USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002HI2B

Title: A win-win approach to water pricing and watershed conservation

Project Type: Research

Focus Categories: Economics, Conservation, Water Supply

Keywords: economics; allocation; pricing; conservation

Start Date: 03/01/2003

End Date: 02/28/2004

Federal Funds: $24045.00

Matching Funds: $48154.00

Congressional District: Hawaii 1st

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Abstract: Several studies have documented that inter-temporal water allocation in Hawaii is inefficient. However, the consequences of misallocation, including the economic value lost, are unknown. Moreover, other sources of mismanagement, including spatial misallocation and under-maintenance of watersheds, need to be considered in an integrated framework in order to assess the nature and size of the problem and the potential gains from policy reforms. Our overall objective is to combine existing hydrological, engineering, and economic knowledge in order to estimate efficient water use in Oahu's central corridor (from East Honolulu to Waialua). Rather than take aquifer recharge rates as exogenous to water management, we will incorporate watershed management as one of the policy instruments. In the first phase of this project, we are estimating optimal groundwater usage with and without recharge-augmenting watershed conservation plans prepared by the State Department of Land and Natural Resources. In the second phase, we will estimate optimal levels of watershed conservation in an integrated framework with spatial and inter-temporal allocation for the four aquifer zones in the Central Oahu corridor. The modeling framework constructed in the first phase estimates optimal groundwater extraction quantities while avoiding over-extraction that would lead to salinity in existing wells, and using desalted water as supplemental source as warranted by demand. Actual costs of well operation and water distribution to different locations and elevations are used to find efficient spatial and inter-temporal

allocation of water for the Southeast portion of the Central Oahu corridor (Honolulu and East Oahu). In the second phase, we will extend this model to include the rest of the central corridor: Wailua, Schofield, and Pearl Harbor sections. In addition, we will endogenize conservation expenditures and simultaneously solve for optimal water use and watershed conservation. We then estimate efficient water prices as full marginal costs of providing water to different locations/elevations including the user cost of aquifer depletion and the cost of the groundwater recharge incurred in maintaining the watershed. It is possible that the efficiency prices, even including conservation costs, will turn out to be lower than efficiency prices without the conservation investment. In this sense, conservation funded by water surcharges could result in efficiency prices less than the no-conservation scenario. This would be a win-win for water consumers as well as for environmental stewardship. Other extensions include allowing inter-aquifer transfers to respond to changing relative pressure gradients between aquifers. These may be supplemented by engineered transfers as indicated. When the shadow prices of water in two zones are different by more than the cost of inter-zone water transport, water trade will increase efficiency. We solve for optimal levels of inter zone trade over time by numerically simulating the model and iteratively selecting trade quantities until the present value of the four systems is maximized.
