Integrated Drain Water Management in the Central Valley

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Executive Summary:
Relevance. Traditionally, the installation of drainage systems that discharge effluent to streams solved many of the problems associated with high water tables arising from deep percolation flows. Environmental damages linked to this effluent have led to restrictions on off-region discharges. Solutions to the drainage problem, consequently, have shifted to alternate management strategies, including source control, drainage water reuse on salt-tolerant crops, drainage reclamation, and in-region disposal options. Given the array of on-farm management decisions confronting flowers and recognition of the physical links between these decisions and their potential environmental impacts, developing a management strategy that is both economically attractive and environmentally sustainable poses a significant task to any grower or policymaker in the region.

Objectives. This research will evaluate alternative management strategies confronting flowers in the Central Valley with recognition of the current regional environmental restrictions associated with drainage water. Theoretical and empirical analyses of alternative land, crop, water type (surface and ground), irrigation system, and drainage disposal choices will be performed. Management strategies will be subject to constraints on land availability, off-region drainage water discharge, and available surface water supply. A hydrologic balance constraint will be imposed, while the impacts of maintaining salt balance will be analyzed. Additional analyses involve evaluating the impacts on net benefits, water use, and land use allocation from changes in the relative prices and/or availabilities of surface water to groundwater. Finally, we investigate the magnitude by which environmental regulations concerned with providing alternative habitat for wildlife in the presence of saline and potentially toxic drainage water impact regional net benefits.

Procedures. Using a nonlinear mathematical programming model, this research will focus on estimating the regional net benefits from agricultural production under a variety of policy scenarios. The nonlinear mathematical programming model employs unique response functions that describe both the yield and deep percolation associated with the volume of salinity of applied-water for six different irrigation systems and five different crop types. The crops include cotton, processing tomatoes, wheat, lettuce, alfalfa, and bermuda grass. The irrigation systems include Furrow 0.5 mile, Furrow 0.25 mile, Linear move sprinklers, Low-energy precise application system, and Subsurface drip (CUC=90). By varying input parameters and/or constraints, this mathematical programming model will be used to analyze the efficiency of both on-farm and regional management strategies. Assumptions regarding inputs, constraints, and/or the applied physical relationships can be investigated via sensitivity analyses. Various policy scenarios (both quantity and price-based instruments) for reducing drainage volumes will be evaluated.