Discuss reasons why each suggested project would or would not be a good one for your group to undertake (taking into consideration cost, time involvement and location). Decide on a first, second and third choice. (If for some reason you cannot carry out one project you'll have a second or third choice to pursue.)

Projects may involve planting, restoration, clean-up or community education. For example, students could plant tree seedlings or flower bulbs in the fall and conduct a community planting project in the spring. Students could involve other grade levels in undertaking the project outlined in *Town Trees*. (See Lesson 19.) They could observe and plot wildlife in the area prior to planting and compare observations over time. Students could conduct a Washington Forest Fair. (See Lesson 22.)

Another option would be to have students call some of the agencies and people identified on the *How Communities Are Organized* worksheet to see if they have suggestions for projects. Perhaps the Chamber of Commerce or city planners have been thinking of a downtown beautification effort, or maybe the Washington State University Cooperative Extension office knows about a streambank that needs restoration work. Perhaps a new school needs landscaping and you can provide a native plant area. Add all suggestions to your list.

If necessary, contact the person or agency that owns the land on which you want to do your project. Ask permission to carry out your project, and explain that you will submit a description in writing, outlining the details, schedule and other community groups involved.

Defining Your Project. In order to be successful, any project needs a clear definition. People carrying out the project need to agree on very specific details so that (1) the project won't become too big and unmanageable, (2) important elements of the project won't be overlooked and (3) all those involved (sponsors, donors, property owners, etc.) understand exactly what is being proposed and what their commitment is.

As a class, create a detailed description or definition of your project by filling out the *Project Description* worksheet. Make copies of this plan to distribute to property owners, sponsors and anyone else involved in your project.

If someone in your group is artistic, it might be fun to design a logo to go with your project. (A project logo could incorporate your class or school logo if you have one.)

Note: For item #12 on the worksheet, some questions for further research may include:

What trees, plants, ground cover, etc. should we plant?

How do we plant a tree?

Where can we get the money for this project?

Who could donate money, supplies or expertise?

Identifying Tasks and Timelines. You now have a plan or a good description of your project and a few questions might have been raised that need to be researched. Besides researching questions, there are other tasks that must be completed prior to the project date. Conduct a "task analysis" to identify all those tasks, assign people to do each task and create a timeline for task completions.

Because your project is unique, only you and your students can decide what each task should be during this planning stage. One way to do this is to close your eyes and imagine that the project day is here. Imagine people arriving, equipment arriving and everyone beginning to take action. Ask questions about each step of the project you are envisioning, questions like, "Where did the equipment come from," and "How do people know what to do?" As you "walk through" the project in your mind, you will be able to identify tasks that need to take place prior to the project day. Some of the

tasks will include finding answers to the questions identified in your project description. Some tasks might be:

- Find out what trees to plant and how to plant them.
- Find a source for trees and other plants.
- Get help on designing the area to be planted.
- Organize a dedication ceremony.
- Get people to donate tools and equipment.
- Contact media for publicity.
- Set up work teams.
- Train team leaders.
- Raise money.
- Develop a clean-up plan.
- Arrange refreshments and first-aid.
- Check on underground cables.
- Check need for liability insurance.
- Personally contact homeowners for street tree project.
- Write thank you notes.

On the blackboard, list all tasks and people responsible. On a long piece of butcher paper, create a timeline by working backwards from the date of the project to see when each task should be completed.

Final Checklist. Use the checklist to be sure that the project is coming together as planned.

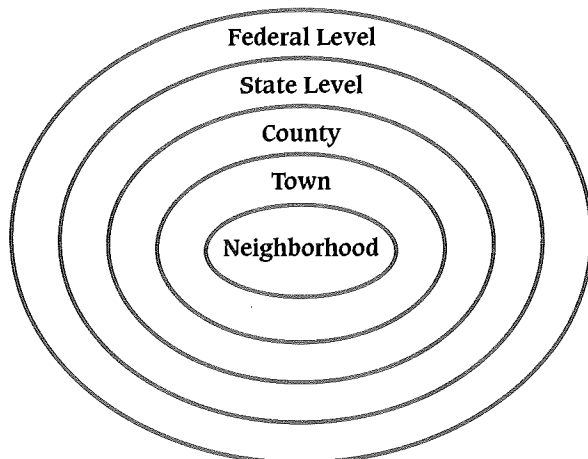
Assessment: What Did We Learn?

Students write or orally present their answers to the following questions:

1. What parts of this project were the most successful and why?
2. What improvements or changes to the project would you suggest?
3. How do you feel about the importance of this project and what you have accomplished?



How Communities Are Organized



Typical Services of Towns	Our Town?	Name of Person or Department	Address & Phone
garbage pickup	yes/no?		
recycling			
parks & recreation			
fire protection			
public works			
planning			

Typical Services of Counties	Our County?	Name of Person or Department	Addresses & Phone
Public Works			
Parks & Recreation			
Health Department			
WSU Cooperative Extension			

Washington State Environmental Resource Agencies:

Department of Agriculture: 206-902-1800

Department of Ecology: 206-407-6000

Department of Fisheries: 206-902-2200

Department of Health:

Environmental Health: 206-753-5956

Shellfish Programs: 206-753-5992

Department of Natural Resources: 206-902-1000

Department of Parks and Recreation: 206-753-2027

Department of Wildlife: 206-753-5700

Puget Sound Water Quality Authority: 206-493-9300

U.S. Government Agencies:

Environmental Protection Agency: 206-753-9437

U.S. Fish & Wildlife Services: 206-753-9440

USDA Forest Service: Check phone book for nearest ranger station

National Parks: See Mt. Rainier, North Cascades or Olympic National Parks

National Monuments: See Mt. St. Helens

Soil Conservation Service: 206-753-9454

Other:

Neighborhood Associations

Basin Planning Groups (county)

Stream Teams (city)

Local Schools

Chamber of Commerce (city)

Utilities: Gas, Electric, Phone and Cable companies

(Underground cable information: 1-800-424-5555)

Project Description Worksheet

1. Project Title: _____
2. Location: _____
3. Description: We plan to _____

4. Project Date(s) _____ and Time(s) _____
(Remember: Late fall, winter and early spring are the best planting times.)
5. Why is the project needed? _____

6. What materials are needed? (plants, tools, etc.) (If you are doing a planting project, but don't know what kind of trees, etc. to plant, that can be researched at a later time.)

7. Who will care for the area after the project is completed, and continue to care for it in years to come?

8. Whose permission do you need? _____

9. What clean-up tasks will there be? _____

10. Do you plan to seek publicity? _____ How? _____

11. Do you plan to have a dedication ceremony? _____
12. What are some questions you have yet to research?

Final Checklist

	notes
<input type="checkbox"/> Permission obtained	
<input type="checkbox"/> Underground cables investigated	
<input type="checkbox"/> Planting design complete	
<input type="checkbox"/> Plants ready for delivery or pickup	
<input type="checkbox"/> Equipment and tools lined up	
<input type="checkbox"/> Sample planting area tested for ease of digging	
<input type="checkbox"/> Property owners, neighbors, etc. notified in person	
<input type="checkbox"/> Long-term care provisions made	
<input type="checkbox"/> Publicity plans carried out	
<input type="checkbox"/> Training complete (for example, on how to plant a tree, or how to use tools safely)	
<input type="checkbox"/> Teams and leaders set up	
<input type="checkbox"/> Participants notified as to date, time, what to wear/bring, schedule of events	
<input type="checkbox"/> Refreshments arranged	
<input type="checkbox"/> First aid provisions made	
<input type="checkbox"/> Liability insurance investigated	
<input type="checkbox"/> Clean-up plans ready	
<input type="checkbox"/> Dedication ceremony planned	
<input type="checkbox"/> Public address systems taken care of	
<input type="checkbox"/> Plaque or proclamation ready	
<input type="checkbox"/> Guests, newspapers, etc. invited	
<input type="checkbox"/> Photographer/videographer lined up	

A Forest Full of Views

Background Information For Teachers

Washington's forests host a number of issues, some more complex than others. When asking elementary students to analyze issues, it is important to help them understand there are no "black and white" situations or easy answers. Because issues have economic, social, ecological, philosophical and political aspects, they are complicated. Some aspects of issues will be too difficult for elementary students to understand. However, they can learn that looking at issues requires researching both sides of a question and thinking about different perspectives ("putting yourself in someone else's shoes"). They can also learn to check for fact versus opinion by considering the source of the information.

Perhaps most important to remember when asking students to think about issues is that, as teacher, you need be a **research facilitator**, not the "leader of a cause." The environmental education guidelines for the state of Washington charge us with the task of helping students become decision-makers, not telling them what to think.

In this lesson the class will work together to look at possible uses of a forested tract of land in order to learn the steps of analysis. Student teams will present arguments to a "city council" for various uses of the land parcel. The city council (comprised of 5 students) will then vote on what to do with the land. Each council member must give reasons for her or his vote.

Learning Outcome

Students will learn steps to analyze an issue and separate fact from opinion while realizing the importance of looking at all sides of an issue. Students also will learn to make presentations to an audience.

Learning Procedure

What is an Issue? Discuss the fact that, as the population increases and more demands are made on natural resources, sometimes there are differing opinions on how those resources should be used. (For more information, refer to the mobiles made in Lesson 11: *Watershed Benefits*.) Explain that a situation about which people hold different opinions often is referred to as an "issue." (For example, ask students what they know about the animal-rights issue on using animals for medical research. Help students understand that an issue always has at least two sides.)

Skills

Analysis, cooperative learning, critical thinking, problem solving, research

Subject Areas

Language arts, social studies

Materials

Land Use Proposals*

Steps for Analyzing Issues*
(Make a transparency.)

Student Issue-Analysis checklist*

* Provided



The Decision to Be Made: Describe to students a situation in which the city owns 100 acres of forested land on the edge of (but within) city limits. The city council must decide the best use for this land, taking into account the differing needs of the landowners (all the town's residents).

Four possible uses of the land are to be considered: development as a park; development as a shopping mall; periodic commercial thinning of the forest; leaving the forest as is. This land has already been logged, so it is not "old growth." Also, the thinning discussed here is not clearcutting. Rather, certain trees periodically would be selected for logging, and the remaining trees would be left standing. (The main points describing the land should be listed on the board for reference by the students throughout the exercise.)

Steps for Analyzing Issues: Using a transparency of *Steps for Analyzing Issues*, briefly discuss each step. Explain that you will be practicing these steps together as you study the issue of what to do with the forested area. When students are familiar with the steps, they will work in teams to analyze separate issues and present them. The forum for this will be presentations to a mock city council meeting. Then council members will take a vote based on their own analyses of the issue.

Practicing Steps for Analyzing Issues: First give each student a copy of the *Student Issue-Analysis* checklist to use in analyzing information on the proposals. Give each student copies of the four Land Use Proposals, telling them each presents a particular view of what should be done with the forest and that there are no "right" or "wrong" views. Explain to pupils that they will be asked to analyze the information in the proposals. Instruct students to read the proposals, then create a heading for each one, i.e., "Land Use Proposal: Create a Park." Under each heading students will make sub-headings of "Reasons For" the proposal and "Other People's Concerns." (At this point students should not begin listing reasons and concerns; that is part of the next step.) Explain that for the sake of time, you will be using information already gathered and presented in the proposals, rather than using the information-gathering techniques listed on the transparency. Collect the proposals.

Analysis: Five students will act as city council members. You are to divide the remainder of the class evenly into Team 1 and Team 2.

Give every student on Team 1 a copy of *Land Use Proposal: Create a Park*. Every student on Team 2 is to receive a copy of *Land Use Proposal: Sustainable Forestry*. The students are to spend a few minutes individually reading and analyzing the material, then filling out the "Reasons For" and "Other People's Concerns" lists. After this, they gather as a team to share the points they've written down. One student is chosen by each team

to present the group's proposal to city council. A second student is selected by each team to present "Other People's Concerns" as given in each proposal.

While the teams are gathering information to present, the five council members are to vote for a chairperson who will lead the meeting. Each council member will list "Reasons For" and "Other People's Concerns" based on information given in the citizens' presentations. Just as the teams analyze information to make their presentations, so too, the council members will analyze information — that which is given them by the presenters.

Hearing All Sides: After the city council meeting is convened by the chairperson, she or he will outline the four uses being considered for the 100 forested acres. Then the chairperson will call on the presenter for the first proposal to "Create a Park." Using the lists as a reference, that presenter takes a few minutes to give the reasons why the forest should be turned into a park. As they listen, council members are to note the reasons under the "Reasons For" sub-heading.

After the first presentation the Team 1 member assigned to give "Other People's Concerns" comes before the council and does so. Council members list these under the appropriate sub-heading.

In all cases, council members are cautioned to separate fact from opinion, and to base their judgments on facts.

Next the Team 2 presenter for the proposal to do "Sustainable Forestry" outlines the arguments for this use. After this, the Team 2 student airing "Other People's Concerns" speaks. Council members make note of these points under the sub-headings for this proposal, again separating fact from opinion.

This is the half-way mark in the presentations. From this point on students will be asked to consider alternative points of view. Team 1 members will be given copies of *Land Use Proposal: Shopping Mall*, while Team 2 members each receive *Land Use Proposal: Leave It As Is*. Students repeat the process of individually analyzing the information and jotting down notes, then collecting the ideas in a list to be presented to council. Again, one student is chosen from each team for the presentation to council, and one is chosen to give "Other People's Concerns." (These should not be the same students as before.) The presentation process is repeated with the new proposals.

Decision-Making: After this is done the council members take a vote. Each member is to tell the class why he or she is voting in a particular way, based on the information presented. The chairperson records votes and announces the result.

Fact vs. Opinion: Every student will use a copy of all four proposals. Talk with students about how all the proposals were valid and how all represented a combination of fact and opinion, given from various perspectives. Review each proposal separately to determine what is fact and what is opinion. Define the difference. Explore what key words showed something to be an opinion.

More Ideas

1. Identify a similar situation on forestry issues in your community. Working as teams, students are to contact various interest groups to find out their views on the issue. Pupils can use the "Student Issue-Analysis" checklists to record information. Encourage students to separate fact from opinion in the information they are given. Pupils may attend zoning hearings or city council meetings to hear the issue discussed. As part of their own information-gathering process, they may contact some of the resource groups suggested below. It might take a few weeks to receive replies to letters.

Pesticide Use in the Forest — Pesticides are chemicals used to control insects, fungi, rodents or other harmful animals, plant diseases and weeds. (Pesticides that kill insects are called insecticides; those that kill weeds are called herbicides; fungicides kill fungi.)

Mt. Baker-Snoqualmie National Forest
21905 64th Avenue W.
Mountlake Terrace, WA 98043

Washington Friends of Farm & Forests
P.O. Box 7644
Olympia, WA 98507

Washington State Department of Agriculture
P.O. Box 42560
Olympia, WA 98504-2560

Washington State Department of Natural Resources
P.O. Box 47000
Olympia, WA 98504-7000

Cattle Grazing in National Forests — Thirty-four percent of the forests in Washington are owned by the federal government and managed by the U.S.D.A. Forest Service. National Forests are managed under a "multiple use" policy. This means that the forests are used to meet a variety of needs including recreation, timber production, preservation (Wilderness), wildlife and cattle grazing. Cattle grazing permits are issued to ranchers in eastern Washington so that ranchers will have some place to graze their cattle during the growing season when their pastures are used for hay production. (National Forests on the east side of the state include the Colville, Okanogan, Wenatchee, Umatilla and part of the Kiniksu.)

National Wildlife Federation
1412 16th Street N.W.
Washington, D.C. 20036

Range Magazine
43 Bellevue Road
Carson City, NV 89704

U.S.D.A. Forest Service
(see resource section for complete listing)

Washington Cattlemen's Association
P.O. Box 96
Ellensburg, WA 98926

Urban Greenbelts — As human population increases in Washington state, cities tend to expand into formerly forested areas. Communities are beginning to feel the need to create and protect green spaces in the form of greenbelts, parks and street trees. For information regarding how people are trying to keep forests in urban areas contact:

Mountains to Sound Greenway
506 2nd Avenue, Suite 1510
Seattle, WA 98104

Washington Park Arboretum
University of Washington, MS: XD-10
Seattle, WA 98195

Washington State Department of Natural Resources
P.O. Box 47000
Olympia, WA 98504-7000

Wilderness Areas — In 1964, the United States Government passed the Wilderness Act, allowing Congress to set aside areas to be protected in their natural state. In Washington state, many Wilderness areas are managed by the U.S.D.A. Forest Service. The Wilderness Act limits the type and amount of human activity allowed to take place in Wilderness areas; they are to be “untrammeled by man.” Wilderness managers face the challenge of protecting the natural state of Wilderness areas while at the same time allowing people to visit these areas.

Northwest Forest Resource Council
1500 S.W. First, Suite 770
Portland, OR 97201

U.S.D.A. Forest Service
(see resource section for complete listing)

Wilderness Society
900 17th Street N.W.
Washington, D.C. 20006

Endangered Species — Endangered species (plants and animals) are identified and protected by the Washington State Department of Wildlife and by the U.S. Fish and Wildlife Service. In Washington there are 28 species listed as endangered or threatened. Endangered species are “seriously threatened with eradication throughout all or a significant portion of its range;” threatened species are “likely to become an endangered species within the foreseeable future without cooperative management or removal of threats.” — Department of Wildlife

Seattle Audubon Society
8028 35th Avenue N.E.
Seattle, WA 98115-4815

U.S. Fish & Wildlife Service
3704 Griffin Lane S.E., Suite 102
Olympia, WA 98501-2192

Washington Environmental Council
5200 University Way N.E., Suite 201
Seattle, WA 98105

Washington Forest Protection Association (WFPA)
711 Capitol Way, Suite 608
Olympia, WA 98501

Washington State Department of Wildlife
600 Capitol Way N.
Olympia, WA 98501-1091

Northwest Indian Fisheries Commission
6730 Martin Way E.
Olympia, WA 98506

2. Working in small groups, have students read different newspaper and journal articles on a certain subject. Instruct them to look for facts and opinions. Create a checklist of words that would indicate an opinion, such as "should", "must", "never", "always", "seems," etc.

Instruct each student to write a "letter to the editor" about the issue she or he analyzed. Encourage students to include all information needed, but without bias. If opinion is given, it should be clearly stated as such.

Assessment: What Did We Learn?

Each student is to write a paragraph describing the steps for analyzing an issue, and one paragraph on the consequences of getting information from only one source.



Student Issue-Analysis Checklist

1. Gather and read information.
 - Library research
 - Letter-writing
 - Phone calls
 - Interviews
2. Make headings on a sheet of paper for each point of view or proposal.
 - Make a sub-heading to list "Reasons For" each point of view.
 - Make another sub-heading to list "Other People's Concerns."
 - Identify concerns surrounding issue.
3. Re-read all gathered information and record notes under appropriate headings and sub-headings. When available, record the source of the information.
4. Look for missing information. Try to track down the missing information.
5. Separate fact from opinion.
6. Identify solutions.

Land Use Proposals

Land Use Proposal: Shopping Mall

This town doesn't have a mall with more than 15 stores and the growing population could use one. This location is big enough to build a large mall, one that would give our residents more places to shop. There is a letter in the mayor's office from the Acme Development firm, stating the company would like to build a big mall in our town if they could just find the right location, for example, right where the forest is now. Real estate markets indicate that the city could potentially sell this 100 acres to the developer for \$2 million. No other town in this area has a big mall, so shoppers from nearby towns would also come and spend their money in our town. This would help with the city's shortage of money by earning more revenue from sales tax and business tax, and by providing increased opportunities for employment.

Other People's Concerns: I own a shop downtown. I think this would be terrible for our town! Studies show that 80% of the time a mall is built on the edge of town, the downtown businesses lose money.

Land Use Proposal: Leave It As Is

A check of city records shows this is the largest piece of forested land in our city. It now has three nature trails. The city parks department reports that these trails receive heavy use by our town's residents. The department also reports that 100 wildlife species live there. We don't know for sure, but it seems that doing anything more to this land would be bad for wildlife. The forest is a destination for city residents who come to escape the hustle and bustle of city-life. They come to share this little piece of country for its beauty and tranquility.

Other People's Concerns: As the newspaper reported today, our city needs money. We should do something with this land that brings in money. If we leave it alone, it could be destroyed by a fire, and then we'd lose the forest completely and wouldn't have a dime to show for it. Only a fool would leave it alone!

Land Use Proposal: Create a Park

This is a great location for a city park! Research shows our town doesn't have a park larger than 30 acres, so this 100 acres would give us a big park. We would have room for three new ballfields to help the well-documented overcrowding at our ballfields now. And we could have a large playground area. Research shows it would cost \$1 million to build the ballfields, playground and other things we need. However, at least some of this could be offset by selling some of the trees to make room for the ballfields and playground. We could raise at least \$400 thousand this way. Income from baseball tournaments to local businesses would be good for the city's economy.

Other People's Concerns: The newspaper reported just this morning that our city budget already is squeezed. We don't have \$1 million to spend on a new park. It would be ridiculous.

Land Use Proposal: Sustainable Forestry

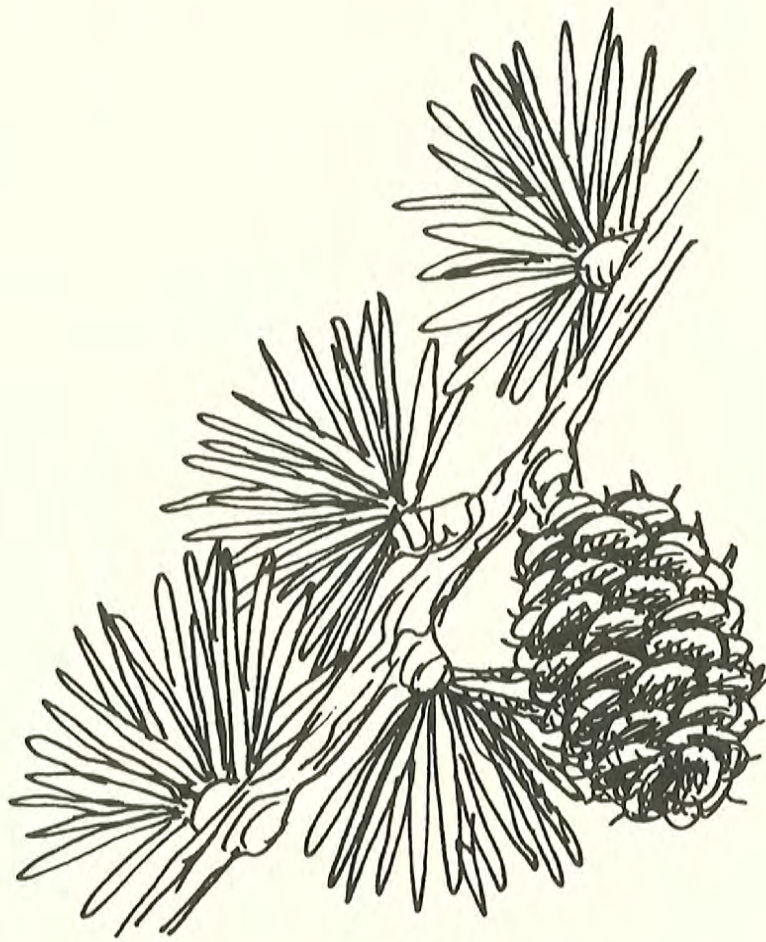
Forest lands owned by the state, counties, or cities (municipalities) can be managed to provide money for schools. If you read this morning's newspaper, you know that our city needs money. Our research has suggested that, by using sustainable forestry techniques such as selective harvesting, shelterwood cuts, or commercial thinning, this forest could provide the city about \$50 thousand per year forever. We could use a combination of these management techniques which would not only bring in money for our schools every year, but also provide a forest of different-age trees for hiking and other recreational activities.

Other People's Concerns: We should not log any of these trees. Our city has very little forest left. City records show only three percent of the land in our city limits is forest. I'm sure everyone wants to keep it as a forest without any logging at all.

Steps for Analyzing Issues

(and Student Issue-Analysis checklist)

1. Gather and read information.
 - Library research
 - Letter-writing
 - Phone calls
 - Interviews
2. Make headings on a sheet of paper for each point of view or proposal.
 - Make a sub-heading to list “Reasons For” each point of view.
 - Make another sub-heading to list “Other People’s Concerns.”
 - Identify concerns surrounding issue.
3. Re-read all gathered information and record notes under appropriate headings and sub-headings. When available, record the source of the information.
4. Look for missing information. Try to track down the missing information.
5. Separate fact from opinion.
6. Identify solutions.



Western Larch

A Washington Forest Fair

Learning Outcome

Students will teach the community about Washington forests.

Learning Procedure

The lessons and activities found in the **Forests of Washington** curriculum offer a multitude of fun, exciting and relevant forest-related projects. Throughout the year, as you use these activities, urge students to be thinking about projects for the Washington Forest Fair that they will produce for the school and the community.

Prior to conducting the fair, establish a steering committee of at least two faculty members, two parents and two business community representatives to oversee the development.

Students will develop the activities and displays for the fair and should be encouraged to contact local or state organizations for information, materials or other support. (See Lesson 20: *Earthkeepers: From Schoolyard to Planet* for information on contacting organizations.)

The forest fair could be held in the gym or in a more public place such as a shopping mall or community center.

Suggested activities/displays:

1. Clinic on proper planting and care of neighborhood trees.
2. Displays on tree rings and parts of a tree.
3. Tree identification games (cone and leaf-sorting and identifying).
4. Panel discussions of issues.
5. Puppet shows, plays, songs.
6. Display of wood products and objects representing other forest benefits (jobs, recreation, natural benefits).
7. Forest fire, disease and weather information.
8. Folklore, story telling.
9. Traditional Native American uses of forest resources.
10. Backyard wildlife sanctuary display (Washington Department of Wildlife).
11. Bird feeders and houses.
12. Animal tracks and signs.
13. Endangered species display.
14. Paper-making from recycled paper.

Skills

Cooperative learning, creative presentations

Subject Areas

Social studies, science, art



15. Forest conservation ideas (pre-cycling and alternatives to paper products).
16. Washington forests — create a mural.
17. Watershed model: Where do trees grow in your watershed? What do they provide?
18. Forest manners: Things to remember when visiting Washington forests.

Assessment: What Did We Learn?

Have each student write a paragraph about what they did to prepare for the fair, and what they learned in the process.



RESOURCES

RESOURCES REFERENCED IN FORESTS OF WASHINGTON

Air Pollution

- Douglas County Air Pollution Control Commissions
(509) 884-1511
- Grant County Clean Air Authority
(509) 754-2011
- Northwest Air Pollution Authority
(206) 336-5705
- Olympic Air Pollution Control Authority
(206) 352-4882
- Puget Sound Air Pollution Control Agency
(206) 296-5100
- Southwest Air Pollution Control Agency
(206) 574-3058
- Spokane County Air Pollution Authority
(509) 456-4727
- Tri-County Air Pollution Control Authority
(509) 545-2354
- Yakima County Clean Air Authority
(509) 575-4116

American Lung Association of Washington
1-800-732-9339

Bonneville Power Administration, Publications Division
1-800-622-4520

Bureau of Land Management

- Spokane District Office
East 4217 Main Avenue
Spokane, WA 99202
(509) 353-2570
- Portland Office
1400 N.E. 44th Avenue
P.O. Box 2965
Portland, OR 97208
(503) 280-7180

Educational Service Districts

- ESD 101
1025 W. Indiana Avenue
Spokane, WA 99205-4400
(509) 456-6320
- ESD 105
33 S. 2nd Avenue
Yakima, WA 98902
(509) 575-2885
- ESD 112
2500 N.E. 65th Avenue
Vancouver, WA 98661-6812
(206) 750-7500
- ESD 113
601 McPhee Road S.W.
Olympia, WA 98502-5080
(206) 586-2933
- ESD 123
1705 W. Rose Street
Walla Walla, WA 99362
(509) 529-3700
- North Central ESD
640 S. Mission
P.O. Box 1847
Wenatchee, WA 98807-1847
(509) 663-8799

- Northwest ESD 189
205 Stewart Road
Mount Vernon, WA 98273-5462
(206) 424-9573
- Olympic ESD 114
105 National Avenue N.
Bremerton, WA 98312
(206) 479-0993
- Puget Sound ESD
400 S.W. 152nd
Seattle, WA 98166-2209
(206) 439-3636

Environmental Education About Forests
Washington Forest Protection Association
711 Capitol Way, Suite 608
Olympia, WA 98501
(206) 352-1500

National Cancer Institute
1-800-422-6237

Nature Conservancy
217 Pine, Suite 1100
Seattle, WA 98101
(206) 343-4344

Office of State Superintendent of Public Instruction
Tony Angell, Supervisor of Environmental Education
2800 N.E. 200th
Seattle, WA 98155
(206) 365-3893

Project Wild Aquatic
Washington State Department of Wildlife
600 Capitol Way N.
Olympia, WA 98504
(206) 753-1702

3-2-1-Contact
Down the Drain video
The Rotten Truth video
Seventh Generation, 1-800-456-1177

U.S.D.A. Forest Service

- Colville National Forest
S. 765 Main
Colville, WA 99114
(509) 684-7000
Ranger Districts: Colville (509) 684-7010;
Kettle Falls (509) 738-7020;
Newport (509) 447-7300; Republic (509) 775-3305
or 684-7040; Sullivan Lake (509) 446-7500
- Gifford Pinchot National Forest
6926 E. 4th Plain Boulevard
P.O. Box 8944
Vancouver, WA 98668-8944
(206) 750-5100
Ranger Districts: Mt. Adams (509) 395-2501;
Packwood (206) 494-5515; Randle (206) 497-7565;
Wind River (509) 427-5645

- Mt. Baker Snoqualmie National Forest
21905 64th Avenue W.
Mountlake Terrace, WA 98043
(206) 775-9702

Ranger Districts: Mt. Baker (206) 856-5700;
Darrington (206) 436-1155; North Bend
(206) 888-1421; Skykomish (206) 677-2414;
White River (206) 825-6585
 - Okanogan National Forest
1240 2nd Avenue S.
Okanogan, WA 98840
(509) 826-3275

Ranger Districts: Tonasket (509) 486-2186;
Twisp (509) 997-2131; Winthrop (509) 996-2266
 - Olympic National Forest
1835 Black Lake Boulevard S.W.
Olympia, WA 98512-5623
(206) 956-2300

Ranger Districts: Hood Canal (206) 877-5254;
Quilcene (206) 765-3368; Quinault (206) 288-2525;
Soleduck (206) 374-6522
 - Wenatchee National Forest
P.O. Box 811
301 Yakima
Wenatchee, WA 98801
(509) 662-4335

Ranger Districts: Chelan (509) 682-2576;
Cle Elum (509) 674-4411; Entiat (509) 784-1511;
Lake Wenatchee (509) 763-3103;
Leavenworth (509) 782-1413;
Naches (509) 653-2205
- U.S.D.A. Soil Conservation Service
W. 316 Boone, Suite 450
Spokane, WA 99201-2348
(509) 353-2337
- United States Department of the Interior
National Parks Service
Pacific Northwest Region
83 S. King Street, Suite 212
Seattle, WA 98104
(206) 553-5201
- Coulee Dam National Recreation Area
1008 Crest Drive
Coulee Dam, WA 99116-0037
(509) 633-9441
 - Ebey's Landing National Historical Reserve
P.O. Box 774
908 N.E. Alexander
Coupeville, WA 98239-0774
(206) 553-0791
 - Fort Vancouver National Historic Site
612 E. Reserve Street
Vancouver, WA 98661-3811
(206) 696-7655
 - Klondike Gold Rush National Historical Park
117 S. Main Street
Seattle, WA 98104
(206) 553-7220
 - Mount Rainier National Park
Tahoma Woods
Star Route
Ashford, WA 98304-9751
(206) 569-2211
 - North Cascades National Park Service Complex
2105 Highway 20
Sedro Woolley, WA 98284-9314
(206) 856-5700

- Olympic National Park
600 East Park Avenue
Port Angeles, WA 98362-6757
(206) 452-4501, Ext. 311
- San Juan Island National Historical Park
P.O. Box 429
125 Spring Street
Friday Harbor, WA 98250-0429
(206) 378-2240
- Whitman Mission National Historic Site
Route 2, Box 247
Walla Walla, WA 99362-9699
(509) 522-6360

U.S. Geological Survey
Geologic Inquiries Group
907 National Center
Reston, VA 22092
(703) 648-4383

Washington Energy Extension Service
1-800-962-9731

Washington Forest Protection Association
711 Capitol Way, Suite 608
Olympia, WA 98501
(206) 352-1500

Washington Forestry Speakers Bureau
(206) 922-6640

Washington State Department of Ecology
(206) 407-6000, information
• Recycling Hotline 1-800-732-9253
• Southwest Regional Office (206) 753-2353
• Eastern Regional Office (509) 456-2926
• Central Regional Office (509) 575-2800
• Northwest Regional Office (206) 867-7000

Washington State Department of Ecology
Wetlands Section
P.O. Box 47600
Olympia, WA 98504-7600

Washington State Department of Fisheries
(206) 902-2200

Washington State Department of Natural Resources
(206) 902-1000

Washington State Department of Natural Resources
Photo and Map Sales Unit (Color Aerial Photos)
P.O. Box 47031
Olympia, WA 98504-7031
(206) 902-1234

Washington State Parks and Recreation
(206) 753-5755

Washington State University Cooperative Extension
Master Gardener Program
7612 Pioneer Way E.
Puyallup, WA 98371-4998
(206) 840-4547

Washington State University Cooperative Extension
Bulletin Office, Cooper Publications Building
Washington State University
Pullman, WA 99164-5912

Washington Tree Farm Program
711 Capitol Way, Suite 608
Olympia, WA 98501
(206) 352-1500

OTHER SUPPORTIVE RESOURCES

Joint information number for National Parks,
U.S. Forests & State Parks (206) 220-7450

Outdoor Recreation Information Office
915 Second Avenue, Room 442
Seattle, WA 98174

Seattle Audubon Society
8028 35th Avenue N.E.
Seattle, WA 98115-4815
(206) 523-4483

Society of American Foresters
5400 Grosvenor Lane
Bethesda, MD 20814
(301) 897-8720

Washington Environmental Council
5200 University Way N.E., Suite 201
Seattle, WA 98105
(206) 527-1599

Wilderness Society
1424 4th Avenue, Suite 816
Seattle, WA 98101
(206) 624-6430

VIDEOS

Forests of Washington: Forest Ecosystems and People
Forests of Washington: Forest History
Forests of Washington: Issues Challenge
Environmental Education About Forests
711 Capitol Way, Suite 608
Olympia, WA 98501
(206) 352-1500

Exploring The Forest
Alfred Higgins Productions, Inc.
6350 Laurel Canyon Boulevard
North Hollywood, CA 91606
(818) 762-3300

Reading Rainbow; Paul Bunyan
GPN
P.O. Box 80669
Lincoln, Nebraska 68501

The Hidden City
(Wildlife in an Urban Setting)
World Forestry Center
Education Department
4033 S.W. Canyon Road
Portland, OR 97221
(503) 228-1367

What Exactly Does A Forester Do
Washington Forest Protection Association
711 Capitol Way, Suite 608
Olympia, WA 98501
(206) 352-1500

Wild in the City
Wild Hare Media
P.O. Box 3854
Portland, OR 97208

BOOKS AND PAMPHLETS

A Guide to Field Identification:
(available in most bookstores)
Trees of North America
Golden Press

Backyard Wildlife Sanctuary Program
Department of Wildlife
16018 Mill Creek Boulevard
Mill Creek, WA 98012

Ethnobotany of Western Washington
(available in most bookstores or libraries)
by Erna Gunther
University of Washington Press
(206) 543-4050

Exploring Washington's Past
(available in most bookstores or libraries)
by Ruth Kirk and Carmela Alexander
University of Washington Press
(206) 543-4050

Eye Witness Books: Trees
(available in most bookstores or libraries)

Fir Trees (available in most bookstores or libraries)
by Heiderose and Andreas Fischer-Nagel

Growing Greener Cities
Global ReLeaf
Available from Washington State
Department of Natural Resources
P.O. Box 47046
Olympia, WA 98504-7046

Introduction to Forestry
(available in most bookstores or libraries)
by Grant W. Sharpe, Claire W. Hendee and
Wenonah E. Sharpe

Maintaining Your Urban Forest
(pamphlet: tips for pruning, weeding, etc.)
Seattle Engineering Department
(206) 684-5047

Northwest Conifers
(available in most bookstores or libraries)
by Dale N. Bever

People and Trees Growing Together
America the Beautiful, National Tree Program
United States Department of Agriculture
Forest Service

Plants and Animals of the Pacific Northwest
by Eugene Kozloff
University of Washington Press
(206) 543-4050

*Shading Our Cities: A Resource Guide for Urban
and Community Forests*
Island Press, 1989
Washington, D.C. / Covelo, CA

Tales of the Wild West Series
Volume 5, Women of the West
Volume 7, Loggers
by Rick Steber
Bonanza Publishing
Box 204
Prineville, OR 97754

The Audubon Society Nature Guides: Western Forests
(available in most bookstores or libraries)
by Stephen Whitney

The Natural History of Puget Sound Country
(available in most bookstores or libraries)
by Arthur Kruckeberg
University of Washington Press
(206) 543-4050

The Olympic Rain Forest

by Ruth Kirk
University of Washington Press
(206) 543-4050

The Right Tree Book

(excellent information and charts on how to choose and plant the right tree for your urban setting)

The Simple Act of Planting a Tree

TreePeople, 1990
Jeremy P. Tarcher, Inc.
5858 Wilshire Blvd, Suite 200
Los Angeles, CA 90036

Timber (available in most bookstores or libraries)
by Ralph W. Andrews

Tree Talk: The people and politics of timber
(available in most bookstores or libraries)
by Ray Raphael

Urban and Community Forestry Program National Resource Directory

America the Beautiful National Tree Program
1455 Pennsylvania Avenue N.W.
Suite 250
Washington, D.C. 20004
(202) 628-TREE

FOREST-RELATED PROGRAMS

In Washington State:

Earth Service Corps
Seattle Metro YMCA
Contact: Richard Conlin / Kara Palmer
(206) 382-5013

Environmental Education About Forests
Project Learning Tree
711 Capitol Way, Suite 608
Olympia, WA 98501
(206) 352-1500

North Cascades Institute
2105 Highway 20
Sedro Wooley, WA 98284
(206) 856-5700

Olympic Park Institute
HC62 Box 9T
Port Angeles, WA 98362
(206) 928-3720

100 Friends of Community/Urban Forests
Keep Washington Green
Anderson Hall
University of Washington
Seattle, WA 98195
(206) 543-2750

Plant Amnesty
906 N.W. 87th Street
Seattle, WA 98117
(206) 783-9813

Urban Forest Outreach Project
301 21st Avenue E.
Seattle, WA 98112
Liz Ellis: (206) 726-1479

Urban Wildlife Project
Washington Department of Wildlife
16018 Mill Creek Boulevard
Mill Creek, WA 98012

Washington Community and Urban Forest
Advisory Council
Department of Natural Resources
P.O. Box 47046
Olympia, WA 98504-7046

Nation-wide:

American Forestry Association /
Global ReLeaf Heritage Forests
P.O. Box 2000
Washington, D.C. 20013
(202) 667-3300

Eugene's NeighborWoods Program
Eugene Public Works
1820 Roosevelt Blvd
Eugene, OR 97402
(503) 687-5220

The National Arbor Day Foundation
100 Arbor Avenue
Nebraska City, NE 68410

The National Tree Trust
1455 Pennsylvania Avenue N.W.
Suite 250
Washington, D.C. 20004
(202) 628-TREE

National Urban Forests Council
P.O. Box 2000
Washington, D.C. 20013
(202) 667-3300

National Wildlife Federation
1400 16th Street N.W.
Washington, D.C. 20036
1-800-432-6564

Old Growth Forests
World Forestry Center
4033 S.W. Canyon Road
Portland, OR 97221
(503) 228-1367

Project Learning Tree Washington
711 Capitol Way, Suite 608
Olympia, WA 98501
(206) 352-1500

Tree City USA
Washington State Department of Natural Resources
P.O. Box 47046
Olympia, WA 98504-7046

Tree Musketeers
233 Main Street
El Segundo, CA 90245
Contact: Gail Church, (310) 322-0263

TreePeople
12601 Mulholland Drive
Beverly Hills, CA 90210
(818) 769-2663

U.S.D.A. Forest Service
America the Beautiful National Tree Program
14th and Independence Streets, N.W.
Washington, D.C. 20090
(202) 447-6657

Wild Wild World of Old Growth Forests
Wilderness Society
900 17th Street N.W.
Washington, D.C. 20006-2596
(202) 833-2300

Glossary

- Air Inversion — a layer of warm air “trapped” near the ground by an overlying layer of cold, dense air
- Alluvial soil — deposited by river
- Angiosperm — broadleaved trees with seed-producing flowers
- Biodiversity — refers to the different kinds of plants and animals in an ecosystem
- Broadleaf — a flower-bearing, broad-leafed tree
- Canopy — the forest layer comprised of tree tops and overlapping branches of large trees
- Clearcut — harvesting a stand of trees in an area
- Conifer — a cone-producing, needle-leaf tree
- Deciduous — trees that drop their leaves each fall
- Ecosystem — all living things linked together by energy and nutrient flow in an area of any size
- Estuary — the mouth of the river where freshwater meets saltwater
- Evergreen — trees that do not lose their leaves in the fall
- Forest — plants and animals living together in a community in which trees are the most obvious members
- Forest Floor — the layer of decomposing material that covers the soil in a forest
- Glacier — a large body of slow-moving ice that melts, thereby feeding creeks and rivers
- Gymnosperm — coniferous trees with seed-producing cones
- Habitat — where a plant or animal naturally grows or is ordinarily found
- Humus — decayed organic matter found primarily in top layer of soil
- Marsh — a wetland where mostly grass-like plants grow
- Pesticides — any chemical used to control insects, weeds, etc.
- Pollution — harmful chemicals or waste materials that have been released into the water, land or air
- Recycle — saving and re-manufacturing materials such as glass, paper and metals to use again and again
- Saltmarsh — a marsh in an estuary, inundated by tides twice a day
- Snag — a standing dead tree from which the leaves and most of the branches have fallen
- Subfloor — the underground forest layer comprised of soil, rocks, roots, fungi, invertebrates and tunnels
- Swamp — a wetland where mostly trees and shrubs grow
- Tributary — a stream which joins a larger body of water
- Understory — the forest layer made up of smaller trees, shrubs, bushes and snags (everything between the forest canopy and the forest floor)
- Watershed — all the land that drains into the same body of water
- Wetland — a low area covered by shallow water most of the time