THE WESTERN RIVERS INITIATIVE FOR SUSTAINABLE AGRICULTURE

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Background: Increasing demands for limited water supplies have reduced the physical, chemical, and biological quality of most rivers in the western United States. Growing environmental water needs for these rivers and increasing urban demand have put pressure on agriculture to use water more wisely while continuing to provide food and fiber for the nation. A holistic view is needed to evaluate the role of agriculture within western river basins in order to provide effective field, farm, and watershed management practices that protect the water resources and ecosystems within these river basins. This initiative focuses on the three major river basins within the Western United States: the Columbia-Snake Rivers, the Sacramento-San Joaquin Rivers, and the Lower Colorado River, including Central Arizona.

The Lower Colorado River is currently over-allocated. California is being forced to reduce its annual use from roughly 5.3 to 4.4 million acre feet. At the same time, water demands are increasing from urban expansion in Southern California, Southern Nevada, and Central Arizona; Native American Entitlements; Mexican urban and agricultural sectors; and environmental needs, including restoring fresh water flow to the Sea of Cortez. With less water available for agriculture, irrigation systems will need to be more efficient and management of soil salinity will become more difficult. Artificial groundwater recharge is expanding , but with little knowledge of the effects on water availability and groundwater quality.

Management of the Sacramento-San Joaquin Rivers is a critical issue in the central valley of California. Water supplies available for agriculture are declining. Drainage restrictions on the west side of the San Joaquin Valley threaten sustainability of agriculture there. These cutbacks and restrictions result from the need to improve the ecosystem in these rivers and in the Delta. To date, groundwater issues have been largely ignored, but they will play an increasing role in future water management.

Management of the Columbia and Snake Rivers has been a balancing act among in-stream flows for salmon and other fish, diversions for irrigation and urban use, and hydroelectric power generation. The aquatic conditions of the Snake and Columbia are degraded in terms of elevated water temperature, excess nutrients, and altered stream flow and timing. Groundwater withdrawals and declining watertables are also reducing stream flows. In some areas, groundwater quality is also degraded.

Justification: Scientific information is lacking on the impact of various agricultural management practices on surface water quality, groundwater quality, air quality, soil quality, and available water supplies. Obtaining reliable scientific information is essential for making choices in managing western rivers considering the wide array of issues involved. These issues are often site-specific, and their impact varies widely even within the same river basin. We propose to study these issues within the three major river basins in a more holistic way. By taking this broad perspective, basic relationships identified across the wide variety of situations can be organized and applied beyond the study area. The problems have been broken down into a number of technical issues that can be addressed across these three river basins, listed below.

Decreasing water supplies and water transfers: Erratic natural precipitation and unresolved Native American and environmental water demands have made water supplies less reliable, which is likely to place more emphasis on agricultural water conservation and water transfers. We currently do not have sufficiently accurate data on water consumption and knowledge of the net impact of various proposed practices that could potentially reduce agricultural water diversions and free up water for transfers and environmental uses. Land retirement, both temporary and permanent, has been proposed to provide water for transfer. However, such retirement must be carefully managed to avoid wind blown dust and/or soil salinization. PM-10 emissions are a considerable problem in the central valleys of California and Arizona and are likely to be an issue with any practices that reduce flow to the Salton Sea. Other methods for reducing agricultural water consumption may or may not be feasible. These all point to the need for better water budgets to document potential water available for transfer. Irrigation performance improvement, in many cases, would provide opportunities for real water savings.

Conjunctive use of surface and groundwater/groundwater recharge: In most states, laws governing groundwater differ from laws governing surface water. However, management of groundwater supplies has become a major issue in most western states. Conjunctive management of both surface and groundwater supplies is essential for long-term sustainability of water supplies. This will require a better understanding of the links between surface and groundwater. Also, groundwater recharge is being promoted to store surplus surface water for later reuse. The effectiveness of getting water into the ground and recovered needs further study.

Water reuse: Water not consumed by agricultural and urban activities is potentially available for reuse. However, this water is typically degraded in quality such that reuse may not be straightforward. Reuse of saline drainage water poses many challenges. The complication in sequential use of increasingly saline waters can be daunting. Volumes of municipal and agricultural processing wastewaters are increasing and their reuse is an important source of water. However, methods for effectively dealing with inorganic ions, chemical compounds, and pathogens are needed to protect public health and avoid contamination of groundwater supplies.

Salinity management: Saline soils and agricultural areas with saline groundwater and high watertables are a significant challenge for irrigated agriculture. Even urban areas are experiencing increases in surface and groundwater salinity. The regions affected by salinity issues are expected to expand over the next decades. Better local and regional management strategies are needed to avert salinization of susceptible regions. Regional assessment of salinity impacts are needed as well as quantification of off-site impacts.

On-field practices to protect and improve river quality (TMDLs): Runoff and deep percolation from agricultural fields often contain sediments, nitrogen, phosphorus, salts, pesticides and trace elements, and may be at a higher temperature. When return flows enter streams and rivers, they usually adversely impact their quality and biological functioning. Considerable effort has gone into developing on-farm management practices for reducing this impact under rainfed agriculture in the Midwest. A similar effort is needed for arid irrigated agriculture in the west – development of on-farm management practices for improving irrigation return flow water quality.

Protecting water resources within the context of a viable agricultural and rural community: Agricultural and rural communities are an important part of the arid west and supply a critical component of our nation's food supply. However, they are more vulnerable to water resources limitations than other regions, both in terms of quantity and quality. Any solutions must consider the impact on these communities and our food supply.

Proposed Research Activities:

ARS is uniquely poised to provide answers to important issues that currently limit the effective management of agricultural water use within these river basins. The proposed research augments ongoing research at the U.S. Water Conservation Lab., Phoenix, AZ; the San Joaquin Valley Agricultural Sciences Center, Parlier, CA; the George E. Brown Salinity Lab., Riverside, CA; and the Northwest Irrigation & Soils Research Lab., Kimberly, ID. Application of these results will help to mitigate the effect of agriculture on the water quantity and quality of these rivers. The suggested new/expanded research areas are:

- Assessing and Managing Water Supplies: Research is needed to improve our understanding of the overall hydrology and water balance within the basins. This present lack of understanding limits our ability to rationally manage and allocate water supplies. Critical information includes basin-wide estimates of water use by both agricultural and native plants, and understanding the interactions between groundwater and surface waters and their sustainable conjunctive use. Remote sensing of evapotranspiration is an evolving and under- utilized technology that offers substantial potential to improve our ability to manage water use within watersheds. Groundwater recharge may provide an effective means to store additional supplies.

- Improving effectiveness of agricultural water use: Research on irrigation improvements are needed in two areas; the field irrigation systems and the water distribution systems. Field irrigation performance can be substantially improved with modern technology, even in the presence of high water tables and/or high salinity conditions. The research focus will be on surface irrigation where more improvement is possible and where soil variability has more impact. Research on distribution systems will focus on improved operations and canal automation, with the focus of improving service, and thus on-farm efficiency, and reducing losses.

- Managing Water of Impaired Quality: Research studies are needed to determine effective ways to manage saline water supplies and to identify which areas with potential salinity problems are sustainable and which are not. Sustainability includes economic viability. Research is also needed to develop effective management strategies for the reuse of municipal and agricultural-processing wastewater to prevent the movement of various chemicals and pathogens through the soil to groundwater. Irrigation of turf grass can be an effective method for utilizing municipal sewage effluent. The goals are improved utilization of the water resource and improved river water quality.

- Protecting Water Quality: Research is needed to understand how nutrients and trace elements are transported over and through irrigated soils. This is important for developing on-farm management strategies that limit this movement. Development of off-site treatment practices (for example buffer strips) and reduction of off-site impacts also require additional research.

- Reducing negative environmental effects of land retirement: Land retirement can have a negative impact on soil, air and water quality. Research is needed to understand how to manage retired, previously irrigated lands in order to avoid environmental degradation problems such as soil salinization, wind erosion, and increased particulate emissions and damage to neighboring cropped lands.