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10:30 AM – 12:00 Noon

SESSION 41: Water Management and Planning

Contrasting Climate and Land Use Changes With Local Perceptions: a Case Study of Water Management Adaptation in The Andes Of Colombia - Felipe Murtinho, University California Santa Barbara, Seattle, WA (co-authors: Christina Tague)

This paper examines how Water User Associations' leaders in the Fúquene watershed of Colombia perceive water shortages and their relationship to actual climate and land use changes. In the Andean region of South America, understanding communities' water perceptions is particularly important for water management as many rural communities receive minimal government support and the communities themselves must decide if and how they will protect their micro-watersheds and distribute their water. In Colombia, for example, autonomous water associations provide water to 41% of the rural population. These associations have to manage their water resources under uncertain conditions due to land-use changes in their micro-watersheds and climate variability from natural events such as El Niño Southern Oscillation. In order to understand how water associations are trying to adapt to environmental change, we need to explore how their environment is changing and how communities perceive these changes. This study presents a case study of community based water management in the Fúquene watershed located in the eastern Andean region of Colombia. Specifically, this article analyze 1) the trends in climate change and land use/land cover changes in the past decades, 2) the water user associations' leaders perception on water shortages in terms of quantity and quality, the shortages changes and their perceived possible causes of these changes, and 3) the relationships between environmental changes and leader's perceptions. The analysis is based on information from 50 years of daily meteorological and hydrological data from 14 stations located inside the Fúquene watershed, land use/land cover maps for 1987 and 2005 at a 1:100.000 scale, and structured interviews to 113 water user association's leaders conducted in 2008. Results from this analysis show how the environment is changing in the Fúquene watershed and, if and how local perceptions are related to these changes. By studying the water associations leaders' perceptions on the environmental changes in Fúquene we will be able to better understand how climate and land use changes shape local initiatives. Specifically, the results will contribute to our understanding of adaptation and the implications of possible mismatches between environmental changes and local perceptions.

Managing Water in the Connecticut River Watershed - Richard Palmer, Civil and Env. Engineering, University of Massachusetts Amherst, Amherst, MA (co-authors: Austin Polebitski, David Ahlfeld, Casey Brown)

Proper management of a complex river system requires careful evaluation of the natural river ecosystem, the constructed infrastructure, environmental requirements, informed decision-making, and the needs of those living in the basin. In many river systems, such as the Columbia and the Tennessee River Valley systems, streamflow forecasts are integrated with computer models to attempt to derive the maximum economic benefit possible while also striving to achieve a variety of other objectives, including maximizing benefits from environmental habitat, recreation, and flood control. Integrated river management has become even more challenging as the impacts of climate change increase the natural variability of such systems and create unanticipated shifts in "normal" conditions. The Connecticut River faces such challenges. The largest and one of the most highly developed rivers in New England, the Connecticut River has had its natural flows altered due to both the development of dams and reservoirs and substantial changes in land use and urbanization (and its associated increase in the discharge of storm water and wastewater). Researchers at the University of Massachusetts are supporting the on-going study of the Connecticut River being performed by the Nature Conservancy and the US Army Corps of

Engineers through four interrelated activities. These activities can be summarized as: 1) Create downscaled climate and hydrology data to investigate climate change, 2) Construct climate informed streamflow forecasts, 3) Develop decision support tools to guide river operations, and 4) Facilitate stakeholder involvement. This paper focuses on stakeholder involvement and development of a large linear program to facilitate solutions that are advantageous for hydropower, flood management, recreation, water supply, and ecological targets throughout the basin. This paper focuses the incorporation of the stakeholders into the development the decision support system, a system that uses a large-scale linear programming formulation to illustrate potential operational trade-offs in the basin.

Analyzing Uncertainty and Risk in the Management of Water Resources for the State of Texas - Abhishek Singh, INTERA, Inc., Austin, TX (co-authors: Richard Hoffpauir, Srikanta Mishra, Marsh Lavenue)

The State of Texas updates its state water plan every 5 years to determine the water demand required to meet its growing population. The plan compiles forecasts of water deficits every decade over the 50 year planning horizon from regional water planning groups around the state and details water supply strategies and associated costs of implementation. To date, the plan has adopted deterministic predictions for population growth, water demand, water availability, etc. These predictions are, in reality, affected by multiple sources of uncertainties such as the impact of climate on water availability, uncertainty in population projections, variability in water usage, feasibility of the permitting process, societal concerns, cost of implementation, etc. The objective of this project was to develop a generalized and scalable methodology for addressing uncertainty and risk in water resources management both at the regional and the local water planning level. This framework captures key components of demand, supply and planning modules along with their associated uncertainties. The uncertainty in the water planning process is broken down into three primary categories: demand uncertainty, supply uncertainty, and uncertainty in water management strategies for meeting water shortages. Uncertainty in demand is related to the uncertainty in population projections and the per-capita usage rates and is characterized by using population projection scenarios and historical usage data. Uncertainty in supply is dominated by the uncertainty in future climate conditions, and is modeled using global circulation models and water availability models (WAMs). Strategies also vary in the degree of feasibility in permitting and future implementation. The final output from the analysis consists of scenarios for future demand and supply as well as reliabilities of different water management strategies, all of which can be used by decision-makers to make more robust decisions when planning for water needs of the future.

Sustainable Water Planning: A Comprehensive Planning Approach for 'Green' Utilities - Rafael E. Frias, Black & Veatch, Tampa, FL (co-author: Peter Binney)

Rather than rush to “get on the green path,” water, wastewater and stormwater utilities must consider several important issues as they look to establish themselves as a “green” or “sustainable” utility. The first aspect is to develop clear expectations and performance standards for what they and their elected or appointed boards are trying to achieve through operating as a “green” utility. Utilities also need to address other factors including supply source management and protection, system sustainability and reliability assessments, environmental regulations, operations management and the funding requirements for operation and implementation of capital projects. These aspects involve numerous stakeholders including governing boards, community, environmental, social and other special interest groups. The adoption of sustainable planning practices and technologies is a function of the limitations and demands utilities face in their operations. Examples include the increase in demand for services as a result of population and development growth, reduced water resource availability in terms of firm yields that are subject to climate variability or assimilative capacity, increasingly strict regulatory requirements and system constraints. Another major influence on operating on a sustainable manner is the cost of operations and capital project funding in a time of constrained economic conditions that can limit or eliminate proposed rate increases. Under those conditions, utilities should look to improving system efficiencies and optimization, as well as demand management approaches, while planning for the large capital costs that will need to be met. Robust long-term planning using principles of sustainability will provide utility managers with a holistic way to approach these limitations. These principles aggregate the multi-objective approaches that consider the environmental, social and economic factors shaping the future of the utility’s operations and

capital improvements programs. Sustainable planning involves the management of numerous complex and interrelated factors to assure all stakeholder needs are met now and into the future in a fiscally responsible manner. These challenges may include resource scarcity or abundance, the ecosystem in which the utility operates and the condition of the utility's infrastructure. This presentation will provide a summary of sustainable planning practices and technologies that "Green" utilities should consider for their operations.