

# 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. Fur-

ther, 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

time to avert the no-profit, depleted state. Given the political environment today, however, it is by no means clear that significant new water development will bail out users of depleted groundwater basins.

In sum, farmers' resistance to controls over groundwater extraction is understandable. State-level management would be particularly onerous, since many basins may not need regulation for years. For some basins intervention is needed. The boundaries of the control agency should correspond as closely as possible to the boundaries of the aquifer. Personnel imposing the controls should be elected by representatives of the basin's water users, if controls are to be approved and if confidence in their administration is to be high.

Luckily, most California groundwater basins will eventually arrive at optimal steady state at a level high enough to sustain a prosperous overlying agriculture. By contrast, the Ogallala, a California-size aquifer stretching from Texas to South Dakota, is threatening to run dry. Regulatory agencies are attempting to curb each farmer's urge to pump what remains. A Kansas farmer was quoted recently by the *Wall Street Journal* (August 6, 1980): "It's a shame we didn't have water management back in the year 1950. We could have put controls on and instead of lasting 40 years, the Ogallala would have lasted 80."

Water can be managed wisely in California so that users of basins in critical overdraft conditions can realize the most from the

resource. Local cooperation to maximize long-term benefits from a basin, including the associated land values, is essential. Other basins far from the critical stage now should, nevertheless, be monitored periodically. The key to California's water management is enough flexibility so that each basin can be assessed independently. Water analysts can contribute to the decision-making process, which should probably remain basically a local matter.

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San Joaquin Valley hydrological study areas.

## Is overdrafting groundwater always bad?

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**L**ike money in the bank, groundwater can be spent now or saved for the future. Unlike a normal bank account, however, overdrafting a groundwater source does not result in a negative balance requiring instant attention, but only indicates that withdrawals exceed deposits and the balance is declining. In nearly all basins, overdrafting initially contributes more to the community overlying the basin than it costs. As the level of the aquifer drops, however, overdrafting costs increase. Thus, a depth will inevitably be reached at which costs will exceed benefits. Clearly, overdrafting should not exceed this depth.

Continuing our banking analogy, the groundwater stock can be compared with capital that can be either invested in business (growing crops) or saved to draw interest. "Interest" accrued by the decision not to