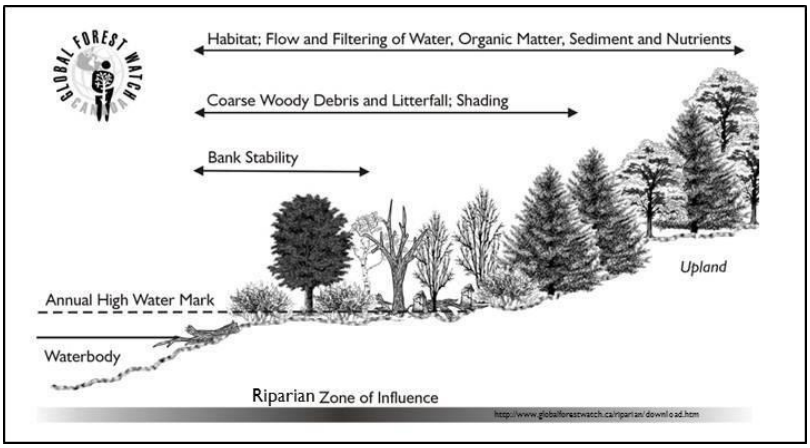
Riparian Ecology Station

OBJECTIVES

Students learn

- The basic definition of a riparian area.
- The condition of any riparian area greatly affects the water quality and aquatic habitat of the water body it surrounds.
- Riparian areas provide functions or 'jobs' in the watershed, but only if they are in healthy, functioning condition. Students can name four main functions.
- Many aspects of the riparian area AND the stream channel must be studied to understand conditions and make management decisions.



INTRODUCTION (10 minutes)

A riparian area is the area of land surrounding a water body. We also call them stream banks and river banks, or shores. All water bodies have riparian areas, even puddles, oceans, wetlands, rivers and lakes etc. Do all riparian areas have trees? No, some riparian areas have been modified into parking lots or buildings, but they are still riparian areas.

Riparian areas are important to know about because *healthy* riparian areas serve several *functions* in the watershed. Functions are like jobs or services that nature does to help keep the watershed healthy.

Riparian functions include: **bank stability, shade, water storage and filtering, and wildlife habitat**. Laminated signs are displayed for each function.

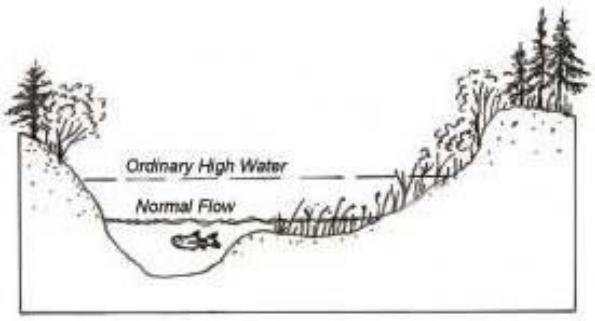
Bank Stability (or erosion control) Lots of roots hold the soil in place, especially during winter floods. Erosion is the separation of soil particles by water or wind. Some erosion is natural, but too much erosion is a form of pollution. A mix of native trees, shrubs, and grasses is best for stabilizing stream banks. Willow trees are really good at holding soil in place because their roots grow so fast and the trees don't mind being broken by floods, they just keep growing. Turbidity is a measure of how much fine soil (or sediment) particles are in the water. Fine soil particles can suffocate fish eggs and clog the gills of fish. Students may have measured turbidity already at the water quality station.

Shade is another important function of healthy riparian areas. What makes a riparian area shady? Tall trees! Shade helps keep the water cool in the stream, which is really important to salmon and trout because cooler water holds more oxygen, and fish need dissolved oxygen to survive. Ask if they tested for dissolved oxygen in the water quality station. Warm water is actually a pollutant and is a problem in our watersheds.

Water storage and filtering. When water flows over the ground it is called runoff. It picks up pollution and carries it to the nearest water body. This occurs during heavy rains and excess irrigation. The pollution might be animal waste from pets or livestock, loose soil at a construction site, or litter and oil on the road. Ask if students can think of other types of pollution. Runoff can be slowed down by riparian vegetation and allowed to infiltrate the soil below, which stores and cleans the water.

Wildlife habitat. Riparian areas are places where wildlife can find food, shelter, and a safe place to rear their young. Riparian areas have water on one side and uplands on the other side, which creates habitat diversity. Native plants, such as trees, shrubs, and flowering plants, provide important food for insects, birds, and other wildlife. Aquatic organisms benefit from riparian vegetation as well. Macroinvertebrates eat the leaves and wood that drops into the stream. Insects and other macroinvertebrates then get eaten by fish and fish become food for humans or other wildlife, or they die and become fertilizer for riparian plants. When trees fall into the stream they help create important habitat structure for salmon by forming pools, little water falls, and places for young fish to hide from predators.

SITE PREPARATION

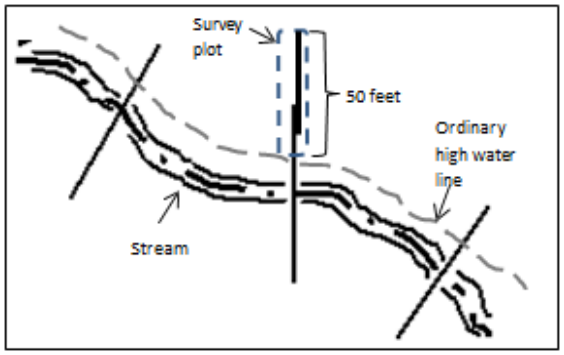


GEOLOGIST AND HABITAT BIOLOGIST STATIONS

1. Use a tape measure to measure out a 100 ft line along the stream.
2. Place cones or pin flags along the line to divide it into 4 equal sections.

BOTANIST STATION

1. Start at the water's edge and look away from the stream. Find the **ordinary high water line**, or where *most* of the plants begin growing on the bank.
2. Measure or estimate 50 feet from this line up into the riparian area. Visualize a 10 foot wide strip along this 50 foot line. That is your **survey plot**. (If available, use the second measuring tape and 10 ft rope to delineate survey area.)



ACTIVITY (25 minutes)

Students perform the duties of different types of scientists. They will conduct a *quick* assessment of the riparian area. In the professional world, scientists study many different things in and surrounding a riparian area to understand how healthy it is. Then they make recommendations about how to improve the *function* of the riparian area. This is much like a doctor uses test data to understand how healthy your body is, and then prescribes a treatment, if needed.

Split group into 4 small teams, preferably each with an adult. Each team receives the corresponding data sheet, a clipboard, and pencil or wet erase marker. Materials for each team are listed on the instruction sheet. Each team will appoint a recorder. Remind students they have less than 20 minutes to complete the survey, so they must use the time efficiently!

1. **Botanists** will study VEGETATION TYPES and RIPARIAN WIDTH.
2. **Aquatic biologists** will conduct a STREAM SURVEY and an INSTREAM HABITAT SURVEY.
3. **Forest biologists** will conduct a CANOPY COVER SURVEY.
4. **Geologists** will conduct a SUBSTRATE SURVEY (rocks and sediment that cover the ground).

REPORTING & WRAP UP (10 minutes)

Each team reports on what they found. **The group totals all station scores to get a RIPARIAN HEALTH score**. Ask students if they think this is a healthy riparian area based on what their teams found. Ask students if they think this riparian area can support salmon. Wrap up with discussion on how the riparian area supports each of the functions.

BOTANISTS

Survey Methods

1. Observe your survey plot and place an "X" in the box that corresponds to each vegetation type you see.
2. Then record the total number of vegetation types you observed by placing an "X" in the corresponding box of the Vegetation Cover data table. Circle the score.
3. Using the same survey plot, observe how far back the plants and trees are growing from the edge of the stream bank. For our purposes, this will represent the extent of the riparian area. Compare the width of the riparian area to the width of the stream behind you. Record your guesstimate by placing an "X" in the corresponding box on the Riparian Area Width data table. Circle the score.
4. In the Plants Identified data table, write the name of any plants or trees you can identify, such as willow or Oregon ash or Reed canarygrass, and write about its role in the health of the riparian area for discussion purposes. See data table for examples.

Analysis

- Did you find all vegetation types in your plot or just one or two? *The more types you found, the better diversity you have which is good for riparian function. Bare ground or gravel does not count as a vegetation type.*
- Of the vegetation you found, was there a lot of each type? *This would be good.* Was there a lot of bare ground? *The soil could easily erode into the stream. Bare ground also means there aren't as many plants for wildlife habitat.*
- Is the riparian area at least as wide as the stream width? *This would be good. A wider riparian area can better provide functions for the watershed.* Is this riparian area providing these functions? *Riparian functions: erosion control, shade to the channel, filtering runoff, providing habitat.*

Conclusions

- How healthy is this riparian area? How could this riparian area be improved? What would you plant and why? Would you preserve it the way it is?

BOTANIST DATA SHEET

School:_____Date:_____

Stream name:_____Weather:_____

Materials: field guides, data sheet and instructions, clipboard and pencil or wet erase marker

Vegetation Type	Shrubs & Short trees	Coniferous canopy trees	Deciduous canopy trees	Grasses & Ferns	Small Plants	Gravel	Bare Soil
Place an **X** in the box for each vegetation type observed							

Vegetation Diversity	4-5 vegetation types present, cover dense	4-5 vegetation types present, cover sparse	1-3 vegetation types present	Bare ground and gravel > 30% of the plot	Bare ground and gravel > 50% of the plot
Place an **X** in the corresponding box					
SCORE	10	7	4	2	0
	Excellent	Healthy	Fair	Unhealthy	Poor

Riparian Area Width	Greater than 1 stream width	Approximately equal to the stream width	Less than ½ the stream width
Place an **X** in the corresponding box			
SCORE	10	7	5
	Excellent	Healthy	Fair

Plant Species Identified	Significance to riparian area *(ex-low habitat value, outcompetes natives, provides food, provides shelter, erosion control)*

BOTANY SCORE 1 (Vegetation Diversity) _____

BOTANY SCORE 2 (Riparian Area Width) _____

AQUATIC BIOLOGISTS

Survey Methods

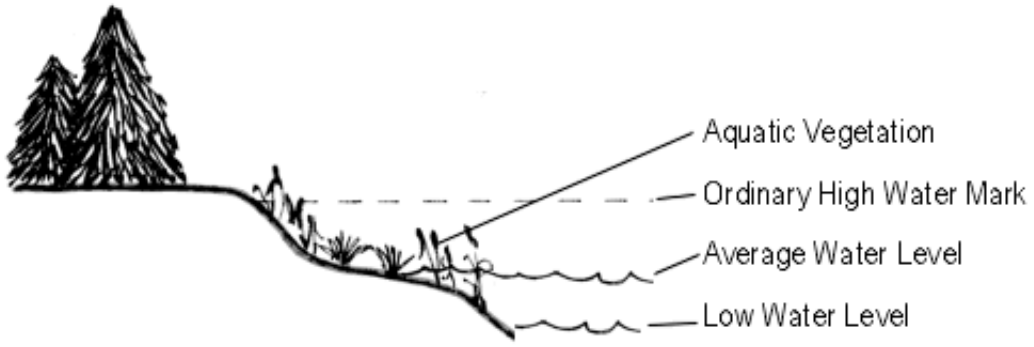
1. You will survey along the 100 ft line, which is broken into 4 equal sections, or reaches, marked by cones or pin flags.
2. Note whether the number of pools and riffles are equal, close to equal or unequal by placing an X in the corresponding box on the Pools & Riffles data table. Circle your score.
3. Walk your reach again, noting the presence or absence of the habitat types listed on the Instream Habitat Assessment data table. Count every habitat type observed between the ordinary high water marks on either bank. Place an "X" in the box for each habitat type found. Tally how many types were found overall. Circle the score that corresponds to the number of habitat types found.

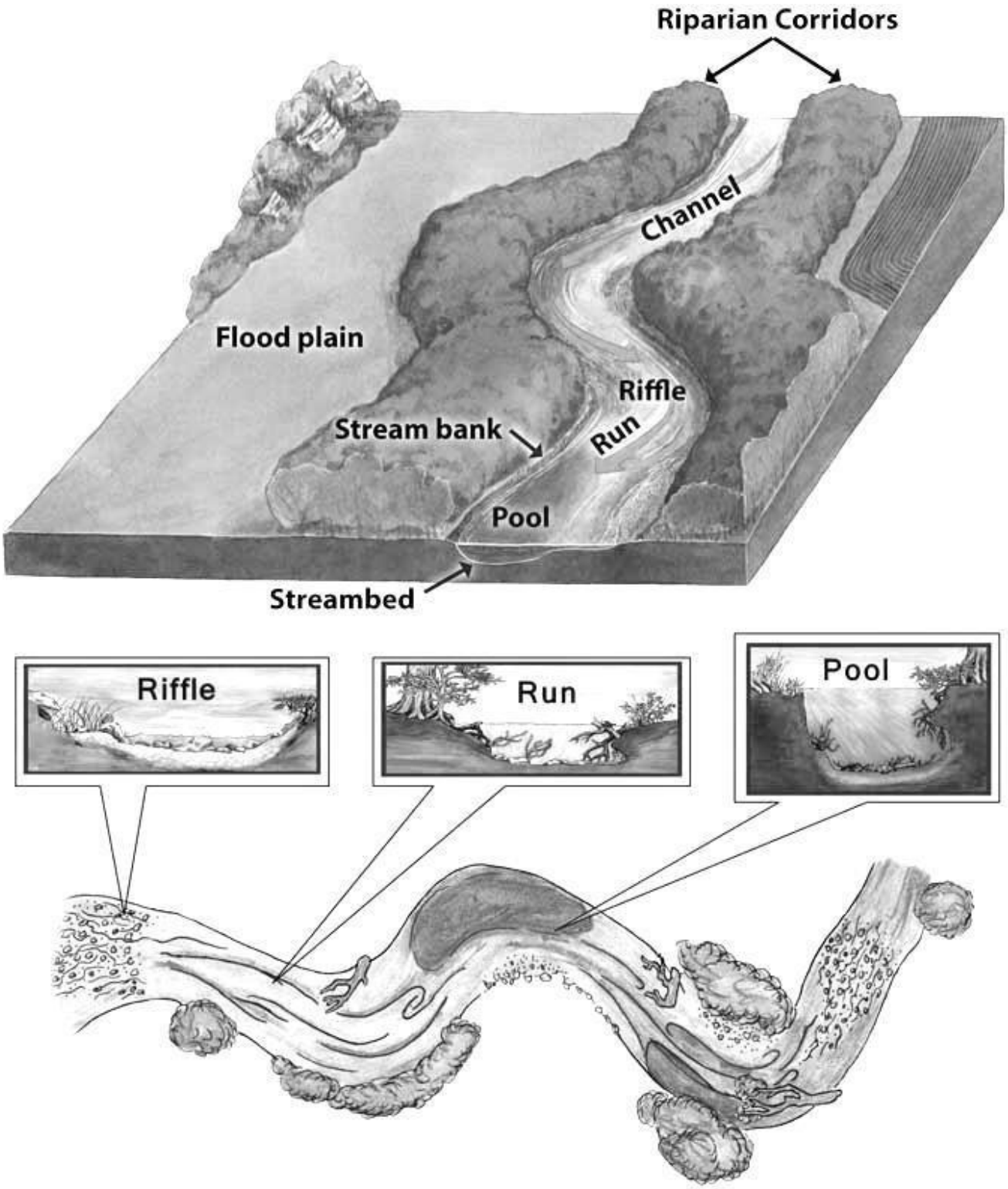
Analysis

- Riffles or rapids add dissolved oxygen to the water. *The best habitat for salmon has 1/3 or more riffle area in the stream. Do you see many riffles in the reach?*
- What would happen to the riffles if there was a landslide or lots of erosion upstream? *They might fill in with sediment and become smooth.*
- Did you see all eleven habitat types? *Habitat diversity is important for a healthy stream. Having habitat diversity means that more animals (fish, macroinvertebrates, etc.) can utilize the riparian and stream habitats.*

Conclusions

- What would you recommend for management?
- How would you create more pools in the stream, if needed?
- Will large wood naturally fall into the stream or should it be placed there?
- By looking at your stream reach, do you see signs of erosion upstream, or erosion in the reach?





RIFFLE: Shallow water; fast current' turbulent surface; substrate gravel to boulders. In big rivers these are called rapids.

RUN: Deeper than a riffle, with moderate to fast current; surface not as turbulent; substrate small gravel to rubble.

POOL: deep, slow-moving water with a flat surface; substrate usually silt, sand or small gravel.

AQUATIC BIOLOGIST DATA SHEET 1 (POOLS and RIFFLES)

School:_____ Date:_____

Stream name:_____ Weather:_____

Materials: Measuring tape Clipboard / pencil

Stream Survey	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**	**Total**
# of riffles					
# of pools					
# of runs					
Comments/ Notes					

Pools & Riffles	**Equal number of pools & riffles.**	**Close to equal number of pools & riffles**	**Many more of one or the other**	**No pools or riffles**
Place an **X** in the corresponding box				
SCORE	10	7	3	0
	Excellent	Healthy	Unhealthy	Poor

AQUATIC BIOLOGY SCORE 1 (Pools & Riffles) _____

AQUATIC BIOLOGIST DATA SHEET 2 (INSTREAM HABITAT)

Instream Habitat Assessment	Reach 1	Reach 2	Reach 3	Reach 4
Small Woody Debris – 6-12 inch diameter and over 10 feet long. Count all pieces, above and below the water, from high water line to high water line.				
Logs / Large Woody Debris – Over 24 inch diameter and over 35 feet long. Count all pieces, above and below the water, from high water line to high water line.				
Pools – Smooth, undisturbed surface, slow current.				
Riffles – Broken water surface, rocky or firm substrate, moderate to swift current.				
Overhanging Vegetation – Trees, shrubs, vines, or other plants hanging immediately over the stream surface.				
Boulders/Cobbles – Boulders are larger than a bowling ball, cobbles are baseball to bowling ball sized.				
Undercut Banks – Eroded areas extending horizontally beneath the surface of the bank forming underwater pockets.				
Thick Root Mats – Dense mats of roots and rootlets at or beneath the surface of the water form invertebrate habitat and fish cover.				
Thick Stands of Water Plants – Beds of emergent, floating, or submerged aquatic plants provide invertebrate habitat and fish cover.				
Disconnected Pools or Side Channels– Pools that have been cut off from the main stem of the stream provide macroinvertebrate habitat.				
Leaf Packs – Floating and submerged packs of leaves provide habitat for macroinvertebrates and fish cover.				

Instream Habitat	9-11 habitats present	7 – 9 habitats present	5 – 6 habitats present	3 – 4 habitats present	1 – 2 habitats present
Place an **X** in the corresponding box					
SCORE	10	7	5	3	1
	Excellent	Healthy	Fair	Unhealthy	Poor

AQUATIC BIOLOGY SCORE 2 (Instream Habitat) _____

FOREST BIOLOGISTS

CANOPY COVER

Materials: spherical densiometer, canopy cover data sheet

Survey Methods:

With a partner take one sample of canopy cover in each cardinal direction

1. Imagine your spherical densiometer (SD) has letters in each square proceeding alphabetically corresponding to the data sheet.
2. Standing at the edge of the water, hold the SD 12" – 18" in front of your body at elbow height so that your head is just outside of the grid area. Do your best to keep the SD steady.
3. Facing the stream, tell your partner which lettered boxes to fill in based on the boxes that are covered more than 50% by shade. (Your partner may want to hold the data sheet up next to the SD to make it easy to relay the letters of the shade covered boxes.)
4. Repeat step 3 while facing away from the stream, downstream and upstream.
5. Add shaded boxes for all directions to get your estimated canopy cover percentage.
6. Place an "X" in the corresponding box of the data table to indicate the amount of canopy cover you estimated and record this score as the FOREST BIOLOGY SCORE below the table.

Analysis:

Was the area at least 75% shaded? Why is this important? *By keeping the sun's rays from reaching the surface of the water, shade helps keep water temperatures down. Salmon are cold water fish, and can only survive and breed in cool water.*

Conclusion:

- Is there sufficient shade along the stream?
- What would you recommend for management?
- What would happen if trees were cut down along the stream?

FOREST BIOLOGIST DATA SHEET

OSU Oregon State University Extension Service

StreamWebs™

Student Stewardship Network

Canopy Cover Survey

Share your field data quickly and easily using StreamWebs. Find out what the macroinvertebrates you found say about your stream, keep track of your photopoints, graph water quality data, upload a video, and much more.

www.streamwebs.org

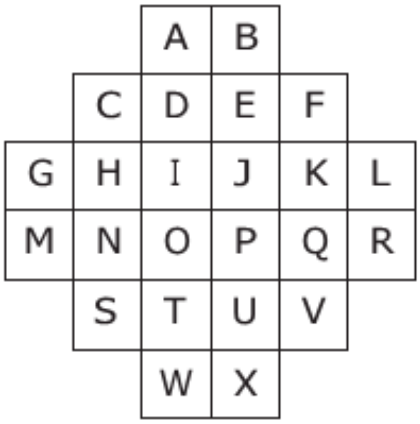
Name: _____

School: _____

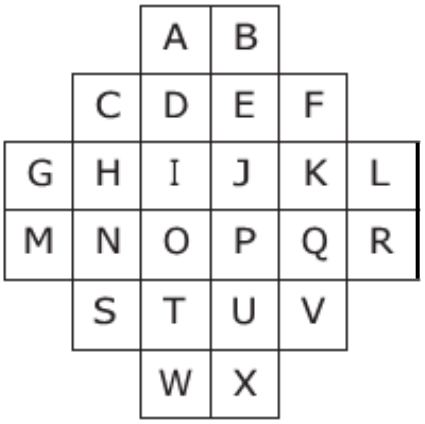
Teacher: _____

Date: _____ Time: _____

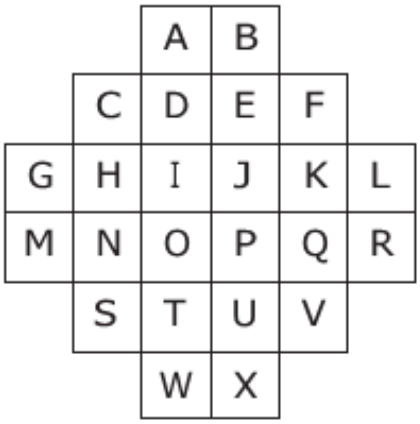
Stream/Site Name: _____ Weather: _____



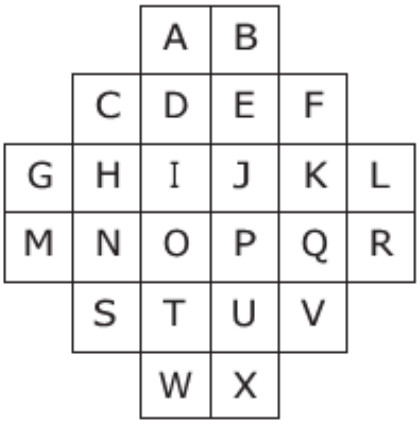
Facing stream
Shaded Boxes _____



Facing away from stream
Shaded Boxes _____



Downstream
Shaded Boxes _____



Upstream
Shaded Boxes _____

_____	+	_____	+	_____	+	_____	=	_____
Facing stream		**Away from stream**		**Downstream**		**Upstream**		***Estimated %***

Canopy Cover	**> 75% shaded**	**50 – 75% shaded**	**20% – 50% shaded**	**< 20% shaded**
Place an **X** in the corresponding box				
SCORE	10	7	3	1
	Excellent	Healthy	Unhealthy	Poor

FOREST BIOLOGY SCORE _____

GEOLOGISTS

SUBSTRATE TYPE

Survey Methods

1. This survey will study the substrate on the channel bottom between the high water marks. If water is too high, too fast, or too cloudy to see through, this survey cannot be performed.
2. You will survey along the 100 ft line, which is broken into 4 equal sections, or reaches, marked by cones or pin flags.
3. Take a moment to observe the whole unit and determine which types of substrate are present.
4. Make estimates of the percentage of each substrate type on the data sheet. **Percentages in the column for each stream unit should equal 100.** Use the pictures above the data table to help with percentage estimates.
5. Note if there is any erosion observed in or near the stream reach or if there are areas of the reach that are not visible. Do not go into the water above mid-calf. Record your observations in the comments section of the Substrate Type data table.
6. Note whether gravel and cobble make up 80% or more of the total reach area (all four reaches), and the percentage of silt observed. Record your answers in the data table by placing an "X" in the corresponding box and circle your score.
7. Record the score as the GEOLOGY SCORE at the bottom of the data sheet.

Analysis

- Did you see very much silt or fine sediment? Where do you think it came from? Is this a good thing? *Fine sediment is natural, but too much can clog fish gills and suffocate fish eggs.*
- Describe in what parts of the stream you found the smaller particles like silt and sand. Where were the larger particles like cobble and boulders? How did they get there? How is this placement related to the amount of stream flow?
- If there was more large wood in the stream, how would the substrate change? *Large wood helps slow down the water, so smaller substrate can fall out of suspension upstream of the large wood. It may also scour out the finer sediments downstream of the large wood as water spills over the large wood and picks up speed.*
- Do you think salmon would want to spawn here? *Salmon want to spawn in clean, cobbley and gravely riffles.*
- What does the substrate tell you about watershed conditions? Does the stream usually flow fast or slow here?

Conclusions

- What would you recommend for management upstream, and what would you change in this reach to make better habitat?

GEOLOGIST DATA SHEET

School:_____Date:_____

Stream name:_____Weather:_____

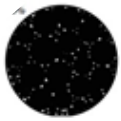
Materials: Measuring tape, boulders and substrate data sheet and instructions, clip board and pencil


10%


30%


50%


70%


90%

Substrate Type	**Percent Substrate in Reaches (%)**				
	Example	**1**	**2**	**3**	**4**
Silt / organic matter (silt is smooth like mud)	5				
Sand (settles to the bottom when disturbed)	10				
Gravel (pea to baseball size)	35				
Cobble (baseball to bowling ball size)	25				
Boulders (larger than a bowling ball)	10				
Bedrock (solid rock)	15				
TOTAL (= 100%)	100	100	100	100	100
Gravel + Cobble	60				

Substrate Suitability	**Gravel + Cobble > 80% in 3-4 reaches**	**Gravel + Cobble > 80% in 2 reaches**	**Gravel + Cobble > 80% in 1 reach**	**Gravel + Cobble > 80% in no reaches**
Place an **X** in the corresponding box				
SCORE	10	7	5	1
	Excellent	Healthy	Fair	Poor

Notes or Comments:

GEOLOGY SCORE: Substrate Suitability _____

OVERALL RIPARIAN HEALTH

Survey	Significance	Riparian Function	Score
Botany 1: Vegetation Diversity	Insects, birds, and animals use different plants for survival. The more types of native plants present, the more species can live here.	Bank Stability Shade Water Storage & Filtering Wildlife Habitat	
Botany 2: Riparian Area Width	The quality of the riparian zone increases with the width and complexity of the vegetation within it.	Bank Stability Shade Water Storage & Filtering Wildlife Habitat	
Aquatic Biology 1: Pools and Riffles	Pools are important resting and feeding sites for fish. Riffles are critical for maintaining high species diversity and for serving as spawning and feeding grounds.	Wildlife Habitat	
Aquatic Biology 2: Instream Habitat	A variety of physical habitats in the stream provide shade and cover, allowing fish to hide from predators and have enough oxygen throughout the year.	Shade Wildlife Habitat	
Forest Biology: Canopy Cover	The canopy shades the riparian area and the water, helping to keep the water cool and limit algal growth. Cold water can hold more oxygen than warm water.	Bank Stability Shade Water Storage & Filtering Wildlife Habitat	
Geology: Substrate Suitability	Salmon need gravel to cobble-sized rocks for their redds. Too much sediment can suffocate fish and their eggs.	Wildlife Habitat	
TOTAL			

Riparian Health	Total ≥ 50	Total 35-49	Total 15-34	Total < 15
Enter your score in the corresponding box.				
Riparian Value	**Excellent**	**Healthy**	**Fair**	**Unhealthy/ Poor**
	This riparian area is very healthy and provides excellent erosion control, shade, habitat for wildlife, water storage and filtering.	This riparian area is healthy and provides adequate erosion control, shade, habitat for wildlife, water storage and filtering.	This riparian area could be in better condition. It provides some functions to some degree and may not provide one or more functions adequately.	This riparian area is not healthy, and does not provide some or any of the functions necessary to the watershed.

DISCUSSION QUESTIONS

Is our riparian area healthy?

Does it provide the necessary conditions for a healthy watershed?