

American Water Resources Association
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10:30 AM – 12:00 Noon

SESSION 45: Water Resources Planning

The Impact of Temperature, Demographics, and Land Use on Residential Water Consumption: An Empirical Assessment of the Portland (OR) Region - Vivek Shandas, Portland State University, Portland, OR (co-authors: G. Hossein Parandvash, Heejun Chang)

Driven in part by the imminent threats of population growth and climate destabilization, recent studies suggest that urban areas face severe water scarcity, with some areas in Australia and the United States already instituting moratoria on water use. Previous research also suggests that the dynamics of water use varies across geopolitical regions. While water managers traditionally avoid such crises by developing demand forecasts based on population estimates, technological developments, and weather predictions, their analysis are often at a regional scale with aggregate measures of water consumption. To date, there exists limited empirical evidence about how urban spatial structure and concomitant socio-demographic and temperature characteristics mutually interact to impact water demand at the scale of individual land uses. In this paper we apply statistical techniques to determine factors affecting residential water consumption at a neighborhood and local parcel scales in the Portland (OR) metropolitan region. We ask whether the variation in water use by household can be explained by density (e.g. households per acre, building footprint), physical (square feet of household, outdoor vegetation), sociodemographics (e.g. income, education, age), or temperature characteristics in the study region? Using a Geographic Information System (GIS), we integrate parcel-level water use data, high-resolution satellite imagery, US Census data, and temperature and land use records, to assess the importance of physical and social parameters on water consumption patterns. At the regional scale, our results suggest that specific thresholds of density can improve water conservation efforts, and at the parcel scale, several sociodemographics and structural attributes, including lot and building size, help explain over 75% of water use behavior. In addition, our results suggest a strong and significant relationship between urban heat and water consumption. Based on our results, we provide recommendations to water managers and land use planning bureaus to improve urban water management during alternative climate scenarios.

Protection of Critical Source Areas for Water Resource Protection through Community-based Land Use Planning and Ordinances - Zeyuan Qiu, New Jersey Institute of Technology, Newark, NJ (co-authors: Christine Hall, Donna Drewes, Grace Messinger, Kathy Hale)

Land use change especially urban development and sprawl is among the most pressing issues today and impose immediate threats to the long-term sustainability of water resources. Although land use change has direct implications to many local water resource issues such as nonpoint source water pollution, not every part of landscapes is equally attributed to those issues because of the variability in topography, soil and other natural resource conditions. The areas in landscapes that actively contribute to runoff generation and the subsequent nonpoint source water pollution are termed as critical source areas (CSAs). Land use decisions that protect the CSAs will help protect water resources and achieve its long-term sustainability in an efficient and effective manner. In many parts of the United States, municipalities play a key role in local land use decision making. This presentation will discuss the protection of CSAs at the municipal level for achieving the long-term sustainability of water resources through community-based land use planning and ordinances. A variable source area hydrology modeling technique called modified topographic index was used to identify the critical source areas for protection/preservation in three major municipalities in Rockaway Creek watershed, Hunterdon County, New Jersey. The existing state, regional and municipal land use plans, zoning and ordinances for protecting streams and water quality in those three municipalities were reviewed to identify the gaps between the critical source areas identified by hydrological science and technology and the areas protected. The preliminary review indicates that the

existing land use plans, zonings and ordinances protects some but most frequently miss to protect VSAs. The protection of CSAs can be carefully incorporated into municipal land use plan, ordinances and best management practices such as farmland and open space preservation, conservation buffer planning, ground water recharge design, low impact development planning, stormwater facility placement, stream restoration planning and direction regulation on CSA protection and preservation. A community engagement planning process was implemented to communicate those ideas of CSA protection with the three municipalities and to evaluate the opportunities, challenges and barriers faced by municipalities to adopt those ideas.

Innovative Approaches in Subwatershed Management Using a Systems Based Approach - Ray Tufgar, AECOM, Kitchener, ON, Canada (co-author: John Kwast)

A case study is provided for a Systems Based approach to Subwatershed Management directed to ecosystem protection and restoration. This plan covers approximately 13 square miles of the headwaters of four watershed systems. This area is subject to urban development and a Subwatershed Management strategy was developed to characterize the natural heritage system and develop a management strategy that would protect and enhance ecosystem conditions. Analysis was carried out to develop an understanding of the ecosystem processes through an integration of the disciplines involves (surface water resources, fluvial geomorphology, terrestrial and aquatic biology, water chemistry and hydrogeology). This was used in a systems based approach to understand the ecosystem processes as well as develop a management strategy that would sustain the Natural Heritage System characteristics. The strategy is broad-based including terrestrial natural heritage strategy, a riparian corridor management strategy as well as a water resources component to provide for erosion control, flood protection, water quality control and groundwater protection. This paper outlines the systems based approach used in NHS characterization, analysis and management strategy development.

Statewide Water Roundtables: Taking Oregon's Water Pulse - Michael Campana, Oregon State University, Corvallis, OR (co-authors: W. Todd Jarvis, Gail Achterman, Megan Kleibacker)

Oregon is one of two western states without a long-term water supply plan. Any plan needs support and input from the State's citizens. To initiate this process, OSU's Institute for Water and Watersheds, Sea Grant Extension, and the Institute for Natural Resources, conducted five 'roundtables' during Fall 2008, which sought to receive input and advice from Oregonians with respect to water issues; 301 individuals attended the facilitated meetings in Bend, Newport, Ontario, Medford, and Salem. Participants 1) represented a broad spectrum of water users; 2) were knowledgeable; 3) expressed a wide range of concerns; and 4) were generally pessimistic about current and future water supplies. Each roundtable lasted six hours, consisting of: 1) lunch; 2) facilitated large group discussion to identify issues; 3) 90 minutes of expert presentations; 4) self-selected small group facilitation, where participants refined and prioritized issues (over 200); identified solutions, examples, and major players; and 5) reporting of results to the entire group. These representative issues were identified by stakeholders: 1) funding for water/wastewater infrastructure and management; 2) regional integrated water planning within state framework; 3) protection of existing water rights and uses; 4) water quality, especially non-point, micro-contaminants and impacts of urbanization; 5) water-land use planning integration; 6) climate change impacts; 7) wetland, floodplain, and instream flow restoration; 8) interstate water allocation/management. Key messages sent: 1) integrated water management planning, implementation; 2) regional solutions to meet regional needs; 3) protect existing water rights and uses; 4) public information and education about water and water management; 5) more support for State agencies involved with water. Potential solutions included: 1) maximization of available funds through agency coordination and streamlining of funding sources; 2) water conservation tax credits, like energy tax credits; 3) water reuse and recycling; 4) water markets, pricing, and incentives; 5) water storage and conservation 6) measurement of water flows and uses systematically; 7) local integrated water planning; 8) interstate compact(s). The roundtables were a first step in the water plan information-gathering process. Additional roundtables should be held. Documentation is available at <http://water.oregonstate.edu/roundtables/docs.htm>.