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.

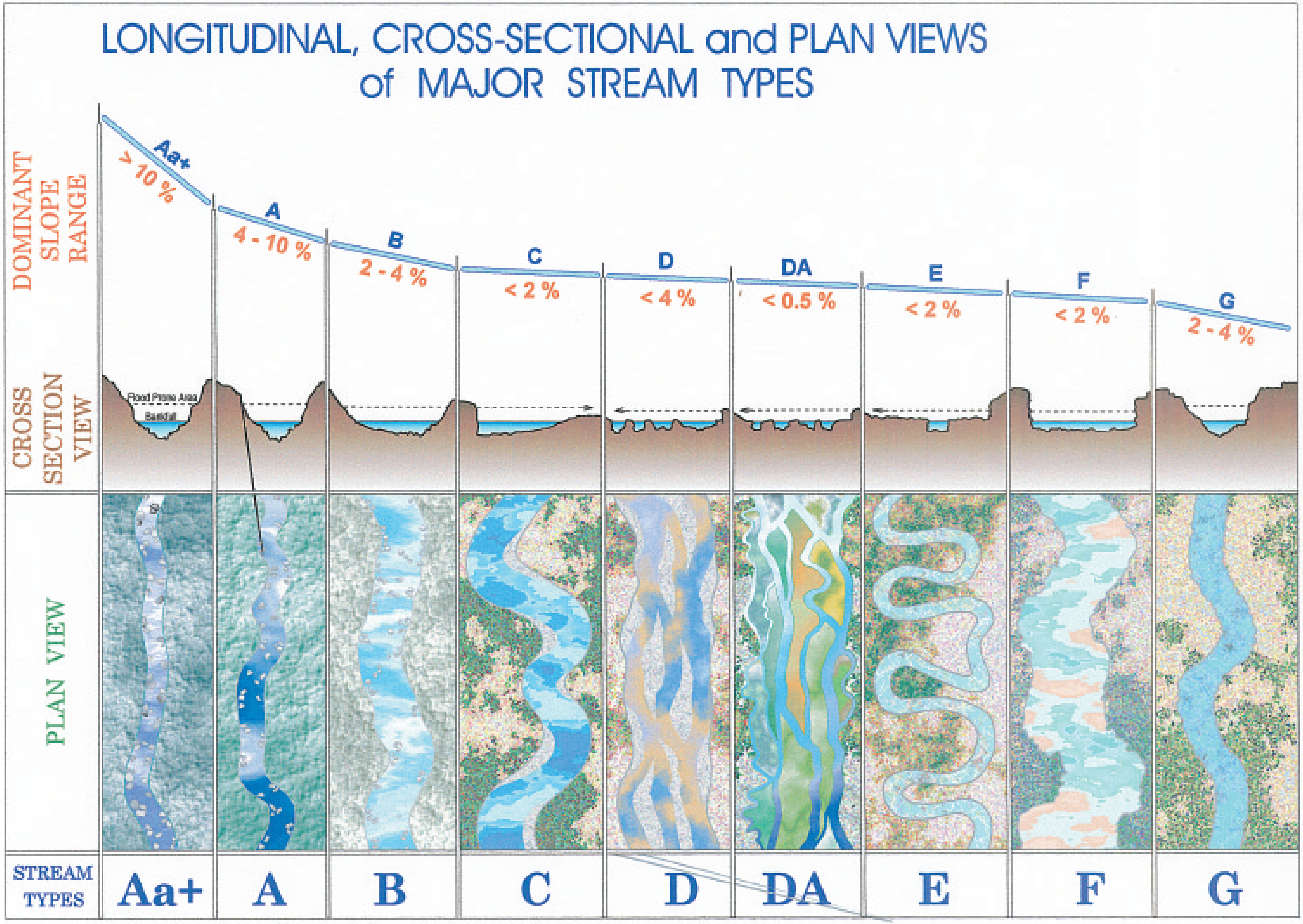
<u>Factors Determining Stream Type</u>:
Valley slope
Channel bed materials (size and type)
Size of the drainage network
Riparian vegetation/woody debris (amount, size, and location)
Sediment supply (input vs. output)
Flow regime (precipitation: amount and timing)
Exposed bedrock locations

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

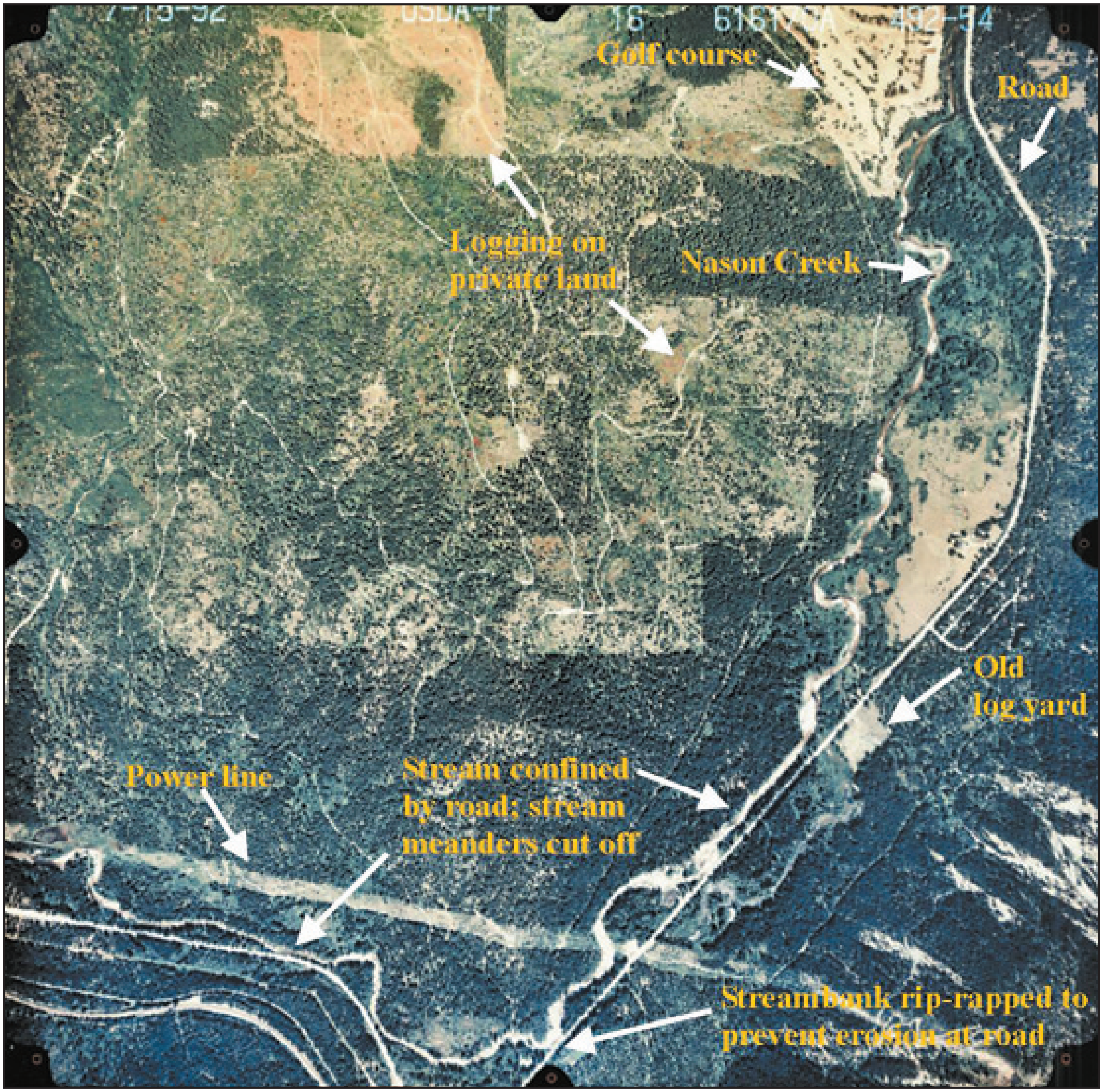


Figure 1. Nason Creek

White River

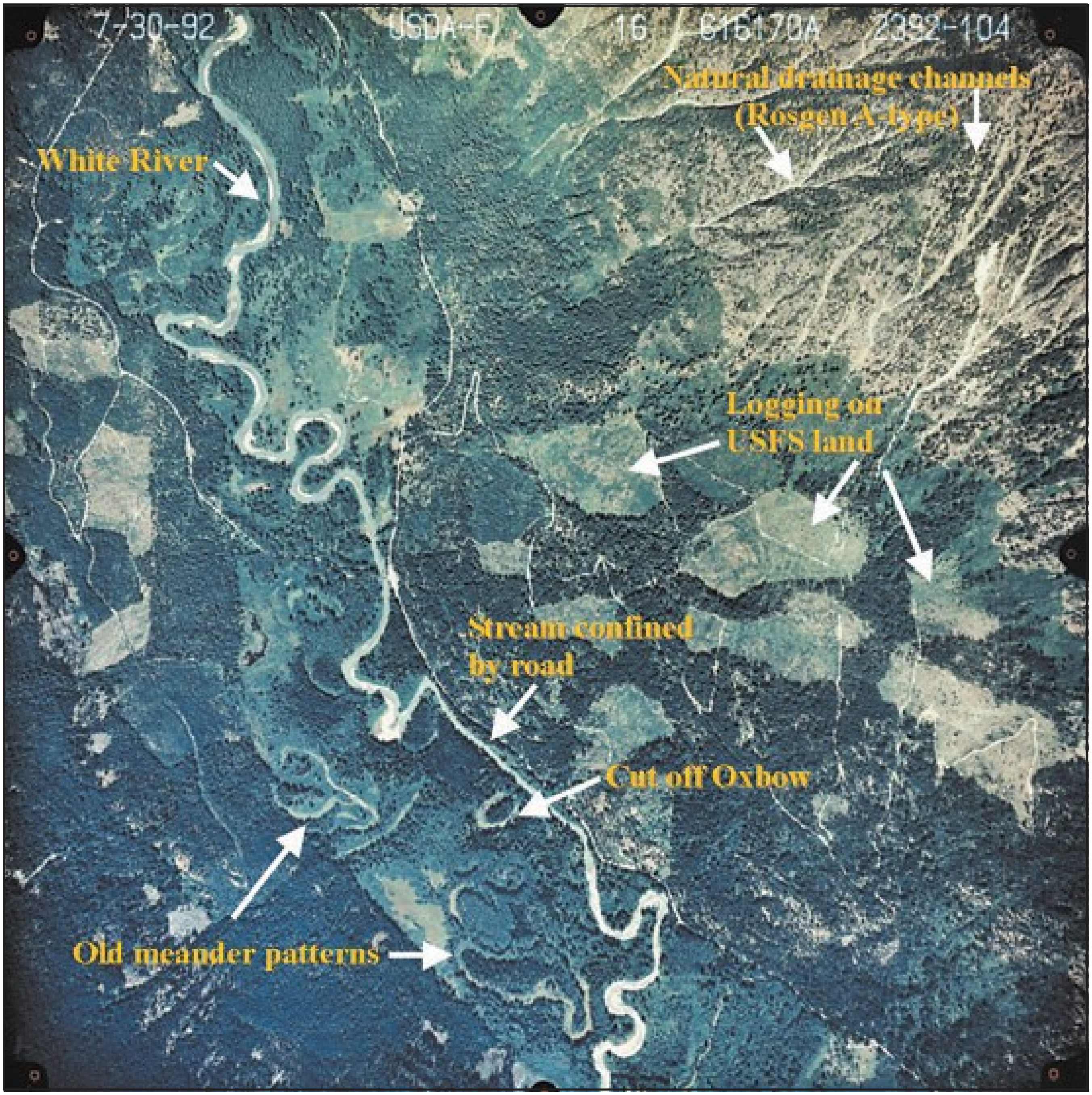
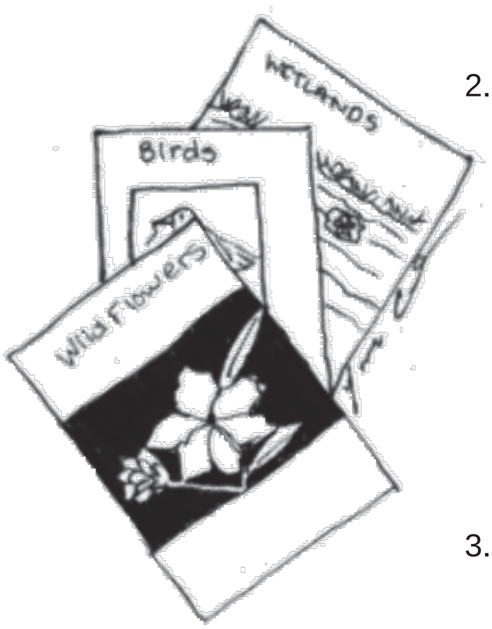


Figure 2. White River

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.