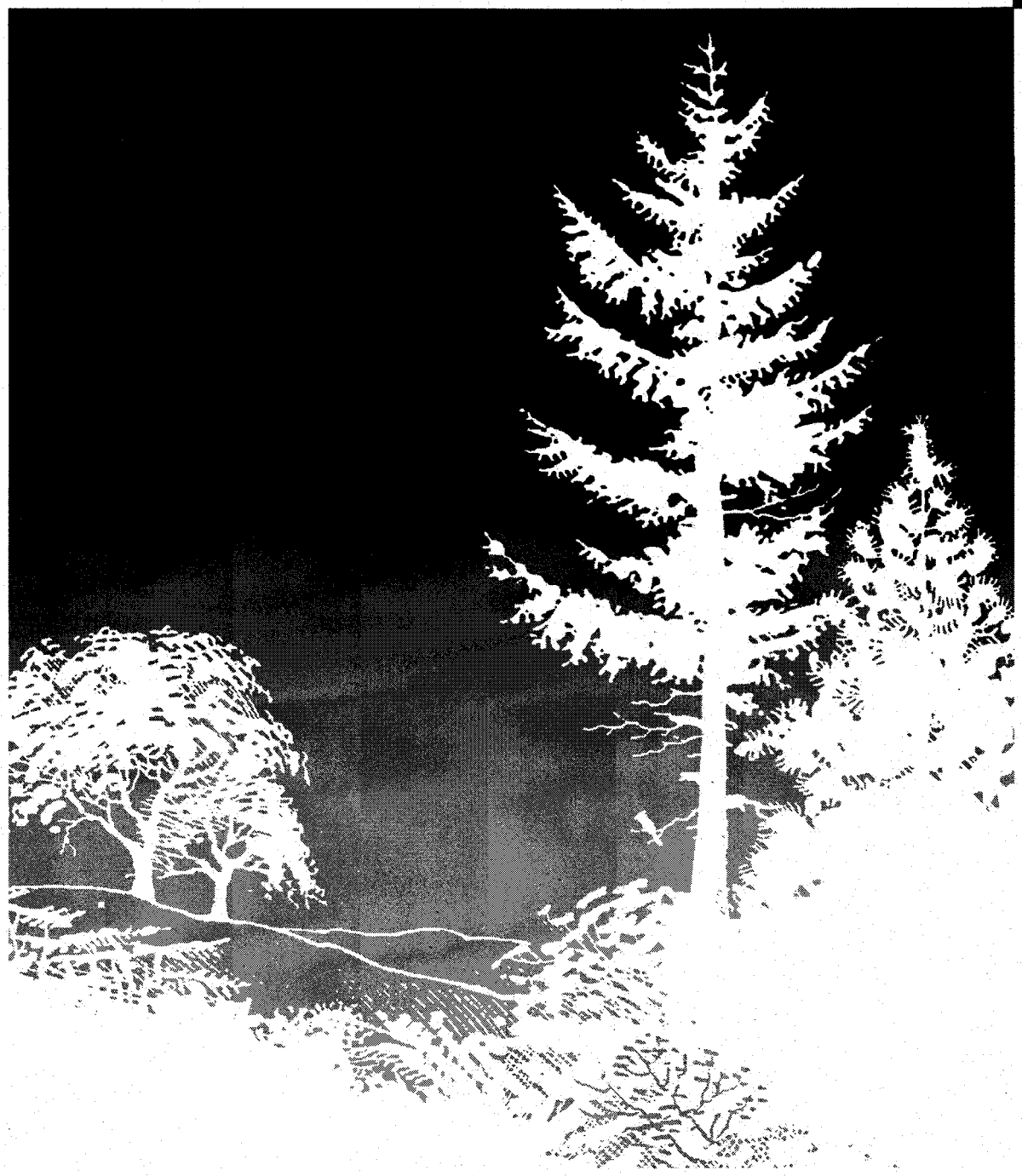
OREGON 4-H FORESTRY

MEMBER MANUAL



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Oregon State University | Extension Service

Oregon 4-H Forestry Member Manual

Contents

Adapted for use in Oregon from Minnesota Extension Service 4-H youth forestry materials by Judy Dickerson, former 4-H youth development faculty, Josephine County; and Virginia Bourdeau, Extension specialist, 4-H youth development, Oregon State University.

Lesson 1

Welcome to Oregon 4-H Forestry

Oregon is a wonderful state. Forested land is found in every region. It's good to know about the types of plants and land use that dominate your home state.

The goals of the Oregon 4-H Forestry Project are to give factual, science-based information about forests and to give you a chance to learn about the many ways forests are connected to our lives and contribute to Oregon's quality of life.

If you enjoy the 4-H Forestry Project, you might consider forestry as your career. But, just because you have an interest in trees and forests doesn't mean you will want to work in the woods. You may use your knowledge of trees and forests when camping or in other types of recreation. Knowing basic facts about the environment, especially in a place like Oregon where forests are so common, helps you make good decisions about your life as a citizen of Oregon.

Forests are loved for their beauty and recreational opportunities. Wood products from forests have a huge dollar value. Good forest management is about both beauty and business. Good decisions about forest use require a balance between art and economics.

Foresters work to find the best balance among all products and uses of the forest. That way, forests will continue to provide resources that animals and humans depend upon.

Using a forest for more than one use or product is called **multiple use management**. Decisions about forests must be well considered. Actions taken will affect the forest for many years—sometimes for several decades—often long after the decision makers are gone and forgotten.

Forest managers make decisions about:

- Wood products
- Campers and hikers
- Skiers and fishers
- Soil erosion
- Wildfire control
- Tree growth
- Fish and wildlife

Imagine you are a chef

You are in charge of writing a recipe for a forest. What ingredients would you include?

Things that make a forest:

1. _____
2. _____
3. _____
4. _____
5. _____

Consider a career

- **Having** a **career** means getting an education about a particular subject (such as forests) and then working at a job using that knowledge.
- **Professional forestry** is the study and practice of managing wooded lands as a career. It is a complex field with many career paths in natural resource science.
- **Foresters** make decisions about the use of trees, forestlands, and forest products.

Activity 1-1

Look for these terms

The Word Find puzzle (page 3) contains common words used in forestry. Check the list below and circle the words when you find them in the puzzle. You can use the letters more than once. The words can run across or down.

Balance
Beauty
Business
Camping
Career
Economics
Erosion
Fish
Forester
Forestry
Hiking
Lumber
Manager
Multiple use
Natural resources
Professional
Renewable
Science
Skiers
Soil
Timber
Trees
Water
Wildfire
Wildlife
Wood
Wood products

Word Find

T M H W D S S P N W X N T M N U Y L
R B P H C R N C A R E E R E S P H M
S E F N K O F E T Z P S A V K R I T
C A M P I N G B U S I N E S S O K M
G U R L R M R P R W K P C S K F I Y
K T R E E S N D A S N Z N T I E N O
T Y S R N L C L L U M B E R E S G T
I O R T M T S F R O S Z A R R S B Y
F M W N G I W R E P F I S H S I W Z
E C O N O M I C S W O O D G H O V X
X E O C C B L R O Y R L M L E N T S
C W D Q R E D K U L E R E T R A R P
L I P L N R F O R E S T R Y K L E N
C L R T L N I D C K T S O T D W N L
H R O Z S L R N E H E H S C W I E J
V C D W N E E L S C R R I N B L W I
I H U B A L A N C E N W O R C D A G
M J C T J C W R I G S A N H F L B E
A H T C R I T Z E M B T T S O I L D
K N S H M L M A N A G E R D G F E C
E T C L T T N D C P R R S L L E N R
I M U L T I P L E U S E H W T H R Y

(Answers are on page 46.)

Lesson 2

Forests in Oregon

Forests

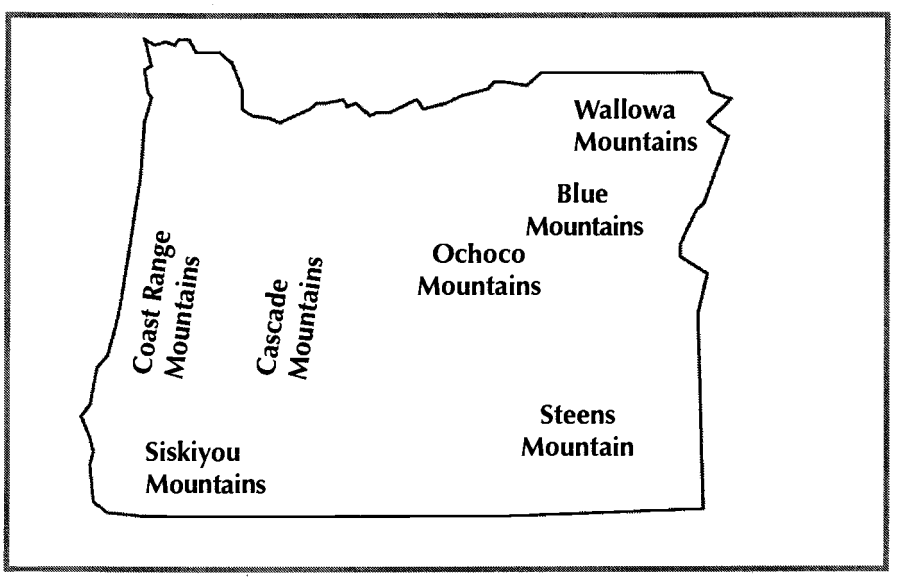
- Feed and shelter wildlife
- Protect soil from blowing or washing away
- Make the world beautiful
- Provide a place for recreation
- Filter loud noises
- Clean the air
- Provide timber for wood products

A good reference

If you are interested in forestry, there is a field reference that can help you identify trees. *Trees To Know in Oregon* (EC 1450) is available from local offices of the OSU Extension Service. Check your local library and bookstores for other resources.

Where they are and what they're like

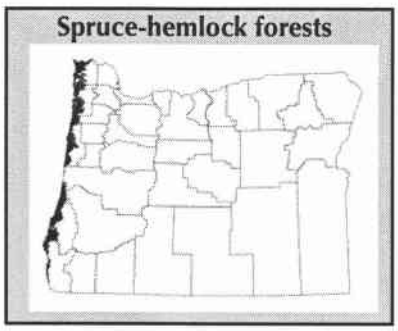
There is nearly the same amount of forestland in Oregon today as when Europeans first visited the Northwest. Of the 62 million acres of land in Oregon, 28 million acres—or 45 percent—are classified as forestland. About 8 percent has been lost to human development such as agriculture, urban growth, highways, electric transmission lines, and other infrastructure. The Oregon Department of Forestry defines forestland as at least 10 percent covered with live trees or formerly having such cover and not currently developed for non-forest uses.



Oregon's seven forest types

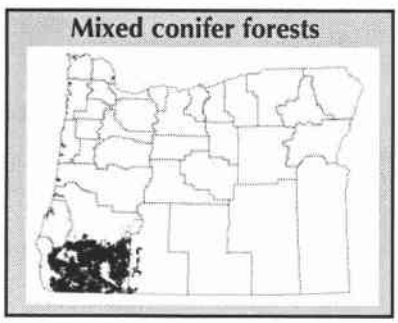
The maps on the next page offer a simplified representation of forest types in Oregon. The types and locations of Oregon's forests are determined by elevation, precipitation, and soil type. The **spruce-hemlock forests** along the Pacific Coast and Coast Range Mountains give way to the **Douglas-fir** zone that surrounds the Willamette Valley and extends well into the Cascade Mountains. The **subalpine forests** grow above an elevation of 4,500 feet in the Cascade, Siskiyou, and Wallowa mountains.

Mixed conifer forests are found in southwestern Oregon. Although they are dominated by conifers, they contain hardwoods as well. The forests of the drier east side of Oregon are primarily **ponderosa** and **lodgepole pine**, with mixed conifers at higher elevations. The **juniper woodlands** are located in the high desert of central and southeastern Oregon down to Steens Mountain.

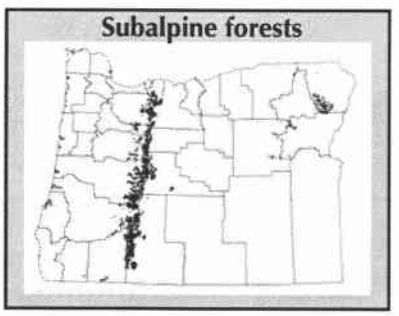


These forests are dominated by western hemlock and Sitka spruce. They grow in a 10- to 20-mile-wide band along much of Oregon's coastline. The climate near the ocean is influenced by frequent fog banks that limit evaporation and keep trees and soil moist.

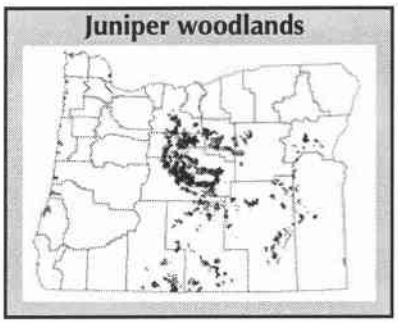
Douglas-fir is the most dominant tree in western Oregon. It grows under a variety of conditions in both managed and unmanaged forests. This tree does best in open sun, while hemlock and cedar, more shade tolerant, commonly occur in the understory. About 270,000 acres of deciduous and 1.68 million acres of mixed-conifer-deciduous forests in western Oregon co-exist in Douglas-fir forests.



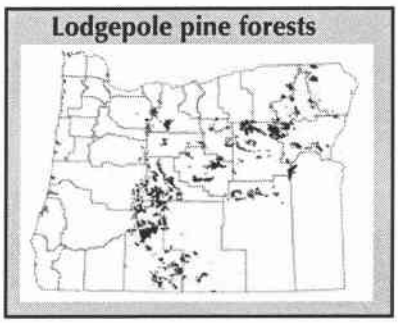
A complex mix of tree species—mostly conifers but also some hardwoods—dominates the Siskiyou and Cascade mountains of southwestern Oregon. Douglas-fir is the dominant conifer. Others include sugar pine, ponderosa pine, and Jeffrey pine plus Port-Orford-cedar and incense-cedar. Tanoak is the most common hardwood. Others include golden chinkapin, Pacific madrone, and canyon live oak. Few pure stands of any single species are found in mixed-conifer forests.



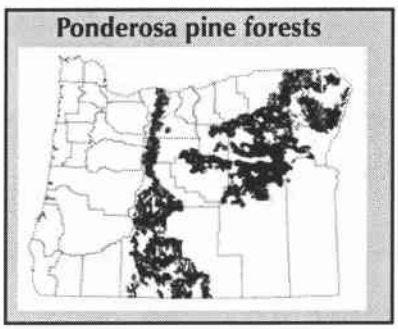
Subalpine forests are a combination of several tree species occurring above 4,500 feet in the Cascade, Siskiyou, and Wallowa mountains. These forests vary widely depending on stand age, fire history, and local conditions. Common trees in subalpine forests include Pacific silver fir, California red fir, noble fir, white fir, subalpine fir, western hemlock, mountain hemlock, Douglas-fir, Alaska-cedar, incense-cedar, lodgepole pine, western white pine, Englemann spruce, and quaking aspen.



Juniper is unique in that it has invaded areas that, due to periodic fire, historically supported few trees. It is found in the drier regions of eastern Oregon often referred to as the "high desert." Because it is a strong competitor for soil moisture and can impact the quantity and quality of forage, range managers consider it a pest. Juniper acreage has increased over the past century due primarily to the aggressive suppression of fire.



Pure and nearly pure stands of lodgepole pine are found throughout central and eastern Oregon. It is a "pioneer" species that rapidly colonizes sites disturbed by fire or logging and then sometimes gives way to more shade-tolerant species like ponderosa pine. It grows in dense stands that contain many dead trees. Because of this, lodgepole pine forests are susceptible to insect attacks and vulnerable to fire.



Although some ponderosa pines grow in southwest Oregon, they dominate the forests east of the Cascade Range. About 7 million acres of ponderosa pine are found in eastern Oregon, particularly on the eastern slopes of the Cascades, in Klamath and Lake counties, and at lower elevations in the northeastern region of the state.

Maps and text reprinted with permission from the Forest Fact Book, *Oregon Forest Resources Institute, Portland, Oregon.*

Activity 2-1

You need a pencil and a road map of Oregon for this activity.

• Find your hometown on the map. Compare the location of your home to the forest type maps provided on page 5.

• Use the information about Oregon's forests to answer the questions below.

1. Write the name of your hometown.

_____

2. What forest type or types are nearest to your home?

_____

_____

_____

_____

3. Write the name or names of the mountains nearest to your home.

_____

_____

_____

4. Write the names of the native forest tree species that probably grow nearest to where you live.

_____

_____

_____

_____

_____

_____

Lesson 3

Looking Closer

Layers of the forest

Forests have plants of different heights, making layers. The main layers are the **canopy** (the tallest), the **understory** (middle-height trees and bushes), and the **forest floor** (ground level).

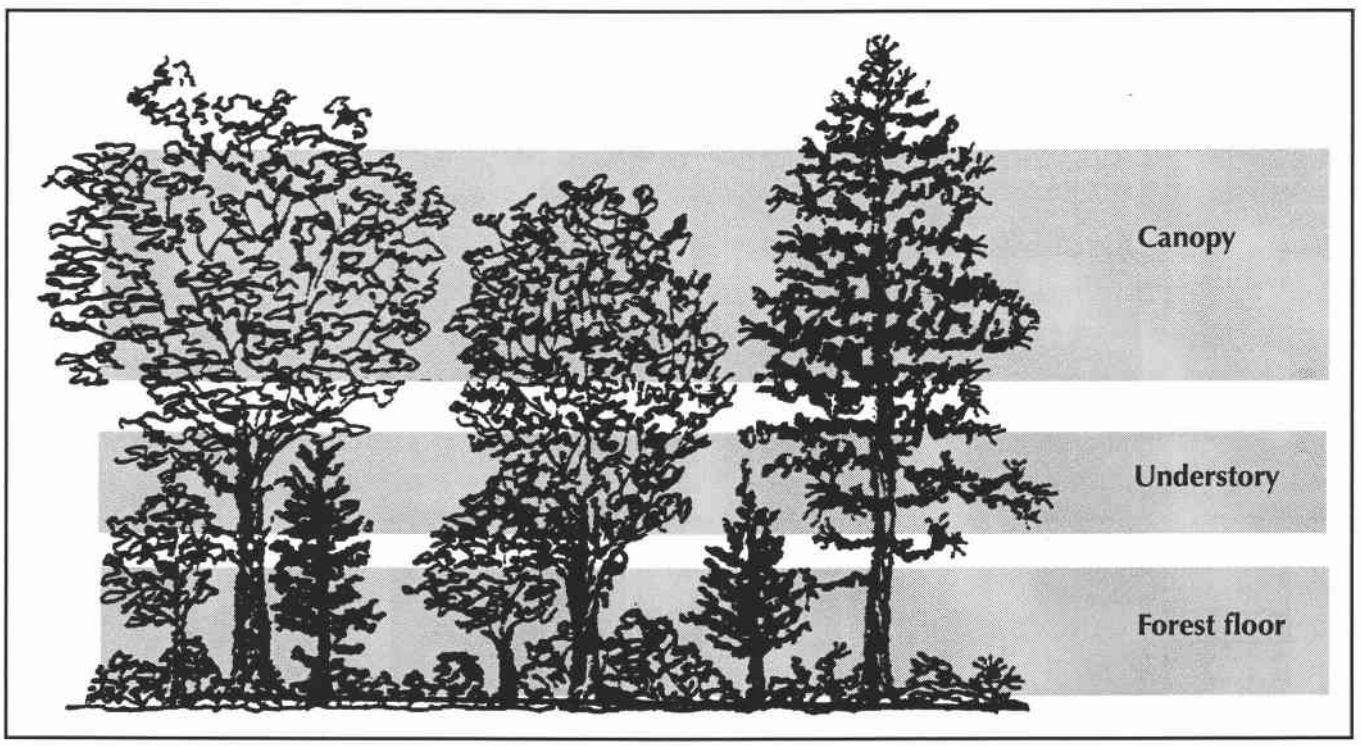
The canopy is made up of the highest branches of the tallest trees. The understory includes the middle-level branches and trees that are either younger or not as tall when mature. It also may include taller woody shrubs. The forest floor may have seedlings, ferns, grasses, and broad-leaved plants (herbaceous, nonwoody), low growing woody shrubs, plus "duff" (fallen leaves and needles) and rotting woody debris.

Depending on the types of trees and their ages, there may be a gap between each layer in some forests. In older or more diverse forests, there may be more than one understory. In younger or single-species forests, a continual mass of undergrowth may go from forest floor into the canopy without any gap. Very dense forests may have little or no plants in the understory or on the forest floor.

Each forest layer is home to different types of plants and animals.

"But the main thing is, folks just hate to see the park change. They think it's being ruined. People have a tendency to want things as they are, but in nature nothing stays as it is.... Nature is hollering, 'I'm getting ready to start over!' We'd like to shout, 'No! Not now! We're not ready for you!' But that ain't the way it works, folks...."

—John Krebs,
fire behavior analyst,
on the 1988 Yellowstone fire.
Journal of Forestry,
December 1989



Fair Display Idea 3-A

Prepare a display of items collected from the canopy, understory, and forest floor. Collect at least six samples from each layer. Be careful when collecting samples from the canopy of a tall tree.

Use items that are compact enough to mount on a 3-sided display board (30" wide by 24" deep [front to back] by 36" high) or in a large box. You can press mosses, grasses, and small plants in a telephone book or thick catalog, or dry them in a sunny place for several days before mounting.

Display collected insects on pins purchased from an entomology or biological supply company. Label the insects on the pins the correct way. (See the *4-H Entomology Project Manual,* 4-H 3221, for instructions on preserving and displaying insects.)

Record where you found each item—canopy, understory, or forest floor.

Fair Display Idea 3-B

Prepare a display of renewable and non-renewable resources using samples, drawings, or photographs. Mount the items on posters or a 3-sided display board (30" wide by 24" deep [front to back] by 36" high). Label each item as renewable or non-renewable.

Be prepared to explain how each renewable resource returns to useable form. Share the information with your club or use it as an oral presentation or fair display.

Renewable and always changing

Both nature and people have touched the face of Oregon and surrounding states. Windstorms, floods, drought, lightning, fires, farming, road building, urban development, and logging all have an impact on the landscape.

Even before Oregon was settled by Euro-American pioneers, Native Americans encouraged or discouraged plant material by using fire as a land management tool.

Whenever something disturbs the landscape—whether natural or human caused—it sets the stage for renewal.

Forests are **renewable** natural resources. When dominant plants and trees that make up the canopy are removed, **succession** begins. If left to nature, new plants quickly reseed and take over where the old plants once lived. If it is well managed by humans, the process of succession can be accelerated.

Activity 3-1

You need a pencil and paper for this activity.

Take a walk in a park, nature area, forest, or wooded backyard. Make a list of the trees, shrubs, herbaceous plants, and animals you see. Describe each one and decide in which layer each lives—the canopy, the understory, or the forest floor.

Collect an item from each layer and examine it. *Check to be sure collecting at this location is permitted before you begin!* If you are climbing a ladder to collect items from the canopy of a tall tree, be sure to use a ladder with an adult present.

After you have completed your walk, answer the following questions from your notes.

1. Which trees and plants are sun loving? Why do you think that these trees and plants are sun loving?

2. Which layer gets the most and the least rain? Why?

3. Which birds and animals did you see?

4. Which layers of the forest did you observe birds and animals using?

5. Which types of insects did you see and in which layers did you observe them?

6. Choose a section of the area you observed. Draw a silhouette of that section (similar to the one on page 7) showing forest layers. Look at your silhouette drawing. How might you change the location you observed to be more like the forest layers in the illustration? What would you add or remove?

Lesson 4

Succession

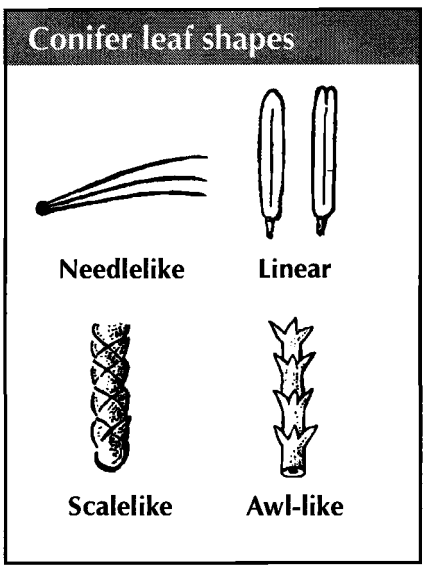
Think of a forest of large trees growing as an unbroken canopy. If the trees are removed, the shade they provided is gone. The first new seedlings to grow in the open space are those that prefer sunlight. These first trees that are regrowing a forest—or **growing in succession**—are called **pioneers** and usually are **shade-intolerant** trees. Although alder, ponderosa pine, lodgepole pine, and Douglas-fir are considered shade-intolerant, some are more so than others; for example, Douglas-fir is less tolerant of shade than is lodgepole pine.

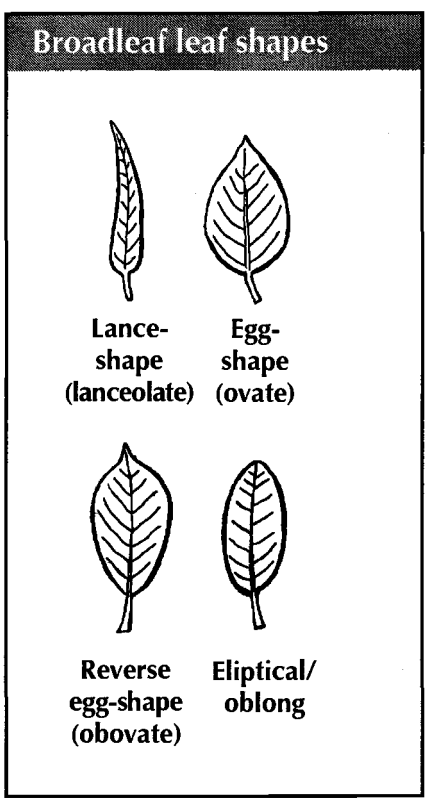
When shade-intolerant trees fill an area and begin to grow, they make a problem for themselves. Remember that the younger trees of the pioneer species need lots of sunlight. They cannot grow up under the shade—even that of the parent tree. This means that different species will begin to grow up in the shade provided by the mature pioneers.

The new species will be **shade-tolerant**. Their seedlings grow best without direct sunlight.

Shade-tolerant tree species include western hemlock, grand fir, bigleaf maple, and Sitka spruce. When the pioneer trees begin to die back, the shade-tolerant trees become the dominant species on that site.

A **climax forest** is a forest where the canopy trees are the same species as the understory trees. Climax trees will remain until fire, harvesting, insects, wind, or another incident allows sunlight to touch the forest floor. Because forests are so **dynamic** (ever-changing), a true climax forest is very rare.





Tree types

Oregon's trees fit into two major groups: conifers and broadleaf. **Conifers** have needlelike or scalelike leaves and usually bear seeds inside woody cones. Conifers usually are evergreen and often are called softwoods because their wood is soft compared to that of other trees.

Broadleaf trees usually have wide, flat leaves and bear their seeds inside soft fruits or nuts. Broadleaf trees also are called hardwoods because their wood generally is harder than that of conifers. (There are a few exceptions.) Most broadleaf trees are **deciduous**—they drop their leaves in winter—but a few are evergreen.

Fair Display Idea 4-A

For a long-term project, observe succession in your own yard or near your house.

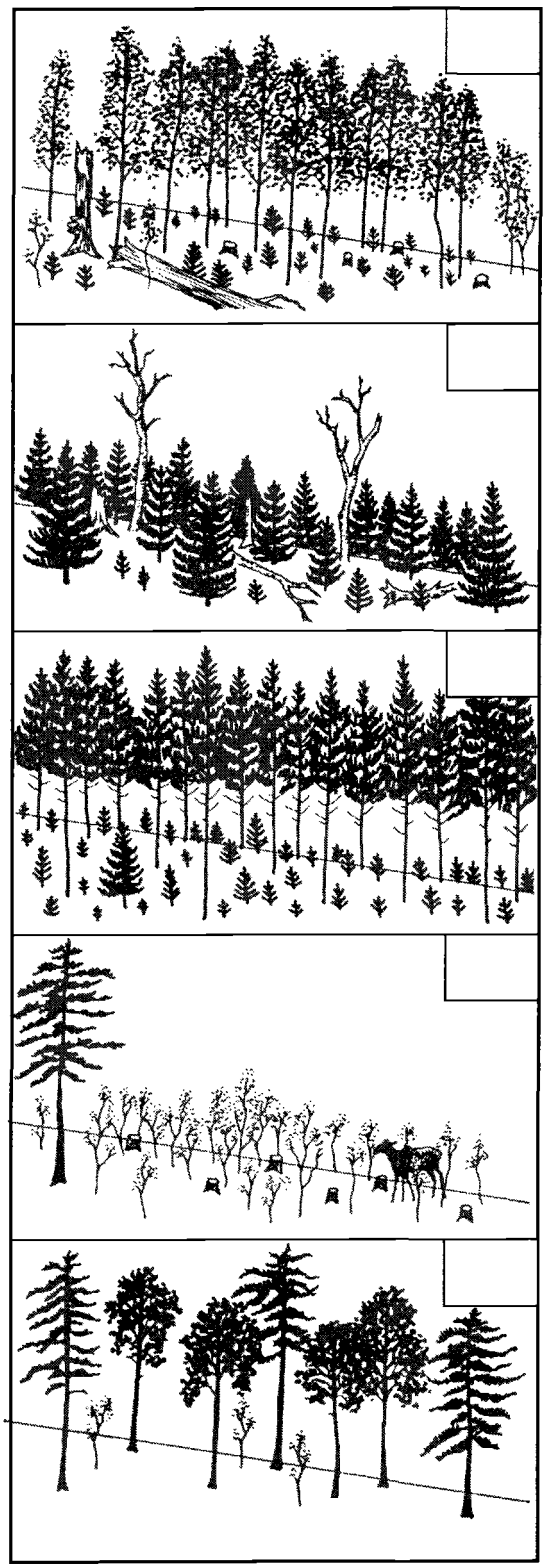
Check with your parents about using a 4-foot by 4-foot area near your house. If they are supportive of your plans, mark off the area, and clear all the plants from the square space. Be sure to expose bare soil. Spade the area and remove any roots you find. Do not water, mow, or fertilize.

Observe this area once a month. At each visit note the plants that are growing. Try to identify them as native plants, wildflowers, grasses, shrubs, or trees. If tree seedlings appear, try to identify them to the genus level (such as oak, pine, alder); see Lesson 5. If **noxious weeds** appear, do not allow them to form seed heads. For help with plant identification, consult an Extension Master Gardener.

Photograph or sketch your plot from the same location(s) each time you visit. Keep a record including the date, the introduction of any new plants, and their growth. Use the *4-H Photo Monitoring Data Sheet* (4-H 303LR-g) to record your information. You can print this from the OSU Extension website (**extension.oregonstate.edu**). Choose "Publications," then search by the series number (4-H 303LR-g).

Continue this activity for at least 18 months. (Don't expect a climax forest—that usually takes many decades and centuries!) Prepare a display using your photographs and/or sketches plus the record you made. Illustrate with the photos or sketches the different plants that came into the plot over time. Identify as many plants as you can for the display.

In the drawings below, label the steps of succession. You may use any drawing as "1," then put the rest of the drawings in order from "2" to "5." (Because succession is like a cycle, drawing 1 then would follow drawing 5.) Put a large asterisk (*) by the drawing that shows a climax forest.



(One possible **answer** is on page 47.)

Activity 4-1

Before you begin this activity, research the time of year when a conifer species (such as ponderosa pine, sugar pine, or Douglas-fir) drops its seeds. Look for a mature tree of the species you select.

- Build three "seed traps" from cardboard boxes, each about 40 inches on a side. Cover the traps with large-holed mesh wire or hardware cloth. Label the traps A, B, C.
- Place the traps on the ground—A at 10 feet, B at 30 feet, and C at 50 feet from the base of the tree.
- Check the traps every 2 or 3 days during the time when seeds fall.
- Count and record the number of seeds in each trap. (Add the total amount of seed collected and multiply by 4,000 to get the estimated amount of seed dispersed per acre. If there were 200 mature trees growing per acre, approximately how many total seeds would be on the ground?)
- Record your answers to the following questions:

  1. Which trap (A, B, or C) collected the most seed?
  2. Which trap (A, B, or C) collected the least seed?
  3. Can you explain the difference?
  4. How might your seed count affect the reseeding of a large open space such as a harvested site or a burned over area?

Extended activity—Repeat the activity using a different species. Compare your data.

Fair Display Idea 4-B

As an alternate display to Fair Display Idea 4-A, build a model to show the succession you observed. Use forest materials and other items that resemble the actual plants.

Lesson 5

Oregon's Most Common Trees

Names of common Oregon trees you should know

Douglas-fir
black cottonwood
sugar pine
California black oak
bigleaf maple
western juniper
dogwood
incense-cedar
grand fir
lodgepole pine
Pacific madrone
Oregon ash
Oregon white oak
western redcedar
black hawthorn
Pacific yew
western white pine
golden chinkapin
noble fir
ponderosa pine
western hemlock
red alder
Sitka spruce
Grand fir
western larch
Engelmann spruce
canyon live oak
quaking aspen
willow
tanoak

Poisonoak leaves

"leaves of three"

There are a lot of different climates and geographical regions in Oregon. Some tree species are versatile and hardy enough to grow in more than one area. If you are interested in forestry in Oregon, you need to be able to identify the most common trees.

Names are important

All plants, including trees, have two kinds of names: a common name and a scientific name. The **common name** usually is something you've heard, such as "oak." The **scientific name** of a tree is in Latin and is used everywhere in the world. That way, all scientists, no matter what language they speak, know they are discussing the same tree. In Latin, the **genus name** comes first and the descriptive **species name** follows.

There often are several different types of one kind of tree. For example, there are more than 500 types of oak trees in the world. Each oak looks different, has different growing needs, and has a different scientific name. In Oregon, the native oaks are the black oak, white oak, and canyon live oak. The word "oak" is the common genus name of the tree. The words "black," "white," and "canyon live" describe the species.

The scientific genus name for oak is *Quercus*. The Latin genus name is written beginning with a capital letter. The species name follows the genus and is not capitalized. When the genus and species names are given together, they are called simply the **species**. The scientific names for Oregon's three native oak species are *Quercus garryana,* the Oregon white oak; *Quercus kelloggii,* the California black oak; and *Quercus chrysolepis,* the canyon live oak.

Learn this shrub first!

Beware, Western Oregonians! Before you go into the woods, learn to identify poisonoak (*Rhus diversiloba*—because it's not really an "oak," its common name is written as one word instead of two).

Poisonoak grows from California into southern Washington, generally at lower elevations west of the Cascades. It is found in sun or shade and especially prefers dry areas. It can be a shrub or a trailing or climbing vine. All parts of poisonoak contain a chemical that irritates the skin. Touching any part of the

plant—sometimes just touching a pet or clothing that has touched the plant—will cause an ugly, itchy rash. Poisonoak is deciduous, but even the bare stems can cause a rash. The smoke from burning poisonoak can cause breathing and other allergic problems for some people.

Look for "leaves of three." Poisonoak leaves are a rich, shiny green in summer, turning beautiful reds and yellows in the fall. Leaves vary in size and shape, depending on where the plant is growing. Your best protection is to identify the plant and avoid it, or wear long-sleeved and long-legged clothing. Take extra care when undressing, and bathe after exposure. When washing hands, use cool water so your pores do not open to the irritating oils of this plant.

Activity 5-1

You need the publication, Trees to Know in Oregon *(EC 1450), and a set of* Tree Identification Cards *(Appendix A,* Oregon 4-H Forestry Leader Guide, *4-H 331L).*

Look up each of the trees from the "Names of Common Oregon Trees You Should Know" list on the previous page. Write the scientific name for each of the trees. For seven of the trees, write a fact you found interesting. Share some of these facts with your group.

Activity 5-2

You need pencil and paper for this activity.

Draw a map of your yard that includes your house and the location of the trees around it. Give the common names of the tree species. Collect a leaf, twig, or seed sample from each tree. Press the leaves between the pages of a heavy telephone book or catalog for at least 2 days, or place them in self-closing sandwich bags. Mount the specimens around the map. Code the specimens to match the tree from which they were collected. On the map, indicate a code to the matching tree specimen. Share the information with club members.

Fair Display Idea 5-A

Make a tree identification display. Collect leaves or needles, seeds and cones, twigs, and samples of bark or bark rubbings from three or four different trees. Group the items on a display board.

Include directions for an observer to match the items to the three or four trees. You might want to include the silhouette drawing of each tree as a helpful hint. Include an answer key with the display.

Fair Display Idea 5-B

Draw your favorite tree (you may want to look at *Trees to Know in Oregon,* EC 1450, for more information). Mount the drawing on poster board. Draw some products and uses we can get from the tree you chose (for example, a swing or bird house). Trees also provide shade or beauty for your yard.

For more specific products or uses, you will need to do a little research using an encyclopedia or other books. Different species provide different products. Share your information with club members or use in a presentation.

Fair Display Idea 5-C

Collect and display leaves, twigs, seeds, or stem and branch cross-sections from six or more tree species.

The cross-section must be at least 1 inch in diameter, with bark. Label each species with its common name. Mount the collection on a three-sided display board (30" wide, 24" deep [front–back], and 36" high) or other backing. You also might share this information as a club presentation.

Lesson 6

How to Find a Tree's Family Tree

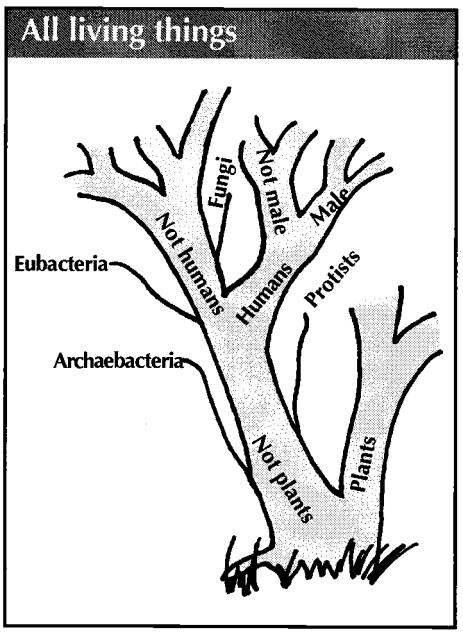
Kingdoms and families

All living things are divided into large groups called **kingdoms**. Every living thing belongs to one of the six kingdoms: Archaebacteria, Fungi, Eubacteria, Protists, Plants, or Animals. Each kingdom then is divided into smaller and more specific groups based on the natural characteristics and relationships of the living things being sorted. This ordered system is called **taxonomy**.

After the kingdom level, each living thing has a phylum, a class, an order, and a family. In Lesson 5, we learned the final two groups that completely describe a living thing: its genus and species name. In most scientific writing, the genus and species names are given together to indicate a particular living thing. For example, the scientific name for Oregon white oak is *Quercus garryana.*

Name	Genus	Species
Common	oak	Oregon white
Scientific	*Quercus*	*garryanna*

To help people identify the species of unfamiliar trees, foresters and taxonomists have developed special identification charts called **keys**. Keys help unlock the identity of a tree species by giving descriptive choices based on the traits of leaves, twigs, and tree shape.



How keys work

Use a **dichotomous** key to find your way through a taxonomy for a plant or animal. Like the key on a map, a key unlocks or gives information. The word **dichotomous** means there are two branches or two descriptive choices you select from as you work through each step of the information given in the key.

Look at the drawing on the left. Think of the branches of this tree as a guide from the large group of "All Living Things" to yourself as a unique and special living person. In the drawing, whenever there is a branching of the tree, there is a characteristic on each branch. You choose the answer "yes" or "no" for each listed characteristic. In a dichotomous key, a living thing cannot have the characteristics of both branches.

By following the branches, the drawing says you are living, but not a plant, that you are human, and if you are male or

female. More branches could be added to show your age or last name, your hair or eye color, and so on. Eventually, the description will fit only you if the key provides enough specifics.

Finding a tree species by using a dichotomous key works the same way as the branches on the tree drawing. Simply follow your answer at each branching. See the keys, "Common Conifers of Oregon" and "Common Broadleaved Trees of Oregon" in EC 1450, *Trees to Know in Oregon.*

More about keys

Using a key to help identify tree species can be fun and satisfying. It's a lot like using clues to track down the solution to a mystery!

There are different kinds of keys. Some are drawn like the illustration on page 14. Others give "go-to" directions according to the properties of the species included (see "Practice what you know," page 17).

Both kinds of keys ask the user to make "yes/no" decisions. A "go-to" key also tells the user what question to ask next. "Go-to" keys are designed for the beginning level, and they include only a small number of samples requiring identification.

Tree key users need to know basic identification characteristics about leaves, bark, cones, and twigs. Here are some of the things you should look for:

1. How are the leaves or needles attached to the branch?

(A) opposite; (B) alternate; (C) clusters or bunches; (D) spirally

2. On broadleaf trees, are the leaves:

(E) individual; (F) compound (several small leaflets on one leaf attachment)?

3. How are the veins of each individual leaf arranged?

(G) palmate; (H) pinnate

4. What are the leaf edges (margins) like?

(I) serrate; (J) wavy; (K) smooth (entire); (L) lobed; (M) double serrate

5. On conifer trees, are the leaves: (N) needlelike; (O) linear; (P) scalelike; (Q) awl-like?

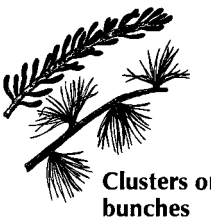
The chart on page 16, "Basic identification characteristics," will help you identify leaves, bark, cones, and twigs.

Basic identification characteristics

Are leaves or needles:

Opposite

Alternate



Clusters or bunches

Spirally arranged

On broadleaf trees, are leaves:

Individual

Compound

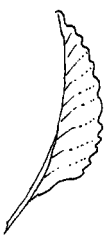
How are the veins arranged?

Palmate

Pinnate

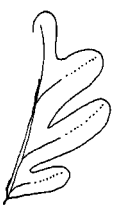
What are leaf edges like?

Serrate



Wavy

Smooth



Lobed

Double serrate

On conifer trees, are leaves:

Needlelike

Linear

Scalelike

Awl-like

Practice what you know

Identify these trees using this "go-to" key.

1A. If the leaf is broad and flat, go to #2A.

1B. If the leaf is needlelike, go to #4A.

2A. If the leaf is not made up of many small leaflets, go to #3A.

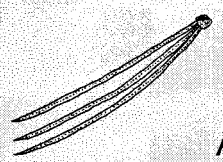
2B. If the leaf has small, pinnately compound leaflets, it is an **ash.**

3A. If the leaf is more round than long, palmate with double serrated edge, it is a **maple.**

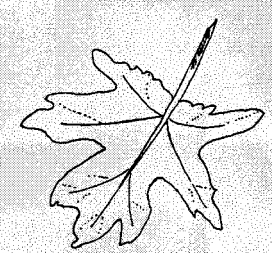
3B. If the leaf is longer than round and pinnately lobed, it is an **oak.**

4A. If the needles are short and individually linear, it is a **hemlock.**

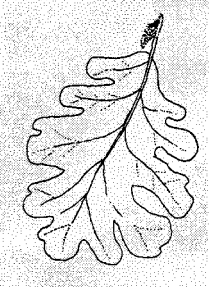
4B. If the needles are long and in bunches, it is a **pine.**



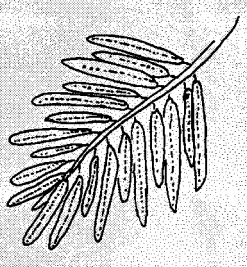
A



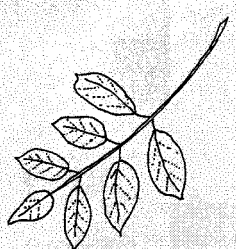
D



B



E



C

(Answers are on page 47.)

Activity 6-1

To do this activity, you need at least four people and their shoes, a large sheet of paper, and a marker, pencil, or crayon.

Have everyone remove his or her shoes and place them in a pile at one end of the paper, with everyone sitting in a circle. Write "All Shoes" next to the pile of shoes. As a group, examine each shoe. Make two groups of shoes each with one basic similarity (for example: right and left, slip-on or tie, sports and dress). Label each group accordingly. Remember, at each branch of the key you can answer only one characteristic with "yes" or "no."

Continue examining and dividing shoes until each shoe is alone with a unique label.

If you have enough people, form two groups, each working to create a key with a different pile of shoes. After each group has completed its key, ask the groups to trade shoe piles and keys. Have each group sort the shoe pile again using the key developed by the other group. Was each group able to use the other group's key to identify the shoes correctly?

Lesson 7

Growing Every Which Way!

Test your knowledge

Let's say a tree is 10 years old and 10 feet tall, and you attach a sign to the tree at a height of 5 feet above the ground. If the tree grows 1 foot taller every year, how many feet from the ground will the sign be when the tree is 50 feet tall?

(**Answer** is on page 47.)

Tree parts

A growing tree has four main parts: leaves, branches, trunk, and roots.

Leaves

The leaves make food for the tree through photosynthesis. **Photosynthesis** is the process by which leaves use chlorophyll (the pigment that makes leaves green) to absorb energy from sunlight to convert carbon dioxide and water into oxygen and sugar. In this process, oxygen is a waste product. The tree uses the sugar as food.

Branches

The branches support the leaves and give shape to the **crown** (the uppermost branches of the tree). Branches contain an internal system of tubes for moving food and water in the tree.

Trunk

The trunk supports the branches. Both the trunk and branches contain several different types of tubes that carry water and minerals to the leaves from the roots and sugars from the leaves to other parts of the tree. Although bark looks tough, damage to it opens a wound and exposes the tree to disease. Such an injury is as serious as a similar wound in your skin.

Roots

The roots of the tree anchor the tree and absorb water and minerals needed by the leaves.

The heart of the story

Outer bark is the "skin" of the tree. It protects the tree from injury, serves as a barrier to insects and diseases, and insulates the tree from winter cold and summer heat.

Cambium

The cambium is located just beneath a tree's bark. It is a very thin layer of living cells. The cambium layer surrounds the tree wherever there is bark. The cells of the cambium make two other different types of cells. The cambium produces the bark (called **phloem**) on the outside of the cambium layer. The cambium produces the new wood (called **xylem**) on the inside of the cambium.

Phloem (inner bark)—Phloem or inner bark is a series of tiny tubes which circle the trunk and branches of the tree and through which food travels from the leaves down the branches, trunk, and roots. When phloem cells die, they become part of the outer bark. If the phloem tubes are destroyed or badly injured, they cannot carry food. After small injuries, a scar is formed to close off the wound and allow the surrounding phloem to continue to do its job. If a large wound occurs, the health of the tree can be affected. Growth on that side of the tree can be stunted, making the tree bend or twist.

Xylem (new wood)—Xylem or new wood is produced on the inside of the cambium. The living xylem carries minerals dissolved in water upward to the leaves from the roots.

Every growing season, the xylem produces new growth rings in the trunk. These are called **annual rings**. Each ring has two kinds of cells. The ring of light cells is the early wood. These cells are produced when the tree is growing fastest. The dark ring of cells is produced near the end of the growing season, when the tree is growing more slowly. As the xylem ages, it also dies, becoming part of the heartwood at the center of the tree.

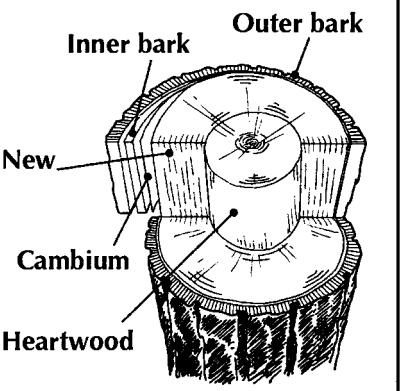
If the xylem suffers a little damage, the scar will show in the wood rings and can cause the tree trunk to bend slightly, but the remaining xylem will continue to carry water up to the leaves. A serious injury to the xylem may rob the tree of necessary moisture.

If too much of the cambium is damaged, the tree will slowly die. It starves and/or dies of thirst because it cannot transport food and water within itself.

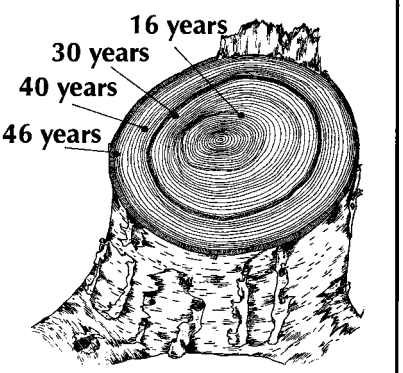
Heartwood

Heartwood is the backbone of the tree. Heartwood is not living wood. It supports the tree. It also is the place where waste products from the tree collect.

Skin of the tree



Growth rings



Fair Display Idea 7-A

Make a display based on a cross-section of a tree. The cross-section you choose should show at least 20 to 40 years of growth. Study the ring pattern and describe the tree's life story, indicating good and bad years. Write a short description and attach labels to the cross-section for these years.

Extended activity—Learn about general weather patterns for the past 20 to 40 years for the location where the tree grew. Use the library or other available resources. Find which years were especially dry or wet. Compare these years with your cross-section. Look for matching rings, and label them according to year and weather.

Fair Display Idea 7-B

During several visits to an area where there are many trees, collect items according to the letters of the alphabet. (Example: A = acorn, B = bark, C = cone, D = deciduous leaf). Make a display of the 26 items you find, explaining what each is.

Hint—The glossary of tree terms in this manual or a dichotomous key of Oregon trees will help you match each letter of the alphabet.

Growth

Trees grow in three directions at once. They grow up (height), out (diameter of trunk, spread of branches and roots), and down (roots). This is the order of priority for the tree's growth: height first, roots next, diameter and spread last.

Height—The height of a tree is measured from the ground, but the growth always comes from the points at the end of the branches. This means that trees grow from the top and ends, not from the ground up.

Roots—The roots of a tree grow in proportion to the size of the tree. Just as an adult eats more food than a small child, a tree needs more water and nutrients as it grows larger. Roots do not just go down. They grow outward.

Like the branches, the roots grow from the tip. Roots also have a cambium layer, but the surface has less need for protection because it is underground. The root covering (bark) is thinner and more fragile than the bark on the trunk.

Diameter—As the tree grows up, it also grows out. Larger trees need more support than new sprouts. Diameter increase is relative to the amount of moisture available to the tree during the growing season.

Activity 7-1

You need a cross-section of wood that is at least 12 inches in diameter and several map pins for this activity.

Try to use a cross-section from a tree about 20 to 40 years old. Starting from the most recent year of growth, count the annual rings back, and label every 5 years. Find the year you were born and label it. Try to find the years that members of your family were born or other important family dates.

Lesson 8

From Seedlings to Spires

Sometimes it is hard to imagine that every tree, no matter how tall and majestic, was a seedling only inches tall—and even before that, it was a tiny seed. Tree seeds contain an **embryo** (baby) tree. The tree embryo has tiny leaves, a stem, and a point that will become a root if development begins. Each of these parts can be seen, but usually only with a special stain process.

The tree embryo is surrounded by **endosperm**. This part of the seed is the food supply for the newly sprouted seed. It provides nutrients until the seed has developed a root system to draw nutrients from the ground and a leaf system to manufacture food.

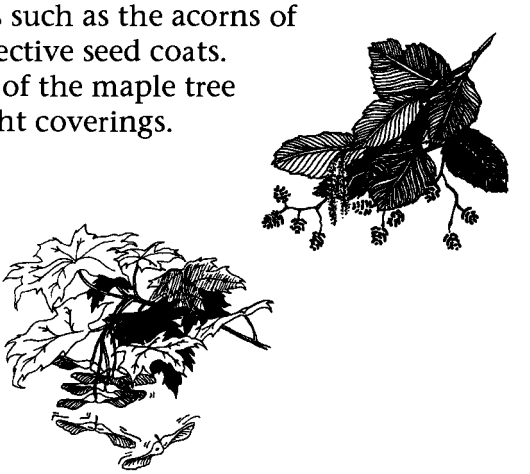
When a seed falls to the ground, it may be mixed with leaves, dirt, and forest duff. If the ground is warm and damp enough, and if other conditions are just right, the seed will begin to grow, using the endosperm for food.

Within a short time, the endosperm is used up. Before this happens, the seed must have established another source of nutrients. The tiny embryo root grows into the soil to draw water and dissolved nutrients to the seed.

Soon the tiny tree emerges from the ground. The first leaves appear. The leaves enable the tree to produce its own food.

The first leaves are often slightly different in shape than those that come later. (In "Try This," you observe an example of seed growth by soaking bean seeds. If you were to grow a bean seed until it produced true leaves, you would see that the first leaves have a different shape and texture.) This makes species identification by leaf shape difficult in the early life of a tree. When identifying seedlings, be patient. Wait until full-sized leaves appear.

When the first leaves appear, the **seed coat** (or shell) usually falls off the seedling. Seeds such as the acorns of oak trees have tough, protective seed coats. Other seeds, such as those of the maple tree (called a **samara**), have light coverings.



A day for trees?

Groundhogs have Groundhog Day, and sweethearts have Valentine's Day. Did you know that trees also have a special day? **Arbor Day** is the day set aside each year to honor trees.

Arbor Day first was celebrated in Nebraska on April 10, 1872. Today, the United States and some parts of Canada celebrate Arbor Day. Look on a calendar that shows holidays to find the date for this year's Arbor Day, and celebrate the day by planting a tree!

Try this

To see an example of seed growth, soak 7 to 10 large green bean seeds in paper towels for 2 days. Keep at least one dry bean for comparison. On the second day, open one seed, examine it, and record its development on a piece of notebook paper. How is it different from the dry bean seed? You can observe most parts of the embryo bean plant.

Continue soaking the remaining beans. Open one bean seed each day. Compare and record the development over time.

Fair Display Idea 8-A

You need a camera with flash and a roll of 24-exposure film.

In the spring when broadleaf and needle-leaf trees are budding out, cut end twigs from four different trees. Immediately put each cutting into a glass of water. Cover the glass with plastic wrap to prevent evaporation. Take a photograph of each twig.

Place the twigs where they will get good light. For the next 10 days, watch the twigs. Take photographs every second day and keep a written record of what you see. Make sure the water level always covers the cut end of the twigs, and record how much water is used.

At the end of the time period, write a description of what you observed, comparing the results of the four twigs. Feature your notes and photographs in the display. For visual interest when you show the display, include similar cuttings from the trees to show the foliage.

Activity 8-1

Collect and germinate seeds from a tree near your home. The kind of seed you select will depend on the time of year.

In the spring and early summer, you will have the best results with maple or cottonwood. Plant these seeds in a pot of regular soil. Cover the seeds with ¼ inch of soil and keep the soil moist but not wet. Keep a daily record of how long it takes for the seeds to germinate. (Be patient—some seeds may take a few weeks.)

In the fall, you will have best results with pine seeds, but these seeds may need **pretreatment** before planting. To pretreat seeds, place them on a moist paper towel on a small plate and put another moist paper towel on top. Leave the plate in the refrigerator and keep the paper towels moist. Change the paper towels about once a week to prevent mold. After about 60 days, remove the seeds from the refrigerator. Keep a daily record of the process. Plant the seeds as directed above.

Observe the pots daily and remember to keep a record of what you see. Once the seeds have germinated and the seedlings are about 1 to 2 inches tall, dig them up. (You might want to keep the strongest plant in its pot, and eventually plant it outside.)

Examine the seedlings for the different parts described above. Create a scale drawing of the seedlings for a display or presentation to your group. Include your record and the process, and be sure to share unique or unexpected results. If you had any seeds that did not germinate, examine these with care as well. Suggest possible reasons why they didn't grow.

Activity 8-2

Gather as many different seeds as you can find. Include beans, sunflower seeds, and other garden seeds as well as acorns from oaks and seeds from pine, maple, or walnut trees. Repeat the keymaking activity from Lesson 6 (Activity 6-1).

You can save the seeds and use them again for Activity 9-1 in Lesson 9.

Lesson 9

Spreading the Seed

Seeds are scattered in many different ways.

Gravity pulls seeds released from their parent trees to the ground and sometimes farther downhill to a new home. Winds may blow lightweight seeds farther from the parent tree. Some seeds, such as those from maples, have "wings" (**samaras**) that help them fly on the breeze. Seeds that fall in a stream or other running water might float for miles before washing ashore.

Another way seeds are scattered is by animals. Some seeds have a sticky or prickly exterior that helps them cling to the fur, feet, or feathers of an animal and ride along to new locations. Human hikers also can carry such seeds on their clothing.

The tough seed coat of some seeds requires a softening treatment before sprouting. Many animals and birds eat seeds and berries (with seeds inside). Often the seed remains intact after passing through the digestive tract because it is protected by a hard seed coat. Digestion softens the hard coat around the seed. After several hours, the seeds are deposited in the animal's scat, with the seed coat softened and ready to germinate.

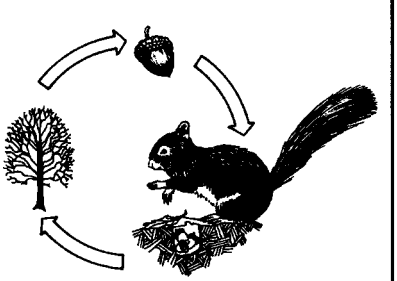
Some animals go so far as to "plant" seeds. For example, squirrels busily gather and bury acorns in the fall, storing them for winter. Many of their food caches are forgotten and sprout as oak seedlings the next spring.

Seeds from most trees germinate best on bare or nearly bare, damp soil. Seeds trying to germinate on thick leaf litter or forest duff may die for lack of water. The fragile new roots cannot penetrate deep litter to reach the moist soil. They also are susceptible to insect damage and organisms that can cause mold or rot.

Scattering seeds

Samaras carry seeds

Birds ingest seeds



Squirrels gather and bury seeds

Time of release

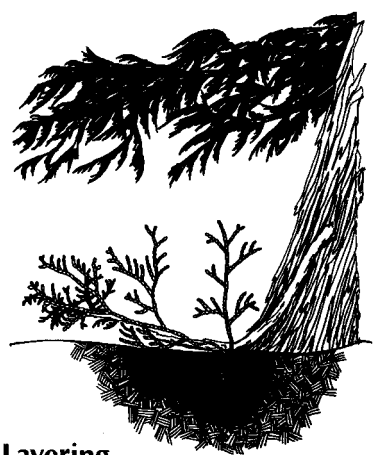
Different kinds of trees drop their seeds at different times of the year. Some trees, such as maple, produce seeds in late spring or early summer. The seeds are mature and begin to grow (**germinate**) as soon as they hit the ground. These seeds need the ground to remain damp from heavy spring rain. Their seed coat generally is thin, so they must get roots into the ground before dry weather arrives.

Other trees, such as Douglas-fir, drop their seeds in the fall. The seed remains dormant over the cold winter months. Usually, dormant seeds need a cold spell before they germinate. Oak seeds (acorns) drop in the fall too. They germinate very early the following spring. The tough seed coat of an acorn must remain damp for several months, or be softened by some other method, before the seed can sprout.

Other ways to start

Stump sprouts

Root suckers



Layering

Look Mom! No seeds??

Many trees get their start as seeds, but not all. Some common Oregon trees that can reproduce using seeds also reproduce by other methods. Willows, oaks, and madrone trees may grow and develop from the stump of a recently cut, fallen, or dead tree.

Aspen, cottonwood, and many fruit trees may begin growing from **root suckers**, special buds on the roots of a few species of trees. Root suckers grow very fast, as the root system from a large tree provides plenty of nutrients. The parent tree often continues to grow along with the suckers, which create a dense thicket around the main trunk.

A third way of seed reproduction is **layering**. Layering occurs when the branch of a living tree touches the ground, becomes covered by leaf litter or soil, and begins growing roots and leaves. Eventually a new tree is created at that spot. Juniper, redwood, hemlock, and some other species can reproduce through layering.

Activity 9-1

Gather as many kinds of seeds as you can find. Keep a record of where each was found. Use the following ideas to help organize your record.

- **Where was each seed found?** Was it on the ground, hanging from a branch, or floating in water?
- **When you pick up a seed, look around for the possible parent plant.** Is it nearby, or are there other plants around?
- **Examine each seed.** Is it heavy or light for its size? Is it big or small (for a seed)?
- **Make a guess about how it came to be where you found it.** Record your ideas about each seed.

Extended activity—Spend time trying to identify the parent plant for each seed. Some, such as acorns, might be easy. Others, such as grass seeds, can be more difficult. This activity will produce information and items that may be used for a Fair Display.

Why...

... is it good that seeds germinate away from their parent tree? Think of as many reasons as you can and record them below.

Fair Display Idea 9-A

Make a seed collection using at least eight different tree species grouped according to how the seeds travel. For example, your groups might include seeds distributed by mammals, seeds eaten by birds, and seeds that float in the wind. Display your seeds in a box or glue them onto a display board (30" wide by 24" deep [front to back] by 36" high).

Extended activity—Gather a second sample of each species, and cut each in half to show the inside of the seed.

Lesson 10

The Dynamic Forest Ecosystem

Oregon is #1

Oregon is the number one producer of Christmas trees in the nation. Millions of Christmas trees will be cut in Oregon this year—and next year there will be millions more. Trees are renewable. They reseed or can be replanted. If care is taken, young, healthy trees will replace those that are gone.

Factors affecting Oregon forests

Time yourself—take 60 seconds to list five natural impacts and five human-caused impacts that may affect a forested area.

Natural events

1. _____
2. _____
3. _____
4. _____
5. _____

Human activities

1. _____
2. _____
3. _____
4. _____
5. _____

From Lesson 2, you know that the types and locations of Oregon's forests are determined by **elevation**, **precipitation** (rain and snow), and **soil type**. The next two lessons look at several factors that cause change in Oregon's forests and trees.

A forest's ecosystems are **dynamic**—they are in constant change. "Change" isn't good or bad. Change just means that things do not remain the same. Succession is an ongoing process in the forest (Lesson 4).

Many things bring on succession in the forest—some natural and some caused by human actions. Look at your list of natural and human impacts ("Factors affecting Oregon forests"). Did you include animals and birds as impacts?

Remember how animals and birds can be involved in seed dispersal? Obviously, they have a role in succession. Did you also consider how the forest affects the animals and birds that live there?

When the forest changes, whether it is a drastic and sudden change (from a climax forest to bare ground) or a gradual change (from a pioneer species to a shade-tolerant species), the animals in the forest also change. Different stages of succession provide habitat for different types of wildlife.

Don't think of "impacts" as only big and sudden events, such as forest fires or logging. Consider millions of tiny, unnoticed actions of wind, insects, daily growth, and even the prints of your shoes as potential instruments of change. The forest will continue to change even if fires are suppressed or controlled and logging is stopped.

Humans often dislike the changes that happen in the forest. That is true both today and in Oregon's history. Historical documents show that centuries before Euro-American pioneers arrived in Oregon, Native Americans practiced different methods of forest management in what became the Oregon Territory.

In the Willamette Valley, the Kalapuya Indians maintained open oak-savanna grasslands by setting fires at regular intervals to remove undergrowth and timber. As a result of fire suppression, Douglas-fir covers more of the valley today than in the 1800s.

These fires eliminated plant competition, encouraged new growth of forage (grass and browse), and increased acorn production. With better grazing, herds of deer and elk grew larger. The increased game animal herds improved hunting opportunities and increased the tribal food supply.

Wildlife plays an essential role in how a forest functions. Animals are particular about their surroundings. Every animal has a specific or preferred place (**habitat**) in the environment. The habitat is where the animal's needs for food, water, shelter, and space are met best in that environment. An adult animal must have enough food, water, shelter, and space in its habitat to raise healthy offspring.

When nature or humans change the habitat, animals that require a specific environment must move or they do not survive. Management of the forest can increase or decrease an animal population by altering the habitat.

Read **Activity 10-2**. Lead a discussion with club members on the basic forest/wildlife management actions taken by native tribes and humans today. What benefits or negative impacts resulted from these management decisions? What motivated the decisions of each group?

Activity 10-1

Design and build a board game that tells participants where animals go during a fire. For example, bears and elk move away from fires, while mice and ground squirrels burrow underground. Snakes find a hole or protective rocky area, but porcupines don't burrow and cannot run fast. Consider which animals might survive and which might not during a fire.

Before the game starts, make and share game rules including a way to determine who wins the game.

Activity 10-2

Choose one animal that lives in a forest near you. Find out what habitat it requires for food, shelter, and space. Shelter can include areas for nesting, sleeping, hibernation, and escaping from predators or bad weather. Share the stages of forest succession your animal would need to meet its requirements.

Activity 10-3

During the holiday season, visit a Christmas tree lot. Look at the different types of trees offered. Compare retail prices according to species and height. Examine different trees for evidence of shaping. Ask the employees for information about the origin of the trees.

Fair Display Idea 10-A

This is a long-term project that may be a fair display for several years. As you complete additional work, you can update the display.

As a club or with family members, plan a small wildlife landscape. Set aside a spot in your yard where you can build the planned site. You also might consider a local park, school, or similar site.

Consider the appropriate type of landscape for the location. Research the most suitable types of wildlife you want to visit the site. (See Appendix B, "Extension publications: *The Wildlife Garden* set.") Make two detailed drawings: one of the current landscape and one of the future site. Be sure to include native food plants. Remember that the plan is for several years, so you should plant or remove according to the research you have done.

Visit the site at regular intervals. Observe the animals using your landscape (it may take months or several years for the landscape to become fully used by wildlife). When you observe the site, sit quietly a short distance away and watch for a block of time (such as 1 to 2 hours). Be sure to visit at different times of the day and during different seasons. Record the number of birds, specialized insects (such as butterflies), and other wildlife that use the site.

Keep a detailed record and shoot photographs of the entire planning and building process. Record your observations and what you learned about the needs of different animals and insects. You also could share the information in an oral presentation.

Fair Display Idea 10-B

Collect twigs from several tree species that grow in Oregon and are used as Christmas trees. Prepare a display with the samples and identify each twig. Include a photograph of each tree.

Fair Display Idea 10-C

Visit a Christmas tree farm and talk with the owner (you might volunteer to help with the operation). Based on your conversation, prepare a display or set of photographs showing the steps in Christmas tree production (planting, shearing, protecting from insects, harvesting, and marketing).

Fair Display Idea 10-D

Research and demonstrate planting, shaping (**shearing**), or other Christmas tree maintenance operations at a 4-H meeting.

Fair Display Idea 10-E

Make a model showing the role of trees in promoting water quality. Include trees, water areas (such as a stream or lake), clouds, and rainfall. Explain and show what the trees do and how their absence can affect the water quality of the runoff from the area. Share your model with your club or as a display for the fair.

Activity 10-4

Visit a Christmas tree farm and interview the owner. Decide on your questions before your visit. Ask such things as:

- What species of trees do you grow?
- How many years does it take before you can harvest the trees?
- What is your biggest insect, disease, or pest problem?
- How do you market your trees?

Write an article about your visit, including quotes from the interview. Submit this article for your county 4-H newsletter, school paper, or local newspaper.

Activity 10-5

Do this activity at least twice—once during a water runoff period (such as after a heavy rain or during the spring flow) and once in midsummer.

Observe the amount of sediment in a flowing stream. Take a large glass jar with a flat bottom to collect water away from the bank just above the stream bottom. Do not disturb the bottom of the stream or the bank as you step in or out of the water. Then, set the jar in a place where it will not be disturbed for about 48 hours after collection.

Use a ruler to measure and record the depth of the sediment that has fallen to the bottom of the jar. Compare and record the measurement each time you take a sample (remember to do this at least twice during different times of the year). Note which sample has the most sediment and discuss the possible explanation for the difference.

Activity 10-6

You need a molded plastic contour map showing mountains and valleys, adjustable spray bottle filled with water, and fine sand or other finely ground substance (e.g., paprika or ground cloves) in a shaker container.

Place the molded map on a flat surface. Gently mist the map surface with a fine spray of water. Shake the finely ground substance over the dampened map so that it is covered evenly.

Adjust the spray to larger drops and gently spray the map with water. Continue until rivulets of water begin to flow down the molded elevations. Note how the ground substance gathers at certain locations.

Discuss the erosion patterns shown in this exercise. Consider how erosion may be beneficial or harmful.

Note: Water flow devices showing erosion and soil types often are available from local Soil and Water Conservation District (SWCD) offices, local watershed councils, and offices of the OSU Extension Service.

Activity 10-7

You need a 5-gallon plastic bucket, a plastic pan, gloves, and several scoops of rotting forest debris (if you don't have access to an undisturbed forest area, scoop from deep leaf piles or wood piles).

Collect rotting forest debris in the plastic bucket. Be sure to collect from the damp duff that is below the dry covering. Try to include a little soil. Mix the debris with a shovel or stick.

Wearing gloves, transfer the debris to the pan one large handful at a time. Pick out the larger pieces such as leaves and bark and examine each for evidence of insects. Place those pieces aside. Examine any insects you find. Record all insects and evidence of insects in the forest debris. Discard each handful after examination and take out another handful. When the plastic bucket is empty, discuss the role of the insects you discovered.

Activity 10-8

You may want to wear gloves for this activity to avoid insect bites and stings.

Find a rotting log and gently pull it apart to look for insects. Draw or collect a sample of each type of insect you find. Use an insect book to identify your insects. Discuss the reasons why each insect was found in the log.

Fair Display Idea 10-F

Develop a three-sided display showing the amount of water needed by various human activities, such as in a normal daily household, a farm growing plants and animals, and a manufacturing business. Show a possible conservation plan for each scenario.

Fair Display Idea 10-G

Survey insect damage in your neighborhood, a park, or a nearby forest. Watch for insect-caused problems such as borer or bark beetle damage, partially eaten leaves or needles, and damage caused by sap-sucking insects or cone borers. Record each type of damage you see, the tree species on which you observed it, and if you saw an insect causing the damage. Use photos or drawings to create a display or a presentation.

Lesson 11

Silviculture Equals Forest Management

Silviculture involves managing forests through planting, assisted growth, and the selection and mixture of species on a given site. Good silvicultural practices allow a forester to produce wood products, improve wildlife habitat, enhance recreational opportunities, control soil erosion, and maintain water quality in the forest watershed.

To decide the best silviculture practices, foresters must understand how plants interact with the immediate environment. The actions below are applied to large areas of forestland rather than specific trees.

- Harvesting
- Thinning dense stands
- Regeneration
- Selecting appropriate species for the site
- Pruning
- Fertilizing
- Controlling pests
- Any other activities that improve a forest or maintain it in a productive, healthy condition

Forest types and stands

Each forest is a unique mix of tree species growing together in a community. The collection of species is predictable. Certain trees grow near one another because they need similar soils, water, and light. A **forest type** is a specific collection of species that occur together (Chapter 2).

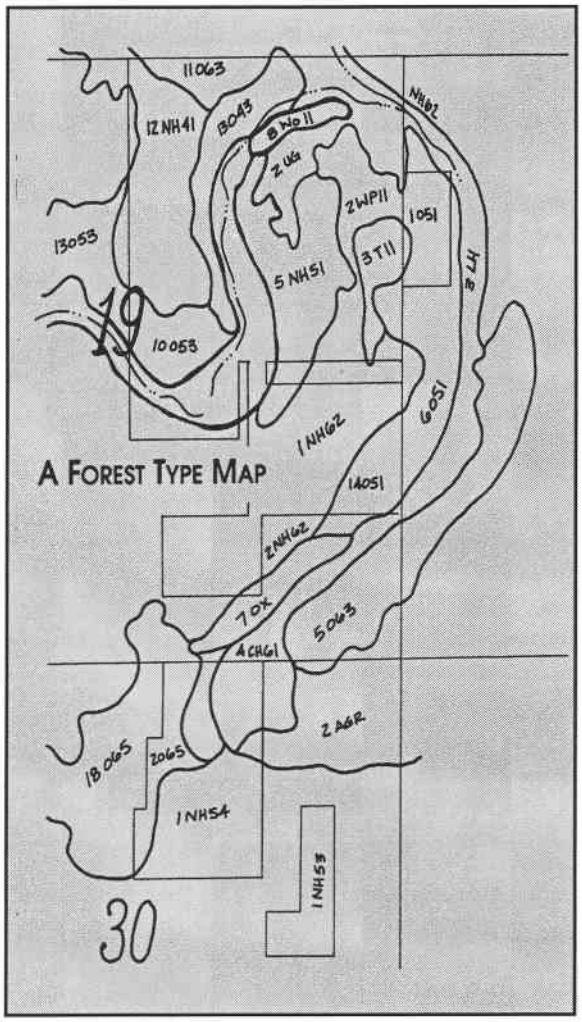
Forest types are named for the main tree species in the group, although other species also can be found there. A Douglas-fir forest type consists mostly of Douglas-fir, but it likely will have oak, ponderosa, and hemlock or other species.

A **stand** is an area of forest that has a composition of similar tree species all of more or less the same age, with generally the same site quality. A **pure stand** has 90 percent of a single species. A **mixed stand** has more than one predominant tree species. Most mature stands are mixed.

Stands can be even- or uneven-aged. When trees are approximately the same age, the stand is **even-aged** with all trees about the same size. Even-aged stands usually consist of shade-intolerant pioneer species or planted trees.

Uneven-aged stands have at least three or more distinct **age classes** (all trees within an age class are in the site because of a specific event, such as fire or replanting after logging). Trees in uneven-aged stands may range from pencil-thin seedlings to towering ancients.

Foresters often map the location of forest types and stands so they have an overall idea of what is happening in an area. The map helps them decide what management practices to prescribe.



Silviculturists classify trees based on five different **crown levels**. This is known as the Kraft Tree Crown Classification system.

In a forest stand, individual crowns occupy different levels in the canopy. The position of a tree crown affects how well a tree grows relative to its closest competitors. Trees that receive the most sunlight generally grow fastest. The different crown levels are especially noticeable in an uneven-aged stand.

- **Dominant** trees have crowns that rise above the general canopy level. They receive full sunlight from above and from all sides.
- **Co-dominant** trees make up the average canopy level. Their crowns receive overhead light, but dominant trees restrict some of the sunlight on their sides.
- **Intermediate** trees occupy a position underneath the dominants and co-dominants. They receive sunlight from above but no direct light from the sides.
- **Suppressed** trees receive no overhead sunlight. They usually grow slowly and are weak.
- **Dead** trees or **snags** have no live vegetation in their tops and sometimes are broken and stripped of bark.
- **Woody debris** is the volume of down logs on a site.

Activity 11-1

Take friends or club members with you into the forest. Using the Kraft Tree Crown Classification system, each person should classify trees in a local stand.

Observe which trees fit the classification system. Note and record the overall health of the suppressed and intermediate trees. Name the species that are most common in the dominant and co-dominant classifications. Compare all information and reach a decision about what you observed.

Kraft Tree Crown Classification		
DO	=	dominant
C	=	co-dominant
I	=	intermediate
S	=	suppressed
D	=	dead
W	=	woody debris

Fair Display Idea 11-A

Make a display of a forest showing dominant, co-dominant, intermediate, suppressed, and dead trees. Use drawings or photographs. Show how a tree's position in the canopy affects its growth rate. Label each displayed tree type with the correct classification.

Fair Display Idea 11-B

Make a model, exhibit, or presentation that focuses on one of the different regeneration methods. Use drawings, photographs, or various forest materials to create your display and explain the method you selected. Be sure to use the correct terms.

Activity 11-2

With your club, visit a site logged between 1 and 4 years ago. Record brush, debris, and seedlings left after the harvest. Record new plant growth since the cut. Check and record signs of wildlife on the site.

If possible, visit with the forester in charge of the site. Ask what plans have been made to reforest the area. Identify the regeneration method and what measures have been or are being made to protect or enhance wildlife and/or fish habitat.

Lesson 12

Fire

Fire plays an important role in shaping the composition of a forest. The appearance of today's forests is a result of fires that happened more than a century ago.

Although Oregon is known for its rainy weather, summers often are hot and dry. On the western side of the state, the damp winter months encourage growth of lush green grass and underbrush. In the summer sun, these potentially fast-burning fuels dry quickly.

East of the Cascade Mountains, Oregon has year-round low humidity. The area's plant species—juniper and sagebrush—are very dry by late summer. When lightning strikes these plants, they easily ignite and start wildfires. Historically, naturally occurring wildfires are common in Oregon in late summer and early fall.

The southwestern and eastern sections of Oregon have an average **burn-over** cycle of less than 10 years. This means *all* land in these areas *average* a fire at least once *every* 10 years. Many forests in these areas do not burn for decades and centuries, but others burn repeatedly. How do you think repeated burns affect the way trees grow on sites that have burned many times?

The fire triangle

Fire is a chemical reaction of three ingredients: **fuel**, **air** (oxygen), and **heat**. These three ingredients make up the **fire triangle**. If one ingredient is missing, a fire will not burn.

Fuel

Fuel is abundant in a forest. Fuel must contain carbon, which comes from living or dead organic materials. As trees die or shed leaves and needles, fuel naturally accumulates in the forest. Trees and branches lying on the ground are a major source of carbon-containing fuel in most forests.

Heavy fuel build-up also occurs after insect infestations or plant diseases damage or kill trees. Logging operations that leave small trees and branches on the ground also create a source of fuel.

Try this simple experiment

1. Place a birthday candle in a small lump of clay or in a piece of hot dog bun so that it stands upright.
2. Light the candle.
3. Carefully lower and set a quart-size canning jar over the burning candle.
4. Watch what happens to the flame.

Which part of the fire triangle did you remove?

_____

_____

_____

Air

Air contains **oxygen**, a highly flammable gas present in Earth's atmosphere. As a fire uses oxygen, it draws more air toward it and creates wind. Large fires develop a brisk wind as they seek oxygen.

Heat

Heat is necessary to start and maintain a fire. Nature provides the heat through lightning. The rapid weather changes of spring and fall often create thunderstorms in Oregon. Dry lightning (without rain) also is common. Each year, thousands of lightning strikes hit Oregon.

People also supply heat sources by misusing matches, campfires, trash fires, cigarettes, and automobile exhaust systems in dry forestland.

Weather and the fire triangle

High air temperatures and **low humidity** (dry air) remove the moisture in fuels, making them ignite and burn more easily than when they are moist or damp. In parts of Oregon, very low moisture content in forest fuels is common every summer.

Wind also contributes to fire by removing moisture from forest fuels, especially when the air is dry. After a fire starts, wind brings fresh air (oxygen) to replace what the fire uses. Wind also spreads a fire by pushing embers and flames into unburned fuel and by lifting burning debris to areas that may not be threatened immediately.

Storms and their behavior dramatically affect fire. Lightning can cause wildfires by striking trees or grassy areas. If the lightning is accompanied by heavy rain, the rain may cool or put out the fire. Plants and trees retain more moisture if there are frequent storms and cooler temperatures during dry summer months. This helps control wildfires because damp or moist fuels are less likely to ignite and, if lit, burn slowly.

Types of fires

Crown, ground, and surface are the three types of forest fires.

Crown fires

Crown fires occur when extremely dry fuels, often mixed with wind, make conditions right for fires to spread rapidly and "top-out" in mature trees. A crown fire is spectacular. Once it is burning, it can leap from treetop to treetop.

Crown fires produce tremendous heat and cause extensive damage to all sizes of trees. If the fire burns hot enough, the earth below the forest also can be damaged. Most crown fires occur in coniferous forests.

Ground fires

Ground fires are not as visible as crown fires, but they can damage the soil if they burn hot enough. Ground fires burn very slowly, but they generate a lot of heat and actually burn tree roots, deep leaf layers, and peat beneath the forest duff. Most ground fires in Oregon result from lightning strikes that smolder deep within trees and roots. The fire appears to explode into flame when it is exposed to air.

Surface fires

Surface fires burn twigs, needles, leaves, branches, and low underbrush on the forest floor. Surface fires rarely kill large trees, but they do kill seedlings and young saplings. Surface fires can become crown fires by climbing a **fuel ladder** through the layers of the forest.

Activity 12-1

*Conduct this activity only under a leader's or parent's supervision—**no exceptions**!*

In a charcoal grill or campfire ring, use wooden matches to ignite and burn each of the following:

- Wet, green pine needles
- Dry, dead pine needles
- Wet, green broadleaves
- Brown, dry broadleaves
- Other forest debris, such as twigs, bark, and rotted duff

Classify and record ignition as immediate, moderate, slow, or none.

Once it is ignited, observe and record how each fuel type burns. Discuss what factors affect the ignition of each type. Do you believe there are conditions under which any forest fuels can ignite easily? Discuss and list the conditions.

Fair Display Idea 12-A

Prepare a display that shows both a low- and a high-fire-hazard forest area. Use photos or drawings to illustrate each. Show four methods of preventing or controlling fires and how each method affects part of the fire triangle.

Fair Display Idea 12-B

Make a historical display of fire activity in your area. If possible, visit a wildfire or controlled burn site and take photographs of fire scars (such as burned bark). Find or draw a map of your area, and diagram the history of fire in the forested land.

Contact or visit the local office of the Oregon Department of Forestry, rural fire district office, historical society, and library for information. Share the display or include it with an oral presentation.

Lesson 13

Wildlife and the Forest

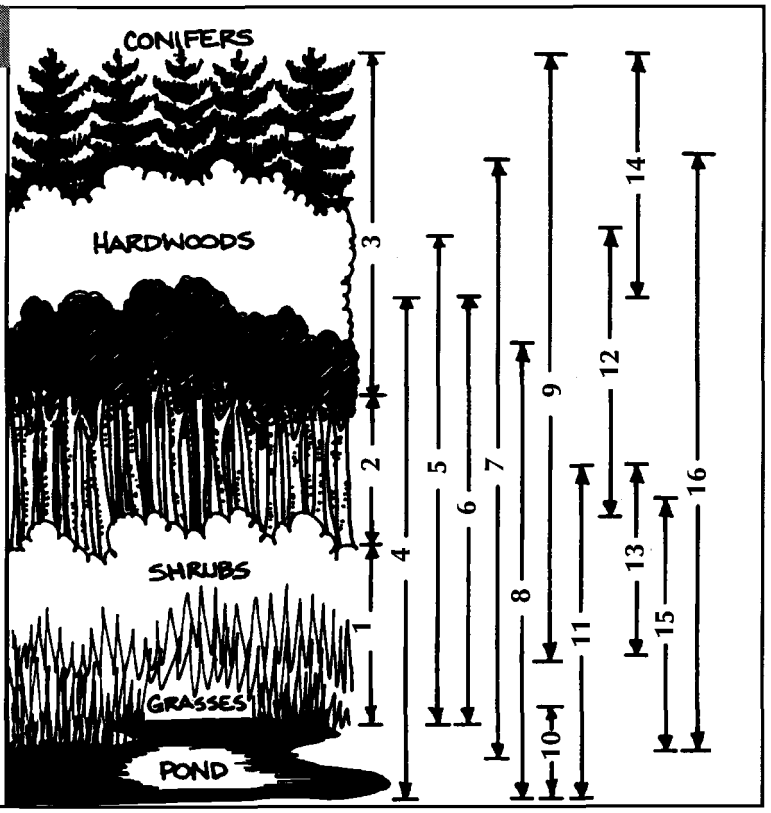
When forests change, the habitat improves for some species and degenerates for others. For example, a replanted area that was burned or logged will improve the habitat for deer. The deer browse on the new young trees and surrounding brush and grass, and use the large trees around the newly planted area as shelter. However, the gray squirrel or owl that lived in the burnt or removed trees will move from the site to find a more suitable habitat.

The **carrying capacity** of a particular site determines which and how many of a species will live in an area. Carrying capacity is the number of animals of a species that can live on a site without depleting the resources. Animals compete to survive and may damage plant life by overbrowsing the area. Animals weakened by the lack of food are more susceptible to diseases.

In the forest, some animals use the entire forest as their habitat. These are called **generalists**. For example, bears are generalists and make use of many types of habitat. They enjoy berries found in early successive stages of a forest, but they also need mature trees for shelter, and they feast on the grubs and

Animal use of forest layers

small rodents—1
grouse—2
pine marten—3
raccoon—4
wild turkey—5
deer—6
bear—7
otter—8
various birds—9
salmon—10
beaver—11
gray squirrel—12
rabbits—13
owl—14
elk—15
red fox—16



insects found in dying and fallen decayed trees. Salmon are an important staple in the diet of the bears of the Northwest.

Specialists need a more specific habitat to survive. For example, the pine marten, a member of the weasel family, needs older pine forests for shelter during cold winter months and for places to hide from larger predators. The marten is a small predator that eats squirrels, birds, lizards, and snakes that share its habitat area.

Managing forests means managing wildlife

The stages of forest succession must be considered when thinking about wildlife. When a mature forest dies and the first plants return, animals that prefer early successive stages will have considerable food. They will thrive and likely increase in number.

Animals that prefer a different habitat may be unable to find cover when they are hunted, food when they are hungry, or nesting sites or dens for their young. Such animals will decrease in number.

When Oregon's early Native American tribes managed the forests by burning, their goal was to increase the deer and elk populations and the number of oak trees growing acorns. Large game and natural food sources were necessary for survival.

Today, Oregon's forests are managed using holistic, scientific methods; for example, emphasizing the importance of the whole ecosystem rather than analyzing or separating it into parts. Modern forest and wildlife managers use multiple priorities when working through the win–lose game of animal habitat. One of the most difficult parts of their job is determining what priority to set. Very few actions taken in any Oregon forest have only one goal.

Priorities usually are based on current populations of the specific animal and/or whether the animal is listed as **endangered** or **threatened**. There are two criteria that must be met for a species to be considered endangered or threatened:

1. The species' overall population has declined to the level that when young animals reach breeding age they may be unable to find a partner.
2. The carrying capacity of the animal's habitat has become too small to maintain the species.

Forest and wildlife managers recognize that areas of the forest are dependent on the animal's preferred habitat and assess the specific species' needs. At the same time, the managers also consider the needs of the trees, water, earth, and air.

When planning a change in the forest that affects animals, a forest or wildlife manager tries to reduce the negative impacts as much as possible. One example is to leave dead snags in a

Fair Display Idea 13-A

Choose a dead or dying tree. Make a diagram of the tree noting holes and cavities. Make a chart on which you can list the animals that use the holes in the tree. Visit the tree at 10 different times of day. Watch the tree for animal and bird activity. If possible, use binoculars.

Write the times of day and the dates when you visit the tree. Record what you see. Try to identify birds and animals accurately. Take a photograph of the tree.

For your display, design a poster using the photographs, diagram, and your activity record.

Fair Display Idea 13-B

Make a display using drawings, photographs, or casts of wildlife tracks you identified. Try to include at least eight species common to your area. For each species, include a description of the animal and its preferred habitat.

cleared area to provide shelter, foraging, and nesting opportunities. Another solution is to divide logged sections into smaller pieces with undisturbed forest left between them. This provides corridors from one forested site to another and also provides food near shelter. Wildlife likely will thrive and increase in number with either of these solutions.

Activity 13-1

Study the drawing of the forest layers that shows the area used by individual animals (page 36). Identify each species by indicating "S" for specialist or "G" for generalist. Be prepared to explain your choices.

Activity 13-2

Contact a local forest or wildlife management agency to learn the location of a beaver dam you can visit. During your visit, look for signs of beaver activity—fallen trees gnawed off at beaver height along the shore, animal footprints, and the dam itself. If you observe the area quietly and from a distance for at least 2 to 3 hours, you may be lucky enough to observe a beaver at work. Consider the following questions:

- What might happen to the beavers if their habitat suddenly changed (for example, their pond dried up or a flood washed out their dam)?
- What might happen if their food source was removed (for example, a flood uprooting trees or fire killing trees)?

Activity 13-3

Build nest boxes for birds of your choice. Put them in your yard or ask permission to place them throughout your neighborhood. Call or visit your local Extension office for nest box plans. (Note to club leader: This activity can be used as a fundraiser.)

Lesson 14

Harvesting

Americans use more wood annually than all other industrial materials combined. Private, state, and federal forests provide much of the wood products used in our country, but wood also is imported from other countries. No other country imports as much wood as the United States.

Wood is a renewable resource—trees are replanted and forests are regrown. Even though there is environmental disturbance involved with harvesting trees, the disturbance is shorter and less damaging than mining or oil drilling.

Commercial harvesting of wood has several steps.

1. Selection of the type of trees to be cut
2. Access method and **landing sites** (an area where logs will be collected). If necessary, roads and trails are built.
3. Cutting (**felling**), using chainsaws or feller/bunchers, depending on the terrain
4. Tree limbs removed (**limbing**) and tree trunks cut into appropriate log lengths (**bucking**)
5. Logs moved (**skidding** or **yarding**) using skidders, bulldozers, horses, and helicopters. Strong cables are attached to each log (**setting chokers**) to lift and move it to the landing site.
6. Logs put onto trucks by **loaders** that look like giant clamps
7. **Primary processing**. Logs may be chipped into small pieces, cut into lumber, or cut in a spiral (like unrolling a jelly roll). Basic products created include fuel wood, lumber, pulp, veneer, or composites (like particleboard, paper, hardboard, insulation board, plywood, or medium density fiberboard).
8. **Secondary processing**. Primary products are converted into furniture, window frames, pallets, cabinets, home construction, or toys.

Harvesting timber is a highly skilled but very dangerous occupation where a single mistake can mean loss of a limb or life.

Using trees

The typical American uses a 100-foot tree every year through forest products. If you are 13 years old, you have used 13 trees in your lifetime.

Wood products? Try this!

Wood is a remarkable feat of natural engineering. It can be stronger than steel of equal weight, but under certain circumstances, it can be tied into a tiny knot. The structure and properties of wood are a function of specific tree species, the growth rate of the trees, and the form of the stem.

Most people can identify many wood products, but some products are less obvious. Rayon cloth, some plastics, photographic film, building insulation, turpentine, and surgical gloves usually are not thought of as wood products.

See if you can identify which products in the list below originally came from the forest. Circle your answers.

Cellophane	Yes	No
Pencil erasers	Yes	No
Car tires	Yes	No
Cattle feed additives	Yes	No
Chewing gum	Yes	No
Ceiling tiles	Yes	No
Ceramic vases	Yes	No
Paint resin	Yes	No
People magazine	Yes	No
Ping pong balls	Yes	No

(**Answers** are on page 47.)

Lumber

This is one of the most obvious forest products. Even though there are more than 1,000 different tree species that grow in the United States, most lumber is made from only a few of these species. About three-fourths of the wood going into lumber production comes from softwoods (conifers) such as pine and fir. Softwood lumber is used mostly in building construction. Hardwood also is made into lumber, but it usually goes to secondary processing for furniture, flooring, and other specialized products.

The forest products industry has developed many composite building products from softwoods. These **composite products** not only expand the uses of basic lumber products, they also use what were once waste products from the manufacture of the lumber itself, such as sawdust and butt ends.

Modern sawmills are highly automated, but the process is the same as 100 years ago. Logs from the forest are delivered to the mill and stored in piles called **log decks**. They are kept damp so they won't crack or warp. Logs then are cut into various-size boards depending on the quality and species of the log.

Plywood is a large, flat "wood and glue sandwich" made from thin layers of wood called **veneer**. Veneer is made in mills using a rotating lathe blade or slicing knife that shaves or peels a very thin piece of wood. A rotary lathe cuts as the log turns, similar to unwinding a roll of toilet paper. The thin pieces are glued together by alternating the direction of the wood's grain.

The process for making particleboard, hardboard, and fiberboard basically is the same. Waste pieces from other processing is chopped or ground into small pieces, bonded with resin, and hot-pressed into panel-size pieces.

Paper

A sheet of paper is a wood product made from pulp. **Pulp** is a combination of wood fibers, bonding, and coloring chemicals mixed together with water.

Making pulp from wood

To turn trees and logs into pulp, the bark must be removed from the cut log. Sometimes jets of water or tumbling smaller logs against each other knocks off the bark.

Pulp only can be made from small pieces of wood, so the next step is to reduce the wood into very fine pieces of wood fiber.

There are three ways to turn wood into pulp.

1. **Mechanically**. The wood is pressed against a grindstone, and the fibers are ground off into water. Although this method yields the most wood fiber, it uses the most energy and produces low-quality paper.

2. **Thermally**. Heat softens the wood chips, but this method uses a lot of energy.
3. **Chemically**. A sulfate or sulfite process "digests" the wood fibers. This process initially is less expensive, but it has limitations because of environmental controls. The process produces less fiber, but the paper quality is high.

A paper mill may use a combination of all three methods to take advantage of the best features of each.

Wood pulp has the consistency of very thick oatmeal. Once the wood fibers have become pulp, the pulp is washed and screened. If white paper is the goal, the pulp is bleached. The pulp next goes into a beater which rubs and frays the wood fibers so they are more flexible. A sizing solution of starch or glue is added as a sealant for fine grades of paper. Color also may be added at this point.

The pulp is diluted and fed onto a broad wire screen where part of the water is drained. The screen moves through a roller that presses what is now damp paper. The damp paper is wound through steam-heated rotating drums and then passed through chilled steel rollers. This process smoothes the paper and gives it uniform thickness. The paper is wound into large rolls with each roll cut into a workable length. The large rolls usually are sent to other plants for additional processing and packaging before the paper is in its finished form.

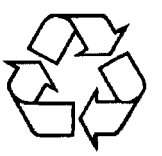
Wood pulp can be made from many different tree species. On some **tree plantations**, fast-growing, hybrid trees are raised solely for making paper. In other places, logs from thinning operations that are too small to be processed into lumber become paper pulp.

If Americans did not recycle newspapers, it would take about 6 years to fill half of all landfills in the United States with old newspapers.

Recycling

People have copied recycling from nature (for example, the breakdown of organic matter and reuse of nutrients discussed in Lesson 3 is recycling).

By recycling paper and cardboard, we have another source of pulp for paper. Turning waste paper into usable new paper is different from making paper from wood.



Recycled Paper

Recycled materials are returned to pulp by soaking them in water and beating the pulp to separate the fibers. Plastic and other unusable materials are filtered from the pulp. **Sludge** is the pulp that's left after the unusable materials are removed.

The sludge is mixed with more water and air so remaining inks rise to the top in foam, which also is removed. For a brighter, whiter paper, the sludge is bleached. The mixture then is spread to form paper sheets.

When different kinds of recycled papers are mixed, the higher grades (like copy paper) are downgraded by the lower grades (like newsprint). Separating the paper by type before starting the recycling process produces a higher quality recycled product.

Fair Display Idea 14-A

Make an appointment with a logging company. Visit and take pictures of a harvesting operation showing all steps of the operation (such as felling, skidding, limbing, and bucking). Mount your photos in the correct sequence of events. Ask the loggers what products might be made from the harvested trees. Include a photo of the final products in your display.

Fair Display Idea 14-B

Schedule a visit to a sawmill or paper mill. Take pictures or sketch the processes at the mill. Build a model of the machinery used in the primary or secondary process. Mount the photos or drawings and display the model. Be sure to include labels and a brief description of what the model or photos show.

Fair Display Idea 14-C

Schedule a tour of a sawmill, paper mill, plywood plant, or other wood products plant. Take notes during the tour about the different machines you saw, how they worked, and what type of trees were used. Develop your notes into an oral presentation or display. Use drawings or photographs to highlight points of interest.

High-quality copy paper can become good quality paper, tissues, or paper plates and cups. Medium-quality typing and other office paper can be recycled into shoeboxes and tarpaper. Low-quality newspaper and cardboard may become egg cartons or be reused as newsprint.

It takes less energy to make certain kinds of paper products from recycled materials than from raw timber. The savings result from the paper production's fuel costs for cutting and transporting logs. The money saved from energy, however, is offset by the costs for collection, transportation, and removal of ink and other unusable substances from the recycled materials.

Activity 14-1

List items in your home that come from the forest. Develop headings such as "Solid Wood Products" for lumber, furniture, and plywood; "Wood Fiber Products" for paper and cardboard; or "Miscellaneous Tree Products" for maple syrup, turpentine, fruit, and nuts. Compare all club members' lists.

Activity 14-2

Visit a sawmill, paper mill, plywood plant, or other wood products plant (always check in at the main office). Write a report on your visit, and develop a presentation for your club. Describe the different machines, how they worked, and what species and size of trees were used.

Activity 14-3

Visit a retail lumberyard (always explain your visit to employees). Bring a ruler and look at various composite wood products. Record the name of the composite and the approximate size of the wood pieces used in its production. Ask an employee what is the best use for each product and record this information.

If trimmings are available, ask for samples. Check to see if there are brochures or photographs of the products. Look for secondary products where composites also are used (such as unfinished cabinets, door cores, and shelving). Be prepared to explain the various differences, uses, and costs of the materials with your club.

Lesson 15

Trees in Urban Ecosystems

Trees and plants require five resources in the correct amounts for good health and normal growth. **Sunlight**, **temperature**, **carbon dioxide**, **water**, and specific **nutrients** are necessary in the right quantities. If any of these "limiting resources" is lacking, the tree may be harmed as severely as if by disease or pest infestation. At best, it will be stressed and weakened.

Different geographic areas of Oregon have different amounts of these resources available. Tree species have adapted themselves to the exact amount of resources available in specific areas and have established stands.

Take water as an example. A lengthy drought usually weakens trees, making them susceptible to insect attack. Repeated dry years will kill trees growing in locations that were only marginally meeting the trees' needs in good years. On the other hand, a flood or excessive wet weather may stress trees used to drier weather. Viruses may thrive in the damp ground, or the tree roots might drown.

Extreme temperatures, light (or lack of), and high or low nutrient levels also will harm and kill trees.

In cities and suburbs, pollution and physical damage can harm trees and may lead to unhealthiness and eventual death. Urban foresters study how to grow healthy trees in human-built environments. In urban yards, parks, and forests, trees may receive water, fertilizer, or be treated with insecticide to improve their health.

It may seem strange to think of trees in the city as part of a forest, yet the vegetation, wildlife, and trees make up a complex urban forest ecosystem. Management of this forest type is the job of urban foresters. It is a challenge, because as many as four trees die for every one planted in an urban area.

Urban trees do more than look pretty. They play an important role in modifying the air temperature in cities. Cities usually are a few degrees warmer than nearby rural areas. Trees provide shade and lower summer temperatures by intercepting, reflecting, and absorbing energy from the sun. Tree leaves also act as tiny air conditioners by giving off moisture that absorbs heat.

Urban trees also obstruct, guide, and deflect wind. Trees planted next to a building create a dead-air space next to the walls. The space acts as additional insulation in winter, decreasing heat loss and reducing energy bills.

Trees also help control soil erosion in cities by reducing the amount and force of rainfall reaching the ground. Tree litter helps slow the surface flow of water which may carry away oil particles and other pollutants.

How many trees...

It takes 20 large city shade trees to offset the noxious emissions generated by an automobile driven 60 miles in 1 day.

When planted in rows or hedges, trees and shrubs absorb, deflect, and diffuse the noise on city streets. When a breeze is blowing, trees help mask city noise by making their own sounds, such as the rustling or whispering of moving leaves and branches.

City trees absorb certain gas pollutants, including ozone. They also reduce particulate pollutants and dust by trapping them with their leaves, stems, and branches. Eventually, the particles are washed away by rain. Trees make the city smell better with their fragrant foliage or flowers.

City parks, with open space, trees, and greenery, fill an important recreational need for city residents. Activities such as walking, playing, jogging, bicycling, picnicking, and team sports are common in city parks. Trees in parks provide homes for squirrels, birds, ducks, insects, moles, and bats.

One of the most important roles of urban trees is **beautification**. Trees improve the appearance of city buildings, private homes, streets, and freeways. Homes and buildings with healthy, attractive trees generally have higher market values than those without trees.

City trees must be tough; concrete, gravel, and glass are not an ideal living environment for a tree. Urban trees also face other problems:

- **Space limitations**—City trees generally have a limited space in which to grow. Streets, sidewalks, buildings, underground utilities, and overhead wires all interfere with tree development.
- **Poor soil**—Urban soil often is drastically different than forest soil. The ground where people live is compacted and has **poor aeration** (not enough oxygen). Necessary nutrients may be scarce in city soils.
- **Pollution**—Where there is a dense population, there is more pollution. In cities, automobiles are the main cause of air pollutants, but other sources such as factories can be an issue. Urban residents often are unaware that herbicides (chemicals) can poison and kill trees. Leaching from road building and repair, building construction, and sewers or cesspools also are potentially hazardous to trees.
- **People pressure**—People hurt trees by digging near or through the roots. During construction or repair work, equipment often compacts the soil around tree roots. A tree's bark and cambium are damaged when lawnmowers and cars hit them. Trees are damaged when humans break branches, carve names in the bark, and hang signs on them.

Activity 15-1

Plant and care for a tree. Prepare a tree diary. Include the species, date planted, how you chose the location, and photographs of the planting process. Take photographs of the tree during different seasons of the year. Include significant events in your tree's life, such as wildlife use, new growth, or when leaves began to fall.

Activity 15-2

Inventory the trees on a neighborhood street that is at least two blocks long, or trees in a park. List the species and the number of trees. Note the number of trees of each species that look healthy and those that appear unhealthy. Describe any maintenance needed (such as trimming a broken limb). Organize a club work day and offer your time to help with the problems you noted.

Fair Display Idea 15-A

Using drawings and/or photographs, prepare a display showing the correct way to plant and care for city trees. Be able to explain your drawings and photos in a display or oral presentation.

Fair Display Idea 15-B

Make a display showing at least five different causes of disease or death in urban trees. Locate and photograph at least two trees that are affected.

Remember to include both natural events and human activities that caused impacts. List possible preventive measures that could have been taken to keep the trees in good health.

Share your information through an oral presentation or fair display.

Fair Display Idea 15-C

Collect photos of stressed or dying urban trees. Find examples of at least five different symptoms or causes of problems. Identify the tree species affected, the probable problem-causing agent, and possible preventive measures. Use this information as an oral presentation or fair display.

Fair Display Idea 15-D

Draw a map to scale of a local area such as a schoolyard or small park. Sketch in existing trees and shrubs and specify the species. Also sketch in trees and shrubs you would add and mark the plants you would remove. On the back of your sketch, explain your choices of plants and their locations. Share your work as an oral presentation or as a fair display.

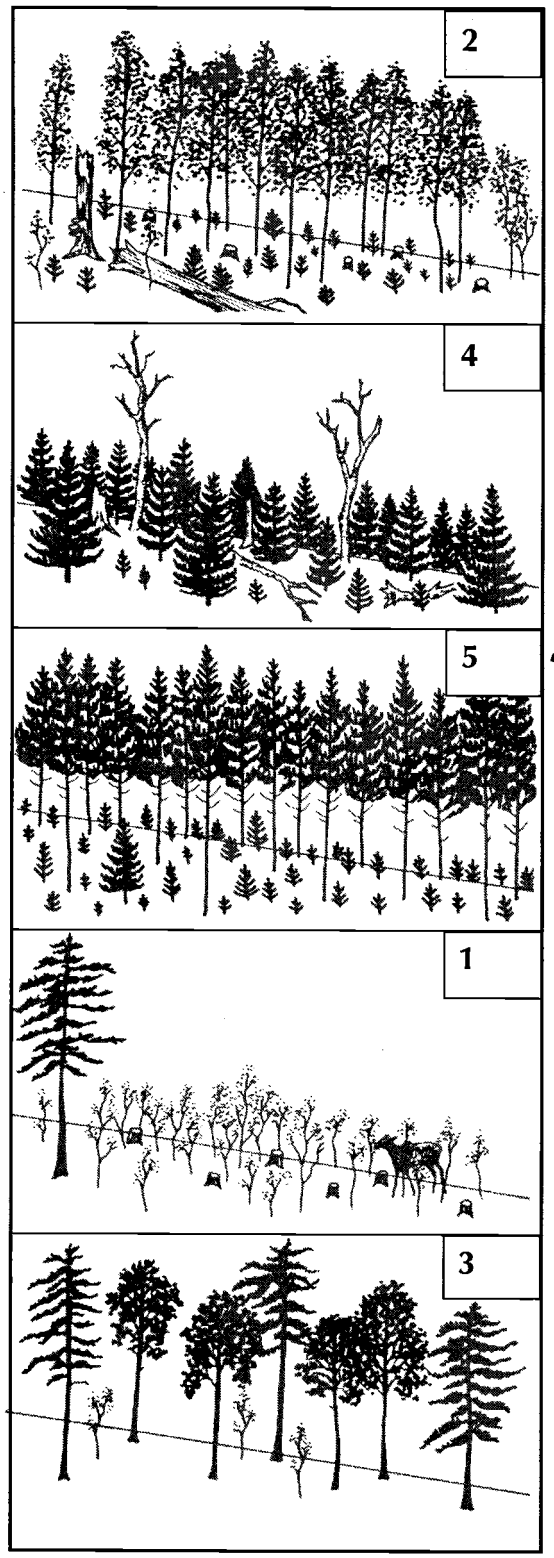
Appendix A

Answers to forestry puzzles

Word Find puzzle, page 3

T	M	H	W	D	S	S	P	N	W	X	N	T	M	N	U	Y	L
R	B	P	H	C	R	N	C	A	R	E	E	R	E	S	P	H	M
S	E	F	N	K	O	F	E	T	Z	P	S	A	V	K	R	I	T
C	A	M	P	I	N	G	B	U	S	I	N	E	S	S	O	K	M
G	U	R	L	R	M	R	P	R	W	K	P	C	S	K	F	I	Y
K	T	R	E	E	S	N	D	A	S	N	Z	N	T	I	E	N	O
T	Y	S	R	N	L	C	L	L	U	M	B	E	R	E	S	G	T
I	O	R	T	M	T	S	F	R	O	S	Z	A	R	R	S	B	Y
F	M	W	N	G	I	W	R	E	P	F	I	S	H	S	I	W	Z
E	C	O	N	O	M	I	C	S	W	O	O	D	G	H	O	V	X
X	E	O	C	C	B	L	R	O	Y	R	L	M	L	E	N	T	S
C	W	D	Q	R	E	D	K	U	L	E	R	E	T	R	A	R	P
L	I	P	L	N	R	F	O	R	E	S	T	R	Y	K	L	E	N
C	L	R	T	L	N	I	D	C	K	T	S	O	T	D	W	N	L
H	R	O	Z	S	L	R	N	E	H	E	H	S	C	W	I	E	J
V	C	D	W	N	E	E	L	S	C	R	R	I	N	B	L	W	I
I	H	U	B	A	L	A	N	C	E	N	W	O	R	C	D	A	G
M	J	C	T	J	C	W	R	I	G	S	A	N	H	F	L	B	E
A	H	T	C	R	I	T	Z	E	M	B	T	T	S	O	I	L	D
K	N	S	H	M	L	M	A	N	A	G	E	R	D	G	F	E	C
E	T	C	L	T	T	N	D	C	P	R	R	S	L	L	E	N	R
I	M	U	L	T	I	P	L	E	U	S	E	H	W	T	H	R	Y

Steps of succession (one possible answer), page 10



*

Practice what you know, page 17

A. pine
B. oak
C. ash
D. maple
E. hemlock

Test your knowledge, page 18

When you remember that trees grow from the ends of the branches and root, you will know that the sign will stay at 5 feet above the ground.

Wood products? Try this!, page 40

Cellophane	Yes	No
Pencil erasers	Yes	No
Car tires	Yes	No
Cattle feed additives	Yes	No
Chewing gum	Yes	No
Ceiling tiles	Yes	No
Ceramic vases	Yes	No
Paint resin	Yes	No
People magazine	Yes	No
Ping pong balls	Yes	No

Appendix B

Extension publications: *The Wildlife Garden*

Ordering instructions

Many OSU Extension Service publications may be viewed or downloaded from the Extension Publications and Videos website. Visit **extension.oregonstate.edu**, then "Publications."

Copies of many publications and videos are available for purchase from Extension and Experiment Station Communications. For prices and ordering information, visit the website or contact us by fax (541-737-0817), phone (541-737-2513), or e-mail (puborders@oregonstate.edu).

Attract Hummingbirds to Your Garden (EC 1541)

Attract Reptiles and Amphibians to Your Yard (EC 1542)

Create a Garden Pond for Wildlife (EC 1548)

Create a Butterfly Garden (EC 1549)

Feed Wild Birds (EC 1554)

Create Roosts for Bats in Your Yard (EC 1555)

Build Nest Boxes for Wild Birds (EC 1556)

Reduce Deer Damage in Your Yard (EC 1557)

Racoon: *Procyon Lotor* (EC 1566)

California Quail: *Callipepla California* (EC 1567)

American Robin: *Turdus migratorius* (EC 1568)

Pacific Chorus Frog: *Pseudacris regilla* (EC 1569)

Rufous Hummingbird: *Selasphorus rufus* (EC 1570)

Gray Squirrel: *Sciurus griseus* (EC 1572)

Glossary of Tree Terms

A

anemometer
An instrument for measuring the speed or force of wind

annual growth ring
A layer of wood—including **springwood** and **summerwood**—grown in a single year

aril
Small, berrylike fruit with a single large seed produced by female yew trees

artificial reproduction
Means of reproducing trees through the use of cuttings or budding and grafting

awl-shape leaves
Long, narrow leaves which taper to a fine point

axis
Main line of growth

B

bole
Trunk of a tree

bracts
A leaf from the axis of which a flower or floral axis arises; also, a portion of a Douglas-fir cone

broadleaf
Trees having broad leaves instead of needles. Often called *hardwoods*

bud scale scar
Scar left where terminal bud scale formed, often visible for several years

C

cambium layer
One-cell thickness of tissue between the bark and wood that repeatedly divides to form new wood and bark cells

conifers
Trees and shrubs, mostly evergreens, including some forms with true cones (pines) and others with arils (yews)

crown
The head of foliage of a tree or shrub-part of a tree bearing limbs or branches, including twigs, leaves, flowers, and fruit

cutting
A short piece of vigorous branch or stem of the past season's growth used in artificial reproduction of trees

D

deciduous
Trees that lose their leaves in the fall

determinate growth
Has terminal and lateral buds; forms buds for next year before the growing season is over

drupe
A one-seeded fruit that remains closed at maturity (for example, a cherry)

E

evergreen
A tree that retains its leaves during the winter

F

foliage
The mass of leaves of a plant

G

genera
Plural of **genus**

genus
Closely related species form a genus; the taxonomic group between family and species

germinate
To begin to grow

graft
A method of reproducing a tree by joining the **scion** from one plant to the rootstock of a like plant (the **host**)

H

habitat
A place or type of site where a plant naturally or normally lives and grows

host
The rootstock to which the **scion** is grafted

hybrid
The offspring of two different species or **genera**. Often has greater vigor than the parent stock

I

increment bore
A tool to help rate tree growth or age

indeterminate growth
Develops only **lateral buds** and never a **terminal bud**. Keeps on growing until cold or drought stops growth

L

lateral buds
Buds growing below or behind the **terminal bud**, generally on the side of the stem

lateral roots
Roots of nearly equal size growing from the bottom of the trunk at ground level or just below

latewood
Portion of annual growth ring formed after springwood formation has stopped (also called **summerwood**)

leader
The primary or terminal shoot above the topmost whorl. Shows growth during most recent growing season

legume
A tree with beanlike seed pods (for example, black locust)

lenticel
A pore in the cork surface of stems, roots, and other plant parts that allows interchange of gases between internal plant tissues and the atmosphere

N

natural reproduction
The reproduction or growing of trees from seed

naval stores
Products such as tar, pitch, turpentine, pine oil, and rosin obtained from pines and other coniferous trees

P

phloem
Inner bark. The principal or main tissue which carries food or sugar made in the leaves

photosynthesis
Process through which the leaves, with the aid of heat and light, make food from water, soil nutrients, and carbon dioxide

pioneer tree species
The first trees that regrow in a forest. Shade-intolerant

pith
Small core of soft, spongy tissue at the growth center of the stem

pole
A young tree with a diameter of 3 to 6 inches (7 to 15 cm) in the small pole stage and a diameter of 6 to 12 inches (15 to 30 cm) in the large pole stage

pome
A fruit consisting of a central core with usually five seeds enclosed in a capsule and an outer fleshy layer (for example, an apple)

R

radial
Wood growth rings developing around a central axis

resin blisters
Lumps or blisters of a yellowish to brown, natural organic substance formed by plant secretions

S

samara
One-seeded, winged fruit (for example, of ash, elm, or maple)

sapling
A young tree's period of growth from the time it is 1 inch (2.5 cm) in diameter and 6 feet (2 m) in height until it is 3 inches (about 7 cm) in diameter and 15 to 30 feet (4.5 to 9 m) in height

scion
A vigorous twig or cutting used in grafting to artificially reproduce trees

seedling
Stage in a tree's growth from germination to the point where it is 6 feet (2 m) high and 1 inch (2.5 cm) in diameter

sheath
Annual layering of wood over the entire tree added by growth activity of the **cambium**. The top of each sheath shows the height of the tree at the end of a given growing season

silviculture
The development and care of forests

S, *continued*

species
Trees having similar characteristics and showing close relationship to each other

springwood
The part of the annual growth ring formed during the early part of the season's growth

sprout
New stems starting from stumps or roots

stomata
Small openings through which the leaf takes in air

stratify
To store seeds in layers alternating with moisture-holding materials such as earth or peat

sucker
New growth from buds hidden in the bark and previously shaded by other growth. May occur as a result of severe trimming of the crown

summerwood
Portion of **annual growth ring** formed after **springwood** formation has stopped. Often called **latewood**

T

tap root
A deep central or primary root growing vertically downward

terminal bud
Growing at the end of a branch or stem. Buds below or behind are called **lateral buds**

W

whorl
The layering or grouping of branches at the beginning of each year's growth

X

xylem
The water conduction, strengthening, and storage tissues of branches, stems, and roots

Resources

Forest Fact Book, Oregon Forest Resources Institute (OFRI), Portland. 2003. 32 pages.

Forests Forever, Forest Resources Advanced Member's Manual by Mary Kroll and Robert Hansen. Publication #BU-3490, Minnesota Extension Service, University of Minnesota, St. Paul. December 1992. 58 pages.

Indians, Fire and the Land in the Pacific Northwest by Robert Boyd (ed). Oregon State University Press, Corvallis. April 1999. 320 pages.

Manual of the Flowering Plants of California by Willis Lynn Jepson. University of California Press, Berkeley. 1951. 1,238 pages.

Manual of Oregon Trees and Shrubs by Warren R. Randall, Robert F. Keniston, Dale N. Bever, and Edward C. Jensen. OSU Bookstores, Inc., Corvallis. Reprinted June 1998. 316 pages.

Oregon by E. Bingham. Gibbs-Smith Publisher, Layton, Utah. 1985. *Out of print.*

Textbook of Dendrology by William M. Harlow (ed.), Ellwood S. Harrar, James W. Hardin, and Fred M. White. 8th edition, McGraw-Hill Co., Inc., New York. January 1996. 534 pages.

The Oregon Forest Notebook, Oregon Forestry Education Program (OFEP), Oregon State University College of Forestry, Corvallis. 1997. *Out of print.*

Trees + Me = Forestry, Forest Resources Intermediate Member's Manual by Mary Kroll and Robert Hansen. Publication #BU-3408. Minnesota Extension Service, University of Minnesota, St. Paul. April 1991.

Trees to Know in Oregon by Edward C. Jensen and Charles R. Ross. EC 1450, Oregon State University Extension Service, Corvallis. Revised June 2003. 132 pages.

Treetop, 4-H Forest Resources Beginner Guide by Mary Kroll. Publication #BU-6201. Minnesota Extension Service, University of Minnesota, St. Paul. June 1994.

Acknowledgments

Maps and text of Oregon's seven forest regions (page 5) reprinted with permission from the *Forest Fact Book*, Oregon Forest Resources Institute, Portland, Oregon.

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