Science Museum of Minnesota

EARTHSCAPES RIVER RESTORATION RESIDENCY PROGRAM

BACKGROUND

The Elwha River is located in Washington State on the Olympic Peninsula, primarily in the pristine Olympic National Park. Historically, the river was a prolific salmon stream, but the construction of 2 major dams on the Elwha at the beginning of the last century has contributed to a drastic salmon population decrease. Currently, as few as 3000 salmon return to the Elwha each spring. Legislation has been passed mandating the removal of the Glines Canyon Dam to restore salmon habitat and presumably salmon populations. "If you un-build it, they will come" is a commonly held belief among proponents of dam removal on salmon streams. Aside from the dams, the Elwha River is otherwise untouched habitat, and as such the Glines Canyon Dam has been chosen as the first large dam (210 ft tall) to be removed in this country. If salmon populations do not recover, salmon restoration strategies need to be reexamined.

The primary motivation for dam removal may be restoration of salmon habitat and populations. However, the consequences of dam construction and removal extend much further, affecting geologic and river processes as well as provoking intense social, political, and economic questions and tensions. A comprehensive background for the Glines Canyon Dam removal can be found at: www.nps.gov/olym/issues/isselwha2.htm

The Science Museum of Minnesota's Earthscapes – River Restoration Residency classes introduce students to the issues surrounding dam removal, gives them the opportunity to explore data and concepts from National Center for Earth-surface Dynamics (NCED) research, and gives them the opportunity to actively participate in current, ongoing research on river systems. The residency was developed to provide connections between NCED and real-life science research involving earth and river systems with Middle School science classrooms. It is designed to support and be incorporated into existing Earth Science classroom curriculum. However the residency classes are self-contained and can be presented to students with no prior knowledge of river systems. The residency has been taught in many different contexts and is easily modified to function as a culminating experience, a stand-alone exercise, or as an introduction or lead-in to more in depth study of river systems.

GOALS OF THE RESIDENCY

Science Topics

Scientific Reasoning, Inquiry, Earth Science, Ecology, Natural Hazards, Risks and Benefits, Nature of Science, Science and Technology in Society

Content / Concepts

Students are given an introduction to river systems in general and the Elwha River in Washington state specifically. They learn and practice using terms to describe river systems (e.g. tributaries, watersheds, erosion, equilibrium, etc.) both qualitatively and quantitatively while making detailed observations. By the end of the residency, students will understand both the scientific and social questions behind the removal of the Glines Canyon Dam and be able to recommend what course of action should be taken.

Higher Order Thinking Skills

Students are challenged to synthesize a large amount of content and ideas relating to river systems and the removal of the Glines Canyon Dam. Based on knowledge of current research involving this dam, students design different plans for removing the dam, identify dependent and independent variables in the system, form and test hypotheses, evaluate data, and brainstorm future lines of inquiry that could be pursued.

Other Skills

Students work in groups and have hands-on experience with a real-world situation of interest to scientists and the public.

THE CLASSES

Intro to Rivers *20 - 25 minutes*

Through the use of a multimedia presentation, students are introduced to key concepts of river systems and how they evolve and interact with the Earth's surface over time. Students build a basic vocabulary to describe the physical parts of a river system and the variables that describe stream flow. Students are then introduced to the concept of equilibrium, how people change rivers, and how those changes can affect the equilibrium of a river.

Maps Investigation – Intro to the Elwha River *25 - 30 minutes*

Students are introduced to the Elwha River in Washington State and the Glines Canyon Dam through a series of maps and questions designed to bring out both the scope of the system and issues surrounding the use and removal of the dam. Students identify the main river channel, tributaries, and watershed of the Elwha River system. Then using information from the maps and supplemental information provided by the instructor, students learn about the history of Lake Mills and the Elwha River watershed. Also, they learn about the current controversy surrounding the proposed removal of the Glines Canyon Dam, they examine the local geography, and they identify stakeholders in the system.

Dam Removal Lab I – Qualitative Observations *40 - 50 minutes*

During this session students work in small research teams using working models of Glines Canyon to explore the changes that have occurred in the Elwha River system over the past 80 years. Students observe the system as it existed historically, build a dam, fill the reservoir with water, and feed sediment into the model to build a delta into the lake. After a brief overview of research conducted at NCED on the topic, students design different dam removal scenarios to test, and as a class fully explore the available options. Students actively make a series of maps showing, and make qualitative observations describing and comparing, how the modeled system evolves over time under different dam removal scenarios.

*The equipment used for this session **CANNOT** be easily moved from classroom to classroom. If multiple sections of this class are presented please provide the use of a single room for this session.*

Dam Removal Lab II – Quantitative Observations *45 – 50 minutes*

Before running the quantitative experiment, students complete a worksheet that guides them through forming a hypothesis, identifying dependent and independent variables, and designing an experiment. After a brief discussion of the previous session's results and the potential ambiguity of qualitative data, student research teams conduct a quantitative experiment to collect detailed measurements on how their system evolves over time. Specifically, each team measures how the sediment load of the stream changes over time. Projection of an interactive graph allows for real time analysis of the data as it is collected and also for comparison of different dam removal scenarios.

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Data Analysis and Interpretation *25 – 45 minutes*

Finally, the residency engages students to interpret, critique, and compare the data the groups collected, to identify and design other research questions that could be pursued using the equipment at hand, and ultimately to develop and advocate a recommendation for the "ideal" dam removal scenario.