

**Lee, D. J. 1989. Salinity in the Colorado River Basin: A dynamic modelling approach to policy analysis. Ph.D. dissertation. University of California. Davis, California. 110 pp.**

Salinity externalities have gained renewed dominance in national water quality policy. This research advances the methodology for evaluating the economics of downstream externalities. Original modelling contributions are three-fold. First, this study applies newly developed Production Equilibrium Modelling to calibrate regional Cobb-Douglas production parameters in land, capital, and water. Second, this research augments the calibrated economic parameters with agronomically derived crop yield response information to obtain models of irrigated production in which both the total product and marginal product of water are functions of irrigation water salinity. Third, for the first time in an empirical economic study on the Colorado River Basin, salt transport is modelled with a stochastic hydraulic equation of motion that links upstream water use and salt load with downstream water salinity.

With these equations, three very useful though fundamentally different models are specified. The first model captures actual economic incentives faced by regional producers and is used to simulate policy. The simulation model predicts regional input substitution and resource allocation under changing physical and economic conditions. The second, an optimization model, internalizes the cost of salinity, reallocates salt and water, and solves simultaneously for the level of production and water quality that maximizes net returns to the entire river basin. The third model uses stochastic methods to determine the influence of both river flow variability and water quality criteria on water salinity and returns to the river basin.

Empirical results indicate that federal water subsidies degrade river water quality and commodity price support programs improve water quality. The optimization model prescribes reduced Upper Basin salt loading and water use to improve the quality of water in the Lower Basin. The stochastic programming model predicts that salinity levels at Imperial Dam will exceed federal water quality standards during drought years. The additional control required to meet water quality standards during drought years, will benefit water users during mean and high flow years as well.