Australian Government

Australian Centre for International Agricultural Research

30th ANNIVERSARY 2012

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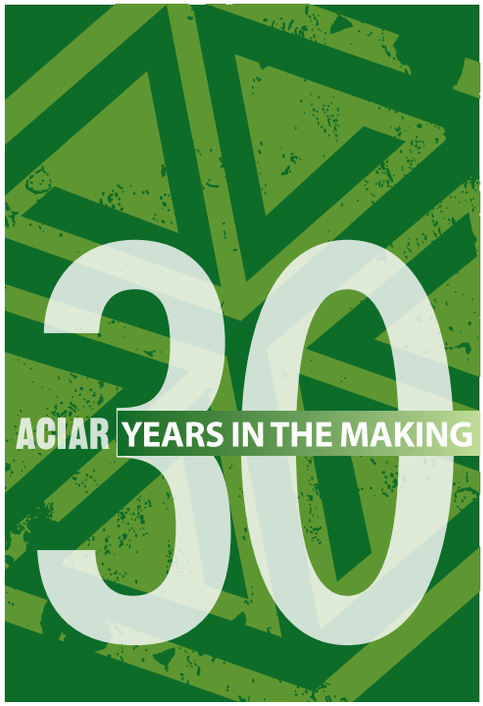
partners

IN RESEARCH FOR DEVELOPMENT

30

ACIAR YEARS IN THE MAKING



This issue…

The idea of a centre to use Australian agricultural expertise to benefit developing countries dates back to the 1970s. ACIAR commenced operations in 1982 and has worked in the Asia-Pacific region and Africa since that time.

This edition of *Partners* celebrates 30 years of achievements, drawing on and reprinting past articles to retell some of our best stories. It also tells the history of ACIAR through the eyes of some former employees as well as contributors and writers involved in producing *Partners*.

We are proud of our achievements, of $31.9 billion in benefits accruing from some of our most successful projects, and of our continuing role in helping smallholders take steps to transform their lives from hunger and poverty to food security and prosperity.

ACIAR would like to thank everyone involved in the delivery of these outcomes, all our projects and the amount of good we have been able to do in the developing world over 30 years.

ACIAR
aciar.gov.au

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Partners in Research for Development is the flagship publication of the Australian Centre for International Agricultural Research (ACIAR). Partners presents articles that summarise results from ACIAR-sponsored research projects and puts ACIAR research initiatives into perspective. Technical inquiries 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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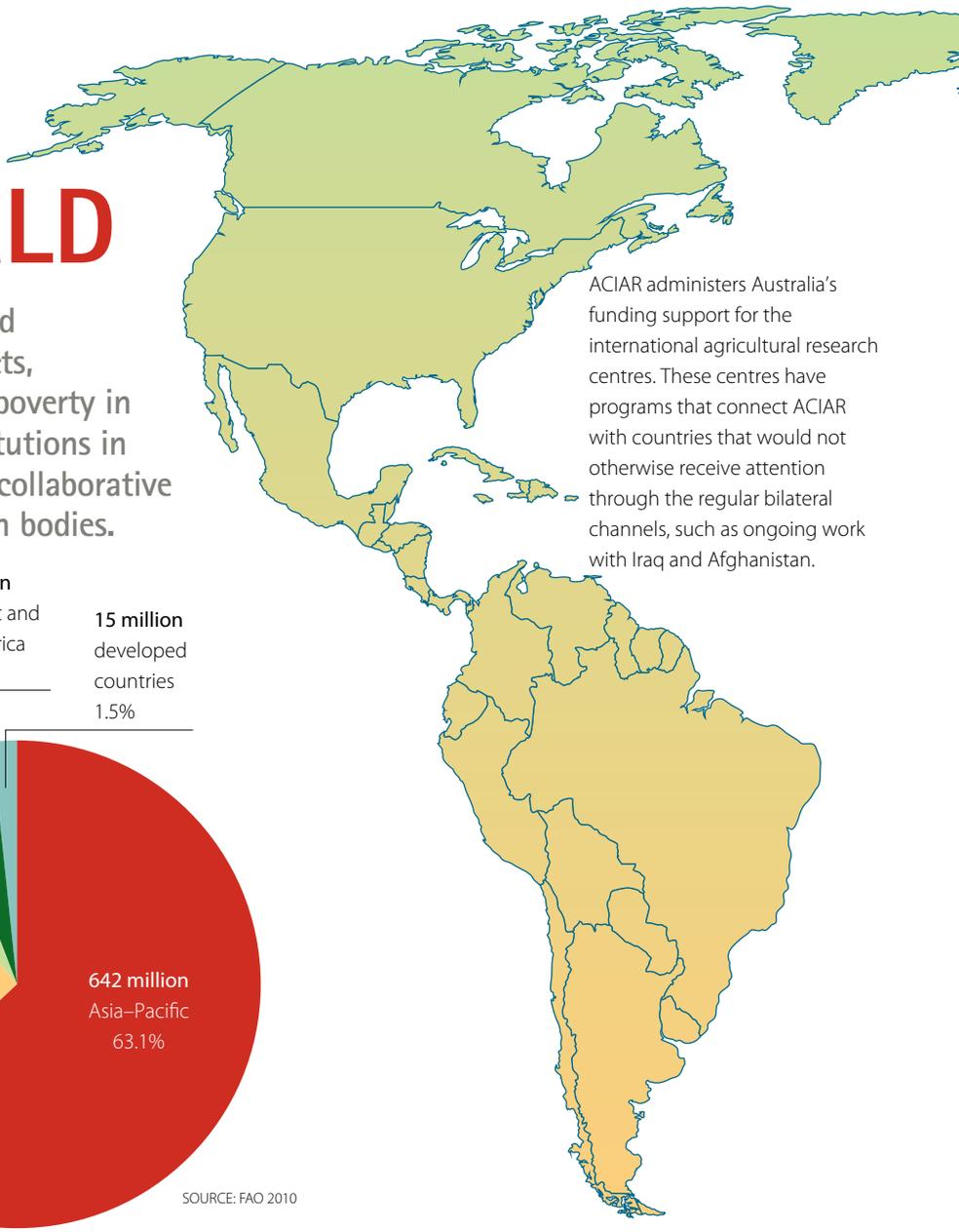
ACIAR's PRESENCE IN THE WORLD

Since 1982 ACIAR has commissioned and managed more than 600 research projects, with a bilateral focus on reducing rural poverty in some 30 countries. More than 150 institutions in partner countries have been involved in collaborative projects with over 50 Australian research bodies.



ACIAR administers Australia's funding support for the international agricultural research centres. These centres have programs that connect ACIAR with countries that would not otherwise receive attention through the regular bilateral channels, such as ongoing work with Iraq and Afghanistan.

There are more than 1 billlion hungry people in the world.

65% of the world's hungry live in only 7 countries: India, China, the Democratic Republic of Congo, Bangladesh, Indonesia, Pakistan and Ethiopia.

SOURCE: FAO 2010

15%

Today 15% of people—about 1 billion—live in extreme poverty. This is down from 40% 50 years ago before the Green Revolution.

138%

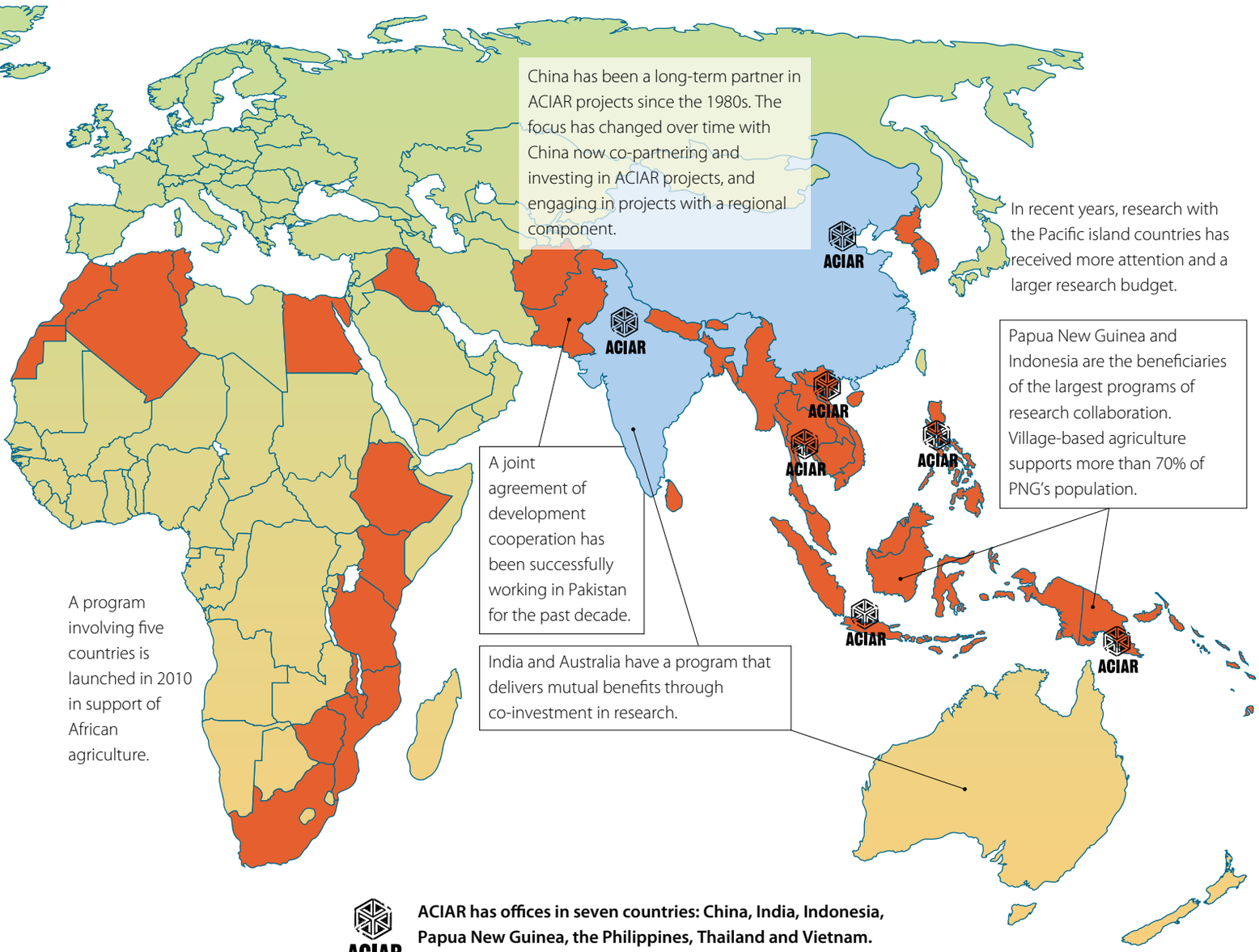
During the past 50 years, agricultural R&D has been pivotal in lifting gross world food productivity by 138%: from 1.84 billion tonnes to 4.38 billion tonnes.

50%

Innovation associated with the Green Revolution helped increase food intake by as much as 50% and reduced the price of wheat by two-thirds.

$3b

In total, only $3 billion a year is spent on researching the seven most important crops. This includes $1.5 billion spent by countries, $1.2 billion by private companies and $300 million by the Consultative Group on International Agricultural Research (CGIAR).



ACIAR has offices in seven countries: China, India, Indonesia, Papua New Guinea, the Philippines, Thailand and Vietnam. The China office also looks after the DPR Korea; and India has regional responsibilities for South Asia, and Thailand for Cambodia, Laos and Burma.

$1.20

More than 350 million rural people have pulled themselves out of extreme poverty over the past 10 years. The percentage of the world's rural inhabitants living on less than $1.20 a day has dropped from nearly half to about one-third.

More

Higher food prices saw the number of undernourished people in the world increase by 75 million in 2007 and 40 million in 2008.

$1

Recent studies found that food prices paid by the poor in developing countries are much higher that previously thought. They cannot buy as much food with $1 as they can in a country like the US, indicating greater poverty than reported in earlier studies.

8m

Eight million people die from lack of food and nutrition every year—about 24,000 deaths each day.

SOURCE: WORLD BANK, FAO, INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

Kajiado District, Kenya—2 February 2012: Maasai Goat Distribution in Africa. The Maasai, traditionally pastoralists, have struggled for years to redefine themselves in light of reduced grazing land, pressure to abandon their nomadic way of life and increasingly unpredictable weather patterns. Before group members could receive the goats, the partners required them to plan and implement their own activities, such as repairing community roads or caring for group farms. Each member is eligible to receive up to five goats. The group helps to pay for the goats, using a graduated fee system.

OUR COMMON HUMANITY

ACIAR's 30th anniversary coincides with a renaissance in Australia's aid program, which is allowing new ideas, investment and capacity to better leverage Australia's scientific expertise in agriculture for global food security.

BY WARREN PAGE

Australia's foreign policy advances and protects our national interest. The Foreign Minister, Senator Bob Carr, defined this interest, in part, as being an exemplary global citizen when it comes to protecting human rights. The most basic of these rights is freedom from hunger.

Yet one in seven people lack sufficient nourishment daily.

Australia is a leader in seeking answers to this problem. We are the world's fourth-largest country donor to the food security crisis in the Horn of Africa, providing nearly $100 million in humanitarian assistance.

We are committed to fulfilling our obligations as a developed country, delivering effective aid to those in need. The fundamental purpose of Australian aid is to help people in developing countries overcome poverty. Close to home, Australia provides half of all global official development assistance to Papua New Guinea and the Pacific islands.

Our aid covers a range of themes, from helping the most vulnerable—women and children, the disabled—to building governance systems and infrastructure.

As Senator Carr said in his maiden Parliamentary speech, foreign policy is about helping the overlap of cultures, celebrating diversity while building tolerance. Australia is a multicultural nation.

This allows us to bring together ideas and values about equality of opportunity for all, including the opportunity of a better life and the right to food security.

Recently Australia's aid program underwent a comprehensive review, to ensure that our aid is delivered effectively and efficiently. The review, commissioned by the former Foreign Minister, Kevin Rudd, recommended ways to improve aid delivery.

Australia's aid program is guided by five strategic goals, as set out in the Government's formal response to the aid review, *An Effective Aid Program for Australia: Making a real difference—delivering real results*.

The strategic goals of the aid program are:

- saving lives
- promoting opportunities for all
- sustainable economic development
- effective governance, and
- humanitarian and disaster response.

As Senator Carr says in the *Comprehensive Aid Policy Framework*, despite the wealth,

PHOTO: iSTOCKPHOTO.COM

knowledge and technology at our disposal in 2012, the lives of 1.3 billion people are still spent in extreme poverty. Scientific advancement is one component of promoting development across the aid program's strategic goals, particularly in Australia's immediate region.

This science element has been reflected in Australia since 1982, providing the developing world access to Australian agricultural expertise through ACIAR.

ACIAR transfers Australia's creativity and expert knowledge in the field of agriculture to smallholder farmers. It taps into the innovation that is at the heart of Australian agriculture. We live on the driest inhabited continent yet produce enough food to feed 60 million people and contribute to the diets of another 400 million.

The partnership model sends Australian scientists into the field to work with their in-country counterparts to find solutions to problems constraining smallholder production.

These partnerships are building sustainable solutions, using agricultural expertise as an investment in developing country agricultural systems and as an investment in the capability of people.

An ACIAR project in Vietnam to produce oysters from hatchery seed has, in the space of three years, resulted in production of cultured oysters rising from virtually zero to an estimated 5,000 tonnes.

Around 200 smallholders plus three larger farmers started cultivating oysters using hatchery seed from the National Marine Broodstock Centre in Vietnam. Oysters are easier to manage than some other species because they do not need feeding, cutting input costs. They earn a farm-gate price in Vietnam of about A$1.40 a kilogram.

Among the smallholders who have adopted the new technology is Pham Thi Lieu. "We have been able to afford a new house, which we built two years ago," Pham Thi Lieu says. "Now we're using our profits to expand our farm. If I have any extra money I will save it for my children and grandchildren.'

Most smallholders are growing their oysters tied to a line and slung beneath rafts. Locals say the filter feeders thrive in the warm nutrient-rich waters, growing from a spat (juvenile) to a commercially acceptable mollusc in less than 12 months.

It is an investment in productivity that generates surpluses and opens markets. This kind of support to East Timor has already helped 12,000 farmers increase yields of rice, maize, sweet potato, cassava and peanut crops by up to 80%.

Improved productivity helps families educate their children, access health care and invest in their farms. It is delivering on the promise of the Millennium Development Goals to lift half the world's poor out of hunger and poverty, and extend to them the opportunities we believe are basic rights.

Most importantly, it is an investment that also pays off. Independent impact assessments of 130 ACIAR projects have demonstrated estimated total benefits of A$31.6 billion, with $29.4 billion of these benefits flowing directly to developing countries.

In a recent speech Senator Carr referenced former US President Bill Clinton's words: "Our differences make us interesting. Our common humanity is more important." Australian aid focuses on furthering the hopes and dreams common to all, of a better life, a future for our children, of human rights and dignity that begins with life's essentials.

These values are not uniquely Australian. They transfer so well to smallholder farmers, scientists and policy makers in the countries where ACIAR operates because they are universal.

The world has seen how the combination of people hungry for food and for freedom can transform the face of nations. In North Africa, rising food prices contributed to the Arab spring. In the Horn of Africa, hungry people are on the move in search of sustenance.

These examples show the reality that it is not possible to have true freedom while living in hunger.

This is why the work of ACIAR is important and why the Australian Government continues to commit to the advancement of food security. The creation of the Australian International Food Security Centre, within ACIAR, will continue to apply Australian creativity to achieving food security. ■

PHOTO: ROSS BIRD

José Ramos-Horta

Timor Leste benefits from our partnership with Australia

East Timor's former President and Nobel Peace Prize recipient José Ramos-Horta looks back at the role agricultural science has played in East Timor's recovery since achieving independence in 2002.

Timor Leste has experienced robust, double-figure economic growth in recent years and our budget surplus is about 300% of GDP. This should be viewed within the perspective of our journey from a Least Developed Country to a Middle Income Country.

Achieving this growth has been the result of a mix of policy options: investment by the Government in public infrastructure, cash transfers to the poorest of our people and investment in agricultural equipment. Much of the credit for the successes to date is also due to the astute management of our Petroleum Fund; the Extractive Industries Transparency Initiative ranks Timor Leste's management as number one in Asia.

Investment in agriculture is vital to achieving our goal of food security within the next five to 10 years. This is a key foundation needed to build a modern, diversified economy that is not wholly reliant on extracting our petroleum and mineral wealth.

The key challenges in agricultural policy are improving productivity per hectare and expanding areas of farmland. Timor Leste cannot achieve this first aim on its own. Bilateral support from a number of countries is essential.

Agriculture accounts for around one-third of our economy. However, 90% of our population of 1.1 million people rely on agriculture for employment. For many of these people the challenge is moving beyond subsistence farming to producing surpluses. The journey to a modern economy cannot occur until we are able to achieve lasting food security, freeing up labour for other industries.

Australia has played a leading role in helping begin this important transition in agriculture. The relationship between our countries is strong. We have had our differences, but remain good friends.

One of the most pleasing aspects of this friendship is the provision of strategic aid to areas where it is most needed, particularly agriculture. Australia's resolve to increase its aid program, as part of its promised commitment to the United Nations Millennium Development Goals, is welcomed by Timor Leste, which remains a beneficiary of that decision.

Australia's support for Timor Leste has played an important role in helping overcome the sense of fragility that followed independence and threatened the confidence of our people in our institutions. Today that fragility is being replaced by a cautious, but growing sense of optimism.

The expansion of improved productivity in agriculture is part of that optimism. There is no more basic human institution than food security. Helping people have enough to eat is the foundation of confidence in all other institutions.

So too is the belief amongst our people that we can grow without exploiting our petroleum and mineral wealth in the short term, at the expense of long-term growth and sustainability.

A key component of this improved agricultural productivity is the Australian aid delivered through the Seeds of Life program. This program dates back to our first year as an independent nation. The Australian Centre for International Agricultural Research (ACIAR) recognised the need to improve our staple crop production and designed a research program to help identify those crop varieties.

In the past nine years, nine new staple crop varieties—adapted to growing conditions in Timor Leste—have been released. The Seeds of Life program has grown, with ACIAR and AusAID now co-funding a partnership with our Ministry of Agriculture, Forestry and Fisheries.

The benefits have flowed throughout the country. New varieties are helping farmers grow surpluses. These are helping to create markets, tapping into an entrepreneurial spirit amongst our young population. Families achieving these surpluses are reporting that they no longer have extended periods of hunger, nor do children miss out on education because they are helping forage for food.

One of the greatest challenges facing the Government is education. It is one of our top priorities. We are providing dozens of scholarships to our students to study in Australia and elsewhere. The aim is a highly educated young population able to compete regionally and internationally.

ACIAR and AusAID have helped through the provision of training and scholarships, including for scientists involved in the Seeds of Life program. One of the reasons for the widespread success of Seeds of Life is its commitment to educating our agricultural scientists so that we are not dependent on foreign expertise.

The next step in that process is the signing of the first trilateral aid initiative between Timor Leste, Australia and Indonesia. We have requested this cooperation as it helps build stronger ties with our closest neighbours and allows Timor Leste to benefit from Indonesian as well as Australian expertise.

This relationship will address some common agricultural problems. It is important in marking the next phase in the transition from subsistence agriculture to food security. Through Australian support we are moving beyond a focus on the most basic elements of food security, to those problems limiting further increases in production.

Australia's role in this transition has been a small, strategic and consistent factor in the growth of our young nation. As we continue our journey towards a Middle Income Country competing in our region and beyond, the friendship we share with Australia will remain important. ■

ACIAR's CEO Dr Nick Austin visits aquaculture projects in Indonesia.

Food prosperity for all

ACIAR's chief executive officer, Nick Austin, discusses Australia's role in the use of agricultural science as a lynchpin for development—via the transition from subsistence to food security to tradable surplus.

When Commonwealth leaders met in Australia in 1981, one of the great foreign policy challenges of the time was discussed—food security. Thirty years later, in 2011, the same issue was again a feature when Commonwealth leaders gathered in Perth.

Since that first meeting, there have been impressive strides in addressing hunger: world crop production has increased by more than 50%. Yet the number of hungry people in the world has increased. Roughly one in seven people lack sufficient nourishment.

And the problem will be compounded as the world's population grows to an anticipated 9 billion people over the next 40 years. That is an extra 2 billion people to feed, mainly in the developing world. Today, 1 billion already suffer chronic hunger.

As recent events have shown, hungry people can change the face of nations. In North Africa, rising food prices contributed to the Arab spring. In the Horn of Africa, hungry people are desperate people who move in search of sustenance.

Most of the world's food-insecure are themselves farmers. Three-quarters of the world's poor and food-insecure live in rural areas and rely directly or indirectly on agriculture for their livelihoods.

Agriculture can be a fundamental driver of economic growth and, in turn, poverty alleviation. No country has been able to transition out of poverty without raising productivity in its agricultural sector.

World Bank research indicates agricultural productivity growth is twice as effective in reducing poverty as growth in other sectors of the economy. The World Bank also estimates that a 1% increase in agricultural yields leads to a 0.6–1.2% reduction in people living below US$1 per day.

Agricultural productivity growth is one of the basic building blocks of food security and is wholly reliant on research, development and innovation.

But rates of productivity growth around the world are slowing.

Australia is uniquely placed to help reverse the decline in agricultural productivity. We share the range of environments found in the developing regions of the world, from arid to temperate to tropical. We are a food-exporting country. Our success is built on agricultural research.

Australia has been sharing its expertise with the developing world since 1982 through the Australian Centre for International Agricultural Research (ACIAR). Our origins are firmly grounded in Australia's foreign policy.

It was in the lead-up to the Commonwealth Heads of Government meeting in Melbourne in 1981 that the following announcement was made: "an agricultural research centre will be established in Australia concerned with the needs of developing countries. It will be charged with contracting research work to existing Australian institutions in the field of agriculture and related disciplines for the benefit of developing countries."

Almost 30 years later ACIAR continues to lead on government priorities relating to food security, including the first of the Millennium Development Goals.

While ACIAR remains modest in scale, our reach is now truly global. We have active

projects in over 40 countries, including 21 Commonwealth nations. We collaborate with, and fund, the Consultative Group on International Agricultural Research (CGIAR).

Through ACIAR Australia makes—and will continue to make—a difference to smallholder farmers in Africa, the Pacific, Asia and beyond.

A TRACK RECORD OF SUCCESS

One of the earliest successes for ACIAR in Africa was the development of a vaccine against Newcastle disease in chickens.

Villagers rely on chickens as a form of income generation and as a source of animal protein. Sra Joauquina Guente, like many villagers in Mozambique, hoped to raise chickens to help feed her grandchildren and contribute income to their education. Outbreaks of Newcastle disease would destroy up to 80% of her flock.

An ACIAR-developed vaccine, delivered through non-government organisations, has helped control the disease. Sra Joauquina now raises more chickens, selling the surplus and using the income for her grandchildren. The estimated economic benefits to Africa from re-establishing the viability of village chicken production are $36.9 million.

In the Pacific region, Australian research has supported the sustainable use of fisheries resources and growth of aquaculture industries.

In Vanuatu, households engaged in harvesting coconut crabs benefited from research that introduced management plans and monitoring controls to ensure the long-term sustainability of crab fisheries. Each household engaged in harvesting coconut crabs earned an additional $2,000 to $2,700 a year, increasing their annual earnings by a third.

Research to improve culturing of black pearls in Kiribati has increased the survival rate of larval oysters that produce the pearls from 10% to 50%.

Pearl exports are important, particularly to the livelihoods of smallholder producers, who can earn up to $100 for a good-quality pearl. This income enables families to purchase food, pay school fees, access health services and meet other essential costs.

At the heart of these projects are scientists working in partnership to benefit smallholders. These partnerships informally build the capacity of scientists in new knowledge and technologies.

Australia also supports formal capacity building, through a comprehensive program of postgraduate training and scholarships. ACIAR supports developing country scientists to gain postgraduate qualifications, which they then use in research at home.

Dr Norah Omot, who gained her PhD through an ACIAR-funded scholarship, is one example of how ACIAR supports our partner scientists. In Papua New Guinea, Norah is working with farmers to improve incomes from growing sweet potato. She is analysing the entire process involved in bringing sweet potato to market.

Helping smallholders move from struggling to produce enough food to creating surpluses is only part of the solution to food security.

In Pakistan, mangoes and mandarines are important crops. However, farmer income is constrained by losses after harvest, which reduces prices paid, which in turn results in reduced farmer incomes. Australia is funding agricultural research with Pakistan to increase the production of mangoes and mandarines through using improved planting material, crop management and postharvest management techniques.

Surveys were undertaken of potential export buyers of mangoes from Pakistan, with feedback provided to growers in the form of ways to improve farming practices. Quality mangoes have been exported on a trial basis to Chinese markets and attracted premium prices. Export trials are expanding, with farmers' incomes increasing.

BENEFITS FROM ACIAR RESEARCH

Independent impact assessments of 130 ACIAR projects have demonstrated estimated total benefits of A$31.6 billion, with $29.4 billion of these benefits flowing directly to developing countries.

These, and many other successes, are the basis of Australia's expanding commitment through its aid program. The Australian Government has committed to an aid target of 0.5% of gross national income by 2015. The Government has also taken decisive action to increase funding for food security.

In 2009, the Government committed $464.3 million in new funding over the next four years, "to support increases in food production globally and strengthen the ability of countries in the Asia–Pacific region and Africa to address food insecurity".

We are establishing the Australian International Food Security Centre within ACIAR. This new centre will initially focus on Africa, aiming to accelerate the uptake of research results that enhance food security.

In the Pacific we are exploring livelihood possibilities by identifying new markets for food and other agricultural crops.
We are helping South and South-East Asian crop and livestock production systems respond to climate change. In Papua New Guinea we are working with women involved in agriculture, developing their business acumen. In Pakistan we are working with policy makers to support pro-poor value chains.

ACIAR is also contributing to global agricultural productivity through increased support to the CGIAR.

Our greatest expansion has been in Africa. In North Africa we are moving to develop a research hub on conservation agriculture. We are also investigating the possibilities surrounding partnerships focused on food security in Sub-Saharan Africa, linking our two continents.

Africa presents one of the best solutions to global food security in coming decades. The continent has not benefited from the range of agricultural research innovations that were delivered elsewhere in the past few decades.

The Green Revolution, that helped begin the transformation of India into an emerging economic power, bypassed Africa. The timing is right for Australia to take a leading role in supporting Africa's transition to a food bowl for the world.

Our program in Africa has expanded from 2% of our research budget to 16%. This has been achieved through increased Australian Government aid investment and not at the expense of other Australian aid initiatives. Our geographic spread now covers eastern, southern and northern Africa.

Our largest project is helping to improve sustainable management of maize and legume cropping in Ethiopia, Kenya, Tanzania, Malawi and Mozambique.

The Liganwa Farmers Group in Western Kenya has been at the forefront of testing this new approach to maize and bean farming. Some of these farmers have more than tripled their yields.

One of the farmers, Jane Jahenda Nyonje, described how this research is changing lives: "The maize is doing very well, we have not had any problems with pests and disease, and the yields have increased," she says. "The benefit of conservation agriculture is that we don't spend time and money on ploughing. It is also helping control weeds such as striga better. I plan to continue with conservation agriculture, and growing maize and beans."

In Tanzania, Malawi and Mozambique the story is the same.

Australia is creating research and aid partnerships that change lives, lifting poor farmers out of poverty, supporting Africa's transition to a food bowl, opening market opportunities for smallholders and a world where food prosperity is available to all. ■

GOOD INTENTIONS ARE NOT EN

It is a measure of how seriously ACIAR takes its commitment to smallholder farmers that project outcomes are reviewed and lessons allowed to inform future programs.

BY GIO BRAIDOTTI

ACIAR prefers not to assume its aid program benefits its developing country partners. Rather, it actively seeks ways to evaluate and review impacts associated with its agricultural research projects.

Heading the Impact Assessment program in 2012 is Dr Deborah Templeton, who stresses the need to respect the complexities associated with measuring outcomes from research activities. The current program is a culmination of lessons learnt since ACIAR's inception and consists of three types of assessments.

The first are primarily economic evaluations, published in ACIAR's Impact Assessment Series (IAS). These are mostly independent studies undertaken by economists with expertise evaluating agricultural research impacts. ACIAR also contributes to the published literature on developing methods to undertake complex investment analysis.

"These involve in-depth analysis of the impact that research findings have in our partner countries and Australia," Dr Templeton says. "In addition to quantitative estimates of the return on investment, a qualitative assessment of social and environmental impacts is also sought."

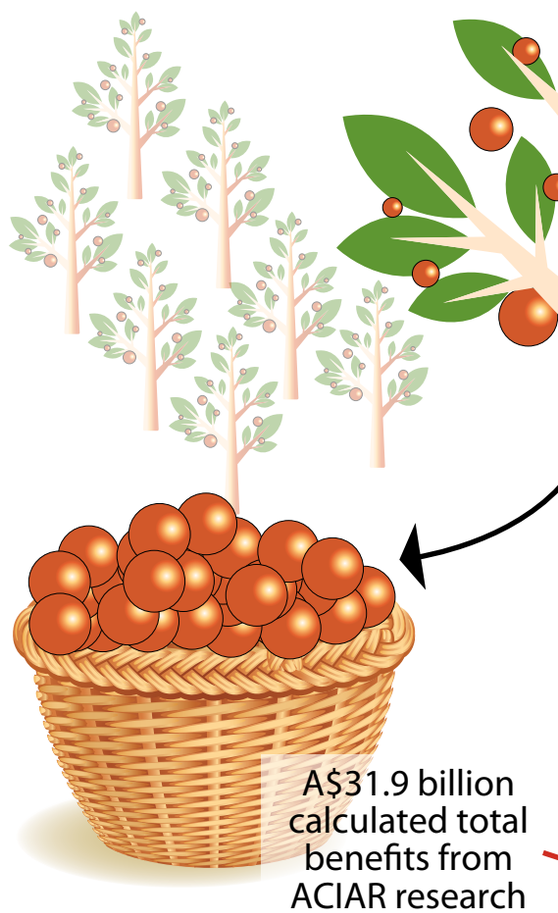
Then there are adoption studies undertaken to understand the pathways to change. These are undertaken by the Australian team leader three years after the project's completion. They provide ACIAR with information on differences the project has made at the scientific and community levels in the partner countries and in Australia.

"The third type is termed an impact pathway analysis," Dr Templeton says. "These provide in-depth analysis of the contextual environment, including the key stakeholders, pathway linkages, the changes that have occurred, and actions that could be undertaken within the project or program to increase the likelihood of the ultimate goals being reached." ■

ACIAR's RETURN ON

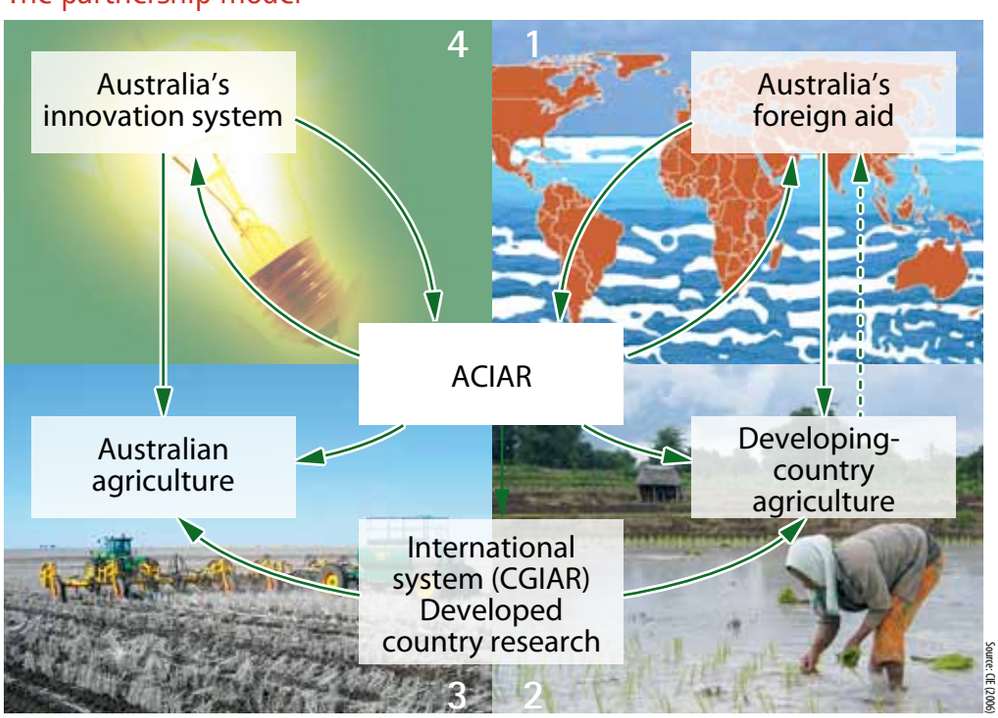
Generates **$31.9** billion

Total project investment A$379 million



A$31.9 billion calculated total benefits from ACIAR research

The partnership model

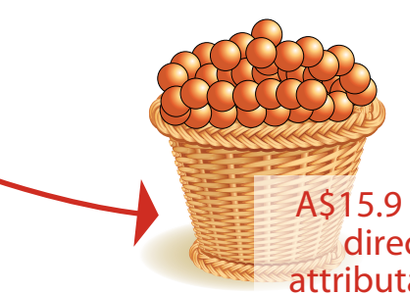


Source: CIE (2006)

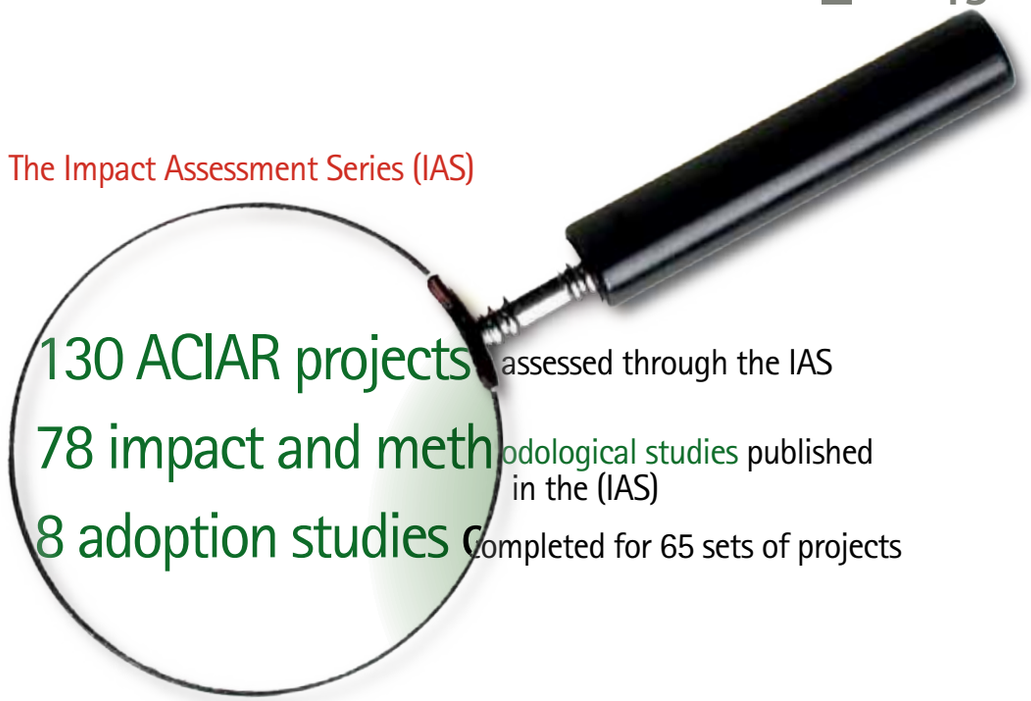
ACIAR integrates foreign aid policy with the Australian innovation system to provide mutual benefits to poorer nations in our region and to Australia.

OUGH

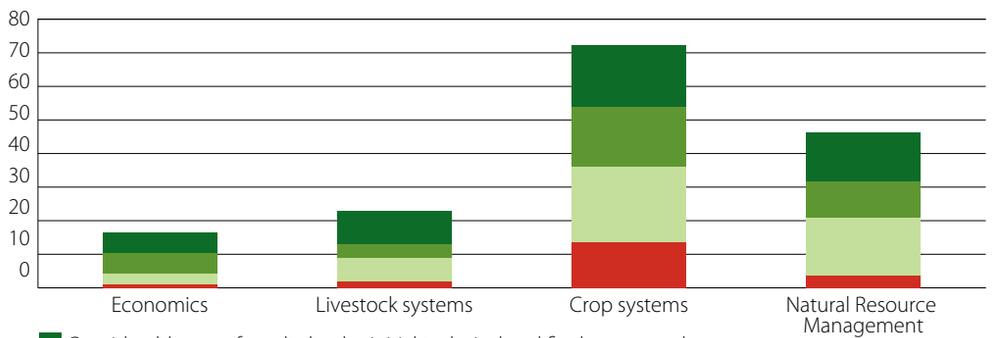
130 PROJECTS



The Impact Assessment Series (IAS)



Adoption studies



- Considerable use of results by the initial technical and final users, producers.
- Considerable use of results by the initial users, but only minimal uptake by the final users.
- Some use of results by the initial users but no uptake by the final users.
- No uptake by either initial or final users.

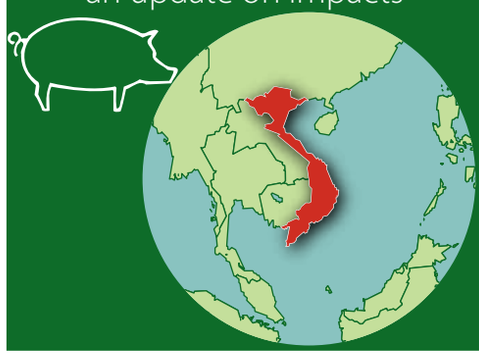
Adoption studies have been undertaken for eight years, with the portfolio now covering 76 sets of projects.

The value of collaboration

The strength of ACIAR partnerships have also been analysed, as in the Vietnam projects with AusAID.

IAS report No. 52

Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts

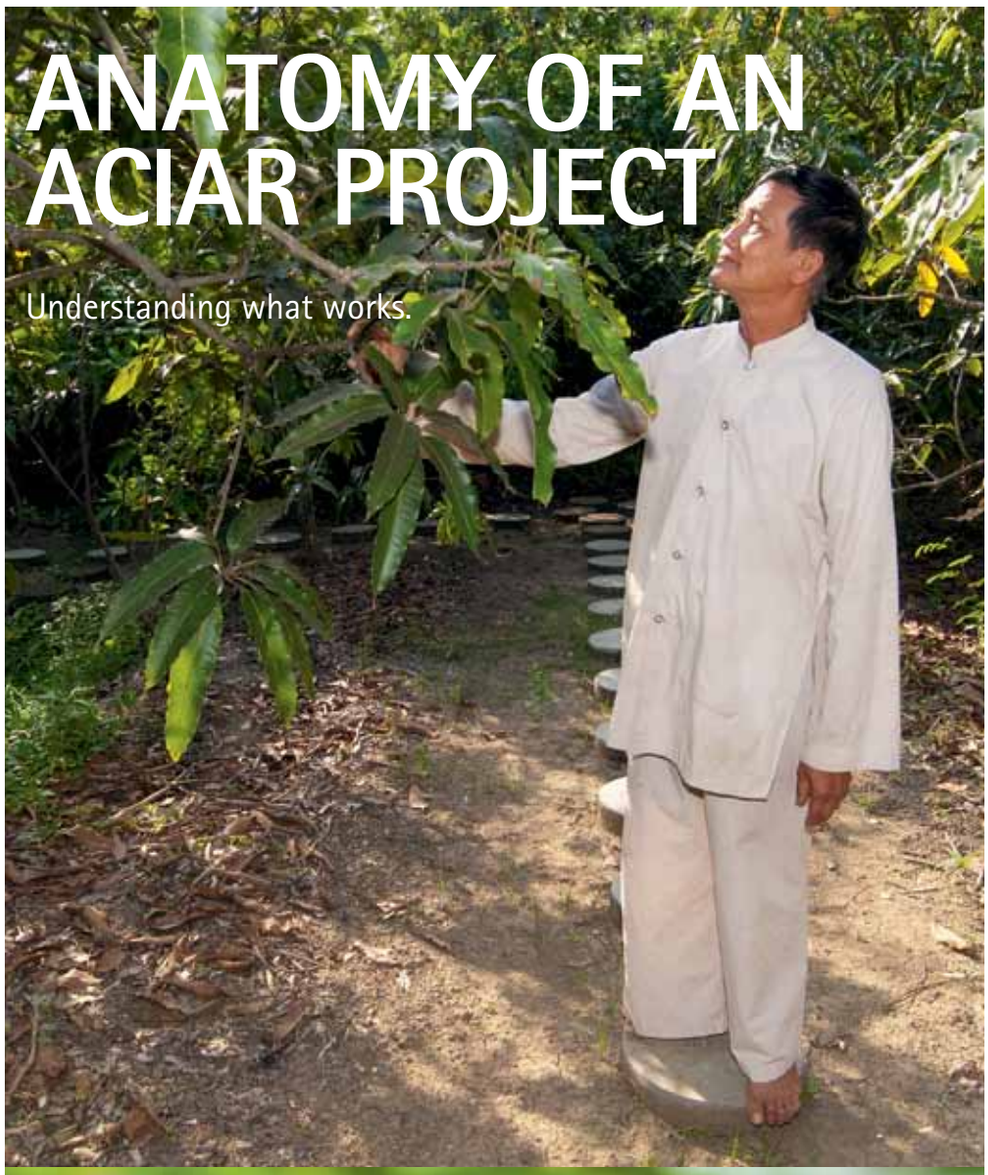


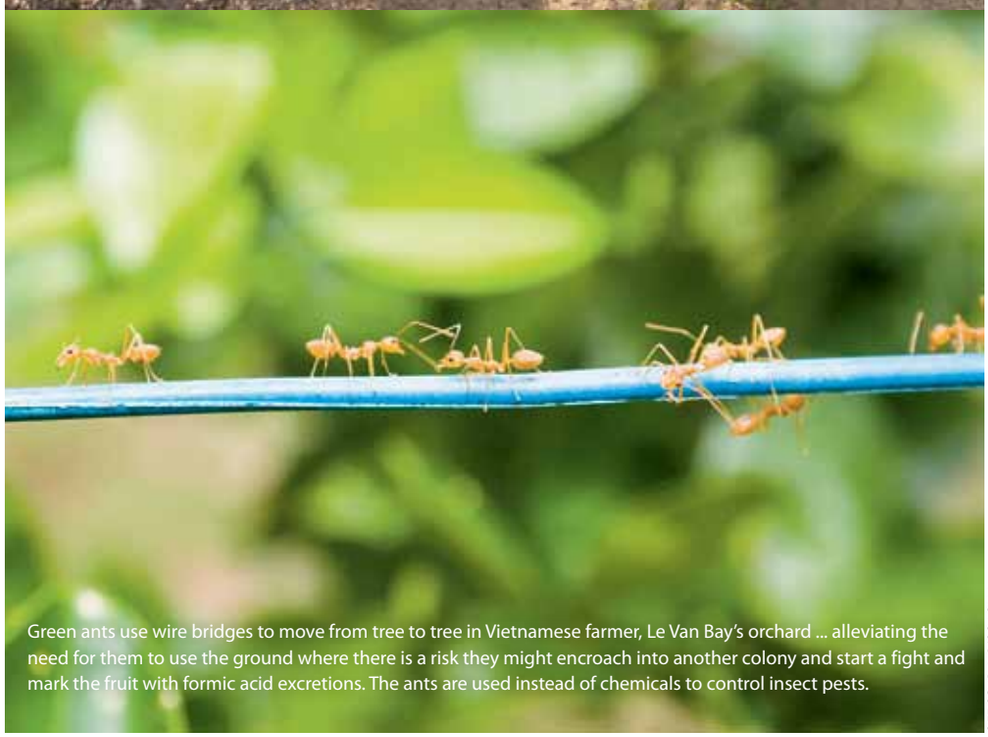
• Net benefits to Vietnam	$2 billion*
• Benefits that can be attributed to ACIAR project	$1.1 billion*
• Percentage of net benefits due to capacity-building activities	40%
• Capacity-building contribution to net benefits	$424 million*

* Seasonally-adjusted to 2012.

ANATOMY OF AN ACIAR PROJECT

Understanding what works.





Green ants use wire bridges to move from tree to tree in Vietnamese farmer, Le Van Bay's orchard ... alleviating the need for them to use the ground where there is a risk they might encroach into another colony and start a fight and mark the fruit with formic acid excretions. The ants are used instead of chemicals to control insect pests.

PHOTOS: BRAD COLLIS

BY WARREN PAGE

What makes a successful project? It is a question that has ebbed and flowed throughout the life of ACIAR. The answer is as fluid as the events and places where we work and the range of contexts in which ACIAR works.

The first step in a successful project begins with the consultations held with partner countries. ACIAR has sought to understand the views of its partner countries and the agricultural systems in which projects operate. This links back to the *ACIAR Act* and the emphasis on identifying the problems where Australian expertise can make a difference.

As ACIAR's CEO Dr Nick Austin describes in the essay on agricultural research on pages 10-11, impacts emerge when research design is cognisant of and responds to the realities within a country. Holding consultations with partner countries is an important step in identifying those realities.

Consultations bring together stakeholders from throughout the national agricultural system within a country, including researchers, extension groups and policy makers. Mutually agreed priorities are set from these consultations, helping to define project goals.

These consultations fit within broader Australian and global initiatives. Linkages are sought both within projects and within and between ACIAR programs and, where relevant, with other initiatives, such as those of development banks, other donors and partner government systems.

Informal consultations are equally important. ACIAR's research program managers bring their unique perspective, both from their experience prior to working for the centre and from their input to project design, delivery and implementation. The RPMs, as they are known throughout ACIAR, also travel and see the projects in action in the field. They meet stakeholders, consulting on projects and priorities, and by doing so develop a greater understanding of the countries in which their programs operate.

ACIAR's Annual Operational Plan identifies the key research priorities for our partner countries and the programs that will operate within those countries. The priority mix links the formal and informal consultations to provide a key insight for partners seeking to engage with ACIAR.

Through the Impact Assessment Program ACIAR seeks to determine the uptake and the economic, social and community benefits after a project has been completed. This is achieved through formal economic impact assessments, which have moved from individual projects

to thematic evaluations of larger groups of projects in similar areas in recognition of the increasing move to cross-disciplinary approaches.

Adoption studies, in which past project leaders revisit concluded research work, are also carried out. Their aim is to identify the level of adoption and identify what factors either contributed to uptake or worked against it. Adoption and impact are intimately linked, with the adoption studies correlating with impact-pathways analysis, which involves in-depth studies of the broader contextual factors contributing to uptake.

It is in the forum of In-House Review where this range of expertise and knowledge come together in the assessment of proposed projects. The review process draws together the wealth of ACIAR knowledge—of scientific disciplines, research approaches, country contexts, adoption and impacts—to determine the merits of individual projects.

PEOPLE POWER

The strength of these frameworks and processes is that they do not define a single template that guarantees success or ensures impacts. Ultimately, the factors that enhance impact in and across countries are diverse and are as much about the intangibles as any obvious cause.

Where all of these factors merge is within project partnerships and the people who deliver on the aims and objectives of each project. In its 30 years, ACIAR has operated with partners from across Australia and around the world. Some have focused on a small component or role within a single project; others have led a number of projects.

The 'magic' that takes the range of factors, frameworks and processes and results in successful projects is found in the people who work for and with ACIAR: its staff, its project partners, its supporters and friends. For every project mentioned in *Partners* magazine over the years, there are many more untold stories.

So many people have quietly gone about their roles delivering project outcomes unheralded. Mentioning each would fill this edition of *Partners* several times over. Detailing the stories in each project would fill a library. Counting every smallholder whose life has been touched by a project could never be fully tabulated.

Yet this is what makes for a successful project—the mix of approaches allowing dedicated people to deliver projects that fit within the contexts in which the research operates.

So with gratitude, we acknowledge all those who have contributed, in whatever capacity, to help change the lives of smallholders.

PROJECTS, PROGRAMS AND PROBLEM SOLVING

Whether the solution to a problem is sought in the form of a project, or cross-disciplinary linkages within and between projects, or as an integrated program, all have at heart a research question that asks how science can overcome that problem.

Over the years of ACIAR's operation, a number of problems have been addressed including:

DEADLY FOODS

Identifying water as the cause of arsenic poisoning and developing management systems for this in Bangladesh; managing aflatoxins in peanuts in India, which have the capacity to kill; and screening for low-cyanide cassava varieties and developing the screening technologies in Africa and the Pacific.

EXPORTING AUSTRALIAN TREES

Eucalypts and acacias are well suited to the soils of India, China, Vietnam and elsewhere in the region, while research to improve production and silvicultural management has generated benefits in excess of a billion dollars.

MANAGING PESTS, WEEDS AND DISEASES

From weeds and crop pests to livestock and fish diseases, research has developed solutions such as identification kits, vaccines and management regimes that limit the spread of these problems.

FISHERIES MANAGEMENT AND AQUACULTURE

Management of commercial and artisan fisheries has helped reduce overfishing and tackled issues from shared fisheries to illegal fishing to building capacity in monitoring and evaluation. Some research is also resulting in the restocking of depleted fisheries such as sea cucumber and trochus, while aquaculture improvements in Asia, the Pacific, PNG and India have helped alleviate pressure on wild-capture stocks, providing smallholders with increased returns.

ANIMAL PRODUCTION

The 'living savings bank' for many smallholders is a large animal, such as a pig, cow or ox, which not only provides draught power, but can be sold to gain a small amount of cash. Yet growing demand for animal protein offers increased returns. A suite of projects has focused on helping increase production by accelerating weaning rates, increasing calf fattening and helping emerging livestock producers enter new markets. Breeding has further benefited smallholders; in Vietnam, for example, more suitable breeds are creating economic returns in excess of half a billion dollars.

CROP PRODUCTIVITY

From matching crop varieties to the agro-ecological environments in which they are grown, to introducing legumes to improve soil quality, to breeding improved varieties—projects have supported the backbone of smallholder agriculture: the staple crops that form the basis of food security.

POSTHARVEST MANAGEMENT

Small improvements can equal big returns for smallholders when it comes to preventing losses from food spoilage, pests and limited infrastructure for moving fresh goods. Gains are possible in increasing the shelf life of produce through management techniques, greater coordination of production to match infrastructure and managing losses to pests, for example during grain drying, by pest disinfestation and controls, and management of sanitary and phytosanitary regulations.

WATER, LAND AND SOILS MANAGEMENT

These are the basis on which agriculture is founded, yet for many smallholders the land they have access to is marginal: sloping land, the least fertile or most eroded, with water access and storage also limited. The combination of poor soils on marginal land with limited water access has been addressed in projects introducing conservation tillage, irrigation and water management, and improved soil management.

SOCIOECONOMICS AND POLICY

World Trade Organization accession, trade policy and its implications, and an equitable flow of benefits from agricultural trade, both within and between countries, including building capacity in regulations and policy advice are essential to helping farmers. Delivering practical approaches to new technologies to ensure that chances of adoption are greatly increased, such as with Landcare in the Philippines and helping women in agriculture in PNG, are also essential.

Any project that improves the life of one person living in poverty has, to some extent, been successful. It is what brings us all together—the pursuit of food security, the belief that agricultural research can change lives and the stories that prove that. ■

BENEFITS BOOMERANG BACK TO THE DONOR

Gains made from agricultural research internationally tend to transfer rapidly from one locus to another, wherever the need exists. For ACIAR, that means its projects haul a net benefit to Australia.

BY GIO BRAIDOTTI

There are two features about ACIAR's operating model in the past 30 years that make it inevitable that its activities also accrue benefits to Australia.

In the process of funding research-for-development projects, ACIAR implicitly strengthens the nation's own RD&E infrastructure while explicitly boosting specific capabilities in fisheries, forestry, livestock, cropping and resource management. By centring its activities on a partnership model, ACIAR also helps to foster ties between Australia and its neighbours in addition to Australian scientists and international sites for agricultural advancement and innovation.

ACIAR's current Impact Assessment research program manager, Dr Debbie Templeton, says that while precise benefits to Australia from its investment are difficult to measure, even the most conservative of assumptions put the return to Australia at just over 4:1. These benefits take many forms:

- direct production improvement to Australian farming systems
- biosecurity benefits in the form of protection from pests and diseases
- increased trade
- access to international research resources and services
- deepening of diplomatic relationships and leadership roles in matters of food security.

SHARED KNOWLEDGE

Funding to ACIAR's Australian project leaders routinely includes support for an Australian research component. Typically, these in-house projects tackle problems with a corollary in the research-for-development project but with an Australian twist.

This arrangement means Australian expertise is continuously improving, with innovations flowing in mutually beneficial ways between Australia and all its partners. As such, many of Australia's leading agricultural scientists lead a double life, helping to sustain agricultural productivity at home but also leading projects that support this continuous improvement in agricultural productivity.

That means when a $20 million push gets underway to intensify maize-legume cropping systems in five east African countries though ACIAR's SIMLESA project, in addition to helping 200 million people living in extreme poverty in partner countries, legume producers in Queensland and other states also stand to benefit.

SOMETHING BORROWED, SOMETHING NEW

For an island nation far removed from the majority of agricultural production centres, ACIAR projects are an opportunity to come in contact with production systems that are new to Australia. For aquaculture and forestry especially, this can mean exposure to new species, culture technologies and markets. Over 30 years, this exposure has inspired new industries in Australia, spurred trade, created investment opportunities abroad, or helped rebuild farmers' livelihoods when disaster hit Australian producers.

A Papua New Guinea forestry project has, for instance, resulted in 3000 hectares of sandalwood being planted in Western Australia using silviculture techniques largely developed in the ACIAR project. The present value of those plantations is estimated at $766 million.

Former forestry research manager Dr Russell Haines says that Australia's traditional research expertise was in pines. It was ACIAR projects that led the way to use hardwood such as blue gum. Now teak is becoming of great interest in northern Australia.

It was also ACIAR experience that helped avert disaster when harvests of wild pipis (a small surf clam) fell away in New South Wales and South Australia—and prices shot up from $16 to $50 a kilogram. Dr Wayne O'Connor from NSW Industry & Investment (now NSW Trade & Investment) says he was in a better position to investigate an aquaculture alternative because of his work for an ACIAR project.

"As a result, we were able to produce pipis in a hatchery to use as seed in a restocking program in the wild or for aquaculture production," he recently told *Partners*. "Having been in Asia and seen the clam-production technology in Vietnam gave us an introduction to clam cultivation that could be used in Australia."

Another notable development is the welcome mat extended to Australian aquaculture businesses in Vietnam. "That is one of the things ACIAR programs offer—they open the door for Australian industry to become involved in business opportunities in other parts of the world," Dr O'Connor says. "Through ACIAR's oyster program, that is exactly what has happened in Vietnam."

COMMON THREATS

Biosecurity is quintessentially important to agriculture. With pests, diseases, and weeds constantly evolving—and climate change adding an extra twist of risk to the mix—constant vigilance and innovation are needed to safeguard farmers' ability to feed the world.

New crop diseases caused by fungi have recently been causing global concern, especially when they attack staples like wheat. A fungus disease similar to blast in rice has recently emerged in South American wheat crops triggering a race to identify effective fungicides and resistance genes.

So too a new strain of the fungus that causes stem rust disease in wheat (Ug99). It has overcome the rust-resistance genes built into wheat during the Green Revolution and is spreading from Africa through the Middle East, endangering the breadbasket in India.

With rust a chronic concern to Australian farmers, scientists have over many years built a world-class rust monitoring, prevention and breeding program. Their expertise has been

Emasculating pearl lupin flowers prior to cross pollinating.

PHOTO: EVAN COLLIS

recruited to international Ug99 projects as ACIAR made it possible for these Australian rust specialists to test 75 Australian wheat varieties in Kenya where Ug99 is prevalent. About one-third proved vulnerable. The specialists are now working with India to reinforce wheat's genetic defences by identifying new sour resistance genes.

"We need to be aware of these exotic threats and do pre-emptive breeding," Professor Robert Park from the Plant Breeding Institute at the University of Sydney told *Partners* in 2008. "It is not a forgone conclusion Ug99 will turn up in Australia but we have to make sure we have effective resistance in our material and stay engaged with the global community." ■

SHARED GERMPLASM—A PILLAR OF AUSTRALIA'S GRAIN INDUSTRY

- Yield gains in Australia attributable directly to the International Maize and Wheat Improvement Centre (CIMMYT) in Mexico averaged 4.6% across Australia in 2001, with gains as high as 10.5% in Queensland and its tropical cropping region.
- By 2001, CIMMYT varieties covered 98% of the area sown to wheat in Australia. An estimated 193 varieties incorporating CIMMYT genetic material had been released in Australia by the end of 2003.
- Benefits from the International Centre for Agricultural Research in the Dry Areas (ICARDA) to Australian producers of legumes, especially faba beans and lentils, was estimated in 2002 to be worth an average of $13.7 million annually up to 2022.
- Similarly, Australian breeding programs have been found to use a large amounts of genetic material from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The net gain to Australia was estimated to average $1.28 million per year.

ACIAR's first staff, July 1983

The gleam in their eye

ACIAR's first director, Professor Jim McWilliam, secretary, Dr Denis Blight, and research program coordinator for crops, Dr Gabrielle Persley, worked with Sir John Crawford through the very early days to achieve the vision of ACIAR and make it a reality by early 1982. These are their reflections on the early days of ACIAR to turn a "gleam in many people's eyes" into an innovative institutional reality.*

BY GABRIELLE PERSLEY

When Prime Minister Malcolm Fraser announced at the Commonwealth Society meeting in Adelaide on February 14, 1981, that the Australian Government intended to establish an international agricultural science initiative to address agricultural problems of mutual interest to Australia and developing countries, this was an idea whose time had come.

But ACIAR was not developed from a standing start at that time.

The idea that Australia could do more within its aid program in agricultural research and development had been in the minds of leaders in the Australian science and development communities for many years. Several activities were in progress throughout the 1970s within AusAID, CSIRO and the universities, to strengthen the contributions of agricultural research within the Australian aid program (see page 19).

Australian scientists and economists were very active internationally in agricultural research, notably since the time of the "Green Revolution" in Asia and the formation of the Consultative Group on International Agricultural Research (CGIAR) in 1971. Sir John Crawford played a pivotal role in both: as adviser to the World Bank and the Government of India; and as the first chair of the CGIAR Technical Advisory Committee.

So in late January 1981, when Prime Minister Fraser asked his officials for ideas for an aid initiative that he could announce when Australia hosted the CHOGM meeting in Melbourne later in the year, an agricultural science initiative was developed quickly for the Prime Minister's key speech on February 14 1981. This drew on several years of policy work in AusAID in Canberra and the experience of many Australian agricultural scientists who had worked in developing countries.

Prime Minister Fraser quickly focused on that initiative as the one to support. The concept of an Australian international agricultural research initiative was on its way to fruition. Formally ACIAR came into being when the *ACIAR Act* was passed on June 3, 1982.

Reflecting on the lessons learned through the establishment and early days of ACIAR, a few points stand out. Politics matter. Leadership matters. And people and partnerships of trust matter.

POLITICS MATTER

The vision and political will of the Government of the day, led by Prime Minister Fraser and ably supported by his Foreign Minister, The Hon. Tony Street, were crucial to the establishment of ACIAR. They supported the initiative in Cabinet, and agreed that ACIAR be established as a statutory authority, thus giving it much more "freedom to operate" than if the new centre lay within a line agency.

This decision was made at a time when statutory authorities were out of favour and many were been closed down. It proved crucial to ACIAR's later success.

ACIAR enjoyed bipartisan support in its establishment. Both major parties supported the legislation during its smooth passage through both Houses of Parliament. Indeed the then leader of the Labor Party in the Senate, The Hon. John Button, shadow Minister for Science, Technology and Innovation,

THE PRECURSORS OF ACIAR

BY DR D.G BLIGHT, EXECUTIVE DIRECTOR, THE CRAWFORD FUND

Australia's farming experience in a dry and hostile environment demonstrated that increased agricultural productivity depended on research and a strong human resource base to undertake it. The first institutional contribution towards international agricultural research came in 1969 when the Australian Vice-Chancellors' Committee established the Australian Asian Universities Cooperation Scheme with funding from the Australian aid program and Australian universities. The scheme strengthened postgraduate and research studies in Indonesia, Malaysia, the Philippines, Singapore and Thailand with an initial focus on agriculture. It engaged many Australians in international agricultural research.

Sir John Crawford understood the potential of a mechanism to bring Australia's research capacity to bear on the problems of agriculture in the developing world. With Guy Gresford and Alban Gurnett-Smith he wrote a report in 1974 recommending the establishment of an Australian body along the lines of the Canadian International Development Research Centre. (IDRC). A further report by Professor Helen Hughes made a similar finding. Sir John found a valuable ally in Mr J.C Ingram, then director of ADAB, as the precursor to AusAID was known. Ingram was anxious to raise the quality and scientific content of the Australian aid program and to these ends, in November 1977, he established the Consultative Committee on Research for Development (CCRD) and asked Sir John to act as chair. Its establishment brought together a number of senior figures in the Australian scientific community, the Australian public service and the private sector. The CCRD developed the intellectual case for a greatly expanded Australian effort through partnerships between Australian, developing country and international agricultural research institutions. The concept of a greater Australian effort in international agricultural research was an idea waiting for its political time.

was especially supportive of a greater role for science and technology in the Asian region.

LEADERSHIP MATTERS

ACIAR was fortunate to have Sir John Crawford as its visionary leader, who saw the political opportunity and seized the day.

ACIAR's first chairmanwas a remarkable man, a brilliant mind, highly respected and influential in Canberra and around the world. It is a tragedy that ACIAR only had him as chair for two years, from early 1982 until his death in 1984, but they were critical years in setting the ACIAR vision and style.

As Jim McWilliam recalls: "He was a great boss, not a micro-manager, and his advice was simply 'Just get going, you know what to do, come and see me if you have any problems, or need any help from me'. "

Watching Sir John chair an ACIAR Board meeting of the great and the good, and see him lead the Board towards the decisions he had wisely decided on the day before was to watch a genius at work. Another lesson learned was 'never hold a meeting unless you know what is going to happen'.

Another visionary leader was Mr Jim Ingram AO, then director of AusAID, who went on to become the head of the United Nations World Food Program. Ingram saw the potential for an ACIAR as a force for good within the overall aid program, but without the strictures imposed through the bureaucracy that may inhibit the most creative science and scientists.

Jim Ingram and a few of his trusted AusAID staff were Sir John's able allies in steering the formation of ACIAR through the Canberra bureaucracy in record time. Documents like the cabinet submission and the *ACIAR Act* were drafted in weeks rather than the more usual months.

PEOPLE AND PARTNERSHIPS OF TRUST MATTER

The ACIAR Board also put great emphasis on recruiting senior staff with extensive experience in developing countries, starting with the director and progressively through the appointments of several research program coordinators during 1982. Several of these appointments were Australians who were working overseas and were encouraged to return home to help establish ACIAR.

Another important feature in building the ACIAR community in Australia and abroad was that ACIAR maintained an 'open door policy' and was welcoming to new ideas, from any source, within Australia or with developing-country partners.

Part of this stemmed from the extensive consultative process undertaken with the Australian scientific community. Workshops to introduce ACIAR were held in every capital city and some regional centres in Australia.

A similar extensive consultation was undertaken with developing-country partners. A Policy Advisory Council was formed, with developing country members and its first meeting held in July 1982, a month after ACIAR's formal establishment. Over 100 submissions were received in the first few months of ACIAR's establishment, and these were all considered in moving towards ACIAR's initial portfolio of projects.

These early consultations helped set an open style, where ACIAR was a partner in the development of proposals and listened to what the partners in the developing countries and in Australia had to say. They also helped establish relationships of trust, between like-minded individuals and between institutions, some of which endure to this day, long after the completion of individual projects. ■

** Professor Jim McWilliam was ACIAR's first director (1982-89). Dr Denis Blight was interim director and then centre secretary (1982-84). Dr Gabrielle Persley was interim science adviser and then research program coordinator for crops (1981-89).*

FACES OF ACIAR

Partners magazine has told many stories of smallholder farmers finding a brighter future through their willingness to get involved in ACIAR projects. Getting involved has also expanded their lives in other ways, introducing them to scientists from their countries, and Australia. The faces of ACIAR featured here are a small collection of those involved in projects over the years. The richness of their stories and experiences cannot be conveyed entirely, but if a picture is worth a thousand words, then here are a few thousand reasons to celebrate the faces of ACIAR.

PHOTO: BRAD COLLIS

In the September, 2004 edition of *Partners,* Farmer Va Yer Lao from the small upland village of Xang, in Laos, told the story of how he has become known as an entrepreneur in his village. Mr Va established a significant income stream by setting aside land for planting forage crops, which in turn were used to fatten undernourished buffalo bought at market. While the initial outlay was more than many people earned in a year, the US$70 profit made the risk worth taking.

PHOTO: AUSAID

Bougainville poultry farmer Helen Tatou relies on selling chickens and eggs at the local market for income. Research into poultry feeding systems in Papua New Guinea identified options for new feeds, based on locally available ingredients, that had the potential to transform lives through increasing chicken production.

Farmer Pearla Binahon, together with her husband Henry, was involved in the Landcare in the Philippines project. While Henry was president of the Landcare Foundation of the Philippines, Pearla helped manage the farm in the Lantapan region of Central Mindanao. Landcare has been one of the successes of research in the Philippines, providing farmers with the opportunity to exchange experiences, by tapping into the expertise and credibility that farmers share.

PHOTO: BRAD COLLIS

Mr Do Hong Tuan, research assistant in the plant protection department of Vietnam's Southern Fruit Research Institute, discusses disease control strategies with Mekong Delta citrus grower Mr Le Van Bay. The two have been involved in a project on managing citrus diseases, such as Huanglongbing disease, that destroyed half of Mr Van Bay's orange orchard. Many farmers face similar problems as Mr Van Bay, who was seeking to diversify his farm beyond rice production. His involvement in the project didn't eradicate the disease, but it did introduce an integrated approach to managing the disease and keeping his orchard viable.

PHOTO: CAT MURRAY

Siziwang Banner, in northern China's grazing lands, is largely desert steppes. Genden, a farmer in the region, had always placed his faith in the traditional maxim of the more animals grazed the better. For Genden and his wife and family, however, more is not always better. Through his involvement in a project, Genden learnt that, in fact, when it comes to the sheep and goats he herds, less is more—that the quality of animals and improved condition of his herd can generate more returns.

Australian researcher Dr Clive Francis is shown combing through a field in Armenia in the search for ancient pulse and legume varieties. The collection work, supported by ACIAR, was reported in an edition of *Partners* focused on climate change. Many of the world's major food crops originated in Central Asia and the Caucuses, including wheat, barley and other cereals. Projected increases in temperatures resulting from a changing climate will put pressure on the yields of these cereal staples. One of the best hopes for breeding more resilient and improved varieties is accessing a diverse range of seed germplasm, such as that collected by Dr Francis and colleagues. (Dr Francis passed away in February 2012).

PHOTO: BRAD COLLIS

Ephraim Matjuda from South Africa's Agricultural Research Council, (left), shown with Albert Ntsoane of the Limpopo Department of Agriculture, was one of the champions of a research project looking at improving the prospects of smallholders growing indigenous cattle in the country. Prior to the research these farmers were largely cut out of the commercial sector, because of perceptions around the quality of meat from indigenous cattle. Research demonstrated that these perceptions were more accurately misconceptions. The result paved the way for emerging smallholder farmers to gain access to the commercial sector.

Mrs Endah Soetanti, shown here with her colleague Mr Islahuttaman, received training in Australia on polymerase chain reaction (PCR) techniques. Mrs Soetanti was able to return to Aceh in Indonesia following the training and use these skills at the Brackishwater Aquaculture Development Centre (BBAP) at Ujung Batee to help rebuild her community following the 2004 tsunami. The tsunami devastated local aquaculture industries. Australian aid funding rebuilt the BBAP, destroyed in the tsunami, as part of the broader rebuilding efforts.

PHOTO: GIO BRAIDOTTI

Dr Shaun Lisson, (left), listens to villagerson the island of Sumbawa, Indonesia, including participating farmer Amaq Sapri. Amaq is participating in a project with Shaun to increase cattle production. Cattle are regarded as a safety net, to provide funds in emergencies. Increasing production can create the means to a better life. Shaun and his team have been working to understand the farming systems, to deliver the means to a sustainable improvement in cattle production.

CHRONOLOGY

Australia's role using agricultural research, development and extension partnerships as part of the nation's aid program has a shared history with the establishment of the Consultative Group on International Agricultural Research (CGIAR), the Green Revolution, and global efforts to eliminate poverty. Here we trace the key events that formalised the use of agricultural science as a development tool.

BY GIO BRAIDOTTI

1970

"…It is true that the tide of the battle against hunger has changed for the better…but ebb tide could soon set in, if we become complacent…"
– Norman Borlaug, father of the Green Revolution

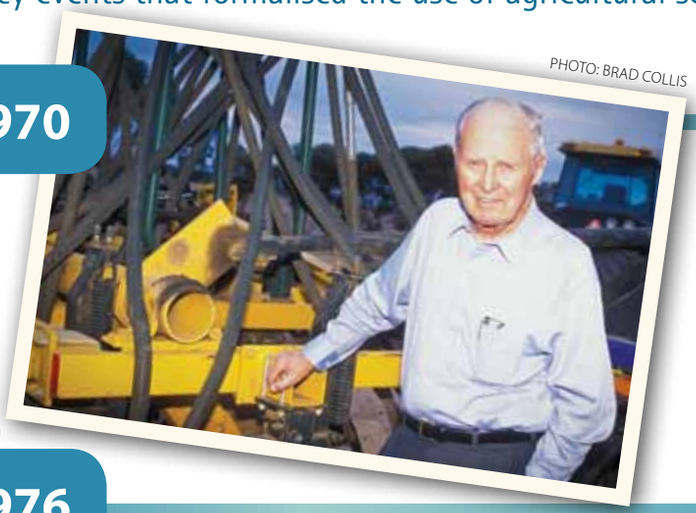


PHOTO: BRAD COLLIS

1971

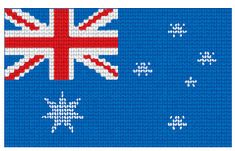
Establishment of the Consultative Group on International Agricultural Research.

1976

A proposal to establish an International Research Assistance Foundation in Australia is tabled, outlining the arguments for establishing an ACIAR-style entity. Led by Sir John Crawford the report recommended: *"To plan and execute an expanded, specialized and highly focused programme of research assistance ... that the Commonwealth Government should allocate a proportion of its aid budget and establish an independent instrumentality for this purpose."*

1975

A small study group established to consider the question – *"Would Australia's aid to developing countries in science and technology be more effective if it were managed through an independent body?"*



1980

"Australia is uniquely placed to assist developing countries in the area of agriculture. We are recognised as having particular expertise and experience in agricultural research and development over a wide range of climatic and environmental conditions, from dryland farming to tropical livestock and agricultural production."
– Second Reading Speech to the Australian Parliament, 1981 on the introduction of the *ACIAR Act*.

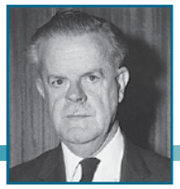
1982

ACIAR commences operations.

ACIAR's first staff, July 1983 (from left): Dr G.J. Persley, Dr J.W. Copland, Dr J.G. Ryan, Professor J.R. McWilliam, Dr D.G. Blight and Dr E.T. Craswell.

1987

Crawford Fund established.



Sir John Crawford

1985

ACIAR is operating in 17 countries, with 34 staff and $10.5 million in Australian Government appropriation.

1983

ACIAR's first projects commence. Projected expenditure for the 1982–83 financial year on research was $1.09 million.

1988

Mid-term review of ACIAR commences, with a positive report delivered in 1989. First edition of *Partners in Research for Development* published.

1990

"For developing countries, agriculture is the foundation of economic growth since the bulk of their resources is in agriculture. Moreover, these resources are characterised by very low levels of productivity. Simply put, agricultural research is vital because it is the source of new production technology, and new production technology is the source of economic growth."
– Derek Tribe, *Doing Well by Doing Good.*

1991

Economic Evaluation Unit within ACIAR is established—by 2012 more than 70 evaluations of 130 concluded projects have been completed, with total benefits of $31.9 billion accruing, of which $29.7 billion are to developing countries.

1992

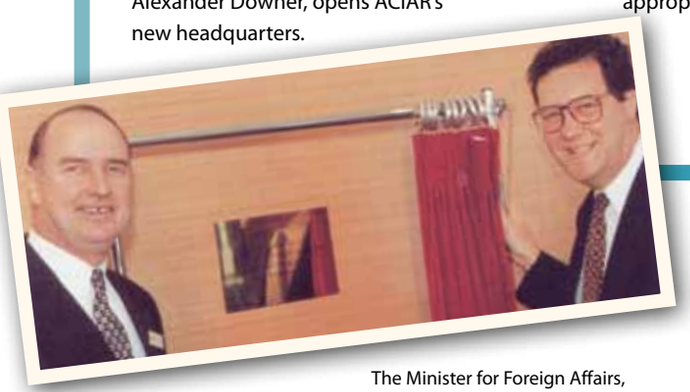
Review of ACIAR's sunset clause, under which the centre was originally established for 12 years only. The review, by the Joint Standing Committee on Foreign Affairs, Defence and Trade recommends that ACIAR continue in perpetuity.

1995

ACIAR is operating in 23 countries, with 47 staff and $36.7 million in Australian Government appropriation.

1996

ACIAR commences formal training program. The Minister for Foreign Affairs, Alexander Downer, opens ACIAR's new headquarters.



The Minister for Foreign Affairs, Alexander Downer, with Professor Ross Garnaut, president of the ACIAR Policy Advisory Council and chairman of its Board of Management, after Mr Downer had officially opened ACIAR House in December 1996.

1998

Review of training program.

2000

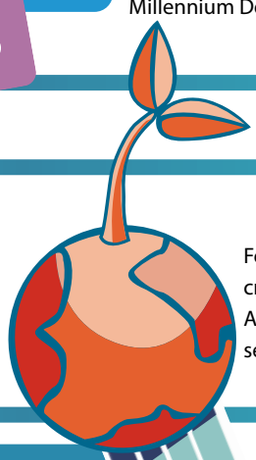
"No country has been able to sustain a rapid transition out of poverty without raising productivity in its agricultural sector." – Peter Timmer, Centre for Global Development and Thomas D. Cabot Professor of Development Studies, emeritus, at Harvard University.
United Nations Millennium Declaration outlines the eight Millennium Development Goals, to be achieved by 2015.

2005

ACIAR is operating in 30 countries, with 48 staff and $49.3 million in Australian Government appropriation.

2007

ACIAR Act is amended following recommendations of the Uhrig Review – the Board of Management is replaced with a Commission.



2008

Food crisis as prices rise sharply for staple crops, driven by falling supply.
Attention returns to the issues of food security and the role of agricultural research.

2010

"I wish to make special note of the impact of the work carried out by ACIAR, which is held up internationally as an innovative example of support to agricultural science for development that pays high returns and benefits to poor farmers and consumers in developing countries and also Australia."
– Dr Derek Byerlee, co-author, *World Bank's World Development Report 2008: Agriculture for Development*.

2011

Announcement of a new Australian International Food Security Centre within ACIAR by Prime Minister Julia Gillard at the Commonwealth Heads of Government Meeting, Perth.

Prime Minister Julia Gillard

2012

ACIAR is operating in 38 countries, with 50 staff and $85.3 million in Australian Government appropriation.

Professor Jim McWilliam (centre), foundation director of ACIAR, with ACIAR program and administrative staff, including Eric Craswell (left of Professor McWilliam) at the centre's office at 10 Moore street, Canberra (circa 1985).

The first decade

He joined ACIAR with the first influx of research program coordinators. Twenty-nine years later, Eric Craswell recalls the people and events that imprinted ACIAR with its collaborative operating modes and its research priorities.

"Give a man a fish and you feed him for one day. Teach him how to fish, provide him with nets, and you have fed him for many days. Teach him as well how to make his own nets, and you have fed him for a lifetime." – Proverb

This ancient Chinese proverb was chosen by Sir John Crawford and his committee to open the document that in 1976 first proposed the establishment of an organisation like ACIAR. Of course, the idea was to extend the concept into agricultural research, but the proverb captures the central concept adopted by ACIAR of supporting partnerships of developing country scientists with Australian counterparts on a mission to help feed the world.

After the establishment of ACIAR through an Act of Parliament and the appointment of the first director—Professor Jim McWilliam—Sir John chaired an interview panel in late 1982 to select the first intake of research program coordinators (RPCs).

Most of us started work in March–April 1983 in the centre's office in Canberra's Reserve Bank Building in London Circuit. Jim Ryan was appointed deputy director and RPC for farming systems and economics, later supported by Joe Remenyi. John Copland was RPC for animal health and fisheries. Gabrielle Persley was RPC for crops. And I was RPC for land and water management and plant nutrition.

Denis Blight was appointed centre secretary and helped coordinate the grains postharvest program, while Lindsay Prior assisted Jim McWilliam to start up the forestry program. Mrs Joan Cahill headed the typing pool, which used the Wang system. A Canadian on secondment from the International Development Research Centre (IDRC)—David Spurgeon—provided the public awareness and publications expertise until Brian Lee was appointed.

The pace of work was fast and furious as we strove to get project runs on the board, but there was time for camaraderie, such as when David (in)famously put a newly printed Wang document through the shredder rather than the photocopier, much to everyone's (except Joan Cahill's) hilarity.

The strategy we used for developing projects and programs involved initiating workshops that addressed high priority problems in developing countries.

Workshop participants were selected from developing country research organisations and from Australian institutions that had relevant expertise. We attracted some eminent scientists: in my plant nutrition program alone we had two Fellows of the Royal Society.

The workshop proceedings were generally published, creating a series of books that contributed significantly to the literature in the various fields. The soils workshop in Townsville in 1983 led to the establishment by ACIAR—with the administrative support of Guy Gresford—of the International Board for Soils Research and Management.

The background papers and discussions at the planning workshops led to research partnerships that were encapsulated as ACIAR projects. We established a system of rigorous in-house reviews, complete with robust discussions supported by external peer reviews, to fine-tune the proposals for consideration by the Board of Management, which in the early days discussed each project proposal in detail.

As the programs and projects took shape technically, the administrative load increased and new staff were appointed, including program assistants, the first of whom was Paul

Ferrar, who worked with the RPCs. Additional offices were rented in London Court and a weekly group afternoon tea was instituted to foster interactions among staff.

Eventually, all the staff were brought together when offices were rented at 10 Moore Street. It also became clear that the overall impact and management effectiveness could be enhanced by grouping projects into several sub-programs coordinated by scientists based outside of Canberra. Examples include the food legume, the forages and the postharvest programs.

After the first few years it became clear to the Board and management that ACIAR's budget was becoming an increasing constraint on the growth and development of the centre, and hence difficult choices among project proposals would become necessary. Treasury was also asking hard questions about potential impacts of ACIAR's work to justify its budget.

The economists then developed a novel priority-assessment framework to help inform the decision-making process. It embraced commodity and regional priorities, with explicit consideration of spillover potentials, as appropriate for a centre aiming to generate both developing country and Australian impacts as a feature of its partnership modus operandi.

The framework led to a set of criteria that project proposals were expected to address as part of the in-house review process. The framework was also published as an ACIAR monograph and had two printings.

Another major question was the geographical spread of the program. Some countries and regions required a special approach. To initiate projects in Africa, workshops were held in Nigeria and in Kenya. These led to ACIAR's largest project, based in the semi-arid area of Kenya and involving the overseas posting of scientists (novel at the time), including Dr Brian Keating who is now a senior research program leader in CSIRO.

This is a noteworthy aspect of the impact of ACIAR's programs, since the project portfolio employed a large number of postdoctoral-level scientists in Australia who gained valuable experience through their involvement.

China was another challenge. Since the country emerged from the Cultural Revolution in the early 1980s, the research priorities and scientific capacity for China required a special approach to assessing its needs. Consequently, Jim McWilliam led a team including Doug Waterhouse, Lindsay Prior, John Copland and myself. In Beijing we met with the Chinese Academy of Sciences and the Chinese Academy of Agricultural Sciences, then split up for visits to provincial academies.

The projects initiated as a result of this China trip constituted one of the earliest major collaborative programs between Chinese and Australian science. Collaboration between Australian and Chinese scientists continued well beyond the life of the ACIAR funding.

The ACIAR programs drew to differing degrees on planning inputs and collaboration with international agricultural research centres, but it was clear that much could be gained from collaboration. Until 1991, ACIAR staff attended meetings of the Consultative Group on International Agricultural Research as advisers to AusAID, which was responsible for the Australian contribution to the international centres; AusAID then passed that responsibility to ACIAR.

This enabled ACIAR to play a stronger role in representing Australia in CGIAR meetings as well as providing a mechanism for closer collaboration between ACIAR projects and the international centres. This collaboration was further enhanced by the work of the public awareness program of the Crawford Fund, which continues that work in addition to supporting training and masterclass programs, many of which are closely linked to ACIAR.

A now little-known feature of the first *ACIAR Act* was the so-called 'sunset clause' by which ACIAR would be closed down if an external review indicated that it was not worthy of continuing. Following an internally commissioned external review in 1989, that provided advice on how to improve the centre, a formal review was held in 1992 by the Parliamentary Joint Committee on Foreign Affairs, Defence and Trade. The Government's response to the review was:

> "ACIAR performs an important function independently in the aid program in improving the well-being of people in developing countries and Australia through collaborative research partnerships aimed at the development of sustainable agricultural systems and the design of appropriate natural resource management strategies. ACIAR's projects mobilise Australian research expertise, thereby contributing to building research capacity both in Australia and developing countries."

We were all relieved and delighted that ACIAR had passed muster and that the need for a further sunset clause was set aside. We feel proud that we helped provide the foundation for the dynamic and effective centre that is the ACIAR of today. ■

ACIAR's research on fruit fly has helped deliver control options for the pest from the Pacific to Asia.

PARTNERS, ISSUE 1, 1988

PARTNERS, ISSUE 10, 1997

PHOTO: ISTOCKPHOTO.COM

Founded in the face of famine

In 1984, two years after ACIAR first commenced operation, the dramatic consequences of a lack of food security were beamed into Australian living rooms. Images of the Ethiopian famine and resulting Live Aid concerts were seen as a turning point in raising awareness of food production, security and the consequences of their failure.

Almost 30 years later a study of English attitudes to hunger and poverty found that images from the 1984 famine were still those most closely associated with a failure in food security.

The story behind those images is that of failed food production. Agricultural research was the solution and ACIAR was the new organisation that would deploy Australian expertise to help. ACIAR was established prior to the 1984 famine, with the mandate to deliver research to poor smallholder farmers in the developing world.

By 1984 ACIAR had its first projects up and running—in India, Thailand, the Philippines, Sri Lanka, Indonesia, China, Kenya, Papua New Guinea, Tonga and the Solomon Islands.

ACIAR's engagement in those countries was undertaken through partnerships linking Australian and developing country scientists. This means of engagement was—and remains today—a point of difference that defines ACIAR. Projects do not operate in a show-and-tell format or as a package for delivery. They are instead collaborative—in knowledge exchange, generation of new technology and training, and capacity building.

Research results were not immediate upon the establishment of ACIAR. As the first edition of *Partners*, published in April 1988, explained: "Scientific research is a long-term endeavour—results rarely come overnight, usually they take several years or more."

During its first few years of operation ACIAR was building foundations, methods and relationships to create processes through which many smallholders would subsequently use to take their first steps up from poverty.

Those processes have, in some cases, played a small role in helping countries lift themselves up the tiers of development. Malaysia is one example. The first story reported in the first *Partners* magazine focused on Newcastle disease, of which much of the research benefited smallholders in Malaysia.

One of ACIAR's first projects, it set the bar high for success. Prior to 'Control of Newcastle Disease in Village Chickens with Oral V4 Vaccine', Newcastle disease was the number one killer of poultry. Most of that poultry roamed free in villages, scratching out whatever food could be found.

Vaccines against Newcastle disease already existed, thereby ensuring the viability of commercial production. The common threat to both village and commercially produced poultry was the virulence of the disease. Whole flocks, in villages or commercial settings, can be wiped out by an outbreak.

This gives commercial producers, who have large flocks in close proximity, a strong imperative to vaccinate. The main barrier in vaccination is the need to either inject each chicken or place drops in its eyes. As *Partners* commented, if you have ever tried to capture a chicken you could immediately see the problem in a village setting.

Some of the research carried out by ACIAR involved 52 villages near Kuala Lumpur, Malaysia, using pellets coated in the vaccine and spreading them out for chickens to eat. This approach, building on existing knowledge and adapting it to the needs of smallholders, would become a feature of many ACIAR projects. So too would building on this foundation, to deliver a suite of projects around a particular problem, and the intricacies and complexities with which that problem would present in different countries and on different continents.

From the late 1980s through the 1990s a range of issues were addressed. What is striking, looking back at the research ACIAR was undertaking during those two decades, is how overcoming the challenges then and now has the capacity to genuinely transform lives and how good research continues to pay off. One of the best examples of good research laying foundations for development began in the 1980s and carried through until the 2000s: the control of fruit flies.

PHOTO: BRAD COLLIS

Dr S. Vijaysegaran with, on the left, the raw yeast waste and, on the right, the protein bait after the waste has been processed and the alcohol removed.

FRUIT FLIES

In 1990, Dr Paul Ferrar of ACIAR wrote an article on fruit fly research in Malaysia. That research had helped identify and catalogue a range of information on the resident species of fruit fly and led to the development of a bait spray that targeted fruit flies while leaving beneficial orchard insects unharmed.

At the time, Dr Ferrar wrote how this had created a platform on which to spread fruit fly work into other countries in the South Pacific region. Following on from that initial work, further research was funded to complete fruit fly surveys in eastern and peninsular Malaysia and extend this into Thailand. As in Malaysia, the Thai component identified economically important species and adapted the fruit fly bait spray to Thai conditions.

The story was next reported in the May 1997 issue of *Partners*.

About the time the first project in Malaysia was coming to an end, several South Pacific countries requested assistance with fruit fly control. Subsequent research and development activities have ensured that understanding of the fruit fly situation in Pacific Island countries has come a long way in the past few years.

Not so long ago these countries had little knowledge of their fruit fly pest species or which fruits these were affecting, and no attempt had been made to arrange regional collaboration to address common problems.

ACIAR-funded research, linking with that of AusAID, the FAO and South Pacific Commission, was initiated. "A great body of knowledge has been accumulated about the species that occur in each country, their host fruits, the damage caused by the more important species, how they can be controlled in the field before harvest and how fruit can be disinfested after harvest."

An important part of the research involved testing of Mauri's Pinnacle Protein Insect Lure (an Australian protein bait used for fruit fly control) and various formulations of modified waste yeast from breweries in the Pacific. The team achieved highly effective control of fruit flies in several crops, in line with the very positive results recorded in South-East Asia.

In Tonga, for example, 97–100% of capsicums and chillies are infested ... The trials ... reduced the losses to less than 7%—an outcome similar to that obtained in Malaysia. In a trial in Fiji, loss of guavas was reduced from more than 45% to less than 4% ... Other trials in Vanuatu, Cook Islands, Solomon Islands and the Federated States of Micronesia have produced similar results.

By the mid-2000s the technology had been deployed in Vietnam, again using brewery yeast waste for baits. Nguyen Van Dung grows fruit on his small farm in Chau Thanh district in Vietnam's Mekong Delta region. The main problem Nguyen faced was fruit flies, which destroyed up to 90% of his crop. A novel protein bait, made using reprocessed beer waste from a nearby factory, was mixed with a pesticide, attracting and killing fruit flies. Nguyen's income from sales of his crop is now almost $5,000, which he is investing back in his farm.

The projects reported here are only a handful of those ACIAR funded in the 1980s and 1990s. Some project outcomes have carried through to the 2000s, as the results are extended through new projects in new countries. Others did what they set out to achieve, addressing a specific problem bound in space or time.

The last word on the projects from the 1980s and 1990s is best left to the late Derek Tribe, author of *Doing Well by Doing Good*, first published in 1991. Tribe's book lays out many of the arguments for agricultural aid that are still in place today. In his book, he addressed the question: 'How effective is Australian aid?'

"Fortunately, the impact and influence that Australians have had on world agricultural development has been much greater than is implied by the size of Australian aid budgets. When praising the 'magnificence' of Australia's contribution to international agricultural research and development, David Hopper, a former senior vice-president of the World Bank, pointed out that:

'This is partly explained by the fact that, for a developed country, Australia has a high proportion of sub-tropical agriculture. But equally important—indeed perhaps more important—is that Australia has produced, and continues to produce, men and women of talent and vision who have recognised the contribution international agricultural research can make toward human development and have not hesitated to immerse themselves in the process.'"

The process that ACIAR instigated in the early 1980s, and which extends through to today, is to find equally talented people within our partner countries who share the willingness to immerse themselves in agricultural research for development, and to link them with those talented Australian scientists. ■

"Fortunately, the impact and influence that Australians have had on world agricultural development has been much greater than is implied by the size of Australian aid budgets."

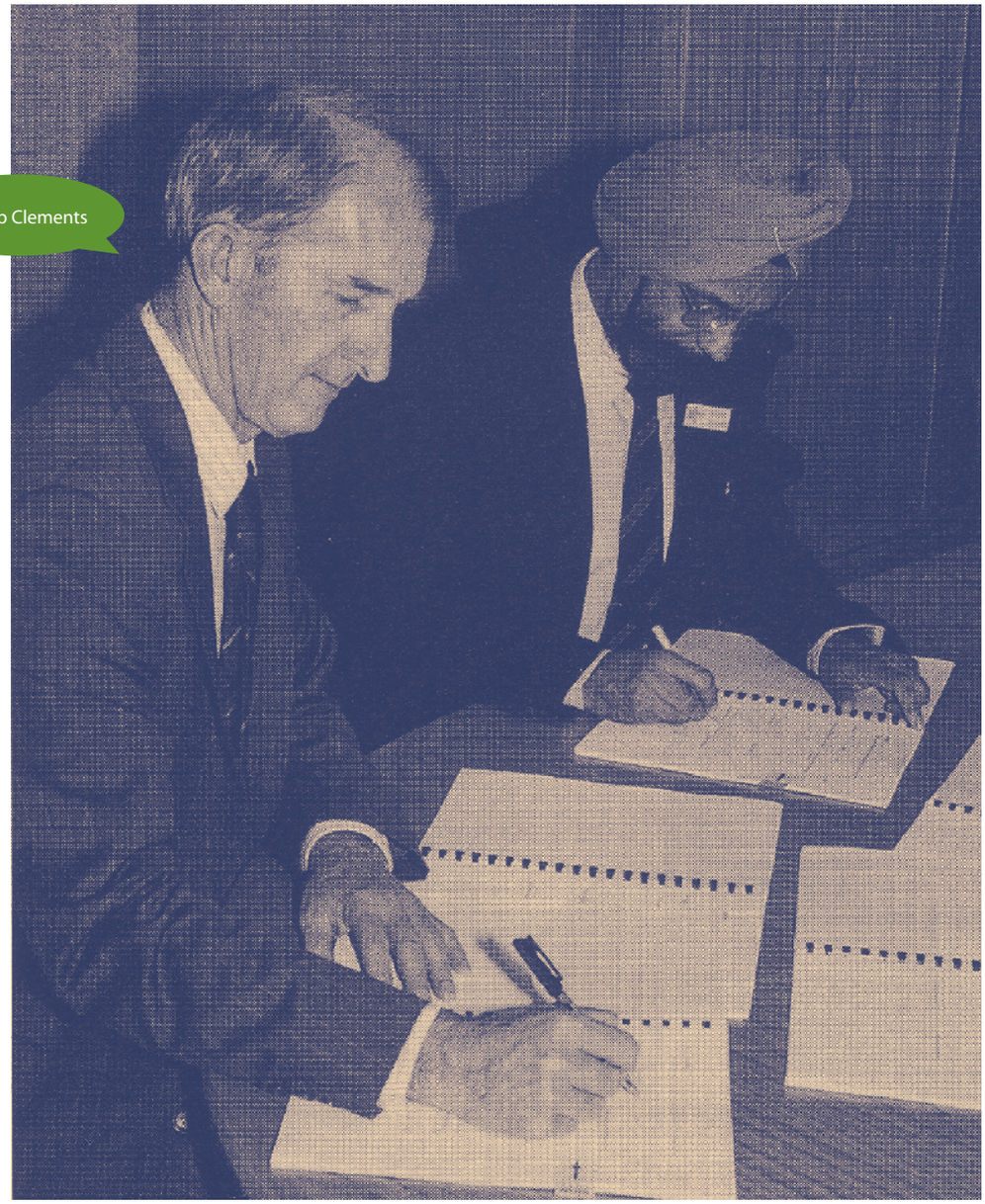
– DEREK TRIBE

PHOTO: PHOTOLIBRARY.COM

SABOCHE (ALSO KNOWN AS SAPODILLA)

Saboche (right) is an egg-shaped fruit with a sweet pulp that, depending on the variety, can taste like peach, banana or apple. Two popular species are grown in Vietnam: orange pulp and white-yellow pulp saboche.

ACIAR TRAILBLAZERS



Dr Bob Clements

BY JANET LAWRENCE

ACIAR is like a second family to me. My association began in October 1984, when the centre was still in its formative stages. I started with the Communications Program on a three-month contract for 20 hours a week and, once my foot was in the door, I proved very hard to shake off. I have worked at ACIAR almost continuously until 2003; since 'retiring' I still contribute in a small way, but from a distance at my Brisbane address.

In preparation for writing this article I went back to the original report published in January 1976, where a committee chaired by Sir John Crawford considered the prospects for setting up an independent organisation to bring aid in science and technology to developing countries.

I confess that I had never read it before, and with the hindsight of 36 years I found that the study was insightful, thorough and visionary in its thinking. The committee commented in terms of the technological aid that Australia was providing at the time: "One inescapable impression from this list of projects is that it represents a well intentioned but unplanned, almost random collection of responses to requests". I also noted the wry observation that "within Australia it has been conclusively demonstrated that research can be better managed if it is separate from routine governmental administrative activities".

This committee sowed the seeds for the formation of ACIAR some six years later. It advocated the establishment of an organisation with the freedom to collaborate with any government or private scientific body, and complementary to the other components of the aid program (led at that time by the Australian Development Assistance Agency).

This new entity would have "a managing body characterised by a deep understanding of the research needs of developing countries, by flexibility and inventiveness, capacity for risk-taking, speed in decision-making and sufficient prestige and dynamism to attract and hold the top rank scientists".

What a fresh and truly radical perspective! Sir John Crawford obviously had a great deal of influence in persuading first the bureaucrats and then the parliamentarians to bring that vision to reality. Thus ACIAR was founded in June 1982, with Sir John as the first chairman of its Board of Management. He proceeded to fulfil his intention to attract and hold top-rank scientists, who were the key to laying the foundations for ACIAR's ongoing success.

Sadly, Sir John lived only long enough to see the launch of his dream. But the exceptional people he helped to choose were more than able to carry the torch for him. They injected energy and purpose into the establishment of ACIAR in the 1980s and 1990s. They were passionate about the task at hand, both in terms of the research that was needed and the people that could be helped. And the passion was infectious—those who joined ACIAR in the early years, myself included, quickly became dedicated members of the crew.

Having been a part of ACIAR's formative years I had the privilege of working with many of these ACIAR champions. So here is my personal retrospective on some of the key figures who built ACIAR.

EXCEPTIONAL LEADERS

The foundation director of ACIAR, Dr Jim McWilliam, had already distinguished himself as a plant breeder and geneticist at CSIRO before serving for 11 years as Professor of Agronomy at the University of New England. Yet he gave the impression that he had really been born to lead ACIAR. Jim used his incredible professional network to promote and develop the fledgling organisation. Early in his term he was part of an Australian delegation to China, led by the then Minister for Primary Industries, John Kerin. This visit planted the seed for the highly successful collaborative program that followed.

I once accompanied Jim to a workshop in Thailand and we had a stopover at Changi Airport in Singapore. While I browsed the shops Jim sought out people he knew—and that seemed to be about every second traveller. I could hear his booming voice echoing around the hall—ACIAR, ACIAR! There was no doubting his missionary zeal. Jim so loved his job that if it hadn't been limited to a statutory term of seven years I think he would still be there. He gave the longest retirement speech I can ever remember, so reluctant was he to say farewell.

The second director, Dr George Rothschild, came to ACIAR from his position as head of the Bureau of Rural Sciences. He realised the need for ACIAR to have greater brand recognition and put his years of experience in the bureaucracy to good use in a successful 'David and Goliath' struggle to have ACIAR present a separate budget to Parliament, rather than be just a one-line entry in the aid program. George worked with Policy Advisory Council chairman John Dillon to steer ACIAR through the 'Sunset Review' that would decide whether we would continue or cease to be after 10 years of operations. Obviously they won. He also led the initial feasibility study visit to Vietnam.

George gained a small piece of notoriety one morning in the office of ACIAR's former premises in the city. A nasty incident in the bus station behind the office led police to clear the area, and they entered the building to check everyone had gone. They encountered George in his office, hard at work, and demanded to know who he was. When he replied, "I am the director of ACIAR," they mistakenly thought he said "director of ASIO" (the Australian Security Intelligence Organisation). They left him alone and beat a hasty retreat. George got his reward at the annual Christmas party when he received a pair of dark glasses with false nose and moustache attached.

When George left ACIAR in 1995 to become director-general of the International Rice Research Institute, Dr Bob Clements succeeded him. Bob had been chief of CSIRO's Division of Tropical Crops and Pastures and his incisive and analytical intellect served ACIAR well at a stage when the organisation needed to show that the outcomes of its research were having the desired impacts in the countries we were seeking to help.

Bob would not be fooled by bright-eyed enthusiasm for some emerging results. He needed to drill down and distinguish between the outputs, outcomes and impacts to produce


Dr Bob Clements

a realistic assessment of just what had been achieved. But he also knew the value of having successful stories in the limelight and drew up a selection of 'best bet' projects that he discerned were going places. He was good at picking winners.

The In-House Review has always been the nerve centre of ACIAR project development. Here Bob was in his element in the chair. He was a master at gathering in the disparate opinions from around the table and drawing together a plan of action that contained all cogent matters and dispensed with the rest. Such a talent ensured that the projects developed were of a consistently high quality and contained within budget.

Those three directors spanned ACIAR's first 20 years. Although in the succeeding 10 years the centre has undergone many operational changes, the commitment and dedication of the team has remained. Recent plaudits in the press confirm this.

I wonder what members of the 1976 committee would think of ACIAR in 2012? My personal conviction is that it truly has fulfilled Sir John's vision—quite a remarkable attainment when you consider the succession of obstacles thrown in its path. In particular, in spite of the layering of more and more administrative requirements and demands for accountability, the organisation has never lost sight of its mission and vision. May it continue to thrive for the sake of the world's disadvantaged and marginalised people. ■

Getting the message out

ACIAR's founding legislation included an unusual objective: to communicate to persons and institutions the results of the agricultural research undertaken. Sir John recognised that since the organisation was dedicated to funding research it was therefore very limited in its capacity for development and extension. He thus guided the legislators to include a communications program as an essential component of the whole operation.

ACIAR was fortunate in securing two key players to put the Communications Program into place. Its founding manager was Brian Lee, a well-known science writer who had worked with CSIRO and taught the emerging professional discipline of science communication at the University of Canberra. He understood well the need to get the message out and also the difficulty of getting the media to notice 'good news' stories.

Brian was the founding editor of *Partners* magazine and also one of the driving forces behind building up the country manager positions to be an effective means of in-country communication.

An early ACIAR policy determined the need to publish material about subjects important in the developing world that would not necessarily attract the attention of mainstream science. The scientific publishing part of ACIAR Communications was therefore an essential tool for connecting with our stakeholders. Its foundation champion was Reg MacIntyre, who was seconded from Canada where he held the position of director of scientific publishing with the International Development Research Centre (IDRC), an organisation whose structure and functions had helped to frame ACIAR's genesis.

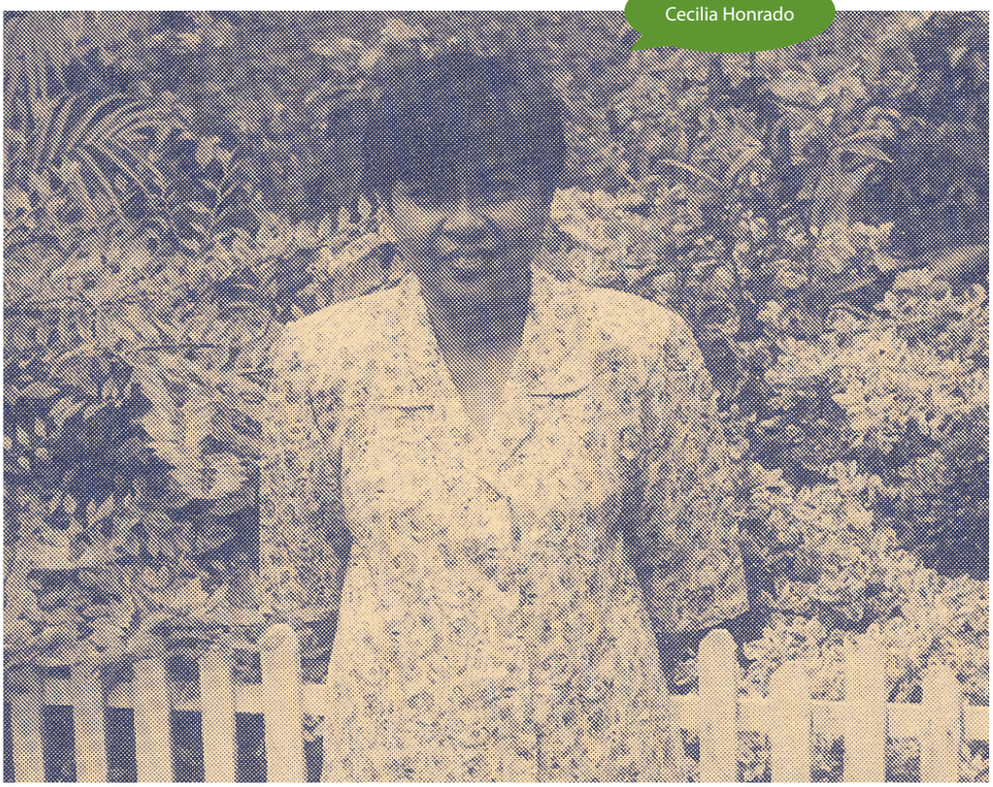
Reg brought an enormous breadth and depth of experience. He advised on the type of publications best suited to the program. His consummate editorial skills ensured high-quality publications in the days before desktop publishing. He added significantly to the list of Proceedings and also established both the Technical Reports and Monographs series. Reg loved to edit—in my abiding memory of his time at ACIAR he is leaning back in his chair with his feet on the desk (shoes off!), manuscript in hand and pencil poised, totally engrossed in the task.

It goes without saying that Brian and Reg were the perfect partnership to launch the Communications Program. I owe them both an enormous debt of gratitude for the training, mentoring and opportunities I received in the early years.


Reg MacIntyre

An early ACIAR policy determined the need to publish material about subjects important in the developing world that would not necessarily attract the attention of mainstream science.


Brian Lee



The women were there

The early history of ACIAR was not written entirely by men. Indeed the first official employee of ACIAR was Dr Gabrielle Persley. Her soft voice and quiet demeanour disguised a steely determination to get things done. She was the one who introduced the adage 'Forgiveness is easier to obtain than permission' to the organisational ethos. I think she has obtained a lot of forgiveness over the years.

Another key person in the early administration was Maureen Kenning. It was recognised early on that travel would be a significant part of the lives of management, and Maureen was engaged as travel officer. She could get you from anywhere to anywhere. When the travel duties were reassigned to the assistants in each program, Maureen found a new home as administrator in Communications—a job she maintained with flair and dedication for many years.

The role of country manager evolved over time. I would like to acknowledge three women who contributed so much to defining and developing the position, which is vital to ACIAR's functioning. Jean Sambhi was the first manager in Malaysia. She had an intrinsic understanding of what the role should encompass, and through personal example and working with ACIAR management she gave it an exemplary definition. A visit to Malaysia would be incomplete without Jean arranging a meal at the Curry House in the Selangor Club in Kuala Lumpur.

Two other country managers deserve special mention. Khun Chiriporn Sunprakit and Cecilia Honrado were not the foundation managers for their respective countries, but they must now be some of ACIAR's longest-serving members. They are shining examples of the dedication and commitment that is the hallmark of ACIAR. The centre has built its reputation on partnership, and Chiriporn and Cecilia have always gone the extra mile to make it happen.

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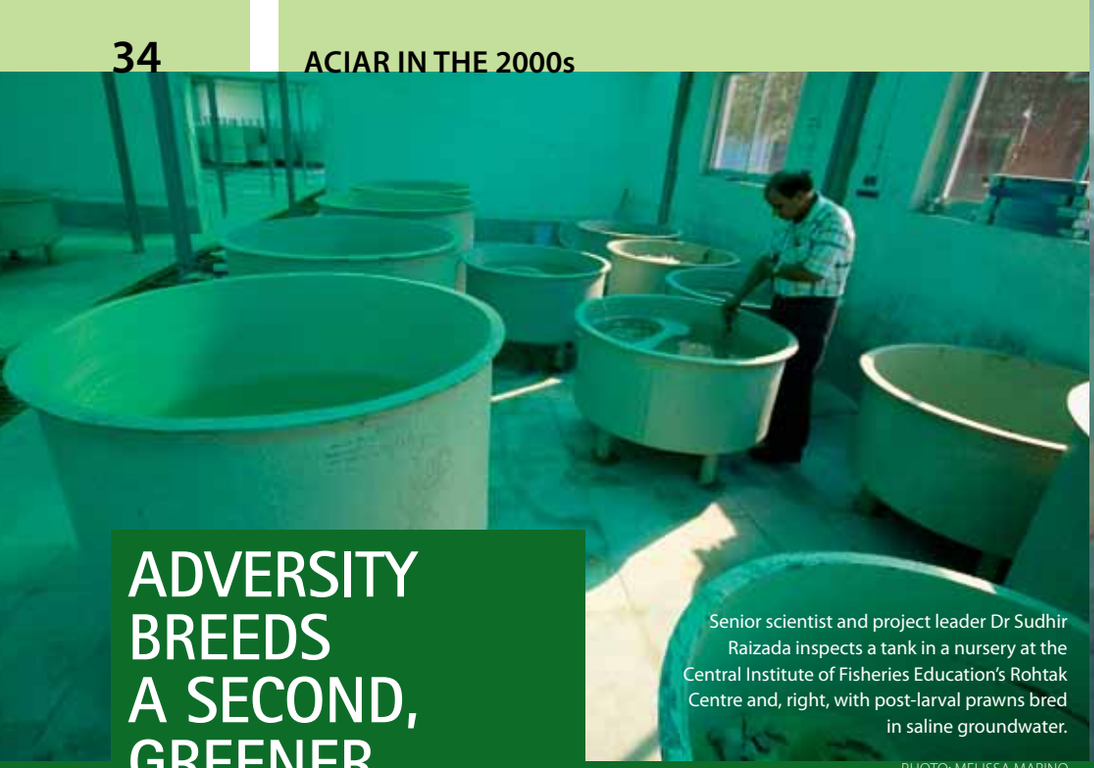


PARTNERS

Senior scientist and project leader Dr Sudhir Raizada inspects a tank in a nursery at the Central Institute of Fisheries Education's Rohtak Centre and, right, with post-larval prawns bred in saline groundwater.

PHOTO: MELISSA MARINO

ADVERSITY BREEDS A SECOND, GREENER REVOLUTION

Food riots, historic low grain reserves, and 110 million people forced back into poverty served as a wake-up call in the 2000s to a world grown complacent about its food production capacity, supply chains and commodity markets.

The global food crisis of 2008 was a pivotal moment as policy-makers made agricultural research the cornerstone of their international response.

For ACIAR, this was a decade when scientific know-how in different disciplines—breeding, agronomy, ecology, genetic resources, economics—were deliberately made to cross-fertilise, resulting in new insights about how to maximise food production opportunities and alleviate rural poverty.

This was a multi-disciplinary approach that exceeded the 'whole-of-farm' system thinking that characterised innovation in the previous decade. We saw breeders target genetic traits that maximise benefits from conservation farming practices … even as agronomists adapted these farming practices to maximise returns from improved land and water management strategies.

This amounted to an integration of agricultural science and it produced outcomes that were often greater than the sum of the scientific parts. *Partners* covered these developments in stories that gave voice to its terrific potential to innovate and its timely flair for thinking outside the box.

What follows are two examples where projects succeeded in the face of adversity and seismic shifts in the landscape. Often this meant a diversification of an existing production system that paradoxically allowed farmers to intensify farm productivity yet improve sustainability.

India's 'fish-out-of groundwater'

BY MELISSA MARINO

PARTNERS, NOV 2008-FEB 2009

In a land-locked state in northern India, 1,000 kilometres from the nearest coast, a most unlikely enterprise is beginning to flourish: seafood.

The new aquaculture ventures are being fed by salty water, pumped from underground to fill man-made ponds. It is the same salty water that has been partly responsible for the gradual degradation of the land, which has made it increasingly unfit to support traditional wheat and rice crops.

Drawing on the expertise of Australian and Indian scientists, the project aims to make saline-affected, unproductive lands in the two countries profitable again and create new industries from popular seafood species, including prawns and trout.

It is being funded by ACIAR, the NSW Department of Primary Industries (DPI) (Fisheries), Murray Irrigation Ltd and the Central Institute of Fisheries Education (CIFE) India.

Across India and Australia millions of hectares of agricultural land is threatened by salinity. Management options, such as pumping rising saline groundwater from shallow aquifers into large ponds to evaporate, have been effective, but are expensive and offer little in terms of outputs.

The ACIAR aquaculture project aims to use saline water to transform otherwise useless agricultural land into lucrative inland seafood production grounds.

In India the program is leading towards a new industry in giant freshwater prawns (*Macrobrachium rosenbergii*), which are capable of living in non-saline water but need saline water in which to breed.

In Australia the most promising species for potential mass production is rainbow trout (*Oncorhynchus mykiss*), which has been successfully grown in ponds using inland saline water pumped from underground.

For India the timing of the project, which began in 2004, could not have been better. The country had been experimenting with the technology for more than 20 years and successful giant freshwater prawn farms were already operating at coastal sites. It had the experience, the know-how and Federal Government support for new farms.

In Haryana, home to the CIFE's specialist Rohtak Centre and experts in the field, there was also a massive salinity problem—half a million hectares.

"There are water-logging problems and salination problems and areas have become quite barren," says CIFE principal scientist Dr Narinder K. Chadha, now based in Mumbai. "Soil fertility is very low and productivity has gone down, so that is why, for many, aquaculture is the only option left."

Project leader in India, CIFE principal scientist Dr Sudhir Raizada, says the research could help turn around farmers' fortunes in a region where more than 50% of the groundwater currently used to irrigate crops is saline.

"It could go from a threat to an opportunity," he says. "What has been a tragedy for the public is an opportunity for the public."

Sowing lentils with a new zero-till planter for a two-wheel tractor at Dinajpur, northern Bangladesh.

PHOTO: RICHARD BELL

Senile palms can be transformed into valuable timber.

FROM SUBSISTENCE TO AGRIBUSINESSES

The idea of a 'cash crop' is a strategic one for ACIAR. In times when food crops fail, cash crops provide a safety net by allowing farming communities to use markets to meet shortfall in essential household needs. ACIAR and its farmer business schools, however, take the idea further by exploring pathways to markets for smallholder farmers and solving supply chain issues along the way.

Done well and the strategy can stimulate growth in rural economies and change the psychology of subsistence farming, opening the door for a more entrepreneurial spirit.

In the 2000s, the cash-crop strategy benefited from the joined-up, multi-disciplinary approach favoured by Australian scientists. The results were projects that sometimes seemed to create the potential for greater prosperity out of thin air.

Dry fallow rice paddies make beds of opportunity

BY JULIAN CRIBB

PARTNERS NOV 2008-FEB 2009

Heavy soil erosion on the slopes of the Himalayas is turning the Ganges delta into one of the fastest-growing arable regions in the world. As fertile silt from the uplands piles up, new expanses of rich, dry soil are appearing on land once located beneath the waters of the Bay of Bengal.

The farmers of southern Bangladesh traditionally grow rice in the rainy season, but for several months a year during Rabi (the dry season) the land lies largely fallow, producing little more than weeds or thin grasses. Because much of the land is under water during the rainy season, livestock are few.

In 2003, when Australian agronomist Howard Rawson started looking into extending opportunities for wheat production in a joint project with ACIAR, the UN's Food and Agriculture Organization (FAO) and the Bangladesh Wheat Research Centre, the situation was becoming urgent.

Each year Bangladeshis consume four million tones of wheat, but local production has steadily fallen from two million to less than a million tonnes, driving up the country's import bills. Recent world grain price hikes have redoubled the pain.

It became clear that southern Bangladesh had untapped farming potential in all the land that was lying fallow from November to March, a time many regarded as too hot, dry and risky to grow wheat or other crops.

At the same time, Mr Rawson and his colleagues from the Bangladesh Agricultural Research Institute (BARI) could not help noticing that there was still plenty of water lying around after the wet—in canals, drainage channels and ditches. Not enough to grow an irrigated crop of boro rice, but sufficient to grow wheat.

The big question was: how much wheat?

Their preliminary on-farm trials, over two seasons, indicated 2.5 tonnes per hectare was assured, using three irrigations and high input of fertilisers.

But it was not clear whether these were two unusually good seasons and whether fewer inputs—within the means of poor farmers—could realise the potential of the land, Mr Rawson says.

BARI and a unique Australian farming model called APSIM (Agricultural Production Systems sIMulator) supplied the answers: there were an estimated 800,000 hectares of potentially suitable, but unused, agricultural land at this time of the year and long-term weather data indicated the climate was also possibly suitable.

Exploring this, using on-farm trials managed by Mr Rawson and an ACIAR research project led by Dr Peter Carberry of CSIRO, revealed that yields of 2 to 2.5 tonnes a hectare were achievable without irrigation, and 3 to 4 t/ha with as little as a single watering.

Working with farmers in the southern regions of Noakhali and Barisal and on Bhola Island in the delta, BARI project leader Dr M. Saifuzzaman, Dr Carberry and Mr Rawson together demonstrated the scope for a dryseason wheat industry capable, conservatively, of producing a million tonnes of wheat a year on the fallow lands.

Potentially, this could generate import savings worth several hundred million dollars a year for the Bangladesh Government, as well as giving a major economic boost to an otherwise poor region.

Pacific's tree of life to rise again

BY MELISSA MARINO

PARTNERS, NOV 2010-FEB 2011

Imagine coconut palms and many people think of tropical islands and lazy holidays in the sun, not suburban homes or sophisticated European buildings. But ACIAR funded research may change that perception to the benefit of Fijian and Samoan farmers. A joint Australia–Fiji–Samoa project is helping to transform nonproductive senile palms that are of no value to farmers into quality building materials,

Peanut farmers in central Lombok, Mr H. Syukri (left) and Mr H. Muhajirin (centre), discuss their crops with senior agronomist Mr Lalu Wirajaswadi.

PHOTO: BRAD COLLIS

suitable for high value flooring, benchtops and furniture. Cocowood from these palms not only offers a distinctive building product but, in a reinforcement of the coconut palm's status in the Pacific as the 'tree of life', it could provide a new income stream for farmers from unproductive older palms that would cover the cost of removing the senile palms and free upland for more productive uses.

In a secondary outcome, the project has revealed the soft, nutrient-rich core of the palm's trunk makes an ideal mulch that could be used across the Pacific to improve poor soils and further increase agricultural prospects for islanders.

Leading these efforts to assist Pacific island communities is Dr Henri Bailleres from Queensland's Department of Employment, Economic Development and Innovation (DEEDI).

Dr Bailleres says he is constantly amazed by the fact that every part of the tree can be used. "Each time I work with it I find new uses," he says.

With senile palms providing little to farmers but a hygiene risk and a waste of land resources, the completed 4-year project analysed cocowood's material properties, developed suitable processes for producing high-value products and provided hands-on training in those processes.

Farmers grasp the business of change

BY BRAD COLLIS

PARTNERS NOV 2008–FEB 2009

Sitting, legs folded, on the mosque's polished porch in their village, Pengenjet, in central Lombok, the farmer group sips coffee and talks animatedly about its first experience of working with agricultural researchers as part of an ACIAR initiative.

In two seasons the new knowledge the farmers have learnt and applied to growing peanuts in paddies after the rice harvest has had a rapid effect on quality and yields and this, of late, has taken on a new significance.

Previously peanuts were a handy, but not overly rewarding, crop that could be grown in the dry season by taking advantage of soil moisture remaining in the paddies. Crop productivity and nut quality were highly variable, generally adequate only for low-priced local markets, and sometimes came with a high aflatoxin health risk.

However, for the farmers of Pengenjet and several other Lombok districts, their peanut crops have new-found stature. While rice provides staple food, peanuts provide money, and the level of payment relates directly and transparently to improved quality and productivity.

Peanut growing, and by extension, farming, is becoming a business, not merely a traditional way of life. And a more reliable income from this business means money for improved health and education and a far more secure existence. These Lombok peanuts, and also cocoa in Sulawesi, are two of the pilot crops at the heart of an ambitious new program—the AusAID-funded SADI initiative. It is an extensive collaboration between a wide spread of research providers and companies and it is introducing a new approach to agricultural development among poor rural communities.

Based on 'market pull' as opposed to 'research push', the program—SADI stands for Smallholder Agribusiness Development Initiative—is endeavouring to lift smallholder farming from its traditional poverty-stricken levels to a farming structure that is more robust and sustainable because it has a commercial driver.

The rationale is that if conditions exist to directly link successes in yield and quality (and landscape management) with significantly higher net incomes, a more permanent improvement in agricultural production will result.

Thinking and working within a commercial framework is a fundamental shift in perception and practice for most smallholder farmers. It is a change being nurtured by the establishment of a vertically integrated supply chain, joining production to processing, and raised market expectations. Research and extension support is being applied at both ends of the chain to make sure higher-quality crops are matched by higher quality—and higher value—processed product.

For both peanuts and cocoa, the International Finance Corporation (IFC) is managing the agribusiness development in partnership with GarudaFood, which provides the buyer/processor input for peanuts, and Mars Symbioscience (a division of the global food company Mars, Incorporated), which is the commercial partner for the cocoa initiative.

For the Pengenjet farmers, researchers from the ACIAR project showed them how regular seed spacing improved sowing efficiency, the crop's water-use efficiency, and made cultivation and harvesting easier. The improved water-use (irrigation is limited), along with improvements to the rate and timing of fertiliser applications, has contributed to increased yields, and new knowledge about the use of fungicides has helped them deliver a much healthier and higher quality harvest.

When they deliver to GarudaFood the farmers remain present while their peanuts are assessed. The company buyers explain or demonstrate the quality parameters behind the peanuts' valuation. For example, if the crop has been harvested too soon, the immaturity results in a lower price, but the farmer is instructed how to avoid repeating the mistake.

Leader of the Pengenjet farmer group Mr A. Indra says the experience has been enlightening for the villagers, who are keen to continue being involved with ACIAR in research trials.

This is the kind of thinking that transforms a farm into a small business.

The unavailability of mechanised equipment requires that 'best farming practice' recommendations must be achievable with only hand and draft-animal labour sources – the local caribou are very hard-working.

A budding pineapple 'flower' growing within a vegetated strip.

PHOTOS: J BAVOR; UWS-WATER RESEARCH LABORATORY

MANAGEMENT OF NATURAL RESOURCES

Conservation and growth are often pitted as conflicting interests in public debates. Within agricultural research circles, however, knowledge about ecological sustainability is becoming productivity's newest best friend.

Ecology on vast geographical scales has been providing ACIAR projects with a big-picture perspective that radically enhances decision-making, especially with regards to vital natural resources like water and soil, or dynamic processes like climate change.

In the joined-up science preferred in the 2000s, ecology has joined breeding, agronomy, system-wide analysis, and socio-economics as essential elements within an integrated development toolkit.

What follows is an example of the intertwining of conservation and growth within an ACIAR project that proved popular with farmers in the Philippines.

Harvestable hedgerows encourage erosion change

BY ROBIN TAYLOR

PARTNERS, MAR-JUN 2009

Income-earning crops such as pineapple and bananas are being grown in hedgerows adjacent to the main crops—such as cassava and corn—as a creative form of 'money-making erosion control' in the mountainous interior of Bohol Island in the Philippines.

It is hoped that the use of plants, which can generate extra income as well as stabilise the landscape, will be a decisive factor in the island's farmers embracing conservation farming techniques that are being demonstrated in an ACIAR-supported project.

The project—'Evaluation and adoption of improved farming practices on soil and water resources'—is in line with ACIAR 's Philippines program on farmer-based land and water resource management for profitable and sustainable agriculture. It is an important component of a cluster of projects managed by Dr Gamini Keerthisinghe, from ACIAR 's Soil Management and Crop Nutrition Program, which are specifically focused on increasing agricultural productivity on fragile sloping lands.

The demonstration of improved ways to both farm and stabilise the landscape follows earlier ACIAR work that mapped out the extent of the land degradation and the poverty it has inflicted in the island's hinterland.

The Australian leader of the initial and follow-up projects, Professor John Bavor from the University of Western Sydney, says the task was to identify the main factors contributing to land degradation, and then to work with local farmers to determine alternative practices that will improve their landscape and their economic circumstances.

"A key objective of the project is to quantify, demonstrate and provide examples to farmers of the farm-level economic benefits that can be realised by implementing selected best management practices for soil, water and crop management in affected areas," he says.

Professor Bavor says most of the damage was being done by up-and-down cultivation on slopes, continuous planting of nutrient depleting crops such as corn and cassava, and extensive cultivation of steep upland soils.

The farmer cooperators greatly value the innovation of varied and mixed planting on their plots. Traditionally, monocropping has been practised on individual farm plots.

"There is no standard recipe for making farming sustainable on marginal lands. We have to look at what the current practices are and what sort of management practices best suited to the local conditions we can introduce to the efficient use of available resources to increase productivity," Dr Keerthisinghe says.

"It is important that intensification of agricultural productivity does not come at the expense of degradation of natural resources. However, one of the challenges is to identify practices that conserve the resources and provide additional farmer income."

PHOTO: BRAD COLLIS

BIOSECURITY

Biosecurity and its links to improved pest and disease control is a key concern for both ACIAR and its in-country partners. It is also an area that consistently returns exceptionally high benefits to Australia.

ACIAR's biosecurity projects also allow Australian scientists to work abroad, acquiring experience with disease-causing pathogens before they spread to Australia. These projects help develop diagnostic tools, establish or improve monitoring efforts, boost farm defences, and achieve the international cooperation needed to prevent a pathogen's further spread.

As an island nation less exposed to farming's biological nemeses, Australia benefits enormously from advances in biosecurity internationally. No project made that clearer than the emergence in the Americas of a fungus that attacks seedlings of Australia's most iconic flora—eucalypts.

Global effort to build rust shield

BY GIO BRAIDOTTI

PARTNERS, JUL-OCT 2007

In the aftermath of an Australian bushfire, one can observe scores of slender seedlings rushing to repopulate the scorched land. Many of these fast-growing plants—be they eucalypts, bottlebrushes or tea trees—tend to belong to the myrtle family, Myrtaceae, whose 155 genera include many species that are native, endemic and iconic to the southern hemisphere.

An infectious pathogen able to parasitise new growth after a bushfire, even if it leaves old growth unscathed, presents a troubling biosecurity threat, with the potential for serious consequences—and a fungus with precisely that capability has been found to exist.

Commonly known as guava rust, the infectious fungus Puccinia psidii is indigenous to South America. According to Australian plant pathologist Dr Ken Old, who has 25 years' experience at CSIRO Forestry and Forest Products, quarantine authorities in Australia have been aware for a long time that the rust is a potentially dangerous pathogen, but nobody really had any opportunity to do sustained research on the needs of Australia and its Asian–Pacific partners:

"We needed much more information about the range of susceptible species, the parts of Australia threatened by outbreaks, and we needed a quick and accurate method for identifying the fungus in case of an outbreak."

In response, Dr Old approached John Fryer, then forestry coordinator for ACIAR, with a funding request for a three-year research project. Of particular importance to the ACIAR project has been the involvement of Professor Acelino Couto Alfenas, of the Department of Phytopathology at the Federal University of Vicosa, Brazil, and Dr Michael J. Wingfield, Mondi Professor of Forest Pathology at the University of Pretoria, South Africa. In Brazil, enough seedlings were raised to infect and screen at Professor Alfenas's facilities.

"We found that some of the melaleucas are very susceptible to this rust," Dr Old says. "We tested Melaleuca alternifolia, the species used by the tea-tree industry along the coast in northern NSW and Queensland. We also tested a number of seed sources for Melaleuca cajputi, the tea tree commonly used in South-East Asia for its wood and its medicinal oil. Both these proved to be susceptible, which in itself poses a substantial threat."

Using samples from different Brazilian seed suppliers, the multinational team found that seed and pollen can carry spores of the rust disease. That finding is likely to prove crucial for quarantine authorities, and also for the ability to run diagnostics to spot the pathogen. To help with that, the CSIRO research group developed a DNA-based tool using polymerase chain reaction (PCR) technology that requires only minute amounts of fungal samples to detect the rust.

Despite the remaining uncertainties and the need for more research, the ACIAR project has already proved its strategic importance. In 2004, a particularly observant officer of the Australian Quarantine and Inspection Service noted spore-like material on wood imported from Brazil.

Despite the remaining uncertainties and the need for more research, the ACIAR project has already proved its strategic importance. In 2004, a particularly observant officer of the Australian Quarantine and Inspection Service noted spore-like material on wood imported from Brazil. Aware of the P. psidii threat, the service sent samples to the CSIRO laboratory in Western Australia, where it was confirmed that the rust had made its way to an Australian port.

Additional tests also established that some of the spores were still viable.

Visiting a CSIRO field site to look at wheat establishment and root vigour are Dr Satish Misra (left) of the Agharkar Research Institute and Dr G.P. Singh (right) of the Indian Agricultural Research Institute. They were shown around by CSIRO's Michelle Watt (second from left) and Dr Richard Richards (second from right).

STRENGTH IN PARTNERSHIP

Also notable in the 2000s was growth in the scale and scope of the partnerships brokered by ACIAR. With more partners engaging on a more regional level, ACIAR projects are tackling challenges relating to entire watersheds or common constraints to greater productivity such as drought, climate change and the emergence of new crop pests and disease.

Of particular note was the launch in 2010 of SIMLESA—sustainable intensification of maize-legume cropping systems for food security in eastern and southern Africa. The Australian Government through ACIAR provided $20 million in financial support for this project. Taking part are five African countries, their agricultural ministries and research infrastructure, Australian research partners, and two international agricultural research centres: CIMMYT and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

A major objective is to increase by 30% the productivity and resilience of a cropping system vital to the region. The methods used, however, break with a long-standing cycle of lifting production by bringing more land under the plough. This is important as the ecological consequences of that approach are catching up with farmers and their environment.

While new partnerships were forged with one hand, older relationships matured to the point that former aid recipients became donors and took a leading role in regional development work. They also jointly financed research projects of common interest with Australia.

This was the case for India and Australia, who share an interest in a major contemporary food security challenge: adapting production of staples like wheat to hotter, drier climates.

Water depth the root of the problem

BY GIO BRAIDOTTI

PARTNERS, NOV 2009-FEB 2010

When it comes to breeding wheat better able to cope with water scarcity, there is one particular problem that has been taunting agricultural scientists for years—accessing deep soil moisture.

Just as crops are about to flower and set seed, residual water in the soil is frequently out of reach of the deepest roots of current wheat varieties. Breeders know that if they could change the 'architecture' of the roots they could make that water available … and, as a consequence, increase food production. Until recently the insurmountable problem was the technical complexity of screening and selecting for different kinds of root systems.

However, from 2009 an ACIAR-brokered project is allowing breeders from India and Australia to pool resources to crack the root problem. The project is the first undertaken as part of the Indo-Australian Program on Marker Assisted Wheat Breeding (IAP MAWB) with ACIAR and the Indian Council of Agricultural Research matching funding.

Pilot field studies have been underway in India since the 2008-09 growing season. Some key sites used in these studies as located in the central and peninsular states, where wheat is grown entirely on soil-stored moisture acquired during the monsoon; this makes them especially suited to root physiology work. With little rain to confound the study, the Indian team has near-ideal conditions to screen for variation in root architecture and evaluate its effects on yield.

Over the next four years, the Indian scientists from the Directorate of Wheat Research, the Indian Agricultural Research Institute and the Agharkar Research Institute will be working with Dr Richard Richards' CSIRO Plant Industry team in Canberra and Queensland, with Dr Michelle Watt serving as Australian project leader.

The CSIRO team ranks among the world's most successful at developing physiological tests that can detect—from among thousands of lines—plant attributes that can lift yields in dry conditions.

Impressive gains are thought to be possible by selecting for deeper roots at around the time of flowering and seed-setting. Dr Watt says that any water taken up about this time is directly used for grain production.

"We have calculated that the uptake of an extra 10 millimetres can contribute to an extra half a tonne of grain per hectare," she says. "So the deep-root trait has very high water productivity—a high conversion of water into yield." ■

The quest for deeper wheat roots is an ambitious one—something of a holy grail for breeders. As soil coring to measure root architecture got underway in 2010, Australian and Indian researchers discovered in their pool of wheat lines the genetic variation needed to make impressive gains. The impact for farmers worldwide is potentially huge.

"I think we will get that extra root length," Dr Watt told *Partners* in 2011. "We easily have an extra 10 cm within the genetic variation in root system depth … in fact, we have up to 40 centimetres."

Researchers worldwide have barely begun to benefit food production through selection of root traits. It is symbolic of the ACIAR ethos that a collaborative partnership with a former aid recipient could open the door to such a promising strategy for safeguarding food production in a climate-challenged future.

SCIENCE AND FOOD SECURITY

PARTNERS, MARCH-JUNE 2010

For ACIAR CEO, Dr Nick Austin, the 'one size fits all' strategy loses favour in poverty reduction endeavours. Here he outlines the way forward based on country and region-specific solutions, market conditions and biophysical constraints.

A series of mini 'green revolutions', each targeting specific needs, may be the best way for agricultural research and development (R&D) to meet challenges posed by the confluence of rising populations, climate change, and competition for land and water resources.

Unlike the Green Revolution of the 1960s, when substantial production gains were possible through plant breeding and improved agronomy, we now need to make gains incrementally by tailoring funding, investment, policy and R&D to a wide spread of countries, communities and markets.

There is no longer the same scope for a 'one size fits all' approach to global agricultural development. The best approaches to ending poverty are those that understand the issues present within a country or region and design responses accordingly to create the right packages in the right place at the right time.

And the urgency of achieving this is starting to be recognised again by the world community.

The connection between population growth, food security and social security is now well recognised. Today, the world's population stands at 6.8 billion and rising. By 2050 it will reach 9 billion. Of today's 6.8 billion, more than 1 billion live in poverty, lacking food security.

The reasons for this lack include a convergence of factors beyond recent food and financial crises: climate change, decreasing funding for agricultural R&D over past decades and a rapidly growing population. These are balanced by the capacity of agricultural science to deliver step-change improvements in cultivation.

Agricultural R&D is our collective insurance against a plateauing of growth in food production must cease at some point. Dire predictions of mass starvation were made during the middle of last century, at least until the Green Revolution. Scientists, led by Norman Borlaug, contributed to a transformation of agriculture that enabled food production to more than keep pace with population growth.

The financial and food crises of 2008, with attendant rises in food prices, have now led many to refocus on the question of feeding the world.

Food security is once again on the international agenda. Some would suggest that feeding 9 billion people requires a new Green Revolution, while others are pessimistic about such prospects.

But agricultural science can continue to match food production to population growth. More than that, it can be a catalyst for lifting many of the world's estimated 1.4 billion poor people from poverty.

Agricultural science has a tremendous track record of success. During the past 50 years, agricultural R&D has been pivotal in lifting gross world food production by 138%, from 1.84 billion tonnes to 4.38 billion tonnes.

Most extraordinarily, that increase has been achieved as international investment in agricultural research has declined over past decades. The value of aid to agriculture has halved since the mid 1980s. The share of aid to agriculture has declined even more sharply, from 17% in the late 1980s to 6% in 2007. Agricultural research represents only a fraction of this amount.

There is an apparent conundrum when you overlay the steep upward trend in agricultural productivity against stagnant or declining research investment. The answer lies in the long lag times, sometimes several decades, between investment and impact.

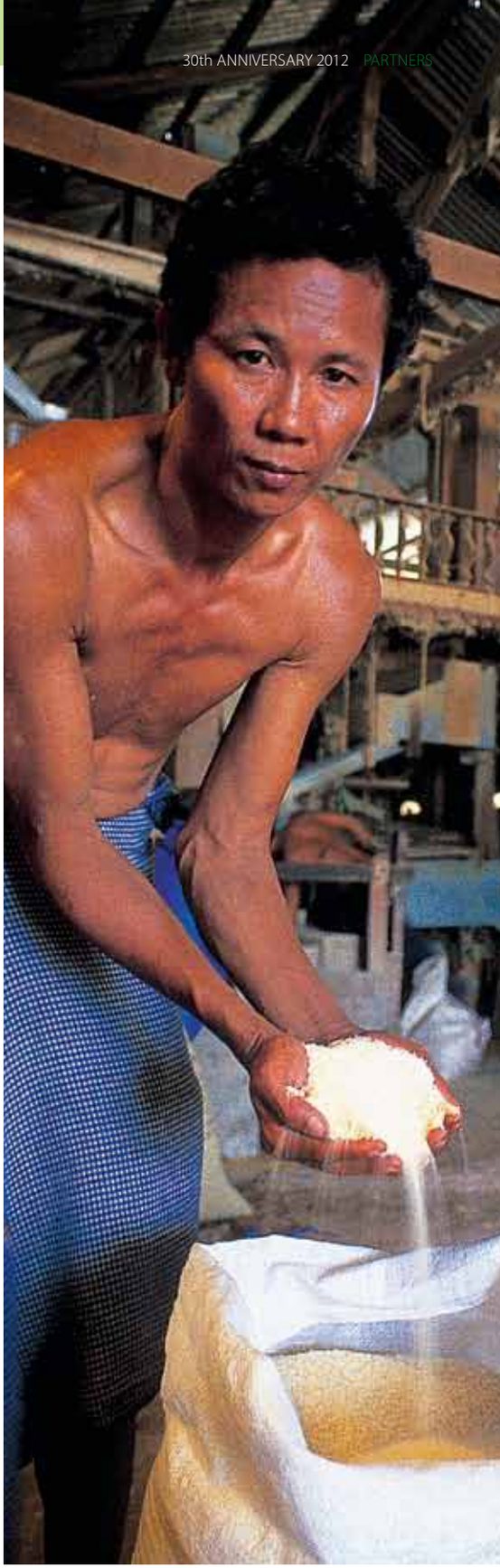


PHOTO: BRAD COLLIS

The global disinvestment in agricultural research is startling when one considers how important agricultural production has been as a driver of growth in the developing world. As Professor Peter Timmer observed, "no country has been able to sustain a rapid transition out of poverty without raising productivity in its agricultural sector".

Broad-based economic growth in developing countries is achieved by focusing on the largest sector—agriculture. In most developing countries 60–80% of the population are employed in, or reliant for their livelihood on, agriculture.

Achieving productivity gains in this sector lifts incomes, reduces poverty and creates opportunities in other sectors, through freeing up labour and generating growth in communities.

The Green Revolution is perhaps the pinnacle of development catalysed by agricultural research. The matches of new varieties and fertiliser and the cultivation of new land in both rainfed and irrigated environments was a perfect package of innovations, at the right time, in the right place.

While it is easy to overlook the policy drivers, and policy environments that enabled such success, the pivotal role of agricultural research cannot be denied.

Since that time, agricultural R&D has endeavoured to replicate these gains. A focus on land, water and fertiliser, in concert with new higher-yielding varieties, represented the low-hanging fruit. It is little wonder that rates of return were so high.

The original successes may have legitimised the assumption that agricultural research can continue to produce these gains well into the future. The reality is that future productivity gains will be far harder to secure.

Rates of agricultural productivity growth are slowing, most markedly in the developed world, where rates have dropped from around 3.5% in the 1980s to about 1.5% today.

To put this in context, agricultural productivity growth of around 1.8% is required simply to maintain pace with population growth.

The multi-decadal lags between investment and return are grounds for concern. Although recent renewed interest in food security has slowed—or in some cases reversed—declines in investment, the flow through to productivity growth is some way off.

The Consultative Group on International Agricultural Research, or CGIAR, is the pre-eminent multilateral body in delivering public-good agricultural innovation. It plays an important role in linking these goods to domestic science, and agriculture, in developing countries. CGIAR centres, such as the International Maize and Wheat Improvement Center (CIMMYT) and the International Rice Research Institute (IRRI) played key roles in the successes of the Green Revolution.

The CGIAR is in many ways a microcosm of the broader trends in agricultural R&D.

Funding to the CGIAR centres stalled during the 1990s, with funding previously devoted to productivity-based research increasingly being diverted to environmental and social considerations.

Some of the research focus has also shifted from productivity to maintenance of gains, ensuring disease, pests and weeds do not erode the gains already won.

Emerging problems, such as the black stem rust fungus known as Ug99, and other issues of interest often result in donors tying funding to specific projects, rather than providing untied funding. The increasing push for a clear line of sight on dollars invested has also contributed to the desire of donors to tie funds to specific projects.

More broadly, agricultural funding trends have been impacted by other factors too. Private sector funding has, like donor funding, sought a clear line of sight, though with profits in mind.

Changing investment environments, propelled by IP rights and tax incentives, skewed private sector investment towards some spheres of research, particularly where productivity gains can be leveraged against IP to maximise profits.

Where such opportunities are not as clear, for example in soil science or environmental management, public investment is required to fill the gap.

Recent history suggests that where agriculture is delivering sufficient food, and prices for that food are falling, imperatives for agricultural research investment are easily forgotten.

The reality is that neither public investment alone nor private investment alone can deliver the solutions needed for agriculture. In developing countries particularly, with the range of markets, coupled with sometimes fragile policy environments, flexibility is needed.

This may be disappointing to those seeking a 'one size fits all' solution, or to those advocating debt relief as an answer to poverty.

The best approaches to ending poverty are those that truly appreciate the issues present within a country or region and respond accordingly.

The danger in a single approach to the challenge of ending poverty is implementing solutions that are not the right package in the right place at the right time.

Designing the appropriate response begins with understanding the environment: getting the balance right between public and private investment, utilising research outcomes and domestic policy environments, along with biophysical characteristics and market constraints.

Potential agricultural R&D solutions within

developing countries must be designed to interact with the reality of governance and policy environments and market conditions, as well as biophysical constraints.

So a more realistic response may be a series of mini green revolutions, each targeting the specific needs of a country or region. These may be localised to areas within nations, centred on similar agroecological zones. The key characteristic of each mini revolution in agriculture will be intellectual capital, that is, the knowledge R&D creates, towards the unique dynamics and challenges presented by such environments.

Research will be needed not only into technological solutions but into human and environmental dimensions: value chains, markets, gender, equity, health, nutrition and so on.

Australia has been a world leader in agricultural research for many years. The benefits flowing from this research have applications beyond our shores. Australia shares the range of agricultural environments—and problems—with many areas in Asia, the Pacific and beyond.

ACIAR enhances spillovers between Australian and developing country research by brokering research partnerships across the spectrum of public and private spheres, providing intellectual capital to agricultural researchers in developing countries.

In East Timor, for example, a survey of subsistence farmers by researchers working as part of Australia's aid program found that no family among those surveyed had sufficient food staples of rice or maize to last a full year.

Seven out of 10 families went without maize for 4 or more months each year. All families surveyed were forced to ration food for 1–6 months each year. Many families reported that they gathered wild food regularly, with the worst affected consuming seed needed for planting crops the following season.

Australia is helping to reverse this situation by introducing crop varieties that are better suited to local growing conditions and which yield higher than the varieties currently grown. Working with the centres of the Consultative Group on International Agricultural Research (CGIAR), the Australian aid program, through ACIAR, sourced a number of staple crop varieties suited to the agroecological conditions in East Timor.

Since research began in 2005, 114 of East Timor's 442 villages have seen improvements in food security as a result of seed dissemination and field trials funded by Australia.

Interviews with farmers participating in the project found that more than half had sold, on average, one-third of their increased crop production and used the extra income to buy rice, protein and other produce to enrich the family diet.

ACIAR's role in East Timor is small but important. We have designed projects that take public-good assets, in the form of CGIAR-held seed, and delivered these into farming areas in the country, testing varieties to determine the most successful.

At the same time we are helping rebuild the research capacity of both government and academic sectors, engaging with the public sector in East Timor to ensure it has the infrastructure and capacity to deliver on publicly funded R&D in the future.

Of course this is different to much of the research undertaken in China, for example, where recent work relates to WTO accession and equalising the flow of benefits from trade across the country. This reflects the differences between the agricultural and policy environments in the two countries.

Were ACIAR to reverse these approaches taken in East Timor and China, neither program would have much success.

The steps to the next series of mini green revolutions—be they in Asia, Africa or elsewhere—will begin with targeted approaches to the unique needs of individual countries and localities. Investment in agricultural research will inform, and should flow from, that understanding.

Agricultural R&D can be a powerful driver of development and provider of food security. Ensuring R&D continues to deliver on this promise begins with an understanding that the way ahead is not the broad avenue travelled by the Green Revolution, but rather a series of winding pathways, each with its own challenges and unique solutions. ■

Why agricultural research works

The origins of ACIAR date back to the mid 1970s, when Sir John Crawford led a committee to investigate the feasibility of deploying Australian agricultural research capability as a component of national aid. The approach from the early 1970s grew, in part, from the success of the Green Revolution of the 1950s and 1960s that resulted in so many lives being saved.

That revolution had demonstrated the value of agricultural research. The emergence of the Consultative Group on International Agricultural Research (CGIAR) in the late 1960s continued to build on that momentum.

Yet it was the architect of the Green Revolution, Norman Borlaug, who saw the potential for that momentum to seep away. Speaking on receiving his Nobel Prize, Borlaug warned: "It is true that the tide of the battle against hunger has changed for the better … but ebb tide could soon set in, if we become complacent."

The report prepared by Crawford and his fellow committee members was in part an effort to ensure that the delivery of science and technology did not submerge in Borlaug's ebb tide, to assistance provided in piecemeal fashion.

Crawford and his committee took the stance that Australian science and technological aid to developing countries would be more effective if managed through one, independent body.

At the heart of the committee's recommendation was the idea that research assistance is one of the most effective ways of helping developing countries to lead their own efforts towards economic and social progress. The report cites an ancient Chinese proverb to make the argument:

Give a man a fish and you feed him for one day.
Teach him how to fish, provide him with nets,
And you have fed him for many days. Teach
Him as well how to make his own nets, and you
Have fed him for a lifetime.

The proverb would be familiar to some, its meaning familiar to many. Fundamentally what Crawford and his colleagues were suggesting was to build up the capacity of research in developing countries. This represented for Australia a unique niche, using our research expertise to solve the problems of developing countries, and equipping those countries to then build on and conduct further research.

This could help those countries to "provide food and the basic elements of decent living standards for their peoples". That link of living standards to food provision recognised the potential of agriculture as "one of the principal engines of development."

It remains as relevant to the global agenda on food security today, as it was in 1976.

Nobel Laureate Dr Norman Borlaug

PHOTO: BRAD COLLIS

Science's fight against hunger

Australian Sir John Crawford played an important part in shaping the use of agricultural science for development purposes. For Australia, the result has been an enduring synergy between ACIAR and the research organisations leading the global fight against the spectre of devastating food shortages.

BY GIO BRAIDOTTI

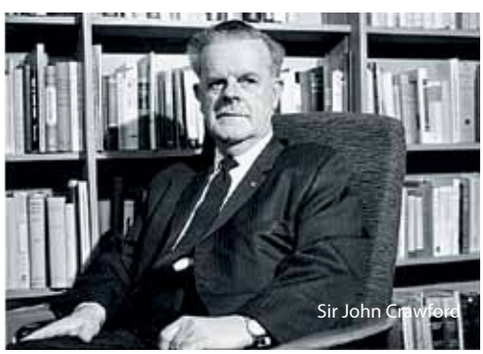
Australian agricultural science is of singular importance to lifting productivity in developing countries. Almost uniquely among developed nations, Australia faces and overcomes food production challenges that also stymie many millions of poor smallholder farmers, especially in tropical regions.

It was the late Sir John Crawford who saw in these shared food-security challenges a poverty-busting opportunity for Australia's national aid program. His advocacy resulted in a centre dedicated to linking Australian scientific expertise with the agricultural needs of developing-country agriculture.

In creating ACIAR, Australia endorsed its place helping smallholder farmers—a mission that aligned with the research organisations that had shaped the Green Revolution and demonstrated that science had a role to play in lifting productivity amongst even the smallest of farmers.

By 1971, these organisations had come together under the umbrella of the Consultative Group on International Agricultural Research (CGIAR).

The CGIAR's guiding philosophy and ACIAR's mission combine as a vision in which agricultural science serves as a bedrock for reducing rural poverty. The flow-on economic benefits include improved health and ecosystems resilience for the world's poorest people. The synergy was recognised from the outset, with ACIAR designated to administer Australia's investment in the CGIAR, currently worth about $18 million annually.



Sir John Crawford

CGIAR centres are also regular partners in ACIAR projects, a situation that sees a steady flow of scientists, expertise and genetic resources move between Australia, the CGIAR centres and partner countries. The benefits to Australia of this special rapport are apparent as a gain in scientific and biosecurity capacity nationally, in productivity gains for Australian farms, and in goodwill earned internationally.

A 2010 benefit-cost analysis by Anthea McClintock and Garry Griffith examined the effectiveness of CGIAR investment in ACIAR's mandated regions. It estimated a return of between $2.7 and $3.9 million to developing countries for every $1 million invested by the CGIAR.

SCIENCE AS A BEDROCK FOR DEVELOPMENT

Agricultural science came of age as a development tool in the 1950s, recruited to avert looming food shortages in many developing countries and prevent devastating famines in others.

The CGIAR traces its own history to a collaborative program between Mexico and

KEY ACHIEVEMENTS SINCE THE GREEN REVOLUTION

CROP GENETIC IMPROVEMENT

Varieties with CGIAR ancestry make up 60% of the area cultivated worldwide to the world's 10 most important food crops. Underlying that amazing uptake are plant traits that take researchers years to identify, select and transfer into national breeding programs. By targeting the most common stresses that constrain yields among the poorest farmers, spectacular discoveries continue to be made by scientists working within the CGIAR system.

- Flood Tolerant Rice—Flooding in South-East Asia causes about $1 billion in rice losses annually. In collaboration with the University of California at Davis, IRRI identified a gene called Sub1A that allows rice plants to survive complete submergence for more than 2 weeks. This trait has been bred into popular rice varieties grown in several Asian countries.
- Drought Tolerant Maize—More than 50 new drought-tolerant maize varieties are now grown on 1 million hectares in Africa, producing average yield gains of 20% over the varieties they replaced.
- Rice for Africa—New rices for Africa (NERICA) varieties developed by the Africa Rice Center have combined the high productivity of Asian rice with adaptation to African drought, weeds and pests. NERICA lines have been tested in 31 countries, with 16 lines released in 15 countries and adopted on 200,000 hectares.
- Biofortified Crops—Vitamin A deficiency leaves people susceptible to blindness and deadly diseases. The International Potato Center has developed improved sweet potato varieties high in beta-carotene, the precursor to vitamin A, that are benefiting over 6 million people in East and Southern Africa.

NATURAL RESOURCE MANAGEMENT AND CONSERVATION

- Cassava Mealybug—Control of the cassava mealybug in 20 sub-Saharan African countries through the introduction of a wasp has produced benefits with a net present value estimated at $9 billion.
- Conservation Tillage—Reduced-tillage technology conserves soil and water and reduces carbon emissions. Its rapid introduction and spread in South Asian rice-wheat rotations has cut farmers' production costs by 10% and raised crop productivity by the same percentage. Close to half a million farmers in India, Pakistan, and other countries in the region now apply this resource-conserving technology on more than 3.2 million hectares, with economic benefits so far estimated at $147 million.

POLICY

- Access to Genetic Resources—The CGIAR influenced a decision by the governing body of the International Treaty on Plant Genetic Resources for Food and Agriculture to extend the range of crops CGIAR centers distribute through the Standard Material Transfer Agreement.

One of the leading figures in the Green Revolution former principle plant breeder at IRRI, Dr Gurdev Khush.

The result is that more species will be subject to the treaty's benefit-sharing provisions and therefore freely available to smallholder farmers.

- Sustainable Forest Policy—CGIAR research stimulated the reform in Indonesia of policies that encouraged deforestation.
- Pro-poor Policy—Policy and institutional reform advocated by the CGIAR allowed small, illegal milk vendors in Kenya to become licensed suppliers of affordable milk. This significantly improved both the livelihoods of the vendors and the diets of poor consumers.

PHOTOS: BRAD COLLIS

Cambodian farmer

Benefits in a snapshot

Without public investment in international agricultural research through the CGIAR, an independent 2008 review estimated:

- World food production would be 4-5% lower;
- Developing countries would produce 7–8% less food;
- World food and feed grain prices would be 18-21% higher;
- 13-15 million more children would be malnourished; and
- For every $1 invested in CGIAR research, $9 worth of additional food is produced in developing countries, where it is needed most.

The average annual economic benefits from CGIAR research has been estimated at US$2.5 billion for wheat, US$10.8 billion for rice in Asia and up to US$0.8 billion for maize.

the Rockefeller Foundation. Led by George Harrar, a team of scientists developed semi-dwarf wheat varieties and a cropping system capable of yielding three times more than traditional varieties.

Among the participating scientists was breeder Norman Borlaug, who would receive the Nobel Peace Prize in 1970 for his contributions to global food security.

Subsequently, a rice program headquartered in the Philippines was inaugurated through the joint efforts of George Harrar and Ford Foundation vice-president Forrest 'Frosty' Hill.

Rice market, Phnom Penh.

Speaking their mind—what they said over the years

DR THOMAS LUMPKIN,
CIMMYT DIRECTOR GENERAL

"We are seeing the new world order begin to emerge and with it, a doubling of our budget in the last three years. All along ACIAR has been a committed partner to CIMMYT's activities. With ACIAR, however, it is not just about funding as we are also getting a lot of creative stimulation from Australia. The synergy with ACIAR is one of the best we have."

DR COLIN PIGGIN,
CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS (ICARDA)

"That is one of the really positive features about ACIAR—they are very collaborative in the way they run projects and that makes it possible to draw the maximum number of benefits to the most players from agricultural science. ACIAR is particularly good at building the foundation required for cooperation, both at the international level and at the national level in developed and developing countries."

JOHN HARVEY,
AUSTRALIA'S GRAINS RESEARCH AND DEVELOPMENT CORPORATION (GRDC) MANAGING DIRECTOR

"Australia's working relationships with the CGIAR, particularly CIMMYT, ICRISAT and ICARDA, is critical to the flow of knowledge and plant genetics into our own crop improvement programs. ACIAR's high standing within the global agricultural research community has been central to this, with GRDC a long-standing supporter and partner in our combined efforts to not only improve the circumstances of Australian farmers, but farmers in poorer countries for whom crop productivity is fundamental to improving people's lives."

INDEPENDENT REVIEW OF AID EFFECTIVENESS, APRIL 2011

"One area of excellence has been in agricultural research, where ACIAR has a strong record of achievement stretching back over several decades.

Independent evaluations show that ACIAR has performed impressively, but its overall funding remains modest. Increased funding for agricultural research seems warranted given high prices and serious concerns around food security."

DR DENIS BLIGHT,
CRAWFORD FUND EXECUTIVE DIRECTOR

"We knew from the work of the Consultative Committee on Research for Development—of which Sir John was the chair and I the executive secretary—that Australia had much to offer international agricultural R&D.

"What emerged in the form of ACIAR and its dedicated staff are the brokerage skills needed to build, manage and fund joint ventures that can address the enormous need to raise the productivity of agricultural systems in ever more sustainable ways, as well as benefitting Australia. It is satisfying to see that some of those partnerships are being sustained well beyond the lifetime of individual projects. The Fund is pleased to have been adding value to much of this work over 25 years through our own training and public awareness efforts."

Innovations developed at these research stations were subsequently adapted and transferred to Asia where they are credited with averting famine in India. This was the start of the Green Revolution, and both Borlaug and Crawford were involved in this transfer of agricultural innovation.

These early efforts led to the establishment of four international agricultural centers:

- IRRI: the International Rice Research Institute in the Philippines in 1960,
- CIMMYT: the International Maize and Wheat Improvement Center in Mexico in 1966,
- CIAT: the International Center for Tropical Agriculture in Colombia in 1967, and
- IITA: the International Institute of Tropical Agriculture in Nigeria in 1967.

At the Bellagio conferences in Italy during 1969–71, talks got under way on how best to cement agricultural research on the international development agenda and how to provide for its growing need for investment. Taking part were the foundations, the Food and Agriculture Organization (FAO), the United Nations Development Programme (UNDP), and the World Bank.

Experts, including John Crawford, produced a series of policy papers covering all the major issues involved in institutionalising this approach from agricultural priorities to capital flows.

As the World Bank had established consultative groups for countries, Robert McNamara of the World Bank took up the challenge of urging the Executive Board to provide an annual grant to a Consultative Group on International Agricultural Research (CGIAR).

The proposal did not gain immediate

Touching the lives of half the world's population

Rice research has become a cornerstone of Asian food security. Underwriting that work is the International Rice Research Institute (IRRI), a long-standing beneficiary of Australian funding.

The impacts from that investment were analysed by an independent 2011 review commissioned by ACIAR and found to pay large development dividends.

High-yielding rice varieties bred by IRRI since 1985 specifically for poor smallholder farmers have contributed benefits worth nearly US$97 billion to South-East Asia. The study focused on three rice-growing countries in ACIAR's mandated region—the Philippines, Indonesia and Vietnam.

ACIAR CEO Dr Nick Austin says such a high return from investment in rice breeding is especially welcome given that rice provides 49% of the calories and 39% of the protein in the South-East Asian diet.

"Impacts from IRRI's work are now estimated to have touched the lives of almost half the world's population, an impressive achievement," Dr Austin says. "This is primarily through helping poor rice farmers in developing countries grow more rice on less land while using less water, labour and fewer chemical inputs."

For farmers, the high yielding varieties made possible by IRRI breeders translated into economic benefits worth $88 per hectare (ha) since 1985. In recent years, however, benefits increased to over $200/ha as commodity prices rose.

Dr Austin says the rate of return would be even higher if benefits from all of IRRI's activities—not just breeding—were included. Primarily these involve refining agronomic practices for specific growing conditions, assistance with land and water management, and opportunities to diversify and to market surplus production.

The return on Australia's investment in IRRI—US$1.16 million in core funds for financial 2008—was estimated at 28%. In addition, ACIAR also invests in IRRI through commissioned research-for-development projects administered by ACIAR.

MORE INFORMATION

IRRI's contribution to rice varietal yield improvement in South-East Asia is available from ACIAR's website at aciar.gov.au/publication/term/25.

PHOTO: BRAD COLLIS

Rice researchers at work near Phnom Penh. Cambodia is working hard to return to the world market as an exporter of high-quality rice.

PHOTO: BRAD COLLIS

Dr Norman Borlaug (second from left) meets with Australian grain growers in South Australia in 2003.

PHOTO: CRAWFORD FUND

Crawford Fund Funded Master Class on Climate Risk Management Training, November 2011, Morogoro, Tanzania. Mandela Village farmers were joined by Australia SIMLESA team members and participants from the National Agricultural Research Systems (NARS) of Ethiopia, Kenya, Tanzania, Malawi and Mozambique.

acceptance. McNamara persevered, however, urging the Executive Board to act so that "the Green Revolution could remain green."

He co-opted Crawford as a World Bank consultant to help with technical planning, while he exercised his own negotiating skills within and outside the bank until full support was lined up.

The first formal meeting of the CGIAR was held on May 19 1971, with 19 members in attendance representing industrialized countries. The CGIAR also established the Technical Advisory Committee, headed by Crawford, to provide it with independent technical advice.

Initially focused on breeding, the CGIAR's brief expanded in the 1970s to include the smallholder farming systems under which the dominant staple grains are grown—primarily rice, wheat and maize—and how to manage the soil, water and genetic resources that support their productivity.

There was a further broadening of the mandate to include social, economic and ecological issues in the 1980s and the inclusion of forest and fishery management, agroforestry,

The Crawford Fund—supporting ACIAR for 25 years

Named in honour of Sir John Crawford, the Crawford Fund was established by the Academy of Technological Sciences and Engineering (ATSE) in 1987 and, so like ACIAR, has a special anniversary in 2012. Over 25 years it has worked to increase Australian engagement in international agricultural research, development and training.

Among its key activities, the Crawford Fund runs a training program for developing world people who are engaged in agricultural R&D with Australian aid agencies and companies. Master Classes are available for more senior personnel from developing countries.

Excellence in research is recognised through the provision of two awards: the Derek Tribe Award that recognises distinguished contributions to the application of R&D, and the Crawford Fund Fellowship for a scientist whose work has shown significant potential.

The Crawford Fund also runs a public awareness program aimed at sustaining community and government support for agricultural research assistance. Activities include:

- annual conferences and other public events on food security issues
- managing regular media outreach including on ACIAR success stories
- organising journalist visits focusing on ACIAR projects in Africa, Asia and the Pacific
- policy research work, and the arrangement of visits for international visitors
- providing opportunities for ACIAR to be part of public or media events
- developing special project-focused publications and activities.

MORE INFORMATION
www.crawfordfund.org @CrawfordFund

The CGIAR centres in the twenty-first century

- Africa Rice Center
- Bioversity International
- CIAT – Centro Internacional de Agricultura Tropical
- CIFOR – Center for International Forestry Research
- CIMMYT – Centro Internacional de Mejoramiento de Maiz y Trigo
- CIP – Centro Internacional de la Papa
- ICARDA – International Center for Agricultural Research in the Dry Areas
- ICRISAT – International Crops Research Institute for the Semi-Arid Tropics
- IFPRI – International Food Policy Research Institute
- IITA – International Institute of Tropical Agriculture
- ILRI – International Livestock Research Institute
- IRRI – International Rice Research Institute
- IWMI – International Water Management Institute
- World Agroforestry Centre (ICRAF)
- WorldFish Center

Wheat trials at CIMMYT's El Batan headquarters in Mexico.

PHOTO: CATHERINE NORWOOD

and aquaculture in the 1990s, a reform that ACIAR actively pursued. In 1991, ACIAR was appointed by the CGIAR to implement the establishment of the Center for International Forestry Research (CIFOR) and identify potential research priorities.

Today, the CGIAR boasts 64 members that support 15 CGIAR centres—11 of which maintain international genebanks—and collaborations with hundreds of partner organisations, including research institutes, civil society organisations, universities and the private sector.

With the global food crisis of 2008 came renewed investment that in 2009 amounted to US$572 million—the single largest investment made to mobilise science for the benefit of the rural poor worldwide.

Since 2008 the CGIAR has undertaken a significant reform process that involve designing new research programs. These cut across the broad disciplines of the centres, creating multi-disciplinary approaches to the main research challenges of securing food supply.

"Australia has been a long-term donor, utilising the expertise of the CG centres to complement and enhance the work of ACIAR and other Australian aid initiatives," says Dr Nick Austin, ACIAR chief executive officer.

"We were there when the CGIAR was established, and today through ACIAR we are part of reinventing agriculture in ways that meet the development needs of partner countries, the productivity challenges facing Australian farms, and the perfect storm facing food production from climate change, population growth and price volatility." ■

PHOTOS: BRAD COLLIS

Daunting challenge: a ruined agricultural research station in Cambodia before the rebuilding began.

Rebuilding after disasters

When smallholder farmers and rural communities are hit hard by natural or man-made disasters their tenuous hold on food security is loosened. Rebuilding is never simple, and the task is even harder in poor communities.

In 30 years of supporting agricultural development, ACIAR has experienced its share of emergency interventions, sometimes dealing with catastrophes on a gargantuan scale.

In these circumstances, ACIAR's aid is different and complementary to emergency food aid. ACIAR projects are about rebuilding farming capacity from the ground up by partnering with communities over the long term—what participating scientists call "walking beside the farmer".

The immediate goal is to remove obstacles to food production—replace lost seed or tsunami-stripped soils—and then to quickly transition from starvation to secure production levels. But the assistance does not stop there. From the worst of disasters, opportunities for new gains can be found.

With the right know-how and support, communities have taken the next step by intensifying production and diversifying to produce admittedly small but dynamic agribusinesses. In time, these have often proven capable of producing enough disposable income to pay for home repairs, schooling and health care and to reinvest back into the micro-enterprise.

Strong and enduring bonds can form in these circumstances, as occurred between Australia and Cambodia, Indonesia and East Timor. Then there are the places around the world where Australian team members have been greeted as heroes by recovering communities.

The scientists themselves often have remarkably warm recollections of their involvement, touched in ways they had not expected. Even so, ACIAR wants to express its deep gratitude to all past members of these extra special teams.

In the following pages, we look back at a *Partners* story that commemorated their achievement and powerfully brought home the essential role agricultural scientists and research infrastructure have played rebuilding lives, communities and hope.

PARTNERS, JULY 2005

HEALING WOUNDS WITH SEEDS AND SOIL

International agricultural research has demonstrated its vital role in rebuilding devastated countries.

BY BRAD COLLIS

It was 1988 and two Australian agricultural scientists, Harry Nesbitt and Glenn Denning, and Harry's wife Betty, were strolling three abreast down the middle of Norodom Boulevard in the centre of Phnom Penh, Cambodia.

For anyone familiar with Phnom Penh's crowded and chaotic traffic today, it is hard to imagine, but back then the city was completely empty, save for the last remaining units of North Vietnamese troops who had driven out the Khmer Rouge.

The two Australian agriculturalists and Betty Nesbitt were among the first outside civilians to enter the abandoned city, and in so doing were perpetuating a timeless practice that requires soldiers to be followed as quickly as possible by people who can rebuild broken communities and lives.

Their unencumbered stroll down a puddled, haunting thoroughfare compared with today's vibrant mayhem is the difference between war and peace. And in between these two points in time is the foundation laid down by a rebuilt agriculture sector.

Nesbitt and Denning had arrived in Cambodia to prevent a famine; alone and without the protection of peacekeeping forces. They had to rally as many able-bodied farmers as possible to get in a rice crop using the product of modern science, the early-maturing IR66 variety, which created enough time for a second crop in the same season.

From this emergency action, they then began the long, gruelling task of showing an entire dislocated country how to farm the

strange soils and topography that people had been forcibly moved to, and to also begin training a new generation of agricultural professionals.

Their success over the next decade helped Cambodia to rise again as a fast-healing country with a positive future.

The work of Nesbitt, Denning and others in what was the CIAP program (Cambodia–IRRI–Australia Project) epitomises the vital role of international agricultural research in rebuilding countries after conflict.

Ideally, agricultural researchers from developed countries would prefer to be able to concentrate on peacetime development; helping people in less developed countries who are dependent on the land for food and basic income to climb from poverty.

But recent histories, like Cambodia, Rwanda, East Timor (Timor Leste), Afghanistan, Iraq and, closer to home, Solomon Islands and tsunami-devastated countries, have highlighted the need for agricultural research to also be responsive to immediate humanitarian crisis.

This work by international agricultural research agencies, such as ACIAR and partner organisations like AusAID and the Crawford Fund, have been highlighted in a new book, *Healing Wounds: How the International Research Centers of the CGIAR Help Rebuild Agriculture in Countries Affected by Conflicts and Natural Disasters*.

Published by the Consultative Group on International Agricultural Research (CGIAR), the book is written by Surendra Varma and Mark Winslow (see www.cgiar.org/publications). It also includes a section, 'Rebuilding agriculture after the Asian tsunami', derived from a report produced by Dr Meryl Williams, with contributions from ACIAR and other international research centres.

From this publication, the Crawford Fund has produced *Healing Wounds: An Australian Perspective*, which looks at the work by Australian agencies in helping damaged communities to rebuild.

While there is a strong Asia–Pacific focus, the book also looks at the role of Australian-supported agricultural research in Rwanda, Afghanistan and Iraq.

In particular, *Healing Wounds* underscores the value of international agricultural research centres being able to quickly rework their programs and strategies to respond to a crisis.

In 2000, ACIAR responded immediately to the post-election violence in East Timor, coordinating the resources of five CGIAR centres to initiate the Seeds of Life program to urgently secure the country's food resources.

This program then became the main vehicle for lifting agricultural productivity and diversity by introducing improved, higher-yielding varieties of staples such as cassava, maize, sweetpotato, peanuts and rice. Many East Timor scientists also received training during the project, to give the fledgling democracy a better chance of sustaining its food supplies and building an agricultural economy.

ACIAR played a particularly important role in rehabilitating the agriculture faculty of the National University of East Timor. This continues to play an important part in building the country's human and institutional capacities.

The Seeds of Life program took its cue from the Seeds of Hope campaign in Rwanda from 1994–96. AusAID was a significant contributor to this CGIAR post-conflict engagement, which

Rising again: Australian agricultural scientist Harry Nesbitt at a farmer field day in Cambodia in 2001.

PHOTOS: BRAD COLLIS

Agricultural aid at work. (Top left) AusAID's Dr Kep Coughlan at work in Cambodia; Cambodian farmers now have the confidence to give over some of their land to ACIAR/AusAID-supported crop-diversification trials; and (bottom right) a Cambodian boy collects water for crops from a well built with Australian aid.

in many ways embodied the consequences of societies left to stagnate in poverty while the rest of the world is seemingly moving on. Rwanda was typical of the hopelessness and ethnic hatred that is so easily fuelled when people see no way out from poverty, political upheaval and economic stagnation.

Again, an initial campaign to revive food production was able to be used to also build a better agricultural base—improved crop varieties and the development of national capacity-building by training local expertise.

Significantly, these programs, launched in times of strife but designed to have long-term impacts, have learned how to get the right seed to the neediest people quickly and without pushing aside local agrobiodiversity and seed enterprises.

The basis for rebuilding Cambodian rice production, for example, was improving local varieties that had been collected before the conflict and stored in the germplasm bank at the International Rice Research Institute (IRRI) in the Philippines.

Similarly in Rwanda and East Timor, complementary research partners were drawn together to identify seed sources appropriate to specific localities and needs.

In Solomon Islands, the challenge has been something else again: the need to develop new livelihoods to create a more even distribution of economic opportunity, which was the cause of ethnic conflict that erupted into violence in 1998.

Through support from ACIAR and others, the WorldFish Center has been developing small-scale aquatic enterprises that can help the coastal poor lift themselves from poverty. Over the past nine years, WorldFish has transferred the technology for catching and growing the blacklip pearl oyster from Polynesia to Solomon Islands. The establishment of just one major pearl farm in the Western Province of Solomon Islands is expected to provide at least 100 households with annual incomes of US$2000.

ACIAR has given ongoing support to the work of WorldFish and current projects on pearl oysters, sea cucumbers and sustainable aquaculture reflect this. Other ACIAR-funded research targets management of migratory tuna stocks, support for regional plant genetic resources development, and domestication and commercialisation of crops from indigenous trees and shrubs.

In Afghanistan, ACIAR and AusAID have been helping the International Maize and Wheat Improvement Center (CIMMYT) to restart wheat farming, in particular local seed production.

More recently in Iraq, a 3 year project has just started in which improved varieties of wheat, barley, pulses and legumes will be introduced to Iraq's dryland cropping systems. The AusAID-funded program is being managed by ACIAR in partnership with the International Center for Agricultural Research in the Dry Areas (ICARDA).

All of these programs contain stories of individual courage and dedication by expatriate and local agriculturalists who are the frontline fighters against poverty and human despair.

As *Healing Wounds* points out, poverty and hunger can breed despair and desperation, and without hope and education one alternative for some young people is to turn to banditry, violence or terrorism. ■

***Healing Wounds: An Australian Perspective* is available from the Crawford Fund, www.crawfordfund.org**

EAST TIMOR TAPS FOR A MIRACLE

There is a critical moment in the calendar when crops need to be sown if famine is to be avoided the following year. When a country is recovering from conflict that has stripped away its infrastructure and expertise, making that deadline often needs more than a little help.

BY BRAD COLLIS

PHOTO: BRAD COLLIS

A young boy, Alberto Mauasa, in the East Timorese village of Miguir in 2002. Piped water could bring immediate relief to a village, freeing women and children from hours spent every day ferrying water in buckets from mountain streams.

There are no manuals on how to build a nation from nothing—especially a small, resource-poor country emerging from repression and war. However, the story of East Timor's struggle to build a basis for its future and meet the exuberant expectations of a people suddenly freed is likely to become a familiar story around the world in coming years.

It's a lesson worth contemplating because it shows starkly the power of timely aid, and the power of basic agricultural science in creating a stable platform for national renewal.

The greatest source of hope invariably lies with agriculture, with the farmers. Adequate food, and in particular local, familiar food, is the first measure of normality.

In the case of East Timor—Timor Leste—this was more problematic than usual. The country had lost an estimated one-quarter of its population: mostly young rebellious men and mostly farmers.

The euphoria that came with the bloody bid for freedom in 1999 was soon tempered by the spectre of widespread starvation and an outside world that was slow to grasp the crisis unfolding.

This is often a time when individuals step in; sometimes without official backing but with the perception to realise what is happening and what needs to be done—immediately. It's no surprise that such individuals tend to be agricultural professionals. It's the story of Harry Nesbitt and Glen Denning in Cambodia, and it's the story of mavericks like Brian Palmer, Colin Piggin and Rob Williams in East Timor.

Dr Brian Palmer, a former CSIRO plant breeder, was one of the first Australian civilians to arrive on the heels of the retreating militia. He had simply seen a need that he was skilled to meet: "I had spent 20 years as a research scientist. Now was a chance to put it to real use," he explained to me three years later as we trudged through the sucking mud of one of his many crop trials scattered across the country.

Brian initially thought he'd spend a few months in East Timor. Three years later he was still there, a larger-than-life-character instantly recognised in the rural communities he worked with, and living almost as frugally as the farmers he was helping. He confessed at the time that he was starting to wonder if he would, in fact, now ever leave.

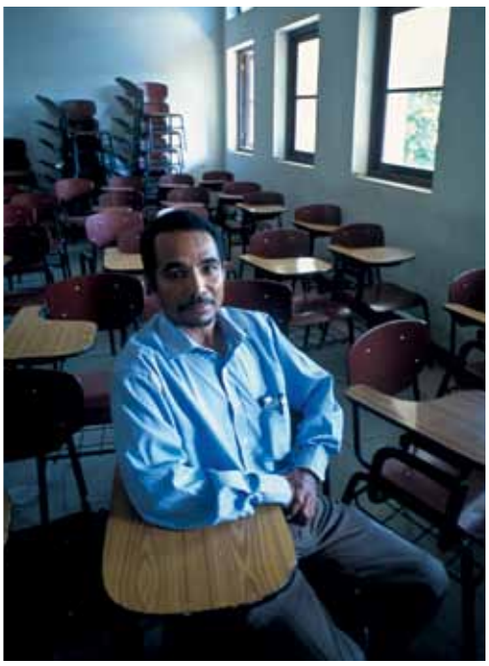
He had become a valued adviser to the new government and was custodian of a string of crop experiments that he hoped would eventually build a whole new, productive, farming system.

Brian became the key in situ volunteer for ACIAR's Seeds of Life program, which began as a race against time to get viable seed to the farmers. Most of what had been stored for sowing had either been burned, eaten or stolen in the aftermath of the violent reprisals against the East Timorese after they voted for independence in September 1999.

The program was a sleeves-up response, with ACIAR enlisting the support of the world's five leading crop research institutes. By December that year, with peacekeeping troops still clashing with militia, the first seeds were going into the ground, averting a certain famine.

Importantly, the seed—for rice, maize, sweetpotato, ground nuts (peanuts), beans and cassava—was the product of the latest agricultural science: high-yielding, disease-resistant cultivars that might otherwise have

Students at the University of East Timor's rebuilt agriculture faculty in 2002. Having won the political fight they were now on East Timor's economic frontline. L-R: Flavian Soares, an Australian volunteer lecturer Robert Williams, and students Aluiziu Assia, Esebio Gomes and Sipriano Martins.



Flavian Soares in a rebuilt lecture room in 2002.

PHOTOS: BRAD COLLIS

remained beyond the reach of East Timorese farmers for decades.

The International Centre for Tropical Agriculture in Columbia (CIAT) provided soybean, mungbean, cowpea and cassava seed; the International Potato Center (CIP) in Peru contributed, as did the International Rice Research Institute (IRRI) in the Philippines, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India, and CIMMYT.

Higher yields soon started freeing up land for more commercial ventures such as vanilla, soybean, peanuts and candle nut (for oil), and agroforestry. Also, much of the terrain is similar to Australia's far north-west and prone to erosion so higher yields also lessened the need to farm unsuitable land.

The Seeds of Life program was first overseen by an Australian agronomist, Dr Colin Piggin, and over time transformed from a humanitarian operation in 1999 to an agricultural extension program for the development of commercial crops. It also restored the University of East Timor's agriculture faculty.

The university's curriculum initially placed a strong emphasis on practical skills, with graduates expected to return home to develop their communities. In 2002 when I visited for *Partners* magazine, most were the first generation to be schooled, coming from rural communities that were largely illiterate. These students understood clearly the challenges ahead. As children they knew only war and violence. They were conscious of the responsibility they carried as survivors.

As teenagers, many had belonged to the Falintil's clandestine courier network. More recently, they became part of the youth movement mobilised to explain democracy and the fateful referendum that was to unleash the Indonesian military's fury. Scores of their friends and classmates had simply disappeared.

One aspiring agronomist at the time, Sipriano Martins, had by the age of 15 acquired the code name, Saruntu, 'fight like a crazy man'. At 24 his ambition was to take new cultivation methods back to his coffee and vanilla-growing village.

Eusebio Gomes, 28, was in school on November 12, 1991, when he heard the heavy gunfire of troops firing on a peaceful memorial procession to Dili's Santa Cruz cemetery. More than 270 people were killed and a further 250 disappeared in follow-up action. Eusebio's father was among the many randomly arrested after the procession and spent the next one and a half years in prison.

The feeling of these young fighters-turned-students was summed up by 24-year-old Aluiziu Assis who was impatient to take his knowledge of animal disease and vaccines back to his home town, Manatuto: "We're optimistic about the future because we have learned already that we can make change—and from now on it's going to be Timorese helping Timorese."

Their dean at the university, Flavian Soares, saw his students as embodying the country's new circumstance: "We are facing the need, and the opportunity, to think differently. Before, everything we did was controlled. When many of these students started university their motivation was political change. Now their motivation is economic change. Science and economic competition are the worlds in which we now have to think and work."

However, at the time this was mostly the new language of the city, Dili. In the farms and villages, life was little changed. Even the white UN Toyotas that sped by, raising dust and feathers, had lost their initial appeal. There were only so many surveys that even a free farmer could tolerate when nothing ever seemed to come of the questioning. It was partly why Brian Palmer was staying around, feeling keenly the need for his work to show results: to sustain people's hopes through patient season-by-season advances in their crops and yields.

Brian had observed that freedom and democracy had been presented as a panacea for the country's long history of suffering. "But I think it's only now starting to dawn that these changes are only an opportunity, that nothing will be achieved if the people themselves don't make it happen."

Over a decade later, East Timor now appears to have settled into a stable democracy, another election recently held, but its future, particularly its economic future, still lies somewhere through the shimmer of improbable hopes, along a path that's sometimes still difficult to see. But it is enough to make people believe in, and to commit themselves, to the future.

It is enough to show how important it is for the outside world to care. ■

Brad Collis showing children their photo on the digital camera.

Stories shared

Reprinted here is an agricultural science story that captured the imagination when it first appeared in *The Bulletin* magazine on January 17, 2006. It was subsequently picked up by news and magazine outlets around the world, and by documentary filmmakers.

Remarkably, the story is about an seemingly arcane scientific discipline—genetic resources and their management by genebank curators. As written and photographed by *Partners*' managing editor, Brad Collis, this seemingly dry topic was transformed into a compelling tale set against the backdrop of a seed hunting expedition in the Caucasus.

Central to the narrative is curator and agricultural ecologist Dr Ken Street. Passionate, personable and knowledgeable, Dr Street exemplifies much about international agricultural research: the urgency of the work, its importance to food security and the resourcefulness of individual scientists.

The story was timely, predating the global food crisis and the emergence of the stem rust strain Ug99, as a reminder of how vital a ready supply of genetic stock was, and is, for breeding. That stock was at risk of disappearing before we even knew what riches it held. Together, the journalist and scientist highlighted that a race was on to conserve crop biodiversity. At stake was the world's most important resource, needed to feed itself in a populous, climate-challenged future.

It was the perfect marriage of storyteller and protagonist.

During the subsequent media coverage, Dr Street made himself available to reporters during a visit to Australia, and was also contacted by the global network NBC as well as the prestigious German natural science magazine *GEO*.

That the story came to light through the support of ACIAR, the Crawford Fund and the Grains Research and Development Corporation (GRDC) is not a coincidence. Together we made it possible for Brad Collis to travel to Syria and meet Dr Street as part of our commitment to communicating the value of agricultural research.

Much has changed since 2006. The story was a catalyst in focusing attention on the importance of seed collections and their need for resourcing. Globally, there is reinvestment in genetic resources, including in Australia, and greater action to preserve existing collections, while efforts are made to collect seed yet to find sanctuary in genebanks.

To commemorate these gains, *Partners* presents the never-before-published full-length version of the seed hunter's story.

PARTNERS, SUMMER 2005-06

ANCIENT SEEDS OF SURVIVAL

Global warming scenarios are starting to register with many, but this may just be part of a wider environmental collapse that is sending agricultural scientists back into early human history in a search for answers.

BY BRAD COLLIS

The farmer's tanned, furrowed face is thoughtful. "You should ask the old women," he says after a pause. He smiles apologetically, dull veins of gold in his teeth. From village to village, farm to farm, others agree. "Ask the old women." They are helpful and nostalgic, and after an obligatory vodka or two, melancholic.

We are on a mission that they understand. They are farmers—in the land where farming began.

So we start calling out the old women, who emerge from lightless kitchens and farm buildings—reliable electricity also just a memory—and we explain our quest. They hurry away and with extraordinary generosity re-emerge with tins, jars and knotted cloth containing biological treasures—the seeds of bygone crops.

Grains of wheat, barley, beans and peas disappear into small yellow envelopes, marked with the name of the village, the name of the family and the GPS position. The handheld satellite positioning device is an object of wonder to scores of children.

The old women wish us well. Some cry, because these visiting scientists seem to understand what they have known intuitively all along, that the traditional varieties were special—the same way other people lament the passing of tomatoes or apples that taste like … tomatoes and apples, before they started being grown for cold storage and mechanised handling.

There is a surrealism to these farmyard meetings, underscored by the dissonant chatter of Australian, Russian and Armenian accents as

the team probes for knowledge of yesteryear crops, and asks for a little of the seed that might have been hoarded. As we travel over rutted mountain roads we are also looking for places where ancestral plants might still grow on high plains that haven't been overgrazed and, hopefully, haven't been mined.

We are high in the mountains of southern Armenia, a stone's throw from Iran to the south, and in sight of the disputed territory of Nagorno–Karabakh to the west, a smouldering fuse threatening to reignite a war between Christian Armenia and Muslim Azerbaijan.

This political and ethnic tension, not to mention the rusted metal detritus of the last flare-up, is the backdrop to a scientific mission that could determine the fate of millions of people, and their capacity in the years ahead to keep putting bread on the table—figuratively and literally.

This is a hunt for genes, for lost genetic resources that agricultural scientists say will be crucial if the world is to keep feeding itself as climate change and deteriorating agricultural landscapes begin to bite.

And no one will be immune, least of all people who today know only how to buy food, not grow it.

So this small band of genetic detectives is scouring the birthplace of agriculture, the Caucasus—Georgia, Armenia, Azerbaijan and parts of Russia—for remnant on-farm storages and for ancestral wild grasses from which modern crops like wheat and barley were first bred some 5000 or so years ago.

The mission is led by a Syria-based Australian, Dr Ken Street, an agricultural ecologist with the International Center for Agricultural Research in the Dry Areas (ICARDA) and comprises leading Russian and Armenian plant researchers, as well as another Australian, Perth-based Dr Clive Francis from the Centre for Legumes in Mediterranean Agriculture (CLIMA).

Their work is part-funded by Australia through the Australian Centre for International Agricultural Research (ACIAR) and the Grains Research and Development Corporation (GRDC)—there being a healthy dose of self-interest in the support. Australian farmers are as desperate as any for crops that can withstand the tightening grip of droughts, frosts, saline soils and fungal diseases such as rust. They might have large, modern machinery and vast acreages compared to their counterparts in developing countries, but they share the plight of food producers everywhere: over-worked soils that have turned saline or acidic, urban growth that is pushing farmers off the best soils and onto increasingly marginal country, and the spectre of global warming.

While a two or three-degree increase in average temperatures may be perceived by people as merely a comfort issue, the chilling fact not widely appreciated is that a fraction of a degree change can be enough to stop many food plants from flowering and delivering grains and fruits—our food.

Added to this, modern crops have been pampered by aeons of farming and breeding for higher and higher yields, or for traits like whiter bread dough. Consequently a lot of the 'toughness' of earlier crop types has been whittled back as the genetic base has narrowed.

It is those genes that allow the old relatives of modern crops to still flourish in frozen or arid landscapes that need to be found and reintroduced. This is becoming an urgent race against time. It is the reason why we are now turning up unannounced at remote hamlets, why we are blithely trampling over ground that later turns out to be marked on military maps as possible minefields, and why our little blue van keeps stopping and people jump out to gently collect seed from scraggy grasses with long Latin names.

"We are going back through time, backwards through man-made evolution," explains Dr Street.

"We are looking for the grasses that were used for bread-making thousands of years ago—at the start of civilisation, when people first saw that keeping and sowing seeds from the best plants gradually improved what they were harvesting.

"We are searching for what our far-distant ancestors were using; not because they are better but because they have a wider genetic base. A modern wheat plant might have a few hundred parents, but the ancient varieties had hundreds of thousands, perhaps millions, of parents."

The genetic diversity of the Caucasus, and the lure of discovery, is also what keeps pulling Dr Francis back to the region, long after he had intended retiring.

"This area is the birthplace of wheat, numerous fruits, vegetables like onions, and a lot of the world's legumes … not to mention scores of flowering plants such as tulips and gladioli," he says.

Gazing across a meadow brimming with plant life—a wind-ruffled soup of botanic diversity—Dr Francis explains that there are 125 species of *Astragalus* alone in Armenia. *Astragalus* is part of the legume family—what most people know as peas, beans or lentils. Legumes are his passion and Armenia is Xanadu, a paradise of agricultural opportunity.

"The legumes we grow in Australia are annuals, but there are perennials here …

Dr Ken Street collecting seeds in Armenia.

PHOTO: BRAD COLLIS

crop plants that could help us manage our wheatbelt watertable and limit the build-up of salinity," he says. "And a lot of these legumes are readily usable by plant breeders here."

In fact, Dr Francis plans to start work on 25 new pasture legumes, from seed collected on the mission, this year (2006).

"They are perennials, very hardy, and look ideal for Australian conditions," he says.

Genetic material from grain legumes—which are distinct from pasture legumes and include human foods such as chickpeas and lentils—will take a few more years to introduce because of the tighter regulations. However, crop research bodies in Australia's mainland states have well-established relationships with ICARDA in Syria. This is where seed collected from the Armenia mission will be planted and assessed. The most promising lines will then be sent to plant breeders in Perth, Adelaide,

Horsham and Tamworth so that they can be introduced to local crop-improvement programs.

Climate and disease-resilient legumes are becoming increasingly important in Australian agriculture as rotation crops in between wheat and barley plantings because they break potential disease cycles and they increase soil nitrogen (a crucial nutrient that otherwise has to be applied as chemical fertiliser). Their deep roots improve soil structure and they more closely mimic native plants in the way they help to prevent the conditions that can lead to salinity.

Legumes have the ability to transfer nitrogen from the atmosphere to the soil, and international research is being done to adapt them to subtropicalenvironments. So they are also seen as a low-cost, practical way to restore impoverished soils in the hunger-ravaged areas of Africa.

By channelling new genetic material through ICARDA, a Future Harvest Center under the Consultative Group on International Agricultural Research (CGIAR), it remains freely available for 'public good' research.

> "We are going back through time, backwards through man-made evolution ... looking for the grasses used for bread-making thousands of years ago—at the start of civilisation."
>
> – DR KEN STREET

Utilising the genes from wheat's ancestral grasses, or just from early wheat varieties, is a longer-term proposition (10 to 15 years), although the process could be sped up using gene technologies such as genetic engineering. Wheat's ancestral grasses are too far removed in time to be able to be crossed with modern plants, especially given that wheat is a man-made crop that doesn't actually exist in nature.

Dr Francis says that while the use of gene modification (GM) technologies would allow researchers to retrieve specific genes, such as drought and frost tolerance, from these wild sources, the main grain-growing states—NSW, Victoria, South Australia and Western Australia—have moratoriums against commercial GM crops.

This said, researchers don't see this as a lasting issue. The moratoriums are set to end in 2008 and the Federal Government is increasing pressure on the states to allow the technology to be introduced. Politics aside, by the time seed from Armenia is planted, analysed and repeatedly screened over several years of field trials in Syria (and also in Mexico) this period will have come and gone before any new genetic material is ready to be introduced into Australian crops.

The work by Dr Street and Dr Francis also involves trying to save, or rebuild, the once pre-eminent plant collections housed in the crumbling, neglected botanical institutes of the former Soviet republics in central Asia and the Caucasus.

"The world is losing irreplaceable seed from these collections simply because the local people can't afford to replace water pumps or stored seed is being eaten by mice. This is an absolute tragedy, doubly so because it is avoidable," Dr Street says.

"The rate of deterioration is very advanced, so we are desperately trying to collect, store, document and manage as much diversity from old varieties and wild relatives before they are gone forever. We don't know what challenges future farmers will face, but we do know the answers to those challenges are held in the genes of the plants we are collecting."

Collecting missions like these, in countries such as Armenia, are now part of an international program developed under the auspices of the new Global Crop Diversity Trust, set up as an instrument of the International Treaty on Plant Genetic Resources for Food and Agriculture. This was formed only a year ago, with considerable Australian support, to try to arrest the erosion of the world's plant genetic resources.

"It's a survival issue," says Dr Street.

"For most people around the world that means avoiding starvation, while for farmers in countries like Australia it's economic survival. For example, late-season frosts destroy millions of dollars worth of cereal crops in Australia every year. This is because the genetic origin of Australian varieties mirror our political and cultural origins—western Europe—which is not the ideal genetic lineage for the Australian environment. By comparison, there are wheat varieties in central Asia and the Caucasus that comfortably tolerate frost and low rainfall. These varieties need to be re-identified, catalogued and made available to Australian plant breeders."

Dr Street concedes that there is a frustrating element of the abstract in the goal because these "horrible old weeds" are too far removed from their modern descendants to be able to be crossed by conventional breeding. It is possible using GM technology, which can precisely locate and reincorporate specific genes, but politics has, for the moment, put the technology beyond the reach of Australian food-crop scientists.

Dr Street's pursuit of botanical antiquity has dropped him into many tense situations, prompting colleagues around the world to dub him 'agriculture's Indiana Jones'. Repositories of ancient genetic resources tend to be located in remote, undisturbed pockets of often troubled parts of the world—meaning they are usually on the other side of minefields, battlefields or deep inside lawless terrain ruled by warlords and bandits.

PHOTOS: BRAD COLLIS

(Top) Dr Clive Francis (CLIMA/UWA) collecting seed in Armenia in 2005.

(Above) Seed-collection missions often call on village households, asking for a little of any seed kept from bygone times. Invariably it is the old women, with an innate sense of the seeds' importance, who reappear with samples often kept "from my father's time", even "from my grandfather's time". Dr Izabella Arevshatian from the Armenian Institute of Botany (left) and the Vavilov's Dr Tamara Smekalova (second from left) collect seed from villagers.

But Dr Street is a rugged and determined personality, driven by a steely belief in his work. The son of philanthropic parents who built hospitals in Somalia and worked among Aboriginal communities in northern WA, Street has the same missionary zeal, except he is pedalling the temporal salvation offered by agricultural science.

"Before university I was a bit of a hippie and wanted to start a commune. When I researched the idea I realised that most communes failed, either because of politics or from a lack of agricultural knowledge. So I went to UWA (the University of Western Australia) to study agriculture.

"Of course, I was idealistic and was soon disillusioned. It was very academic, while I just wanted to get my hands into soil."

Dr Street's 'search for meaning' inevitably led to an interest in agricultural development and a PhD in agricultural ecology through ICARDA. Fifteen years later he still lives in the ancient citadel city of Aleppo, speaks Arabic and spends as much time as funds allow scouring the centre-of-origin for food-crop species.

"The situations you find yourself in sound dangerous when you are sitting back in Australia, but if you're sensible they are just a bit hairy and uncomfortable. The key is to understand the people and their history. You are in the middle of nowhere in Tajikistan, for example, where people have suffered over such

Natalia Rukhkyan (left), who is being trained in germplasm conservation, with ACIAR support mentor Dr Izabella Arevshatian, from the Armenian Institute of Botany.

a long period that they are brutal … I mean, parents tell you how they were forced to watch their children being burned alive. So when a truckload of guys with guns arrive at your camp you know they are capable of doing anything. It gets tricky because telling them you are collecting grass seed is not the most plausible story they've heard."

Most confrontations stem from economic desperation; the collapse of the Soviet Union has left its former southern republics littered with abandoned factories, collapsed infrastructure and town squares that 15 years later still steadily fill during the day with unemployed men with nothing to do.

The same economic breakdown has ripped the heart from the region's agricultural infrastructure, especially its once renowned herbariums and seed collections.

"The agricultural research sector is basically bankrupt. So you've got all these ageing ex-Soviet scientists who are incredibly knowledgeable, dedicated and desperate to hand their knowledge to a younger generation. But young graduates end up in careers like tourism, where a command of English alone is enough to qualify them for a reasonable job. No one is going to work in plant genetics. There's no money in it and people have to live."

For Dr Izabella Arevshatian, this Australian-funded collecting mission in her own country is a rare opportunity for fieldwork. She and her colleagues at Armenia's Institute of Botany in Yerevan, the country's capital, have almost no sources of official support. Their government salaries are US$24 a month, from which they not only have to feed and clothe themselves, but also keep the institute running.

"It's like it was in the war … no water or electricity, but we saved the collection … and that's what we are doing again."

But Dr Arevshatian and her colleagues, Professor Eleonora Gabrielian, the institute's director, and Dr Estella Nazarora, are now old women. The determination that has kept them and their work alive through freezing winters and the crushing sense of apathy from outside can't last.

Yet they are driven still by the vision of the institute's founder, Alexander Shelkovnikov, and their student-days mentor, Professor Armen Takhtajian. These are famous names in international botany, but their once glorious institute is a worn-out building disappearing into an abandoned jungle that used to be the adjoining botanic gardens. That it functions at all is due solely to the extraordinary faith being kept by this small group of former students.

"Professor Takhtajian inspired in us the beauty of plants," says Dr Arevshatian simply.

The inside is spartan and dusty, rooms overflowing with head-high piles of pressed plant specimens, brittle inside the pages of Soviet newspapers dating back to Stalin's regime. There is not a single computer. The records of generations of scientists remain on paper cards in wooden filing cabinets. It is a treasure-trove of fragile, rare botanical history.

"I am optimistic," says Dr Arevshatian, "because we have come through hard times before. Sometimes politics tries to ignore, or destroy, science. But science always wins because science serves the people."

In her upstairs office, Professor Gabrielian proudly displays a colour photograph of a rare flower, *Ornithogalum gabrielianae*, a new species discovered on Mount Aragatz, Armenia, in 1997 and named after her—the eleventh plant species to be named in her honour.

She is renowned in world botany, yet she sits in a small room stacked high with fading hope and memories. She is surrounded by her lifelong collection and the 11 weighty monographs she has authored and published. It is a priceless repository but has no clear future or home when she and her septuagenarian colleagues die.

She opens her arms, indicating the piles of newspapers that hide tens of thousands of dried, pressed specimens. "Some of the most beautiful and rare wild plants on the planet are here," she says. "And like all plants they hold crucial places in delicately balanced ecosystems. Some of these plants come from landscapes that swing from plus 40°C to minus 40°C between summer and winter. It is vitally important to find out what plants like this can teach us."

Eleonora Gabrielian has been collecting since she was a student in 1946. She met her husband, who worked alongside her for the next four decades until the winter of 1994. There was no heating at all that year—the year he died.

"Perhaps we are crazy," says the Professor solemnly. "We are paid 74,000 drams (US$24) a month and we each have to put in 20,000 drams for electricity. But botany is our life. It is the science of life and it keeps us going. Future generations will need this knowledge if they are to sustain the planet's biodiversity … but I am 76 years old and I need to be able to put what's in my head into the heads of future generations."

The lament is heartfelt and for younger scientists like Ken Street it is a critical, global issue: "In 10 years from now we are facing the prospect of this region having no trained agricultural scientists in germplasm conservation," he says.

"This is frightening, because the genetic origins for a very large proportion of the world's food crops, including the crops we grow in Australia, do not exist anywhere else."

This is why outsiders like Ken Street and Clive Francis are playing significant global roles, with Street having been particularly influential in rallying international support for the Global Crop Diversity Trust.

In an age in which technology and globalisation have many people anxious about the origins of their 'daily bread', this work may go part way to restoring a sense of familiarity with our food and its farming credentials.

And for Australian agricultural scientists generally, foraging for lost genes is a much-needed step to better matching the crops we grow with the landscapes we farm. ■

30 YEARS IN THE MAKING

ACIAR has operated across a range of disciplines, within more than 40 countries, over 30 years. During that time, some common themes have been addressed and new challenges have emerged. In each case, Australian expertise in agricultural research has been applied in partner countries to help smallholders, build scientific capacity and develop new and innovative ways of tackling problems.

PHOTO: BRAD COLLIS LOCATION: EAST TIMOR

FOOD SECURITY: About half of the world's population depends on rice as a diet staple. Consequently, improved rice varieties and management techniques have a huge impact on both local and global food security. However, agricultural aid needs to be managed appropriately, with experience showing practical 'capacity building' has a greater impact over time. Following the declaration of independence by East Timor, donated rice seed created major difficulties for farmers. Inadequate harvests resulted from the mix of poorly adapted varieties that lacked uniform growth rates and maturity. ACIAR was among the first agencies to establish crop trials to put farming on to a reliable footing and to increase agronomic capacity, crop quality and crop diversity. This Seeds of Life program in East Timor has become a case study for building in-country farming capabilities.

PHOTO: SHU FUKAI LOCATION: THAILAND

CLIMATE CHANGE: Climate change, or global warming, is creating an added layer of uncertainty for farmers everywhere. ACIAR is working with the Consultative Group on International Agricultural Research, in particular its international research centres such as IRRI (rice), CIMMYT (wheat and maize), ICRISAT (farming in the semi-arid tropics) and ICARDA (dry region agriculture), to develop adaptation technologies. These cover new crop varieties, improved water management and research into some of the fundamentals of agricultural security such as genetic diversity. Soil science is also an important part of this broad agenda—the condition of nutrient-depleted and rainfall-depleted soils in areas that need to sustain large populations is one of the most critical elements in the fight against poverty.

PHOTO: BRAD COLLIS LOCATION: LAOS

ANIMAL POWER: The family pig or buffalo is a prized possession, the 'big ticket' capital investment that can reward a family with high returns if they succeed in 'buying skinny, selling fat'. This ambition, however, puts enormous pressure on farmers to find enough feed. In the uplands of Laos this has traditionally been achieved through grazing in forests. This environmentally damaging (and nutritionally poor) practice is now being replaced by the introduction of protein-rich tropical grasses and legumes. This provides a regular, convenient supply of nutritious fodder that is resulting in faster growth rates. The time saved by not having to shepherd animals far from home is also allowing farmers to improve all of their farming practices. Here farmer Pa Heu shows off her prized buffalo being conditioned on the new fodder.

PHOTO: BRAD COLLIS LOCATION: CAMBODIA

GENETIC SECURITY: A tropical downpour sends Cambodian plant breeder Heang Dany hurrying from an in-field banana 'germplasm bank'. As farmers in developing countries move from subsistence agriculture to more diverse and robust farming systems, quality is starting to take precedence over quantity. For horticultural crops (like these bananas) to earn a premium for quality, they need ongoing varietal improvement and adaptation to different farming areas. As part of this progression, the Cambodian Agricultural Research and Development Institute (CARDI), which was established with Australian support, maintains this germplasm bank for every banana variety grown in Cambodia. This ensures there is a ready supply of appropriate varieties for farmers in different agroclimatic regions and the researchers supporting them.

PHOTO: BRAD COLLIS LOCATION: CAMBODIA

IMPROVING VARIETIES: Agricultural researchers are constantly striving for technologies that will lift production despite the constraints imposed by climate change and pressures such as urban sprawl and nutrient-depleted soils. Mr Long Ky Meng, a field production officer involved in an agricultural quality improvement project in Cambodia, shows the more prolific shoots that come from planting a new higher-quality rice variety. This particular variety has allowed farmers to increase yields by up to 30% from a third less seed. Yield increases like this, particularly among food staples such as rice, not only improve farmer incomes and food security, but can also free up land for diversification into other crops.

PHOTO: MELISSA MARINO LOCATION: INDIA

INLAND FISH: Aquaculture is one of the world's fastest growing primary industries, especially in Asia, where more than 90% of aquaculture production is centred. Inland aquaculture is a growing part of this, providing income and a rich source of protein in areas that, in some cases, have become too degraded to crop. Research into feed and hatchery technology (the main constraints for inland aquaculture development) is helping to build a viable industry. In Rohtak, northern India, water from saline acquifers is being treated and pumped into aquaculture ponds dug into salt-affected fields. Partnered by ACIAR-funded research, the project is helping to establish lucrative businesses in the area, growing prawns and fish for the high-end tourist and city markets. Here, workers net fish grown at the Central Institute of Fisheries Education, Rohtak Centre.

PHOTO: BRAD COLLIS LOCATION: CAMBODIA

CROP DIVERSIFICATION: Traditionally, staples like rice and wheat have been Asia's main agricultural crops. However, today there is a push towards increased crop diversification, particularly into horticulture. Traditional rice farmers who learn how to grow high-quality fruit and vegetables for rising urban populations are able to move to a more secure existence. This forms the basis of a robust agricultural economy. A case in point is ACIAR-supported research in Cambodia where the traditional rice monoculture is giving way to a diverse spread of horticultural crops; even cut flowers. Here Sok Khim from Prey Yeay in Kandal Province, harvests chilli which has become a valuable export crop.

PHOTO: BRAD COLLIS LOCATION: ARMENIA

BOTANY PARTNERS: The search for germplasm for plant breeders working on improved crop varieties brings in a range of scientific disciplines and partnerships, from genetics through to agronomy and botany. ACIAR has been funding seed-collection missions over the past decade to help the CGIAR genebanks preserve the genetic resources that are essential to future, sustainable agriculture. On a 2005 collecting mission in Armenia, Dr Clive Francis from the Perth-based Centre for Legumes in Mediterranean Agriculture caught up with internationally renowned botanist Professor Eleonora Gabrielian at the Institute of Botany, Armenia.

PHOTO: MELISSA MARINO LOCATION: INDIA

HAPPY SEEDER: Punjab province is India's rice and wheat bowl, producing about one-third of India's grain crop. The conventional practice of burning rice stubble as a cheap, fast way of preparing for the following wheat crop is causing serious atmospheric pollution and loss of soil water and nutrients. Enter the Happy Seeder—a power tiller implement designed by semi-retired Australian farm manager and agronomist John Blackwell. The seeder mulches the heavy rice stubble into which the wheat can be sown directly. Conservation farming is an ACIAR priority and the benefits are acknowledged world-wide. However, until recently, Asian farmers have not benefited from the no-till revolution. Technology advances such as the Happy Seeder bring conservation farming to a whole new audience.

Mr Cletus Oengpepa, pictured here with a giant clam off Gizo in Solomon Islands, has been a valuable partner of ACIAR's for more than 12 years through his work with the WorldFish Center (previously ICLARM). Cletus started his career at the old ICLARM research center near Honiara as an aquaculture technical assistant. Supported by ACIAR he attained a Masters of Aquaculture at Deakin University's Warrnambool campus in 1999. As his career progressed, he became the Station Manager of the WorldFish Center research station at Gizo in the Western Province of Solomon Islands.

During the ethnic tensions in Solomon Islands in the late 1990's the ICLARM Research Station near Honiara was destroyed. At extreme personal risk Cletus personally saved much of the equipment as well as some of the giant clam broodstock by arranging their transfer to a region remote from where the troubles were. Giant clams are under threat in Solomon Islands from overfishing. The WorldFish broodstock are kept within a protected area; one of the few such repositories of broodstock in the country. Cletus is still working with WorldFish in Solomon Islands, where a new 'crop' of local scientists are now making their mark.

"I have all the praise for the ACIAR as an organisation that has grown from strength to strength. It has made great contributions by making a difference in the lives of the people of Solomon Islands and the Pacific Island Nations through scientific research and development projects, and also by providing scholarships for Pacific Islanders to attain post graduate degrees", Cletus said recently.

Solomon Islands

PHOTO: ISTOCKPHOTO.COM

Cletus Oengpepa

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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.