Well-grounded water management

PHOTO: BRAD COLLS

Smallholder farmers in the Philippines are beginning to benefit from modern amenities but, as with many developments, this new opportunity also brings a challenge: to ensure sustainable management of water resources

BY WARREN PAGE

Smallholders farming in the northern Philippine island of Luzon do not rely entirely on rainfall as their only source of water. Pumping of water from underground aquifers is an important source, particularly for use in growing non-rice crops, such as mung bean, onion, garlic and other vegetables, in the dry season. These crops present the opportunity to help smallholder farmers earn new sources of income to escape poverty.

However, rising demand for these high-value crops has resulted in increased levels of groundwater extraction during the dry season. Extracting too much water becomes unsustainable, depleting the aquifer and altering the balance of these naturally occurring underground water storages.

Ilocos Norte province, on the north-western tip of Luzon, is one area where dry-season cropping is beginning to be practised. The

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province experiences two distinct seasons: wet from May to October and dry from November to April. The wet-season rainfall ensures lowland agricultural production and also recharges lowland aquifers.

Before vegetable cropping, rainfall had been sufficient to ensure that irrigation from pumped groundwater was needed only at the beginning of the dry season, to finish rice crops.

The main barrier to increased vegetable production has been the cost of pumping groundwater, as the diesel-fuelled pumps are expensive to run. Electricity is a cheaper source of power but has not been available in Pasuquin and Burgos municipalities, Ilocos Norte.

A new wind-turbine power station near Burgos is making electricity more widely available and reducing pumping costs. As a consequence newer, deeper-drilling pumps are becoming cheaper, threatening to significantly increase rates of water extraction.

The dangers of over-exploitation of groundwater include wells running dry, reduced crop yields or total failure, rising salinity and saline intrusion and, potentially, land subsidence. Finely balanced aquifers can reach levels of over-extraction quickly and once an overdraft of water occurs, a return to sustainable management is difficult.

Avoiding over-exploitation through management has been a goal of the Philippines Government and local authorities. However, their expertise was in the sand-based coastal aquifers common in the country, whereas the aquifer in Ilocos Norte is limestone.

ACIAR funded a project, partnering Australia's CSIRO Land and Water with the Philippines Bureau of Soils and Water Management, to develop planning and management options before groundwater depletion became unsustainable.

Without planning and management, poverty reduction and food security, respectively, would be threatened. While poverty may increase in the short term, as income from vegetable production is lost, food security could be compromised if in the long term groundwater became unavailable to finish rice crops and if wells providing household water ran dry.

The project team found some good news for smallholders: the combination of limestone aquifers and available run-off in the wet season suggested that a management plan for water recharge could protect the aquifer and still potentially support production even if a water overdraft were to occur.

To achieve this, a topographic survey was undertaken at project sites in Pasuquin and Burgos. The location of wells was mapped and combined with soil and land-use surveys and geological investigations to draw a complete picture of water use and aquifer health.

Watertable maps and salinity maps were then prepared, and water chemistry analysis undertaken. The survey of wells revealed 546 across the two project sites, with 355 wells used for household water and the remaining 191 used for irrigation.

Water in the aquifers fluctuated by as much as 3.5 metres at Pasuquin and 2.5 m at Burgos. Of total rainfall, about 10% of falls recharged Pasuquin's aquifers and 13–17% recharged the aquifers at Burgos.

Once a total picture of water resources was drawn, three groundwater models were used to forecast differing levels of sustainability. Four future scenarios were developed for each project site that modelled specific combinations of increased groundwater extraction, reduced recharge due to anticipated climate change impacts, and recharge augmentation. From the three models, one was chosen for each of the two project sites as the basis for economic modelling to demonstrate examples of increased or more efficient groundwater extraction and the resulting potential economic opportunities.

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For example, in Pasuquin modelling of sustainable groundwater extraction demonstrates that about 90 hectares can be used for intensive garlic production in suitable areas in the dry season. This would involve relocating some production to more suitable soils, with a production increase of some 810 tonnes per year, representing an estimated 28.4 million Phillipine pesos in income.

The equivalent model for Burgos indicated that sustainable extraction was best in the mid-range of predictions relating to water usage, and could support some 60 hectares of intensive garlic production, yielding about 186 tonnes for a return of PHP11.1 million. Differences in production levels and returns are due to the soils in Burgos being only moderately suited to garlic production and evidence of increasing salinity during pumping.

Pumping of groundwater during the dry season must be done sustainably to ensure long-term use.

Limits to future groundwater extraction were projected. A crucial component of this management is educating farmers so that they recognise when overuse is occurring and have the ability to undertake immediate remediation practices. The project team focused on engaging farmers in planning and management, to ensure that the farmers themselves were able to become resource managers for the aquifers.

In June 2008, a farmer-managed groundwater system (FMGWS) in the project sites was implemented as a key component of the management strategy. This approach has been designed to increase farmers' awareness and understanding of groundwater and its occurrence, cropping pattern development and other technological concepts, leading to a more sustainable management of the groundwater resource.

An important element in management is reducing competition in groundwater extraction during the dry season. A coordinated pumping schedule could significantly reduce pressures on the aquifers.

Training modules suited to the needs of smallholder farmers, including elements unique to the Philippine setting and culture were prepared.

With these modules, several other sub-modules expressed in local dialect were developed. From January to June 2009 FWS classes were conducted at both project sites.

The result of this engagement with farmers has been a Covenant of Support to protect and manage the shallow groundwater resource. This covenant was presented to local policymakers who showed their willingness to provide a parallel effort to protect and manage the shallow groundwater resource by espousing related local policies. Furthermore, it was agreed that this should be referred to the National Water Resources Board, the agency that regulates the utilisation, protection and management of Philippine water resources. ■