

Mid-Year Report: Suspended Sediment Budget for the Elwha River Floodplain

CENTER FOR ENVIRONMENTAL JUSTICE AND SUSTAINABILITY (CEJS)

Wes Lauer, Civil and Environmental Engineering, Seattle University

1. Project Summary

The removal of two large dams from the Elwha River, near Port Angeles, Washington, represents one of the largest river restoration projects in history. The second and larger of the two dams was finally removed in August of 2015, liberating large amounts of sediment that had been stored in the reservoir upstream from the dam. Because of the many monitoring datasets being collected as part of the project, there are several interesting scientific opportunities. My project focuses on identifying what controls the storage of sediment on the river's floodplain. Floodplain sediment plays an important role in building soil and in changing the hydraulic characteristics of the river. The project relies on both field observations and computer modeling. The field component uses simple, low-tech repeat cross-section surveys to provide high-resolution measurements of elevation change within forested areas of the Elwha river floodplain. The sections were originally installed in 2013 between large reference trees that were flagged in the field and marked with nails so that the sites can be re-occupied. The computer modeling part uses the CAESAR landscape evolution model to simulate floodplain flow conditions over the post-dam period. These simulations are used to scale up the sediment deposition measurements to the entire system.

2. Update

Summer 2014

Field work: Cross sections were re-occupied during August, 2014. A total of 25 of the 43 sites had experienced significant sediment deposition.

Computer modeling: A preliminary CAESAR model of the system was developed based on topography/bathymetry provided by the U.S. Bureau of Reclamation and U.S. Geological Survey.

Fall 2014

Computer Modeling: The CAESAR model was optimized and calibrated using river stage data collected by the U.S. Geological Survey.

Code Development and Analysis: Source code for the CAESAR model modified so that the model would store cumulative flow across each 10m x 10 m grid cell. This variable was regressed against observed sediment deposition to develop a model of floodplain sediment storage that could be applied to the entire system. The results indicate that through August 2014, roughly 250,000 cubic meters of sediment had been stored on the floodplain. This is probably less than 10% of the total release through that date. However, no large post-dam floods occurred prior to December 2014.

Dissemination: Results were presented at the Fall 2014 meeting of the American Geophysical Union in San Francisco, CA.

Winter 2015

Field work: I attempted to visit my field sites during early February, 2015 to collect sedimentation rates after a large flood that occurred in December 2014. However, an even larger flood occurred on the morning I arrived at the site. Instead of collecting sediment deposition data, I instead collected suspended sediment samples from inundated portions of the floodplain. These will be useful for model calibration.

Work Planned for Spring/Summer 2015 and beyond

The main work remaining for Spring 2015 is to re-calibrate the CAESAR model using observed suspended sediment concentrations and observed sediment fluxes. I also intend to use the model to simulate the movement of gravel released from the reservoirs. While the gravel transport modeling effort is beyond the scope of the original CEJS project and will probably extend through the summer, I see it as an excellent way of consolidating data collected by a range of researchers on the Elwha. I hope to use this as the basis of a grant proposal to the National Science Foundation that would be focused on developing a data repository for Elwha-related datasets that could have value as a well-documented full-scale model test case for future sediment transport modeling.