RIPARIAN STATION

Overview

A riparian zone is the land area located adjacent to a river that plays a significant role in the salmon life cycle and habitat. In this lesson, students will learn about the importance of the riparian zone in addition to learning how to identify some of the plants at their specific field site including native and invasive species. Students will be introduced to characteristics and features of a riparian zone through the use of metaphors. They will then find an example of the metaphor at their field site recording observations of what they find. Finally, students will discuss how the riparian zone would be impacted by the introduction of invasive species. For the educator teaching this lesson, use the background information prior to the lesson plan to supplement your understanding and knowledge. Definitions for italicized words can be found in the appendix.

Time: 30 Minutes

Learning Goals: By the end of the station, students will have a better understanding of:

- The form and function of the riparian zone as it relates to both salmon biology and general ecology
- How invasive plants impact riparian habitats and the salmon ecosystem

Materials: The Riparian Station kit includes the following:

- 'Metaphor' kit: towel, umbrella, string, house, snack, coffee filter
- Terrestrial Invasive Species Guide
- Nature Journals or paper and pencils for students to draw
- Pojar's Plant ID book
- 7 Clipboards

Teaching Tips

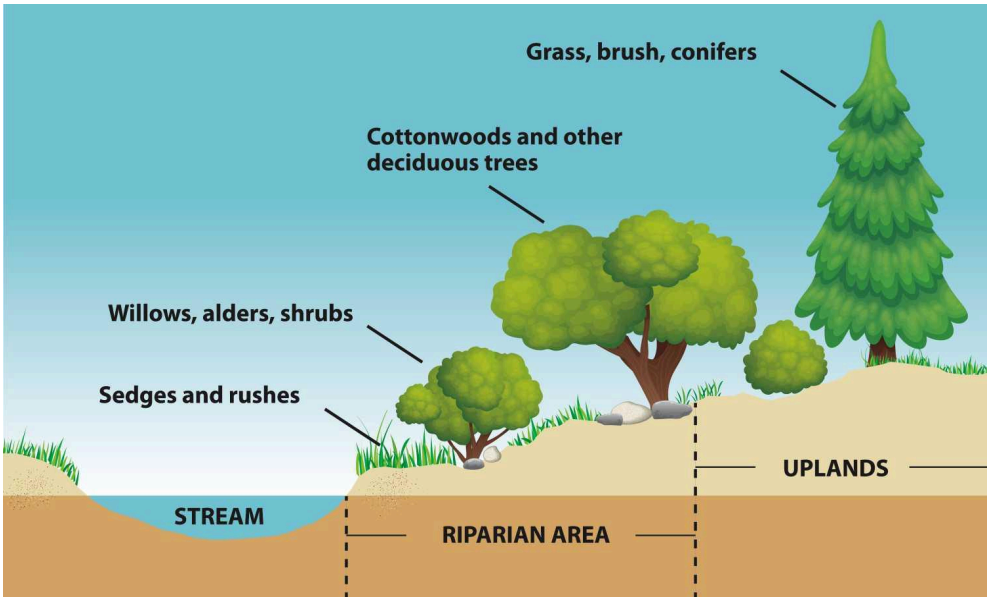
Get students focused with brief introductions and allow them to make general observations about their environment. Depending on where you are, there could be dozens of plant species within a short distance. Other locations may require a bit of walking. Be mindful of students' energy level and mobility considerations.

Ask students to describe, observe and look closely at the species they find. When students share encourage them to use the phrases:

- " I notice…" " I wonder…" "It reminds me of…"

Background Information

The word “riparian” is drawn from the Latin word “riparious” meaning “bank” (of the river) and simply refers to land adjacent to a body of water or life on the bank of a body of water. Plants along the riverbank influence the entire river ecosystem. Riparian habitat is a combination of three areas: aquatic area, riparian area, and area of influence. Each is distinctive and contributes to the entire ecosystem. Upland habitat also contributes to riparian and river health.



Aquatic area

The *aquatic* area of rivers, 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 moist soil and is characterized by a noticeable change in plant composition and abundance from upland habitats. 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. The transition in vegetation between riparian areas provides a variety of wildlife habitat, including *travel corridors*.

Upland Habitat

The upland forest that sits adjacent to the riparian area along a river provides an important function. Although it is not directly connected to the river, the upland area that contains taller trees also provides valuable shade that keeps rivers cool. A dense overhead canopy cover can shade the riparian area as well as the river channel to reduce the potentially harmful effects of water warming from the sun. These trees may eventually fall into the riparian area and water bodies, providing valuable habitat for species inhabiting either. By assessing the canopy cover, or density of shading that is associated with upland trees, river and riparian health can be better understood.

Role of Riparian Vegetation

Riparian vegetation provides cover for aquatic and terrestrial animals. Shade created by the riparian vegetation moderates water and air temperatures. Riparian vegetation root systems limit water contamination by filtering and collecting large amounts of sediment and debris. Uncontrolled sediments can kill fish and destroy spawning areas. The root structures of aquatic and wetland plants slows water velocity and allows particulate matter like metals to settle. Vegetation roots also stabilize the ground and water body banks, protecting them from erosion. Sediment settling leads to larger amounts of penetrable sunlight which encourages the growth of phytoplankton and algae that make up the base of the food web. Riparian vegetation in the river can slow water down offering new habitat to macro invertebrates and salmon. Riparian vegetation can contribute large wood to streams, providing structure to the associated water body, collecting gravels, scouring pools, and providing cover for fish and other aquatic species.

Riparian Vegetation Site Component Function		
Riparian Location	**Riparian Component**	**Ecosystem Services or Function**
Above ground - Above channel	Canopy and stems	Shade helps moderate temperatures and in-stream photosynthesis productivity. Source of large and fine plane debris. Source of terrestrial insects and plant matter - *Allochthonous*
In channel	Large debris derived from riparian vegetation	Regulates the routing of water and sediment. Shape habitat-pools, riffles, cover. Substitute for biological activity.
Riverbanks	Roots	Increase bank stability. Create overhanging banks-cover.
Floodplain	Rivers and low-lying cover	Slows the movement of sediment, water, and floating organic debris in flood flows.

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

Riparian Composition

Riparian Edges

Riparian areas have a high number of *edges* (habitat transitions) within a very small area. Edges are typically characterized by a large diversity of plant vegetation. This vegetation typically includes a variety of trees, shrubs, grasses, and herbaceous plants that are well-adapted to the fluctuating moisture levels and soils found near water bodies. These plants serve multiple ecological functions: they stabilize stream banks with their root systems, reducing erosion and sedimentation in the water; they filter pollutants from runoff, improving water quality; and they provide critical habitat and food sources for wildlife, including birds, mammals, and insects. Additionally, this vegetation acts as a transitional zone between aquatic and terrestrial ecosystems, contributing to the overall biodiversity and ecological resilience of the area. The plant life in riparian buffers is not only vital for protecting water resources but also enhances the beauty and recreational value of these natural landscapes. The large number of plant and animal species found in these areas reflects habitat diversity. 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 shades and directly contributes material to rivers. River channels rely on natural flooding patterns. Frequency of flooding and groundwater supply are the major factors controlling the growth of floodplain trees. Floodplains 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. They provide slow water habitat for aquatic species during floods.

Plant Composition

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 riparian areas to complete the river's nutrients cycle and food chain. Flooding is critical to the exchange of nutrients and energy between the river 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 riverbanks 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 river minimum flow levels. Dry phases are when vegetation needs the most water and the period of lowest river flow. These periods are also associated with higher water temperatures and high nutrient concentrations that increase phytoplankton and algae.

Soil Types

Soil types in both riparian areas and associated floodplains can tell a lot about the current and historic conditions of the river. In addition to providing helpful information about current soil composition, an understanding of soil types can reveal the location of historic riverbeds, 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 gravel and cobble might indicate that you are standing on an ancient floodplain.

Microclimate

Riparian areas play a crucial role in creating a cool, moist microclimate. The dense vegetation, including trees, shrubs, and ground cover, provides significant shade that reduces direct sunlight exposure, thereby lowering temperatures in the surrounding environment. This shading effect not only cools the air but also helps to retain moisture in the soil, further contributing to the overall humidity of the area. The proximity to water bodies also ensures a consistent supply of moisture, which, combined with the shading, creates a microclimate that supports a diverse range of plant and animal species. This cool, moist environment is particularly important for aquatic species like salmon, as it helps regulate water temperatures and provides a hospitable habitat critical for their survival and reproduction.

Riparian Ecology

Riparian ecosystems provide the essentials of wildlife habitat (food, water, and cover). In general, the area within two hundred yards of a river is used most heavily by wildlife. The riparian area provides cover, food, and water for organisms over the course of their lives. 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 commonly seen wildlife in a riparian ecosystem.

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 covered river areas which are necessary for fish habitats. This submerged woody debris also increases the diversity of invertebrates, which are a basic part of the food chain on which fish depend.

Aquatic Food Chain

River food chains depend on organic debris for nutrients. In small rivers, a majority of the energy for organisms comes from the vegetation along the river, and a small amount is derived from photosynthesis. The leaves, needles, cones, twigs, wood, and bark dropped into a river 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. Large amounts of the debris are retained and processed in the river by bacteria, fungi, insects, and abrasion, with very little leaving the system until it has been processed.

Human Impacts to Riparian Areas

Riparian areas house unique organisms that provide essential services or resources for the land, air, waters, and organisms. The rivers of riparian areas are important for the survival of humans presently and over thousands of years including the rivers that surround the lands now known as Portland Oregon. The Sandy River, Eagle Creek, Salmon River, and the other tributaries to the Willamette and Columbia flow through the ancestral homeland of many Indigenous Nations including the Multnomah, Clackamas, and Chinook Peoples. Riparian areas and the rivers that run through them are a fundamental piece of human history, and their individual stories present a unique opportunity to explore the Indigenous perspectives and knowledge that has contributed to their preservation for much of the time before white settlement. We can strengthen our understanding of the places we occupy by looking at them in the present, connecting to their past, and imagining what they might be like in the future. We also would like to honor the many groups of Indigenous

peoples whose nations are not presently recognized at this time but whose history, presence, and ways of life have stewarded and continue to shape the lands of present day Oregon and Washington.

Colonial & Encroachment Impacts

Development in riparian areas has generally degraded the value of the aquatic and riparian resources. Degradation has included filling and altering of river channels, removing vegetation for agriculture and building construction, and paving large amounts of land for roadways. Historical and ongoing effects of colonialism within riparian areas impact Indigenous lands and cultural ecosystem services. For salmon, colonial impacts include displacement of Indigenous communities from traditional lands, alteration of river systems for agriculture or industry, and changes to traditional management practices that sustain salmon populations. These impacts disrupt ecological balance and reduce salmon populations.

Roads

Road building may damage wildlife habitat including increased sedimentation, which can adversely affect aquatic and riparian life, including fish. Roadways increase warming in riparian habitats and carry pollutants in runoff.

Agricultural

Riparian vegetation is often cleared for farming purposes. This can weaken bank structure, making it more susceptible to erosion and contributing sediment to the water. 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 river to wash away that same valuable land during periods of high flow.

Livestock

Livestock, like wildlife, are attracted to shade, water, and forage in riparian areas. By allowing the area to be grazed excessively or at the wrong time-livestock can severely affect the riparian area's integrity. 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 riverbanks 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 riverbanks. By utilizing good management techniques, ranchers can actually increase economic gains as well as enhance the value of their property.

Recreation

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.

Drinking Water and Other Downstream Uses

Rivers 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.

Non-Native & Invasive Species

Organisms that occupy a niche in an ecosystem they are not originally from are non-native and depending on how they impact the ecosystem can be classified as invasive.

Non-native species are not originally from this place. They have been introduced accidentally or on purpose, but don't necessarily harm the native species. If they can compete with native species, they are considered invasive.

An Invasive Species is a species that is not originally local to this place. They have been transported here and now negatively impact the other species.

There are many different non-native and invasive species in the United States, some of the species typically seen in the riparian areas include: knotweed, Invasive blackberry, scotch broom, english ivy, flowering rush and water primrose.

Non-Native Species:

<u>Curly Dock Weed</u>

Location: Native to eastern Asia

Initial Introduction: Introduced to North America as a contaminant in grain shipments in the 1700s.

Traits: Can tolerate a wide variety of soil types and forms dense shrubs with long stems growing 3-4 feet. When stems are broken off at the surface, roots quickly grow fresh stems and leaves making them resilient plants.

Invasive Species:

<u>Knotweed</u>

Location: Native to eastern Asia and invasive to almost all of the United states and parts of Canada.

Initial Introduction: Introduced to North America through the sales of seeds and plant catalogs.

Traits: A tall dense shrub that grows rapidly to a height of up to 3 meters, about 9 feet tall. It grows from deep rooted creeping rhizomes that allow it to form expansive patches that disperse during flood events.

Impacts: Knotweed can form dense canopies that block out tree seedlings which are important for fish habitat and survival. Knotweed can create monocultures that exclude native plants,

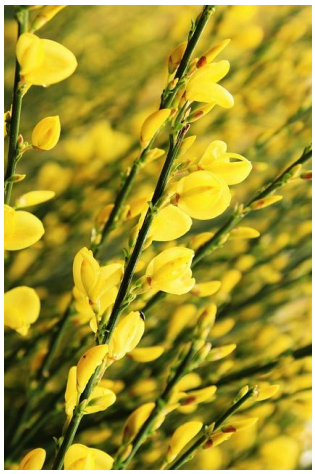
Invasive Blackberry (also known as Himalayan Blackberry or Armenian Blackberry)

Location: Native to the Caucasus region in Eurasia

Initial Introduction: Introduced to North America in the late 1880's as a cultivated crop.

Traits: A rambling perennial , woody shrub native to the western Europe. It can grow up to 4 meters, about 13 feet tall with hooked prickles and dense thick stems**.**

Impacts: Invasive blackberries can dominate the riparian area and significantly decrease native plant diversity. Many native riparian plants help with sediment deposition as well as filtration of heavy metals and pollutants out of the water. Native plants provide shade, provide diversity, and support macroinvertebrates that juvenile salmon rely on. Rhizome mass can be two times greater below ground than the plant's size above ground.



Scotch Broom

Location: Native to Northern Africa and parts of Europe, including the British Isles, Sweden, and Ukraine.

Initial Introduction: Was initially introduced to North America as an ornamental plant for gardens.

Traits: A perennial shrub of the pea family. Broom seeds have hard coats that allow it to survive being transported in rivers during flood events. These rapidly growing plants can take over and change whole ecosystems especially in clear cut forested areas.

Impacts: Scotch Broom forms dense stands in the riparian area that crowds out native species. It can prevent conifer trees from seeding leading to total domination of land. The large root systems of conifer trees play a big role in stabilizing river banks. The loss of stable river banks leads to erosion which can wash away fish habitat including redds and the eggs salmon have laid. It modifies the soil and inhibits germination for other plants.

English Ivy

Location: Native to Europe

Initial Introduction: Introduced to North America as an ornamental vine for landscape design.

Traits: An evergreen perennial vine that can grow up to 30 meters or 99 feet in length. It spreads by shooting out long stems that can root into the soil. This aggressive invasive threatens most forest types in Oregon as it kills large trees overtime by unevenly weighing tree branches and crowding out leaves for sunlight.

Impacts: When English ivy takes over trees in a riparian area slowly killing native trees, rivers lose their shade and cover. More direct sunlight on rivers can cause an increase in water temperature, affecting fish habitat. When ivy causes trees to die and fall, the loss of their root structure can lead to significant erosion affecting the riparian area from soaking and filtering rain and snow melt**.**

Flowering Rush

Location: Native to Europe and Asia
Initial Introduction: It's likely that the plant was introduced to North America through the ballast waters of trans-Atlantic ships and as an ornamental plant in water gardens.
Traits: A perennial aquatic plant that grows in water along riparian shore lines. Flowering rush grows stiff narrow sword-shaped leaves with deep roots allowing it to live submerged in water without needing to flower. They are able to reproduce rapidly with rhizomes as well as by seeds. This invasive can be challenging to identify when not flowering as it resembles many of the native rushes.
Impacts: Flowering rush can create dense thick stands that can prevent many organisms from moving through the river including salmon swimming and even humans in boats! Aquatic plants are important for maintaining healthy water quality. Invasive flowering rush negatively impacts water quality by increasing nutrient levels. This happens when they transfer nutrients found in the river's soil to the water. Decaying flowering rush plants utilize oxygen within the water, decreasing available oxygen for other aquatic species.

Water Primrose

Location: Native to Uruguay and Brazil
Initial Introduction: Introduced to North America as an aquatic garden plant.
Traits: A perennial aquatic plant that grows in slow moving water and is capable of producing large floating mats over the surface of the water. Water primrose is able to spread through seed, root, and plant fragmentation. This invasive causes rapid sedimentation and contributes to lower oxygen levels by slowing the flow of fast moving water over riffles. Dense floating mats also shade rivers negatively impacting native aquatic plants.
Impacts: Dense thick mats of water primrose have been known to slow and even stop water in river and riparian areas leading to the loss of salmon habitat. Water primrose has the ability to release chemical signals that kill native plants in the water around it. This is known as allelopathic activity. Water primrose harms a river's water quality by removing the native plants that help to filter the

water leading to rivers becoming uninhabitable to salmon. Decaying water primrose plants utilize oxygen within the water, decreasing available oxygen for other aquatic species.

<u>St John's Wort:</u>

Location: Europe, Asia, and North Africa

Initial Introduction:

Traits: An upright perennial herbaceous plant which typically grows 1 to 2.5 feet in height.Infestations spread rapidly on disturbed, well drained sites such as roadways, trails, meadows, grasslands, overgrazed range, logged areas,

Impacts: Over-exposure to common St. Johnswort can cause various animal health problems including severe skin lesions and necrosis when their skin becomes hypersensitive to sunlight. Common St. Johnswort spreads both by underground rhizomes, above-ground creeping stems, and by seeds that are dispersed by wind and animals. One plant can produce up to 15,000 to 34,000 seeds per year that are viable for up to 30+ years.

Lesson Plan - Riparian Area

Objective: Students will understand the function of the riparian area, how it is threatened by invasive species, and why the Riparian zone is critical to salmon habitat and health.

Introduction (3 Minutes)

1. Introduce yourself to the group and the station.
2. **Tell students:** I want you to go find 3-4 pieces of nature, these can be things from the ground or the river that won't harm an organism if removed. When you find your piece of nature I want you to bring them back and make a collective group art piece.
    a. Designate a boundary that students are free to walk through.
    b. Give students 1-2 minutes to walk around and find their pieces.

1. Once everyone has returned, tell them that they just found pieces of nature from a very important place called a **Riparian Area**.
2. **Ask students:** What do you know about the Riparian Area?
    a. **Tell students:** A riparian area is a transitional area between a water body and the land around it, characterized by the presence of water and its effect on the soil and vegetation. Riparian areas are found along rivers, streams, lakes, and other bodies of water, and include areas such as riverbanks, streambanks, and floodplains. This place is very important and is one of the main reasons why salmon are able to swim and spawn in this place.

Riparian Metaphor Activity (10 Minutes)

1. Share with students that today they are going to learn about this Riparian Area using a metaphor.
2. **Ask students:** What is a metaphor and what do we use them for?
    a. If needed, expand on the student definition, being sure to frame that metaphors are how we can compare two similar things and that today we will be using metaphors about household items to describe characteristics of this place we call the Riparian Area.
3. Begin by passing out all of the objects in the metaphor kits to small groups of students.
4. Give student groups time to think about what they know about the function of this object. ie: a towel is good for soaking up water.
    a. Go around the circle and have students share the function of their item.
5. In their small group, have students observe the riparian area around them identify what in the riparian zone could function in a similar manner?
6. Have students go around the circle and share where they see their metaphor.
    a. Expand on student answers of how a riparian area provides a similar benefit as the metaphor item using the information below.
    b. **Tell students**: Riparian areas serve a number of important functions that help keep a river and its inhabitants healthy.
    c. Remind them that the riparian area is made up of soil, rocks, and most importantly, plants that don’t mind getting their roots wet.
7. Collect the objects for the metaphor.

Metaphors for the Functions of the Riparian Area:

TOWEL—Like a towel, 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 river to water the plants.
- It filtrates water into groundwater sources (aquifers)

SUSPENDERS —The purpose of a suspender 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 river 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 river 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 animals that might use the riparian area here as habitat?

SNACK—Food: it's what gives us nutrients and energy. River food chains depend on organic debris for nutrients. The leaves, needles, cones, twigs, wood, and bark dropped into a river are a storehouse of readily available organic material that is processed by aquatic organisms and returned to the system as nutrients and energy. Juvenile Salmon in turn eat the macroinvertebrates found in rivers.

Nature Journal (7 Minutes)

1. **Whole Group:** Explain to students that they will have 7 minutes to journal about the riparian area they are in. The goal is to draw what we see in this place to better understand the metaphors that we discussed.
2. **Model:** Have students make a circle with their hand to create a viewing lens. Ask them to put it up to their eye and close the other eye. Share with them that what they see is what they will draw.
3. Before students draw, remind them that there are different ways that scientists record observations.
    a. **Tell students:** In your drawing make sure to take lots of details. You can do this by adding words or short sentences about what you see: as well as colors, shapes, numbers, ect..
4. Outline a perimeter that students are allowed to stay in for their individual nature journal time. Before you send them to begin, make sure that you have shared a signal that will indicate it is time to return. A barred owl call is a great option! “Who cooks for who? Who cooks for you all?”

Invasive Discussion and Wrap-up (10 Minutes)

1. After students have completed their journal in their sit spot, have them circle back together. Lay their journals on the ground in a circle so that everyone can see each other's sketches.
2. **Ask students:** What similarities do we see in each other's drawings?
3. Pull out the Invasive Species Cards or Terrestrial Invasive Species Guide
4. **Ask students:** Did any of you notice any of these when you were drawing your Riparian area?
    a. If students share that they saw these, ask them to show us where in their drawing they sketched them.
    b. After they share where they drew it, ask if anyone else saw that species or another species from the cards/sheet.
5. Once they have finished sharing what they saw, ask students to show us where they saw that invasive species and take the group over to where they noticed it.
6. **Tell students:** This species is an Invasive Species.
7. **Ask students:** What do you already know about invasive species? Add on to what they share to clarify their background knowledge.
    a. **Tell students:** Non-native species are not originally from this place. They have been introduced accidentally or on purpose, but don't necessarily harm the native species. They can compete with native species and then are considered invasive.
    b. **Tell Students:** An invasive species is a species that is not originally local to this place. They have been transported here and now negatively impact the other species.
8. Walk students through what they notice about this invasive species.
    a. **Ask students** to describe this plant, what do you notice, wonder, or are reminded of?
    b. **Ask students**: Is it taking over the ares? How do we know?
    c. **Ask students**: Is it making it harder for other plants to get sunlight and energy?
    d. **Ask students**: Are there any characteristics of this plant that might give it an advantage over others? Ex: Invasive Blackberries have thick thorns and long arching branches that allow it to reach farther areas.

8. Return back to the metaphor and have students discuss in their pairs.
    a. **Ask students** How is this invasive species impacting the Riparian Area?
    b. **Ask students:** Could this invasive species impact your metaphor? If so, how?
    - If you have an older group of learners you may want to have them pick one of the objects from the kit and share with the group how that part of the Riparian Area is impacted by that one invasive species.
    - With younger learners you may want to have the group pick one or two items from the metaphor that they think are impacted by the invasive species.
9. **Ask students:** How might a healthy forest's riparian zone benefit salmon?
    a. **Tell students:** Salmon need cold, clear water, food, resting places and protection from predators. A healthy riparian zone has trees and shrubs with roots that prevent soil from eroding into the water and burying redds in silt. Strong soil composition helps to filter water and retain water, impacting the health of the river and water quality that allows sensitive macroinvertebrates, juvenile salmon, as well as many other aquatic and amphibious organisms to thrive. The shade from riparian trees helps keep the water cool. Leaves from alder and other riparian trees feed many macroinvertebrates. Trees that fall in the river slow the current and add structure, providing places for salmon fry to rest, safe from many predators.

Appendix: Definition

Allochthonous - Insects, branches, and leaves falling from terrestrial ecosystems into streams. Allochthonous input in deciduous ecosystems is high in fall. Allochthonous input is year your in coniferous ecosystems.

Aquatic - Refers to anything related to water. It describes environments, plants, and animals that live in or are connected to water bodies like rivers, lakes, oceans, and streams.

Coniferous - Is used to categorize trees and shrubs that have needles instead of leaves and usually keep them year-round. Pines, firs, and spruces, are types of coniferous trees that may be seen during Salmon Watch field trips. Coniferous trees produce cones and are often found in cooler climates. Coniferous forests are important for the health of rivers and streams, as their needles help to protect the soil and prevent erosion, which keeps water clean and clear for salmon. The trees also provide shade, helping to maintain the cool water temperatures that salmon need to thrive.

Deciduous - Is used to categorize trees and shrubs that lose their leaves seasonally, typically in the fall, are deciduous. Maples, oaks, aspen, are types of deciduous trees that we might see during Salmon Watch field trips. The fallen leaves decompose and provide nutrients to the soil, which can affect nearby streams and rivers where salmon live. The presence of deciduous trees along riverbanks also helps to shade the water, keeping it cool and suitable for salmon.

Edges - In ecological terms, "edges" refer to the boundary or transition zone between two different habitats, such as the area where a forest meets a meadow or where land meets water. These edge habitats are often rich in biodiversity because they provide resources and shelter from both adjacent environments. For salmon, edges along rivers and streams, like the transition between water and land, are crucial. These areas offer shelter, food sources, and places to rest during their migration. The edges of aquatic habitats can also help protect young salmon from predators. Riparian areas have high numbers of edges.

Oxbow - An oxbow refers to the u-shaped bend in a river or stream. Over time, this bend can become cut off from the main flow of the river, creating a small, curved lake called an "oxbow lake." These oxbows provide important habitats for various aquatic species, including salmon, as they often offer calm, protected waters.

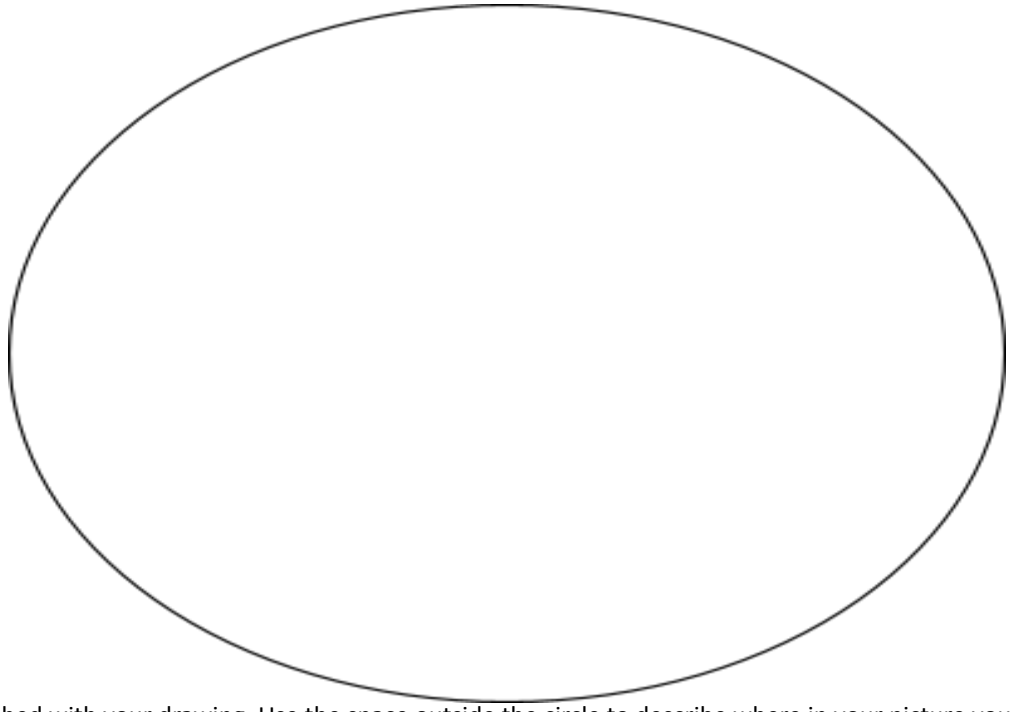
Travel Corridors - Specific routes or pathways that animals use to move between different habitats or areas. For salmon, travel corridors are the rivers and streams they swim through during their life cycle. These corridors are essential for salmon migration, as they provide the necessary paths for salmon to travel from their spawning grounds in freshwater rivers to the ocean and back again. Healthy travel corridors are crucial for the survival of salmon, as they need clear, unobstructed, and well-maintained pathways to complete their journey.

Nature Journal: Riparian Area

Name:_____

Date:_____ Location:_____ Temperature Outside:_____

1. Draw what you see with your hand, inside the circle below. Be sure to include words, numbers, or short sentences to describe your illustration.



2. When you are finished with your drawing. Use the space outside the circle to describe where in your picture you see characteristics of the riparian area from the metaphor. Example: The leaves on the trees function like an umbrella to shade the stream from the hot sun.

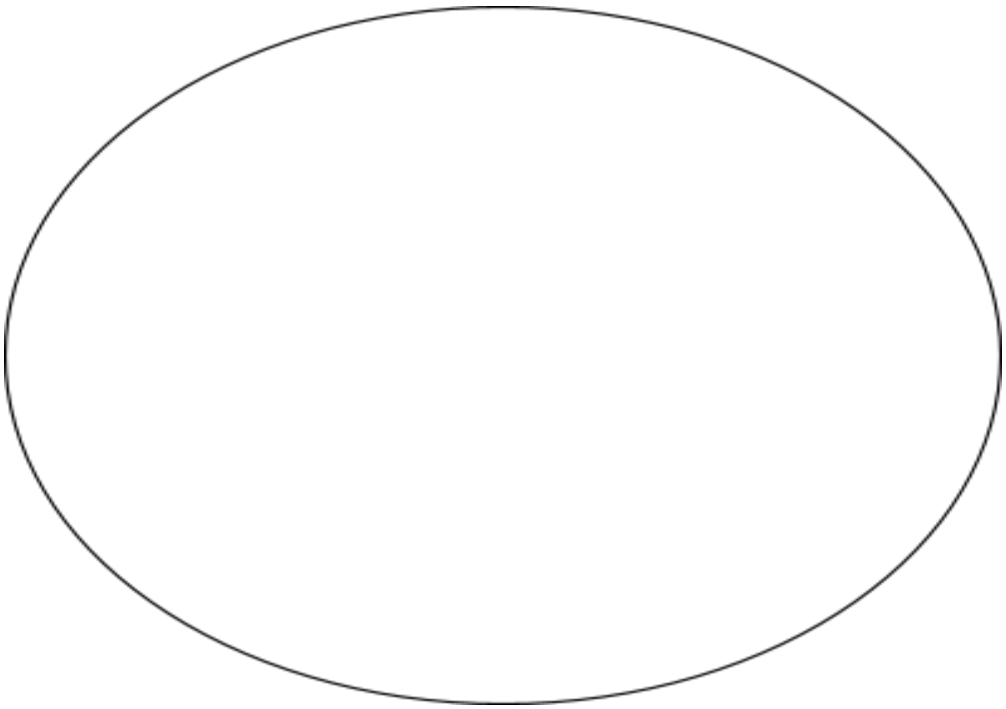
Riparian Metaphors: Towel, Suspenders, Coffee Filter, House, Umbrella, Snacks

Nature Journal: Riparian Area

Name:_____

Date:_____ Location:_____ Temperature Outside:_____

1. Draw what you see with your hand, inside the circle below. Be sure to include words, numbers, or short sentences to describe your illustration.



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Riparian Metaphors: Towel, Suspenders, Coffee Filter, House, Umbrella, Snacks

Terrestrial Invasive Species

Knotweed

Reynoutria japonica

A tall dense shrub that grows rapidly to a height of up to 3 meters, about 9 feet.

It grows from deep rooted creeping rhizomes that allow it to form expansive patches that disperse during flood events.

Invasive Blackberry

Rubus armeniacus

A woody shrub native to the western Europe. It can grow up to 4 meters, about 13 feet, with hooked prickles and dense thick stems. This plant grows rapidly displacing native herbaceous plants and shrubs spreading by seed or by shooting larger older canes in order to plant new roots several feet away. Rhizome mass can be two times greater below ground than the plants size

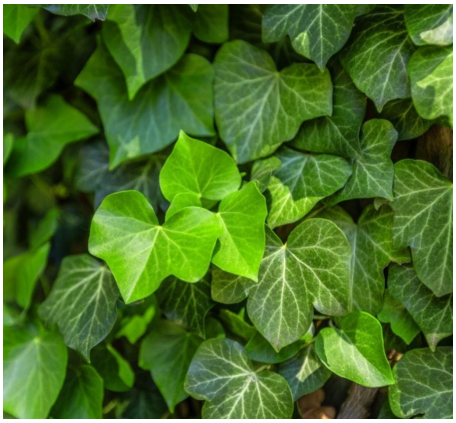
Scotch Broom

Cytisus scoparius

A perennial shrub of the pea family. Broom seeds have hard coats that allow it to survive being transported in rivers during flood events. These rapidly growing plants can take over and change whole ecosystems especially in clear cut forested areas.

English Ivy

Hedera helix



An evergreen perennial vine that can grow up to 30 meters, 99 feet. Native to Europe, this aggressive invasive threatens most forest types in Oregon. English ivy kills large trees overtime by unevenly weighing trees branches and crowding out leaves for sunlight. It spreads by shooting out long stems that can root into the soil.

Flowering Rush

Butomus umbellatus

A perennial aquatic plant that grows in water along riparian shorelines. Native to Europe and Western Asian, flowering rush grows deep roots allowing it to live submerged in water without needing to flower. They are able to reproduce rapidly with rhizomes as well as by seeds. This invasive can be challenging to identify when not flowering as it resembles many of the native rushes. Leaves are stiff, narrow, sword-shaped, triangular in cross section, & stands up to 3 feet above the waters surface.

Water Primrose or Ludwigia

Ludwigia hexapetala

A perennial aquatic plant that grows in slow moving water. Water primrose is capable of producing large floating mats over the surface of the water. It can spread through seeds, roots, and plant fragmentation. This invasive causes rapid sedimentation and contributes to lower oxygen levels by slowing the flow of fast moving water over riffles. Dense floating mats also shade rivers negatively impacting native aquatic plants by preventing them from photosynthesizing.

Impacts to the Riparian Zone

Knotweed

Reynoutria japonica

Habitat: Knotweed can form dense canopies that block out tree seedlings which are important for fish habitat and survival. Knotweed dies back at the first frost, exposing stream banks to high winter and spring flows which can increase erosion and result in sedimentation.

Food Web: Knotweed can create monocultures that exclude native plants, which disrupts the aquatic food chain.

Invasive Blackberry

Rubus armeniacus

Habitat: Himalayan blackberry can dominate the riparian area and significantly decrease native plant diversity.

Water Quality: Many native riparian plants help with sediment deposition as well as filtration of heavy metals and pollutants out of the water.

Food Web: Native plants provide shade, provide diversity, and support macroinvertebrates that juvenile salmon rely on.

Scotch Broom

Cytisus scoparius

Habitat: Scotch Broom forms dense stands in the riparian area that crowds out native species. It can prevent conifer trees from seeding leading to total domination of land. The large root systems of conifer trees play a big role in stabilizing river banks. The loss of stable river banks leads to erosion wish can wash away fish habitat including redds and the eggs salmon have laid.

English Ivy

Hedera helix

Habitat: When English ivy takes over trees in a riparian area slowly killing native trees, river loose their shade and cover. More direct sunlight on rivers can cause an increase in water temperature, affecting fish habitat.

When ivy causes trees to die and fall, the loss of their root structure can lead to significant erosion affecting the riparian area from soaking and filtering rain and snow melt.

Flowering Rush

Butomus umbellatus

Habitat: Flowering rush can create dense thick stands that can prevent many organism from moving through the river including salmon swimming and even humans in boats!

Water Quality: Invasive flowering rush negatively impacts water quality by increasing nutrient levels. This happens when the plant transfer nutrients found in the river's soil to the water. Decaying flowering rush plants utilize oxygen within the water, decreasing available oxygen for other aquatic species.

Water Primrose or Ludwigia

Ludwigia hexapetala

Habitat: Dense thick mats of water primrose have been known to slow and even stop water in river and riparian areas leading to the loss of salmon habitat.

Water Quality: Water primrose has the ability to release chemical signals that kill native plants in the water around it. This is known as allelopathic activity. Water primrose harms a rivers water quality by removing the native plants that help to filter the water leading to rivers becoming uninhabitable to salmon. Decaying water primrose plants utilize oxygen within the water, decreasing available oxygen for other aquatic species.