

Booker, J. F. 1990. Economic allocation of Colorado River water: Integrating quantity, quality, and instream use values. Ph.D. dissertation. Colorado State University. Fort Collins, Colorado. 213 pp.

Colorado River water is the dominant water supply for much of the southwestern United States, satisfying agricultural, municipal, and industrial needs. Basin water is now fully utilized, and new demands, particularly in Arizona and rapidly growing southern California, will cause increasing pressure to reallocate basin water. Water transfers would require foregoing some existing uses and would be possible only with significant institutional changes in the set of compacts, state laws, and court decisions which together control allocation of Colorado River water.

Instream flows are used at many basin locations for hydropower production. Water quality improvements which reduce salinity concentrations increase crop yields and lifetimes of household appliances. These nonconsumptive uses of Colorado River water physically interact with consumptive uses and are of similar economic significance.

The objective of this work is to evaluate policies for increasing beneficial use of basin water resources. This is achieved by estimating consumptive and nonconsumptive use benefits using a nonlinear economic optimization model. Up to fourteen water demand sectors are linked with river flows to find allocations maximizing net economic surplus under alternative institutions. The work extends previous efforts on Colorado River allocation by including all major use sectors in an integrated economic-hydrologic optimization model. For the first time, alternative water allocation institutions and economic values are formally considered in a full Colorado River basin model.

Solutions are found under priorities governing present allocation, and under increased intra- and interstate trade between existing consumptive and nonconsumptive users. Model solutions are presented using estimates of present and future economic demands under two levels of basin water flow. The first flow level is equivalent to estimates of the long-term mean, while the second simulates serious drought, or a climate change induced reduction in mean flows.

Present consumptive uses are almost satisfied in full with the first flow level. Significant shortfalls occur under other conditions, and within-state water transfers are found to be particularly effective for increasing net consumptive use benefits. It is concluded that continued emphasis on facilitating within-state transfers will have the greatest impact in achieving economic efficiency in basin water use.