INTRODUCTION TO RIPARIAN AREAS

Plants along the streambed influence the entire stream ecosystem. This green zone is called a riparian area and has several unique properties. A riparian area is linear, has a water transport channel and floodplain, and is interrelated with upstream and downstream ecosystems. Riparian habitat is a combination of three areas: each is distinctive and contributes to the entire ecosystem:

Aquatic area
The aquatic area of streams, lakes, and wetlands is generally wet. During dry periods, aquatic areas have little or no water flow. Any side channels or oxbows containing freshwater ponds are included in this area.

Riparian area
The riparian area is a terrestrial zone where annual and intermittent water, a high water table, and wet soils influence vegetation and micro-climate. Since these areas are next to water, they tend to have more moisture, and plants and soils that reflect wetter conditions. For example, they may have more tree species such as cottonwoods or alders that need more saturated soils.

Area of influence
This is a transition area between a riparian area and upland cover. An area of influence has soil moisture and is characterized by a noticeable change in plant composition and abundance. Trees in this area contributes shade, leaves, woody debris and insects to the stream. In the Pacific Northwest, the area of influence includes ground covers, shrubs, and understory trees (usually deciduous) on the floodplains, and canopy trees (usually coniferous) on hillsides. This stair-stepping of vegetation provides a variety of wildlife habitat.

Role of Riparian Vegetation
Riparian vegetation provides cover for aquatic and terrestrial animals. Shade created by the riparian vegetation moderates water and air temperatures. This vegetation limits water contamination, slows water velocities, and filters and collects large amounts of sediment and debris. Uncontrolled sediments can kill fish and destroy spawning areas.

Riparian Vegetation Site Component Function		
Above ground-Above channel	Canopy and stems	Shade- controls temperature and in-stream photosynthetic productivity Source of large and fine plant debris Source of terrestrial insects
In channel	Large debris derived from riparian vegetation	Control routing of water and sediment Shape habitat—pools, riffles, cover Substrate for biological activity
Streambanks	Roots	Increase bank stability Create overhanging banks--cover
Floodplain	Streams and low-lying cover	Retard movement of sediment, water, and floating organic debris in flood flows

Source: William Meehan et al., influences of Riparian Vegetation on Aquatic Ecosystems With Particular References to Salmonid Fishes and Their Food Supply, 1977, p. 137.

Stream food chains depend on organic debris for nutrients. In small headwater streams, 99 percent of the energy for organisms comes from the vegetation along the stream, and only 1 percent from photosynthesis. The leaves, needles, cones, twigs, wood, and bark dropped into a stream are a storehouse of readily available organic material that is processed by aquatic organisms and returned to the system as nutrients and energy.

A diverse population of insects depends on this varied food base. Sixty to 70 percent of the debris is retained and processed in the headwaters by bacteria, fungi, insects, and abrasion, with very little leaving the system until it has been processed.

Riparian areas have a high number of edges (habitat transitions) within a very small area. The large number of plant and animal species found in these areas reflects habitat diversity. Since they follow streams, riparian areas are linear, increasing the amount and importance of edge effect. Extensive edge and resulting habitat diversity yield an abundance of food and support a greater diversity of wildlife than nearly any other terrestrial habitat.

Floodplains

Floodplains are an important part of a riparian area. Floodplain vegetation that shades or directly contributes material to a stream is considered part of the riparian area. Stream channels rely on natural flooding patterns. Frequency of flooding and groundwater supply are the major factors controlling the growth of floodplain trees.

Floodplains and backwaters act as reservoirs to hold surplus runoff until peak floods are past. This controls and reduces downstream flooding. Floodplains also spread the impact of a flood over a larger area as vegetation helps collect debris and sediment.

Composition of riparian plant communities depends on the water pattern (fast or slow moving or dry or wet periods). Both wet and dry phases are necessary in this area to complete the stream's nutrient cycle and food chain. Flooding is critical to the exchange of nutrients and energy between the stream and the riparian area.

When healthy, vegetated banks in the riparian area act as natural sponges. They help maintain soil structure, allow increased infiltration, and reduce bank erosion. Vegetated streambanks also contribute to aquifer (groundwater) recharge. Precipitation is filtered through the riparian soils and enters underground reservoirs called aquifers. Good cover slows the flow and increases percolation into underground aquifers. Stored water is then available during drier periods to maintain and improve minimum flow levels. A major benefit of this aquifer recharge is maintenance of year-round streamflow.

Riparian vegetation uses large amounts of water in transpiration. Often, vegetation needs the most water during the period of lowest streamflow. At these times vegetation may actually reduce streamflow.

Soils in riparian areas and floodplains

Soil types in both riparian areas and associated floodplains can tell a lot about the current and historic conditions of the stream. In addition to providing helpful information about current soil composition, an understanding of soil types can reveal the location of historic streambeds, floodplain location, and moisture content of the soil. Examining the types of rock materials found within the soil can unearth gravel, cobble, Sand, loam, or clay. Certain soil types such as gravels and cobbles might indicate that you are standing on an ancient floodplain.

Wildlife in riparian areas

Riparian ecosystems provide the essentials of wildlife habitat-food, water, and cover. In general, the area within two hundred yards of a stream is used most heavily by wildlife. ln western Oregon, of 414 known species of wildlife, 359 use riparian ecosystems extensively and 29 species are tied exclusively to this area. While riparian areas cover less than one percent of the land in eastern Oregon, 280 of 379 species use this area extensively.

Riparian areas provide migration routes and corridors between habitats for many animals. The riparian area provides cover, food, and water during these movements. Woody plant communities in the riparian area provide cover, roosting, nesting, and feeding areas for birds; shelters and food for mammals; and increased humidity and shade (thermal cover) for all animals.

Birds are the most common and conspicuous form of wildlife in a riparian ecosystem. In this important breeding habitat, as many as 550 breeding pairs have been found per l00 acres. Bird density is just one indicator of the productivity of a riparian area.

Mammals of all sizes are found in riparian areas. Many rodents are parts of various food chains. Some, such as beaver, may modify riparian communities. Amphibians and reptiles are another indicator of riparian quality. Nearly all amphibians depend on aquatic habitats for reproduction and overwintering.

Certain turtles, snakes, and lizards also prefer riparian ecosystems. Animal populations in riparian areas are affected by the size and diversity of available habitat. Adjacent land-use activities may have a direct impact on wildlife population size within a riparian area. Fish populations can be an indicator of watershed and riparian ecosystem health. Large woody materials, such as fallen trees and limbs, create pools, and protective cover-necessary components of fish habitats. This woody debris also increases the diversity of invertebrates, which are a basic oart of the food chain on which fish depend.

People in riparian areas

Since the land along streambanks and floodplains is often fairly flat, riparian areas are attractive locations for roads. Road building may increase sedimentation, which can adversely affect aquatic life, especially fish. Runoff from roads can carry oil, antifreeze, and other contaminants into the stream. Road construction can also damage valuable wildlife habitat. Traffic, a hazard in itself, may disturb or displace many wildlife species.

Roads probably have a greater and longer lasting impact on riparian areas than any other human activity. Routes should be selected and designed with careful consideration of potential long-term impacts.

Riparian vegetation is often cleared for farming purposes. This often weakens bank structure, making it more susceptible to erosion and a contributor to sediment deposition downstream. Landowners who convert riparian areas to farmland for short-term gains in agricultural production may lose in the long run.

The loss of vegetation on stabilized banks could cause the stream to wash away that same valuable land during periods of high flow.

Livestock, like wildlife, area attracted to shade, water, and forage in riparian areas. lf mismanaged-allowing the area to be grazed excessively or at the wrong time-livestock can severely affect the riparian area's value. Livestock can compact the soil near the water, reducing its infiltration capacities. When riparian vegetation is damaged-either by trampling or overgrazing-shading is reduced, erosion potential is increased as streambanks slough away, water tables are lowered, and water quality is affected. Animal wastes may also threaten water quality.

Livestock can be managed, thus the impact of livestock can be reduced by controlling access and grazing levels along stream banks. By utilizing good management techniques, ranchers can actually increase economic gains as well as enhance the value of their property.

Residential and commercial development has occurred near riparian areas throughout history. Development in these sites has generally degraded the value of the resources. Degradation has included filling and altering of stream channels, removing vegetation for building construction, and paving large amounts of land for roadways.

Some problems associated with development can be avoided by good planning and site design. Residential communities can be planned with riparian area values in mind. Construction sites can avoid steep slopes, wetlands, and sensitive biological sites. Areas that offer the amenities of a relatively healthy riparian area often have an increased real estate value.

Construction of campgrounds and recreation sites in riparian areas encourages use by anglers, birdwatchers, hikers, boaters, and others. This use, especially irresponsible acts like littering or erosion caused by improper use of off-road vehicles, may conflict with the welfare of wildlife and reduce water quality.

Streams and their riparian areas are the source of domestic water for many cities. High water quality is important for these uses. To maintain it, riparian areas must be carefully managed. Mining in and near streams has severe impacts on riparian ecosystems. Mining often increases sedimentation and disrupts spawning areas by moving large amounts of gravel, rock and soil. In addition, mining may introduce poisonous or toxic heavy materials into streams.

Forest canopy in riparian areas

The upland forest that sits adjacent to the riparian area along a stream provides an important function. Although it is not directly connected to the stream, the upland area that contains taller trees also provides valuable shade that keeps streams cool. A dense overhead canopy cover can shade the riparian area as well as the stream channel to reduce the potentially harmful effects of water warming from the sun. By assessing the canopy cover, or density of shading that is associated with upland trees, instream and riparian health can be better understood.

Timber harvest in riparian management areas

Timber harvest in riparian areas requires careful management. Until the Oregon Forest Practices Act, which regulates state and private land, was enacted in 1971, clearcuts commonly went to the stream's edge. Ln addition to removing trees that shade streams, the understory and ground cover were heavily damaged. A future source of woody debris in streams was eliminated and erosion increased. Historically, direct destruction of spawning grounds occurred by dragging logs through streams, building roads along banks, and transporting logs down streams and rivers. These practices affected water flow, bank erosion, siltation, and temperature fluctuations.

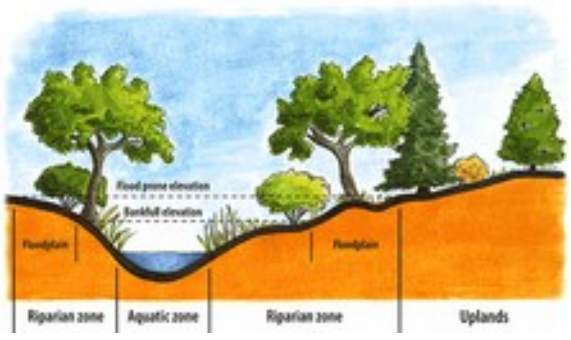
Modern forest management calls for the maintenance of vegetation buffer strips along the sides of streams, lakes, estuaries, and wetlands. These riparian management areas (RMAs) are required by the Oregon Forest Practices Aci, the State Board of Forestry, and federal management agencies because they protect fisheries, domestic water supplies, and recreational water use.

A riparian management area includes both sides of a stream and usually includes the riparian area and riparian area of influence. RMA widths and harvest regulations are based on a stream's size and beneficial use as habitat for salmon, steelhead and bull trout and for recreational fishing. Widths of RMAs range from 50-100 feet. Twenty feet of the RMA that borders the stream is generally a no tree harvest zone, beyond this point harvests are allowed provided that tree stocking standards are met. All downed and snag trees within the entire RMA are retained for wildlife habitat, provided they do not cause a safety hazard.

All streams are protected by the Oregon Forest Practices Act although not all require RMAs. To qualify for protection, streams must fit guidelines set by the Oregon Forest Practices classification system. Under the Oregon Forest Practices Act, all forest activities-including road building, timber harvesting, chemical use, and slash disposal-must be planned and completed in a manner that protects riparian areas, as well as other forest resource sites. Other Oregon Forest Practices Act rules that impact stream health address logging on steep slopes, pesticide application, wood retention on clearcuts and required reforestation. The Act is enforced and records show that only a very small number of forest operations are conducted in violation of the Act's rules.

The Oregon Forest Practices Act provides other regulations for responsible timber harvest management. Seventy-five percent of the initial shade potential that existed over an aquatic area must remain to protect stream water temperatures. Fifty percent of the original tree canopy material must be left to provide organic material essential to a stream and a source of insects for fish food.

All downed timber in an aquatic and riparian management area is to be left to provide instream structure as habitat for fish and aquatic insects and den sites or burrows for other forms of wildlife. All snags (dead standing trees) not designated as a safety hazard, as well as future down logs or instream woody debris, must be left to provide habitat for insects, birds and small animals. Live conifer trees must be left in the riparian management area, preferably in clumps, to provide better wildlife habitat.



RIPARIAN ECOSYSTEM FIELD STUDY

Objectives

The objective of this station is to provide students with an opportunity to:

1) Explore the riparian and aquatic ecosystems in the riparian area,

2) Understand the link between riparian and stream ecosystems with the focus on the four most important components that riparian areas provide to create fish habitat and maintain water quality:
   a. Shade
   b. Food sources
   c. Erosion control
   d. Instream structure

3) Consider the intersection of the riparian zone with the upland forest.

Activities

There are different ways to explore riparian areas. The following six activities can be used (in any combination, feel free to use one or many) to give students an awareness of what the riparian area of a stream "looks like," and how the components of the riparian area affect Salmon. For instance, students may use the Riparian & Aquatic Area Survey to gain a general idea of the components that constitute the riparian area, then use the Riparian Mapping Activity to illustrate specific components of the riparian area that they think are important.

The Soil Survey activity helps students to examine what is right under their feet and the Canopy Cover Survey guides them to look up! By evaluating what is above and below them, students are encouraged to consider how all elements of the riparian zone interact and play important roles in the creation of healthy habitat conditions for salmon and steelhead.

Teaching Tips

Through each of the above activities, (or through any combination of the activities) students should leave the Riparian Ecosystem station with a basic idea of what the riparian area is, how it relates to salmon, and why healthy riparian ecosystems are important to the health of both the streams and the animals that live there.

In addition, and wherever possible, information that connects to the other three stations (water quality, macroinvertebrates and fish biology) should be emphasized so as to paint the most complete picture possible for students, so that they understand that the concepts covered at each of the four stations are interrelated.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
- Observe objects, events and patterns and record both qualitative and quantitative information.
- Distinguish between factual statements and inferences.
- Develop and use classification systems.
- Construct models, simulations and metaphors to describe and explain natural phenomena.
- Use mathematics as a precise method for showing relationships.
- Form alternative hypotheses to explain a problem.

2. Manifest Scientific Attitudes and Interests
- Raise questions about objects, events and processes that can be answered through scientific investigation.
- Maintain an open and questioning mind toward ideas and alternative points of view.
- Evaluate scientifically related claims against available evidence.

3. Demonstrate Understanding of Science Concepts, Principles and Systems
- Know and explain science information specified for the subject being studied.
- Apply principles and concepts of science to explain various phenomena.
- Solve problems by applying science principles and procedures.

4. Communicate Effectively Using Science Language and Reasoning
- Provide relevant data to support their inferences and conclusions.
- Use precise scientific language in oral and written communication.
- Use proper English in oral and written reports.
- Use reference sources to obtain information and cite the sources.
- Use mathematical language and reasoning to communicate information.

5. Demonstrate Understanding of the Nature of Science
- Science is a way of knowing that is used by many people, not just scientists.
- Understand that science investigations use a variety of methods and do not always use the same set of procedures; understand that there is not just one "scientific method."
- Science findings are based upon evidence.
- Understand that science conclusions are tentative and therefore never final.
- Understandings based upon these conclusions are subject to revision in light of new evidence.
- Understand that scientific inquiry is characterized by a common set of values that include logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results and honest and ethical reporting of findings. These values function as criteria in distinguishing
- between science and non-science.

RIPARIAN MAPPING & PROFILE ACTIVITY

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Objective

To provide students with an opportunity to 1) creatively explore the riparian and aquatic zones, and 2) identify and discuss important differences in the components of the riparian area that they observe from a "birds-eye-view" or "cross section".

Outcome

Students should leave this activity with an awareness of what the riparian and aquatic zones of a stream look like and some specific examples of its important components.

Materials

Riparian Area Profile and Mapping Data Form (data form is available at the end of this section and in the Field Trip Data Forms section) Pencils

Procedure

1) Give each student a copy of the Riparian Area Profile and Mapping Data Form.

2) Giving them clear boundaries and ask them to locate an area where they can draw individually.

3) Give the students 10 -15 minutes to draw a map or profile.

4) Regroup the students to share their map or profile and discuss the important components of each.

Discussion

-What features of this riparian area do you think are the most significant? Why?

-What important features seem to be missing? How does this affect the stream (and salmon)?

-ln what ways do salmon affect this riparian area?

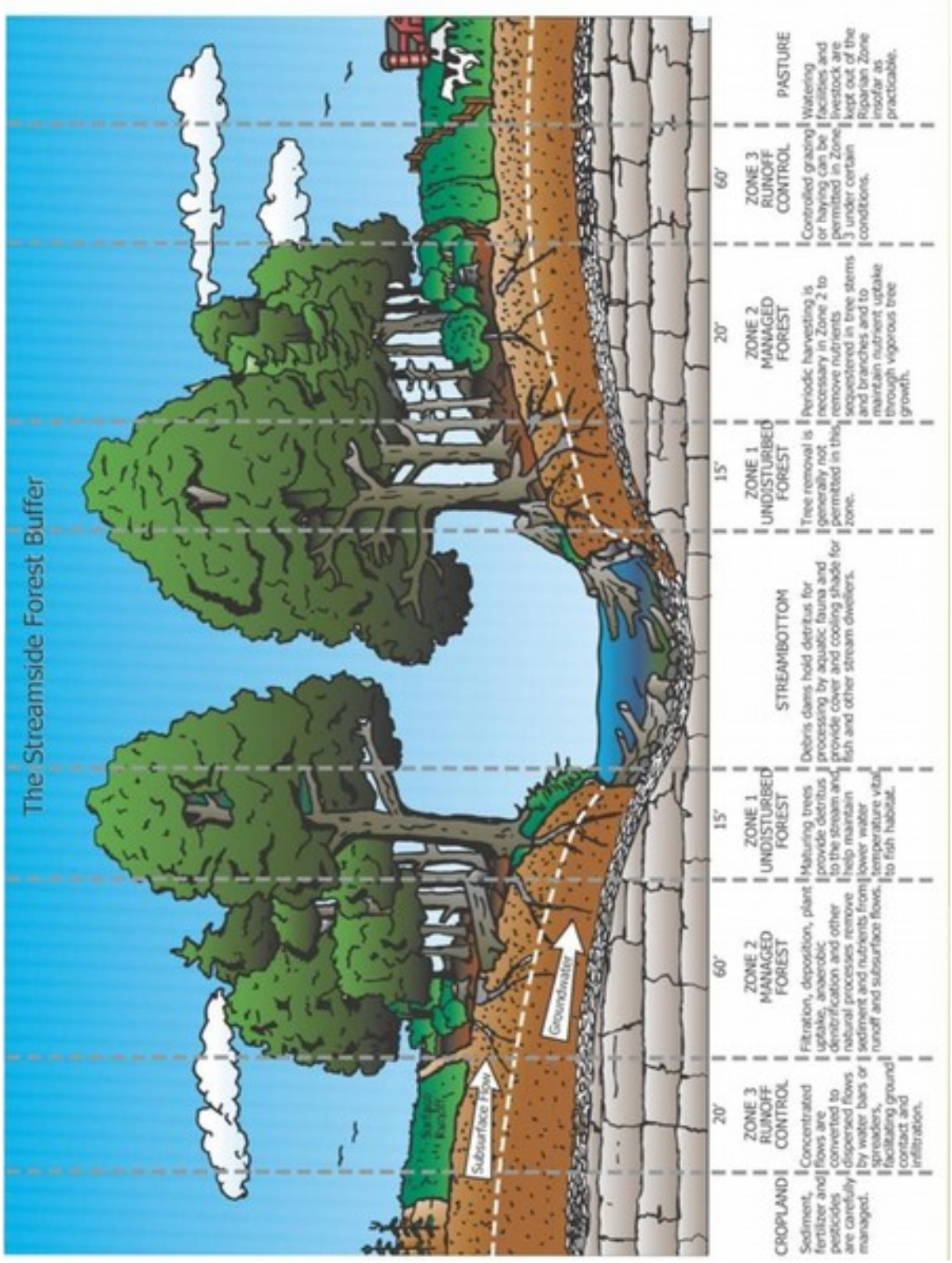
-How is this riparian area similar to riparian areas near your school? How is it different?

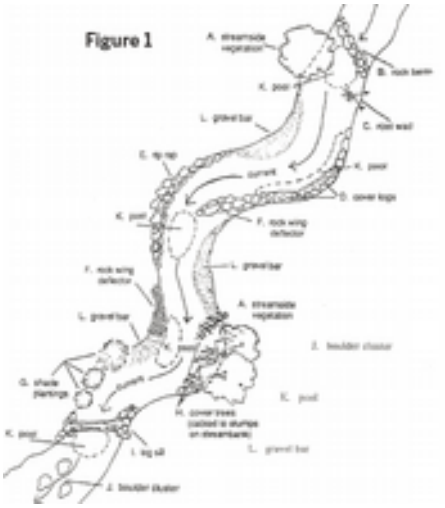
-What helps us understand how well a stream bank resists erosion?

-How does the canopy cover affect the physical properties of the stream itself?

-How do humans affect the health of the riparian zone?

-Why would a stream area be a good habitat for wildlife?


The Streamside Forest Buffer
Subsurface Flow
Groundwater
CROPLAND
Sediment, fertilizer and pesticides are carefully managed.
ZONE 3 RUNOFF CONTROL
Concentrated flows are converted to dispersed flows by water bars or spreaders, facilitating ground contact and infiltration.
20'
ZONE 2 MANAGED FOREST
Filtration, deposition, plant uptake, anaerobic denitrification and other natural processes remove sediment and nutrients from runoff and subsurface flows.
60'
ZONE 1 UNDISTURBED FOREST
Maturing trees provide detritus to the stream and help maintain lower water temperature vital to fish habitat.
15'
STREAMBOTTOM
Debris dams hold detritus for processing by aquatic fauna and provide cover and cooling shade for fish and other stream dwellers.
ZONE 1 UNDISTURBED FOREST
Tree removal is generally not permitted in this zone.
15'
ZONE 2 MANAGED FOREST
Periodic harvesting is necessary in Zone 2 to remove nutrients sequestered in tree stems and branches and to maintain nutrient uptake through vigorous tree growth.
20'
ZONE 3 RUNOFF CONTROL
Controlled grazing or haying can be permitted in Zone 3 under certain conditions.
60'
PASTURE
Watering facilities and livestock are kept out of the Riparian Zone insofar as practicable.

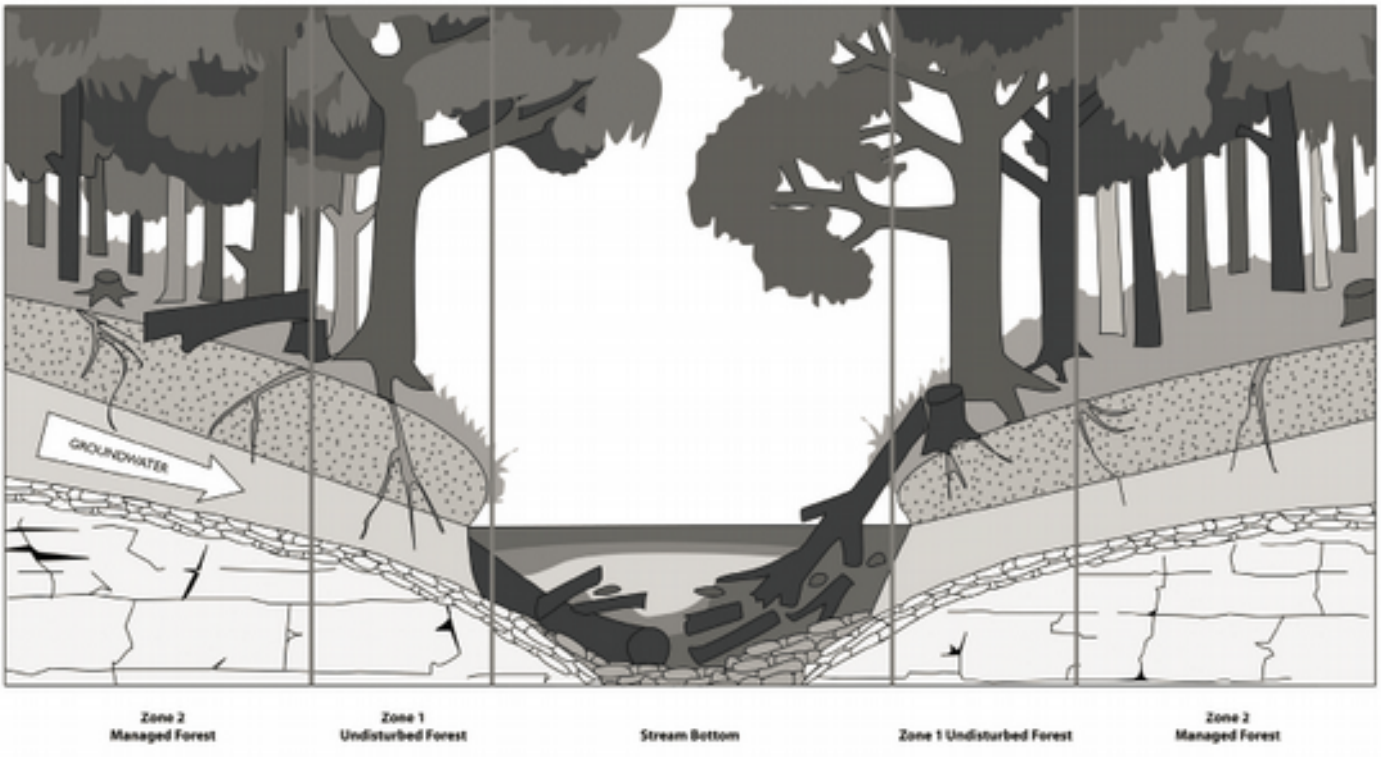


RIPARIAN AREA MAPPING DATA FORM

Directions:
Use this space to make a map of the part of the stream that you think is important (imagine the stream from a “bird’s-eye-view”).
Be sure to map both the aquatic and riparian zones.
Draw in all the features you think are important.

RIPARIAN AREA MAPPING DATA FORM

Pick a place along the stream that you particularly like. Draw a profile of this place. Include the near bank, stream, and opposite bank in your drawing. If you aren't sure how to do this, ask your adult group leader. Show the water level in your drawing. Now, draw in features of the riparian zone that you think are important to salmon.



RIPARIAN METAPHOR ACTIVITY

Objective
Students will understand what a riparian area does & why it is important.

Method
As you explain each of the riparian area functions under #2, pull out the corresponding "metaphor item" and have a student hold it. Ask the students what the item is good for—ie: a sponge is good for soaking up water. Then explain how a riparian area provides a similar benefit to the stream & its inhabitants.

You can also pass out all of the objects and have pairs of students identify the purpose of the item and how it relates back to a riparian area.

Riparian areas serve a number of important functions that help keep a stream & its inhabitants healthy.

1. What is a riparian area?

    It is the transition area between the stream and the land.

    The riparian area is wetter than the upland, but drier than the stream

    The riparian area is made up of soil, rocks, and most importantly, plants that don't mind getting their feet wet part of the year.

2. What does a riparian area do, and why is it important?

    SPONGE—Like a sponge, the riparian area soaks up moisture. When it rains a lot, some of the runoff is absorbed by the plants & soil in the riparian area.

        This is important for two reasons:

        - It keeps water from rushing down the slope, causing erosion.

        -It keeps water stored up for later in the summer & fall when there isn't as much rain filling up the stream to water the plants.

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RIPARIAN METAPHOR ACTIVITY

BELT—The purpose of a belt is to hold up your pants & keep them from falling down. Similarly, the roots of the ground plants, hardwoods, & conifers in a riparian area intertwine to hold up the sediment (cobble rock & soil) & keep it from falling down into the creek where it would make the water muddy (turbid).

COFFEE FILTER—A filter separates the stuff you want from the stuff you don't want. When it rains, water washes down from roads, buildings, orchards, and crop fields, carrying toxins with it. Fortunately, when you have a riparian area, many of these pollutants get trapped in the plants & soil where they are stored or "neutralized" instead of going directly into the stream where they may cause harm to fish & macroinvertebrates.

UMBRELLA or VISOR—An umbrella/visor provides shade. In the same way, tall leafy shrubs & trees shade the stream from the HOT sun. This is really important for animals like salmon, which require their water COLD in order to survive. The riparian area provides habitat for both land & water animals alike!

PICTURE of HOUSE—A house is the place where you live. Another word for the place you live is habitat, where an animal can find food, water, & shelter. In the Pacific NW, 85% of all land animals (vertebrates) use a riparian area at some point in their life to find food, water, and/or shelter (WDFW). Can you think of any animas that might use the riparian area here as habitat?

JAR of PEANUTS—Food: it's what gives us energy. Without a riparian area, some animals in the stream would not get food.

-What do macroinvertebrates eat?
Answer: Fallen leaves and organic matter

-Where does all of that organic matter come from?
Answer: From plants living in the riparian area.

-What other animals, in turn, eat the macroinvertebrates found in freshwater streams?
Answer: Juvenile salmon, among others! Riparian areas are important for maintaining the food chain in the stream.

RIPARIAN SCAVENGER HUNT

You will have 15 minutes to find or answer as many of the following things as possible. Draw or describe what you find that fits each category.

- ☐ Find 3 different types of cover that help protect fish from predators
- ☐ How many different kinds of evergreen trees are there in this area?
- ☐ How many kinds of berries can you find? (do not eat them!)
- ☐ Find three different kinds of seeds or cones.
- ☐ Is there an eroded stream bank in the area? If so, what do you think caused the erosion?
- ☐ Find three types of wildflowers
- ☐ Where do you find lichens in this area?
- ☐ Find a sword fern.
- ☐ Find a non-native plant.
- ☐ Is there any evidence that beavers use this area? If so, what is it?
- ☐ Find an insect that lives on the ground and an insect flying in the air
- ☐ Find an insect on the bark of a tree or on a leaf
- ☐ Find three different types of evidence that birds occur in the area.

RIPARIAN AREA TRANSECT ACTIVITY

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Objective

To provide students with an opportunity to 1) explore the riparian area of a stream, and 2) identify and discuss differences in the components of the riparian area that they observe.

Outcome

Students should leave this activity with an awareness of what the riparian area of a stream "looks like," and some specific examples of its components.

Materials

1OO-foot tape measure
1S-foot rope with a ring attached in the middle of its length
Instructions
Plant and tree identification books or charts.

Procedure

Look for a place where students can get down to the shoreline safely. Students will set up a transect and count conifer and hardwood trees, shrubs and percentage of land occupied by grasses along the transect at each location.

1) Set the transect. Organize the students into pairs. Assign one pair to stretch the transect tape measure from the water's edge or a clearly discernible high water line perpendicular to the stream into the riparian area. They should hold the two ends so that the tape is stretched out to its full 100'length.

The tape is divided into five parts, each20 feet long. These divisions arbitrarily mark off five 20-foot "zones" in the riparian area, "Zone 1:', "2:', "3," etc

2) Count trees. Assign one pair to place the ring on the 1S-foot rope over the transect tape. Start from the 0-foot mark, and walk parallel to the transect tape towards the 100 foot mark. Each time they reach one of the 2O-foot marks, have them check to see if the rope touches any trees, shrubs, etc, by using the rope to measure out a circle with a diameter of 15 feet (an area with a radius of 7.5 feet, with the attached ring as the centerpoint- see diagram below.) Identify any plants within the diameter of the area that the rope covers. Then tell the recorders (see Data Sheet) whether the plants are conifers or hardwood trees; shrubs; or types of grasses, and the zone that they are in.

RIPARIAN AREA TRANSECT ACTIVITY

3) Record data. Assign one pair to record data on the data sheet provided. The recorders should fill out the information about the transect site at the top of the data sheet, add their names at the bottom of the sheet, then record numbers and types of conifers, hardwood trees and shrubs, and percentage of land covered by grass as this information is called out.

Additional comments about dead wood, side channels, etc., may also be recorded. Either during the data collection or after, the recorders enter data on the graph on the reverse of the data sheet. They do this by filling shading in the box above the appropriate zone in either the conifer or hardwood category. Shade one box per tree tallied.

Riparian Area Transect Discussion Questions

Ask the group to review the data and graph, and look for patterns and changes.

-Are there any differences in the numbers and species of plants that were found the various "zones"? *What may account for these differences?*

Depending on the site, students may find that grasses and shrubs are most dominant in the zones closest to the stream, with hardwoods primarily growing in the "middle zones" and conifers growing farthest away from the stream. This trend is due to the different requirements that each species has for the amount of water it needs to survive and grow.

-**How does the riparian area influence the stream?** *Riparian vegetation provides cover for aquatic and terrestrial animals. Shade created by the riparian vegetation moderates water and air temperatures. This vegetation also limits water contamination, and provides the organic debris that is a major food source for aquatic and terrestrial insects. In-stream wood slows water velocities, provides protection for juvenile fish and can protect spawning areas from being scoured out during high-water events, and filters and collects large amounts of sediment and debris.*

-**How does the stream influence the riparian area?** *The stream provides crucial water to the many various species of plants that rely on large amounts of water for growth. Seasonal flooding or high-water events may deposit sediment and nutrients into the riparian area. The stream is also a water source for the many types of wildlife that live in riparian areas.*

-**What do salmon provide to the riparian area?** *Nutrients from salmon carcasses provide food sources for many animals (both aquatic and terrestrial) in the riparian area. Trees and plants also obtain nutrients from carcasses.*

CANOPY COVER SURVEY ACTIVITY

Objective

To introduce students to the concept of a forest canopy and guide students to understand the role that the forest canopy plays in the health of the stream and fish habitat conditions.

Outcome

Students will understand what is a forest canopy.
Students will conduct a survey to determine the density of the forest canopy at their study site.
Students will be able to make connections between forest canopy cover and stream health.

Materials

Spherical Densiometer
Compass
Canopy Cover Data Form

Procedure

With a partner take one sample of canopy cover in each cardinal direction.
1) lmagine your Spherical Densiometer (SD) has letters in each square proceeding alphabetically corresponding to the data sheet.
2) Hold the SD 12"-1B" in front of your body at elbow height, so that operators head is just outside of grid area. Do your best to keep the SD steady by utilizing the provided level.
3) Tell your partner which lettered boxes to fill in based on the boxes covered more than 50% by shade. *(Your partner may want to hold the data form up next to the SD to make it easy to relay the letter of the shade covered boxes)*
4) Repeat step 3 for North, South, East and West.
5) Add shaded boxes for all directions, the result is your estimated canopy cover for your location.

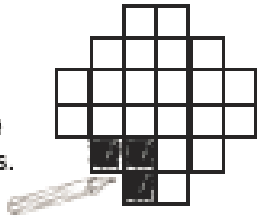
Overview/Discussion

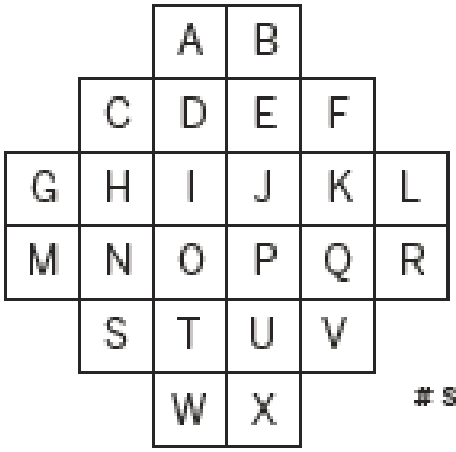
The overhead canopy cover in a forest plays an important role in affecting the amount of sunlight that reaches either the forest floor or the stream channel. ln the forest, when a large amount of sunlight is allowed to penetrate areas of the canopy, a dense understory can develop. Along a stream, when a large amount of sunlight breaks through the forest canopy, the water in the stream may heat up more rapidly which can create conditions that are inhospitable for fish and other aquatic species. Scientists classify forest canopies as open (10-39% of the sky is obstructed by tree canopies), moderately closed (40-69% of the sky is obstructed by tree canopies) or closed (70-100% of the sky is obstructed by tree canopies).

A densiometer is used to measure the amount of light that penetrates the forest canopy. A simple densiometer is a device with a mirror apparatus inside that reflects the canopy above. lt works somewhat like a periscope. The viewer sees a mirror image above, which allows him/her to estimate how much of the sky above is blocked by tree canopies

CANOPY COVER DATA FORM

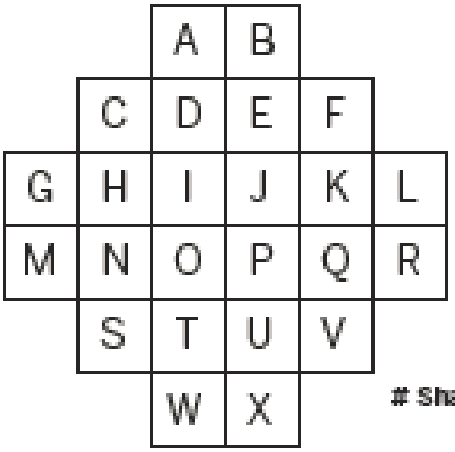
Directions: Working with a partner, take one sample of canopy cover in each cardinal direction using the spherical densiometer. Once you have the densiometer positioned correctly, fill in the areas on this worksheet that are covered with canopy shade. **If the square is 50% shaded or more, fill in the entire square.** Record the number of shaded boxes for each sample. Add up the numbers for all four samples. The result is your estimated percent canopy for your location.





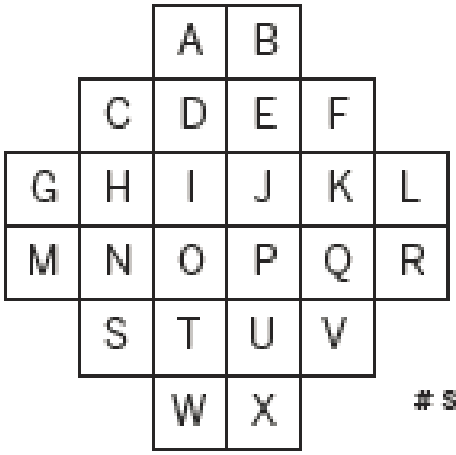
North

Shaded Boxes _____



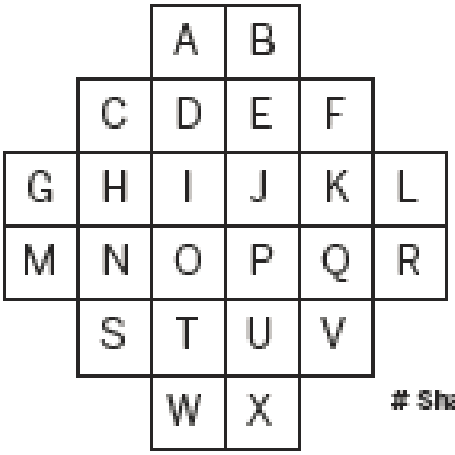
East

Shaded Boxes _____



South

Shaded Boxes _____



West

Shaded Boxes _____

_____ **North** + _____ **East** + _____ **South** + _____ **West** = _____ ***Estimated % Canopy***

IDENTIFICATION OF NORTHWEST NATIVE TREES

The following native trees are commonly found in areas west of the Cascades. Their presence and placement can help define riparian zones characterized by plant communities arranged by their tolerance to wet soils. Native American cultural uses are also included for each species listed.

Douglas Fir (Pseudotsuga menziesiki) Family - Pinaceae

Description: A very common and familiar tree in western Oregon, Douglas fir is a massive (up to 300 feet), elegant, fast growing conifer. It commonly grows in mixed stands with hemlock and cedar. It can be identified by its tall, straight trunk, deeply furrowed, corky brown bark, and its cones, which stay on the tree year-round. The three to four inch cones of leathery brown scales reveal protruding papery, three-pointed seed bracts (look for the mice hiding in the cones).

Habitat: Throughout the Pacific Northwest, in all but the wettest and driest sites. Notes: Douglas fir bark and wood were thought to be an excellent fuel, but it also had a reputation for throwing sparks and giving slivers to those who handled it. The wood was used to make items such as spear handles, harpoon shafts, spoons, dip-net poles, fire tongs, salmon weirs, caskets, and halibut and cod hooks. Its pitch was used for sealing joints of implements such as harpoon heads and fishhooks as well as for caulking canoes and water vessels. The pitch was also used to make a medicinal salve for wounds and skin irritation.

Sitka Spruce (Picea sitchensis) Family: Pinaceae

Description: Sitka spruce is a majestic conifer found in moist lowland sites' It can be identified by its gray, "scaly" bark, sharp pointed needles, and four-inch long papery cones. It grows rapidly and can attain massive proportions.

Habitat: Found in low-lying, moist forests and forested bogs.
Notes: A quick way to identify Sitka spruce is to grasp a branch in your hand: the stiff, sharp needles pointing out on all sides of the branch hurt. The sharp needles of spruce were believed to give it special powers for protection against evil thoughts. The Ditidaht and other Nuu-chah-nulth peoples used the boughs in winter dance ceremonies to protect the dancers and to "scare" spectators. Some central and northern coast peoples ate the inner bark fresh or dried it into cakes and ate it with berries. The pitch was often chewed for pleasure and was also used as medicine for burns, boils, slivers and other skin irritations. The roots of the Sitka spruce were used to make beautifully twined watertight hats and baskets

IDENTIFICATION OF NORTHWEST NATIVE TREES

Western Hemlock (Tsuga heterophylla) Family: Pinaceae
Description: Hemlock is an evergreen conifer that can grow as tall as 180 to 225 feel, with drooping branches and furrowed, dark brown to reddish-brown bark. lt can be identified from a distance by its drooping leader at the top of the tree. The needles are flat and distinctly grooved, glossy yellow-green on top, with two broad white stripes on the bottom. Needles are of unequal length (one quarter to three quarters of an inch long), and spread at right angles to the branches to form flat sprays. Cones are abundant, one inch long, oval, and directly attached to the branch. They turn from green to brown at maturity and fall intact to the ground.

Habitat: Hemlock is found throughout the region, especially in moist conditions. lt is tolerant of deep shade and often grows near other conifers like cedar and Douglas fir. Notes: Western hemlock bark has a high tannin content and was used as a tanning agent, pigment, and cleansing solution.

The hemlock bark was made into a solution for tanning hides and soaking spruce-root baskets to make them watertight. The hemlock bark solution was also used as a red dye to color mountain-goat wool and basket materials, and as a facial cosmetic and hair remover.

The hemlock wood was carved into implements such as spoons, roasting spits, dip-net poles, combs, spear shafts, wedges, children's bows, and elderberry picking hooks. The hemlock tree was used extensively as medicine by most groups of the Northwest Coast.

Hemlock pitch was applied topically for a variety of purposes, including poultice or poultice coverings, liniments rubbed on the chest for colds and when mixed with deer tallow as a salve to prevent sunburn. A hemlock bark tea was made for internal injuries and hemorrhaging.

IDENTIFICATION OF NORTHWEST NATIVE TREES

Western Red cedar (Thuia plicata) Family: Cupressaceae
Description: The most common cedar of the Northwest forests has a massive tapering trunk, buttressed at the base. Western red cedar can be as tall as 200 feet with thin, shaggy, reddish bark that easily peels off into long strips. Its branches tend to spread, droop slightly, and turn up at the ends. Cedar needles are flat and overlap like scales. The flattened branches are shiny bright green above and paler below. Clustered near the ends of branches, cones start small and bluish-green and develop into half-inch brown cones with woody scales.

Habitat: Cedar ranges from moist or swampy soils to dry upland sites and grows from lowlands up to 4500 feet.

Notes: Red cedar has been called "the cornerstone of the northwest coasts Indian culture" and the large-scale use of its wood and bark delineates the cultural boundary of the northwest coast peoples within its range. The easily split, rot resistant wood was used to make important cultural items such as dugout canoes, house planks and posts, totem and mortuary poles, bentwood shafts, harpoon shafts, spear poles, barbecue sticks, fish spreaders and hangers, dipnet hooks, fish clubs, masks, rattles, benches, cradles, coffins, herring rakes, canoe bailers, ceremonial drum logs, combs, fishing floats, berry-drying racks, fish weirs, spirit whistles, and paddles.

Red cedar was considered an excellent fuel, especially for drying fish, because it burns with little smoke.

Red cedar was used for a variety of ailments.

IDENTIFICATION OF NORTHWEST NATIVE TREES

Big Leaf Maple (Acer macrophyllum) Family: Aceraceae
Description: This large broad-leaved deciduous tree can grow to 75 or more feet with a spread of 5b feet, and can have leaves up to a foot in diameter. Lt has the distinctive form of a single squat trunk that separates into several large, spreading upright limbs. The leaves have five simple lobes, and the winged fruits disperse the seeds by flying "helicopter style." The foliage turns a distinctive bright orange-yellow in the fall.

Habitat: Found throughout lowland areas in dry sites. Big leaf maple grows in mixed stands with conifers, along stream banks, and in the open.

Notes: Preparations were made from the big leaf maple for internal medicines and to treat sore throats. The leaves of the big leaf maple were rubbed on a growing man's face so that he would not grow thick whiskers.

This maple is called the 'paddle tree' because the wood was used to make paddles. lt was also used for spindle whorls and various other implements.

The sap can be used to make a passable maple syrup, but it takes several times more big leaf maple sap than eastern-sugar-maple sap to make a given quantity of syrup.

IDENTIFICATION OF NORTHWEST NATIVE TREES

Red Alder (Alnus rubra) Family: Betulaceae
Description: Red Alder is an aggressive, fast-growing, but short-lived hardwood that can grow up to 120 feet tall. The bark is thin, gray, and smooth, often with white patches of lichens. With age the bark becomes scaly at the base and the wood and inner bark turn rusty-red when cut. Alternate leaves are broadly elliptic and sharp-pointed at the base and tip. Leaf margins are doubly serrated and tightly rolled under and the veins are very straight. Male and female flowers in hanging cylindrical spikes (catkins) appear before the leaves. Fruits are clusters of brownish cones that remain on the tree over the winter and contain oval, winged nutlets.

Habitat: Moist woods, streambanks, floodpains, slide tracks, and recently cleared land, often in pure stands at low elevation.

Notes: Red alder is the most common broad-leaved tree in western Oregon. Alders shed their leaves while still green, and therefore, return many nutrients directly to the soil. Also, alder roots contain bacteria filled nodules that capture nitrogen from the air for the tree's use and when these roots die, the nitrogen is returned to the soil, greatly enhancing soil productivity.

Red Alder wood is considered to be the bet possible fuel for smoking salmon. lt is soft and even grained and is still used for making feast bowls, masks, rattles and a variety of other items.

lts bark is used to make a red or orange dye and is especially valued for coloring inner red cedar bark.

IDENTIFICATION OF NORTHWEST NATIVE TREES

Ponderosa Pine (Pinus ponderosa) Family: Pinaceae
Description: Ponderosa pine is a large tree that lives 300 to 600 years and reaches heights of 90 to 150 feet tall and one to five feet in diameter. The oldest trees can exceed 200 feet in height and six feet in diameter. The bottom one-half of the straight trunk is typically without branches. The crown of ponderosa pine is broadly conical to round-shaped. The bark is characteristically orange-brown with a scaly plate-like appearance. Twigs are stout, orange-brown, and rough. Needles are eight to ten inches long, thin and pointed with toothed edges, occur in bundles of three, and give a tufted
appearance to the twig. Male cones are orange or yellow and are located in small clusters near the tips of the branches. The female cone is oval, woody, and has a small prickle at the tip of each scale. Flowering occurs from April to June of the first year, and cones mature and shed winged seeds in August and September of the second year.

Habitat: Ponderosa pine trees can be found in pure stands or in mixed conifer forests. Ponderosa grows on a variety of soils from shallow to deep, and from gravelly sands to sandy clay loam. Once established, it withstands very cold winters and can survive hot and dry conditions, exhibiting medium to good drought tolerance. Ponderosa generally grows at elevations between sea level and 3,000 m. The populations at higher elevations usually occur within the southern part of its range. Shrubs and grasses typically associated with ponderosa pine within its range include ceanothus, sagebrush, oak, snowberry, blue stem, fescue, and polar grass.

Notes: Native Americans used various parts of ponderosa pine for medicinal, building, food, and ceremonial purposes. Needles were used as dermatological aids and were found to reduce coughs and fevers. The pitch was used as an ointment for sores and scabby skin, backaches, rheumatism, earaches, inflamed eyes, and as a sleeping agent for infants. The boughs of the plant were used in sweat lodges for muscular pain, as decoctions for internal hemorrhaging, and as infusions for pediatric treatments.

The roots of ponderosa pine were used to make blue dye and needles were used as insulation for underground storage pits.The wood was used extensively for fence posts, boards for general construction, and to fabricate snowshoes. Single logs were used to make dugout canoes. Bark was used to cover houses. Most parts of the plant were used for food, including the pitch, seeds, cones, bark, buds, and cambium. The pollen and needles were used in healing ceremonies.

Red-winged blackbirds, chickadees, mourning doves, finches, evening grosbeak, jays, Clark's nutcracker, nuthatches, rufous-sided towhee, turkeys, chipmunks and squirrels consume the seeds of ponderosa pine. Blue and spruce grouse use ponderosa pine needles for nesting material. Mice, porcupines, and other rodents use the bark for nesting material. The trees are also important to various birds for cover, roosting and nesting sites.


IDENTIFICATION OF NORTHWEST NATIVE TREES

Oregon Ash (Fraxinus latifolia) Family: Oleaceae
Description: The Oregon ash is a straight-trucked tree of up to 60 feet bearing opposite branches and compound leaves. The leaves grow up to 12 inches long with five to seven bright green, broadly tapered leaflets which turn yellow in the fall. Dense clusters of greenish flowers (male and female on separate trees) bear winged fruits. The bark is dark gray or brown, and thick, furrowed into forking, scaly ridges.

Habitat: Low-lying areas, wet soils along streams.

Notes: one use of Oregon ash seems to be for protection from snakes. Traditional wisdom suggests that rattlesnakes will not crawl over an Oregon ash stick, and areas where this tree grows are free from poisonous snakes.

The wood of the Oregon ash is often used in the manufacturing of furniture and tool handles..