

**Implications of Rising Temperatures and Changing Land Use on Water Consumption:  
An Empirical Assessment of Portland, Oregon**  
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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. While water managers traditionally avoid such crises by developing demand forecasts based on population estimates, technological developments, and weather predictions, their analyses are often at a regional scale with aggregate measures of water consumption. Previous research also suggests that the dynamics of water use varies across geopolitical regions. To date, there exists limited empirical evidence about how urban spatial structure and concomitant socio-demographic and temperature characteristics mutually interact to affect water demand at the scale of individual land uses.

In this paper we examine factors affecting residential water consumption at a neighborhood and local parcel scales in the Portland, Oregon 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 that differ across the study region. Using a Geographic Information System (GIS) we integrate parcel-level water use data, high-resolution satellite imagery, and land use records to assess the importance of physical and social parameters to explain 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 sociodemographic, 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 events and water consumption, particularly those events occurring during weekends. Based on our results, we provide recommendations to water managers and land use planning bureaus to develop resilient policies for future growth, while developing alternative climate scenarios.

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Vivek Shandas' research and teaching interests include urban ecology, water resource management, geographic information systems, and interdisciplinary education. He has degrees in biology, economics, and environmental policy and completed his Ph.D. in Urban Design and Planning at the University of Washington in 2005. Vivek is currently a faculty member in the Toulan School of Urban Studies and Planning, and a Research Associate in the Center for Urban Studies, at Portland State University.