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Center for Environmental Justice and Sustainability
Mid-term Report

Following the Oso Landslide, large amounts of sediment were deposited into the North Fork Stillaguamish River, which could potentially have a significant impact on the river's flow. For the last six months, it has been our goal to see how influential this increase in sediment deposition has been on the river flow and local salmon population. Thus far, we have taken soil samples from along the riverbank, developed grainsize distribution curves for each sample site, and developed flow duration curves for the river at the Oso Landslide site.

The program that we plan to model the North Fork Stillaguamish with is called Morphodynamics and Sediment Transport in One Dimension (MAST-1D), and was written by Seattle University's Dr. Wes Lauer. In order to get MAST-1D up and running, we need several key pieces of information, such as a realistic flowrate, channel bathymetry, and floodplain geometry, and multiple grain size distributions along the river.

To select which flows we will route through our model, we must develop a Flow Duration Curve (FDC) for the river. We used daily average flow data (1928 – 2016) from the United States Geologic Service (USGS) Flow Gages 12167000 in Arlington, Washington. However, we are not interested in the flow at Arlington, rather we are interested in the flow near the Oso Landslide which has only had a flow gage since October of 2015. To develop the Oso flows based on what we observed at Arlington, we analyzed the data sets from both flow gages. Figure 1 shows a flow duration curve for each decade between 1928 and 2016. It is clear from the figure that each decade experiences more flow than the last, which correlates well with the idea that climate change will cause geographic locations with high annual precipitations values to see an increase in these values over time.

As of the end of February 2016, we have soil samples for six locations along the Stillaguamish (see Figure 2 for a grain size distribution at Site 2, and Figure 3 for the geographic location of each site). Ideally, we will take more samples in the coming month as to have a more detailed soil profile of the river. However, we have encountered quite a few problems with actually reaching the gravel bars between high water levels and poor road access. Although, more samples will be needed, one trend we do already see is a significant increase in grain size at the confluence of Deer Creek with the North Fork Stillaguamish, which is to be expected.

The last piece of the puzzle is the channel bathymetry and floodplain geometry. We were able to coordinate with USGS to obtain a Hydraulic Engineering Center River Analysis System (HEC-RAS) of the river. After the Oso Landslide in 2014, USGS surveyed the entire North Fork Stillaguamish River in January of 2015 with cross sections approximately 500 meters apart. The floodplain data comes from LiDAR data taken in 2014. Coordinating with USGS has provided us with far more information than we actually need, and has saved us many hours of data analysis and interpretation.

Moving forward, we plan to start modeling the river as soon as Dr. Lauer has the program ready. We will collect more grain size data before we begin modeling if possible, but it is not safe (or even really possible) for us to sample grain sizes at flood stages above two or three feet (a flood stage of three feet is exceeded most of the rainy season). As we move into the spring, we will begin to reach out to the City of Darrington to coordinate a community outreach about our project.

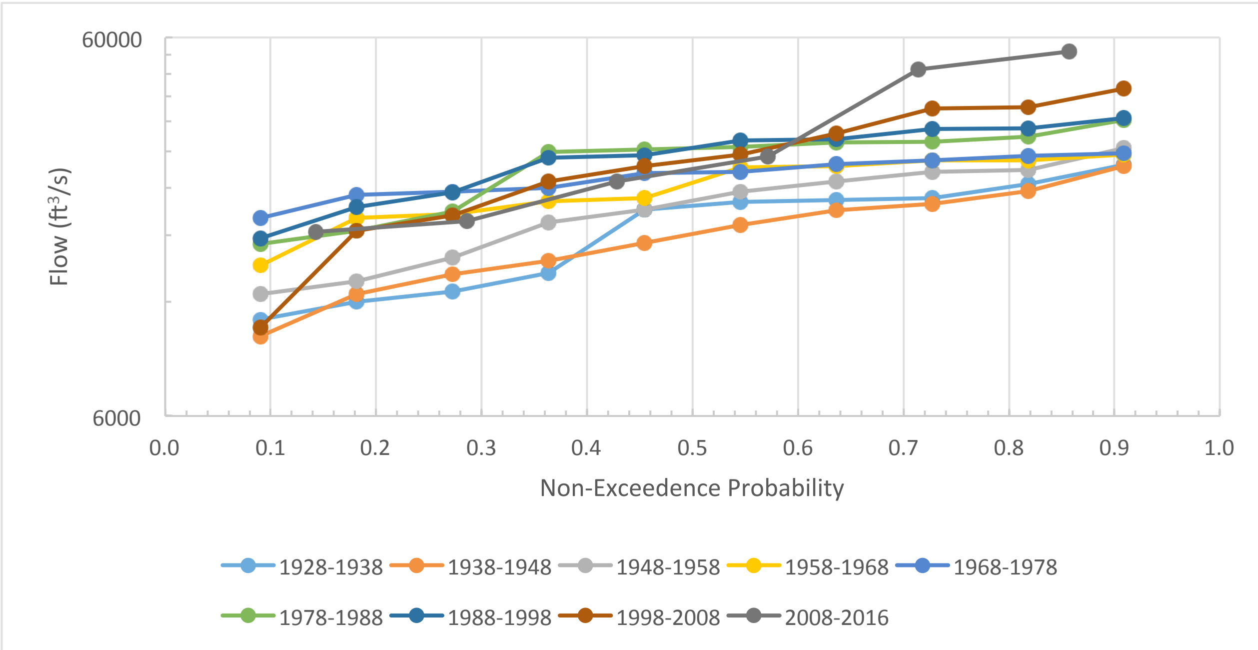

Figure 1, Flow duration curve for each decade between 1928 and 2016. The figure shows a strong correlation with climate change.

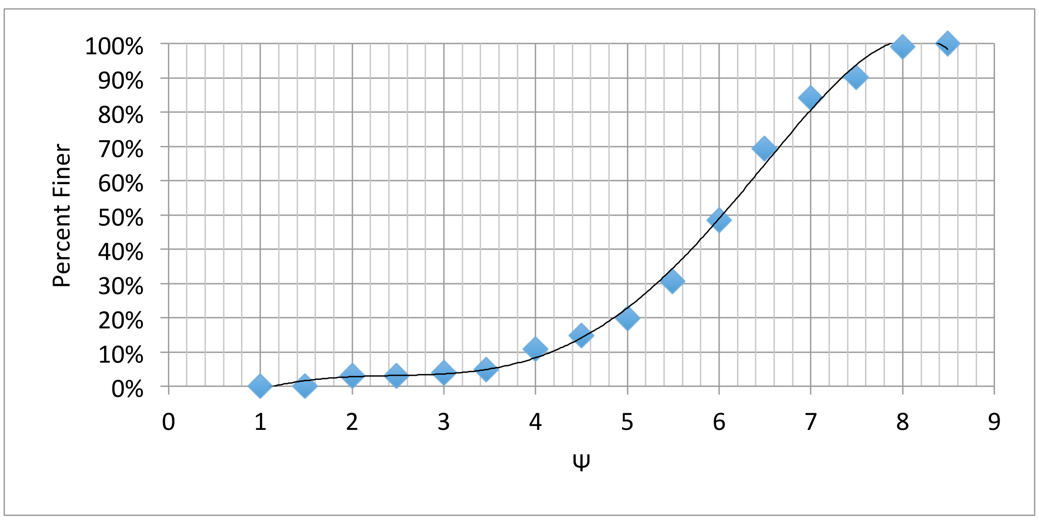

Figure 2, Grainsize distribution at Site 2. The actual grain size can be calculated as $D = log_2(\Psi)$. D_{50} (the number that 50% of the grain size is finer than)= 64 mm, D_{60} = 76.1 mm, and D_{84} = 137.2 mm.

Figure 3, Location of pebble count sites relative to the North Fork Stillaguamish River.