Riparian Rx

Introduction

RIPARIAN Rx (prescription) connects the watershed with its terrestrial residents. In this station, students study and evaluate the riparian ecosystem s flora, fauna, soil, and the geomorphology that influences the watershed.

"The very uprightedness
of the pines and maples asserts
the ancient rectitude and
vigor of nature."

Thoreau

Riparian Rx

Teacher Section

Objectives

Students will be able to:
1) List the functions and adaptations of riparian plants
2) Discuss the benefits of a riparian area to its watershed
3) Record flora and fauna data on a survey form
4) Describe the cultural uses of certain plants
5) List ways the geomorphology of the area formed the watershed
6) Illustrate stream and valley types

WA SCIENCE Essential Academic Learning Requirements (EALRs): 1.1, 1.2, 1.3, 2.1, 2.2, 3.2

Concepts

- Adaptation
- Flora—fauna—land watershed interrelationships
- Function of riparian areas
- Stream bank restoration
- Cultural uses of plants

Study Site Description

Students arrive at the marked site and divide into three groups. Each group goes to a brightly flagged plot. A resource facilitator and students explore the plot and fill out a survey form. Students move three times to analyze the riparian ecosystem: flora, fauna, soil, and geomorphology.

Vocabulary

(Definitions can be found in the Glossary)

Adaptation	Fauna	Intermittent (stream)
Aspect	Flora	Infiltration
Canopy (tree)	Forb	Riparian
Cryptogam	Geomorphology	Succession
Ethnobotany	Herb	Transect

Classroom Pre-work

MINIMUM PRE-WORK NECESSARY FOR FIELD STUDY:
Two hours to include *Plants with a Purpose*, *Classroom Cover,* the *Water, Land, and Plant Connection*, and an overview of student worksheets to be used on the field trip.

Plants with a Purpose

(30 minute activity)

Objective

Students will be able to:
1) Illustrate the placement of riparian vs. upland plants
2) List plants that may be found at field trip site
3) Describe traditional medicinal uses of selected plants

Materials

- ❑ Plant photographs on compact disk
- ❑ Projector and screen or monitor
- ❑ Copies of *Plants in Transition* Worksheet
- ❑ Pencil

Background

A *riparian* area is an area of vegetation adjacent to and influenced by an intermittent or annual body of water. Riparian plants function to stabilize shorelines and streambanks adjacent to a body of water, provide food and cover to wildlife, and shade to keep the water temperature cool. As distance from a water body increases, plant demands for water decrease and ecosystems change. Upland plants have adapted in different ways to survive drier conditions. At the *Riparian Rx* station, students will be looking at adaptive and functional features that enable plants to exist in their environment.

Plants may serve a vast array of purposes. At this station, we will consider some uses of selected plants on our list by Native American groups who lived in the interior of Washington and British Columbia. This information is taken from work by a scientist in *ethnobotany*, who interviewed many Indian people still practicing traditional ways.

It is difficult for us to remember or even imagine how scarce manufactured items were to these peoples. If you could not produce it yourself or trade for it, you went without. This includes the most basic items that we barely consider in our lives; rope, string, nails and pegs, containers, aspirin, cloth, and shampoo. Getting away from the processed and packaged foods, plastic items and medicines of daily use we are accustomed to seeing, let us take an *ethnobotanical* view of the common plants that are all around us and consider their many uses. We will focus on plants that often occur in the riparian zone. These are plants found on both the student and teacher list.

Background
continued

A word of caution!
The medicinal uses listed below are not recommended for use unless directed by a physician! Most traditional practitioners had years of experience and knowledge passed along by generations of practitioners before them. Often what is recorded by researchers is only a minimum amount of information. Also important is the place, time of year, harvest and storage methods, and final preparation of a plant. This information is being passed on to you as information only and as an illustration of how use of these plants was a critical element of a people s heritage.

Native American Beneficial Plant Uses

Grand Fir *(Abies grandis)*
The needles were boiled for medicinal tea, boughs used as air freshener and burned as incense, and needles dried and crushed for baby powder. The thin bark of young grand fir trees have pitch blisters. These blisters were pierced, and the pitch was collected for use as a medicine for consumption (tuberculosis) or appendicitis. The bark was powdered, dried, and rubbed on the skin as a deodorant. Dried and powdered needles were mixed with marrow from bones to make a hair dressing. Fresh boughs were used as floor coverings in sweat lodges.

Big Leaf Maple *(Acer macrophyllum)*
Uses such as tuberculosis remedy and dermatological aid.

Vine Maple *(Acer circinatum)*
Used as a love medicine.

Serviceberry *(Amelanchier alnifolia)*
The fruit of this shrub was highly prized. Berries are one of the early ripening fruits of the lowland and harvest could be extended into higher elevations as the summer progressed. Dried fruits were often mixed with dried bitterroot, salmon eggs, or with black tree moss, as well as eaten fresh. The berries were one of the sweetest foods available.

The burned ashes of the shrub were mixed with pine ashes to become a contraceptive. The branches were boiled for various medicinal uses such as treating colds and stomach problems.

The wood is hard and strong and provided arrows, digging sticks, spear shafts, tool handles, and seed beaters. Young branches were used as rope.

Oregon Grape *(Berberis nervosa)*
The tart berries were eaten fresh and dried.

The inner bark of the stems and roots produced a yellow dye used in coloring basket materials, mountain goat wool, and porcupine quills. The stems and roots were boiled until the water was almost all boiled away and a powdery yellow substance was left. This was mixed with ochre paint and the resin of cottonwood buds.

It was a multipurpose medicine, eye wash, tonic, and blood purifier. For some groups, the branches of Oregon grape also served ceremonial functions; they were placed in graves and around the walls and furniture.

Red Osier Dogwood *(Cornus stolonifera)*
This member of the dogwood family is also known as red willow since it adds a red color to the late winter landscape with its bare branches. The white, bitter berries were considered to be good eating because they gave extra sweetness to midsummer chokecherries and serviceberries. The inner bark, mixed with kinnikinnick or tobacco, became a smoking mixture.

The larger stems were used to make fish traps and spatulas and the large limbs made frame poles. The older branches created smoking fires for buckskin. The bark was stripped, twisted into rope and used for lashing together fish traps, raised food cache platforms, and other utilitarian uses. Powdered bark, mixed with cottonwood bud resin, made a red paint.

Medicinal uses of a tea made from the young twigs or the outer bark of this shrub were numerous and could be used for almost any kind of sickness. It clears the blood,   helps circulation, and heals sores and rashes. A daily concoction for a year after childbirth prevented another pregnancy.

Horsetail *(Equisetum arvense)*
Numerous medicinal uses were identified such as a wash for skin sores, a tea for colds, and as a diuretic for the kidneys and backache.

Horsetail s primary use was as sandpaper, especially useful to polish bone tools and soapstone pipes and ornaments. Soapstone items were first covered with a varnish of warm salmon slime that was allowed to dry and harden, then rubbed with horsetail stems. Women polished their nails with the stems. The dark roots created patterns in woven baskets.

Ocean Spray *(Holodiscus discolor)*
Numerous medicinal purposes such as: antidiarrheal, eye medicine, cold remedy, disinfectant, and others. The dried and pulverized leaves healed sores.

Also known as ironwood. The wood of this shrub is very hard, especially when it is heated in a fire. It was used to make digging sticks (used mainly by women) for digging roots and bulbs of edible plants, arrows, fish-spear heads and teepee poles.

Engelmann Spruce (Picea *engelmannii)*
Spruce roots were sometimes substituted for the preferred cedar roots in the manufacture of basketry.

The needles produced a pleasant tea and a medicine for tuberculosis and respiratory ailments was created from the bark steeped in hot water.

Ponderosa Pine *(Pinus ponderosa)*
Medicinal uses were numerous. The pitch was mixed with grease and used as a skin lotion, the needles were brewed into a tea used to stop internal hemorrhaging, and used as an eye wash.

The inner cambium layer was harvested in the spring by prying a rectangular shaped slab of bark from the tree and scraping the moist cambium layer from that. The scars from this activity can be seen on living trees in some locations today. Sometimes the seeds were collected from cones in the fall and the hard, red pitch chewed as gum.

The heavy outer bark was saved and became a covering on winter houses (house pits), bent bark containers, and as trays and platters for serving food. Its wood and poles aided in general construction. The pitch was used as glue and as a caulking for canoes.

Black Cottonwood *(Populus trichocarpa)*
Used as a disinfectant, skin aid, and throat aid.

The black cottonwood tree is always an indicator of water and spotting it on the landscape was a welcome sight to people traveling in an arid land. The trunk of the tree was sometimes used to make a dugout canoe. The wood itself was very light when dry. Often the rotted, punky wood was used to smoke hides, imparting color and some waterproofing to them. The upper branches made fire drills and the roots were used as hearths for making friction fires. Cottonwood ashes became a soap to clean buckskin clothing and for washing hair.

The aromatic resin from the buds was used as a glue that was reputedly better than traditional fish slime glue for attaching arrow heads to arrows and spears.

Douglas-fir *(Pseudotsuga menziesii)*
Pitch made water jugs watertight and was chewed as a gum.

As in our modern society, Douglas-fir was a basic building material providing teepee poles, spears, shafts, and general use poles. Fresh boughs were used for bedding and were thought to be especially useful for purifying the households of people who were in mourning.

A special product of these trees was produced in hot, dry weather when certain compounds crystallized on the needles into a sweet sugar-like substance.

Medicines for colds, stomach problems, anemia, fever, and loss of energy and weight was made by making a tea from the first year s needle growth.

Woods Rose *(Rosa woodsii)*
The outer rind of the fruits were eaten, although they were not highly favored. They had the advantage of being available in the winter if food stores were low. Camas and bitterroot were flavored while they cooked with rose leaves.

Rose leaves, chewed and applied to bee stings, reduced the swelling and discomfort. A tea made of the rose stem and poured over a hunter s body was said to reduce or eliminate the human odor and contribute to the success of the hunt.

Thimbleberry *(Rubus parviflorus)*
Fruit was eaten fresh, pressed into cakes and sometimes dried. Tender shoots were eaten in the spring. The large leaves were used to line steam — cooking pits or ovens or to line berry picking baskets.

The roots were used to make a facial wash for the control of pimples and blackheads and as a medicine for stomach problems.

Coyote Willow *(Salix exigua)*

Used for basket making, building shelters, roof thatching and other household related uses.

Willow leaf tea was used to treat many diseases and health ailments. Chemical analysis has shown that the salicylic acid contains the same active ingredient as in aspirin.

However, this is a perfect example of how an herbal chemical can vary depending upon which part of the plant is harvested, and how the material is stored.

Young willow shoots can be stripped of their bark and eaten. The inner bark was eaten raw, eaten like spaghetti, or made into flour.

Solomon s Seal *(Smilacina stellata)*
The roots of this plant were said to taste like onions, were used to flavor other foods, or were eaten green by themselves.

A medicine for colds or lack of appetite was made from the boiled roots.

Snowberry *(Symphoricarpos albus)*
The white berries were considered poisonous and not consumed.

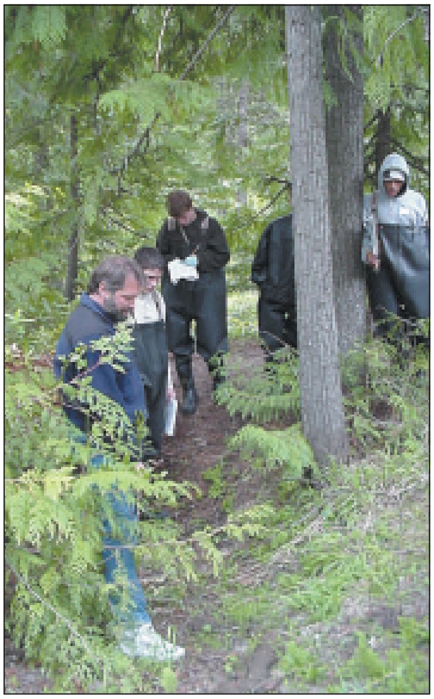
The entire plant was boiled and the resulting brew was used as a physic to clean out the system. The mashed berries were used as a poultice on skin sores or to relieve itching. The mashed berries were put into the eyes to relieve sores or rubbed in the arm pits as an antiperspirant.

Western Red Cedar *(Thuja plicata)*
The cedar tree was one of the most prized and versatile of the tree resources. In the dry interior, it is confined to the riparian areas in the mountains and foothills. It was valued for housing, boxes and canoe construction. The wood was easily split and often planks were split from a living tree. The bark was peeled off the tree in long strips or cut into rectangular slabs. The inner layer once removed, was used for a myriad of items that included basketry, skirts, capes and complete dresses. The small roots were dug up, split, and used for basketry and ropes.

The cambium was eaten fresh in the spring and dried for later use.

Many medicinal uses were reported such as an analgesic, heart medicine, toothache remedy, kidney aid, hair rinse, and dandruff wash. Arthritis sufferers sometimes soaked in a cedar bough solution to ease their discomfort.

Procedure



1. Ask questions to assess knowledge of plants such as:
   - ❑ What are some typical plant species found in this area?
   - ❑ Where do they grow? Consider aspect to the sun, elevation, water access.
   - ❑ What do plants contribute to the ecosystem? (e.g., food, soil and bank stabilization, cover, oxygen, filtering, and flood control as in wetlands.)
   - ❑ What beneficial uses do plants have to humans? To animals?

2. Show photos from this section. Ask students to name what plants they know, but do not discuss where they grow.

3. Ask students to complete *Plants in Transition* Worksheet.

4. Present photos again and ask students to compare answers with those you provide. Discuss *adaptations* and functional differences of the various species. Continue the discussion with samples of local plants (only if they are abundant in the area) or take a walk outside. Point out physical characteristics that exemplify riparian, transitional, or upland plants.

5. Discuss the human uses of plants.
   Ask students to create a handbook based on the plants listed in the *Native American Beneficial Plant Uses* Section. Illustrate each plant in its common habitat, describe how animals and humans use it, and list its benefits to the ecosystem.

Assessment

Ask students to:

- ❑ Illustrate plants on the list, emphasizing adaptive features; use field guides as needed.
- ❑ Explain the functions of riparian plants and how they contribute to the ecosystem.
- ❑ Name other vegetation that grows in the same communities as the plants from the photos.
- ❑ Discuss pertinent answers on the *Kids in the Creek Scavenger Hunt*.

Extensions

- ❑ Locate outdated aerial photos from your nearest U.S. Forest Service. Ask students to locate the riparian areas and predict which plants might be found there.
- ❑ Practice using a dichotomous plant key for identification, starting with tree species in the schoolyard.
- ❑ Assign students to start a journal of local riparian plant species, drawing and noting features for future identification needs.
- ❑ Visit a nearby waterway and note riparian, transition and upland plants. Are they similar or different to those discussed in class?

Riparian Rx Photos (Teacher s List)
Remember plants are found where the water delivery system suits them. For example, vine maples need wet feet, yet may be found up hillsides when they would only be expected to grow in riparian areas. This may be due to either surface or subsurface water movement patterns. Photos provided include:

Botanical Name	Common Name	Riparian(R), Transitional(T), Upland(U)
1. Abies grandis, foliage	grand fir, foliage	T, U
2. Abies grandis, bark	grand fir, bark	T, U
3. Acer circinatum	vine maple	R, T, U
4. Acer macrophyllum	big leaf maple	R, T
5. Alnus sinuata	Sitka alder	R, T, U
6. Amelanchier alnifolia	serviceberry	R, T, U (Drought Resistant)
7. Berberis nervosa	Oregon grape	T, U (Drought Resistant)
8. Cornus stolonifera	red-osier dogwood	R
9. Equisetum spp.	horsetail	R, T (seeds? spores?)
10. Galium triflorum	sweet-scented bedstraw	R, T
11. Holodiscus discolor	ocean spray	R, T, U (Drought Resistant)
12. Pachystima myrsinites	mountain box	R, T, U (Drought Resistant)
13. Picea engelmannii, foliage	Engelmann spruce, foliage	T, U
14. Picea engelmannii, bark	Engelmann spruce, bark	T, U
15. Pinus ponderosa, foliage	Ponderosa pine, foliage	T, U (Drought Resistant)
16. Pinus ponderosa, bark	Ponderosa pine, bark	T, U (Drought Resistant)
17. Populus trichocarpa, foliage	black cottonwood, foliage	R
18. Populus trichocarpa, bark	black cottonwood, bark	R
19. Psuedotsuga menziesii, foliage	Douglas-fir, foliage	T, U
20. Psuedotsuga menziesii, bark	Douglas-fir, bark	T, U
21. Rosa woodsii	woods rose	R, T
22. Rubus parviflorus	thimbleberry	R, T, U
23. Salix spp.	willows	R
24. Smilacina stellata	starry Solomon-seal	R, T, U
25. Symphoricarpos albus	snowberry	R, T, U
26. Thuja plicata	western red cedar	R, T

Classroom Cover

(20 minute activity)

Objective

Students will be able to:
1) Estimate percentages of existing classroom items

Materials

- ❑ Chalk board or whiteboard
- ❑ Chalk or Pens

Background

Botanists and ecologists typically estimate vegetation cover when mapping an area. They look at plants at all levels from herbs to trees - and estimate absolute cover. This enables them to ascertain the importance or dominance of the various plants. One reason to do this is to help predict the plant communities in a given ecosystem. The prediction extends to wildlife known to occupy certain vegetative areas. Knowledge such as this is extremely valuable especially when planning land use activities and for making management decisions, including wildlife habitat development, timber management, forest insect and disease control, fire management, recreation, and maximizing the benefits of natural spaces in developed areas.

Absolute cover includes several levels above the ground. Its features can (and usually do) add up to more than 100%. Overhead, the tree *canopy* casts a shadow that can range from open, allowing a great deal of sunlight through, to very dense, with little light filtration to the levels below. Beneath the tallest trees is the understory layer, with a variety of shrubs and smaller tree species. These, too, can be open and sparse or thick with broad leaves.

Herbs such as *forbs* and grasses, as well as *cryptogams* such as ferns, fungi, lichens and mosses are also part of the understory. All of these features are a function of the climate and availability of water. Their characteristics will affect the amount of light and water reaching the ground, and influence the percentage of bare ground and the makeup of the litter covering the soil.

Background continued

In contrast to absolute cover, relative cover considers the relationship of various plant groups and how much area they take up as a percentage of the total. The dominant plant groups can give clues to the types of wildlife that might be found in the vicinity and the function of the plant community. For example, the dense understory plants of a riparian area offer more food sources, travel corridors, and breeding grounds for small animals than do more open, sparsely covered areas. The shrubs and grasses provide dense root systems to hold soil and prevent erosion. Their many flexible stalks and branches are especially important during flood periods. They absorb the energy of the high water, helping it to slow down and spread out. This reduces the erosive force of the water and aids *infiltration*. The stored water is slowly released during the following periods of low flow.

Relative cover can be illustrated by envisioning the shadow beneath each plant group at high noon in a specified plot of land. Imaginary lines drawn straight down from the outermost branches define the perimeter of the plants. Subtract a portion for the amount of light filtering between the branches of the tree or shrub. The area covered by the shadow is estimated and expressed as a percentage of the total area in the sample plot. For example, in a 20-foot square plot on the school grounds, there might be a tree, two large shrubs, a border of flowers and ground cover, and some lawn grass. The estimates for these elements might look like this:

Tree Canopy (perimeter minus light filtering through)	60 sq. ft.	15%
Shrubs (same method as for trees)	40 sq. ft.	10%
Flowers/ground cover (forbs)	80 sq. ft.	20%
Lawn grass	200 sq. ft.	50%
Bare ground/plant litter	20 sq. ft.	5%
Total	**400 sq. ft.**	**100%**

In the example plot, the dominant plant group is grasses. It makes up 50% of the total area. Plants growing under a plant from another group are not considered in estimating the total (such as mosses or small plants under a tree or shrub).

During *Riparian Rx,* students must estimate vegetation relative cover at every stop along the transect and record it on field worksheets. This simple classroom activity is essential for their understanding of the station dynamics.

Procedure

1. Tell students they will be estimating relative cover. Have them look around the classroom while you explain that everything in it covers a portion of the floor, and the cover plus the open spaces add up to 100%. For example, cover could include desks, tables, chairs, trash cans, you and the students, etc. Do not count the ceiling or overhead fixtures.

2. As a class or divided into groups, have them calculate the percentage of floor space filled with computers, with tables, with desks, with people, etc. Record their answers. Assist them with their estimation techniques, making certain numbers do not add up to more than 100%.

Assessment

Ask students to:
- ❑ Draw a schematic of their home, with everything in it.
- ❑ Estimate the percent of items in it. (For example, what percent of their home is empty space? What percent has tables, etc.?)

Extensions

Ask students to:
- ❑ Go outside and mark off an area about the size of an average classroom.
- ❑ Estimate plants and other objects within the study plot (The transect plots will be circular. Try doing the same exercise in a circular plot).
- ❑ Repeat the process by creating a circular plot.
- ❑ Practice this concept in the classroom by drawing various-sized colored circles on a paper plate.
- ❑ Estimate the percent of cover of the circles, grouping them by color (You could also use paper cutouts, and overlap the circles slightly with the color representing trees on the top layer. These would be counted first, followed by the visible portions of the next layer).

The Water, Land, and Plant Connection

(45 minutes activity, plus optional field trip)

Objectives

Students will be able to:
1) Describe characteristics of specific stream channels
2) Illustrate valley types
3) List ways that *flora* and *fauna* habitat are determined by geomorphologic processes

Materials

- ❑ Paper, pencil
- ❑ Drawing supplies for illustrations
- ❑ Overhead transparencies
- ❑ Local topographic map

Background

Why are plants, particularly riparian plants, located where they are along a stream? What are the forces constantly at work that create stream deposition areas? What happens when we channelize a stream to build a road?

People have altered rivers to construct homes, dams, farms, malls, etc., to meet perceived needs. In a natural system, flooding is a way to deposit important material for spawning beds and seeding plants. Habitat is created. Ground water supplies are replenished. When humans change a river s flow, instability can result. Flooding can also ruin crops and neighborhoods. The removal of riparian vegetation further perpetuates the loss of valuable property. The natural processes forming fish and macroinvertebrate habitats are disturbed. It is important to understand *geomorphology* to assist in land use planning. This insight could have the dual benefit of improving the quality of human endeavors and enriching the biological integrity of natural waterways.

Background continued

Scientists have classified stream and valley types to help explain the way water flows with its consequential effects on terrestrial and aquatic systems. As many as nine different classes have been used to define stream channel types. River valleys may be divided into as many as 12 classifications. For our purposes, these categories are condensed into three major valley types and the four most common stream channel types.

Stream Channel Types

Researcher David Rosgen developed a system for the classification of stream types that has proven useful in the field and is easy to understand. Ultimately this system allows the observer to not simply classify, but also to predict the behavior of a stream by its appearance. The *Riparian Rx* section will concentrate on stream channel types A, B, C, and D, that are determined by several landscape factors. Note that some of these may be altered by human activities such as grazing, logging, road building, and agriculture, thus changing the way a stream behaves.

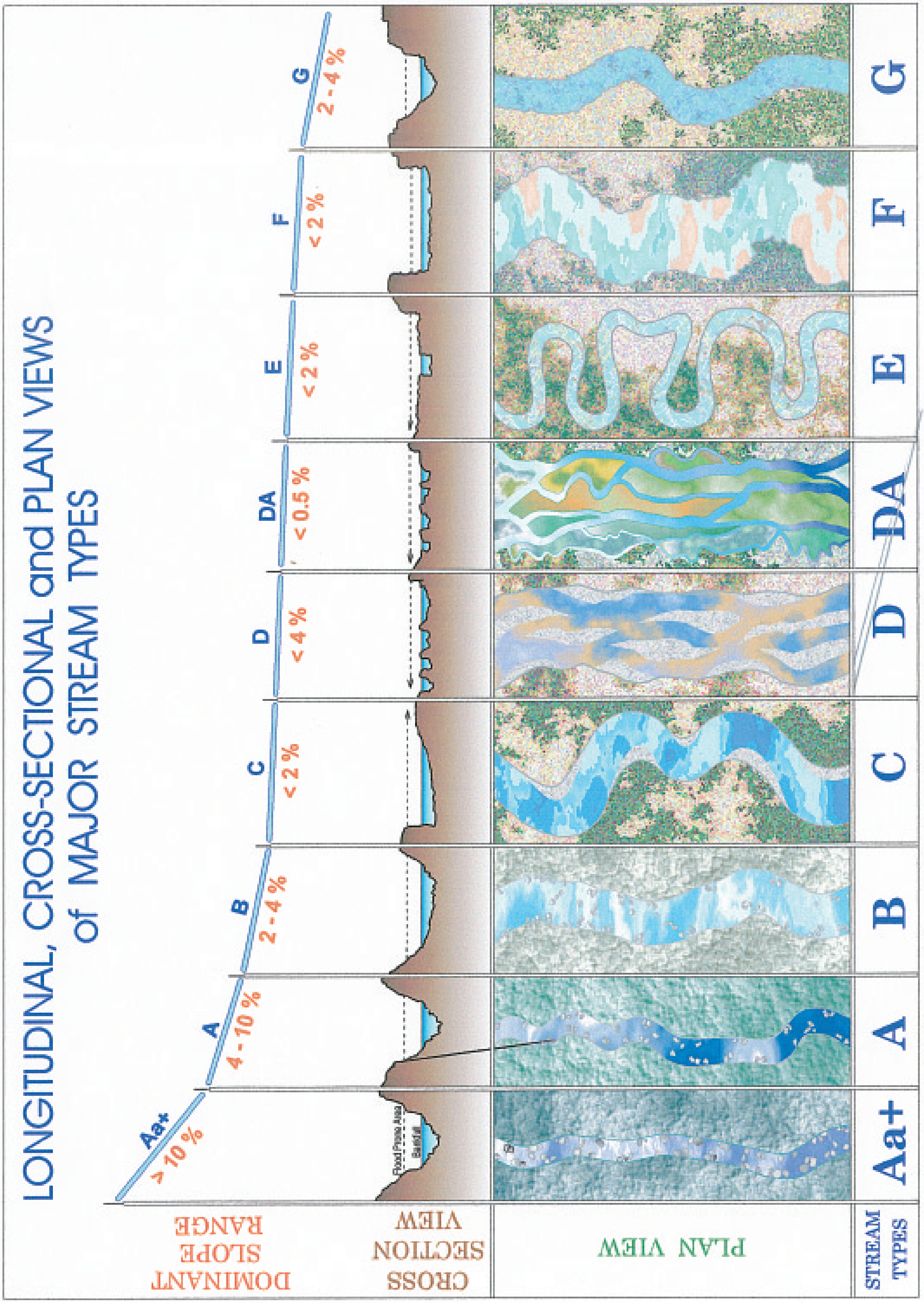
<u>Factors Determining Stream Type</u>:
Valley slope
Channel bed materials (size and type)
Size of the drainage network
Riparian vegetation/woody debris (amount, size, and location)
Sediment supply (input vs. output)
Flow regime (precipitation: amount and timing)
Exposed bedrock locations

A-Type Streams are typically where deep pools and cascading reaches are found, and often in steep canyons. They have low sinuousity, low width/depth ratio, and are fully entrenched or confined by the surrounding land such as bedrock.

B-Type Streams are generally stable with a moderate *gradient*, sinuosity, width/depth ratio, and entrenchment. There are riffles and rapids in this category with occasional pools.

C-Type Streams have low gradient, high sinuosity, moderate to high width/depth ratio, and are slightly entrenched. These have broad, well defined flood plains with some riffles and pools.

D-Type Streams have low gradient and sinuosity, a very high width/depth ratio, multiple channels, and are not entrenched. There are often braided channels (multiple active channels within one stream) with eroding banks and sedimentation.



Rosgen, D. L. 1996. Applied Fluvial Geomorphology. Wildland Hydrology Books, Pagosa Springs, CO

VALLEY TYPES:

1. V-shaped \/
2. U-shaped _/
3. Wide valley floor _______/

Valley type may change as you follow the course of a stream, but each type will likely have the following similarities:

1. **V-shaped** \/
   - Has steepest gradient
   - No floodplain
   - Has step-pool, riffle, and rapid stream channels
   - Is youngest in geologic age
   - Little or no lateral movement or migration
   - High sediment supply
   - Usually contains A-, sometimes B-type streams

2. **U-shaped** _/
   - Has moderate gradient
   - Sparse, or poorly developed floodplain
   - Has all types of stream channels
   - Is moderate in geologic age
   - Slight lateral channel movement or migration
   - Sediment supply varies
   - Usually contains B-, sometimes C-, and occasionally D -type streams
   - May have glacial origin or influence

3. **Wide Valley floor** _______/
   - Has low gradient
   - Well developed, wide floodplain
   - Has pool-riffle channels
   - Is oldest in geologic age
   - Little or no lateral movement or migration
   - Low sediment supply
   - Usually contains C-, sometimes D-type streams

By *meandering*, a stream is expressing its natural energy distribution. As with meanders, a stream channel will *migrate* within and through a valley bottom if allowed by the channel bed materials and the slope (see previous illustration and aerial photos, Figures 1 & 2). If erosion is occurring on the downslope and outside edges of the channel (and deposition vice-versa), the channel must move back and forth and down the valley over time.

Procedure

1. Ask students what type of valley best describes where the school is located. What stream type(s) would most naturally flow there? Are there stream reaches(sections) that have been changed by human activities? Are there floods in those areas?

2. Make transparencies of the aerial photographs (Figures 1 & 2) showing Nason Creek and White River. Discuss the examples of meandering, channeling, oxbows, and other features such as deposition and vegetated areas. Is there a floodplain? What areas are subject to erosion? Where are advisable vs. inadvisable building areas? What current or previous human activities are visible? What impacts might those activities have on the aquatic ecosystem? Would they facilitate flooding?

3. Take students outside to a location where there is sand or soil exposed. An incline is preferred. Using a hose, turn on the water and gently pour it over the area of study. Watch how it moves and where it goes. Notice the tiny winding (C) or braided (D) stream channels form as the water flows downslope and cuts its path. This demonstrates that if allowed by the channel bed materials and the slope, a stream channel will meander. Ask students where the eroded areas would occur over time and where vegetation will grow. Of course, it will grow in slower areas away from strong, direct currents of water.

4. Find a local topographic map. By reading the contours (practice with the *Watershed Cartography* activity in *Watershed Wonders)* and looking at the flow of a creek or river, predict the locations of the stream and valley types.

5. Go outside and analyze the valley type where you are located. Ask students to predict if the valley type changes up or down valley. If there is a creek or river nearby, repeat the question using the stream type. Take a trip up and down river and valley. Ask students to map how the river flows and how the valley appears. Either return to the classroom or sit somewhere and have students illustrate likely areas of erosion, deposition, flood, and vegetation. Indicate pools, riffles, and glides (see *Habitat Sense*). Return to the river and valley areas previously visited to see if their predictions are correct.

If not, why? Are there human activities or forces of nature that changed what might have naturally occurred without those influences?

Assessment

Look at the maps again. Ask students to illustrate where they would place a community if they were city planners. Include agriculture, industry, libraries, schools, and other elements of the usual development. Gather the class to critically look at where students are developing. Are they in the most ideal places to avoid flooding, landslides, avalanches, etc.? If not, what are the alternatives? Further considering the development locations, what are the implications for wildlife, terrestrial and aquatic? Is there enough water for everyone?

If students can agree, create a class mural showing the ideal community development of the watershed being studied, delineating valley, stream types, vegetation zones, fish habitat areas, and human land management activities.

Ask students to:

- ❑ Illustrate stream and valley types and explain their characteristics
- ❑ Describe the ways streams are changed by people and possible alternatives to those changes

Nason Creek
at Highway 2 Junction

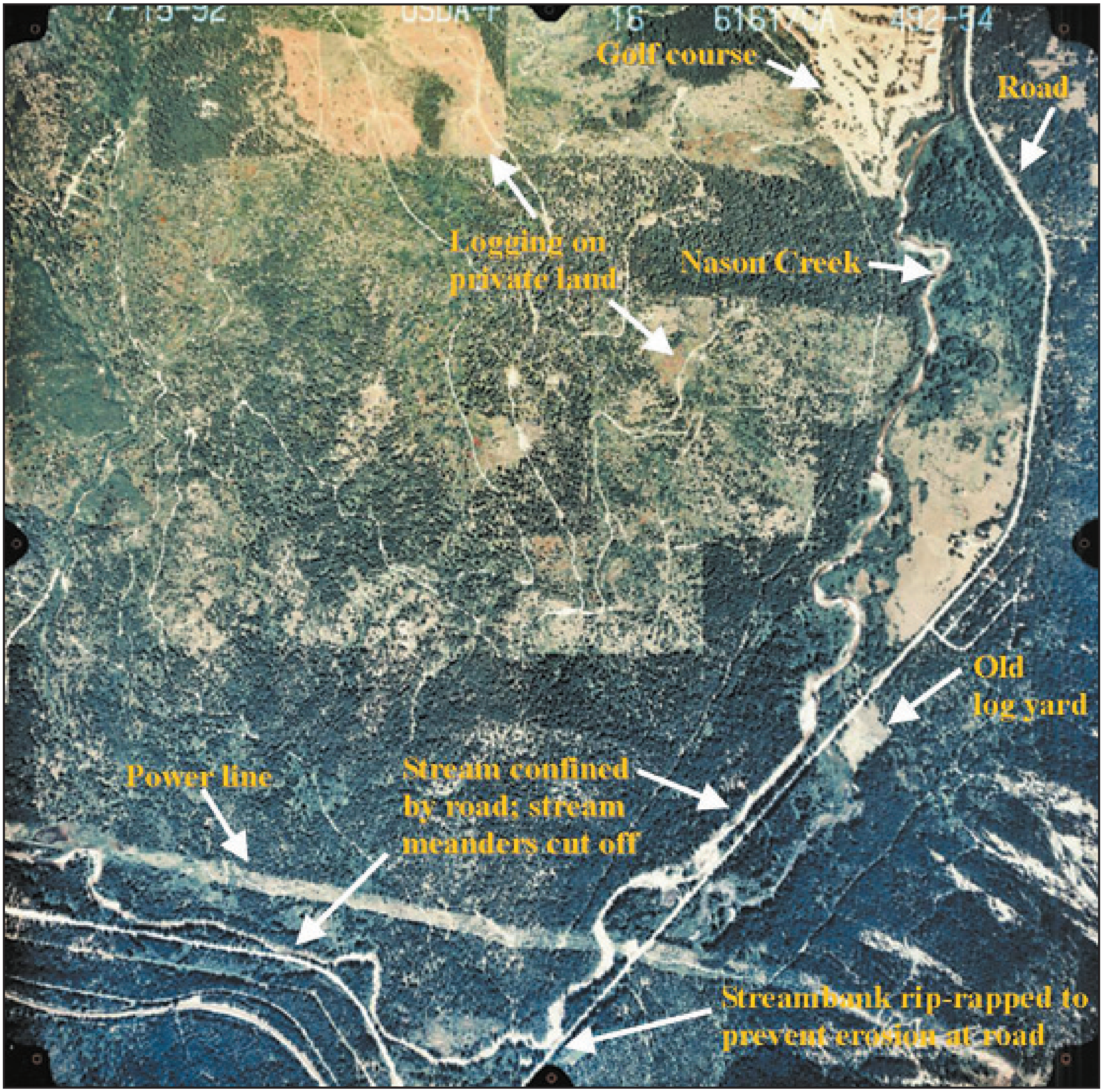


Figure 1. Nason Creek

White River

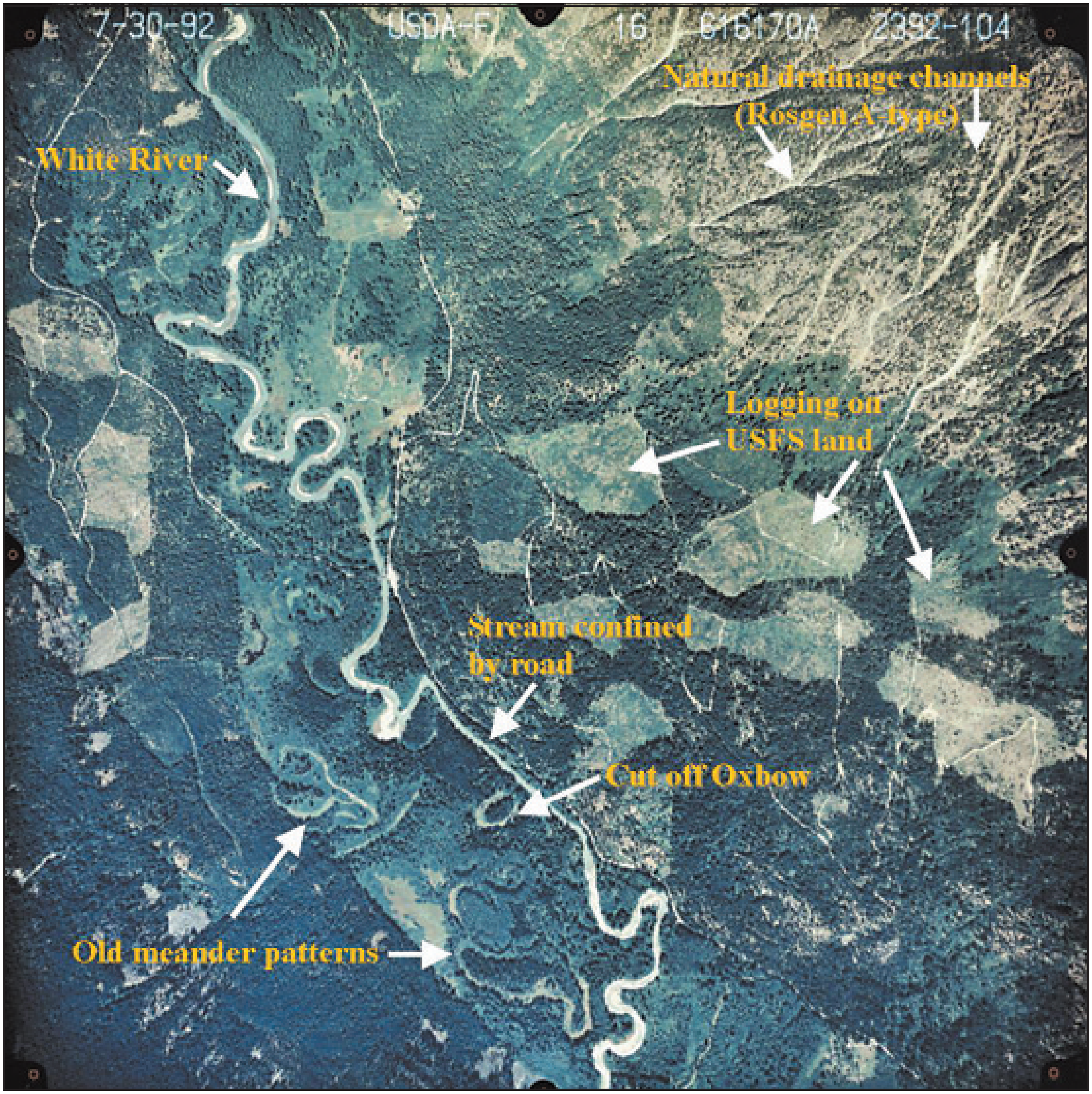
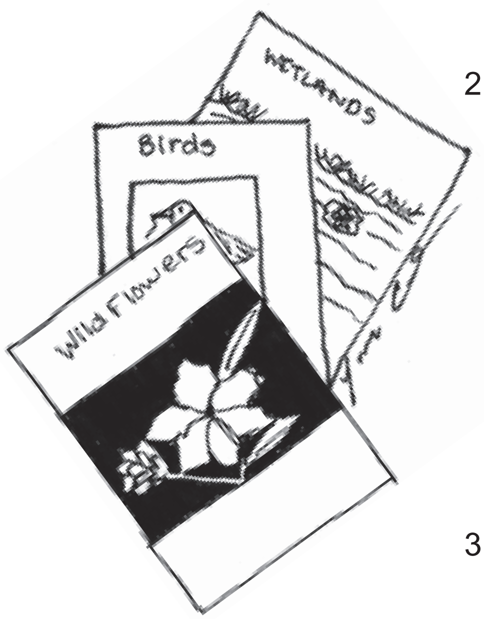


Figure 2. White River

Preparing for the Field Study

- ❑ Familiarize students with station equipment listed in the *Resource Specialist* section
- ❑ Copy *Riparian Rx* student worksheets. Use waterproof paper if possible.
- ❑ *Students must save worksheets for post work!*

Classroom Post-work



1. Visit another watershed and compare its riparian ecosystem to the *Kids in the Creek* site. Investigate any differences or similarities. Is it a question of soil, water quality or the amount of vegetation? What are the stream and valley types? Is there a human influence present?

2. Plants and their roots help hold the soil in place, reducing soil erosion. As plant roots work their way through the soil, they keep it loose, preventing compaction. Air movement and water infiltration are important to healthy plant growth and proper function of other systems such as the water cycle and microbial action in the soil. Do a percolation test in two areas of the school yard, one with plants growing on it and another that is bare. Pour equal amounts of water in each area and check how long the water takes to infiltrate into the soil. Does it infiltrate or run off? Evaluate the role of plants.

3. Research the multiple use aspects of riparian areas. Look at recreation, roads, urban development, agricultural, and other uses. Develop a management plan and defend your point of view to a panel of peers.

4. Class project: Identify a waterway needing an improved riparian zone. Research local plants, consult with a natural resource agency, contact the landowner for permission, and take on a planting project. There may be area watershed associations and fishing organizations willing to lend financial and/or volunteer support. Write a *Restoration Tips* booklet for the community.

5. Look at the results from the *Kids in the Creek* field trip and research adaptations and characteristics particular to various plant species. Sketch all parts of each plant, indicating functional features. Create a graph comparing the percent of individual plant types (species richness) found at the relevant stop. Using a field guide, identify each species.

6. Research the fauna found in riparian areas. What do the plants provide for animals and how do they use it?

7. Look at local plants and the traditional, medicinal, and cultural uses of those plants.

8. Illustrate a detailed riparian ecosystem, showing the landscape and geomorphology found on the field trip. Include plants, soil and animals. Label features of the sketch. Interpret the work.

Student Section

Name ____ Date ___________________

Plants In Transition Worksheet

Botanical Name	Common Name	Prediction of Where it is found; eg. riparian (R), transitional (T) away from water, upland (u)
Abies grandis, foliage	grand fir, foliage	________________________
Abies grandis, bark	grand fir, bark	________________________
Acer circinatum	vine maple	________________________
Acer macrophyllum	big leaf maple	________________________
Alnus sinuata	Sitka alder	________________________
Amelanchier alnifolia	serviceberry	________________________
Berberis nervosa	Oregon grape	________________________
Cornus stolonifera	red-osier dogwood	________________________
Equisetum spp.	horsetail	________________________
Galium triflorum	sweet-scented bedstraw	________________________
Holodiscus discolor	ocean spray	________________________
Pachystima myrsinites	mountain box	________________________
Picea engelmannii, foliage	Engelmann spruce, foliage	________________________
Picea engelmannii, bark	Engelmann spruce, bark	________________________
Pinus ponderosa	Ponderosa pine	________________________
Populus trichocarpa	black cottonwood	________________________
Psuedotsuga menziesii	Douglas-fir	________________________
Rhus spp.	poison ivy	________________________
Rosa woodsii	woods rose	________________________
Rubus parviflorus	thimbleberry	________________________
Salix spp.	willow	________________________
Smilacina stellata	starry Solomon-seal	________________________
Symphoricarpos albus	snowberry	________________________
Thuja plicata	western red cedar	________________________

Riparian Rx Station Worksheet

Name(s) ___________________________Date __________

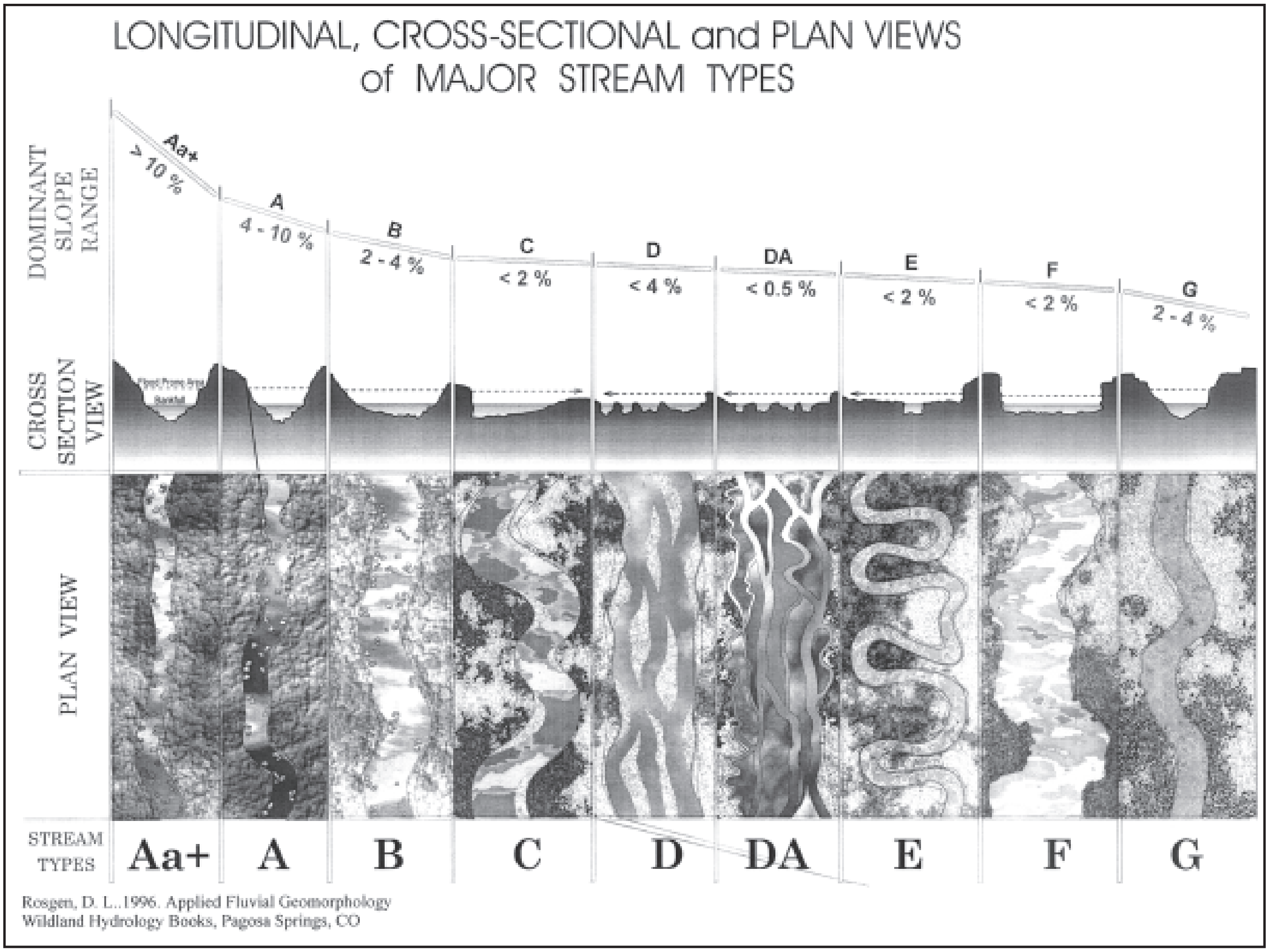
Transect Station Measures ______ feet or meters from the water.

Description of plants; indicate shrubs, trees, grasses, herbs, etc. If possible, include the common name of the plant.	*Extend* flagging connected to transect line; Look at plants within its circumference; *estimate* % of each species in the area in comparison to the others; eg. shrubs 5%, grasses 80%, trees, 5%, herbs 10%. The total of all estimates cannot exceed 100%!	*Estimate* the height of the plants

The % of canopy cover is_________.

Riparian Rx Station Worksheet

Name(s) ____________________________Date __________



Geomorphology Station

VALLEY TYPES:

1. V- shaped \/ 2. U-shaped _/ 3. Wide Valley floor _______/

What stream channel type(s) do you see?

What valley type(s)?

How does the bed material influence the behavior of the stream?

Does it create or degrade fish and wildlife habitat? How?

Riparian Rx Station Worksheet

Name ____ Date ___________________

Name ____

Flora and Fauna Station

Measures _____feet or meters from the water.

Observe the adaptations of plants found in plants. Write your findings here. Consider the conditions in which they live and if they have large vs. small leaves, waxy needles, thorns, etc..

Name at least four functions of these plants.

1. ___________________________________ 3. ___________________________________

2. ___________________________________ 4. ___________________________________

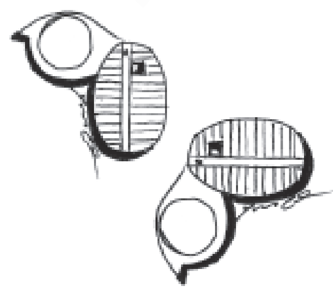
What are (and were) Native American uses of some of these plants?

Look around you carefully. Describe any **animal signs** you see.

Resource Specialist Section

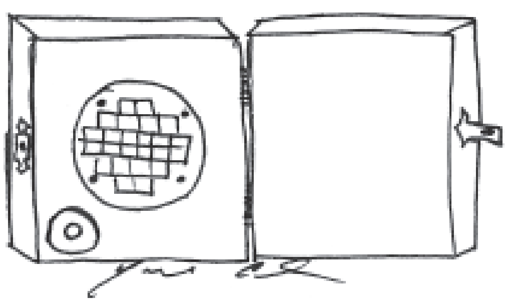
1. **Review *Tips and Tricks for Resource Specialists*** in the Appendix.

2. **Read the entire *Riparian Rx* section** to become familiar with the pre-work. Then you will have an idea of what the student knows. Always praise the classroom teacher for prepared students!



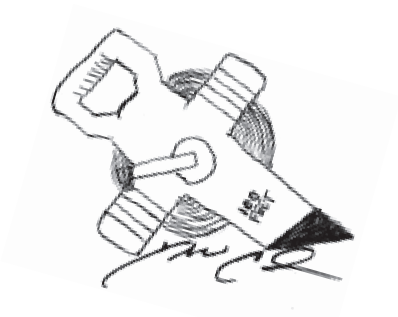
3. **Field study description:** A short hike is conducted to include three pre-selected stops; 1) vegetation transect and transition zone (if not demonstrated in the transect); 2) stream geomorphology, valley, and channel types, and, 3) plant identification (if appropriate), functions, adaptations, cultural uses, and animal signs.

4. **Checklist of equipment necessary for this station:**
   - ❑ 5' piece of bright flagging for plot study radius on transect
   - ❑ One100 ft./meter measuring tape for transect
   - ❑ Two magnifying lenses for flora/fauna station
   - ❑ Field guides for references
   - ❑ Student field worksheets (see Student Section) provided by the teacher; you might have extra worksheets copied on write-in-the-rain paper just in case
   - ❑ Yardstick
   - ❑ Spherical densiometer (local U.S. Forest Service office)

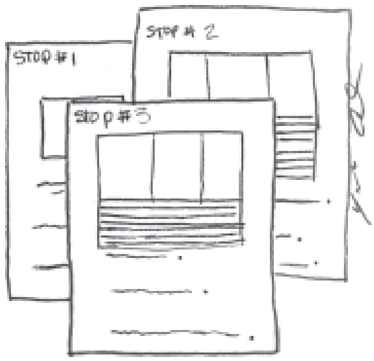


5. **Directions to students:**
   - ❑ Keep on waders throughout the riparian station; they can be rinsed in the stream later if needed

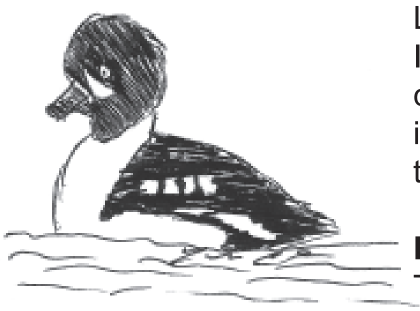
6. **Selecting and preparing the site:** Choose a short hike or walk with a clear travelway and as few overhanging obstructions as possible. Find a short loop that s about 10 minutes nonstop, and mark it with flags or instructional materials if necessary. Name the stations as they occur on the trail and organize worksheets to reflect what occurs in the field. Try to design the walk to minimize damage from trampling or repeated plucking; however, some hands-on collection may be desirable.



Transect Station: Along the trail route, set up a transect the where the vegetation shows as much transition between types as possible. Use a 100’ tape and flagging to show students how a transect is done. Choose one stop along the transect as a study plot. Set up a central stake tied with a piece of flagging 5’ long to be used as a radius; when extended, it will describe a circle 10’ in diameter. The transect may emphasize the diversity of plants in the zone represented, or perhaps a dynamic change between two vegetation types.



Geomorphology Station: Choose a site where you can see the stream and as much of the valley and valley walls as possible; up and/or downstream. Discuss valley types, stream channel types and how the bed material may be influencing the behavior of the stream, and possible formation (or loss) of fish or wildlife habitat. Look for evidence of a floodplain and discuss its function. If possible, have students measure depth across the channel in one or more places and plot the points to illustrate the shape of the channel bottom. Compare this to the surrounding valley for clues to stream type.



Flora and Fauna Station: Select the site carefully. Try to have some common plants or trees nearby to identify, as well as some plants with interesting adaptations and multiple functions in the ecosystem. Discuss functions and adaptations. Select a location with as much animal sign (birds, insects, too) as possible. Try to include plants that have or have had cultural uses by Native Americans.

7. In the final 10 minutes (time permitting), students report findings. While reporting ask about the functional differences and importance of plants. Remind students to save data for follow-up work back in the classroom. Help them with plant identification and Native American uses. Have them look across the river and identify vegetation types and differences between both sides. Brainstorm ideas for restoration/improving the site. Emphasize the importance of geomorphology as it relates to land management, riparian systems, and fish and benthic macroinvertebrate habitats.