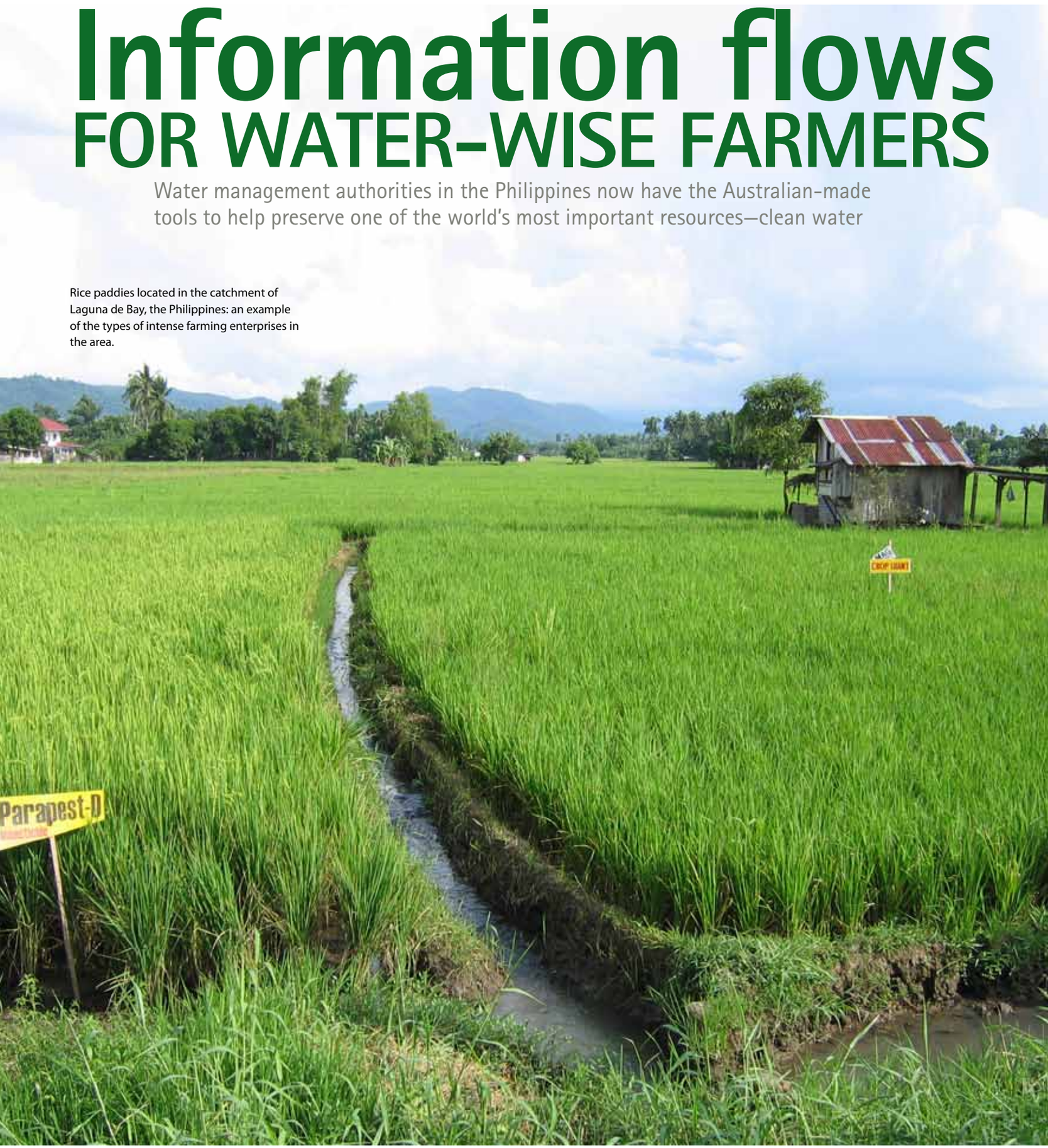
Information flows FOR WATER-WISE FARMERS

Water management authorities in the Philippines now have the Australian-made tools to help preserve one of the world's most important resources—clean water



Rice paddies located in the catchment of Laguna de Bay, the Philippines: an example of the types of intense farming enterprises in the area.

BY KELLIE PENFOLD

Fertilisers, herbicides and pesticides have, over the past 50 years, brought about unprecedented levels of food production, helping to feed a growing global population. But they have also created an unexpected danger by polluting the water people rely on for survival.

A need for both food security and clean drinking water has landed agricultural science with a new challenge wherever inputs such as fertilisers, herbicides and pesticides are used near the water sources of populated areas. As climate change brings water security to the forefront of global concerns, two affected nations have joined forces to tackle the agricultural contaminant challenge head on.

Dr Rai Kookana is the CSIRO Land and Water scientist charged with running an ACIAR-funded project that links fruit growers in South Australia's Mount Lofty Ranges with the stewards of the Philippines' most important fresh water source, Laguna de Bay. The aim is to turn the tide in agricultural contaminant management in a densely populated tropical ecosystem shared by farming and urban communities.

Coming to the end of its three years of funding in October 2009, the ACIAR project has seen CSIRO work with the University of the Philippines Los Baños (UPLB) and the Laguna Lake Development Authority (LLDA) to improve water quality in Australia and the Philippines by developing tools and techniques to measure pollutant loads from different sources and monitor water contamination.

Laguna de Bay is the second-largest freshwater lake in South-East Asia, and the Philippines' largest and most important freshwater resource, providing water for more than 13 million people. More than 28,000 fishing families rely on the lake for their income.

The project builds on earlier ACIAR-funded work from 2001 to 2005, in Australia and the Philippines, which worked on minimising the impact of pesticides from agricultural systems and uses measurement techniques refined in the Mount Lofty Ranges in earlier studies.

"The LLDA has a mandate to improve water quality in Laguna de Bay, but before we started this project they were in the dark about the agricultural pollution," Dr Kookana says. "Authorities had no option but to make guesses about the contributions of agricultural pollution to water quality impairment."

The latest research in the Philippines has centred on measuring the nutrient, pesticide and sediment loads being transported from the numerous sub-catchments to Laguna de Bay, and educating local authorities in measuring water quality and quantity, so lake-water quality modelling can be done with greater accuracy and confidence. This data will lead to greater predictability of farm waste runoff in accordance with weather patterns and farming programs. Dr Kookana says greater understanding of 'hotspots' will lead to appropriate future management and intervention measures on the ground.

DATA COLLECTION

The eastern bay's main water source is the Pagsanjan River, a part of the Pagsanjan–Lumban sub-catchment, which is home to diverse agricultural industries, including large rice and vegetable plantings, which are increasingly the source of agricultural chemicals that make this sub-catchment ideal for sample collection and measurement.

In the second year of the project auto samplers were installed on four sites—covering the four main land uses of rice, vegetable, coconut and pig production—in the Pagsanjan–Lumban sub-catchment. LLDA and UPLB staff were trained in the use and maintenance of the auto samplers and CSIRO hosted two researchers (one each from UPLB and LLDA) in its South Australian quarantine laboratory where they learnt about water analysis and sediment-transport modelling.

"When we first started the project some of the most basic information was missing," Dr Kookana says. "Rainfall records for the selected catchment were non-existent.

"But this was easily overcome when we realised schools could play an important role by installing rainfall gauges and keeping daily rainfall records. The schools' response was astounding and some of their record keeping would put trained scientists to shame." (See page 19.)

Joey Carino is the LLDA's community development division chief and has worked closely with the Australian researchers to engage the lake community in the project.

"This research is showing us the way forward. Before it started we knew there was lots of waste running into the water, but we had little understanding of agricultural waste," Mr Carino says, adding that the cooperative nature of the project has seen community members and authorities "mobilised" on tackling the issue.

"We now have a set of technically correct data that we can show to policy and decision-makers to help preserve a potable water source."

Manila is already experiencing problems with reliable drinking water, much of which,

Keeping the water clean

The largest body of water in the Philippines, Laguna de Bay, is also the nation's most important. It supplies drinking water to about 13 million people, of which 3.5 million live along the shoreline. Laguna de Bay supports much industry, including approximately 28,000 fishing families who depend on the lake for their livelihoods. The Laguna Lake Development Authority (LLDA) says more than 343,829 tonnes of fish are harvested from the open waters each year and another 85,000 tonnes of fish are grown out in aquaculture structures within the lake. The lake also supplies the water requirements of local industry and farming.

One of the greatest challenges is maintaining the health of the lake's water. Waste water and sewerage canals in 61 cities and towns within the region drain into 21 tributary rivers, which all drain into the lake. The polluted waters of Manila Bay also make their way into the lake daily, via the tidal flows from the Pasig River. The result is pollution that can kill fish species and native plants and pose a safety risk to humans. Another challenge is biological pollution—the number of non-native fish species, such as the janitor fish, is rising.

More information: Laguna Lake Development Authority, www.llda.gov.ph

PARTNER COUNTRY

The Philippines

PROJECT DESCRIPTION: SMCN/2004/069: Minimising agricultural pollution to enhance water quality in Laguna de Bay (the Philippines) and Mount Lofty Ranges (Australia)

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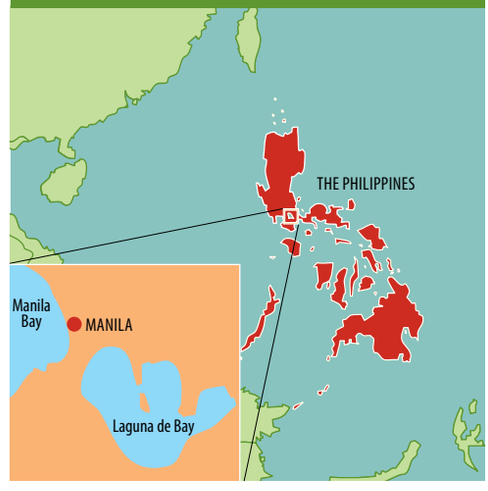


The Laguna de Bay delta.

Mr Carino says, is piped from a river in the Laguna de Bay catchment some distance away. Water sourced from underground is becoming increasingly saline, he says.

"There is an abundance of water in the Philippines, but we have an obligation to make sure it is kept clean to ensure quality water in the future."

With additional funding from the Crawford Fund and ACIAR, a one-week training course in measuring water quality and water quantity was developed by LLDA, CSIRO and UPLB, and last year it was delivered to more than 50 people, including academics, students, local government staff and community groups in the Philippines.

Study tours by Australian scientists early in the project identified the challenges to water quality in Laguna de Bay. Dr Kookana says it was not uncommon to see a large piggery located on a riverbank with discharge running directly into the water, or the high use of pesticides by rice growers coping with tropical environments.

"It is not as dramatic as it sounds," Dr Kookana says. "It would be easy to capture the piggery waste in a single outlet and redirect it to a treatment works, once infrastructure is established."

Farmers in the Philippines, like their counterparts in Australia, have significantly increased their dependence on pesticides in the past three decades. According to LLDA data, between 1977 and 1991 pesticide use in the Philippines rose from 3,738 tonnes annually to 10,773 tonnes, mainly for banana, rice and vegetable production. In the period from 1981 to 1997 pesticide sales in Australia increased from $166 million to $1.1 billion according to CSIRO Land and Water.

An important difference, however, is that in Australia most pesticides are used as herbicides (65%), whereas in the Philippines they are used as insecticides (46%), which are highly toxic to fish. However, in recent times fewer pesticides have been used in the Philippines due to greater awareness of their environmental impacts and greater adoption of alternative and more integrated pest-management measures.

With the measurement and monitoring tools now in place and data banks being established, Dr Kookana says the LLDA can more accurately predict the impact of agricultural activities on water quality and educate land users about the potential outcomes of their choices.

LLDA and UPLB staff are ideal research partners, Dr Kookana says, as they are used to working on international aid projects with strong links to non-government, grassroots organisations, such as the farmer-driven River Councils.

"It's also been a delight to work with the Filipinos—the workers are confident, there is no hesitation and they will ask questions and share their views. It was easy to find volunteers to train to ensure the samples were correctly taken and stored ready for analysis," he says.

RUNOFF IN THE MOUNT LOFTY RANGES

Back in Australia, four auto samplers and flow data loggers were installed in 2006 at three sites in the Mount Lofty Ranges' Lenswood Creek and Charleston sub-catchment.

The Mount Lofty Ranges are home to many intensive, but less varied, agricultural enterprises. An earlier CSIRO project, funded by ACIAR with the National Landcare Program and the

Volunteers in the Laguna de Bay water quality monitoring project standing over a waste water channel from a piggery, which flows directly into one of the bay's catchment rivers.

South Australian Centre for Natural Resource Management, measured and assessed the transport of contaminants from grape, apple and cherry farms into the Onkaparinga River and, subsequently, the Mount Bold reservoir.

The main outcomes from the Mount Lofty project were:

- a detailed dataset of concentrations and loads of pesticide, nutrients and sediment moving to runoff water from apple, cherry and grape production in the area over three years;
- an understanding of the behaviour of these agricultural chemicals moving to runoff water, which can be used to develop a set of recommendations for horticulture to minimise environmental impact from this fruit production;
- a set of reference charts, distributed to Mount Lofty Ranges growers, outlining the risks of pesticides being transported to runoff water as assessed by the CSIRO-developed Pesticide Impact Rating Index (PIRI) software. These charts allow growers to make informed decisions about their choice of pesticides and timing of application with regard to their impact on runoff water; and
- growers in Mount Lofty Ranges can use the management techniques in selecting spraying and nutrient programs for their farms.

The general manager of the Apple and Pear Growers Association of South Australia, Trevor Ranford, says much of the $60-million-a-year South Australian fruit tree industry is located in the Mount Lofty Ranges and Adelaide Hills—the catchment for Adelaide's drinking water.

"It is important we have knowledge gained on a scientific basis for making sound decisions on natural resource management in our industry," he says.

Mr Ranford says the industry is investigating ways of taking runoff management to the next stage by eliminating the risks posed to drinking water sources, particularly in large rainfall events. Those tools could involve working with the water flow in creating wetland areas to filter the water and developing on-farm strategies to avoid high concentrations of nutrients, pesticides and sediments leaving the farm.

"Our industry understands we need to coexist with the general population and if some of the knowledge we have gained helps the Philippines that's a great outcome. Who knows? We might learn something from them."

Between July 2006 and July 2007 researchers measured the nutrient loads from each of the Mount Lofty sites, recording total nitrogen, total phosphorus and total organic carbon. The grapes site generated the largest loads, followed by cherries, then apples.

Interviews were also carried out with 21 growers covering the four main land uses—apples, pears, cherries and grapes—to get a broader picture of pesticide use in these industries.

A separate assessment of the relative risk of off-site transport of pesticides was made for each of the 21 growers using the CSIRO-developed PIRI. A booklet outlining the findings was produced and supplied to each grower.

This risk information also formed the basis of a series of chemical reference charts, which have been produced and distributed to growers and stakeholders in the region to allow growers to compare the relative risk of off-site transport to surface water of different chemicals in a range of environments representative of those in the Mount Lofty Ranges.

Growers have also expressed interest in being trained in using PIRI, an idea CSIRO has now taken to the Apple and Pear Growers Association of South Australia, who could potentially fund such training. ■

(Top) installation of a rain gauge at a high school in the Laguna de Bay catchment.

(Above) ACIAR research project manager Dr Gamini Keerthisinghe (right) with volunteers from one of the River Councils within the Laguna de Bay catchment following training in how to use the water sampling machine.

Rain gauges have global appeal

Australians pride themselves on being able to start a conversation based on millimetres of moisture measured in the backyard.

This proclivity has spread to the Philippines, near one of the country's most important water sources, Laguna de Bay, as an offshoot of ACIAR-funded research to minimise agricultural pollution and enhance water quality.

When researchers first started working in the Pagsanjan–Lumban catchment—where much of the area's agricultural production takes place, and much of the water that flows into the Laguna de Bay is caught—accessing correct rainfall data proved one of the project limitations.

However, a simple solution was found. Rain gauges were installed in nine high schools across the catchment. At each school two students and a teacher were trained in rainfall measurement procedures.

Initially a project member travelled monthly to each school to collect the data, but owing to distances and times involved this was not sustainable. A novel solution was found: the data are now sent by text message to the Laguna Lake Development Authority in Calauan.

The figures are stored in a database available to all members of the research team when collating their data and assessing rainfall trends or using runoff models.

To enhance the schools' involvement a teacher's resource booklet was written that suggests how rainfall data could be incorporated into the school curriculum along with experiments about the water cycle and related issues.

Printed in the Philippines, the book is being distributed to 100 schools in the catchment.