CEE 6410 Project: Literature Review

Author: Greg Goodrum

Date: 09/22/2020

Submit a list of relevant literature you have read related to your semester course project in WORD format. Briefly describe the prior work that has been done and the gap your model/work will fill.

**Abstract**

My objective is to develop a dual optimization model for the Bear River watershed that identify instream barrier assemblages that maximize connected aquatic habitat and minimize water scarcity. Instream barriers alter natural stream conditions (O’Hanley, 2011), fragment aquatic habitat (King *et al.*, 2017), and limit the distribution, abundance, and persistence of native freshwater fishes (Bourne *et al.*, 2011). Barriers also provide human benefits such as water storage, hydropower, flood control, and transportation. Optimization models that include both human and ecological objectives can identify paths to protect and restore habitat connectivity while maintaining human water demands (Null *et al.*, 2014). Previous studies have included aquatic habitat and economic water supply objectives in optimization models, but often rely on simplistic, ecologically irrelevant habitat models and only consider large dams for removal (Kuby *et al.*, 2005; Neeson *et al.*, 2015; Null *et al.*, 2014). Kraft *et al.* (2019) developed a dual-optimization barrier-removal model that maximized connected aquatic habitat and minimized water scarcity in Utah’s Weber River, but based economic objectives on economic loss functions and water demand price elasticities on highly urbanized areas including Ogden and Salt Lake City. Alafifi and Rosenberg (2020) developed a systems optimization model for allocating water, financial resources, and revegetation efforts in the Lower Bear River watershed, but was not focused on barrier removal. Water development is slated to continue in the Bear River basin (UDWRe, 2019). My work will help to improve water resources decision making by creating a model that can quantify environmental-economic tradeoffs between suitable habitat connectivity for fish species of management concern and competing human water demands in the Bear River. The model solutions will identify promising solutions for barrier development and removal to protect and reconnect quality aquatic habitats while satisfying human water needs.

**References**

Alafifi, A.H. and D.E. Rosenberg, 2020. Systems Modeling to Improve River, Riparian, and Wetland Habitat Quality and Area. Environmental Modelling and Software 126:104643.

Bourne, C.M., D.G. Kehler, Y.F. Wiersma, and D. Cote, 2011. Barriers to Fish Passage and Barriers to Fish Passage Assessments: The Impact of Assessment Methods and Assumptions on Barrier Identification and Quantification of Watershed Connectivity. Aquatic Ecology 45:389–403.

King, S., J.R. O’Hanley, L.R. Newbold, P.S. Kemp, and M.W. Diebel, 2017. A Toolkit for Optimizing Fish Passage Barrier Mitigation Actions. Journal of Applied Ecology 54:599–611.

Kraft, M., D.E. Rosenberg, and S.E. Null, 2019. Prioritizing Stream Barrier Removal to Maximize Connected Aquatic Habitat and Minimize Water Scarcity. Journal of the American Water Resources Association 55:382–400.

Kuby, M.J., W.F. Fagan, C.S. ReVelle, and W.L. Graf, 2005. A Multiobjective Optimization Model for Dam Removal: An Example Trading off Salmon Passage with Hydropower and Water Storage in the Willamette Basin. Advances in Water Resources 28:845–855.

Neeson, T.M., M.C. Ferris, M.W. Diebel, P.J. Doran, J.R. O’Hanley, and P.B. McIntyre, 2015. Enhancing Ecosystem Restoration Efficiency through Spatial and Temporal Coordination. Proceedings of the National Academy of Sciences 112:6236–6241.

Null, S.E., J. Medellín-Azuara, A. Escriva-Bou, M. Lent, and J.R. Lund, 2014. Optimizing the Damned: Water Supply Losses and Fish Habitat Gains from Dam Removal in California. Journal of Environmental Management 136:121–131.

O’Hanley, J.R., 2011. Open Rivers: Barrier Removal Planning and the Restoration of Free-Flowing Rivers. Journal of Environmental Management 92:3112–3120.

UDWRe, 2019. Bear River Development Report Executive Summary. Salt Lake City, Utah.