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Tuesday, Nov. 10
10:30 AM – 12:00 Noon
SESSION 22: River Impacts

Freshwater Flow to Puget Sound is Declining. Why? - Curtis DeGasperi, King County Department of Natural Resources and Parks, Seattle, WA

A recent study of continental global freshwater discharge since 1948 found that with the exception of runoff from Arctic areas, trends in discharge to the earth's oceans have been small or downward. A statistically significant decline in discharge to the Pacific Ocean was detected that was largely attributed to a similar trend in precipitation. A downward trend in total discharge to Puget Sound has also been observed over the same time period. The decline in freshwater discharge to Puget Sound over the period 1948-2008 is on the order of 20 percent. There is also a downward trend in regional precipitation over the same period, but changes in precipitation can explain only about 5 percent of the decline. Other components of the water budget are analyzed to account for the additional loss of freshwater inflow to Puget Sound. These components include consumptive use, diversion of freshwater to wastewater treatment plants that discharge directly to Puget Sound, and the effects of increasing air temperature on evaporation from surface waters and evapotranspiration from vegetation. Declining runoff implies heightened competition for in-stream and out-of-stream uses. Nearly 4 million people currently live in the Puget Sound region and over a million more are expected over the next decade, mostly in urban and suburban areas along the Puget Sound shoreline. The increasing population and the decline in total runoff have the potential to exacerbate conflict between human demands for water and the desire to protect and restore aquatic ecosystems.

Climate Change on the Colorado River: A Method to Search for Robust Management Strategies - Ryan Keefe, Pardee RAND Graduate School, Santa Monica, CA (co-author: Jordan Fischbach)

The Colorado River is a principal source of water for the seven Basin States, providing approximately 16.5 maf per year to users in the southwestern United States and Mexico. Though the dynamics of the river ensure Upper Basin users a reliable supply of water, the three Lower Basin states (California, Nevada, and Arizona) are in danger of delivery interruptions as Upper Basin demand increases and climate change threatens to reduce future streamflows. In light of the recent drought and uncertain effects of climate change on Colorado River flows, we evaluate the performance of the Lower Colorado River shortage sharing agreement adopted in December 2007 by the Department of the Interior. We build on the current literature by using a simplified model of the Lower Colorado River to consider future streamflow scenarios given climate change uncertainty. We also generate different scenarios of parametric consumptive use growth in the Upper Basin and evaluate management strategies in light of these uncertainties from multiple decision perspectives. Uncertainty associated with climate change is represented with a multi-model ensemble from the literature, constructed streamflow scenarios based on paleo-hydrology reconstructions, and observed natural flows. This analysis uses a two-tiered decision model, where the higher level represents the actions of the Secretary of the Interior and the lower tier represents actions taken by contractors in the Lower Basin states in the face of different future scenarios of consumptive use and the effects of climate change on river flows. Using Robust Decisionmaking (RDM), we create a large number of futures in which to assess current and long-term decisions. In addition to identifying robust policies for system and resources management, this research uses search algorithms to quantitatively identify vulnerabilities that may threaten the current set of operating policies and agreements between states and major contractors, providing a direction for future negotiations in the Basin.

Assessing the Impacts of Changing Climate on the Future of Water Resource Management in the Snake River Plain - David Hoekema, Boise State University, Boise, ID (co-author: Venkataramana Sridhar)

Flows from the Snake River and its tributaries are used primarily used for irrigation, hydropower generation, aquaculture and navigation among others. The Snake River Basin (SRB) has a vast expanse of irrigated areas with over 3,820,000 acres, including 742,000 acres by groundwater. SRB flows are used for operating commercial rainbow trout aquaculture,and augmenting streamflow to flush juvenile salmon down the Snake and Columbia Rivers. The basin is experiencing an increasing trend in wintertime temperature. This trend is also related to declining snowpack in the mountains, earlier spring runoff, and increased flooding due to more rain-on-snow events. This study will assess the flexibility of Idaho's water resource system to meet current demands under changing climate scenarios using MODSIM, a priority based water resource management decision support system (DSS). Future flows will be generated using a hydrology model driven by forcings from a suite of climatic models recommended by the Special Report on Emission Scenarios (SRES) and from the Intergovernmental Panel on Climate Change (IPCC).

Possible Signals of River Response to Climate Change in Western Washington - Tim Abbe, ENTRIX, Inc., Seattle, WA (co-authors: Paul Kennard, Jenna Scholz, Jim Park)

The magnitude and rate at which landscapes will respond to climate change is a critical question for managing water resources and infrastructure. Evidence from rivers in Western Washington show an increase in the magnitude and frequency of peak flows consistent with changes in rainfall events. Glacial recession and thinning has resulted in the disappearance of approximately 25% of Mount Rainier's glacial volume between 1913 and 1994 (Nylen, 2001). This is exposing large volumes of unconsolidated, oversteepened and unvegetated sediment, while simultaneously altering hydrologic regimes. Climate induced changes to natural flow, sediment and wood debris regimes further compound landuse and development-related geomorphic response. Geomorphic evidence from rivers draining Mount Rainier provides a dramatic illustration of how glacial systems are responding to the warming climate and some of the implications to transportation infrastructure. These new sources of sediment and elevated frequencies of highly erosive debris flows are increasing sediment supply to downstream rivers. This is accelerating channel aggradation which in turn is causing dramatic alteration of alluvial landforms within the receiving river valleys (Beason 2007). Channel surveys taken before and after the November 2006 floods indicate that even this record setting event that delivered 46 cm of rain in 36 hours did not provide sufficient runoff to transport sediment inputs and most channels continued to aggrade. In this flood, channels rose an average of about 1 meter, something that would take 20 years based on historic aggradation rates. River aggradation is altering entire valley bottoms, burying old growth riparian forests and overwhelming infrastructure constructed with assumptions about flow, sediment and wood regimes that are no longer valid. The changing landscape within Mount Rainier National Park and its river drainages is a siren call to those downstream and alpine glacier-sourced watersheds in general. The long-term geomorphic response will be complex since we can expect that sediment budgets will eventually diminish and trigger a period of channel degradation. Successful habitat restoration must be designed to accommodate and moderate the effects changing sediment and flow regimes that are being manifested by climate change.