

## Guest Editorial

The importance of water in the western United States is nowhere more manifest than in the case of irrigated agriculture. This is evidenced by the fact that irrigation accounts for over 74% of the west's total freshwater withdrawal and 90% of its consumptive use. Market sales of crops from the 43 million irrigated acres in the 19 states comprising the United States west stood at \$32 billion in 1997, representing one-third of the United States' total crop sales. Given this centrality of water in the economy of the western United States, it has been for an extended period a topic of choice for Western Regional Research. Over the years, these regional research projects have dealt with many important issues of water ownership, allocation, management and planning. The specific themes explored include micro-irrigation, groundwater and surface water contamination, precision farming, water markets and pricing, water conservation, water laws and institutions and water policy.

An important research project entitled 'Water conservation, competition and quality in western irrigated agriculture' (W-190) was initiated in 1994 to address major issues in western water resource management. During its first five-year period (1994–99) the project made significant contributions to the understanding of the complex dynamics of water management in the western United States, a sampling of which appeared in the research papers included in a special issue of the *International Journal of Water Resources Development* on 'Water and agriculture in the American west' published in June 2000. This research project was extended in 1999 for another five-year period (1999–2004) to further examine the rapidly changing configuration of water use and the attendant economic, environmental and institutional problems with profound impacts on western United States irrigated agriculture. The papers included in this special issue of the *International Journal of Water Resources Development* largely represent the work of W-190 researchers during the first three years of the renewed project.

The changing configuration of water demands in the western United States has markedly diminished the effectiveness of the once highly successful prior appropriation doctrine in achieving water transfers in a timely and judicious fashion. Gardner in his paper provides an instructive survey and synthesis of recent legal challenges to the conventional criteria used by regulatory agencies to evaluate water change applications. Empirical data on transfer applications from Utah and Nevada are presented as part of the analysis. The paper concludes that the "ownership and administration of water rights in the west are in a state of flux" and makes a strong case for revamping the current legal-institutional regime in order to improve market efficiency and reduce inefficient allocations.

Institutional changes induced by the changing and challenging water needs of the western United States, as exemplified by the growing transfer of water from agricultural to environmental uses, constitute the theme of the paper by Loomis, Quattlebaum, Brown & Alexander. This paper provides a concrete illustration of

the shifting priorities in water demand that accompany changes in societal perceptions as evidenced by the significant market purchases of water rights by public agencies for environmental purposes (e.g. wildlife, recreation and fisheries). Based on environmental transactions data in the western United States for a five-year period (1995–99), the paper concludes that water transfers to meet environmental needs have increased significantly in both numbers and quantity. This development suggests that environmental values of water have begun to exceed the marginal value of irrigation water in some locations.

Gopalakrishnan & Cox provide yet another example of the shift in water demand from conventional to newly-emerging sectors. This paper documents and analyses the significant growth in fresh water consumption in the burgeoning visitor industry of Hawaii. Hawaii's gradual but sustained transformation from a plantation economy rooted in irrigation-intensive sugar and pineapple production to a sprawling urban and tourist economy has triggered this increase in water use by the visitor industry. The Hawaii situation closely parallels the changing complexion of economies and the attendant changes in the configuration of water demand that have been occurring in most of the American West in recent years.

The three papers that follow offer fresh perspectives on water conservation, an issue of considerable interest to water planners and policy analysts because of the looming shortages in water supply to agriculture in the American west. Huffaker & Whittlesey develop a conceptual model to test the impact of two divergent economic policies—higher water prices vs. subsidies to the farmer—on water conservation. The model incorporates a wide array of economic and hydrological factors, unexamined in previous studies, in assessing the impact of economic policies on conservation. Herein lies the contribution of this paper. The authors conclude that increasing the cost of applied water may be more efficient in achieving conservation than subsidizing the cost of enhanced on-farm irrigation efficiency. This is a conclusion worth noting in designing economic incentive policies for agricultural water conservation.

The impact of an increase in surface water price on agricultural water use is further examined in a conjunctive use setting by Schuck & Green. The paper concludes that in such a system, which uses both surface water and groundwater, irrigators may find it cheaper to rely on on-farm wells than on a regional irrigation district, in the event of an increase in surface water price. The study findings suggest that the water rate reforms currently under consideration by the United States Bureau of Reclamation could lead to the irrigators switching from surface water to groundwater from farm wells. The possibility of such substitution poses new questions about the efficiency of surface water pricing as a conservation-inducing economic instrument in a conjunctive use system.

Water conservation, along with water quality, comes under further critical scrutiny in the next paper, by Schaible & Aillery. The authors use a Parks-modified multinomial logit model to study the impacts of irrigation technology transitions in the mid-plains states (Kansas, Nebraska, South Dakota and Wyoming) on water conservation, water quality and institutional change. The study results indicate that the impact of a transition to water-conserving irrigation technology in Kansas and Nebraska has been significant, especially in Kansas, far more than in the Pacific north-west. As for water quality impacts, the study results suggest a likely reduction in non-point-source pollution in the mid-plains states, although its extent would hinge heavily on the potential

increase in water use efficiency. The authors make the important point that a narrow definition of agricultural water conservation based entirely on water quantity gains should give way to a broader definition that includes social-institutional perspectives along with an integration of on-farm water conservation and regionally unique innovations in water institutions. Such a change in perspective, Schaible & Aillery argue, will have a more significant impact on human health and environmental policy goals and the sustainability of regional agriculture.

In the final paper, Supalla critically examines the conventional, widely touted market failure paradigm, especially in the context of water quality problems involving individual irrigators, and concludes that this approach is inadequate as a policy guide. The author develops an alternative approach based on stewardship and presents an empirical application of it in terms of nitrate pollution of groundwater in central Nebraska. This view holds that a typical farmer today is sufficiently socially conscious and environmentally sensitive that a voluntary substitution of some environmental quality for income is part of his rational expectations calculus of decision making. The study results point to the telling conclusion that education can exert a strong positive impact on environmental quality enhancement.

The papers in this special issue, as the foregoing discussion shows, have addressed and offered fresh perspectives and insights on some of the pressing issues—water allocation, water conservation and water quality—facing water management in irrigated agriculture in the western United States. A survey of the global water scene suggests that these issues are of compelling importance in the context of water management and planning in many other parts of the world, both developed and developing. Thus, it is hoped that the problems identified, the solutions offered and the policies suggested in the papers in this special issue of the *International Journal of Water Resources Development* will prove to be relevant and valuable to a global constituency of water professionals and policy makers.

Chennat Gopalakrishnan  
University of Hawai'i at Manoa

