UNIT ONE - ECOLOGY

# What is the shape of our watershed?

**KEY WORDS:** WATERSHED, GATHER, LANDFORMS, FUNCTIONS, ENVIRONMENT

**THEME:** "KNOW YOUR PLACE"

**LEARNING OBJECTIVE:** In this unit students trace the boundaries, map the geographic functions and identify some of the Human Environmental Interactions of the Lake Roosevelt watershed. Students also review the Five Themes of Geography and create a class definition for a "healthy watershed environment."

**TEACHER NOTES:** Understanding our relationships with the Lake Roosevelt watershed involves a close look at the effects of our actions. Just how much air, land and water does it take to support our community? How big is our "ecological footprint?" Through the consumption of natural resources and the production of waste, every community leaves an ecological footprint. An ecological footprint defined:

"Human and natural forces interacting with the environment"

The Lake Roosevelt watershed is not only our home and life-provider, as well as, the home of many plants, fungus and animals, it is at the confluence of our region's history and geography. Closing the gates at Grand Coulee Dam in 1942 created more than a new agrarian frontier in the Columbia Basin; more than a hydropower engine for the Pacific Northwest's evolving economy; and more than a recreational mecca on a newly formed reservoir behind the dam: it created a new watershed. Previously divided by the region's tributaries to the Columbia River, the replacement of the free-flowing river with a lake-scape formed by human hands created a new geographic focus with new watershed boundaries -- Lake Roosevelt, with its 515 miles of shoreline and a contributing landscape of 44,969 square miles. As citizens of this special region, our watershed provides us the opportunity to explore with students the many effects our daily lives have on its ability to provide for us.

A watershed defined:

"The water flow region or area of a river, stream, etc.; a water flow"

For our purposes, a watershed refers to all of the elements and functions that interact within the geography of the watershed including, but not limited to: people, plants, trees, animals, fungus and mushrooms, insects, and a multitude of other living creatures.

**TEACHER NOTES:**

THE FIVE THEMES OF GEOGRAPHY

1. Region - Characteristics of an area such as climate, cultural traits, economic activities, natural boundaries, or landforms.
2. Location - Exact latitude and longitude of an area and/or its relative location.
3. Place - Natural and human features of an area, such as mountains and rivers or cities and towns.
4. Human Environmental Interaction - The way humans live with and can change their surroundings. The way people and nature live together.
5. Movement - How areas of the world are connected by transportation, trade and communication.

**TOOLS:**

DAY ONE

*Transparencies:*

1. Five Theme Match-Up (page 11)
2. Word Web Sample (page 12)
3. Definition: What is an ecological footprint? (page 13)
4. Definition: What is a watershed? (page 14)
5. Definition: What is the function of a watershed? (page 15)

DAY TWO

*Maps:*

1. Satellite Map of Lake Roosevelt region (30x40)
2. Rand McNally Washington State Map
3. Lake Roosevelt Area Watershed Maps (10 in all) (11x17)
4. Lake Roosevelt Area Resources-Gifts Map (11x17)

DAY THREE

*Maps:* All

*Transparencies:*

1. Definition: Ecology (page 16)
2. Watershed of the Lake Roosevelt region (page 17)

**DAY ONE LESSON:**

## THE WATERSHED

There are three FOCUS TASKS listed below. Your class may need one, two or all three FOCUS TASKS to get up to speed with this science concept. The first deals with a review of the five themes of geography. The second helps students arrive at a working definition of a watershed environment. Thirdly, students learn the function of a watershed. Each of the FOCUS TASKS leads to class discussions.

FOCUS TASK #1: Five Theme Match-Up
Match the Five Themes of Geography to the vocabulary words. (Transparency: Five Theme Match-up, page 11)

*Bonus:* List five of your favorite landmarks, landforms or other geographic features that come to mind when you think of the Lake Roosevelt region.

FOCUS TASK #2: Recognizing environments that are part of the Lake Roosevelt Watershed.
Create a word web model of the Lake Roosevelt Watershed Environments using the Word Web Sample Transparency, page 12. Include student suggestions to further complete the Word Web Sample as a whole group activity. Have students copy the class word web into their journals, or issue photocopies to each student, following completion of class word web.

*Class Discussion:* Using the Overhead Transparency entitled "What is an ecological footprint?" page 13, teacher introduces information included in TEACHER NOTES, page 3. Discussion follows.

Have students find definitions for the words *watershed* and *environment*. Have them combine both definitions into one definition for "watershed environment." Students share their definitions with the class. Post definitions on the board.

*Student Activity:* Place the definition: "What is a Watershed?" up on the overhead (page 14). Have students copy definition into journals.

*Definition Transparency:* What is a watershed?

The natural boundaries, or landforms, that surround and contribute water to a river, lake, aquifer, stream, or creek.

FOCUS TASK #3: What is the function of a watershed?

*Definition Transparency:* What is the function of a watershed?
A watershed is a collection of landforms and life forms that work together to collect, hold and release water.

*Ask the students*: Does this definition tell you how a watershed works? (Answer: No)

**JOURNAL:** Have students create a list of many places in the Lake Roosevelt region that match this definition and enter the list into their journals.

Make a class list of the landforms that make up a watershed.

Examples:

| | | |
|---|---|---|
| Mountains | Hills | Streams |
| Rivers | Basalt Formations | Wetlands |
| Lakes | Creeks | |

**BRAINSTORM:** *Metaphorically Speaking:* A metaphor is a form of comparison, where figurative language is used to describe ordinary life. Have students create examples of metaphoric language that serve to depict the "collecting", "storing" and eventual "releasing" of water.

Example: The lake, a giant cradle, rocks its glistening treasure gently.

Example: My bloated tummy became a storage tank for my glutenous trips to the water fountain.

Example: His ripe red blood flowed from the open wound, a river of over-warm jello.

**CLASS ACTIVITY:** Refer to the Satellite Map of Lake Roosevelt region (30"x40"). Can your students identify the various landforms that are visible on the satellite map? Have students name a few of the lakes, rivers and streams they can identify as a part of their local watershed.

**DAY TWO LESSON:** THE SHAPE OF THE WATERSHED

Gather students into five or six teams; each team receives a different set of maps (see Tools pages 7 and 8). Place the Satellite Map of the Lake Roosevelt watershed (30"x40") at the front of the class to be used as a reference, and an aid to presentations.

Using the maps included in each team's tool list, students label their map of the Lake Roosevelt watershed as directed on pages 7 and 8. Each team uses different colored post-it notes for their subject labels. After completing the team's assigned activities in a group setting, teams then affix their post-it notes on the "class map" (30"x40") in preparation to present their findings to entire class.

1) LANDFORMS TEAM: Identify and label mountain ranges, lakes, and rivers. Determine north, south, east and west on the map; create a compass rose to add to the map.

   *Tools:* Rand McNally Washington State Map

2) WATER FLOW TEAM: Using the Lake Roosevelt Water Resource Inventory Area Maps: label the surrounding sub-watersheds of the Lake Roosevelt watershed. Cut out each of the 10 subwatersheds and mount in its correct location on a larger piece of tagboard (see matching Watershed Maps Key for help with locations). Color each subwatershed. Detail the direction of water flow for Lake Roosevelt. Devise a method of showing how and where rain and snow enter the Lake Roosevelt watershed. (Hydrologic Cycle/Weather)

   *Tools:* Lake Roosevelt Area Watershed Maps (10 in all) 11" x17"

3) POPULATION TEAM: Affix post-it notes with the populations of each of the counties on the Satellite Map of Lake Roosevelt region (30"x40"). (See page 10 in the Lake Roosevelt Area Handbook.) Start from Grant County and work eastward into Lincoln County; northward into Okanogan, Ferry and Stevens counties; including the Colville and Spokane Indian reservations. Using the Washington State Rand McNally map and Lake Roosevelt Area Handbook, estimate the size in square miles for the Lake Roosevelt region. Then divide the square miles by population to arrive at a population density estimate.

   *Tools:* Rand McNally Washington State map, Satellite Map of Lake Roosevelt region (30"x40"), Lake Roosevelt Area Handbook

   *Answer Key*: See page 10 in Lake Roosevelt Area Handbook

4) WATERSHED RESOURCES-GIFTS TEAM: Identify the gifts, products or resources in the Watershed. Place post-it notes on the Satellite Map of the Lake Roosevelt region to locate where the gifts of the watershed are found, harvested, extracted, utilized, shared or cultivated.

*Tools:* Lake Roosevelt Area Resources-Gifts Map, Satellite Map of the Lake Roosevelt region (30"x40"), see FWEE web site at: www.fwee.org

Sample List:

| | | |
|---|---|---|
| Drinking Water | Food/Farming | Recreation |
| Trees/Forest | Minerals/Mining | Land/Development |
| People/Economic | | |

5) POLITICAL BOUNDARIES TEAM: Identify the various governments and agencies from the Lake Roosevelt watershed. Create a list of all of the governing bodies that might need to be contacted regarding watershed issues. Include Federal, State, County or City, and Tribal Governments.

*Tools:* Rand McNally Washington State Map

**DAY THREE LESSON:** THE RELATIONSHIPS WITHIN A WATERSHED

Study this definition of the word/concept Ecology.

*Definition Transparency*: ECOLOGY

"Ecology is the patterns of relationships between living things and their environments." (Definition from Communities by Choice.)

SUGGESTED CULMINATING CLASS ACTIVITIES:

ACTIVITY CHOICE #1: Exploring Interrelationships

Having completed the team research and reported findings to classmates, each team that selected this Activity Choice #1 now designs an activity to show the interrelatedness of their specific team's information with all other teams' findings.

Guiding question: How important is "our team's study" in relation ship to all other team studies? Now design a poster, skit, report, song, poem, story, etc. exemplifying the interrelatedness of all team findings.

This project design is then presented to entire classroom of students and teacher(s).

ACTIVITY CHOICE #2: Each team of students selecting this Activity Choice #2 will plan a public meeting (town hall format). See Lake Roosevelt Watershed, Overhead Transparency, page 17.

The Lake Roosevelt Forum, formed in the late 1980s by the citizens, community groups, government agencies and tribes that comprise the Forum have identified their mission as establishing a dialogue based on trust and respect for all views. Forum constituents seek common ways to protect and preserve the quality of the environment and enhance the quality of life as they relate to the lake and economies of the region. This is a complex constituency. The population within this watershed is decidedly rural, with about 3.2 persons per square mile. Two tribal reservations, the Colville Confederated Tribes and Spokane Indian Tribe are located here. The north side of the lake is dominated by mountains and forests with a resulting timber and mining based economy, while the south side is primarily desert plateau and farmland. From 1 to 1.5 million tourists enjoy the recreational offerings of the lake each year. The Lake Roosevelt watershed is part of a much larger Columbia River Watershed, which is about the size of France or Texas.

The key to all seemingly intractable environmental problems is adopting the appropriate time frame for remedy, and crafting strategies accordingly. While the pollution problem seems to have sprung into creation with the closing of Grand Coulee's gates, in reality the pollution has been flowing down the river for more than a century. Many of the contaminants previously loaded into the system will continue to be delivered to the lake by the region's rivers regardless of control efforts at the sources. What is needed is a long-range intergenerational transfer of environmental awareness and ethics.

Participants of the town hall meeting should keep in mind the interconnected complexity of human interaction/manipulation of the environment and the key role that individual decisions/choices play in shaping the environment. Presented as the Three E's: Ecology, Economy and Equity, community members will be offered an intellectual "viewing tool" to better understand and act on interactive complexities.

Institutionalizing environmental and public needs is a critical step in the long-range intergenerational transfer of environmental awareness and ethics. Incorporating the centuries-old traditions and awareness of the native tribes of the watershed will bring a different perspective to the "technological" orientation of Euro-American thought, and also provide a slender bridge for better mutual understanding between the two cultures that co-inhabit the region.

Team members plan a public meeting to report on the health and condition of the Lake Roosevelt watershed. Next, the team decides on the dignitaries that need to be invited to the meeting, including constituent groups.

Student Team determines where to hold their meeting and what to include on the agenda. Post a public announcement/poster to hang up in their classroom. Each team selecting this Activity Choice #2 will present their watershed update to the class, using the town meeting format. Team members select individual "roles" to play at the town meeting (i.e. dignitary, constituent, or townsperson.) Their watershed report is revealed through the debates and comments presented by each actor at the town meeting.

*Tools*: All maps, contact websites

**EXTENSION ACTIVITY:**

WATER TASTE TEST

Gather water samples from three different sources within the school in clean gallon jugs. Label each gallon with a number and keep a record (undisclosed to students) of the source.

Give each student three small paper cups, asking her/him to write the numbers from the corresponding gallon jugs on the bottoms of each paper cup, as they pour themselves a sample of water.

Have students do a taste test of the three water samples, ranking each according to taste, texture, clarity, and smell. Students create their own rating scale that goes from 1 to 5, or use the scale below. Students place a scoring (see example below) number on the side of each cup to match the tastes of the water.

Example:

| | |
|---|---|
| TASTES REALLY GOOD | SCORE 1 |
| TASTES GOOD | SCORE 2 |
| HAS NO TASTE | SCORE 3 |
| TASTES NOT SO GOOD | SCORE 4 |
| TASTES BAD | SCORE 5 |

Calibrate the results of the class survey on the overhead or board, to determine the best tasting and worst tasting sources (jugs) of water, then identify the sources to students.

WEB SITES TO CHECK OUT:
For some insights into the "ways of water," visit The Hydrological Cycle at:
water.usgs.gov/public/educational.html

See Water Ways Website at: www.lsw.org/scd

Visit the Foundation for Water and Energy Education (FWEE) site at:
www.fwee.org

For more information about watersheds go to:
www.ior.com/~swic

Overhead Transparency

# Five Theme Match-Up

## Themes of Geography

REGION - Characteristics of an area such as climate, cultural traits, economic activities, natural boundaries, or landforms.

LOCATION - Exact latitude and longitude of an area and/or its relative location.

PLACE - Natural and human features of an area, such as mountains and rivers or cities and towns.

HUMAN ENVIRONMENTAL INTERACTION - The way humans live with and can change their surroundings. The way people and nature live together.

MOVEMENT- How areas of the world are connected by transportation, trade and communication.

Directions: Study the definitions for the five themes of geography above. Place the first letter of each theme next to its matching vocabulary word from the list below.

## Vocabulary

Climate

Exact latitude and longitude of an area

Natural and human features of an area

The way humans interact with environment

How areas of the world are interconnected

Cultural traits

Economic activities

Relative location

Mountains

Rivers

Streams

Change in environment

Interrelationships

Agriculture

Transportation

Trade

Communication

Natural boundaries

Landforms

Cities

Towns

Watersheds

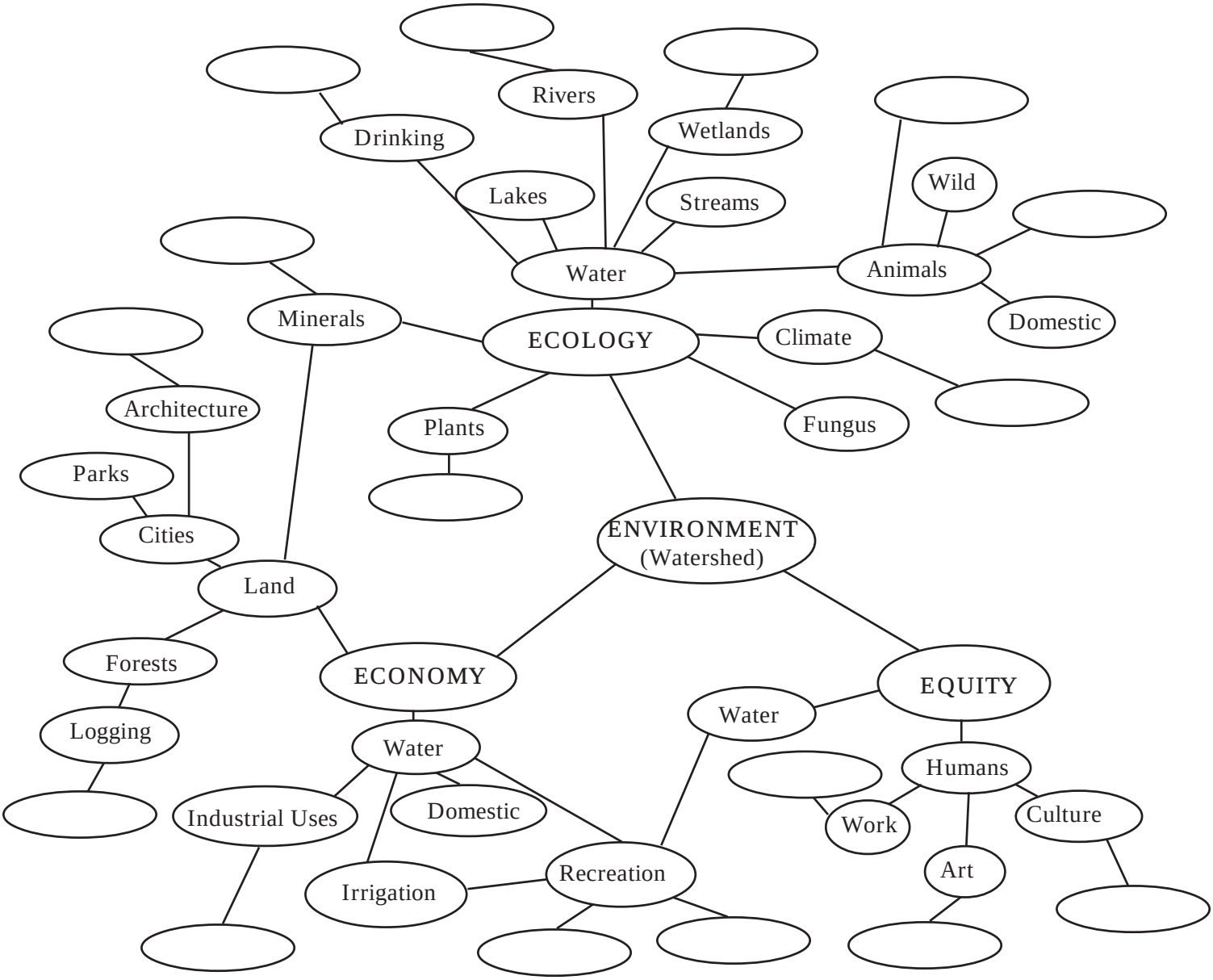
Wetlands

Lakes

Aquifers

Overhead Transparency

# Word Web Sample




Directions: Students suggest answers to fill empty circles, adding more "words" to web as appropriate.

Overhead Transparency
Definition

## What is an ecological footprint?

Human and natural forces interacting with the environment.

Overhead Transparency
Definition

## What is a watershed?

The natural boundaries, or landforms, that surround and contribute water to a river, lake, aquifer, stream or creek.

Overhead Transparency
Definition

## What is the function of a watershed?

A watershed is a collection of landforms and life forms that work together to gather, hold and release water.

Overhead Transparency
## Definition Overhead

# What is ecology?

Ecology is the patterns of relationships between living things and their environment.

Overhead Transparency or Hand-Out

# Lake Roosevelt Watershed

## Lake Roosevelt Watershed

Closing the gates at Grand Coulee Dam in 1942 created more than a new agrarian frontier in the Columbia Basin; more than a hydropower engine for the Pacific Northwest's evolving economy; more than a recreational mecca on a newly formed reservoir behind the dam: it created a new watershed. Previously divided by the region's tributaries to the Columbia River, the replacement of the free-flowing river with a lake-scape formed by human hands created a new geographic focus and new watershed boundaries -- Lake Roosevelt, with its 515 miles of shoreline and contributing landscape of 44,969 square miles.

The river's water, however, was not the only thing impounded behind the dam. Pollution from lead, zinc and silver mining in Idaho and Canada also found its resting place in the still waters and sediments of Lake Roosevelt. More than a million tons of toxic heavy metal-contaminated sediment is now estimated to line the bed of the lake, with the highest concentrations found in the Spokane Arm (the now submerged confluence of the Spokane River and the Columbia). Radioactive waste from uranium mining in Washington state; dioxin, furans and associated chlorinated hydrocarbons from a pulp mill in Canada; PCBs and mercury from industrial plants; sediment, pesticides and nutrients from agriculture; and residential development all contribute to a common focus for the inhabitants of the region: how to clean up and protect the common point of the watershed, Lake Roosevelt.

The Lake Roosevelt Forum, formed in the late 1980s by the citizens, community groups, government agencies and tribes that comprise the Forum have identified their mission as establishing a dialogue based on trust and respect for all views. They seek common ways to protect and preserve the quality of the environment and enhance the quality of life as related to the lake and economies of the region. It is a complex constituency. The population within this watershed is decidedly rural, with about 3.2 persons per square mile. Two tribal reservations, the Colville Confederated Tribes and Spokane Indian Tribe, are located here. The north side of the lake is dominated by mountains and forests with a resulting timber and mining based economy, while the south side is primarily desert plateau and farmland. From 1 to 1.5 million tourists enjoy the recreational offerings of the lake each year.

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Agencies are restricted in their approach to environmental issues by the inherent short-term focus of their activities. As agencies of state or federal executive branches, agencies by necessity operate on a four year macro-scale cycle (elections) and an annual micro-scale cycle (budget). They may hope for more, but they can only provide within those restrictions. By strengthening an environmental awareness and ethics in the region's children, through the public school system, it is hoped that the momentum for restoration and protection will span the agency cycles.

Through educational programs addressing the challenges surrounding the Lake Roosevelt watershed, the predominantly Euro-American inhabitants of the watershed will gain a deeper understanding of the native tribes' relationship to the same landscape. It is appropriate and necessary that we learn from the people who have inhabited the watershed for thousands of years, the lessons the land may teach us to aid in our healing of it.