



Australian Government  
Australian Centre for  
International Agricultural Research



Science lifts  
Pacific Island  
economies

# PARTNERS

IN RESEARCH FOR DEVELOPMENT

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## PEARLS IN THE PACIFIC

New developments in the culture of pearls offer rewards for Pacific Island economies

## FIGHTING PESTS AND DISEASES OF TARO

Protecting one of the Pacific's staple crops

## REBUILDING AQUACULTURE IN ACEH

ACIAR provides essential technical support to redevelop ponds and infrastructure

# Partnerships in the Pacific

**T**he agricultural economy, both for basic food security and cash incomes, affects the livelihoods of the vast majority of Pacific Islanders. It has the potential above all other economic sectors to broadly raise incomes and economic growth.

Many smallholders live in isolated rural communities dependent on household food production and intermittent crop, fish and small livestock sales. Improving and transforming these systems into consistent income-generating activities through raised productivity and better marketing will enhance self-reliance and reduce poverty. Exports of commodities such as sugar, fruits and vegetables, spices, forestry products and fish and other marine resources are valuable sources of income. But the Pacific Islands face major challenges in developing markets for these products.

Research supported by ACIAR in the Pacific is focusing on implications of World Trade Organization (WTO) accession, quarantine and biosecurity issues, product quality, scales of production and remoteness of export markets.

Fishing and marine resources are vital sources of income and nutrition for many Pacific Islanders. ACIAR has supported a number of fisheries projects over the years in collaboration with the Secretariat of the Pacific Community (SPC) and the WorldFish Center. On page 16, Janet Lawrence looks at some of this fisheries research.

A pearl aquaculture industry is being developed in Kiribati, following on from a successful harvest of cultured pearls (page 4). This precious resource, which grows naturally in many parts of the Pacific, could become a good source of income for other islands.

Crops provide the bulk of staple food in the Pacific Island countries; taro and yam are two of these important food staples. ACIAR is working with SPC on a number of projects to tackle pests and diseases of taro (pages 6 to 9). Another recently completed project has identified positive yield responses in yam crops to soil fertiliser (page 14).

ACIAR's projects in the Pacific will continue to emphasise technologies that are suited to smallholders or have application at a community level. Projects are focusing more on past research to encourage adoption, and the exploration of opportunities for closer links with industry and NGOs.

## Pacific Island countries

**4 PACIFIC PEARLS:** Cultured black pearls have the potential to be a significant source of income for Pacific Islands.



**6 FIGHTING TARO DISEASES & PESTS:** A multinational research effort to characterise taro viruses and develop reliable detection tests bears fruit, and a four-year project on taro beetle management in PNG and Fiji investigates biocontrol.

**10 THE MISSING LINK:** Ensuring that information about pre- and post-harvest management of fruit and vegetables reaches the people who need it.

**12 TESTING TASTY FISH:** Taste-testing of wild-caught and farmed reef fish shows aquaculture to be a viable way forward for a sustainable Asia-Pacific live reef fish trade.

**14 YAMS BACK ON THE MENU:** Can falling Pacific yam yields be elevated using soil fertility management techniques to correct imbalances?

**16 MAKING A SPLASH:** An update on more than a decade of joint research on capture and culture of reef fish and invertebrates in the Pacific by ACIAR and WorldFish.

**18 OFF TO A FLYING START:** Identifying alternative forms of poultry feed for farmers in the Solomon Islands.

## Other features

**20 RURAL POVERTY IN CHINA:** Assessing the impact of current policies and public investments on improving the livelihoods of the rural poor in China's western provinces.

# PARTNERS IN RESEARCH FOR DEVELOPMENT

Partners in Research for Development presents articles that summarise results from ACIAR-sponsored research projects, and puts ACIAR research initiatives into perspective.

Technical enquiries will be passed on to the appropriate researchers for reply. Reprinting of articles, either whole or in part, is welcomed provided that the source is acknowledged.

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# CONTENTS



PAUL SOUTHGATE

**22 FIRE IN EAST INDONESIA:** Similarities between northern Australia and Indonesia are driving the development of fire management strategies.

**24 ACEH'S AQUACULTURE:** Rebuilding the brackish water aquaculture industry in Aceh which, before the tsunami, involved more than 90,000 people.

Making a splash: Pacific fisheries.

**26 SUPPLY CHAIN OVERHAUL:** Improving efficiency and quality for small agricultural producers in the Philippines.

**27 FARMING FRUITS OF THE FOREST:** Domesticating native forest species can provide income for indigenous communities.

## Around ACIAR

**28 AROUND ACIAR:** Latest news about people, publications and projects.

Sunset over Tarawa Atoll lagoon in Kiribati, site of the ACIAR pearl project hatchery.



# Pearls

## IN THE PACIFIC

Pearl culture has the potential to be a significant source of income for the Pacific Islands.

Roger Beckmann reports on a project which has overcome some of the hurdles the islands face

**F**rom dark grey and purple through to coppery pink and silver, black-lip pearl oysters, which grow naturally in many parts of the tropical Pacific, produce beautiful and highly priced pearls. But growing them is no easy matter. Large numbers of the right kind of oysters are needed, along with knowledge, skill and – above all – patience.

However, pearls could provide many Pacific Islands with a good income. They are light and non-perishable, and can be easily transported from remote places to world centres where they can fetch high prices and bring back valued foreign exchange.

French Polynesia has long been involved in pearl culture and its multi-million dollar industry has shown the potential for the region. Other Pacific states could also benefit and this is the reason behind an ACIAR project on pearl oyster resource development concentrating on Kiribati and Fiji.

Pearls are made inside mature oysters that are at least two years old. A skilled technician must carefully insert a nucleus into the oyster tissue, which is then covered in nacre or mother-of-pearl by the oyster. The nucleus is inserted into the host oyster along with a small piece of tissue from another oyster. The donor tissue grows and forms a ‘pearl-sac’ around the nucleus and secretes nacre onto the nucleus within the recipient oyster.

A pearl of 10 millimetres in diameter usually consists of an 8mm bead (the nucleus) covered by about 1mm of nacre all around. To grow such a spherical pearl takes about two years.

Inserted nuclei can be used to form half-pearls, known as mabé. This process happens without any donor tissue. The nucleus is glued onto the flat surface of the inside of the oyster’s shell and the animal’s own tissue covers it, forming a hemispherical pearl. This process takes about six months.

Choosing appropriate donor tissue for round pearl production allows the experts to influence the properties of the final pearl. The donor tissue is chosen from oysters with attractive colours in the nacre lining their shells, which gives an indication as to the colour of the resulting pearl. Recipient oysters are generally larger and older than donor oysters.

The fully formed pearl is taken out of the oyster, leaving a sac into which a new, larger nucleus may be inserted so that the next pearl will be bigger. The pearl-growing cycle can be repeated three or four times as oysters live for 10 years or more.

Although black-lip pearl oysters (*Pinctada margaritifera*) occur naturally in much of the Pacific, Kiribati faces a problem. Its atolls are large and open and the rough sea washes them out, taking oyster larvae with it.

In much of French Polynesia, on the other hand, the atolls are more sheltered and the oyster larvae, which settle as minute oysters known as spat, remain within them.

One of the first jobs of the ACIAR project was to survey the atolls in Kiribati to determine the numbers of oysters present. The results were disheartening. There were few oysters in the atolls and the adult oysters that were present were highly sought after because part of their shell is traditionally used as a fishing lure.

The project leader, Professor Paul Southgate of James Cook University in Queensland, realised that collecting suitable adult oysters from the wild was clearly out of the question.

“We knew that if the industry was to develop in Kiribati it would need to rely on hatchery production of oysters. In other words, we’d need to grow the oysters from the larval stage,” he says.

This is not easy.

“First you have to collect your adult oyster to be used as brood-stock and induce them to part with their eggs and sperm. Following fertilisation, the larvae are nurtured for around three weeks before they become spat. The young oysters must be grown for another two years before they are large enough for pearl production. The Kiribati hatchery now regularly produces large numbers of new spat.”

At the time, little was known about the biology of this non-wild species of oyster. As Prof. Southgate put it: “We were ignorant about the requirements of the larvae. Kiribati would be pioneering a relatively new concept for black-lip oysters.”

“The hatchery is now performing well and is one of the most productive in the world,” he says. “They achieve a 50 per cent survival rate of their larvae, whereas 10 per cent is the norm in many places



**PARTNER COUNTRIES:** Kiribati, Tonga, Fiji  
**PROJECT:** Pearl oyster resource development in the Pacific Islands  
**DESCRIPTION:** Recent developments in eastern Polynesia showing the potential for cultured black pearl and cultured mother-of-pearl shell industries with major export earnings have aroused considerable interest in these Pacific nations  
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The local community in Savu Savu, Fiji, collects young pearl oysters (spat) and sells them to J. Hunter Pearls, a local commercial pearl operation (below left).

PAUL SOUTHGATE



JACQUI WRIGHT



PAUL SOUTHGATE

Kiribati Project Manager Beero Tioti (right) inspects the first harvest of cultured pearls produced in Kiribati with the President of Kiribati, His Excellency Anote Tong.

and 20 per cent is considered exceptional. It seems to be not only the excellent local staff and their dedicated work, but also something to do with the water there. It's a definite advantage for Kiribati."

Another advantage is that some of the oysters can produce an unusual and attractive salmon-pink to bronze nacre which is unknown elsewhere in the world, giving scope for niche marketing.

Kiribati now has plenty of young black-lip oysters and is moving on to the process of developing routine production of full-size spherical pearls. The country should soon be able to compete with other islands where large numbers of adult oysters occur naturally. However, growing spherical pearls requires very experienced and specialised pearl technicians to graft the nucleus and donor tissue. Currently, these specialists must be hired from overseas.

Although the hatchery is an added expense for Kiribati, it has brought some advantages. One is that it gives scientists the opportunity to carry out selective breeding. Experts can select oysters that grow quickly or that may produce a particularly desirable pearl colour.

The second advantage is that the hatchery allows scientists to produce triploid larvae. Usually every animal or plant contains two copies of each gene in its cells, known as diploid. However, it is pos-

sible in some species to create individuals with three copies, referred to as triploid. Triploids can be created in the hatchery and are faster growing and hardier than normal diploid oysters of the same type. As adults they are sterile, but can still be used for pearl production. They can also be sold to other farmers for 'one-off' use without losing the sole ownership of the special Kiribati colour.

Things are looking promising for the black-lip pearl industry. The increase in production may lower the global price a little, but there is still room for expansion. As the industry takes time to produce returns on investment, the mabé half-pearls come in handy. Produced from an adult oyster in just six months, they do not need the services of an experienced oyster technician. Although they sell for much less than spherical pearls, they can be readily stuck to a surface and so are widely used in jewellery.

In addition to the hatchery, the project has resulted in the establishment of a demonstration pearl farm used for showing the community what can be achieved and for training. Four smaller farms have been started elsewhere in Kiribati. With good-quality spherical pearls worth more than \$100 each – and some worth much more – it is easy to see that small Pacific Islands are likely to find pearl-growing an attractive and sustainable industry. ◀

# FIGHTING BACK AGAINST DISEASES AND PESTS OF TARO

Diagnostic software and virus-free germplasm are spearheading efforts to protect taro's value to the South Pacific, reports Gio Braidotti

**T**he impact of diseases and pests on taro production in the South Pacific has been mounting steadily in recent years, reaching devastating proportions in Samoa in 1993 when the fungus that causes taro leaf blight effectively wiped out the crop, causing export earnings to fall from 9.5 million to 158,000 Tala in just one year. This economic loss was coupled with an increase in export costs – staple foods had to be imported to replace taro. With many other Pacific countries similarly at risk, several ACIAR projects are providing the scientific resources to help build more effective disease and pest management programs.

Taro is cultivated for its potato-like root or corm, edible stem and spinach-like leaves, which provide the South Pacific with food security, cash and export income. Additionally, taro carries cultural value as a prestige crop with a role in gift-giving and ceremonial activities.

About 130 pests and diseases of taro have been documented, with impacts ranging from mild to lethal. These pests and diseases do not, however, occur in all countries in the region. Indeed, the majority of severe pathogens have restricted distributions, occurring in only a few locations. But it leaves many countries highly susceptible to the kind of outbreak that affected Samoa through a lack of resistance.

The Secretariat of the Pacific Community (SPC) Plant Protection Service in Suva, Fiji, has a large brief to deal with plant health and is working to combat factors that can ruin taro production. These include an increasing risk of exposure to lethal pathogens and susceptible plant varieties, plus inadequate diagnostic, screening and pest management procedures.

In 1993, a breeding program was established based on disease-resistant taro varieties in Papua New Guinea (PNG) but efforts to

exploit the country's rich genetic resources fell hostage to a disease 'Catch-22' situation. The PNG germplasm could not be moved to other countries for fear of also transmitting the two viruses thought to cause the lethal taro disease *alomae*. To help SPC break the deadlock, ACIAR provided support for Associate Professor Rob Harding, of the Queensland University of Technology, to lead a multinational research effort to characterise taro viruses and develop reliable detection tests.

"Increased knowledge of *alomae* would also benefit growers as the disease is now one of the main constraints on taro production in PNG and the Solomons," says Prof. Harding. "Elsewhere it seems that the two viruses do not occur together and when only one virus is present, disease symptoms are much milder."

Infected taro samples from 11 countries, including PNG, Solomon Islands, Fiji, New Caledonia and Vanuatu, provided the raw material for the team to clone and partially sequence the genomes of all known taro viruses. The sequence data was used to design diagnostic tests based on PCR (polymerase chain reaction), that were subsequently applied to about 450 tissue culture taro lines held in SPC's TaroGen collection. The cell lines were sent to Brisbane and grown in Australian Quarantine and Inspection Services greenhouses prior to virus testing.

Prof. Harding says that of these, 159 have been indexed for each of the taro viruses according to an internationally recommended schedule in order to facilitate safe international movement of taro germplasm.

Molecular techniques were also applied to the taro genome itself, allowing the cataloguing of the region's germplasm collections. This work was done by a collaborator at the University of Queensland,



JACQUI WRIGHT

Ian Godwin. The researchers mapped genetic diversity in the entire taro germplasm collections from Fiji, Samoa, Tonga, Niue, Palau and Cook Islands. Another 20 per cent of samples were tested from collections in PNG, Solomon Islands, Vanuatu and New Caledonia.

“From the overall collection of 2206 accessions, 527 were DNA-fingerprinted,” says Prof. Harding. “It was evident that most – if not all – of the genetic diversity within South Pacific taros could be sampled from Papua New Guinea and the Solomons. These countries should be seen as major sources of diversity for genetic improvement programs.”

While retaining at least 85 per cent of that diversity, the size of the collection was reduced to about 10 per cent, allowing the core collection to be conserved and used more effectively. In total, 211 accessions were stored as in vitro tissue cultures, primarily at the Regional Germplasm Collection at SPC in Suva, Fiji.

Duplicate collections are now kept at the University of the South Pacific, Alafua Campus, Samoa, with plans to maintain a sample at the International Potato Centre in Peru. Australian researchers and growers in northern Queensland have already requested and received accessions from SPC.

In a separate project, ACIAR is helping to develop a broader diagnostic tool for the full spectrum of taro pests and diseases. In conjunction with SPC, Dr Anthony Clarke, of the Queensland University of

Technology, aimed to develop a computer-based package to facilitate identification of pests, pathogens and disease symptoms using the Lucid software system.

As part of the collaboration, Dr Clarke has already developed an experimental Lucid ‘key’, a set of questions that drives the diagnostic process, designed to help field extension officers and research staff make reliable diagnoses.

The software package is undergoing a 12-month testing process to ensure scientific accuracy and user-friendliness. The system is also designed to interlink to fact sheets with information about appropriate pest-management strategies. Once completed, the diagnostic package will be delivered to SPC who will be responsible for updating the tool and training staff.

Dr Clarke relates the need for such a broad diagnostic capability to changes in the way taro is farmed. “Traditionally in Papua New Guinea, an area would be cleared and taro cultivated for one or two years exhausting the soil, at which point the farmer would walk away for 10 to 15 years,” he says. “That allows any build-up of taro pests and diseases to die out. But the trend now is for more intensive, continuous cropping with less inter-planting and biodiversity.

“That creates the same problem intensive farming experiences anywhere: the more intensive the agriculture, the greater the problem with disease and pests.”

Villagers from Morobe Province, PNG, inspect a taro crop with Mathew Boang, Chairman for Lands and Physical Planning in the Morobe Provincial Government.

**PARTNER COUNTRIES:** Fiji, Papua New Guinea, Samoa  
**PROJECT:** CP/1994/043: Virus indexing and DNA fingerprinting for the international movement and conservation of taro germplasm  
**DESCRIPTION:** Taro growers across the Pacific stand to benefit from more effective disease and pest management programs  
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READ MORE ON TARO PEST CONTROL

BATTLING THE BEETLE





4 - HEAVY DAMAGE  
USELESS

Taro beetle  
damage to corms.

SECRETARIAT OF THE PACIFIC COMMUNITY

# BATTLING THE BEETLE

Helen McGlashan reports on a project that aims to combat the devastating taro beetle

**B**urrowing deep into the bulbous corms of the taro plant, forming holes and tunnels up to two centimetres in diameter, taro beetles (*Papuana* spp and *Eucopidocaulus* spp) are the nemesis of taro growers across the Pacific Islands. The taro plant is grown throughout the tropics and is an important food source for many Pacific Islands. The root crop is grown by subsistence and commercial farming and, once nurtured to maturity, is uprooted and the bulbous corms, stems and leaves prepared to feed the family.

However, the taro beetle plays havoc with these plans by burrowing into the plant's corms and forming holes and tunnels that make the taro unappealing to eat or buy and expose the corm to fungal infection. When populations are high, taro beetles can cause severe damage to the base of the new plant, leading to plant death. Other root crops such as sweet potatoes and yams and banana experience similar damage. Changes in cultivation patterns associated with increasing population density continue to intensify the damage caused by the taro beetle.

In countries such as Papua New Guinea (PNG) and Fiji the beetles can cause up to 30 per cent yield loss. In PNG, 99,600 tonnes of taro was damaged by the beetle in 2000, resulting in an estimated annual loss of A\$45.9 million.

In 2001, a team of entomologists, agronomists, scientists and plant protection, research and extension professionals from PNG, Fiji, Vanuatu, Solomon Islands and Kiribati banded together to work on strategies to combat this insect pest.

With support from ACIAR, the Land Resources Division of SPC implemented a four-year project on taro beetle management – the TBM project – built on previous work supported by the European Union and the Food and Agriculture Organization. The EU also provided funding for field research activities in Vanuatu and Solomon Islands and some activities in Fiji.

The project focused on assessing and developing insecticidal measures, alone or in combination, and with biological control – a fungus, *Metarhizium anisopliae*, and a baculovirus extracted from the rhinoc-



eros beetle. The aim was to develop an integrated crop management package to minimise damage caused by taro beetles. The project team identified two specific chemicals as providing the best control, but more work is needed to determine the best application methods, dosage rates and frequency of applications.

In December 2005, the project team geared up for the next phase of the project, which will involve participatory research and technology development activities such as farmer field trials and on-farm demonstrations.

The TBM project is important for the Pacific as the knowledge gained from research and field trials conducted in Fiji and Papua New Guinea, Vanuatu and Solomon Islands will be transferred to other Pacific Island countries and territories.

The director of SPC's Land Resources Division, Aleki Sisifa, says it is vital that research on the development of control strategies for the taro beetle continue.

"Taro is a staple food and cash crop and is particularly important in Pacific Island culture," he says. "The taro beetle pest, therefore, is of great concern to taro production in the affected countries."

Taro earns many Pacific Islanders a livelihood and contributes greatly to national economies. Known in Fijian as 'dalo', the root crop, along with cane sugar, is a major agricultural export commodity for Fiji, earning A\$25-30 million a year. Taveuni – 'the Garden Island of Fiji' – contributes about A\$12.45 million annually to the Fijian economy through its taro industry. The dalo of Taveuni is widely regarded as the best-tasting in Fiji and finds its way on to dinner plates throughout Fiji and overseas. It is estimated that 70 per cent of export taro comes from Taveuni, where the soil-dwelling pest is yet to venture.

Taro beetles are native to the Indo-Pacific region. Six species of taro beetle are endemic to PNG, four to the Solomon Islands and two to Vanuatu. Taro beetles have spread to Fiji, Kiribati and New Caledonia. Other countries are considered to be at risk of playing host to the pest and quarantine regulations are in place. The subsequent annual loss in trade across the region was estimated to be A\$40 million in 2000.

The spread of the taro beetle also has adverse environmental and social impacts. Farmers burn and abandon beetle-infested taro plots and cultivate new land in the hope that it will remain infestation-free for one crop cycle. According to TBM project coordinator Sada Lal, the success of the project will benefit taro farmers and the environment.

"Coming up with a recommendation to control taro beetle is very significant to farmers as they currently do not have any effective control method," Mr Lal says. "Many farmers have lost faith in planting taro, so developing a control measure will restore confidence in this important crop. Farmers will also be able to return to previously infected crops and will no longer need to rely on shifting cultivation, which is detrimental to the environment and is very labour-intensive and costly to the farmer."

While the TBM project investigated a combination of chemical and biological controls with the objective of developing an integrated control measure, Mr Lal says the results steered researchers towards the use of chemical insecticides.

"Biological control would be ideal but unfortunately, despite a lot of effort and work in this area, it has not been very effective in the control of the taro beetle," he says. "The results have shown that the metarhizium fungus can only provide up to 30 per cent control of the beetle – which is not enough. The fungus takes two to three weeks to kill the beetle and within that time the beetle has already done its damage."

In PNG, the scientist-in-charge, Dr John Moxon, found that applying metarhizium fungus with the chemical insecticide Imidacloprid

gave consistently good control, yet the fungus is too expensive for farmers in the Pacific to produce.

Mr Lal says it is essential the project identify a control measure that is effective but also affordable and accessible. "Ideally we want to recommend a low-cost technology that can be adopted by farmers in the village," he says.

Four years of research and trials culminated in proving Imidacloprid to be the most effective and accessible measure. Although this is an important discovery, Mr Lal says that chemical insecticides must be used with caution.

"Imidacloprid is the second largest selling pesticide in the world and is used extensively for the control of insects on many crops in many situations, yet its use should be closely monitored," he says. "Insecticides are poisons and all care must be taken to see that they are properly used when recommending them to farmers.

"There is also the risk the chemical could seep into the environment as taro is typically grown in moist conditions and subsistence farms are usually near creeks or on river banks."

The project team, therefore, is conducting trials to determine the best way to apply chemical insecticides. Other groups of insecticides (organophosphates and carbamate) will also undergo screening to ensure an effective control program can be formulated.

Mr Lal says residual analysis of the chemical insecticide was another important feature of the research, as it is not yet known how long the chemical residue lasts in taro plantations.

"We want to determine the latest time that a farmer can apply the chemical before harvesting, so we can provide protection for the taro plant right up until the time of harvest yet also achieve minimal residue and environmental impact.

"The aim is to be able to lower the dosage rate but increase the frequency of the application. This would hopefully give farmers better control of the pest and have less residual and environmental impact than higher dosages."

Samples extracted at the University of the South Pacific will be sent to the Queensland Health Scientific Services laboratory in Brisbane for residue analysis.

The re-establishment of taro as a leading crop in the Pacific will ultimately contribute to the enhancement of food security, income generation and export earnings. It is hoped it will also reinstate the value of taro export markets in Fiji, as well as make the potential for taro to be an export cash crop for PNG and Vanuatu a reality for the first time.

*Helen McGlashan is an Australian Youth Ambassador for Development working in the Land Resources Division of the Secretariat of the Pacific Community in Suva, Fiji Islands.*

**PARTNER COUNTRIES:** Papua New Guinea, Fiji

**PROJECT:** Taro Beetle Management in PNG and Fiji (CP/2000/044)

**DESCRIPTION:** The project is developing biological controls for the taro beetle and investigating the combined actions of pesticide and bio-control

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Taro bundles being sold at a market in Papua New Guinea.

# The missing link

Information about advances in tropical horticulture does not always reach the people who need it. Rebecca Thyer reports

**PARTNER COUNTRY:** Samoa **PROJECT:** Horticulture industry development for market-remote communities (SFS/2001/023) **DESCRIPTION:** Remote communities in Samoa and Cape York, Australia, stand to benefit from information to influence choices of what fruit to grow and how to deliver improvements to the supply chain

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**W**hen it can take a day to get to the nearest commercial centre, farmers and processors in remote areas of Samoa, and also in northern Australia, need to know their goods will still be saleable by the time they reach the market. Perishable goods that do not survive the trip reduce an enterprise's profitability. Yet information about technical advances that can improve both pre- and post-harvest management and give fruit and vegetables a longer shelf life does not always filter through to these remote growers, processors and retailers.

A new ACIAR project is redressing this information gap by developing and distributing relevant information to the industry. For example, the project – led by Rowland Holmes from the Queensland Department of Primary Industries and Fisheries – has developed and distributed a series of peninsula garden notes, native food and ornamental crop notes to growers and communities on both Cape York Peninsula and Samoa. It has also produced and translated crop management notes on papaya and taro into Samoan. The

team decided on information packages such as these following interviews and participatory rural appraisals with industry.

It found that the main issues raised by taro growers in Samoa were identifying new varieties and managing and identifying pests and diseases without excessive pesticide use. Samoan papaya growers wanted more information on growing, husbandry, harvesting and grading standards for papaya as well as marketing information.

For Australian commercial growers, the main issue was the need to customise a wide range of horticultural information to take advantage of unique market windows and reduce environmental damage. Samoan processors were most concerned about packaging and labelling and finding and accessing information on food standards and safety. Roadside stallholders identified overnight storage and maintaining quality and shelf life as their main concerns.

Mr Holmes says the right information packages are key to delivering agronomic and commercial improvements to remote communities.

“Communities in Samoa and Cape York Peninsula stand to benefit significantly from existing information already out there,” he says. “Good

information can help influence choices about what fruit to grow and how to improve the supply chain.”

Although written resources such as brochures, leaflets and harvest guides are important, relationships with other members of the community are just as vital. “Relationships play a key role in a person's ability to find relevant information. For instance, farmers are more likely to listen to other farmers because they have shared experiences.”

Building relationships has been an integral part of the project. The team has found that relationships with individual members of the Mapoon community in northern Australia and those being established with information providers in Samoa, such as Women in Business, the Food and Agriculture Organization and the Institute for Research, Extension and Training in Agriculture, are critical for the project and its legacy.

“Too often, information developed or put together by specific projects becomes unavailable once the project finishes or project team members move on, highlighting the importance of relationships in knowing that information exists and who to contact about it,” Mr Holmes says.

Building these relationships has been helped by an understanding of how information flows in northern Australia and Samoa.

“We looked into what impact information has on decision-making, what information growers are looking for, who makes the decisions and how information is rated,” he says. “For example, is one source of information favoured more than the other?”

The project team identified information supply chains used by growers, processors and stallholders. For example, the team found that Aboriginal communities on Cape York make decisions about land use through locally elected councils and traditional landowners, who are in turn influenced by other community members. In Samoa, families are an important source of information, particularly when making decisions about traditional crops such as taro.

The project finishes this year, but Mr Holmes hopes it will leave its mark. “We aim to leave a system whereby information can continually be updated and users can access it to aid better decision-making.”



Shared knowledge: notes on cropping techniques make their way from scientists to farmers.

## New ACIAR Country Manager for PNG and Solomon Islands

ACIAR's new Country Manager for Papua New Guinea and the Solomon Islands, Dr Jacqui Wright, is already a familiar face to many people at ACIAR and brings a wealth of experience in agriculture in the Pacific. Jacqui comes to ACIAR from the Secretariat of the Pacific Community (SPC) in Suva, Fiji, where she has worked for the past seven years with the Plant Protection Service, managing a program of plant-health related agriculture activities across 22 Pacific Island countries and territories. Jacqui is known to many of our project partners across the Pacific Islands, including PNG and the Solomon Islands.

Leaving the science focus of her role as a plant pathologist, she is following her interest in the field of development and the role of agriculture.

"I love science but I love working on the bigger picture," says Jacqui about her move to ACIAR. "I have long had a close association with ACIAR – Greg Johnson (former ACIAR Research Program Manager) was my PhD supervisor."

Jacqui grew up on a small banana farm in Yandina, southeast Queensland, and finished her high school education in the nearby town of Nambour. She completed a bachelor of science at the University of Queensland, becoming interested in plant diseases when her family's farm became infected with a banana disease called fusarium wilt, and subsequently undertook her PhD in Hong Kong. Last year she completed a Masters Degree at Deakin University in international and community development, wanting to learn more about the development and community aspects of the work she has been doing in the Pacific.

Jacqui has also led community development missions in the Philippines, Thailand, China and Mongolia and been a youth worker in Spain and Hong Kong.

She is passionate about encouraging Pacific Island women to go into science and about creating opportunities for women scientists of the Pacific, particularly in the field of agriculture. She looks forward to doing this in a number of ways, such as through the John Allwright Fellowships for scientists on ACIAR projects.

What she is most looking forward to about her new job is continuing relationships with colleagues and getting to know projects in other areas such as fisheries and forestry.

"With her mix of program management experience and technical skills in agriculture, her experience working in the developing world and her relevant contacts in 'ACIAR's world', I am confident that Jacqui will prove to be a most valuable country manager for ACIAR in PNG/Solomon Islands," says Allan Barden, Manager of the International Program Support Unit. ◀

Jimmie Rodgers: "Making a positive difference in people's lives."

## Pacific Community appoints new SPC Director-General

Jimmie Rodgers has been appointed as the new Director-General of the Secretariat of the Pacific Community (SPC). Dr Rodgers comes from the Solomon Islands and has been with SPC since 1996, first as Director of Programmes and since 2000 as Senior Deputy Director-General based in Suva, Fiji.

Dr Rodgers says his motto is "empowering communities and making a positive difference in people's lives".

"The post of Director-General entails a long list of responsibilities. It requires someone who is extremely capable, who is a natural leader and who has vision and foresight – which Dr Rodgers certainly does," says the Hon. Alexander Merep, Minister of Community and Cultural Affairs and Chair of the Pacific Community Conference.

"SPC is a strong organisation and I have full confidence that Jimmie will continue to steer the most

direct course towards its vision," says outgoing Director-General Ms Lourdes Pangelinan.

Dr Rodgers said he felt honoured at his appointment. "Having been given the opportunity to serve in this position, I look forward to working for the people of the region with commitment and vigour and to the best of my ability," he said.

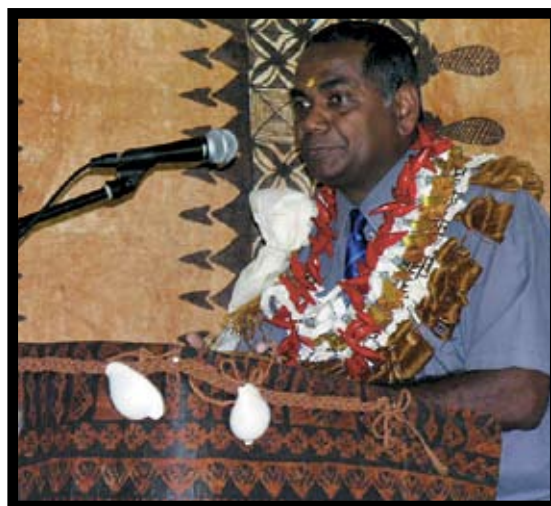
In a recent interview with the *Fiji Times*, Dr Rodgers said: "The Director-General provides the overall vision for the organisation to ensure it accomplishes its vision for the region, its mission for Pacific Island people and takes its place in the broader regional development agenda of the Pacific Islands region.

"The Secretariat of the Pacific Community is in an excellent position in that as an organisation we have adopted a more strategic approach to the planning and delivery of our regional service.

"We need to be strategic in our approach to prevent or minimise poverty. We need to ask where we want to see each of our countries in five, 10, 15, 20 years time.

"Having considered this we can then plan for the future, learning from the lessons of the past, the realities for today and our hope of where we want our tomorrow to be in the Pacific."

ACIAR Deputy Director John Skerritt has welcomed the appointment. "Dr Rodgers has an unusual combination of vision, a sharp mind and strong people skills. He will be a tremendous asset for the Pacific in his new position and we at ACIAR look forward to continuing to work closely with SPC and with Jimmie in his new role." ◀



ACIAR Deputy Director John Skerritt with ACIAR's new Papua New Guinea and Solomon Islands Country Manager, Dr Jacqui Wright.

## AQUACULTURE

The use of cyanide to capture fish for the live reef fish trade threatens coral reefs.

# TESTING TIME FOR TASTY FISH

A project to taste-test wild-caught and farmed reef fish in Hong Kong has shown that aquacultured product is an acceptable substitute for fish caught in the wild, report researchers Noel Chan and Brian Johnston



Strategies to improve the long-term sustainability of the live reef fish trade in the Asia-Pacific region are the focus of an ACIAR project that is also looking at the economic and market aspects of the trade. Live reef fish are regarded as premium fish for consumption in Southeast Asia and China and have long been a traded commodity. However, with the growth in incomes in Asia in the past 30 years, the demand for live reef fish has grown to the point where there is concern about the ability of the tropical reefs of the region to remain sustainable.

Consequently, the project researchers are also examining the acceptability of an alternative product from aquaculture.

The project is closely integrated with another ACIAR project that is developing improved hatchery and grow-out technology for marine finfish production in the Asia-Pacific region – a project headed by Dr Mike Rimmer of the Queensland Department of Primary Industries and Fisheries. Because the supplies of wild-caught fish from reefs are under pressure, the potential to supplement wild supplies with aquaculture is considered important to the long-term sustainability of the



From fish farm to table: tasting just like the real, wild-caught thing.



THIERRY CHAN

trade. Aquaculture production of grouper species is now expanding rapidly and the acceptability of the product to consumers is an important aspect to examine.

More than 20 countries supply the trade, valued at more than \$450 million a year, with the principal consuming markets being the Hong Kong Special Administrative Region and the People's Republic of China. Demand is growing strongly, particularly in China. Principal supplying countries of wild-caught fish are Indonesia, the Philippines, Australia, China, Malaysia, Thailand and Vietnam, with small volumes from Pacific countries such as Fiji and Papua New Guinea. A wide variety of live reef fish species are traded, the higher-value species being mostly groupers.

In order to assess the acceptability of an aquaculture product to Hong Kong consumers, trial taste-tests were conducted in Hong Kong in November 2005. In the test, 30 consumers were presented with portions of wild-caught and aquaculture-raised live reef fish for comparison.

The taste-test was 'blind' in that the tasters did not know whether the portion was wild or aquaculture-raised. And to make the test as realistic as possible, the cooked fish portions were served in an established seafood restaurant.

The test was conducted using the triangular taste-test, used widely in the food industry to test for differences in food samples: consumers are presented with three bowls of food and told that only one of the samples is different. They are asked to taste the samples, identify the different one and describe the key food sensory characteristics that make it different. They are also asked to identify which sample they preferred. The research reported here also sought to establish whether such techniques could be successfully applied to the taste assessment of reef fish products.

The testers comprised 16 consumers – guests of the Hong Kong Chamber of Seafood Merchants – and 14 staff from local seafood restaurants. Each consumer was seated at a separate table and asked not to converse with adjacent tables. They were given a survey questionnaire to answer and results were statistically analysed for significance.

The fish chosen for the test were all of the same species – *Comileptes altivelis*, commonly known in Hong Kong as humpback grouper. This is a relatively highly priced fish in the Hong Kong market, selling at about A\$200 per kilogram in restaurants. The fish were provided by the Gondol Research Institute for Mariculture in Bali, who are partners in the ACIAR marine finfish project, and transported to Hong Kong by Bali Minatama Ltd in Denpasar.

#### PARTNER COUNTRIES: Fiji, Indonesia

**PROJECT:** Economic and market analysis of the live reef food fish trade in Asia Pacific (ADP/2002/105)

**DESCRIPTION:** This project aims to enhance the sustainable economic development of the live reef food fish trade, through economic analysis of policy options for improved market performance

**CONTACT:** Brian Johnston, njvj@iimetro.com.au

Two types of aquaculture product were included for comparison with the wild-caught fish. Some aquaculture products were fish that had been fed on what is commonly called 'trash fish' (smaller fish of lower value) and some were grown on fish pellets, a scientifically formulated feed of fish meal and vegetable products.

Of the 30 consumers, 16 were able to correctly identify the odd sample on the

plates. However, only 11 were able to correctly determine which bowl was the wild-caught sample and which was the aquaculture sample. A statistical test conducted on the results indicated that there is a 95 per cent chance that the difference detected between wild-caught and aquaculture product by the sample of consumers is real (that is, the results would be repeated if the experiment was conducted again.)

A closer analysis of results was conducted of those participants who correctly identified the wild-caught fish in the blind triangle taste-test, finding that those participants preferred the wild-caught fish because of their more elastic skin texture, richer flavour and meaty flesh texture. However, many commented that the cultured fish samples were acceptable and would be commercially suitable, boding well for the widespread commercial acceptance of aquaculture products.

The project has also identified aspects of the trial taste-test that could be improved. First, because the taste-test did not distinguish between pellet-fed and trash-fed fish, there is a need to determine whether consumers prefer one to the other. Such information would be valuable to scientists and aquaculture operators in formulating optimum feeding strategies in the future.

Second, it would be desirable to broaden the sample to include a larger group of more typical consumers of live reef fish, rather than relying on representatives of restaurants and the trade to provide taste assessments.

The triangular blind taste-test worked well in a restaurant setting and could easily be extended to a larger and more representative sample in the future. It would also be useful to evaluate the visual aspects of the fish swimming in the restaurant tanks to ascertain whether consumers would discriminate for or against the aquaculture product. Further cooperation between the two ACIAR projects is planned, to allow more research to be undertaken on these aspects. ◀

*Ms Chan is a Masters student in the Asia-Pacific School of Economics and Government at the Australian National University and Dr Johnston is a Visiting Fellow.*

# PUTTING NUTRITIOUS YAMS BACK ON THE MENU

Efforts are being made to resolve some of the agronomic and economic constraints that are holding back the production of yams in Pacific Ocean communities, reports Janet Lawrence

A traditional yam storage house on Kiriwina Island in Papua New Guinea's Trobriand group. Yams are the only root crop that can be stored for long periods; they must be stored in a well-ventilated space away from sunlight and vermin to provide food over many months.

**W**hile yams – numbering about 500 species of the genus *Dioscorea* – have dietary and cultural significance in many Pacific nations, production is falling in the face of soil fertility issues and less nutritious, but cheaper, imported foods.

*Dioscorea* yams are climbing, perennial vines that produce underground tubers that weigh anywhere between one and 25 kilograms. They are abundant in tropical and subtropical regions and certain species are staple foods in many developing countries.

However, among the tropical root crops yams are the most demanding in terms of soil fertility, which has been declining in many areas and needs a concerted soil improvement program to restore yields.

Cheaper but less nutritious imported foodstuffs have started replacing yams, leading to serious health implications for Pacific populations. And although islanders prefer yams, they find prices too high when compared with imported foodstuffs. Farmers are disinclined to grow more than they require for their own needs because they make so little from what is a labour-intensive crop.

A new ACIAR project is looking at the extent to which soil nutrient deficiencies could be to blame for reduced growth and tuber production. The project will determine whether yields can be economically elevated using soil fertility management techniques to diagnose and correct nutritional disorders.

Involving institutions in Queensland, Papua New Guinea (PNG), Tonga and Vanuatu, the project has had formidable obstacles of distance, environmental stresses such as drought, crop diseases and nematodes and technical challenges to surmount. Many findings were inconclusive and some results differed substantially from year to year. Yet an improved knowledge of soil and nutrient levels was obtained in all regions.

To determine the impacts of different nutrients, scientists employed solution culture where different nutrients are progressively excluded to define specific symptoms of each deficiency. In glasshouse trials at the University of Queensland (UQ) researchers adapted techniques already developed and successfully applied to sweet potato in another ACIAR project. They produced deficiency symptoms of all of the nutrient elements of interest and established critical concentration values for most nutrients in leaf tissue of *Dioscorea alata*, and to a more limited extent for *Dioscorea esculenta* and *Dioscorea rotundata*.



PHILIP HOLZKNECHT

This work was an essential prerequisite to the study of deficiencies in the field. Under the direction of the project leader, UQ's Dr Jane O'Sullivan, project team members located throughout the partner countries began to undertake pot experiments to characterise yam nutrient requirements at their selected sites, trying to discover what nutrients were lacking for optimal yam growth in particular soils. Their results suggested that nitrogen, phosphorus and potassium (and sulphur in some places) were major limiting nutrients – findings that agreed with previous data for sweet potato and taro.

The next big question was how to alleviate the deficiencies. Through field trials in Tonga and PNG, yield responses of yams to inorganic and organic soil treatments were tested. In particular, the team tested a range of legumes to see if they could improve yams' nitrogen nutrition levels. Many trials focused on using legumes as green manures, or growing a legume crop as fallow to increase the nitrogen supply in the soil and to recycle phosphorus and potassium.

Good research results were recorded for Tonga, especially for



PHOTOS: JAMES ERNEST

## NEW SKILLS GAINED AT UQ

Marie-Vianney Melteras is a scientist based at VARTC in Vanuatu. As a project research assistant she carried out the Vanuatu trials looking for plant responses to nutrients in selected soils. Her work continued in Brisbane as she undertook a Masters degree based on the research of the Vanuatu program. She was granted an ACIAR John Allwright Fellowship to support her study. Project leader Jane O'Sullivan reports that Marie gained many competencies during her intensive year of study at the University of Queensland. She also contributed to the 4th International Crop Science Congress held in Brisbane in September 2004.

Farmers harvest a yam crop under the shade of *Gliricidia* trees, Bogia District, PNG. The trees have been allowed to grow unpruned since the yam vines began to die off.

grasslands eight to 12 months before planting yam. Planted in a grid pattern, each tree supports four yam vines. However, data from four trial sites harvested in 2003 showed no difference in yield could be attributed to the staking system.

The hoped-for cumulative effect of nutrient addition over successive seasons was not realised due to nematode damage. Nevertheless, preliminary results indicate that when regularly pruned, the trees do not compete to the detriment of the crop and can reduce management inputs for weeding and staking. The system may alleviate many of the problems associated with shortened fallows, including weed intensity, decline in soil nutrient availability and organic matter content and shortage of staking materials. Further benefits to farmers include softer soil texture, enabling the yams to be harvested more easily, and shading of workers at planting and harvest.

In Vanuatu, research at the Vanuatu Agricultural Research and Training Centre (VARTC) initially revealed little response by yams to fertiliser in many of the field trials. Therefore, scientists decided to study more closely the growth and development of *D. esculenta* by investigating its rooting structures.

Destructive harvests each month involved careful excavation of the roots and recording of root length and depth. Roots were observed to remain very shallow (less than 10 centimetres) while extending out from the plant for more than two metres and ultimately growing down to about 30cm depth. Feeder roots were not concentrated in or under the mound except for those growing from developing tubers.

These results called into question the efficacy of placing fertiliser in the mound and the distance required to separate fertiliser treatments in the field. Field trial designs adopted from other crop species appeared to be inappropriate for yam as the roots may travel into adjacent treatments. This was a likely cause of the inconclusive results of earlier trials.

To explore these issues further, Dr O'Sullivan established a small trial in Brisbane applying strontium, a non-toxic element of low abundance in nature, which plants take up in a similar way to calcium. By 'spiking' specific locations in the soil with strontium she could trace root activity and determine the ability of roots to reach a certain location based on the level of strontium in the leaves.

Her experiment showed that yam roots may reach horizontally for at least 5.5 metres and go to depths exceeding 40cm. Fertiliser placed in the planting hole under the seed tuber was rapidly accessed by the plant, but that uptake was greater when fertiliser was placed in a ring around the set within the mound. Fertiliser placed between the rows was accessed more slowly but resulted in similar or greater uptake over the growing season. These findings have great promise for future trials.

Meanwhile in Vanuatu, the Development of Sustainable Agriculture for the Pacific (a program funded by the European Union and managed through the Secretariat of the Pacific Community) has now adopted the project-developed facilities and techniques for pot experiments to determine soil nutrient requirements. Support from this program is a resounding vote of confidence for the project team.

*Gliricidia* prunings are used as mulch, providing nutrients as well as holding in moisture and suppressing weeds.

**PARTNER COUNTRIES:** Papua New Guinea, Tonga and Vanuatu  
**PROJECT:** Nutritional Disorders of Yams  
**DESCRIPTION:** Research into soil nutrient deficiencies will determine whether yields can be economically elevated using soil fertility management techniques to diagnose and correct nutritional disorders  
**CONTACT:** Dr Jane O'Sullivan, j.o'sullivan@uq.edu.au

phosphorus fertiliser field trials and legume fallow rotated with yams. Green manure trials found that mucuna (velvet bean) was able to improve phosphorus nutrition, as well as provide nitrogen through biological nitrogen fixation. Tongan soils, like all volcanic soils throughout the Pacific, bind phosphorus tightly, which is a problem for crops. However, the velvet bean proved efficient at extracting phosphorus and as a green manure alleviated phosphorus deficiency in subsequent crops.

In PNG, research revealed a growing tension between shorter fallows and/or competition for fertile land for cash crops, along with a general decline in soil fertility and resultant decline in yam production.

Another widespread impact of reduced fallows was a shortage of pole timber for staking yams. To address this, the team introduced a novel agroforestry system, using the leguminous tree *Gliricidia sepium* to improve the fallow and as a live stake for yams. The trees are established from pole cuttings planted directly into degraded

# Making a spl

## FOR PACIFIC FISHERIES

In 1999, while employed by ACIAR, Janet Lawrence spent time in the Solomon Islands observing the ACIAR-funded research under way through WorldFish (then ICLARM). In an interview with Warwick Nash of WorldFish, she discovers what has taken place in the ensuing seven years

**A** CIAR and the WorldFish Center (WorldFish) have been partners in Pacific fisheries research for more than a decade. When I talk to Warwick Nash, director of the WorldFish Pacific Office based in New Caledonia, he is adamant that the time has come to focus on the delivery of benefits to coastal communities throughout the Pacific.

“Together we have produced some excellent research results,” he says. “But both ACIAR and WorldFish are now looking for genuine impacts from that research. They are mindful of the extensive investment in research over this extended period, and they recognise that they are accountable for turning those results into income-generating or food-security enterprises for people across the region.”

### Pioneer work

During my 1999 trip I visited the Coastal Aquaculture Centre on Guadalcanal, Solomon Islands, stationed about 20 kilometres west of the capital Honiara, and later flew to Marau Sound on the eastern tip of the island. Visits to these two sites showed me that research efforts were being rewarded. Giant clams and sea cucumbers were being successfully cultured – the first step towards replenishing areas that had been depleted through overfishing for prolonged periods.

It was still early days for the sea cucumber work, which had established that sandfish (*Holothuria scabra*) was a desirable species of sea cucumber for restocking and that juveniles could be reared *en masse* in simple, land-based nursery systems. But clam culture had been well tested and juvenile clams were being distributed to villagers who were ‘on-growing’ them to boost the natural populations and to harvest and sell as a desirable, high-value product in the aquarium trade, with further potential as restaurant fare.

After 1999 the Solomon Islands were beset with years of civil unrest. The Aquaculture Centre was ransacked, leading to a decision to relocate the ACIAR WorldFish program to New Caledonia. However, limited field R&D operations were maintained at the Nusa Tupe research station in Western Province. I question Warwick about the fate of the giant clam and sea cucumber work.

“Clam culture and village on-growing came to a stop during those years,” he says. “But since June 2005 NZAID has funded a sustainable livelihoods project at our field station on Nusa Tupe Island, near Gizo in Western Province, allowing us to restart the culture of clams for the aquarium trade. We now have a small but effective hatchery there, so the distribution of seed clams can continue. The villagers are very keen to be involved.”

### Adapting to a new environment

The sea cucumber research was continued in New Caledonia. “In the early stages we had considerable challenges,” Warwick says. “We had to build a new hatchery and adapt to the new environment because, unlike in the Solomon Islands, the sea cucumbers do not spawn year-round in New Caledonia – it is more like October to January. Water quality is different, and controlling the large daily variation in temperature was a challenge, but important to achieve high survival rates of the sea cucumber larvae. We surmounted those challenges and now we are seeing very good research outcomes.”

Warwick joined the program three months after the move to New Caledonia. He brought with him an extensive knowledge of fisheries biology and management garnered from years of research work with abalone, trochus and giant clams and studies of management with inland fisheries. He teamed up with project leader Dr Steven Purcell, an ecologist with previous research experience on an ACIAR project investigating the restocking of depleted trochus populations. Warwick has supported Steve in the research that has brought advances in culturing and restocking the sea cucumbers.

They supervised the successful repetition of experimental-scale juvenile production that had been developed in the Solomons. The next step was to scale up the production of juveniles. They were aided by new facilities for culturing sea cucumbers, including a 10 by 15-metre greenhouse and a system of flow-through tanks and raceways. They also adapted some successful work undertaken in Vietnam, and evaluated methods for growing juveniles in earthen ponds.

Release experiments in the marine environment followed. “Steve, as the ecologist, had so many issues to address in the releasing trials,” Warwick says. “He had to identify suitable habitats and answer questions such as the optimal size for their release, how to transport them, the best time of day for release to minimise predation, the ideal depth of water, whether they needed shade and the best time of year for release. To track the progress of the juveniles after release he developed a very effective method of tagging them, which is a break-



# ash

through in sea cucumber research. He has been able to sample and re-release many of the cultured juveniles every two months and tracked their progress for more than a year.”

Warwick’s main focus has been sustainable management of sea cucumber fisheries – to study the natural populations and the communities that fish them. He has come to realise just how important sea cucumbers are as a source of income for the villagers in many parts of the Pacific. For many, they provide the main source of income, being so easy to harvest, and since many villagers have accumulated debts, they need reliable income to service them. It is little wonder that the resource is being overfished.

Another disturbing factor is that when the sea cucumber populations go into decline the villagers seek other sources of income, leading to exploitation of other vulnerable species such as sharks. It is salutary that the situation in the Solomon Islands led to an indefinite ban being placed on harvesting and export of sea cucumbers. (It was the ACIAR–WorldFish studies of fishing patterns that alerted national authorities to the crisis across the archipelago.) Already there is anecdotal evidence of a rise in the culling of sharks for their fins.

This new situation highlights why it is so important for ACIAR, WorldFish and others to work together to encourage cooperative donor action in support of a mosaic of projects covering a wide range of potential income-producing activities, in order to foster alternative livelihoods and thereby protect vulnerable marine species. This is indeed happening in the Solomon Islands, with agencies supporting research on seaweed culture, black pearls and capture and culture of fish and crustacean species for food and for the aquarium trade.

Warwick and WorldFish are eager to see more involvement from those countries that stand to benefit from the work. “It is important to note that agencies such as ACIAR and WorldFish can provide funding to develop new technologies and extend them in limited trials in small numbers of villages. But it takes the combined efforts of various concerned groups – national and provincial fisheries authorities, extension services and locally based NGOs – to apply the work more widely,” he concludes.

All these and other matters will be on the agenda at a workshop to be held in Papua New Guinea in late March (see panel).

BRAD COLLIS

## A GOOD LITTLE EARNER

ACIAR and WorldFish have recognised that capture and culture of reef fish and invertebrates can provide a small but consistent income for Solomon Islands and other Pacific Island countries. They have invested in developing simple, low-cost techniques so that establishment costs can be repaid in a few months. It has provided an opportunity to build a market niche in the aquarium trade for species not caught by conventional methods, such as painted lobster and cleaner shrimp. The Nusa Tupe Field Station in Western Province, Solomon Islands, has trained village participants and national fisheries officers in techniques to capture and culture coral reef species.

As a result, community members of two coastal villages began catching and rearing post-larval lobster, cleaner shrimp and fish.

Warwick Nash describes the technique for collecting the lobster and shrimp: “All that is needed is a length of coconut palm trunk cut to size and drilled with holes,” he says. “The villagers secure these vertically with stakes in the sandy lagoon behind the reef front and when they come back a few days later, they find the tiny crustaceans have taken shelter in the holes. They have learnt how to gently remove them to holding tanks where they on-grow them for about one month before they are sold to a distributor in Honiara. The painted lobster and cleaner shrimp are in demand for the aquarium trade and a single animal is worth around eight Solomon dollars – that is considerable reward for a village enterprise.”

## SEA CUCUMBER WORKSHOP

ACIAR is hosting a sea cucumber fishery management workshop in March near Port Moresby, PNG. ACIAR and WorldFish believe that research work on sea cucumber culture and release and the studies of natural populations have now reached a sufficient stage for wider dissemination and the involvement of other organisations. This workshop is an opportunity for many to discuss the implications of wild stock management and the effectiveness of restocking. Unless proper management plans are in place, the released cultured juveniles will not be left to grow and reproduce to lift the depleted populations.

ACIAR will also use the meeting to develop a project aimed at sea cucumber fishery management strategies in PNG and begin the process of establishing future directions for a Phase 3 WorldFish restocking project.

ACIAR will look for financial commitment from many of the parties who stand to gain from the extension of the results to their communities. ACIAR and WorldFish have no doubt that in promoting the sustainable development and use of sea cucumbers they have backed a potential winner for the Pacific region.



Healthy catch: ACIAR and WorldFish are helping ensure the fishing industry is not the one that goes away.

# Off to a flying start



A poultry research facility at the Solomon Islands College of Higher Education (above and far right).

Poultry is important to Solomon Islands villagers' diet, but farming practices are poor. Whitney Macdonald reports

**'G**ive a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime.' Substitute 'poultry farm' for 'fish' and this Chinese proverb accurately depicts the nutritional plight facing many village families in the Solomon Islands.

Poultry (especially chicken) is the primary source of protein for most families, but few eggs are produced and only one bird is eaten each month, due to suboptimal feeds available for chickens and the small flock sizes maintained by families.

As a result of this low protein consumption, many islanders suffer from malnutrition, causing nearly 30 per cent of infants to be significantly underweight. Add to this the poverty affecting many of the islanders and it is easy to understand how people would greatly benefit from a little dietary help and an increase in income.

Enter the wisdom of a Chinese proverb that reflects a new collaborative project funded by ACIAR that aims to lift islanders' poultry production capacity. The project is helping village poultry farmers

identify alternative forms of poultry feed rations from within their own gardens as the start of a chain leading to improved health and welfare overall.

The three-year project – led by Dr Phil Glatz from the South Australian Research and Development Institute (SARDI) Pig and Poultry Production Institute in Adelaide – was designed to address the plight of village families in the Solomon Islands.

By establishing a local poultry production research facility, islanders will be able to produce more poultry and also acquire the research capabilities to develop further sustainable farming practices, with the prospects of continually optimising their feeding resources for chickens in the future.

As part of the project, Dr Glatz and collaborators are helping the Solomon Islands establish their own poultry production research facility to test and identify local feed resources suitable for village poultry.

“By improving the rations for village poultry, village farmers will be able to raise poultry production and increase their income as well as lift consumption of eggs and meat by village families,” Dr Glatz says.

“We anticipate that this will greatly help many families who currently rely on sweet potatoes as their main source of nutrients. Unfortunately, these contain very little protein. Given that most children in remote areas walk two hours each way to school every day, a diet low in protein is inadequate to supply them with necessary nutrients.”

# Start

TONY JANSEN



Phil Glatz with a village lady taking food scraps to feed poultry at a village near Buscarate in Malaita Province, Solomon Islands.

**PARTNER COUNTRY:** Solomon Islands  
**PROJECT:** Feeding village poultry in the Solomon Islands (LPS/2003/054)  
**DESCRIPTION:** Village poultry are a vital source of food security and supplement incomes for smallholder farmers. Improving poultry production would boost health and overall wellbeing  
**CONTACT:** Dr Phil Glatz, 61 8 8303 7786, fax 61 8 8303 7689, glatz.phil@saugov.sa.gov.au



Kastom Gaden Association, one of the Solomon Islands' local non-government organisations working with SARDI, predicts that if families are able to produce between 20 and 40 chickens, they will have enough poultry resources to maintain healthy nutrition and still have enough extra eggs to sell, substantially increasing their income.

"We have made good progress in the first year with help from the National Agricultural Research Institute in Papua New Guinea," Dr Glatz says. "So far, we have developed and built the research facility. We have also transferred research protocols from PNG and Australia and trained local Solomon Islands staff."

Basing the research facility at the Solomon Islands College of Higher Education meant that local students can reap the benefits of this knowledge, with the added advantage of strengthening ties between lead staff members from the college, the Department of Agriculture and Livestock and Kastom Gaden Association – both positive outcomes for a society rebuilding its community ties in the wake of recent political turmoil.

As part of this long-term research, a variety of crops, including sorghum, pigeon peas and cowpeas, have been planted to measure the various nutritional values of locally-available feed resources. These feed resources along with fresh coconut, pigeon pea leaves and paw paw leaves are being used in a demonstration trial to compare the benefits of a mixed diet with a free-choice diet.

The team has also established 'model farms' – places where villagers can visit and spend the night, learning new poultry feeding options. Three farmers have been hosted already at a model farm in

Burns Creek, with one farmer returning to his village to introduce a moveable shelter for the poultry (enabling the poultry waste to be used as fertiliser) and another creating a feed garden for his poultry flock.

Integrating these research techniques and results into the local villages in the Solomon Islands is a key priority of this project and the team undertook a comprehensive survey to gather information on current poultry practices within the villages. About 80 villagers contributed information on their poultry farming practices, including their general attitudes, needs and obstacles in maintaining small-scale poultry farms.

The results of the survey will be used to shape the research and extension programs.

Poultry farmers in Australia will also benefit from the results of this research into feed rations. Organic poultry farmers in Australia use creative alternatives for feed compared to those used by industrial poultry companies. The team is assessing the nutritional value and palatability of some of these alternatives, such as herbs, and will convey the results to small producers and the commercial industry as options they can use in the development of innovative feeding systems.

Although it is still early days for this project, its potential to improve the overall quality of life for many Solomon Islands villagers is undeniable. Dr Glatz says: "It's only when you go there and see how tough these people are doing it, that you realise how important these types of projects are." ◀

Alxa League in western Inner Mongolia. Western China is a region marked by poor agricultural land and weak infrastructure.



# TARGETING RURAL POVERTY IN CHINA

The emergence of millions of Chinese people from rural poverty has not been evenly distributed across the nation. Veronica O'Connor reports on progress to reduce the gaps

China's rapid economic growth over the past few decades is regarded by many as a success story with a significant human dimension. For millions of the country's poor, particularly in rural areas, this growth has provided a way out of poverty. In just over two decades the number of people classified as 'rural poor' by the Chinese Government has fallen by more than 200 million – from 250 million in 1978 to 26 million in 2004.

Yet despite this overall achievement, the decline has been uneven across the country, particularly in western China, a region marked by poor agricultural land and weak infrastructure.

According to the Chinese National Bureau of Statistics, western China accounted for 13 million rural poor in 2004, followed closely by the central region with nine million. By comparison, the eastern

coastal region, endowed with favorable geographic and natural conditions, accounted for four million. Although such regional disparities persist, progress has been made in reducing the gaps. In the western provinces, for example, the number of rural poor fell by almost 18 million between 1996 and 2004.

With these statistics in mind, Chinese policymakers are renewing efforts to identify the major drivers of poverty reduction. To help in this effort, the International Food Policy Research Institute (IFPRI), Chinese Academy of Agricultural Sciences and Guizhou University (China) have partnered with ACIAR to assess the impact of current policies and public investments on improving the livelihoods of the rural poor in the western region.

Reflecting the Chinese Government's new rural development



PHOTOS: IAN WILLET

Land is an increasingly important factor underpinning rural inequality.

strategy, IFPRI and collaborators are examining the issue by focusing on communities and households in western China rather than on the region as a whole. Few studies to date have paid attention to poverty in the region at this close level, so to address this knowledge gap IFPRI led a large-scale survey of 800 households in 286 villages across four townships in Puding County, Guizhou Province (the poorest province in China).

In order to reach all these households and strengthen local capacity, IFPRI senior research fellow Zhang xiaobo trained 30 graduate students from Guizhou University in development economics and survey methodology as part of the Chinese Economists Society and Ford Foundation's Teaching Program. Preliminary survey results underscore how targeted policy and investment choices can accelerate poverty reduction in western China.

For farmers in the region, land is the most important asset and agriculture remains a major source of income. In Guizhou Province, for example, land has not been readjusted for more than two decades. With demographic change, and agriculture remaining the dominant source of income, land has become an increasingly important factor underpinning rural inequality.

Adequate health care and educational opportunities are essential for the poor. In rural western China, however, limited access to public health care and education contribute to rising poverty rates, as the poor are left to spend a disproportionate amount of their income on these vital services. High tuition fees have become a heavy burden and, for many households, when one member falls ill the rest of the household becomes poorer.

Government financial supports have had minimal impact on

farmers' incomes, primarily because the amounts are so small. However, lessening state control over the booming natural resource sector, such as logging and coalmining, could provide farmers with an alternative means of generating income.

For the rural poor in western China, proximity to markets can translate into higher incomes. Unfortunately, poor rural roads undermine such prospects. Public investments targeted at improving such vital links greatly enhance connectivity to markets and help increase incomes.

Remittances (that is, payments made to people working in an area from those working outside) are a significant source of income for poor households in many developing countries. However, the flow of remittances is quite low in the surveyed western provinces. Further research is needed to identify existing constraints.

The survey findings also highlight how economic growth does not automatically lift everyone out of poverty, particularly in the absence of policies and investments targeted at impoverished regions.

In the months ahead IFPRI and collaborators will discuss these findings with high-level Chinese policymakers and key stakeholders at several conferences and workshops in China. ◀

*Veronica O'Connor is a communications specialist with the International Food Policy Research Institute in Washington.*

**PARTNER COUNTRY:** China

**PROJECT:** Rural poor and smallholders in western China under WTO: a regional and community level analysis (ADP/2002/114)

**DESCRIPTION:** The Chinese Government has identified development of the western region as a top medium- to long-term priority. With WTO accession, policymakers will need to re-evaluate current policies to ensure smallholders are not disadvantaged

**CONTACT:** Zhang xiaobo, x.zhang@cgiar.org, www.ifpri.org/country/china.asp

# NEIGHBOURHOOD WATCH ON FIRES IN EAST INDONESIA

Similar landscapes across northern Australia and Indonesia are driving a collaborative approach to understanding the social, political and economic drivers affecting fire management, reports Jenni Metcalfe

Uncontrolled fires bring devastation to the subsistence farmers of eastern Indonesia as well as to pastoralists, Aboriginal people and conservationists in northern Australia. Although fire is a fundamental part of traditional and current land management in the savanna lands of these regions, some burning regimes encourage weeds, promote soil and nutrient loss and threaten forests, property and water catchments as well as the livelihood of farmers.

Andreas, who lives in the Ngarukahiri village on the island of Sumba in East Nusa Tenggara Province (NTT) of Indonesia, says the impact of fire can be very destructive. "Annual crops in the garden can be destroyed as well as our house. This sort of fire can occur if we are not very careful in our use of fire. Usually fire helps clean out the gardens, but with little control these fires can escape and be destructive."

The impact and management of fire in eastern Indonesia were recognised as a high priority for research by the Indonesian Government and educational agencies a decade ago, and a collaborative project on fire management in Indonesia and northern Australia has been funded by ACIAR for the past three years. The project included research, education and training in fire, land and resource management and was a partnership between the Tropical Savannas Cooperative Research Centre, the Bushfires Council of the Northern Territory and Charles Darwin University.

The main eastern Indonesian partners were Wira Wacana University, Sumba and BAPPEDA (the Provincial Planning Boards in Sumba and Flores).

Australian project coordinator Dr Bronwyn Myers says the landscape of northern Australia is very similar to that of its closest neighbour, Indonesia. "This is particularly true of eastern Indonesia with its wet-dry monsoonal climate and extensive fire-prone savanna vegetation. Some of the issues and challenges faced are also similar."

While much has been documented about fires in northern Australia and western Indonesia over the past decade, little was known before this project about the extent, causes and impacts of fire in eastern Indonesia. For a long time, fire has been viewed as the key agent in converting tropical and monsoonal rainforest to savanna lands.

Focusing on the islands of Sumba and Flores in east NTT, the ACIAR project used satellite and Geographical Information System (GIS) technology to map the extent and timing of fires. The project also worked and consulted with the community to understand the social and economic causes and effects of fire.

The NTT, one of the Archipelago provinces of Indonesia, is made up of 566 islands, 50 of which are inhabited by 3.5 million people. With an increasing population, low rainfall and decreasing land productivity, this is the poorest region in Indonesia. More than 80 per cent of its inhabitants depend on subsistence agriculture for survival.

In most of the villages fire is used to clear and prepare old and new garden plots in readiness for planting in the wet season. It is also used in broad-scale hunting to round up animals, especially wild pigs and rusa deer, and to encourage pasture regrowth for cattle, horses and other livestock.

"The problem is that fire is too often used carelessly and wantonly with little regard for where the fires may end up," Dr Myers explains. "Uncontrolled landscape fires, especially in the late dry season, can destroy buildings and crops and inflict irreversible damage on mature forests."

Northern Australia has a similar problem with late dry season fires, but on a much larger scale and requiring much bigger fire breaks.

"The issues were not just agronomic or ecological," Dr Myers says. "We also needed to consider the social, political and economic drivers affecting the management of fire in the region. And this is not too different from the issues in Australia."

Current government policy in Indonesia reflects the country's Dutch colonial past, where all fires were seen as problematic.

Another issue is that land ownership systems vary from village to village, depending on local social structures. Open conflicts both within and between villages are common, resulting in a complete lack of fire management on disputed land. Fire can also be used as a weapon in these disputes. Conflicts are further exacerbated by land tenure issues between local communities and regulatory authorities.

"These ecological, social and political issues create a climate where fire impacts on the environmental assets, livelihoods and the economic well-being of many poor villages," Dr Myers says.

The project used focus groups to learn from the community. Through these processes, villagers were able to air their concerns and discuss solutions to current land management issues. This led to very real changes on the ground.

"Fire is a usual occurrence in our land ... ACIAR provides us with training in decreasing fires, planting more trees and protecting our springs," says one of the villagers. Another says: "Our focus group has decreased burning and increased trees."

Similar comments came from another village: "Because of the project between the Australian and Indonesian governments, our problems with fire have become less ... because we are planting (trees),



Villagers being trained in prescribed burning practices in East Sumba.

BRONWYN MYERS



Paulina Hada Ndima, of the ACIAR fire project team in East Sumba, demonstrating controlled burning practices.

TANIA PAUL

our community will not burn because they know it would destroy our hard work.”

Some of the new management practices discussed with villagers included leaving steep slopes unburnt and not burning all the hill-sides around the villages. Fire management integrated with agroforestry practices was demonstrated in several villages.

Eastern Indonesian project leader Dr Siliwoloe Djoeroemana says it was very important for the villagers and the local government officials to be made aware of the benefits of prescribed burning.

“The project brought about good cooperation in managing fire at the village level between local government, local departments of forestry and NGOs,” he declares. “There is goodness in people in rural areas. They are very honest and they know what they need and if you give them the opportunity they will get involved.”

Training and education was an important part of the project. Field training and demonstration days were held in Sumba and Flores for villagers and government officers. Villagers were trained in the strategic use of fire at the same time as they worked with the project to develop agroforestry plots.

“Agroforestry is an important alternative farm income that we hope will encourage more strategic use of fire in land management,” Dr Myers explains. “By creating fire breaks around the seedlings, gardens and houses during the early dry season, they were protected from larger hot fires later in the dry season.”

Josef Maan, a project officer in Flores, says the benefits of the project have been three-fold: economic, environmental and institutional. “The project supported villagers to form a small credit union where they can save and borrow money for their needs,” he says. “When they plant vegetables in summer and get profits from the sale of these vegetables, they can save some money.

“To help in conservation, the villagers are planting trees like mahogany, eucalypts and local species in the contours to protect from spring floods and erosion and to keep their land fertile. Fire breaks decrease the amount of fire on their land.”

Rohan Fisher, a Darwin-based fire researcher, worked with the project’s local GIS officers to map the extent and timing of fires in Sumba and Flores. This resulted in further training and capacity building for the Indonesian GIS officers and indicated that about 50 per cent of the study area in Flores and 19 per cent of the area in Sumba was burnt each year. The villagers took part in mapping and now actively refer to the land use maps when planning their burning activities.

On a regional scale, BAPPEDA officials are enthusiastic about the improved mapping capabilities and are using the maps for their regional plans.

Wilfrida Ruba is a Ngada government officer trained in GIS through the project. She is now working to share her skills with other officers in the region. “With this project, I learnt about GIS application in the agricultural sector,” she says. “This knowledge provides us with spatial data that is an effective and accurate information system. This has led to better control and management of burning practices for local people.”



ROHAN FISHER

**PARTNER COUNTRIES:** Indonesia  
**PROJECT:** Impacts of fire and its use for sustainable land and forest management in Indonesia and northern Australia (FST/2000/001)  
**DESCRIPTION:** To develop and implement appropriate fire management strategies and policies for Indonesia and northern Australia  
**CONTACT:** Bronwyn Myers, [bronwyn.myers@cdu.edu.au](mailto:bronwyn.myers@cdu.edu.au); Dr Siliwoloe Djoeroemana, [siliwoloe2005@yahoo.com](mailto:siliwoloe2005@yahoo.com); <http://fireindon.cdu.edu.au>



BRONWYN MYERS

Course materials explicitly related to tropical savanna ecology and management were jointly developed by Charles Darwin University and Satya Wacana Christian University in Indonesia. The Crawford Fund supported cross-visits between the universities.

“Education and human resource development are very important,” Dr Siliwoloe says. “Without the skills for good land management it is very difficult to develop sustainable agriculture.”

Government officers in NTT have acknowledged the outcomes of the project and want to extend it further in the region, especially to West Timor. A new project, funded by AusAID, is helping with this process.

“The key to successful fire management, whether it is in Indonesia or northern Australia, is two-fold,” Dr Myers concludes. “It requires a coordinated and supportive policy framework and a cooperative partnership between government authorities and local communities.”

Dr Siliwoloe agrees: “Cooperation between the people, local government, NGOs and professional institutions is very important for sustainable rural development.”

Top: An inventory of forest resources in Dorameli, Ngada, Central Flores; above: Forest resource inventory trainers Dr Jeremy Russell-Smith and Dr Taka Nuhamara, in East Sumba.

# REBUILDING ACEH'S AQUACULTURE

More than 12 months after the Indian Ocean tsunami, ACIAR project leader Dr Jes Sammut, from the University of New South Wales, reports on work in Aceh to rebuild its aquaculture industry

It is more than a year since the tsunami caused widespread loss of life and damage to infrastructure and the environment in Aceh, Indonesia, where more than 90,000 people were directly or indirectly involved in the aquaculture industry.

Before the tsunami, the local aquaculture industry, which is based on low-intensity, extensive culture systems, produced 10,300 tonnes of shrimp and 6100 tonnes of milkfish annually. The farmgate value of shrimp is estimated at US\$46.5 million and for fish at US\$9.6 million.

Local broodstock, considered the best in the region, also formed a lucrative hatchery industry. Almost all of these hatcheries were lost. Brackish water aquaculture accounted for about 32 per cent of the total fishery value in Aceh. Many shrimp-farming families have no alternative income sources.

ACIAR's involvement in the rebuilding started soon after the emergency phase had passed, and focused on building technical skills among government staff who survived the tragedy. A new ACIAR project will continue to build technical capacity but with a wider reach and in partnership with other projects.

Information on environmental constraints is scant, making it difficult to rebuild sustainable systems. So the project team's first task is to determine the engineering and environmental limitations of local soils and hydrology before they can design ponds, canals and dykes. The next step will be to provide technical training to the government staff and NGOs who are driving the reconstruction effort. Many NGOs are funding small rehabilitation projects in the sub-districts, but lack the skills to deal with environmental issues. Many government staff are also unfamiliar with environmental limitations and suitable construction methods.

The team from the Regional Brackish Water Aquaculture and Development Centre (RBADC) and Gadjah Mada University will help develop and implement the new technical training and capacity-building program.

RBADC staff will play a major role in locally managing the technical training program and will be responsible for training people at Dinas Perikanan (Bureau of Fisheries). We aim to establish a core group of trainers at RBADC who will provide ongoing training of Dinas Perikanan staff and also help educate NGOs and farmers.

Donor agencies have recognised the need to collaborate and most have entered agreements to fund capital items, machinery and farm inputs. ACIAR's program will provide technical inputs across all programs.

This technical support will be essential for redeveloping ponds and infrastructure. For example, thousands of tonnes of soil need to be moved to rebuild ponds and canals. The risk of failure is high unless all of the programs apply best-management practices.

ACIAR is well placed to offer this support. Past and current projects on brackish water aquaculture elsewhere in Indonesia have produced technologies and information relevant to Aceh. A new manual on pond and canal engineering and soil management will be released mid-2006, along with a series of technical notes.

Soil constraints and disease are two of the greatest problems the industry must deal with to secure its long-term future. Acid sulfate soils are common and some farmers had previously constructed ponds in highly erodible, sandy soils. Fortunately, acid sulfate and sandy-textured soils are easy to identify in the field; nevertheless, some farmers unaware of the problems have redeveloped on these soils. Disease is a problem because it can be a symptom of poor hatchery and farm management practices.

The tsunami knocked out many of the primary dykes and demolished most of the secondary and tertiary dykes. This has led to the exposure of acid sulfate soils at low tide and increased acid production because more soils are exposed to oxygen and for longer periods. We know from our work in South Sulawesi and Australia that disturbed soils can produce acid for decades if they are not properly managed.

During our field visits we measured soil pH less than 4 and found that at some locations the pH was close to that of vinegar. Standard liming practices will not correct this.

We have started to promote low-technology solutions from our work in South Sulawesi but it will be hard to get the message out to all the farmers and to convince them that the cost of additional, higher-grade lime will bring them longer-term benefits and reduce the risk of total crop failures.

We need more skilled people working in the community where they can directly advise farmers and demonstrate the neces-

**PARTNER COUNTRY:** Indonesia

**PROJECT:** Technical capacity building and research support for the reconstruction of tsunami-affected, brackish water aquaculture ponds in Aceh (FIS/2005/028)

**DESCRIPTION:** Training staff and developing strategies to support technical teams working with farmers in rebuilding aquaculture ponds for production

**CONTACT:** Dr Jes Sammut, j.sammut@unsw.edu.au





Dinas Perikanan technical team members sampling for acid sulfate soils in a damaged dyke.



Dinas Perikanan staff measuring the pH of soil before and after oxidation to determine the acid-generating capacity of the soils.

PHOTOS: JES SAMMUT

sary reconstruction methods. Demonstration sites will be established in collaboration with other agencies in different districts.

Although we have raised awareness of technical issues, in particular highlighting soil and disease problems and how to tackle them, getting the technical teams out into the community has been a challenge.

We trained several teams and equipped them with field sampling equipment, but the scale of the problem is enormous and staff are thinly spread. Team members also reported that they were still grieving and coming to terms with the impacts of the tsunami. Many are still homeless and picking up the pieces of their shattered lives. The pressures on staff are intense and there is a need to continue offering support.

By late 2005 the need for technical assistance from NGOs and farmers exceeded the capacity of the local fisheries staff and we seconded one of our Acehese team members, Mr Aliman, from another ACIAR project in South Sulawesi to Aceh to provide technical inputs while we developed a new training and capacity-building program.

Mr Aliman, from the Research Centre for Coastal Aquaculture in Maros, moved to Aceh, where his skills are desperately needed on the ground, in September 2005.

On his return he expressed an enthusiasm for the task ahead: "There is a lot to do – more than you can imagine – but you can see positive changes already. The farmers have a will to restart their businesses. There are thousands of kilometres of dykes to rebuild and this will take a long time," he said.

The UN's Food and Agriculture Organization (FAO) has initiated a farm cluster program to help facilitate the reconstruction efforts. This approach has already been applied by ACIAR in South Sulawesi through Dr Dick Callinan's disease management project. The program establishes small groups of farmers who can share resources and cooperate to rebuild farms, manage production systems and eventually to work together on the market end of their business.

We will target technical extension activities through the farm clusters. We will also help the FAO and the farm clusters to produce rehabilitation plans. We will provide pond and canal design criteria,

## TIDAL HYDROLOGY TEAMWORK

A new member of the project team, Mr Taruna from the Research Institute for Coastal Aquaculture in Maros, South Sulawesi, describes what he thinks of the project:

"Hydrology is an important factor to consider in reconstruction. Tidal hydrology will need to be considered for the design of the ponds and canals and pond management. There is no use in rebuilding dykes, ponds and canals if their dimensions are all wrong. There will be too much erosion and sedimentation and pond management will be difficult. We will be modelling tidal hydrology and producing tidal charts for the farm clusters. We have been writing computer programs to make it easier for consultants, NGOs and government officers to apply the hydrological data. The software is user-friendly and we will train people in its use.

"Being involved in the ACIAR programs is exciting for me. I learned a lot from past ACIAR projects and here I am, applying the information in one of the most challenging situations. Knowing you can make a difference is exciting. I feel privileged to be a part of this and I know my colleagues in South Sulawesi are very happy that our past research is being used. This is a good example of how Australia and Indonesia can achieve good results working together."

Damage to primary and secondary dykes has left many ponds exposed to air on every low tide since the tsunami. These soils are producing more acid than before the tsunami and if not properly managed will cause production losses when the ponds are rebuilt.



advise on the soil constraints and how to manage them, and also help to produce maps and plans.

Mr Taruna, an AusAID-funded Masters student at the University of New South Wales, has given up his spare time to help out by translating educational materials, authoring software and technical information and helping with the coordination of activities.

Some of the participants from the earlier ACIAR project stay in regular contact by email or text messages. They keep me up to date on how they are going personally and professionally. In between requests for technical information the participants share how they are feeling and rebuilding their lives.

At one of the workshops I asked the participants to write down their name, address and other contact details. One of them joked that for most of them their mobile number was their address; although said in jest, his comment was a reminder that most of them were left with nothing. ◀

# Supply chain overhaul

An ACIAR project has helped to improve efficiency and quality for small agricultural producers in Mindanao, reports Janet Lawrence

**PARTNER COUNTRY:** Philippines **PROJECT:** Positive impacts at farm-household, institutional and community levels, improved cooperative operations and better developed buyer-seller relationships **DESCRIPTION:** A project to demonstrate that the marketing system used by a group of farm families in Mindanao might be improved through the establishment of well-run producer cooperatives **CONTACT:** Roy Murray-Prior, r.murray-prior@curtin.edu.au

**O**n the island of Mindanao in the southern Philippines, farmers grow produce on the mountain slopes – largely potatoes, cabbages, tomatoes and other temperate vegetables that they sell both locally and beyond. Growing conditions are good; the area is free of typhoons, rainfall is regular and the soils are young.

However, farmers rarely receive a high price for their produce. Current market structures in the supply chain, little or no value-adding and high post-harvest losses result in generally poor prices.

What's more, vegetable farmers face strong competition in the supermarket sector from China. Consequently, farmers are poor and efforts to improve themselves through the formation of cooperatives have been largely unsuccessful.

Both the Philippine and Australian governments have focused their efforts on alleviating poverty in Mindanao, particularly in rural areas. ACIAR commissioned a project to find out how to improve the efficiency and quality management in vegetable supply chains in southern Mindanao. The project involved the Curtin University of Technology in Western Australia in partnership with the University of the Philippines in Mindanao.

Project leaders Dr Roy Murray-Prior and Professor Sylvia Concepcion steered a study of the supply chain for temperate vegetables from Kapatagan, on the slopes of Mount Apo near Davao, in southern Mindanao.

The study involved rapid appraisal, analysis of case studies and personal interviews with farmers, rural traders, wholesalers and retailers. The team conducted research and extension activities along the entire supply chain, from investigating the soils to consumer preferences, and determined the institutional changes needed for the new approaches to be successful.

The team found that farmers were unlikely to improve their incomes by focusing on the highly competitive 'wet' markets, as these markets did not provide sufficient premium for quality.

Wet markets are fresh-produce, local markets common throughout Asia.

The team also recognised that cooperatives were unlikely to be competitive in supplying wet markets because the existing system was efficient. Trials were initiated, designed to develop long-term buyer-seller relationships that would improve the efficiency of the supply chain and assist the flow of timely market information.



Growing conditions are good, but weaknesses in the supply chain have kept prices down.

## DISPELLING SOME POPULAR MYTHS

- ▶ **Pesticide use is a serious health risk to consumers:** residues were detected at relatively low levels and the pesticides used tended not to be associated with serious health problems. Beneficial insects were present.
- ▶ **Low crop productivity is due to use of low inputs:** on the contrary, it was often a case of excess inputs – not knowing how much to apply was the problem. Lime use has increased to overcome soil acidity, micronutrients are being applied, and applications of phosphorus, nitrogen and potash have decreased.
- ▶ **Farmers are being taken advantage of by financiers:** this was not a major issue. Farmers prefer to transact with market intermediaries who pay cash and with many traders to choose from, they may also trade opportunistically.
- ▶ **Market information is lacking:** farmers talk among themselves, and information on prevailing market prices is widely known. Farmers' main problem until now has been their incapacity to respond. However, knowledge of alternative marketing systems to the 'wet' market was poor, and this is now being addressed.

A key component of the project was the encouragement and support it provided to farmer groups and cooperatives. Results can be seen in the improved operations of the Vegetable Industry Council of Southern Mindanao, the Kapatagan Livelihood Development Cooperative (which was the only remaining cooperative when the project began and was on the verge of collapse) and the establishment of Maharlika Farmers' Cooperative and Kapatagan Upland Farmers' Development Cooperative.

"The positive impacts of the project are apparent at both the farm-household, institutional and community levels," Dr Murray-Prior says. "Farm households are changing their agronomic and mar-

keting practices because they realise this is the way to lift incomes."

The good news is that farmers who are members of cooperatives or who participated in the workshops now have higher incomes than farmers without direct involvement in the project. Maharlika Cooperative has lifted prices paid to farmers and improved their growing practices.

Project members from the University of the Philippines in Mindanao have improved skills in supply-chain analysis. This is recognised through their involvement in Mindanao Policy Review Forums, in drawing up policy recommendations for the President, and also their participation in Mindanao Vegetable Congresses. ◀

# Fruits of the forest farmed

By Roger Leakey

**M**any non-timber forest products such as fruits, nuts, medicinal products, fibres and gums, which have been traditionally collected from forests, are now being grown by farmers for domestic use and sale. They generate income for poor households when sold in local or regional markets. When used domestically they provide valuable nutrition and health products.

The agricultural revolution had labelled these products of minor importance. Nevertheless, in many places around the world, rural people know the value of species that provide many of their daily needs for everyday products. About 1.5 billion people (24 per cent of the world's population) are thought to use non-timber forest products, indicating that perhaps they are not so minor after all.

As forests have been cleared in areas with high population density, subsistence farmers have initiated their own silent revolution and started cultivating and domesticating these useful plants – species such as marula, damar, shea nut, African plum and galip or ngali nut.

To distinguish them from other resources extracted from natural forests, these plants are now recognised as new crop species, providing agroforestry tree products.

In acknowledgement of the importance of these products, domestication programs have been initiated for a number of species in several eco-regions of the tropics. An important approach has been participatory domestication, which involves local communities in selection and improvement to capture their traditional knowledge and, in particular, their knowledge of variation in important traits.

This process is based on measuring tree-to-tree variation in fruit or kernel shape and size, properties of the tree products as food additives and the sensory (taste and smell) properties of the tree products, targeted at specific market opportunities.

ACIAR has been involved in two projects on indigenous nuts in the Pacific region. Richard Pauku recently submitted his PhD thesis, undertaken with the support of a John Allwright Fellowship, on domestication of pau and Tahitian chestnut in the Solomon Islands.

The other project involved galip/ngali nut in Papua New Guinea and the Solomon Islands. Domestication of high-value and multipurpose tree species is a key element of ACIAR's forestry



Galip/ngali nut – one of the indigenous species being domesticated.



ROGER LEAKY

strategy for Papua New Guinea and the Pacific. The forestry program also manages domestication projects on sandalwood in Vanuatu, and on PNG walnut, callophyllum, taun, sandalwood and other species in Papua New Guinea.

This global initiative to domesticate the indigenous trees producing these agroforestry products enhances opportunities for subsistence farmers to generate income to meet their needs for food, medicines, children's school fees, agricultural inputs and other daily needs.

In this way it contributes to global efforts to meet the UN Millennium Development Goals. However, for this to become a reality, it is essential that domestication works in parallel with market development. This combined focus is a specific aim of ACIAR's ngali nut project, as a number of previous attempts to promote this species have failed due to differences in supply and demand.

Ideally, initiatives like this involve partnership with commercial companies, but this raises the issue of ensuring indigenous communities are the clear beneficiaries.

The participatory domestication process empowers communities to protect their traditional knowledge, but in many developing countries the legal instruments for them to protect intellectual property rights, for example by the registration of Plant Breeders' Rights, needs either to be enacted or reformed.

Thus, if the overall development aims are to be achieved, what starts as a biological study has to be integrated with commerce and policy, and also training and skills development. ◀

*Professor Leakey is head of the Agroforestry and Novel Crops Unit, School of Tropical Biology, James Cook University, Cairns, Australia.*

## Fellowship winner begins sandalwood research

An ACIAR project working to stimulate the development of the emerging sandalwood oil industry through genetic improvement of sandalwood trees has been enhanced through the latest John Allwright Fellowship awards. One of the latest recipients is Hanington Tate, the leader of the ACIAR sandalwood project in Vanuatu.

In February 2006, Mr Tate began studying for a Masters degree in Tropical Plant Science at James Cook University under the supervision of ACIAR project leader Roger Leakey. The title of his thesis is 'Domestication of sandalwood (*Santalum austrocaledonicum*) for agroforestry in Vanuatu.'

"My proposed study will focus on biological investigations of sandalwood that will contribute valuable information for use in its domestication in Vanuatu, and will have wider implications for domestication of other sandalwood species," Mr Tate says.

Produced from the heartwood of sandalwood trees, sandalwood oil is a valuable commodity that is widely used in perfumes, medicines and incense. Sandalwood has been and will continue to be an important high-value product in many remote areas in Vanuatu, where it grows naturally.

"To ensure that investment is worthwhile, it is most important that the economic analysis of *S. austrocaledonicum*, which is the main sandalwood species grown in Vanuatu, is well undertaken," he says.

Mr Tate's Masters project will build on the domestication strategy for the ACIAR project through investigating current breeding systems of *Santalum* in Vanuatu and identifying optimum vegetative propagation.

Mr Tate has worked for the Vanuatu Department of Forests for the past 10 years, most recently as the acting Director of Forests (Policy and Planning).

The ACIAR Fellowships Scheme was introduced in 1986 to provide the opportunity for partner country scientists involved in ACIAR-supported collaborative research projects to obtain postgraduate qualifications at Australian tertiary institutions. The primary aim of the scheme is to enhance research capacity in ACIAR's partner country institutions. Postgraduate studies undertaken by each award recipient are based on the research work being carried out under the collaborative research project in which the award recipient is engaged prior to taking up the award.

For information about applying for a fellowship, contact Sharon Harvey, [harvey@aciar.gov.au](mailto:harvey@aciar.gov.au) or visit [www.aciar.gov.au](http://www.aciar.gov.au)

## Australia Day honour for John Copland

ACIAR research program manager Dr John Copland was recognised in the 2006 Australia Day honours. He has been made an Officer in the Order of Australia for service to veterinary science, particularly in the areas of veterinary parasitology and fish pathology, and the application of this research to agricultural programs in developing countries.

In recent years, Dr Copland's program has been responsible for animal health and production projects including major successful projects on rodent control in Southeast Asia, and developing a thermotolerant vaccine for Newcastle Disease for village and commercial poultry production systems. This vaccine has been widely adopted in Africa and Southeast Asia.

Dr Copland, who is taking pre-retirement leave from ACIAR, is well known among animal health and production researchers in Asia and Australia. He joined ACIAR in 1983 as the first research program coordinator for livestock and later established

Dr John Copland



Roger Leakey and Hanington Tate

the ACIAR fisheries program, which had a major emphasis on management of the giant clam and the management of coconut crabs and bait fish for the tuna fisheries in the South Pacific. In addition, he laid the foundations for the second livestock program in ACIAR. From 1990 to 1992 he took leave of absence and was based in Indonesia where he carried out an agricultural sector review for AIDAB and a variety of assignments, including a risk assessment on the introduction of exotic fish species in Papua New Guinea for FAO and lecturing on fish quarantine at the Universiti Pertanian, Malaysia.

Dr Copland has been actively involved in a number of Australian and international committees and societies and was a reviewer for several international journals. Among his awards and honours are the PNG Independence Medal in 1976, the AIDAB Award in 1988 for Excellence (jointly with Professor Peter Spradbrow from the University of Queensland), and the 1996 Kesteven Medal for International Animal Health Research and Development. He has a Bachelor of Veterinary Science and a PhD from the University of Sydney, as well as a Master of Science (Aquaculture) from the University of Stirling, UK. In 1979, he was awarded the Royal Highlands and Pastoral Society Medal and the Maudsley-Thomas Prize for fish pathology and was a Nuffield Scholar.

Before joining ACIAR, Dr Copland spent seven years in the livestock sector in PNG and returned to Australia in 1976 to set up the North East Regional Veterinary Laboratory in Victoria as the foundation director. In 1980 he established at Benalla, Victoria, the National Fish Health Reference Laboratory in Australia.

## Participatory Agricultural Extension in the Pacific

An 'Extension Summit' held in Tonga in November 2005 brought together a wide array of policy and extension decision-makers in governments, regional organisations, tertiary institutions, NGOs and private sector organisations in Pacific Island countries and territories. The main purpose was to assess the successes of participatory approaches in the region and to contribute to generating support for participatory agricultural research and extension, recognising that, to be effective, extension agencies and officials need to adjust their management and methods of delivering services.

ACIAR senior adviser Dr Simon Hearn presented a paper on lessons learnt from the use of information and communication technologies (ICTs) in agricultural extension. The paper drew on Australian experience and looked at how the lessons learnt might be applied in a developing country context, examining both new and more traditional systems of ICT. Examples of work on ICT being undertaken in ACIAR projects were also provided.

The approach of the conference was to listen to the experiences of Pacific countries, examine the extension problems and limitations and develop recommendations for moving forward in this important area.

The essential element of participatory agricultural research and extension is the facilitation of learning processes in rural communities by empowering people to make decisions about improvements to their own livelihood, through activities such as farmer field schools, participatory technology development and participatory plant breeding.

The impact and utilisation of this approach in the Pacific has been limited. Most Pacific countries still rely on the traditional delivery systems of extension services on a linear or top-down transfer basis.

Conference proceedings illustrated that progress is unlikely to occur without significant intervention and partnerships between governments, NGOs and private sector organisations. The enthusiasm for improved extension (while not surprising among extension workers) was the main positive from the conference. The lack of funding and coordination, as well as unconstructive differences between government extension services and NGOs, were the main negatives, according to Dr Hearn.

A coordinating group has been established to follow up conference deliberations and design a plan for the future. ACIAR will maintain contact with this group, not least because the summit has underlined the critical importance for ACIAR and other research organisations of securing improved extension to maximise the scope for research adoption and effective project development in the future.

## 'Seeds of Life 2' project launched in Dili

"Australian assistance is going to make a real difference to agriculture in this country," said East Timor's Minister for Agriculture, Forestry and Fisheries, Senhor Estanislau da Silva, at the launch of the new 'Seeds of Life 2' project in Dili recently. The new project, funded by the Australian Government, is a five-year, A\$7 million project that will work in the Ministry of Agriculture, Forestry and Fisheries to improve food security in East Timor through the use of improved crop varieties and associated technologies to result in increased food production.

The focus of the project is on major food crops such as maize, sweet potato and cassava, and on upland and dryland agriculture in particular, which face the biggest food security challenges. These are major priorities in the Ministry of Agriculture, Forestry and Fisheries Policy and Strategic Framework.

The project is jointly funded by AusAID and ACIAR in partnership with the Centre for Legumes in Mediterranean Agriculture (CLIMA).

"The new seeds from this project will help the people of Timor-Leste feed themselves," said Ms Margaret Twomey, the Australian Ambassador in Timor-Leste.

"The project will ensure the new improved varieties are thoroughly tested against the standards that mean the most for the Timorese – such as reliability and taste. Everything will be tested in real farm conditions."

## Stakeholder survey

ACIAR has recently published the results of a survey of its Australian stakeholders and the ACIAR response. The survey, carried out by Professor Tim Reeves and Professor Graeme Robertson, involved interviews with 61 stakeholders from the government, industry and research sectors, using a pre-designed questionnaire.

The questions and related discussion were based on six key strategic themes: ACIAR's role and performance; operating environment; developing and managing projects; prioritisation of R&D agenda; ACIAR's resource allocations; and research adoption and communication. The feedback generated from the survey,



The Minister for Agriculture, Forestry and Fisheries, Estanislau da Silva, at the Seeds of Life 2 project launch in Dili.

# ROUNDUP

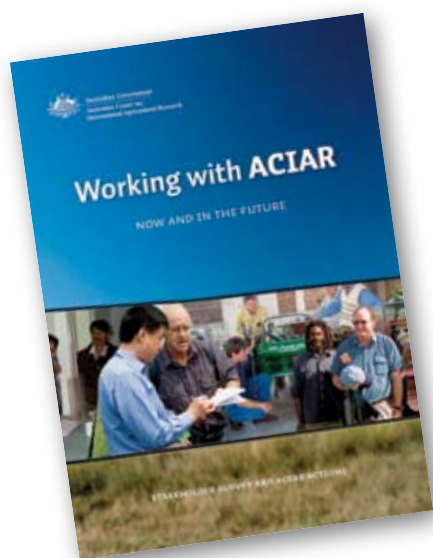
together with a range of recommendations for the improvement of future directions and operations, was delivered in November 2005. ACIAR has addressed the views and recommendations provided by the survey and designed an action plan in response.

According to the stakeholders interviewed, ACIAR has an impact in partner countries well in excess of resources applied and communicates very well with those overseas partners. Many Australian stakeholders benefited from their partnership with ACIAR, through development of an international perspective and associated staff development and science linkages.

While, overall, stakeholders believe that ACIAR has developed an outstanding reputation for achieving project outcomes that have made a positive impact in developing countries and contributed significantly to Australia's interests, some areas were identified where improvements could be made. These mainly focused on improving the transparency of the project selection process and communication with Australian stakeholders in setting strategic directions and priorities.

These suggestions and recommendations form the basis of the management action plan.

To see the report *Working with ACIAR now and in the future*, visit [www.aciar.gov.au](http://www.aciar.gov.au). For a printed copy of the report, contact [comms@aciarc.gov.au](mailto:comms@aciarc.gov.au)



## NEW APPOINTMENTS

### Les Baxter

Research program manager for ACIAR's new horticulture program is Mr Les Baxter. Les has a Bachelors degree in horticulture with first-class honours, two Masters degrees (Research Masters in agriculture and a MBA), a Postgraduate Diploma in law and a Company Directors Diploma. He has wide experience across the total supply chain from production, crop protection, processing through to marketing and more than 20 years experience in horticulture and related industries, with 11 of those years working in research and development.

Mr Baxter began his career in industry as a research agronomist and has worked for both the Queensland Department of Primary Industries and Fisheries and the Tasmanian Department of Primary Industry and Fisheries as a researcher and research manager, rising to the position of manager of the horticulture branch. In mid-1997, Les was appointed program manager at the (then) Australian Horticultural R&D Corporation and from January 2000 to mid-2001 was its acting chief executive. Over the past five years, Les has worked in senior management roles with IDP Education Australia, AusIndustry and the Illawarra Technology Corporation.

The horticulture program is expected to have a primary geographic focus in South Asia (including the Pakistan Agriculture Sector Linkages Program), the Philippines, the Pacific, Laos and Cambodia.



### Executive Assistant/ Training Project Officer

Mrs Cherree Webeck has also started working at ACIAR in a new position as executive assistant/ training project officer. As well as being executive assistant to the deputy director, Cherree is providing support in the training program.

Before joining ACIAR, Cherree worked as office manager for the ACT Independent Competition and Regulatory Commission, where she also had responsibility for improving records management and managed the website. Prior to that she had worked as an executive assistant for the Maltese High Commissioner to Canberra.

In the 1990s, she worked as office manager/correspondence specialist for the USDA counsellor at the American Embassy in Canberra, and in Western Australia provided administrative support for the Department of Conservation and Land Management.



# ROUNDUP

## NEW PROJECTS

ADP/2005/006	Scoping study on trade policy reform in Vietnam
ASEM/2004/041	Productivity and marketing enhancement for peanuts in Papua New Guinea and Australia
FIS/2002/076	Land capability assessment and classification for sustainable pond-based aquaculture systems
FST/2002/112	Domestication of <i>Meliaceae</i> species in Southeast Asia and Australia, particularly management of the problem of <i>Hypsipyla robusta</i> attack
HORT/2004/063	Integrated pest management in a sustainable production system for Brassica crops in Fiji and Samoa
HORT/2003/045	Improvement of vegetable production and post-harvest management systems in Cambodia and Australia
PLIA/2005/148	Papua New Guinea coffee and cocoa policy linkages scoping study
SMCN/2004/035	Technology for direct drilling into rice and other heavy stubbles in Pakistan and Australia

## NEW PUBLICATIONS

### Monographs

#### Better-practice approaches for culture-based fisheries development in Asia

Culture-based fisheries are an effective way of increasing supplies of fish in rural areas. Farmers with relatively little experience in fish culture can productively engage, manage and benefit from culture-based fisheries around lakes and reservoirs. This manual will provide guidance to development workers and program planners for integrating community based fisheries into rural development plans. The manual is being translated into Laotian by the Mekong River Commission. Sena De Silva, Upali Amarasinghe and Thuy Nguyen (eds). ACIAR Monograph 120, \$24 (plus postage and handling).

#### EXTRACT:

What is the 'better practice approach' and why is it needed?

It is important to outline the major factors causing some nations to fail in their attempts to popularise culture-based fisheries. These factors could be common to most nations planning to develop culture-based fisheries as a rural fish production strategy.

Some of the factors that contributed to previous failures:

- ▶ lack of sufficient and effective community consultations;
- ▶ lack of cooperation and/or consultation among multiple users of the water bodies, often leading to conflicts among the users and government authorities;
- ▶ unavailability of suitable seed stock, often a problem of timing to coincide

with periodic filling of the water bodies;

- ▶ lack of suitable preparation of the water bodies prior to stocking, for example, removal of unwanted fish, including carnivorous species;
- ▶ ineffective training of potential fish farmers;
- ▶ heavily subsidised developments;
- ▶ inadequate and inappropriate legislation; and
- ▶ poor marketing strategies

The better-practice approach takes these reasons into account, along with recently accumulated scientific, social, and economic knowledge on culture-based fisheries. This approach also provides a comprehensive and pragmatic strategy to successfully develop culture-based fisheries in rural Asia as an important and significant fish production strategy.

### Proceedings

#### Evaluation and performance of permanent raised-bed cropping systems in Asia, Australia and Mexico

Permanent raised-bed cropping systems are being adopted under a wide range of irrigated and dryland farming conditions. ACIAR has supported research into permanent raised-bed systems in Asia and Australia. Results from these projects and other research were presented at a workshop in 2005. The papers in this proceedings bring together the work that was presented at the workshop and provide a valuable resource for researchers and practitioners of permanent raised-bed cropping systems. C H Roth, R A Fischer and C A Meisner (eds). ACIAR Proceedings 121, \$28 (plus postage and handling).

### Impact Assessment Series

#### Management of fruit flies in the Pacific

Economic analysis of project benefits and costs suggests that the total investment in fruit fly research will deliver considerable benefits, mainly to Fiji, but also to Tonga, Samoa, the Cook Islands and Vanuatu. Ross McLeod. ACIAR Impact Assessment Series No. 37

### Working papers

#### Economics and marketing of the live reef fish trade in Asia-Pacific

Papers from a workshop to examine the status of the live reef fish trade and the issues faced by the various countries involved. Brian Johnston and Being Yeeting (eds). ACIAR Working Paper 60.

The impact assessment series and working papers are freely available as pdf files at [www.aciar.gov.au](http://www.aciar.gov.au)

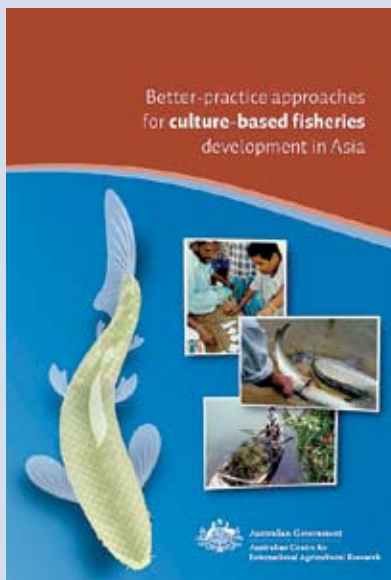
ACIAR's distribution policy is to provide complimentary copies of its publications to libraries, institutions, researchers and administrators in developing countries with an involvement in agriculture and to any scientist involved in an ACIAR project.

## PLEASE WRITE TO:

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## ACIAR'S VISION

ACIAR looks to a world where poverty has been reduced and the livelihoods of many improved through more productive and sustainable agriculture emerging from collaborative international research.



The Australian Centre for International Agricultural Research (ACIAR) operates as part of Australia's international development cooperation program, with a mission to achieve more productive and sustainable agricultural systems, for the benefit of developing countries and Australia. ACIAR commissions collaborative research between Australian and developing country researchers in areas where Australia has special research competence. It also administers Australia's contribution to the International Agricultural Research Centres.