

American Water Resources Association
2009 SPRING SPECIALTY CONFERENCE
Managing Water Resources Development in a Changing Climate
May 4-6, 2009
Anchorage, AK

Wednesday, May 6

3:30 PM – 5:00 PM

Session 35: Changing Water Demand and Uncertainty II

1. AWRVI: An Integrated Water Resource Vulnerability Index for the Arctic - Andrew Kliskey,
University of Alaska Anchorage, Anchorage, AK (co-author: Lilian Alessa)

People in the northern latitudes face increasing uncertainty in their daily lives as they contend with rapid environmental changes at multiple scales. Despite the importance of water resources at local scales indicators have been developed that operate from regional to global scales and for mid-latitude to equatorial environments. Until 2008, no appropriate index existed for assessing the vulnerability of Arctic communities to changing water resources. The Arctic Water Resource Vulnerability Index (AWRVI) was developed in response to this key need so that stakeholders could easily assess their relative vulnerability to changes in their water resources. AWRVI is based on a social-ecological systems perspective that includes physical and socio-economic indicators of change and is demonstrated in three case study communities / watersheds in Alaska. For the first time, AWRVI allows an improvement in the diagnostic capability of examining the suite of constituent physical and social scores as a composite in which individual indicators yield valuable guidance for developing adaptive strategies for resilience.

2. Erosion of Water Supply Predictability under Climate Change? - Levi Brekke, Bureau of Reclamation, Denver, CO (co-authors: Kevin Werner, Donald Laurine, David Garen)

Does climate change with warming lead to reductions in water supply predictability? Reclamation develops seasonal to annual plans of operation. These plans are based, in part, on forecasts of seasonal runoff volumes (e.g., of April-July volumes, forecast as early as January with monthly updates through spring). In snowmelt-dominated basins, snowpack offers significant predictive information of seasonal water supply. Under climate warming, several trends seem possible, such as precipitation regime of gradually more rain and less snow and reduced development of snowpack. It is questioned whether such trends would reduce snowpack's influence in water supply prediction and perhaps water supply predictability. This study explores past occurrence and future development of predictability trends along with potential mitigation strategies to preserve predictability. Project collaborators include the National Weather Service (NWS) Northwest River Forecast Center and Colorado Basin River Forecast Center and the USDA NRCS National Water and Climate Center (NWCC). Methods involve process-based hydrologic simulation using NWS SacSMA/Snow17 models to develop synthetic hydroclimates from historical to future (i.e., generating runoff projections consistent with 1950-2099 temperature and precipitation projections at the "Statistically Downscaled WCRP CMIP3 Climate Projections" archive). NWCC statistical procedures are then applied to generate water supply forecast models and periodic model updates from historical to future within these synthetic hydroclimates. Results are analyzed for change in snow predictor influence in these forecast models and change in forecast error characteristics. This presentation will focus on work to-date, including development of synthetic hydroclimates and preliminary forecast model development. Findings have ramifications for (1) interpreting water supply forecasts in the context of contemporary operations planning, and (2) representing forecast-driven management in prospective system analyses under future climate conditions.

3. Hydroclimatic Change on the Salt and Verde Watersheds, Arizona - Timothy Hawkins,
Shippensburg University, Shippensburg, PA

Climate models project the southwestern United States to become both warmer and drier in the coming decades. This fact, coupled with large population growth and the subsequent demand for water will place extreme pressure on future water resources. The demands of climate change and population growth are well illustrated in Arizona where the Salt and Verde River watersheds provide much of the surface water to the Phoenix metropolitan area. To understand the stress that may be faced by this region it is useful to place future projections in the context of historical hydroclimatic change. The hydroclimate of the Salt and Verde

River watersheds was examined for 1895-2005 using data from a hydroclimatic model and available station data. The average temperature trend for the period of record over both watersheds is 1.7°C/century. Since 1971, the trend has been 5.1°C/century. Warming has been greatest in the months of March through May. No significant trends in precipitation over the period of record exist. Precipitation appears to be more strongly correlated with the Pacific Decadal Oscillation and El Niño/Southern Oscillation. During the current PDO warm phase that began in 1977, precipitation has decreased 40.77 mm per decade and snowfall has significantly decreased on average 311.28 mm/decade. Maximum seasonal snow water equivalent has decreased on average 52.6 mm/decade since 1983. Also since 1977, modeled potential evapotranspiration has significantly increased on average 23.7 mm per decade, actual evapotranspiration has decreased on average 19.5 mm per decade, and average soil moisture as a percent of field capacity has decreased 3.9% per decade. Average annual streamflow during this same time period has decreased 8.99 and 6.92 m³/s/decade and maximum monthly stream flow has decreased 30.21 and 41.64 m³/s/decade for the Salt and Verde watersheds respectively. This work suggests that projected warming and drying of the climate in the southwestern United States may in fact already be occurring.