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The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 10 member countries: Cambodia, China, Indonesia, Lao PDR, Malaysia, Papua New Guinea, the Philippines, Sri Lanka, Thailand, and Vietnam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to policymakers.

EEPSEA Policy Briefs summarize the key results and lessons generated by EEPSEA-supported research projects, as presented in detail in *EEPSEA Research Reports*.

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Pulling the Plug on Water Mining: A Groundwater Conservation Strategy from the Philippines

EEPSEA POLICY BRIEF • No. 2003 - PB8

The excessive extraction of groundwater for industrial, agricultural and domestic use is a major issue worldwide. In many parts of the globe, it is affecting water supplies and causing land subsidence and saltwater intrusion. In the Philippines - where El Nino has recently increased climatic uncertainties - it is a particularly pressing challenge, since groundwater plays an important role in ensuring a year-round supply of water. →

A summary of EEPSEA Research Report 2003-RR8, Metering and a Water Permits Scheme for Groundwater Use in Cagayan de Oro by Rosalina Palanca-Tan and Germelino M. Bautista (Institute of Philippine Culture, Ateneo de Manila University, Loyola Heights, Quezon City 1108, Philippines; contact: rtan@ateneo.edu)

Groundwater is scarce

→ A new study from Cagayan de Oro has found strong evidence that the area's aquifers are being depleted. The research investigated the feasibility of metering and charging for groundwater extraction. This shaped its recommendations for a permit system to limit the amount of groundwater used. It found that such a system could be an effective way to conserve groundwater and could also generate money for conserving water catchment areas.

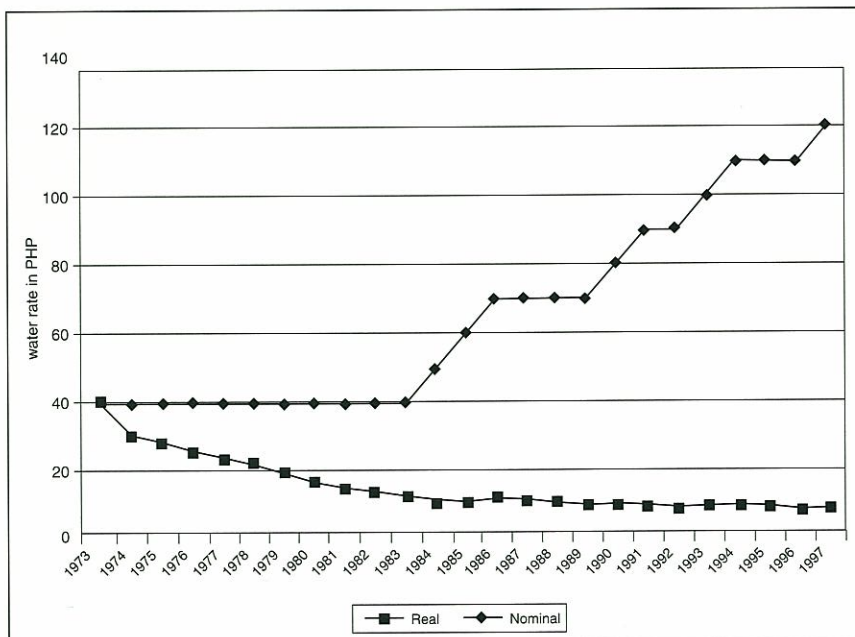
Draining the aquifers

The research was carried out by Rosalina Palanca-Tan, with Germelino Bautista, from the

Institute of Philippine Culture, Ateneo de Manila University, Quezon City. The team studied the area around the city of Cagayan de Oro (CDO) on the coast of Macalajar Bay. Within the city's political boundaries are three major watersheds that supply five major rivers and creeks that drain into the bay. Despite the many bodies of water within and around CDO, the city has no surface source of potable water, since the area's rivers and streams are all used for other purposes, such as irrigation.

The research team found that the static water level in representative wells around the region has been dropping at an accelerating rate

since the late 1980s. Analysis of pumping water levels also revealed statistically significant declines. The researchers attributed these problems to the high population growth and rapid industrialisation in the region. This has led to ever-higher rates of groundwater abstraction. Indeed the most recent survey of water replacement in the main CDO aquifer put the daily water replacement rate at only 94,000 m³ per day. Using figures from the Cagayan de Oro Water District utility (COWD) - and from their own survey of businesses - the researchers put the current daily water abstraction rate at 114,000 m³ - well over a sustainable level.



COWD Minimum Water Rates for Commercial/Industrial Users, in Nominal and Real Terms, 1973-1997

Misleading prices

Drs. Tan and Bautista then looked at the factors that have led to this problem and came to the conclusion that water conservation has been given no economic encouragement. Over a twenty-five year period when annual inflation rates were around 10% - with occasional bouts of hyper-inflation - the COWD's minimum water rates have only tripled. In real terms, the water rate for users had actually dropped, creating the illusion that groundwater is not scarce.

e but prices remain low

Willingness to Pay (WTP) for Raw Water

Amount (per m ³ of water)	Industry	Com'l	Govt	Institution	Subd	Private	Total (% Share)	
Below PHP 1.00	1	2	2	0	1	0	6	7
PHP 1.00	2	8	3	5	0	0	18	20
PHP 1.01 – PHP 5.00	0	4	2	2	2	3	13	14
PHP 5.01 – PHP 10.00	1	5	0	2	2	0	10	11
PHP 10.01 and above	0	1	0	0	0	0	1	1
Not willing	1	6	0	1	0	1	9	10
No answer							34	37
Total							91	100

Private wells

The researchers also investigated the level of private water abstraction in CDO. They discovered that of the nearly 8,500 registered businesses in the area, fewer than 3,000 have water connections with the COWD. Many of these establishments have their own wells, most of them dug without permission from the National Water Resources Board. The researchers found that most of these businesses have, up until now, not wanted to connect to COWD for cost reasons. (Rates for industrial and institutional users are double those for residential users.) Thus it is often cheaper for industrial and commercial establishments, especially the larger ones, to pump water from their own wells. This is particularly significant given the fact that private wells (which are mainly operated by

businesses) account for one-third of CDO's groundwater withdrawal.

Paying for water supply

The team then looked at whether businesses would be willing to have their water supply metered and contribute to the conservation of the water catchment areas. Of the 91 businesses that responded to the questionnaire, more than half expressed some willingness to pay (WTP) for raw water. This was attributed to increasing problems with the quality and predictability of supplies from private wells. The amount these private well owners were willing to pay ranged from PHP 0.40 (USD 0.01) to PHP 10.00 (USD 0.19) for every m³ of water. On average, the 48 respondents indicated a WTP for raw water of PHP 3.31 (USD 0.06) per m³.

Pointing the way to permits

These findings point to the potential for a system of groundwater withdrawal permits as a way to conserve CDO's aquifers. The stock of groundwater could be preserved by limiting the number of permits, so that the maximum amount of water withdrawn would not exceed the CDO aquifer's recharge rate of 94 thousand m³/day.

Under this proposal, water permits would be allocated among groundwater abstractors through a yearly auction. This allocation would be done according to business's WTP. This would result in a permit price that would reflect the true scarcity value of CDO groundwater – the price the marginal user would be willing to pay. It would also remove the complex and politically and socially

disruptive task of calculating a system of water charges.

Putting a price on water

Drs. Tan and Bautista calculated that, if the amount of water for which permits are issued is set at 94 thousand m³/day (34.3 million m³ per year) and if users are willing to pay PHP 3.31 (USD 0.06) per m³ of water as revealed by the survey, then the total annual revenue from water permit sales would amount to PHP 113.6 million (USD 2.123 million). This revenue, they argued, could be used for implementing and monitoring the system and for protecting watersheds. Indeed, they calculated

that the cost of monitoring and metering would be minimal, leaving the greater portion of total revenue for watershed protection.

They also argued that making the permits tradable would offer further advantages. First, trading would allow flexibility in the transfer of water to more productive or higher value uses. Second, with the potential to sell water permits would come an incentive for permit holders to economize on water use in order to realize extra revenues. Prospective buyers of permits, on the other hand, would have a strong incentive to conserve water to keep costs to a minimum.

Strengthening the water police

The researchers' estimates show that the initial capital outlays for meters and recurring monitoring costs could be easily covered by proceeds from the auction of permits. However, they caution that a more crucial - and more challenging - aspect of the scheme would be to establish a strong institutional infrastructure for its implementation. Trading in permits can only work if the trades are strictly verified and monitored. Strengthening the National Water Resources Board's capacity to do this would be an important first step.

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