



# FREEING THE ELWHA CURRICULUM

## LESSON PLAN OVERVIEW



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# INTRODUCTION

## FREEING THE ELWHA EDUCATIONAL CURRICULUM OVERVIEW

The Freeing the Elwha Curriculum is an inquiry and standards based, integrated curriculum designed to guide middle school students in understanding the natural and manmade processes involved in river restoration. The removal of two dams from the Elwha River began September 2011, and is historic as it is the biggest dam removal project in the world. The Elwha River flows through the beautiful Olympic National Park, in Washington, and is unique in having been largely protected from adverse human impacts. When the dams come out, the Elwha River will once again host its famous salmon runs. The curriculum focuses on this historic event.

The curriculum's science component leads students from how weather affects water flow, through the habitat needs of salmon and the process of dam removal, to the state of the world's fisheries. The social studies component moves from the settlement of the Elwha and its surroundings, through issues involved in dam removal, ending with the importance of salmon to the Lower Elwha Klallam Tribe. Math, language arts, and assessments fall naturally within the science and social studies units. A Creative Response section gives students a chance to express themselves artistically. Handouts and grading rubrics are included. The curriculum is flexible and educators can adapt the lessons depending on grade level requirements. Lessons can be taught individually or as part of the whole unit. Our goal is to provide educators with everything they need to use and enjoy this curriculum in the classroom while students are enriched and challenged.

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### SCIENCE OVERVIEW

The science lessons in the Freeing the Elwha Curriculum are designed to connect students with an understanding of the natural forces that create a healthy river environment and thus healthy ocean and terrestrial environments. An essential question encompasses the entire curriculum and each lesson is led by a guiding question. Students are asked to respond to reflection questions both before and after each lesson to help organize their learning. Reflection journal questions can be compiled in a notebook as notes towards the culminating research paper outlined in lesson 19. Lessons 1-19 move students from the effects of weather on water flow, through the habitat needs of salmon and the process of dam removal, to the state of the world's fisheries. Each lesson includes a PowerPoint presentation, vocabulary, and handouts. Many lessons contain simple hands-on experiments that can be easily conducted in the classroom. Math, language arts, and assessments are integrated as they fall naturally within lessons. Our goal is for each lesson

to provide educators with everything they need to teach and enjoy this curriculum while students are enriched and challenged.

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#### SOCIAL STUDIES OVERVIEW

The social studies lessons in the Freeing the Elwha Curriculum will guide students to on a voyage of discovery through the rigors of homesteading and community development to their final destination as stakeholders in a debate over dam removal. The curriculum also provides a look into the importance of salmon to the indigenous people of the Elwha River. An essential question encompasses the entire curriculum and each lesson is led by a guiding question. Students are asked to respond to reflection questions both before and after each lesson to help organize their learning. The lessons in the social studies units will help students prepare and meet many of the Washington State classroom-based assessments (CBAs). Handouts, grading rubrics and web links are provided so that each lesson is ready to teach and enjoy as needed.

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#### CREATIVE RESPONSE OVERVIEW

The creative response component of the Freeing the Elwha Curriculum gives students a chance to respond artistically through poetry and sculpture to the issues of river restoration and history. Inspired by Odyssey of the Mind, students are asked in these lessons to follow some simple guidelines in producing a product that they will publish and/or present. Students are asked to share their work with Olympic National Park with a possibility for publication on the web site. This is a standards based opportunity to cut loose and have fun with words and found objects.

## ESSENTIAL QUESTION

*What combination of factors both natural and manmade is necessary for healthy river restoration and how does this enhance the sustainability of natural and human communities?*



# SCIENCE

## UNIT 1: WEATHER AND RIVER EROSIONAL PROCESSES

### LESSON 1: WEATHER PATTERNS OF THE PACIFIC COAST

#### GUIDING QUESTION:

How can learning about weather patterns help us to understand our water resources?

#### OVERVIEW:

The weather in the Pacific Northwest is dependent on the Pacific Ocean. Generally speaking, weather in the region is mild, with cool wet winters, and warm dry summers with extremes in temperature and precipitation being unusual. However, despite the moderating effects of the Pacific Ocean, the mountains are very important in terms of the distribution of precipitation across the region and the development of water storage in the form of a snowpack during the summer drought. The mountain, via topographical lifting and the rainshadow effect, causes some areas to be temperate rainforests, while others become deserts.

### LESSON 2: WHAT IS A WATERSHED?

#### GUIDING QUESTION:

Healthy watersheds are vital for a healthy environment and economy. How can understanding watersheds and particularly the Elwha watershed help you protect the water and other natural resources?

#### OVERVIEW:

A watershed is an area where all precipitation either drains on the surface or underground into an outlet stream or river. Watersheds can vary by scale, with a large watershed containing many smaller ones. In addition to surface waters, much of the precipitation filters through the soil and bedrock into the aquifer. Aquifers are bounded by impermeable layers and once water reaches those, they begin to flow more horizontally. Groundwater flows along the rock layers until it reaches a surface point that is below the water table. Then, the water reemerges as springs or seep that flow over the surface.



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## LESSON 3: RIVER FLOWS AND SEDIMENT MOVEMENT

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### GUIDING QUESTION:

Seasonal weather patterns affect the flow patterns of water into the rivers (and watersheds) of western North America. What landform features can form when erosion is caused by fast-moving water from Spring and Fall rains, and snowpack melt off?

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### OVERVIEW:

The focus of this lesson is to learn about the seasonal flow patterns of rivers in western North America and the erosional effects of fast-moving water. Rivers in the west tend to experience high flows during the spring rains and snowpack melt off, low flows during the long summer drought, increased flows during the return of the fall rains, and slightly lower flows in winter when much of the precipitation is trapped as snow. However, strong storms can result in sudden spikes of water flows and flash flooding.

Fast-flowing rivers can move large stones and carry a lot of sediment, so they have the ability to pluck stones from the bedrock and can carve deep canyons. Eventually fast-flowing rivers form V-shaped valleys, with terraces/benches forming along former riverbeds. Where flows reach steep gradients, rapids and waterfalls will form. The goal of this lesson is to demonstrate the features that can form in these fast-flowing streams.

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## LESSON 4: SEDIMENT DEPOSITION AND RIVER STRUCTURES

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### GUIDING QUESTION:

As rivers age and slow they deposit sediment and form sediment structures, how are sediments and sediment structures important to the river ecosystem?

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### OVERVIEW:

The focus of this lesson is the deposition and erosional effects of slow-moving water in low gradient areas. These “mature rivers” with decreasing gradient result in the settling and deposition of sediments and the formation sediment structures. The river’s fast-flowing zone, the thalweg, causes erosion of the river banks forming cliffs called cut-banks. On slower inside turns, sediment is deposited as point-bars. Where the gradient is particularly level, the river will branch into many separate channels that weave in and out, leaving gravel bar islands. Where two meanders meet, the river will straighten, leaving oxbow lakes in the former meander bends.



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## LESSON 5: SEDIMENT DEPOSITION AT THE SEA

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### GUIDING QUESTION:

As rivers carry sediment to the sea different sediment structures are formed along shorelines, how is sediment important to both river and the shoreline ecosystems?

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### OVERVIEW:

The focus of this lesson is depositional and erosional effects as rivers meet the sea. As a river meets the sea, the sediment it carries is deposited in a fan-like formation called a delta. As longshore drift picks up and transports the sediment, it can be carried and deposited down current to form shoreline sediment features such as sand bars, spits, and barrier islands. These sediments can protect areas behind them from the effect of ocean waves to form estuaries, salt marshes, and lagoons. Features such as headlands and sea stacks can intercept and deflect the currents, allowing sediments to be deposited on beaches in sheltered coves.

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## LESSON 6: EFFECTS OF THE ELWHA RIVER DAMS ON SEDIMENTS

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### GUIDING QUESTION:

The building of the Elwha River Dams has had a huge effect on the natural sediment transport and sediment structures along the Strait of Juan de Fuca. What benefit will the removal of the dams have to natural and human communities along the Strait of Juan de Fuca as natural sediment transport resumes?

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### OVERVIEW:

The focus of this lesson is on the effects that building the Elwha River dams had on the natural sediment transport and deposition mechanisms in the Strait of Juan de Fuca. The formation of Lake Mills caused most of the sediment to deposit in a delta at the head of the reservoir, rather than at the mouth of the river. In addition to a large delta, a bed of fine silt covers the lake floor. The loss of this sediment has resulted in severe consequences downstream. Sandy beaches at the mouth of the river, which used to contain rich shellfish beds, have washed away. Salmon spawning beds in the lower five miles of the river have eroded away and sediment transport to Ediz Hook by longshore drift has stopped as well.

## UNIT 2: SALMON NATURAL HISTORY AND ECOLOGICAL PROCESSES

### LESSON 7: ASPECT AND SOIL MOISTURE

#### GUIDING QUESTION:

What role do aspect, slope, sun, snow melt, blackbody absorption and elevation play in soil moisture conditions and why is soil moisture important to the structure of an ecosystem?

#### OVERVIEW:

This lesson focuses on the role of aspect, slope, seasonal sun availability, snow melt, blackbody absorption, and elevation in soil moisture conditions. Soil moisture is one of the most important factors determining the composition of plant communities and ultimately the ecosystem structure. The amount of snowpack and the amount of time it takes to melt off each summer impacts the growing season and the ability of trees to survive. Where trees can no longer survive, alpine meadows predominate, but soil moisture conditions determine whether they are “wet” or “dry” meadows.

### LESSON 8: ASPECT, TREELINE, AND CLIMATE

#### GUIDING QUESTION:

Trees play an important role in salmon habitat. How can an understanding of climate, aspect, soil moisture, and treeline add to our understanding of healthy river restoration?

#### OVERVIEW:

This lesson focuses on the factors that determine the location of the treeline in different locations in the world. The elevation of treeline is affected by the combined effects of snowpack depth, minimum winter temperatures, aspect, and soil moisture conditions. Treeline varies by latitude, but is also affected by whether it is an arid, temperate, or tropical climate. In addition, in arid regions, aspect and elevation affects soil moisture conditions and determines where the transition from desert to forest occurs on sky islands. In addition, human impacts such as grazing and fires can impact the elevation of treeline.

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## LESSON 9: GETTING TO KNOW THE SALMONIDS OF THE ELWHA RIVER

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### GUIDING QUESTION:

Salmonids are a crucial part of the Elwha River ecosystem. How can our understanding of their life cycles help restore the Elwha River ecosystem?

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### LESSON OVERVIEW:

Students will be introduced to the wild salmonid species of the Elwha River. After watching a power point presentation on the anadromous life styles of pacific salmonids, students will work in groups to research. Then students will compose a presentation on the lifestyle of a specific species of anadromous fish found in the Elwha River: Chinook, chum, coho, pink, sockeye, steelhead, bull trout, or Dolly Varden. Student groups will then apply their knowledge by constructing a model healthy river habitat in which their species, along with other species of salmon, can grow and thrive.

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## LESSON 10: SALMONID NATURAL HISTORY

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### GUIDING QUESTION:

How does biological evolution account for the diversity and distribution of salmonid species?

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### OVERVIEW:

This lesson focuses on some of the natural history and stochastic events that have influenced the current distributions of salmonid fish in western North America. The relatedness of salmonid species and some of the events of the past, of which the ice age is the most important, can be examined using phylogenetic trees. This information can then be used to determine how the phylogenetic tree branched as it did. Genetic isolation, the founder effect, genetic drift, and stochasticity have all played a role in the diversification of the various species, subspecies, stocks, and runs of salmonids in western North America.

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## LESSON 11: HABITAT REQUIREMENTS FOR PACIFIC SALMON

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### GUIDING QUESTION:

Salmon are survivors; nevertheless, they have very specific habitat requirements, what are the important habitat needs of the anadromous fish of the Elwha River watershed?

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### OVERVIEW:

This lesson focuses on the specific habitat requirements for each Pacific salmon species, as well as, other anadromous fish of the Elwha River watershed. The ecological habitat of each salmon species includes their adult range in the ocean and the specific parts of the river, and its tributaries, that are critical spawning habitat.

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## LESSON 12: MARINE DERIVED NUTRIENT CYCLING

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### GUIDING QUESTION:

How do the carcasses of dead adult salmon support young salmon and how are salmon essential to the marine food web as well as the freshwater ecosystems of the Pacific Northwest?

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### OVERVIEW:

Discuss the marine food web related to salmon. Introduce the idea of algal blooms in the cold nutrient-rich waters of the North Pacific. Explain trophic levels, energy movement, bioaccumulation and biomagnification of nutrients and chemicals into top-level predators such as salmon. Introduce the idea of these marine-derived nutrients entering the freshwater ecosystems and becoming the basis of the freshwater ecosystem food web. Freshwater ecosystems in the Pacific Northwest tend to be oligotrophic (containing few nutrients), so these marine-derived nutrients constitute an important influx that greatly increases the productivity of these rivers.

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## LESSON 13: SALMON NUTRIENT CYCLING

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### GUIDING QUESTION:

Salmon nutrients find their way into terrestrial environments, how is it possible that trees show evidence of having derived nutrition from Salmon?

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### OVERVIEW:

This lesson focuses on how marine-derived nutrients from salmon carcasses find their way into terrestrial environments and how scientists can track these marine-derived nutrients to analyze their importance to ecosystems today, as well as, reconstructing past ecosystem processes. Terrestrial vertebrates such as mammals and birds, as well as, insects consume salmon carcasses and then release those nutrients onto land, either by dragging the carcasses or defecating onto the forest. These nutrients then enter the soil, where they are taken up by plant roots. Once entering plant tissue, they are consumed by herbivores. Salmon nutrients have been found in every living organism investigated and up to seven miles from the stream of origin. Scientists use stable isotope  $N^{15}$  to track marine-derived nutrients, because this isotope is more common in marine environments than freshwater ones. Analyzing sediment layers of lakes for this isotope, scientists can reconstruct ancient salmon abundance and can make inferences to historic climate and ecological processes.

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## UNIT 3: CHALLENGES AND OPPORTUNITIES FOR RESTORATION

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## LESSON 14: THE IMPACT OF HYDROELECTRIC DAMS ON SALMON

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### GUIDING QUESTION:

Dams are important to people but they have a serious impact on salmon migration. How do dams affect salmon and what successes have people had in trying to help salmon migration?

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### OVERVIEW:

This lesson focuses on the impacts that hydroelectric dams have had on anadromous salmon migration and some of the mitigation techniques that have been designed to reduce these impacts. Hydroelectric projects were started during the Great Depression and continued through the 1960's and 1970's for the purpose of channeling water for irrigation in the arid Columbia Basin and to generate cheap electricity. However, the dams created obstructions for migrating salmon. Even those dams built with fish passage, such as fish ladders and navigation canals, have had major impacts on the survivorship of juvenile salmon due to mortality in the turbines and spillways, increased water temperatures, predation, and a myriad of other factors.

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## LESSON 15: EFFECTS OF THE ELWHA RIVER DAMS

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### GUIDING QUESTION:

The building of the Elwha River Dams had a huge impact on the anadromous fish of the Elwha River, why were the dams built in the first place, how have they affected anadromous fish and the surrounding environment, and why are they coming down?

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### OVERVIEW:

This lesson focuses on the impacts that the building of the two dams on the Elwha River had on anadromous fish species, including the loss of 70 miles of river habitat for migrating fish, the effects of sediment loss on spawning grounds downstream, and general habitat degradation downstream. Learn about pre-dam conditions both in-river and in the surrounding terrestrial environment. Then hear the story of Thomas Aldwell, the entrepreneur who built the first dam and refused to accommodate fish. Finally, discuss the political and environmental conditions that led to the decision to remove the dams.

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## LESSON 16: REMOVING THE DAMS AND RESTORING THE RIVER

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### GUIDING QUESTION:

There are many important factors involved in removing the Elwha Dams and restoring the Elwha River. What strategies is Olympic National Park employing to help the river and its anadromous fish recover?

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### OVERVIEW:

This lesson focuses on the plans to remove the dams, restore the river, and return salmon to the Elwha River watershed. Managers will have to use different strategies depending on the current population levels, life histories, and habitat requirements for each species of salmon, to ensure recovery. Some species will be able to naturally recolonize the river and return to anadromy. During the dam removal process, there is expected to be great amounts of sediment released from the deltas which have formed at the mouth of the reservoirs. To assure their survival, some salmonid species will be stored and propagated in hatcheries, protected from the high levels of suspended sediment. Some species will need to be out-planted up river to facilitate recolonization following dam removal. In addition, a great deal of ecological work will be necessary post dam removal to restore vegetation, engineer logjams, and return the sediment regime to form spawning beds.

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## LESSON 17: HATCHERIES, SAVIORS OR SCOURGE FOR WILD SALMON?

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### GUIDING QUESTION:

Hatcheries seem like a good idea, but they are fraught with problems, how are hatcheries both a danger and a blessing to wild fish?

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### OVERVIEW:

This lesson focuses on the history and roles that hatcheries serve in sustaining commercial fisheries, native fish populations, and saving endangered fish stocks. Hatcheries were historically a popular tool for propagating large numbers of fish for sustaining commercial fisheries, however, a series of problems have resulted in increasing controversies over their use. Some of the problems include the use of non-native stocks, the development of non-competitive behaviors, and over-stocking fish beyond the natural carrying capacity of the environment at the expense of wild native fish. However, as wild fish runs become threatened with extinction, hatcheries are also proving to be a valuable tool for saving these wild native runs.

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## LESSON 18: OVERFISHING AND FISHERIES COLLAPSES

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### GUIDING QUESTION:

What factors have led to the collapse of marine fisheries around the world?

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### OVERVIEW:

This lesson focuses on the recent collapse of marine fisheries across the world due to increased commercial fishing pressures, a result of increased technology coupled with the changing climate of marine environments related to greenhouse gas pollution. Collapsed fisheries include Pacific salmon, Atlantic cod, and Orange Roughy, among others. The collapse of these fisheries has resulted in dramatic shifts in food webs and ecological processes at sea and on terrestrial ecosystems. In addition, it has had major impacts on human coastal communities.



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## LESSON 19: SALMON FARMING; A POTENTIAL, BUT NOT IDEAL SOLUTION

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### GUIDING QUESTION:

Salmon farms seem like an ideal solution for helping wild salmon and increasing the worldwide demand for salmon production, what are the problems associated with salmon farming and are there ways of solving these problems?

### OVERVIEW:

This lesson focuses on the economic and ecological values and costs of salmon farming. Salmon farms have been seen by many as an opportunity to help wild salmon runs, by producing fish to meet increased worldwide demand for salmon and taking some of the pressures off wild salmon by commercial fisheries. However, salmon farms have developed several serious ecological and economic problems that must be addressed. Escaped salmon from farms represent competition for food resources and spawning grounds. Their dense populations are susceptible to disease outbreaks and parasite infestations. Their food contains high concentrations of chemicals such as PCB's and mercury which bioaccumulate in their bodies and contaminate the nearby environments.

# SOCIAL STUDIES

## UNIT 1: TRIBAL HISTORY

### THE POINT NO POINT TREATY

#### OVERVIEW

Several lesson plans were developed by Dr. Llyn De Danaan and the Evergreen Center for Educational Improvement, on the topic of tribal sovereignty.

Additional lessons for this unit can be found at <http://tribalsov.ospi.k12.wa.us/course/view.php?id=2> or <http://www.indian-ed.org/>.



## UNIT 2: THE HOMESTEADER ERA

### LESSON 1: TO GO OR NOT TO GO

#### GUIDING QUESTION:

What hardships and rewards were involved in maintaining a sustainable homestead?

#### LESSON OVERVIEW:

To introduce the Homestead Era of United States history, students will read a summary of the Homestead Act of 1862. Through classroom discussion the conditions required to “prove up” a homestead will be listed. Students will be given a scenario and an 1870 catalogue to complete a graphic organizer to decide if they would make the move west. They will write a short essay of their decision.

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## LESSON 2: NEIGHBORS ALONG THE ELWHA RIVER

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### GUIDING QUESTION:

Who were the people that homesteaded along the Elwha? How and what can we find out about their lives?

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### LESSON OVERVIEW:

After reading an article explaining the use of Township and Range to identify land parcels, students will look at two specific townships along the lower Elwha River. The teacher will assign each student a name to research on the BLM website and find information about homesteads. The student place the homesteader's name on an individual Clallam County map, the teacher and students will fill in a large class map to show all the homesteaders in each section of Township 30N and 31N, Range 7W. Students will write a journal entry on the additional name they selected to research on the website. The paragraph will include who they selected, why they selected that name and what information they found. If they were successful in finding another homesteader the journal entry should include where the homestead was located.

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## LESSON 3: LIFE ON THE HOMESTEAD

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### GUIDING QUESTION:

What was the life of a homesteader like and what tools from today would make their lives simpler?

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### LESSON OVERVIEW:

After reading articles, as a class, students will brainstorm how living in 1890 was different than living today in the 21<sup>st</sup> century. Students will examine photographs of homesteads on the Olympic peninsula and complete a graphic organizer. Students will write a short essay to describe a homestead then choose something from today that would be useful to an 1890 homesteader and explain why.

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## LESSON 4: LOCAL HISTORY

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### GUIDING QUESTION:

What chronology of people and events lead to the development of the Olympic Peninsula? How did those same people and events lead to the building and ultimate removal of the Elwha Dams?

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### LESSON OVERVIEW:

During this lesson students will read three articles and create a time line by putting the events in chronological order using a graphic organizer. The time line can be used in future lessons to add later occurring events. The time line will allow students to see how events in one area can affect local, state, national and world history and visa versa.

## UNIT 3: ELWHA DEBATE

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## LESSON 5: GOOD INTENTIONS

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### GUIDING QUESTION:

How did an 1881 law in Washington interfere with then support the building of the Elwha Dam and what was the consequence for salmon? What did the building of the dam do for the economy of the Port Angeles area?

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### LESSON OVERVIEW:

The Territory of Washington code of 1881 made it a crime for anyone to obstruct the passage of salmon in any waterway. When Thomas Aldwell built the lower Elwha Dam in 1912 it became clear during construction that the dam was an impediment to salmon. Aldwell failed to include a fish ladder or passage as required by law making the Elwha Dam an illegal dam. In 1913 Washington State fish commissioner, Leslie Darwin, found a loop hole in the 1881 law that allowed the Elwha Dam to function legally. In this lesson, students will read about the loop hole and the subsequent repeal of the 1881 law and its replacement by a 1914 law that allowed below dam hatcheries to be built instead of waterways. The Elwha Dam is important in that it set a precedent for dams in Washington. The students will then compare the early economic gain from the dam to the Olympic Peninsula in the form of hydropower with the loss of the salmon and write an editorial for *The Port Angeles Evening News* either supporting the dam or supporting the salmon.

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## LESSON 6: A LONG AND DIFFICULT PROCESS

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### GUIDING QUESTION:

It would be nice if a few sticks of dynamite could quickly remove a dam, but there are many big issues involved in dam removal, what are those issues and how do they relate to the Elwha River dam removal project?

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### OVERVIEW:

In this lesson, students working in four groups will use *Exploring Dam Removal: A Decision Making Guide*, a web document published by American Rivers and Trout Unlimited, to research one of the four issues involved in dam removal as it relates to the Elwha River. The students will synthesize their research for presentation to the class.

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## LESSON 7: SHOULD THE DAMS ON THE ELWHA BE REMOVED? A CLASSROOM DEBATE

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### GUIDING QUESTION:

Dams have been useful to human populations in providing water and energy for development of wilderness areas. Should dams that have outlived their use be removed in order to enhance the sustainability of natural and human communities?

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### LESSON OVERVIEW:

For this lesson, we direct you to The American Field Guide at:  
[http://www.pbs.org/americanfieldguide/teachers/salmon/salmon\\_unit.html](http://www.pbs.org/americanfieldguide/teachers/salmon/salmon_unit.html)

They have built a fantastic lesson plan for the debate over the removal of the dams on the Elwha River. We brainstormed some answers for the *Environmental Decision Making Model* for this lesson which we've included here.

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## LESSON 8: SALMON THE LIFE GIVING GIFT

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### GUIDING QUESTION:

Salmon play a crucial role in the lives of Pacific Northwest Native people. How are salmon truly the “life giving gift” to the Elwha River and the Klallam People that live along its banks?

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### LESSON OVERVIEW:

Students will be given a handout to read which includes an Introduction, an account by a Salmon Priest of the Skagit River, and two legends. Students will examine the two stories for the themes of greed, sacrifice and renewal. They will then investigate the relationship of the Klallam Tribe to the salmon of the Elwha River before the dams were built and after the dams were built. Students will organize information on to a chart. Using the information they have gathered from the stories and on their chart, students will use the writing process to compose their own story about how the salmon returned to the Elwha River.

# CREATIVE RESPONSE

## LESSON 1: A TRIP TO OLYMPIC NATIONAL PARK AND THE ELWHA RIVER

### GUIDING QUESTION:

Where in the world are Olympic National Park and the Elwha River?

### OVERVIEW

In this lesson students will use web resources to find Olympic National Park and the Elwha River on a map. Students will generate a map which they will use as part of a travel brochure they will create for Olympic National Park and the Elwha River Valley.



## LESSON 2: CALLING THE SALMON BACK TO THE ELWHA: POEMS FOR THE ADVENTUROUS ANADROMOUS

### GUIDING QUESTION:

How can asking someone to respond to a request help to build understanding?

### OVERVIEW:

In this lesson students will write a question and answer poem that uses two voices, one to call the salmon back to the River and the other to respond to the caller. Students will perform their poems.

## LESSON 3: TOTEM POLE FOR THE ELWHA

### GUIDING QUESTION:

If you were to create a totem pole for the Elwha River what combination of current and historical symbols would you include in it?

### LESSON OVERVIEW:

Students will work in small groups to research Totem Poles their history, meaning and symbolism. Then in the same small groups students will construct a totem pole for the Elwha River out of found objects that represents the historical and modern significance of the river and its restoration. Groups will then give a short presentation to introduce, explain and justify their totem pole.



# OTHER RESOURCES

## MATHEMATICS

Data Set 1: Analysis of Elwha river flow patterns

### TOPICS:

Understand the range of data, including max, min, median, mode, and variability. Discuss reasons for these flow changes and whether any repeating cycles develop.

### PLAN:

Take a look at the flow data of the Elwha River from 1968-1971. Plot the data on an X/Y graph. Determine which variable is dependent and which is independent. Determine from the data set, what the range of the data is over the three year period, within each calendar year, and within each weather season. Then, determine what the median flow is for each season.

Finally, using your knowledge of the weather patterns and snow pack buildup in the Olympic Mountains, come up with some explanations for the seasonal flow patterns, as well as, obvious spikes in the flow.

## DATA SET 2: DATA ANALYSIS OF DEMOGRAPHICS ON THE PENINSULA

### TOPICS:

Analyzing population changes in Clallam County and Washington State since the late 1800's. Analyze shifts in the demographic makeup of the region. Discuss some reasons for these changes and the effects that these changes have on the Elwha River Ecosystem.

### PLAN:

Examine the data set which shows changes in the population of Clallam County and Washington State. Plot these data sets on an X/Y graph and discuss some reasons for this population growth, whether the trend appears to be linear or exponential (growing continuously faster), and what impacts it has on the Elwha River watershed. Students can also engage in a little extrapolation to see where the trend is going and discuss the danger in that method.



Students can also analyze the data sets showing economic and racial changes.

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### DATA SET 3: ANALYZING TREELINE ELEVATIONS AND CLIMATE TRENDS

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**TOPICS:**

Examining tree line elevation trends across latitudes of the northern hemisphere (and southern hemisphere), as well as, some of the reasons why the trends differ in coastal versus continental climates, wet versus arid, polar and tropical.

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**PLAN:**

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### DATA SET 4: DATA ANALYSIS OF SALMON POPULATIONS

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**TOPICS:**

Look at historic population levels and modern levels to discuss trends in population returns. By comparing several similar rivers on the Olympic Peninsula, plus a couple outside of the peninsula, it can help students grasp what is “normal” or “expected” and compare that to the effects the dams had on species in the Elwha river.

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**PLAN:**

# ACKNOWLEDGMENTS

Written by Sherilyn Seyler, Jeff Taylor and Diane Williams, National Park Service

Edited by Dean Butterworth, National Park Service

Design by Kiley Barbero, National Park Service

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# CONTACT

Dean Butterworth  
Outreach and Education Specialist  
Olympic National Park  
(360) 565-3146  
dean\_butterworth@nps.gov

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