Water and Land Management in Irrigated Ecosystems

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Executive Summary:
Farmers on the west side of California's San Joaquin Valley face extremely serious environmental and economic problems. Highly saline, shallow water tables containing naturally occurring ions such as selenium and boron threaten agricultural productivity and have the potential for significant environmental damage.

Significant research has been done on these problems, both in the economic and hydrologic disciplines. However, few studies have attempted to combine sophisticated economic and hydrologic models. Furthermore, the spatially heterogeneous nature of the problem (nonuniformities in salinity, water table depths, and drainage) has not been adequately represented in previous integrated modeling efforts.

Acknowledging the need for a more realistic, spatially distributed description of the economic and hydrologic sub-systems, as well as their linkages, a research project was initiated to quantify the local and regional economic and environmental impacts of policy decisions in a sub-area of the western San Joaquin Valley. The USDA Fund for Rural America Program(FFRA) and the USBR (Fresno Office) funded the first three years of research but at a reduced level to the original proposal.

A layered, integrated model has been constructed for the Firebaugh zip code area, consisting of a coupled hydrologic model linked to an agricultural production model. Given initial conditions on surface water allocation, and soil, surface water, and groundwater salinity, the agricultural production model simulates agricultural production on an annual basis and produces spatially distributed information on: annual cropping patterns and irrigation efficiencies, monthly water applications, and groundwater pumping, as well as information on crop yields. The output from the agricultural production model is subsequently used by the coupled hydrologic model to simulate the impacts of these management decisions on the natural system. The agricultural production model in turn is updated annually by the coupled hydrologic model to account for changes in soil salinity. Outputs include district-level farm profits, crop yields, and spatially and temporally distributed values of soil salinity, groundwater salinity, water table depths, and drain volumes and loads.

Given the large amount of work that has already been done under the FFRA and USBR grants in building the integrated modeling system, the additional work proposed here will vastly enhance the project results. Specifically, our main objectives for the fourth and final year of the project are: (1) to improve and calibrate and extend the agricultural production and coupled hydrologic models to the entire study region, (2) to create a regional economic impact model, and (3) to use the combined modeling system to quantify local and regional economic and environmental impacts of policy decisions. Relevant policy scenarios have been developed in concert with the Advisory Committee*, and include a permanent reduction in surface water supply, restrictions on drain loads into the San Joaquin River, and a land retirement program.

*Organizations Represented on the Advisory Committee:

- California Department of Water Resources
- US Bureau of Reclamation
- US Fish and Wildlife Service
- US Geological Survey
- San Joaquin Valley Drainage Implementation Program

- Natural Resources Conservation Service
- CALFED Bay-Delta Program
- Community Alliance with Family Farmers
- San Luis and Delta-Mendota Water Authority