The case for regional groundwater management

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A dual allocation problem is encountered in determining the best use of any groundwater basin: its best use over time (intertemporal allocation) and the best distribution of the resource among users (spatial allocation). If only one claimant were making decisions within one year, the allocation problem would disappear. A single farmer whose farm overlies a basin and who considers only this year's use of the water would pump the amount producing his greatest net return. Thus, he would earn the greatest possible "rent" for the water, extracting it as long as the value in use of an incremental unit of water exceeds the costs of pumping it.

The first complication—an intertemporal allocation problem—is that use of the water this year means foregoing rents that the water could earn if pumped in future years. The expected future rents earned by the water, however, must be discounted before a valid comparison can be made with the water's current earning power.

The decision either to use or save the water is further complicated by changing yields, prices, and costs over time and by increased future pumping costs (which also must be discounted) as pumping lowers the water table.

Adding to the dilemma for just the one farmer are other water claimants—other landowners whose properties overlie the basin. Now one farmer's pumping means that less water is available to others as well as himself, it is at lower depths, and it may be of lower quality. Thus, one farmer's pumping increases costs for each of the others, and the more he pumps in the present, the higher the future costs to himself and the others.

Since an individual pumper does not have exclusive rights to future use of the water, he tends to disregard future values in decision making, considering only the value he gets from using the water in relation to his personal pumping costs. Each pumper can be expected to act similarly. As a result, the pool is exploited at a faster rate than is most beneficial for the basin as a whole; the economic rents that the water might have yielded are dissipated, and the entire basin is drawn down to a no-profit situation. Further, the individual pumper, in attempting to capture the groundwater before the stock is depleted by other pumpers, is likely to overinvest in size of wells, pumps, and other equipment.

The better-than-average farmer may still be able to extract some rent from the water after the others have reached the no-profit state, but even this farmer would be far better off had the basin been managed for the mutual benefit of all users. To correct this "common pool" problem some regional management entity, operating in the best interests of the joint pumpers, is needed to stop overdrafting the basin at exactly the socially optimal point where the overall rent to all users is at a maximum.

First, many groundwater aquifers are actually underutilized. Obviously, a basin such as Kings, which has perhaps 62 years before reaching the optimal steady-state level, does not yet need controls. Water policy must permit enough flexibility to impose controls only where needed.

Second, rents earned by water use over time have been increasing. Cost-reducing technological advance, for example, and expansion of foreign trade in agricultural products have increased the value of water in use, thus perhaps shielding farmers from the isolated effects of overutilizing groundwater aquifers. Long-term rents could be still higher, however, if the optimal steady-state level for the region were achieved.

Economic Benefits of Regional Regulation

	Tule	Kaweah	Kings	Madera
Years to regional optimum	11.5	17.7	62	36
Years to no-profit state	53	67	154	93
Benefit per acre at time of optimal steady state, 1979 dollars	152.85	194.04	453.52	286.33

We made some rough calculations for four adjacent San Joaquin Valley basins: Tule, Kaweah, Kings, and Madera. "Steady state," when net withdrawals equal the average annual recharge, can be established at various levels, but only one level is best for a particular basin. Using a discount rate of 8 percent and an electricity price of 6 cents per kilowatt-hour, we computed for each basin the number of years until the optimum level steady state would be reached at current rates of overdrafting. We also computed the years to reach the no-profit state and the per-acre benefit of stopping at the regional optimum rather than continuing to overdraft to the no-profit state (see table).

With such impressive benefits to be achieved by stabilizing at the best level for the region, why have California farmers resisted regional control?

Third, farmers fear that regulations will bring a shift of control from farmer to non-farmer interests. As the number of farms has declined, the number of municipal, industrial, and recreational users competing for scarce water has increased greatly. Farmers feel that extracting ever-diminishing water rents is still preferable to losing the water entirely to nonagricultural uses.

Fourth, controls that diminish pumping mean giving up, for the sake of the future, dollar values that could be enjoyed this year. Still, reducing pumping to the regionally optimum level has to be the best for all over the long term. Some of the immediate negative impacts of pumping reductions could probably be mitigated by water-saving technology and improved irrigation efficiency.

Finally, some farmers believe that newly developed replacement water will arrive in