**Title:** Toward water and energy security via improved characterization of reservoir sedimentation

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**Research Objective(s):** The goal of this research is to improve estimates of the reservoir storage loss to sedimentation by leveraging recent advances in hydro-climate modeling with ensembles of state-of-the-art sediment prediction algorithms.

Reservoir sedimentation affects the long-term prospect of both water and energy security in the western U.S., a region that is heavily reliant water storage, and that makes use of hydro-power. By improving our understanding of reservoir sedimentation, this project supports the objectives of the Water-Energy Nexus.

**Research Activities/Methodology:**

This research enabled us to explore the following questions:
1) Can hydrologically-forced sediment algorithms help us improve reservoir sedimentation estimates to improve future planning?
2) To which processes and inputs are reservoir sedimentation estimates most sensitive?
3) What can we learn from models that the linear sediment accumulation assumption fails to assess?
These questions were addressed through a Sobol sensitivity analysis of a hydrologically forced sediment algorithm ensemble, as well as an evaluation of differences between the hydrologically forced and linear sedimentation assumptions.

**Results:**

Key model parameters driving sediment production were revealed with the Sobol sensitivity analysis. While first and total order sensitivities explain the overall production of sediment, interactions between parameters (right side of Figure 1) were notably strong for some algorithms underscoring important connections between processes that need further investigation. The hypothesis that sediment would accumulate in a linear fashion—built into many sediment projections—was largely disproven. Mean squared differences in sediment accumulation over a 40 year period between modeled and linear assumptions were between 24 and 89 %, suggesting that much is to be gained by refining the analysis and applying it across other domains.

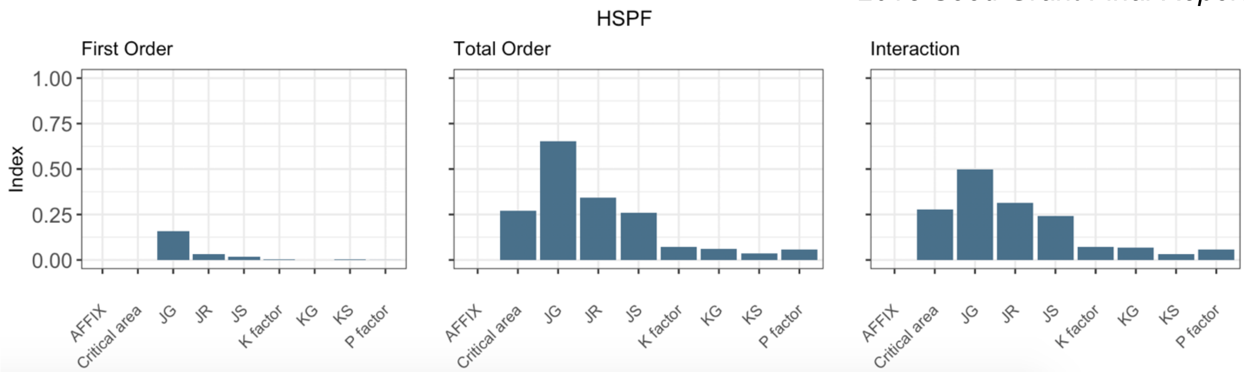


*Figure 1: Bar graphs of Sobol sensitivity index values for the HSPF sediment algorithm. A value of one signals most sensitive, and zero signals no sensitivity.*

**Accomplishments:**

1. M.S. student, Leah Bensching, to graduate Spring 2019
2. M.S. Thesis to be submitted Spring 2019 titled: Diagnosing Drivers of Reservoir Sedimentation in the Western US: A Case Study of Prineville Reservoir, Oregon.
3. NSF-GRFP proposal submitted (pending)

**Conclusions/Next Steps:**

Based upon the analysis conducted as part of this WEN-IRT funded project, we have advanced our understanding of reservoir sedimentation, which can improve future projections relevant for water-energy nexus applications.

We now hypothesize that a parabolic, rather than linear assumption is most appropriate for estimating long-term reservoir sedimentation. This result was identified in the RESSED observational database. Yet, this hypothesis underscores the need to understand regional patterns and their drivers more clearly.
We plan to pursue an NSF proposal, as well as further funding from the U.S. Bureau of Reclamation as follow on efforts from this work.