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Watershed Conservation or Efficient Groundwater Pricing? Optimal Policy Sequencing in Pearl Harbor

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Watershed degradation can lead to reduced recharge of groundwater aquifers. Conserving the watershed can help to preserve the groundwater supplies by avoiding this loss of recharge. This is an especially valuable benefit in places such as Oahu, HI, where water sources are geographically constrained. The benefit of groundwater supplies depends, however, on how they are used. One example of wasteful management is the current policy on Oahu of pricing water at extraction (plus distribution) costs. Since the user cost, or the cost of driving down the aquifer is ignored, the water is under-priced and overused. Correcting this overuse or adopting efficient pricing can avoid the untimely depletion of groundwater supplies and yield large welfare gains. Thus, watershed conservation and efficient pricing can each help to augment the groundwater aquifer. However, since efficient prices are generally higher than the current, inefficient prices, watershed conservation may be considered as an alternative to efficiency pricing.

We examine the welfare effects of adopting watershed conservation alone, efficient pricing alone, and both of them in either order, using the Pearl Harbor water district on Oahu as an example. We set up, calibrate, and numerically solve a model of growing water demand and hydrologically-determined groundwater supply. The groundwater aquifer is recharged from a watershed. In the absence of watershed conservation, there is a risk of recharge loss. We obtain efficient price paths over time and compute the welfare with and without efficient prices and watershed conservation. We find that watershed conservation without efficient pricing results in a negative present value. However, if efficiency prices are in place, the present value of conservation benefits substantially exceeds costs. Efficient pricing alone yields very large welfare improvement (over \$3 billion) and slightly more in combination with watershed conservation.