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IN RESEARCH FOR DEVELOPMENT

AUSTRALIAN
RESEARCH LEADERS

HELPING TO MAKE THE WORLD A BETTER PLACE

Dr Meryl Williams

AUSTRALIA'S CONTRIBUTION INTERNATIONALLY IS NOW WELL ENTRENCHED. BOTH INDIVIDUALS AND INSTITUTIONS HAVE BEEN IMPORTANT.

AUSTRALIA AND INTERNATIONAL AGRICULTURAL RESEARCH



PHOTO: ROB PARSONS

BY DR MERYL WILLIAMS

Former director-general of the CGIAR WorldFish Center and member of the Governing Board of the International Crop Research Center for the Semi-Arid Tropics

Whether husbanding native food or farming exotic crops and livestock, Australians have had to use ingenuity to feed themselves in the peculiar environment and climate of this continent. Have these conditions acted as a crucible for Australia's farm-to-plate research ethos and our significant contribution to international agricultural research?

Ingenuity has always been key to surviving on the Australian continent. Over millennia, people learned to husband and harvest native plants and animals to feed, clothe, house and heal themselves. Unfortunately, much of this traditional knowledge has been lost and/or subjugated to newer methods, although some is being resurrected.

The settlers of the first fleets initially relied on meagre rations brought with them, supplemented by sporadic catches of fish, kangaroos and occasional sea turtles from expeditions to Norfolk Island; but ever-larger concentrations of people needed food and shelter.

In the often harsh environment, the new settlers learned by experience and science to produce their exotic crops and livestock that originated directly or indirectly from other continents, via Europe, southern Africa and India.

Australia gradually became part of the global food production and trade system and today Australia's primary products come almost entirely from non-native crops and animals, using varieties adapted to local soils, climate and biology. It is a knowledge base that has found many applications in international research-for-development initiatives.

Australia's contribution internationally is now well entrenched. Both individuals and institutions have been important. Leaders such as Sir John Crawford, Professor John Dillon, Professor Derek Tribe and Dr Gabrielle Persley (see page 35) created enduring institutions, such as the Consultative Group on International Agricultural Research (CGIAR), ACIAR, the Crawford Fund, and the Biosciences Eastern and Central Africa hub. Some of their stories are told in this issue of *Partners*.

Many other Australians have worked within the international agricultural system in multilateral organisations, such as the CGIAR Centres and their committees, boards and councils, as well as in bilateral projects and activities.

I have observed firsthand the respect that Australia's formal representative to CGIAR—the serving CEO of ACIAR—has earned, without exception, from his peers.

At one period during my term as a CGIAR director-general, four of the (then) 16 CGIAR directors-general were Australians and another, from New Zealand, had received his PhD in Australia. Several board chairs were also Australian. Still today, most CGIAR Centres have an Australian

on their boards, including three that have Australian chairs, and many have key senior staff from Australia.

The Australian Government's international development assistance, including through ACIAR, has formed the bridge over which many Australian researchers have contributed their expertise to help solve agricultural development problems and create new opportunities.

These Australians have varied from young researchers getting early-career experience overseas, through to mature professionals at the pinnacle of their careers. I met many of these researchers during my time on the ACIAR Board of Management and later the Commission for International Agricultural Research, and a common view from so many of them was that "this has been the most rewarding work I've done in my whole research career".

Our overseas collaborators have appreciated our partnership in a personal and practical sense, as shown in ACIAR's rigorous impact assessment program and expressed during overseas and Australian field visits.

One interaction stays with me from the 2005 ACIAR Board of Management visit to the Seeds of Life project in Timor-Leste (<http://seedsoflifetimor.org>). A young Timor-Leste researcher, just returned with his PhD from Australia, explained with pride the joint work that was just then starting to improve crop production in the challenging local environment. A decade later, local researchers have taken over running it. ■

FOOD FOR THOUGHT

BY DR ROD LEFROY

Former regional research leader for the International Center for Tropical Agriculture (CIAT) in Asia

To some degree, you would expect the involvement of Australians in the various modes of working internationally to be related to history, to the status of Australia in the organisations and to the level of Australian financial contributions.

In fact, Australia is one of 10 countries contributing the most research staff, which puts it ahead of several larger donors. In addition, Australia has had good representation in management of the 15 Consultative Group on International Agricultural Research (CGIAR) Centres.

The same holds for representation of the United Nations' global and regional organisations for disaster relief and development, and of development agencies such as the World Bank and the Asian Development Bank.

There are multifaceted reasons for the disproportionate nature of Australians' influence and engagement. The success of ACIAR and the Crawford Fund* as gateways to international roles is part of the reason. Both are important vehicles for linking Australian researchers, many for the first time, to challenges in international agricultural development.

Additionally, Australians historically appear to have greater appreciation for the importance of agriculture in poverty alleviation. For instance, Australia directs above-average funds towards agriculture, and an above-average proportion of those funds are directed to CGIAR.

Then there is the biophysical and technical nature of Australia and Australians.

The harsh biophysical resources of Australia—combined with the large distances to both internal and external markets—have imposed pressures on agricultural systems, often at an earlier stage in their development than in other countries.

This has resulted in the development of relatively low-input, low-cost agricultural production systems with efficiencies in labour, and nutrient and water use.

The same forces that fashioned, and continue to fashion, Australian agriculture and agricultural research are similar to the problems that plague many farmers in developing countries, especially those on more marginal lands.

These forces further conspired to forge strong links between pure research, applied research and practical application by farmers—a hallmark of Australian agricultural research.

When coupled with a strong education sector, there is a potential for innovative and productive

research, with direct impact and critical capacity-building potential. However, it is the quality—not specific outputs—of Australian research that makes the greatest contribution to developing-world agriculture.

It is about high-quality training and a research tradition forged through industry funding, close collaboration with farmers and farmer groups, and experience with the Landcare approach. In Australia, there is a balance between science, practical application, and the critical social and economic components of agriculture.

In the same way that Australians abroad have provided a new view for developing-world agriculture, their experience abroad provides a new and challenging perspective to Australian agriculture, in biophysical, economic and social terms.

Given the success of Australia's contribution to world agricultural development, there remains a place for Australian agronomists abroad, now more than ever. ■

* The Crawford Fund is a non-profit non-government organisation that works to raise awareness of the benefits to Australia and developing countries from international agricultural research, commissions studies on research policy and practice, and arranges specialist training activities for developing country scientists.

IT IS THE QUALITY—NOT SPECIFIC OUTPUTS—OF AUSTRALIAN RESEARCH THAT MAKES THE GREATEST CONTRIBUTION TO DEVELOPING-WORLD AGRICULTURE.

Dr Rod Lefroy, CIAT Asia regional coordinator, at the first national Conference on Crop Sciences in Hanoi, Vietnam, in September 2013.

PHOTO: CIAT



THE IMPACT OF PARTNERSHIP

In most of the developing countries in the Indo-Pacific region, agriculture remains a major sector for local economic development and poverty alleviation. Agricultural growth, based on the adoption of market-based productivity research, contributes to national economic growth in developing countries in a way that is more inclusive of the often low-income rural segments of the economy.

As Australia's specialist agricultural research-for-development agency, ACIAR's contribution to the overall aid objectives is to improve the productivity and profitability of agricultural systems in countries of the Indo-Pacific region through bilateral and multilateral research partnerships. The ultimate beneficiaries are farmers and consumers in developing countries and in Australia.

ACIAR research partnerships are in four areas of endeavour: crops, livestock and fisheries; natural resources and forestry; socioeconomics; and policy. They use a multidisciplinary approach between research clusters to focus on delivery of impacts of the centre's projects.

ACIAR's global program provides core funding to, and engages actively with, the Consultative Group on International Agricultural Research (CGIAR)—the leading international system of global, public-good

agricultural research. CGIAR remains ACIAR's main multilateral research partner. By working with CGIAR and its centres, ACIAR has greater impact on the wider research potential across regions, and can build a more extensive partnership base with both developed-country contributors and developing-country research agencies.

ACIAR also engages with and supports a range of international multilateral institutes and associations, including the Asia Pacific Association of Agricultural Research Institutions, the Association of Southeast Asian Nations, CABI (an inter-governmental not-for-profit organisation), the Food and Agricultural Organization of the United Nations, the Secretariat of the Pacific Community and AVRDC—the World Vegetable Center.

ACIAR's strategy is to be both a valued donor and research partner through establishing active working relationships, constructive scientific engagement and timely and consistent funding. We work in close collaboration with regional agricultural associations and forums to promote the development and coordination of national agricultural research systems in the Indo-Pacific region.

Through our partnership arrangements, ACIAR has sent many Australian scientists into the field to assist developing countries build the sustainability of their own agricultural systems and

ACIAR'S STRATEGY IS TO BE BOTH A VALUED DONOR AND RESEARCH PARTNER THROUGH ESTABLISHING ACTIVE WORKING RELATIONSHIPS AND PROVIDING TIMELY AND CONSISTENT FUNDING.

the capacity of their people. Many have worked in the international institutes and associations mentioned above.

This issue of *Partners* magazine is intended to recognise the work of just some of the scientists who have worked in, or alongside, ACIAR over the 33 years of its existence. The impact of their work, and many others, has been felt in many of the poorest countries of the world and has resulted in billions of dollars being returned to Australia. We at ACIAR celebrate their achievements. ■



Dr Nick Austin
CEO of ACIAR



Ms Nong and Ms Luyen, the farmers and collectors from Moc Chau District, Son La Province, are proudly showing Dr Nick Austin their temperate vegetable products in Fivimart in mid-summer.



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IN RESEARCH FOR DEVELOPMENT

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 enquiries will be passed on to the appropriate researchers for reply. Reprinting of articles, either whole or in part, is welcomed, provided that the source is acknowledged. This publication is freely available from ACIAR's website at aciar.gov.au. It is also freely available on request from ACIAR. The use of a trade name does not constitute any endorsement of, or discrimination against, any product by ACIAR.

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THE LEGACY OF QUIET ACHIEVERS

PHOTO: BRAD COLLIS

Australian agriculture has required new ways to farm. It has forged an innovation ethos among farmers and scientists, and may explain Australian researchers' strong contributions to international agricultural development and innovation

KEY POINTS

- Australia has built an international legacy from its unique flair for advancing global capacity for food security.
- This legacy is intimately tied to the nation's investment in agricultural R&D in all its multidisciplinary forms.

BY BRAD COLLIS

Torched buildings in the Timor-Leste capital, Dili, were still smouldering when Australian agronomist Dr Brian Palmer arrived in late 1999 to help surrounding villagers to plant and tend famine-averting crops. It was the same in Phnom Penh, Cambodia, 20 years earlier, when Dr Harry Nesbitt and Dr Glen Denning arrived on the heels of the routed Khmer Rouge to urgently begin restoring food production.

Although these were extreme circumstances they nonetheless illustrate the blend of sleeves-up leadership, innovation and expertise that Australian agriculturalists have exercised in sharing skills honed in challenging local environments with farmers struggling with similarly harsh circumstances in developing countries.

It reflects an extraordinary legacy of knowledge-sharing that has averted potential famines and helped lay the groundwork for steadily improving food security within the world's poorest communities. And while in recent decades much of this Australian contribution has been packaged into projects championed and managed by ACIAR or through other Australian Government funding, it has still often been driven by motivated individuals.

Drawn from state agriculture departments, universities and CSIRO, they form a long list, a

who's who of Australian agricultural research, whose impact has been felt from Africa to the Indian subcontinent, South-East Asia and the Pacific region.

In recent years some scholars have sought to quantify and reflect on this contribution, which has been visibly much more than Australia's assigned places on the Consultative Group on International Agricultural Research (CGIAR) boards or managerial appointments. Australia has usually been among the top 10 donors to CGIAR, which has helped it to fill about eight of the 140–150 board positions at the 15 Centres. As meritorious as this is, it has been the on-ground science where so much has been achieved in a practical sense to build agricultural systems and economies, stabilise stressed communities, and contribute to the knowledge needed by humanity to keep

THE 15 CGIAR CENTRES

- AfricaRice
- Bioversity International
- Center for International Forestry Research (CIFOR)
- International Center for Agricultural Research in the Dry Areas (ICARDA)
- International Center for Tropical Agriculture (CIAT)
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- International Food Policy Research Institute (IFPRI)
- International Institute of Tropical Agriculture (IITA)
- International Livestock Research Institute (ILRI)
- International Maize and Wheat Improvement Center (CIMMYT)
- International Potato Center (CIP)
- International Rice Research Institute (IRRI)
- International Water Management Institute (IWMI)
- World Agroforestry Centre (ICRAF)
- WorldFish

PHOTO: BRAD COLLIS



Dr Harry Nesbit at a farmer field day in Cambodia in 2001.

food production resilient in the face of population growth, urban encroachment onto farmland and climate change.

In his analysis of Australia's contribution to international agricultural research, tropical agriculture research leader Dr Rod Lefroy attributed much of this achievement and impact to the quality of Australian agricultural research and educational institutions, and the long experience of linking researchers with farmers—in other words, a deep understanding of collaborative processes.

In an address to the Australian Society of Agronomy in 2008 he also noted that many of the biophysical constraints that have challenged Australian farmers and researchers, such as poor soils and low rainfall, are not dissimilar to those experienced by poor farmers in many parts of the developing world. This means knowledge accrued in what primarily might be poverty alleviation projects frequently adds to the continuing development of farming systems in Australia.

This 'mutual benefit' aspiration was given a formal, coordinating structure in 1982 with the establishment of ACIAR, which was charged with encouraging Australian scientists and institutions to use their skills to solve agricultural problems in developing countries.

In the three decades since, ACIAR has evolved into one of the most important agents of change in smallholder farming, particularly in the Asia-Pacific region. The organisation has been helped in this role by another Australian institution, the Crawford Fund. This was established in 1987 by the Australian Academy of Technological Sciences and Engineering to similarly increase Australia's engagement in international agricultural research, development and education to mutually benefit developing countries and Australia.

THE GLOBAL FARMERS' INNOVATION NETWORK

Agricultural science came of age as a development tool in the 1950s. It originated in a philanthropic partnership between the Rockefeller Foundation and Mexico. Under the leadership of Dr George Harrar, breeders such as Dr Norman Borlaug developed high-yielding, disease-resistant wheat varieties, improved cropping systems and extension services that trebled grain production. Subsequently, a rice program headquartered in the Philippines was established with assistance from the Ford Foundation.

This innovation not only started the Green Revolution, but it also created the impetus to systematically extend research-for-development initiatives to all the major crop and livestock production systems. Integral to those efforts was an Australian, Sir John Crawford, who was also a driving force behind the establishment of ACIAR. With backing from the foundations, the United Nations and the World Bank, a Consultative Group (CG) was established in 1971 that today administers grants to a total of 15 International Agricultural Research Centres (IARCs) whose core mandates have evolved to remain at the forefront of global efforts to ensure food security.

In a recent assessment, it was concluded that in the absence of the Consultative Group on International Agricultural Research (CGIAR), crop yields in developing countries would have been 19.5–23.5% lower, prices for food crops 35–66% higher, the land area planted to crops higher (for instance 4% for wheat and 2% for maize), imports 27–30% higher, calorie intake 13.3–14.4% lower and 32–42 million more children would have been malnourished.

CGIAR's lowest point in terms of public awareness and funding coincided with the global food crisis of 2008. Since then, investment in the CGIAR Centres has doubled to A\$1 billion with research initiatives expanding and projects now on a scale beyond what a single nation could undertake in solitude. For instance, the C4 Rice Project is a US\$25 million (A\$33.5 million) initiative that is re-engineering the efficiency of rice photosynthesis to lift a recently discovered ceiling to further yield gains. This project is just one that sits within a A\$100-million-plus push to ensure yield gains can match population growth.

Across the administration of CGIAR and its policy development and research activities, Australians continue to play leadership roles that bring Australian expertise to the world but also draw immense benefits to Australian primary industries, the gross value of which in 2010–11 was in excess of A\$48 billion.

Both ACIAR and the Crawford Fund are recognition of Australia's unique circumstances among developed countries: a long history of internationally recognised excellence in multidisciplinary research combined with difficult farming conditions more representative of developing countries than the well-established agricultural systems of Europe and North America.

To this, Dr Lefroy added the strong link in Australia between pure research, applied research and practical application by farmers: "These have been the hallmarks of Australian agricultural research. When coupled with a healthy education sector ... there is a strong potential for innovative and productive research, with direct impact potential, and with critical capacity-building potential."

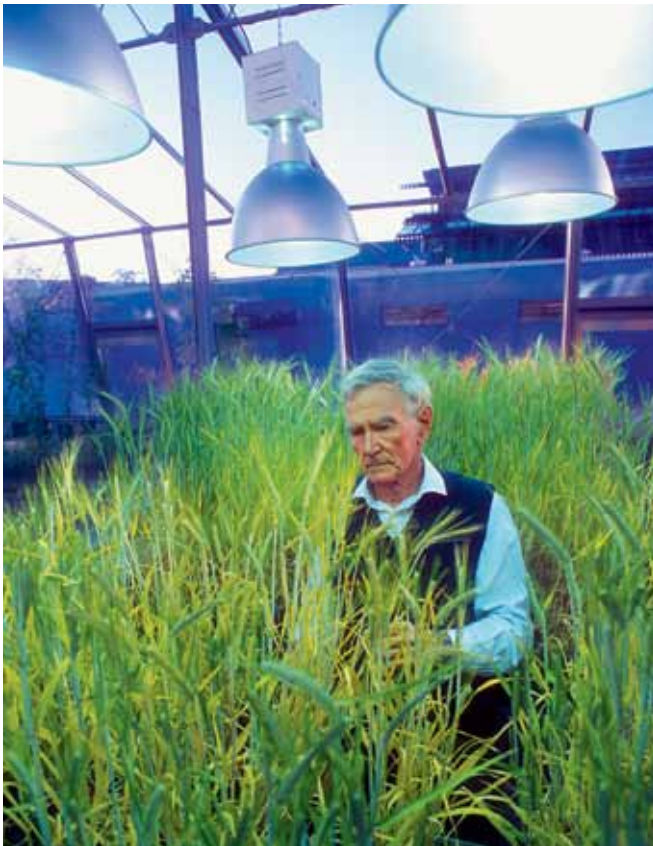


PHOTO: BRAD COLLIS

DR LLOYD EVANS 1927–2015

Dr Lloyd Evans's influence on global food security will long be felt. It is present in the strategies used today to improve crop yields on Australian farms. It pervades Australia's advanced capacity in plant pre-breeding, especially through the extraordinary impact of discoveries made at CSIRO Plant Industry. And it can be felt in the enduring strength of ACIAR and the Consultative Group on International Agricultural Research (CGIAR) Centres' ability to achieve global food security.

Dr Evans was a pioneer whose research challenged prevailing views on what limited crop yield. He boosted the ability to unravel the influence of environment on crop growth by establishing the CERES phytotron, the controlled-environment plant-growing facility that has served agricultural science for 50 years.

His work is of quintessential importance to dryland farming systems worldwide in which plants must flower and set seed within a narrow time period, determined by environmental constraints, such as frost and terminal drought. This is the case in much of Australia's wheatbelt and advances made in Australia are today used to alleviate poverty and hunger in the semi-arid growing regions of the world.

His influence straddles scientific research, national science capacity, and administration of science affairs and policy with international reach. Along with Sir John Crawford, his influence was instrumental in Australia's support for the CGIAR Centres, serving for many years on their Technical Advisory Committee.

ROLE	ORGANISATION
Chief	CSIRO Division of Plant Industry, 1971–78
President	Australian Academy of Science, 1978–82
Board of trustees	International Rice Research Institute (IRRI), 1984–89
Board of trustees	International Maize and Wheat Improvement Center, 1990–95

HONOURS

1971	Fellow of the Australian Academy of Science
1976	Fellow of the Royal Society
1979	Farrer Medal
2001	Centenary Medal
2004	Adolph E. Gude, Jr., Award of the American Society of Plant Biologists for outstanding contributions to understanding the physiological basis for yield in major crop species and for the control of flowering in higher plants.
2015	Groundbreaking ceremony for the Lloyd T. Evans Plant Growth Facility, IRRI, in Los Baños, the Philippines.

The CGIAR Centres are very close to my heart, because the people there have made a colossal difference to the world food situation. The important question is whether they can continue to do it fast enough.

– Dr Lloyd Evans, interviewed by the Australian Academy of Science (www.science.org.au/node/328092#24)

Since 1982, ACIAR has supported well over 1,000 projects. Of these, about 200 have had a prime focus on agronomy.

Another agricultural research leader, Dr Bob Clements—a former director of ACIAR and former executive director of the Crawford Fund—has also sought to analyse the high visibility of Australians in international agricultural development.

Dr Clements concurs with Dr Lefroy, but also makes the distinction between conception of an idea or practice and implementation, which is often a result of extensive modification and adaptation. This is almost the default approach to agricultural extension in Australia, given its own vast range of climates and geography.

In a keynote presentation in 2012, also to the Australian Society of Agronomy, Dr Clements calculated that Australian agronomists had in the past two decades increased crop and livestock production to sufficiently support about 30 million people.

However, he conceded a certain difficulty with such computations because even the term 'world food security' has become a flexible and evolving concept: "The game has moved on from the supply-side thinking of the 1980s (for example, food production/supply and price stability) to include demand-side issues (food access, ability to pay for food and food preferences)."

He said global food security was now not just linked to alleviating hunger and poverty, but to the broader scope of human nutrition and health, and sustainable farm landscapes.

Where this is heading, in terms of outcomes and processes, is near impossible to predict in a world in which geopolitics and the planet's climate are in such a state of flux.

Against this, one pertinent challenge raised by Dr Clements was whether Australia would continue to graduate enough agronomists for its own needs, let alone to maintain its share of global agricultural research: "And will we be

smart enough to develop better bilateral research collaboration arrangements with China, India and other heavily populated regions as they 'graduate' from the aid program?" he asked.

However, irrespective of changes to the management of international agricultural development, history shows that the challenges on the ground will persist.

Improving and sustaining arable soils, controlling pests and diseases that continue to evolve their way around defence systems, improving farmer access to fair markets and maximising agricultural water use efficiency in a changing climate will continue to require the sharpest minds, working closely with farmers and policymakers.

The world cannot risk hunger and the crushing social, political and economic toll this inflicts. Agricultural leadership will continue to be paramount and it will continue to need policy encouragement and support. ■

BUILDING TRUST

Reputation management is a crucial part of keeping the funds flowing for the research needed to help defeat hunger and protect global food security

BY CATHERINE NORWOOD

Debates around the boardroom table about the tax status of staff or administration procedures for scientists seem far removed from the gritty business of food security for smallholder farmers struggling to grow crops on tiny parcels of land.

But the details of good governance are a crucial part of instilling confidence that funding grants will be properly managed and well spent. When governments look for budget cuts, international aid and agricultural research are easy targets; trust can be the difference between some money and none.

When it comes to international finance and agricultural science, Australia's Nicole Birrell knows what it takes to build that trust. She has worked as an international banker for 25 years with leading financial institutions in the UK and Australia. In the past 20 years she has also served as a director with a range of agricultural trading, processing and research agencies in Australia, including six years as a director of the Grains Research and Development Corporation (GRDC).

In 2014 she joined the Board of Trustees at the International Maize and Wheat Improvement Center (CIMMYT), bringing her expertise in corporate governance and risk management to a new forum.

She says it is a difficult balancing act for organisations such as CIMMYT to manage the fluctuations in international funding. Unlike private organisations, the centre's operating rules prevent it from building any significant financial reserves.

"As the year progresses, the dollars don't always come in as expected, for whatever reason, and budgets change," she says. "It's part of good governance to have the systems in place to keep track of funding and manage that process so that you don't run out of money."

She has particularly pressed for improvements to administration that will allow scientists to spend more time doing the best science, as efficiently and effectively as possible, and less time doing paperwork.

As the trustees meet only a few times a year there is a heavy reliance on these management systems, which include regular project reviews, internal audits and external audits. As a member of the Board's audit committee, Ms Birrell has been able to play a role in ensuring CIMMYT's management systems allow any problem "to bubble to the surface" so that it can be dealt with.

"We have to be mindful of both good governance and good reputation," she says. "It takes many years to build a reputation and just one bad incident can destroy it."

This extends from policies and procedures to prevent bribery, to compliance with national, state and regional laws in the many countries in which CIMMYT operates, to ensuring the scientific rigour of research.

"Take genetically modified (GM) crops, for instance," she says. "We would need to be very mindful of what regulations apply in each country if contemplating any activity involving GM crops, and ensure we complied with not only our own policies, but also those of our partners and host governments. Even one GM 'incident' could seriously damage CIMMYT's reputation."

Ms Birrell has also been able to combine the experience of many previous roles in Australia to help bridge communication gaps between the various specialists on the CIMMYT Board.

As a past director of the GRDC and a present director of Wheat Quality Australia, she is familiar with the way scientists work. She has experience along the grain supply chain through past roles as a director of South Australian bulk grain handler and marketer Ausbulk Ltd and its subsidiary AusMalt Pty Ltd, director of Queensland Sugar Ltd and as a member of former regulator Wheat Exports Australia. In addition to this, her family has a longstanding involvement in farming, including a 425-hectare mixed crop and livestock property on the Murray River at Howlong, New South Wales, which is share farmed.

All of this aids Ms Birrell's ability to translate the critical issues and potential of complex science to other non-scientific specialists on the Board, as well as grounding the Board's considerations with feedback from farmers and research partners.

Ms Birrell says the CIMMYT Board spends a lot of time reassessing and discussing what the best science is—what will have the most impact—and adjusting strategies. What research will best



PHOTO: CIMMYT

Nicole Birrell

Nicole Birrell holds a Bachelor of Applied Economics from the University of Antwerp (Belgium) and a Master of Science (International Relations) from the London School of Economics and Political Science. She is a fellow of the Australian Institute of Company Directors. She is passionate about Australia's significant role in global food supply and about maximising the potential for both Australia's farming sector and the smallholder sector in the developing world.

PHOTO: CIMMYT-BISA

Nicole Birrell in the fields of India, launching a new nitrogen calculator program to help farmers make use of inputs to increase yields.



CIMMYT

The International Maize and Wheat Improvement Center (CIMMYT) exists to deliver the best seed, agronomy and agricultural research to farmers in the developing world. It maintains one of the world's largest and most diverse maize and wheat seed collections and is best known for work leading to the Green Revolution.

support the sustainable intensification of food production in a way that does not jeopardise the health of the soil or wider environment?

But it is standing in the fields of research trials in India, hearing from local farmers and research partners about what is working and what is not that makes the work worthwhile—and worth protecting.

"You know you are doing something useful, that is absolutely necessary." ■

THE QUEEN OF RICE

Being strategic about how agricultural research is structured, managed and financed is a skill that has grown in global importance and is a particular contribution that Australia's Professor Beth Woods OAM has made to international poverty reduction efforts

BY GIO BRAIDOTTI

When an improvement can be made to rice yields, quality or supply chains, the impact is enormous. As a research strategist, Professor Beth Woods OAM notes that there are 2.5 billion people worldwide who depend on rice every day and that still includes regions where rice represents 80% of the local diet.

Improved rice farming and poverty alleviation go hand in hand. The key site for research-driven innovations that make large and measurable changes for rice farmers is the International Rice Research Institute (IRRI), the centre where Professor Woods was dubbed the 'queen of rice'.

An example of the impacts possible include work by Australian rice breeder Dr Melissa Fitzgerald in developing molecular markers to a quality defect—chalking—that reduces edible grain amounts and devalues it by up to 30% in international markets. Then there is IRRI's work developing rice varieties tolerant to flooding, which otherwise causes A\$600 million losses a year.

Professor Woods's relationship with IRRI spanned a decade, joining the Board in 2005 and chairing it between 2008 and 2010. Her particular expertise relates to structures and strategies that help get "the most bang" from the money invested in research.

It is a role that this agricultural economist has also played extensively in Queensland where she is the newly appointed director-general of the Queensland Department of Agriculture and Fisheries (DAF). "My day job in Australia is thinking about the strategy and the effectiveness and efficiency of investment in R&D," Professor Woods says.

"When the total spend reaches in the region of \$100 million, my role is to think about how you manage that—how you ensure you have the infrastructure to support high-priority

R&D going forward. I'm hands on in an R&D management role and that's what I bring to the international system."

That includes chairing the Board of WorldFish, a role that director-general Dr Stephen Hall describes as critical to the running of WorldFish, providing direction to management and strategic guidance on research and funding.

"We welcomed Professor Woods and her in-depth knowledge of the CGIAR system and excellent credentials," he says.

Recently Professor Woods was also a member of the expert panel for the World Bank's Agricultural Pull Mechanism, an initiative that is creating the architecture and incentives to encourage more rapid adoption and quicker delivery of benefits from agricultural R&D.

"The investment required to meet the food needs of the global population in 2050 is estimated to be US\$83 billion (A\$110 billion) per year, a sum that requires 'pull mechanisms' (incentives) to draw in private-sector engagement," she says.

Adding to the urgency is the food crisis of 2008 and the global financial crisis of 2010. "The task facing international agricultural research has just become a lot more complex," she says. "Fortunately we have technologies and relationships that will allow us to meet this challenge."

For example, Queensland scientists who worked on drought tolerance in sorghum collaborated with IRRI scientists working on the same mechanisms in rice, with the work drawing on advanced rice genomic technologies and exploiting genetic similarities across crop species.

This kind of multilateral sharing of R&D resources—and the resultant efficiencies—is something that Professor Woods has long sought to strengthen both domestically and internationally.

Ultimately, she embodies the belief that a spectrum of problems—in food security, economics, health and the environment—can be solved by producing food more smartly.

In Professor Woods, this tendency to see in agriculture the means to solve problems more broadly is a trait that traces back to childhood. "I dug up the end of the family's grass tennis court so that we could have vegetables by growing them." ■

PHOTO: QUEENSLAND DAF

Professor Beth Woods

As the newly appointed director-general, Professor Beth Woods leads agriculture development initiatives that aim to deliver a highly efficient, innovative, productive and successful Queensland agriculture sector. Professor Woods was also responsible for the fisheries and forestry portfolios until 2 September 2013. She obtained her PhD in agricultural economics at the University of Oxford.

WORLD FISH

In the developing world, more than one billion people obtain most of their animal protein from fish and 250 million depend on fishing and aquaculture for their livelihoods. WorldFish is an international, non-profit research organisation that harnesses the potential of fisheries and aquaculture to reduce hunger and poverty.



AN ADVENTURE COMES FULL CIRCLE

When the call was made in the 1970s to extend the Green Revolution from wheat and rice to all important farming systems, it took more than agricultural science to realise that dream

BY GIO BRAIDOTTI

It was a different world when Dr James Ryan left for India in 1974 to apply agricultural economics to help with the decision to invest in research to avert famine on a global scale.

There was no ACIAR, no established international models for collaborative research, no templates for establishing priorities for such an ambitious research centre as the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in an India vastly different to today's confident economic and cultural powerhouse—nor in Africa.

As a young Australian with a newly minted PhD from North Carolina State University, Dr Ryan says he was initially confounded by the list of crops targeted by ICRISAT. He told his wife, Wendy, that the interview request, received from India, was to lead the economics program at an institute dedicated to research on “bird seeds”.

“Pigeonpea, chickpea, pearl millet ... I was not flattered,” he jokes. “You see, these were not common crops on Australian farms and I had no idea then how important ICRISAT would become for Indian, African and Australian agriculture.

“We went for the excitement of it all. There was an optimism at the time, born of the success of the Green Revolution. The Consultative Group on International Agricultural Research (CGIAR) Centres intended to do to other foodgrain crops what the Green Revolution had done for wheat and rice—to avoid catastrophic shortages through improved crop productivity and stability.”

By the early 1980s, contingents of Australian farmers had visited ICRISAT at Hyderabad, India, germplasm was flowing from the centre's genetic resource collections and breeding programs, and an important legume industry was being born in Australia along with rising yields on subsistence and smallholder farms in developing countries.

ICRISAT quickly became one of the largest of the new CGIAR Centres.

Dr Ryan explains that the role of economics within the CGIAR system was to provide tools to assess research priorities in the first instance, and then provide the means to learn from each cycle of investment by developing the ability to credibly assess impact.

To do that requires experimental, farm and household data, and one of Dr Ryan's enduring legacies is the time-lapse packages of data or ‘videos’ that captured farm and household



Dr James Ryan

ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is the Consultative Group on International Agricultural Research Centre dedicated to the five major food crops of the poorest regions in the semi-arid tropics of the developing world—sorghum, millet, pigeonpea, chickpea and groundnut. Natural resource management research is also undertaken at ICRISAT to address the challenges of land degradation and integrated soil, water and nutrient management, while socioeconomics are used to analyse constraints to development in the semi-arid tropics.

information over time in the ICRISAT Village Level Studies. “In contrast to village ‘snapshots’, these ‘videos’ involve panel datasets recorded over time of the same villages and households,” he says. These are still being gathered and used today.

“It culminates in the ability to assess the economics of prospective agricultural technologies and policies using budgeting, simulation and other research techniques,” Dr Ryan explains. “My other interests were in determining priorities for the allocation of agricultural research resources, human nutrition and technology development, and rural labour markets and technological change.”

He carried over these interests and skills to ACIAR when, in 1983, he became the centre's first deputy director—a role he held until 1991. In recent reviews, ACIAR has been praised for the high return on its investments and for its impact assessment program, headed by Dr Andrew Alford. ACIAR's innovative approach to assessment is another of Dr Ryan's legacies.

“When ACIAR began, Dr Jeff Davis and I set up a priority assessment framework, which stressed the partnership model that we are proud of,” he says. “There was no ‘buzz’ around partnerships as an operating mode at the time; then it was all about development assistance. ACIAR was one of the pioneers in pursuing mutual benefits to developing countries and Australia, and it was an approach that resonated with our partner countries.”

The ease with which he married the domains of agricultural science, innovation and socioeconomics is something that, like many other Australians of that era, he attributes to the Australian education of that time.

“When I was an undergraduate in the 1960s, we received a lot of agricultural science training with

a focus on practical applications,” he says. “These were hybrid degrees that included the best of agricultural science, not just economics. That meant I could dialogue easily with agricultural scientists. A number of Australian agricultural economists with that background ended up at the CGIAR Centres and have played particularly prominent roles.”

He would return for a second stint at ICRISAT, as director-general, in 1991 to reorganise the institute into a project mode with a clearer focus on linking priorities to resource allocations. There have been many other roles since, including chairing a review of Australia's agricultural aid program: Dr Ryan describes himself as a “failed retiree”.

His current interest is a succession plan to avert a disastrous decline in the number of young Australians drawn to careers in agricultural science and agricultural economics, even as the international research agenda becomes more nuanced and challenging.

“Just in the past year I have seen promising signs that we are pulling out of the decline in agriculture students of the past 15 years. But we must do more,” he says. ■

A MAN FOR ALL SEASONS

Technology that simulates the complex interactions determining farm productivity and profitability was first developed in Kenya by an early ACIAR project; that work continues today, a legacy of ACIAR's vision and international engagement

BY GIO BRAIDOTTI

Dr Brian Keating oversees hundreds of researchers deployed across CSIRO Flagships dedicated to agriculture, food, nutrition and biosecurity. Yet for all his years at CSIRO, he says it was his association with ACIAR that most profoundly shaped his career. "My career evolved in parallel with ACIAR," he says.

In 1984, just two years after ACIAR's establishment, Dr Keating was recruited to join what was then one of ACIAR's largest projects in Africa under a program led by Dr James Ryan (page 11).

The aim was so ambitious that the team had to pioneer analytical technology that enabled researchers to work at a whole-farm-system level. For Kenya, the goal was to develop and use this enhanced analytical capability to identify pathways to sustainably intensify maize/bean/livestock farming systems in semi-arid landscapes. A sister project was undertaken in Katherine, in Australia's Northern Territory.

Over the five years Dr Keating spent in Kenya, he started on a research endeavour that culminated in the world's best systems-wide farm model—the Agricultural Production Systems sIMulator (APSIM).

APSIM's flexible architecture allows data pertaining to landscapes, soils, climates,

germplasm, gene-by-environment effects and farming practices to interact in simulations that allow virtual experiments on ways to improve farming outcomes to be undertaken in hours instead of decades. It is a software package also capable of supporting agronomy research and is even helping in the design of breeding programs.

The technology's capacity is so advanced that APSIM thrives even when modelling highly marginal landscapes and rainfall variability, as is the case across much of Australian agriculture. Today, APSIM is the engine within Yield Prophet, one of the most powerful and widely used crop and yield-management tools employed in Australian agriculture.

In Kenya in 1984, where APSIM was born, ACIAR was brought to a new level, ultimately providing the means to analyse whole farming systems in the prevailing environment and to identify the most optimal ways to lift productivity and profitability.

"It all started on a plane trip to Africa," Dr Keating recalls. "We were responsible for bringing the first PC into Kenya. This was before laptops; it was called a luggable PC and weighed 12 kilograms ... and I lugged that machine around the world."

Simulations and outcomes on the ground were closely monitored for 20 production cycles (10 years). Year after year, the results matched the predictions, and so CSIRO's computational approach was validated.

This new-found modelling capacity meant that when an ACIAR team acted on the ground it was as if they had decades of experience improving the target farming system.

"My time in Kenya with ACIAR was fantastic," Dr Keating says. "In terms of problem-solving, building confidence and sheer research opportunities, it shaped my career. It was enabling and uplifting. And best of all, because of the way ACIAR is set up to promote research in both the partner country and Australia, it did not require a choice between working internationally and remaining engaged with promoting Australian agriculture."

He names Dr Ryan, Dr Gabrielle Persley, Dr Denis Blight and ACIAR's first director, Professor Jim McWilliam, as the visionaries who, alongside Sir John Crawford, were most responsible for creating the ACIAR model, including the strong relationships built with Australian research institutions.

So strong are those bonds that CSIRO has remained engaged in agricultural research aid to Africa every year since 1984 and the APSIM team is today the strongest in the world at computational modelling of farm systems.

Dr Keating believes CSIRO's interest in both modelling and Africa will only continue to grow. He notes that six of the world's 10 fastest-growing economies are in Africa, along with untapped mineral and land resources. Australia's business footprint is big in Africa, he says, and with common interests and challenges, it will remain big across business, trade and education especially.

"The landscapes, climate, crops and animals in Africa can be quite similar to Australian agriculture," he says. "That makes for a solid partnership. Additionally, Australia, unlike much of the developed world, had to acquire skills farming these risky landscapes to survive. I describe it as an 'environment of sub-optimality' in which you have to work smarter just to survive, and that means managing risk, in part through the parsimonious use of inputs."

The result of sustained applied research that is delivered alongside Australian farmers is a nation with some of the world's best low-input farming systems and a research infrastructure especially suited to working internationally. ■

PHOTO: LOUISE RALPH



Dr Brian Keating

As executive director of CSIRO's Agriculture, Food and Health Sector, Dr Brian Keating directs research that is vital to the Australian economy, environment, food security and industrial capacity, such as aquaculture. CSIRO research in this sector is also responding to a strong demand for science-based solutions to major global challenges, including issues of international significance to poverty alleviation, such as the need to increase agricultural productivity, disease prevention, biosecurity and the need for strong and sustainable industries and economies in rural regions.

THE MESSENGER

It is not just agricultural practice that is innovated by research at international centres; the means to communicate those findings also require innovation and leadership

BY MANDY GYLES

International Crops Research Institute for the Semi-Arid Tropics

It takes mastery in marketing and communications to ensure that agricultural innovations reach farmers, consumers and policymakers. The role is especially important to the 15 centres of the Consultative Group on International Agricultural Research (CGIAR).

A name that is often mentioned when the role of agricultural development communications is discussed is Joanna Kane-Potaka, director of strategic marketing and communication at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The crop that particularly demonstrates the importance of marketing and communications to agriculture is millet, a highly resilient cereal—the last crop standing when all else has withered because it can withstand high temperatures and survive with little water.

SMART CHOICES, SMARTER FOODS

“Foods such as millet are only known in Australia for bird seed, yet they are highly nutritious,” Ms Kane-Potaka explains.

“Pearl millets can provide the daily allowance of iron—which is important given that anaemia is the largest global issue for nutrition deficiencies. Finger millet has three times the amount of calcium than the equivalent of milk. Millets are gluten free and have a low glycaemic index.”

Ms Kane-Potaka—who began her career as an agricultural economist with the Australian Bureau of Agricultural and Resource Economics and Sciences and later moved into market research with the then Queensland Department of Primary Industries—believes there is a huge opportunity to develop this market and overcome the funding gap for these grains.

She wants to bring them out from under the shadow of “the big three”—wheat, maize and rice.

“We need to bring more grains into mainstream consumption: to deliver more diverse and healthy diets,” she says.

“To do this we have to also work at the consumer end and secure more policy support.”

Ms Kane-Potaka has initiated a campaign to raise the profile of millets as ‘smart foods’ that are good for people, good for the planet and important for food security for smallholder farmers in developing countries.

PUSHING ADOPTION

The tools used to make research findings available to farmers are also a focus for Ms Kane-Potaka, who is keen to deepen and broaden the end benefits of research findings. One way she did this, while at the International Water Management Institute, was to study 10 of the institute’s projects that were most successful in making positive change for poor communities. That knowledge has allowed her to push the boundaries around the practice of extension. Included is the creation of a software platform for making ICRISAT’s scientific information more easily accessible.

“I led a team to create a platform for our scientific information called EXPLOREit @ ICRISAT,” she says. “We first determined how people come looking for our information. Then through the use of metadata and multiple navigation, made the same information available no matter how a person searches for it. Information is also automatically fed into the platform as soon as it becomes available.”

Bringing agriculture into more mainstream communications and standing out from the crowd is another big challenge that excites Ms Kane-Potaka.

“We have a lot of new initiatives coming out this year to help with this,” she says. “We will launch ‘100 Voices’, a video series around topical issues where we interview people from different disciplines around the world. The first one will be on the future of genomics. ‘Take 2’ will produce short highlights of videoed science seminars.”

A range of e-timelines will come out later this year as a new interactive way to show research work over time. Her ICRISAT team is working with the Ramoji Group to develop content for the world’s first TV station dedicated to farmers and is also setting up an Agri Park to deliver extension messages through ‘info-tainment’.

INVOLVING WOMEN

Ms Kane-Potaka routinely sees a gender gap in the way extension is undertaken: “Only last year I gave the opening talk at a workshop attended only by men,” she says. “I was told that women’s home duties prevented them from spending four days away from home.”

“A few weeks ago I was talking to farmers who had all been through training programs but not the women who do the actual planting and

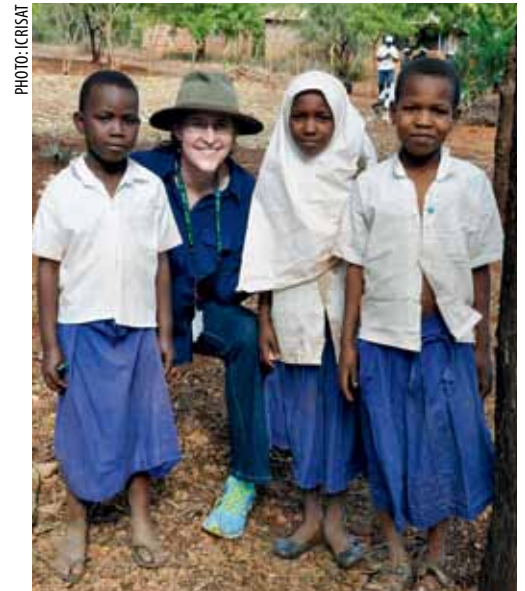


PHOTO: ICRISAT

Joanna Kane-Potaka

Joanna Kane-Potaka has worked and lived in India, Sri Lanka, Italy, Malaysia and the Philippines with four of the CGIAR Centres—the International Crops Research Institute for the Semi-Arid Tropics, the International Water Management Institute, Bioversity International and WorldFish.

harvesting. When I queried this, the men said they let the women know what to do.”

Ms Kane-Potaka believes the full potential of farming systems cannot be reached unless a conscious effort is made to include women. ■

JOANNA KANE-POTAKA'S INTERNATIONAL FOOTPRINT

The International Crops Research Institute for the Semi-Arid Tropics improves the crops, land and farming systems of the poorest of the poor.

The International Water Management Institute focuses on the sustainable use of water and land resources in developing countries.

Bioversity International acts to safeguard the agricultural and tree biodiversity to attain global food and nutrition security.

WorldFish harnesses the potential of sustainable fisheries and aquaculture to increase food and nutrition security.

TO MAKE A DIFFERENCE: HOW GOOD IS THAT?

A life as a farmer on the back blocks of north-west New South Wales beckoned to Dr Peter Carberry before a flair for agricultural science opened a career that took him to the back blocks of Africa, India, Australia and places in between

BY MANDY GYLES

International Crops Research Institute for the Semi-Arid Tropics

On finishing his agricultural science degree at the University of Sydney back in 1981, being a farmer and getting involved in the local rugby team were foremost in Peter Carberry's mind.

But wind the clock forward 34 years over a remarkable research career and Dr Carberry today is the deputy director-general for research at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad, India. This follows a 28-year research career with CSIRO.

Along with Dr Brian Keating (page 12), Dr Carberry is a co-creator of the Agricultural Production Systems sIMulator (APSIM). It was APSIM and the need for a crop model for pearl millet that first brought Dr Carberry to ICRISAT 33 years before his current appointment, having been lured to India by the opportunity for postgraduate study and to see the world.

"We always say that APSIM started in Kenya with an ACIAR-funded project," he says. "It was there we realised you can't just deal with a single crop model. We also had to consider how the crops interface with the farming systems as a whole—the seasonal pattern of rainfall and dry, the rotations and soil. We had to rethink the way modelling worked."

That is the reason APSIM is different to most other models—it is a systems model, not a crop model. It incorporates the best knowledge from soil science, crop physiology, crop agronomy, genetics and environmental mechanics to create a virtual landscape.

"It allows researchers to explore their theories about how to change farming practices for the better in virtually no time," he says. "Having worked on APSIM now for 30 years plus, I would be confident that if you ran it for a new environment around the main farming systems, it will give you 80% of the story. You don't have to do five, 10, 15 years of experiments."

About 15 years ago Dr Carberry shifted his research emphasis from building APSIM to exploring if it could support farmers, advisers and agribusiness professionals in Australia.

"We built a tool called Yield Prophet that's attuned to farmers who want to check on their own intuition or analyse their situation," he says.

"It's a commercial service developed by farmers and owned by farmers through the Birchip Cropping Group (now called BCG) and delivered for farmers and agribusiness on a subscription basis. It's mainly used to analyse production risk through factoring in optimum sowing time for different cultivars, and other variables such as nitrogen requirements during the season and rainfall."

Dr Peter Carberry speaking with a pearl millet farmer in Gujarat, India.

Dr Peter Carberry was previously a senior researcher and manager at CSIRO for 28 years. In that time he worked on ACIAR projects in Kenya, Indonesia, South Africa and India. For the past five years he has held a senior role in the Australian Food Security Initiative in western and eastern Africa.



PHOTO: JOANNA KANE-FOTAKA

The latest version of Yield Prophet links climate and rain forecasting models to reduce production risks in low-rainfall areas in southern Australia.

Given its origins within an ACIAR project, APSIM is also associated with many international farming developments. For example, it has changed the way smallholders produce beef cattle in Indonesia.

"Australian researchers did a lot of work on pastures in Indonesia, but it wasn't being adopted by the farmers," says Dr Harm van Rees, who recently evaluated the impact of APSIM internationally.

Through an ACIAR project, CSIRO adapted APSIM to consider a household model—looking at how the family structure operated in terms of time and resources. It evaluated the impact of growing a small amount of forage near the home and keeping the cattle in nearby pens. It resulted in farming innovations that have since been widely adopted.

"The high adoption rates achieved by the CSIRO team—and Dr Carberry was central—is that its focus was on the farmer; it is an approach that is in these Australian scientists' DNA," Dr van Rees says.

That creates a near-perfect synergy with ICRISAT and Dr Carberry says he is thrilled to be back, accompanied by his wife, Anne.

He is planning to build up the farming systems focus within ICRISAT research, creating more robust impacts for farmers in the semi-arid tropics of south Asia, Africa and Australia.

"I argue that you will always see Australians at ICRISAT," he says. "If I go out to Indian farms, I can

walk onto the same soil that I would have been farming if I'd become a farmer years ago.

"The vertisol soils here are the same as my brother Andrew's farm at Narrabri, New South Wales. It has the same climate variability—a drought one year and flood the next. So I think Australians are attuned to thinking about these systems."

He encourages young people to step out of their comfort zone and use their expertise to take on these big challenges in the world. "I've been to places—the back blocks of Burkina Faso or India or Zimbabwe—not many people get to see and I get to make an impact. How good is that? Agricultural science is a fantastic career." ■

ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) conducts agricultural research to empower people to overcome poverty, malnutrition and a degraded environment through better agriculture. It has a strong focus on sustainable on-farm intensification and building agribusiness opportunities for smallholder farmers.

THE ECONOMICS OF POVERTY ALLEVIATION

A new generation of specialists is using Australian agricultural research capacity to reduce hunger and to produce public resources—gene banks, breeding programs and farming systems—of global significance

BY GIO BRAIDOTTI

Australian economist Professor Kym Anderson AC helps guide investment of the annual US\$1 billion (A\$1.3 billion) available to the world's Consultative Group on International Agricultural Research (CGIAR) Centres to alleviate hunger and poverty through agricultural development.

Professor Anderson is chair of the Board of Trustees of the International Food Policy Research Institute (IFPRI), which operates out of Washington DC, in the USA, as well as in Africa, Asia and Latin America. Professor Anderson is also the president of ACIAR's Policy Advisory Council.

IFPRI provides economic research and analysis of national, regional and global food policies, institutions and markets. It has a large program of research on ways that agriculture can improve nutrition and health in developing nations as they push for sustainable economic development and adopt new technologies and policy reforms to improve agricultural productivity.

It is a role first filled by another Australian economist: Sir John Crawford, an architect of Australia's postwar growth from the late 1940s and through the 1950s. Sir John Crawford was

instrumental in the establishment of IFPRI in 1975 and served as its first chair. According to Dr Isher Judge Ahluwalia, chair on the occasion of IFPRI's 30th anniversary, IFPRI was fortunate to have Sir John Crawford at its outset: "He was a passionate advocate for international agricultural research and an architect of CGIAR," she said.

"John Crawford and the rest of the first Board of Trustees helped set the Institute on a course that has proven to be fruitful and sustainable."

Professor Anderson says he was inspired by the achievements of CGIAR, particularly the success of the Green Revolution in averting famine in south Asia after the 1960s. It was the shock of the 2008 global food crisis that saw him deepen his engagement with international agricultural development, culminating in him following in Sir John Crawford's IFPRI footsteps.

"What fascinates me about the CGIAR system of funding research for agricultural development is the high pay-off," he says. "It has impacts well beyond its funding, with spillover effects to many countries, including donor nations such as Australia."

IFPRI has grown since Sir John Crawford's days, evolving to meet both the funding challenges faced by CGIAR in the lead up to the 2008 food

crisis and a broadening of its core activities to include reducing poverty, improving food and nutrition security, and improving natural resource systems and the environment.

Professor Anderson says this evolution was necessary to better deal with the interconnected complexities facing agricultural production systems. This stems from numerous sources—climate change, the erosion of natural resources

PHOTO: STEVE KEOUGH



Professor Kym Anderson AC

Professor Kym Anderson, a leading Australian economist specialising in trade policy, has a strong interest in agricultural and environmental economics.

The Australian-developed 'Happy Seeder' has given Indian farmers access to no-till practices in their heavy stubbles that previously had to be burned, causing air pollution and diminished soil structure. It is an example of a developed agricultural technology being adapted to lift farm productivity in regions where food security is an ongoing challenge.



(particularly water and soil), a growing emphasis on the nutrients needed from food to maintain health, and the need to double food production by 2050 within worsening land and water constraints.

"Part of the Board's challenge is to convince governments to contribute more to CGIAR," Professor Anderson says. "While investment has doubled since 2008, CGIAR is still seriously underfunded relative to global needs."

Each year, the IFPRI Board opts to deepen its engagement with partner countries—donors and recipients alike—by meeting in a nation that is pivotal to future food security. In May 2015, that was China, a nation with a growing profile in international aid to poorer countries.

Professor Anderson took the opportunity to better understand China's views on development and to encourage the country to deepen its relationship with CGIAR research and capacity-building initiatives. As to Australia's disproportionate presence and influence within international agricultural circles, Professor Anderson attributes this to a combination of two factors.

"Australia has built some of the world's best agricultural research infrastructure and capacity," he says. "Furthermore, as a food-exporting nation, Australia knows how to bring the power of trade and open markets to bear on efforts at poverty alleviation and economic growth."

Professor Anderson is a professor of economics at the University of Adelaide and the Australian National University, Canberra. He was the first economist to serve on dispute settlement panels at the World Trade Organization (concerning the European Union's banana import regime, 1996–2008). He has published extensively, including on global distortions to agricultural incentives while on leave at the World Bank (2004–07). Most recently he has been focusing on prospects for global trade and food and energy security to 2030. ■

IFPRI

The International Food Policy Research Institute (IFPRI) is a member of the CGIAR Consortium that analyses national and international policies and strategies for meeting the food needs of the developing world on a sustainable basis, with particular emphasis on low-income countries and on the poorer groups in those countries.

Australians on IFPRI's Board of Trustees

- Sir John Crawford 1975–81
- Dr James McWilliam 1984–89
- James Ingram 1990–97
- Geoff Miller 1997–2003
- Professor Ross Garnaut AO 2003–10
- Professor Kym Anderson AC 2010–present

IN THE VANGUARD OF THE DNA REVOLUTION

Dr Elizabeth Dennis has made an outstanding contribution to plant genetics and to international agricultural research

BY ROBYN HENDERSON

Dr Elizabeth Dennis has been the recipient of Australia's pre-eminent science award, the Prime Minister's Prize for Science, awarded each year to scientists who promote human welfare through an outstanding achievement in science or technology. In Dr Dennis's case, it is an apt honour given the manner in which she has married a flair for making important discoveries about plant genetics with a concern for the nutritional welfare of poorer countries.

Her journey to scientific pre-eminence began when as a young girl, Dr Dennis read stories about Marie Curie and decided she wanted to be like her. She attended the University of Sydney, where she went on to undertake a PhD with Professor Gerry Wake in nucleic acids and how bacteria replicate their DNA. In 1982–83 she spent a year's sabbatical as a Fulbright Fellow in Professor Paul Berg's laboratory at Stanford University.

Moving to New York and the Albert Einstein College of Medicine, Dr Dennis worked as a postdoctoral fellow with Dr Julius Marmur, one of the founding fathers of molecular biology, during his tenure as professor of biochemistry. From there she crossed the world to lecture at the University of Papua New Guinea (PNG) and to work on chromosome and DNA studies on the native rodents.

Back and forth between the CSIRO Division of Plant Industry in Canberra and PNG, she switched to working on DNA from plants to cloning haemoglobin genes. The CSIRO group showed that all plants have haemoglobin genes, not just nitrogen-fixing plants. These genes can be switched on by low oxygen, such as occurs in flooding or waterlogging.

The work on the haemoglobin gene aimed to use modern techniques to address nutritional problems. As Dr Dennis points out: "People in developing countries who eat rice as their major food source face two major problems of nutrition. One is that people can go blind from vitamin A deficiency, and the second major problem is anaemia. Rice doesn't have much iron, so something like a billion people suffer from iron deficiency anaemia. One of our projects has been to try and increase the iron content in

rice. We've added genes for haemoglobin and iron-containing proteins under the control of strong regulatory sequences so that they'll have high levels of activity in the seed and the seed will contain large amounts of haemoglobin." Unfortunately the levels of iron achieved were not

PHOTO: BRAD COLLIS



Liz Dennis at CSIRO Plant Industry, Canberra.

Dr Elizabeth Dennis is an eminent plant molecular biologist and a chief research scientist working with the CSIRO Division of Plant Industry in Canberra, where she leads a team of researchers. Her work has been internationally recognised. She is a past president of the Australian Society for Biochemistry and Molecular Biology. She was elected to the Australian Academy of Technological Sciences and Engineering in 1987 and to the Australian Academy of Science in 1995. Together with her colleague Dr Jim Peacock AC, Liz was awarded the inaugural Prime Minister's Prize for Science in 2000.

sufficient to make a difference to the nutritional value of rice.

Dr Dennis and her colleagues have hosted students and postdoctoral fellows from several developing countries to provide them with experience in sophisticated molecular biology approaches to plant science.

Dr Dennis and her long-term colleague Dr Jim Peacock AC, together with a group of young scientists, are working on understanding the molecular basis of hybrid vigour. Hybrids have been widely used in agriculture to provide greater yields and better performance without requiring greater levels of inputs such as water or fertiliser. Up until now the molecular basis of hybrid vigour has largely not been understood.

Dr Dennis and her colleagues have shown that as well as genetic contributions to hybrid vigour,

epigenetic marks are also involved. Epigenetics involve unusual mechanisms that allow plants to respond to environmental conditions by altering the behaviour of genes—even eliciting mutant-like behaviours—but without involving changes to the genes' DNA but rather to the way the DNA is packaged. Such mechanisms are in play in hybrids and these alterations may contribute to the hybrid phenotype.

Another feature of hybrids is that the next generation of plants does not show the hybrid advantage and so farmers cannot keep hybrid seed for planting the next year. Instead, farmers must purchase new hybrid seed each year. Dr Dennis and colleagues have developed a method using recurrent selection for the hybrid-like characteristics that produces plant lines that have most of the benefits of hybrids that are

inherited so farmers can keep seed. They hope that such methods can be transferred to crop plants. These plants could be used in situations where there are no hybrid systems or where farmers do not have the money to purchase new hybrid seed each year.

Dr Dennis has contributed to research and capacity building in PNG, and has links to many developing countries. ■

CSIRO PLANT INDUSTRY

CSIRO Plant Industry is at the vanguard of plant research in the world, maintaining a suite of research activities closely aligned to the challenges facing Australian farmers and making staff, skills and resources routinely available internationally, including through a long association with ACIAR.



LIVESTOCK FUNDAMENTAL IN THE FOOD CHAIN

An Australian was instrumental in establishing an international research centre dedicated to smallholders' livestock and today Professor Lindsay Falvey carries on that tradition



BY GIO BRAIDOTTI

The incoming chair of the International Livestock Research Institute (ILRI), Professor Lindsay Falvey FTSE, views food security as the sum of many interlinked parts that encompass social, political, managerial and economic factors. He draws on all these to expand and refine the role of research and of livestock in international development.

Driving it all is a flair for systems-wide thinking, a sturdy moral compass and the courage to speak out when evidence points to a better way forward. Currently, that means advocating on behalf of a singular conclusion derived from a long career in research: "Livestock are essential to food security," he says.

Along the way he has debunked popular misconceptions of livestock as inefficient and unsustainable sources of protein.

Instead he describes farm animals as particularly essential to the poor, but not necessarily in forms recognisable to the global middle class.

"I see livestock playing a major role in basic food security, which in turn is the first principle of national and international security," says Professor

Falvey, who notes that food-insecure populations historically can undermine precarious states and cause mass emigrations.

"Outside single-product industrial farms, livestock meet multiple development objectives, providing high-quality protein, income, draught and traction power for agriculture, nutrient recycling, various edible and non-edible by-products, and they can reproduce themselves."

He cites the example of dung, which serves as manure, a construction material, a cooking fuel and can be used for biogas conversion. This points to the extraordinary efficiencies of small mixed-farming and nomadic-herding systems, where meat is often viewed as an end-of-working-life by-product.

"Rather than assume commercial production is the end game of development, we may do well to see that small subsistence farmers and their animals are providing a great service by feeding up to two billion smallholder farming families around the world, many of whom are not otherwise in the 'buying' economy," Professor Falvey says.

"If those families were to migrate to cities, the consequent increase in food demand would not be met by current levels of production of

broadacre agriculture, even if it used all the land once tilled by smallholder farmers."

He adds that the contribution of smallholders' livestock to greenhouse gases is unlikely to resemble that of intensive production systems and is unassessed, while the protein and nutrients provided by these animals are of "monumental importance" to human health and development.

"Children and reproductive-age women whose diets are deficient in amino acids not readily available from plant foods benefit significantly from even small amounts of animal protein," he says.

EFFICIENCY TARGET

Looking ahead, Professor Falvey views as especially important those research programs that minimise the costs of maintaining livestock while improving efficiencies. As an example he cites research efforts to breed cattle resistant to the parasite that causes the devastating sleeping sickness when transmitted to humans by the tsetse fly.

"Healthy animals produce more, and productive animals mean healthier humans," he says. "That's the kind of impact possible through a realistic appreciation of livestock in international development. Everything that impacts animals—

from stress to pasture—is something agricultural science should be interested in.”

Looking back on his career, he says that the education he received during Australia’s “golden age” of agricultural science (in the late 1960s) was pivotal. He describes his training as the “best in the world”, encompassing a full science curriculum, in addition to economics and even a smattering of sociology.

It is the same integration of that mix of disciplines that is fundamental to the best research-for-development projects, including much of ACIAR’s contemporary work.

His confidence and determination to make a difference is in part attributable to a religious background and to his association with Australians who made important marks on the world. In particular there is the man that Professor Falvey honoured with a biography—Professor Derek Tribe FTSE OBE—who was instrumental in establishing the organisations that became ILRI and the Crawford Fund.

“Doing research for development is not just about the science,” Professor Falvey says. “Like any other pursuit, you need good governance, secure finances and the right management. These are critical to research and to ensure young scientists are drawn to pursue research careers into the future.” ■

PHOTO: ILRI



Professor Lindsay Falvey FTSE

Professor Lindsay Falvey FTSE has been dean of Land and Food Resources and chair of Agriculture at the University of Melbourne, adviser to all major agricultural development agencies and several governments, and CEO of international consulting companies. He has published 20 books, including the biography of Professor Derek Tribe, and more than 150 papers on subjects related to agriculture and human values. He is a director of major agricultural investor Hassad Australia, and assumes the chair of the International Livestock Research Institute in November.

ILRI

The International Livestock Research Institute (ILRI) is a member of the Consultative Group on International Agricultural Research (CGIAR) Consortium and works with partners worldwide to enhance livestock pathways out of poverty, principally in Sub-Saharan Africa and Asia.

CASE STUDY: A PASSION FOR RESEARCH, AGUSTINA ASRI RAHMIANNA

Dr Agustina Asri Rahmianna’s passion for research was noticed almost straight away by Australian scientists seconded to an ACIAR groundnut (peanut) project in Indonesia in the early 1990s.

Then an agronomy graduate from Gadjah Mada University, Dr Rahmianna (or Anna as she is known among the farmers she works with in Indonesia) was encouraged by Queensland peanut researchers Dr Graeme Wright and Dr Mike Bell to apply for a John Allwright Fellowship to undertake a PhD in Australia, which she duly did and completed in 1998.

Dr Rahmianna’s work since then is a clear demonstration of the capacity building value of ACIAR scholarships such as the John Allwright and John Dillon Fellowships.

Dr Rahmianna is a leading researcher with the Indonesian Legume and Tuber Crops Research Institute, focusing on lifting groundnut production through improved agronomy and water use efficiency. Peanuts are grown in rotation with rice and give farmers an extra crop that can use the soil moisture remaining in paddies.

Her work also involves educating farmers on the correct use of fungicides to control aflatoxin. The long-term objective is to lift production, plus raise overall quality to an export standard. This would go a long way to lifting smallholder communities from traditional subsistence farming to having a more productive and sustainable agricultural economy.

While it was painful to leave behind a young family during her PhD at the University of Queensland, Dr Rahmianna says the experience was life-changing: “Everything about research still excites me,” she says. “Research gives you a freedom for thinking and problem-solving.”

But she adds that change cannot be achieved by research alone: “It needs extension support and the participation of industry; in the case of our groundnuts, the buyers and processors [are needed] to ensure the new knowledge is maintained after the researchers have gone.”

**Research gives you a
freedom for thinking
and problem-solving.**

– Dr Agustina Asri Rahmianna

PHOTO: BRAD COLLIS



Farmers gather around researcher Dr Agustina Asri Rahmianna to ask advice on crop samples they have brought with them.

A MARKET DAY SUCCESS: ACIAR CELEBRATES PARDI PHASE ONE COMPLETION

On 30 June, ACIAR held a successful market day to celebrate the completion of phase one of the Pacific Agribusiness Research for Development Initiative (PARDI). More than 150 researchers, farmers, agribusiness and government representatives from Australia and across the Pacific came together in Fiji. The event provided an opportunity to network, share experiences and see firsthand the impact of agribusiness research on economic and social development in the region. The market day proved to be a highly popular and innovative way to present the outcomes of agricultural research for development.

More information is available through the ACIAR blog: <http://aciarblog.blogspot.com.au>



PHOTO: ACIAR



PHOTO: ACIAR

ABOVE ACIAR forestry research program manager Tony Bartlett (left) and Australian Department of Foreign Affairs and Trade deputy secretary Ric Wells at the market day in Fiji.

LEFT ACIAR's Tara McKenzie (left) learns about breadfruit from Livai Toru.

CRAWFORD FUND FELLOWSHIP

ACIAR congratulates Aye Sandar Phyo as the recipient of the Crawford Fund Fellowship for 2015. Ms Phyo has been involved in ACIAR's project on 'Strengthening institutional capacity, extension services and rural livelihoods in the central dry zone and Ayeyarwaddy Delta Regions of Myanmar' (ASEM/2011/043). In this project Ms Phyo has led qualitative and quantitative analysis of household livelihoods, change and rural dynamics. The Crawford Fund Fellowship provides the opportunity for further training of a scientist in agriculture, fisheries or forestry from a selected group of developing countries whose work has shown significant potential.

MORE INFORMATION: www.crawfordfund.org

Aye Sandar Phyo



PHOTO: THE CRAWFORD FUND

FISHERIES PROJECT LEADERS MEETING

From 9 to 12 June, the Fisheries Program held its biennial Fisheries Project Leaders meeting in Hobart. It was a great opportunity for project leaders from across the program to come together to share information and discuss future strategies. Positive feedback was received for the format of the meeting, with encouraging comments for future discussions.



PHOTO: ACIAR

Nguyen Thi Thanh An (left) from ACIAR's Vietnam office with Professor Neil Loneragan from Murdoch University in Australia share their experiences in Australia and Vietnam.

STAFF NEWS – FAREWELLS

ACIAR was sad to say goodbye to three colleagues recently. We farewelled Dr Caroline Lemerle as she begins a life of leisure. Caroline was an outstanding research program manager for agricultural systems management and was with ACIAR for eight years. Her knowledge and humour will be greatly missed. We wish her all the best for her future.

ACIAR also said goodbye to Nadeem Samnakay, who has returned to his 'home' agency at the Murray–Darling Basin Authority. Nadeem contributed a tremendous effort in the food innovation systems area as a project knowledge broker. ACIAR will miss Nadeem's insights and knowledge and we wish him future success.

We have said farewell to our colleague Luisa Schiavello from the finance area as she begins a new role at the Department of Immigration and Border Protection in July. Luisa has been a great asset to the ACIAR team and we will be very sad to see her (and her Lego creations) leave.

NEW VIDEO

ACIAR's latest video on our project 'Increasing vegetable production in Central Province for Port Moresby Markets' (SMCN/2008/008) is now available on ACIAR's YouTube channel: www.youtube.com/user/ACIARprojects

YouTube

PHOTO: 123RF.COM



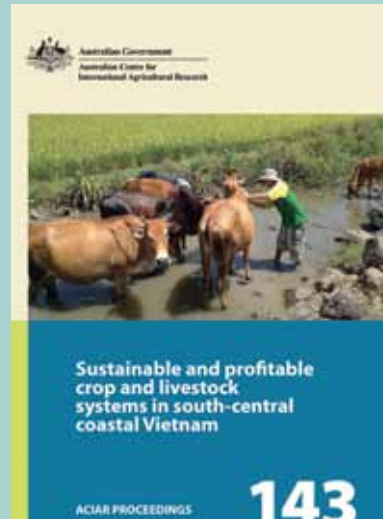
ACIAR'S DISTRIBUTION POLICY

ACIAR provides complimentary copies of its publications to developing-country libraries, institutions, researchers and administrators with involvement in agriculture in developing countries in ACIAR's operating areas, and to scientists involved in ACIAR projects. For enquiries about complimentary copies, please contact ACIAR's Communications and Stakeholder Engagement team, aciar@aciar.gov.au.

For other customers, please use our online ordering facility at aciar.gov.au or direct enquiries to our distributors, Canprint Communications, PO Box 7472, Canberra BC, ACT 2610, Australia, phone +61 2 6295 4422, fax +61 2 6295 4473, aciar@infoservices.com.au. Copies of most publications are available as free downloads from the ACIAR website aciar.gov.au.

NEW PUBLICATIONS

For details on ACIAR's scientific publications series and corporate publications please visit: <http://aciar.gov.au/publication/latest>



PROCEEDINGS

Proceedings 143—*Sustainable and profitable crop and livestock systems in south-central coastal Vietnam*

<http://aciar.gov.au/publication/pr143>



ASSESSMENT SERIES

Assessment Series 88—*ACIAR-funded crop-livestock projects, Tibet Autonomous Region, People's Republic of China*

<http://aciar.gov.au/publication/ias88>

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A scholarship took Dr Sam Periyannan from a smallholder farm in India to Australia and world acclaim for helping to defeat the most serious threat to global wheat production in modern times.



A SCIENTIST'S GLOBAL TRIUMPH

In international agricultural research it is the development of researchers that leads to the scientific discoveries driving progress

KEY POINTS

- Capacity building is an integral aspect of the international agricultural research system.
- Of mounting importance is the mentoring of the next generation of agricultural scientists.

BY GIO BRAIDOTTI

The hidden impact of the Green Revolution has been a surge of capacity building across agriculture, fuelled by a network of partnerships and shared food-production goals between developed and developing world scientists. Include the farmers who have participated in research—through myriad variety and agronomy trials—and the resulting knowledge network's breadth and reach is extraordinary.

This network can link a smallholder farmer to the world's most advanced laboratories—to a plethora of technology, decision-making and computing capability—and also to a broadening base of funding that includes public, private and philanthropic revenue.

Consider Kuppusamy Periyannan and his wife, Subhulakshmi. They farm 1.3 hectares on the banks of the Cauvery River in southern India. They are tropical crop farmers who are considered innovators in their local community.

Despite their own lack of educational opportunities, they have tremendous faith in the power of agricultural science to improve the lives of farmers. So strong is that faith that they borrowed money against their land to educate their children, but on the condition that one child—Sambasivam ("Sam")—commit to studying agricultural science. In 2004, Sam qualified as a plant pathologist.

In fundamental ways, the choices made by Kuppusamy and Subhulakshmi made a difference, not just to their circumstances but to the world. Their decision to risk a loan to educate their son led to helping world-best laboratories in Australia to meet

one of the great contemporary threats to world wheat production—the fungal stem rust disease, Ug99. It caused global alarm when the fungus overcame the disease-resistance genes bred into wheat during the Green Revolution.

The bridge between the Indian smallholder family and the advanced Australian laboratories took the form of a scholarship, which makes it possible for developing world scientists to train in advanced laboratories. In 2007, Dr Sam Periyannan applied for and received an Australian Government International Postgraduate Research Scholarship and support from ACIAR to pursue the arduous training associated with a PhD degree in Australia.

"At the time, there was an IT boom in India and not many parents liked their children to get into

agricultural science," Dr Periyannan told *Partners* in 2013, on the eve of acquiring his doctorate. "But my parents were different. My father especially pointed me to agricultural science and it was the science's links to farming that pushed me to try to excel at research."

He joined the Australian Cereal Rust Control Team—an initiative that ties together all the Australian laboratories with expertise in rust disease control. This includes one of the world's oldest and largest rust pathogen collections at the University of Sydney and world-leading expertise understanding rust genetics at CSIRO Plant Industry.

Dr Periyannan was based in the CSIRO laboratories headed by Dr Evans Lagudah, who also hails from the developing world, having

CASE STUDY: LAO EXTENSION MASTER, VIENGXAY PHOTAKOUN

A master's degree earned at Charles Sturt University on an ACIAR John Allwright Fellowship saw Viengxay Photakoun return to Lao PDR with some firm views on how to build the capacity of agricultural extension officers to benefit livestock producers. Prior to coming to Australia, Mr Photakoun worked on an ACIAR project introducing fodder crops for livestock production in the uplands of Lao PDR. He worked closely with Dr Joanne Millar, who has a special interest in developing successful extension methods.

The fellowship allowed Mr Photakoun to visit Australia to complete his master's degree with Dr Millar. He investigated ways to build institutional capacity to implement participatory research and extension in Lao PDR. That expertise will be applied through the National Agriculture and Forestry Extension Service, as he takes responsibility for extension services for livestock and fisheries.

SEND IN THE VOLUNTEERS

A strategic alliance that assists Australians to volunteer in agriculture-related projects in developing countries has been formed between ACIAR and Scope Global Alliance, a core partner of the Australian Volunteers for International Development program, which is administered by the Australian Department of Foreign Affairs and Trade. The alliance will facilitate the placement of Australian Government-funded volunteers on ACIAR projects throughout the Indo-Pacific region, in support of agricultural production, market supply and business development opportunities.

ACIAR and Scope Global have worked together for more than 10 years and ACIAR's Australian partner organisations have supported more than 150 skilled Australians to work on agricultural research projects since 2002, in direct support of the Australian development strategy.

MORE INFORMATION: www.volunteering.scopeglobal.com

gained a science degree from the University of Ghana prior to obtaining his PhD from the University of Melbourne.

As part of the Durable Rust Resistance in Wheat project, Dr Periyannan developed a high-resolution genetic map of the wheat genome and identified DNA markers to three novel resistance genes that are effective against Ug99. The genes offer unprecedented opportunities to rebuild commercial wheat's rust defences on a more durable foundation.

In 2013 he realised what was then the 'holy grail' of rust resistance research: he isolated the world's first stem rust resistance gene (*Sr33*) from wheat's gargantuan genome.

It was a discovery that made headlines around the world. Dr Periyannan was subsequently a

Something that really interests me now is to further my ties with ACIAR to help train scientists, introducing them to gene cloning technology and how it can be applied to help farmers.

— Dr Sam Periyannan

co-recipient of the Australian team's 2013 Gene Stewardship Award, awarded internationally by the Borlaug Global Rust Initiative. The Australian team was commended for the collaborative spirit of its research program and was selected for outstanding achievements in 15 areas—a world-first scoop of all prize categories. Among these was recognition for highly effective training programs.

Additionally, Dr Periyannan was singled out with several awards, including the Frank Fenner Scholarship Award and the Young Scientist awards from the Society of Applied Biotechnology, India.

He has since been appointed a postdoctoral fellow to continue to isolate useful resistance genes. In collaboration with Dr Brande Wulff's team at the John Innes Centre in the UK, advanced genetic tools are being used to rapidly isolate resistance genes from cereals.

Most recently he was appointed adjunct fellow and lecturer at the University of Queensland and the University of Sydney for his collaborative research and role in training postgraduate students at the Queensland Alliance for Agriculture and Food Innovation and the Plant Breeding Institute, respectively.

"Something that really interests me now is to further my ties with ACIAR to help train scientists, introducing them to gene cloning technology and how it can be applied to help farmers," Dr Periyannan says.

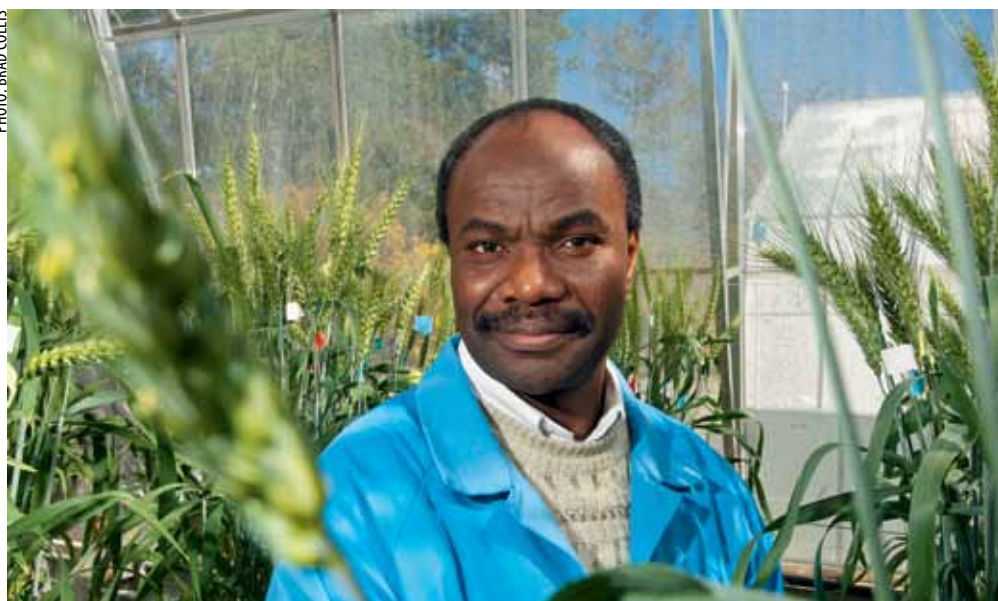
International scholarships are a vital tool in building global capacity to meet food security challenges and for maintaining agricultural productivity and profitability. They accelerate the scientific discovery phase and build capabilities to mentor, train and inspire both scientists and farmers, while enabling faster sharing of vital know-how.

As Dr Periyannan illustrates, it spurs a drive—even a belief—in the ability of individuals to make a difference and commit to working in this important domain.

Several decades worth of international capacity building through international research for development have changed the world through the creation of public goods that flow indiscriminately among rich and poor, developed and developing.

Having played a leadership role both in creating the international system and in administrating its subsequent evolution, Australia is well and truly integrated in ways that are crucial to Australian primary industries. ■

PHOTO: BRAD COLLIS



Dr Sam Periyannan was based in the CSIRO laboratories headed by Dr Evans Lagudah (above), who gained his science degree from the University of Ghana prior to obtaining his PhD from the University of Melbourne.

ACIAR FELLOWSHIPS

ACIAR's John Dillon Memorial Fellowship provides career development opportunities for outstanding young agricultural scientists or economists from ACIAR partner countries who are involved in a current or recently completed ACIAR project. The fellowship supports training that develops leadership skills in agricultural research management, agricultural policy or extension technologies through exposure to Australian agriculture across a range of best-practice organisations. Up to 10 fellowships are offered annually. Applications for the 2016 program are open until 31 August 2015.

MORE INFORMATION: www.aciar.gov.au/training/JDF

ACIAR's John Allwright Fellowship (JAF) provides the opportunity for partner country scientists involved in ACIAR-supported collaborative research projects to obtain postgraduate qualifications at Australian tertiary institutions. The aim is to enhance research capacity in ACIAR's partner country institutions.

MORE INFORMATION: www.aciar.gov.au/training/jaf

THE RAID ON THE NEXT GENERATION

Worldwide there is concern about the declining number of students enrolling in agriculture courses. An initiative seeking to arrest this worrying trend was recently launched in Australia. Researchers in Agriculture for International Development (RAID) is an Australian-based network that connects, engages and supports early to mid-career Australian agricultural scientists to work in agricultural research for development.

A founding member of RAID, Jack Koci, explains: "We want to help address the decline in agricultural research capability in Australia, by encouraging young agricultural scientists to expand their horizons and see the positive contribution they can make in Australia and abroad."

A RAID website has been launched to share knowledge, resources and promote opportunities for employment, further study and volunteer posts. RAID is also organising informal workshops to encourage capacity building. "We want as much member input as possible—the success of the network really depends on the ideas, knowledge and enthusiasm of our members," Mr Koci says.

MORE INFORMATION: www.raidaustralia.net

AUSTRALIA'S WHEAT WARRIORS

When the board of trustees of the International Maize and Wheat Improvement Center (CIMMYT) elected to meet in Australia in 2010, CIMMYT opted to honour Australian scientists who had played key roles as directors-general, board members, staff or collaborators, dubbing them the "Australia-CIMMYT wheat warriors":

- John P. Brennan
- Paul S. Brennan
- Edwina C. Cornish
- John M. Dixon
- Terence Enright
- Lloyd T. Evans
- Kenneth S. Fischer
- Tony Fischer
- Paul N. Fox
- Anthony Gregson
- Robert A. McIntosh
- James R. McWilliam
- Ligia Ayala-Navarrete
- Peter J. Ninnes
- Timothy G. Reeves
- James R. Syme
- Richard M. Trethowan.

The synergy between CIMMYT and Australian agricultural science continues to deepen, acquiring even greater significance as CIMMYT attempts the monumental task of doubling wheat yields by 2050 without increasing inputs, especially irrigation, water or fertiliser.

It is a goal that resonates deeply with Australian grain growers and a task that is drawing liberally on Australian expertise. Already scientists such as CSIRO's Dr Richard Richards and Dr Bob Furbank have taken on leadership roles in large-scale, multimillion-dollar, global projects that include the Wheat Yield Potential Consortium and the C4 Rice Project.



ICARDA's crop trials site near Aleppo, Syria, before researchers were forced to evacuate to Jordan.

THE BIG DRY

With the world's greatest rainfall variability, frequent droughts and parched landscapes, Australia must be water savvy or face dire consequences. This fundamental law of survival means that of the 15 Consultative Group on International Agricultural Research Centres, it is the two dedicated to cropping arid environments that are especially significant for Australian farmers. These are the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the International Center for Agricultural Research in the Dry Areas (ICARDA). Here, too, Australians have left a large institutional footprint.

ICRISAT GOVERNING BOARD

- 2008–13: Meryl Williams
- 1996–2003: Donald R. Marshall
- 1988–95: Max N. Birrell
- 1980–86: John L. Dillon
- 1982–86: Chairman John L. Dillon

ICRISAT MANAGEMENT

- 2012–13: Joanna Kane-Potaka (director—strategic marketing and communication)
- 2009–11: Peter J. Ninnes (director—resource planning and marketing)
- 2000–02: Jill M. Lenné (deputy director-general—research)
- 1992–97: Donald E. Blyth (associate director-general—research)
- 1991–97: James G. Ryan (director-general)

ICARDA BOARD OF TRUSTEES

- 2011–12: Eve Bosak
- 1993–98: July Virgo Noolan
- 1988–94: Norman Halse
- 1981–87: Ralph A. Fischer
- 1976–81: James McWilliam

DROUGHT'S NEMESIS

ACIAR was among a handful of organisations especially thanked by the 2015 recipients of the prestigious international award for outstanding contributions to plant breeding—the Gregor Mendel Innovation Prize.

The recipients safeguarded one of the world's great gene banks when civil strife in Syria overtook the research station and headquarters of the International Center for Agricultural Research in the Dry Areas (ICARDA) in 2014. The prize went to local scientists within the Genetic Resource Section, headed by Dr Ahmed Amri, who remained behind when international staff were evacuated to duplicate and transfer ICARDA's gene bank to the Svalbard Global Seed Vault in Norway.

ICARDA's gene bank is one of the premier resources for protecting the world's grain farms from yield-damaging stresses, particularly drought. It is a genetic resource of particular importance to Australia's lucrative grains industry, a fact long recognised by both ACIAR and the Grains Research and Development Corporation (GRDC), who together have developed a special rapport with ICARDA.

Dr Francis Ogonnaya, a former ICARDA breeder and now GRDC senior manager for crop genetics, says: "Today in Australia, for example, we have a pulse industry and breeding programs that improve productivity thanks to the relationship with ICARDA."

Each year, ICARDA fast-tracks elite material to Australian breeders as part of the CIMMYT–Australia–ICARDA Germplasm Evaluation (CAIGE) Program that is broadening the productivity, stress and disease tolerance of Australian cereals. Dr Ogonnaya says that saving the gene bank was of monumental national importance.



PHOTO: ICARDA

The ICARDA genebank team at Tel Hadya station. The team's work duplicating and safeguarding the seed collection won the 2015 Gregor Mendel Innovation Prize.



PHOTO: MELISSA MARINO

The sharing of genetic resources across countries is integral to breeding crops with enhanced productivity traits and resilience against disease and environmental threats. A partnership between ACIAR and the Indian Council for Agricultural Research linked Indian and Australian scientists who screened wheat germplasm from both countries and used marker-assisted selection to breed more resilient varieties. Here, CSIRO's Dr Richard Richards is being shown around Indian Agricultural Research Institute laboratories by an Indian colleague as part of the project's inaugural workshop in New Delhi in 2007.

SCIENCE NAVIGATES TROUBLED WATERS

Arguably one of the most pressing global challenges is water management and water-resource sharing among neighbouring communities, states and countries



Watering vegetables grown in Cambodia.

PHOTO: ACIAR

KEY POINTS

- Australia is considered one of the key centres of expertise in water management, both for technology and policy.
- Australian expertise is being deployed in south Asia and Africa.
- Effective strategies have been developed to improve both on-farm and catchment-scale management.

BY GIO BRAIDOTTI

CAN SCIENCE QUENCH A GLOBAL THIRST?

About 700 million people in 43 countries suffer from water scarcity but as grim as this statistic is, it is projected to rise to 1.8 billion people by 2025.

By 2030, the shortfall between forecasted demand and water supply is predicted to reach 40%. Modelling further indicates that between 75 and 250 million people in arid areas could actually be displaced by water scarcity.

These are indicators of tumultuous hardships associated with any attempt to sustain a business-as-usual approach to water use and management.

Central to crafting a better way forward is agriculture, given that it accounts for 70% of the

world's use of fresh water. The future of food security—especially the high-yielding, irrigated production system most closely associated with the Green Revolution—hinges precariously on the ability to innovate the way water resources are managed and used.

At the World Bank, water security is considered the number-one emerging global risk issue in terms of impact on social and economic development.

No sector is unaffected. Besides food security there are effects on global health, energy security and the liveability of cities. For example, lack of access to safe water and poor sanitation already leads to about 675,000 premature deaths annually and in some countries causes economic losses of up to 7% of gross domestic product a year.

PIONEERING REFORM MODELS A NEW DIRECTION

Few understand the scale of challenges the world faces or has a better grasp of ways to safeguard water resources than Australia's Dr Don Blackmore. He is the former CEO of the Murray–Darling Basin Commission, the current Board of Governors chair at the International Water Management Institute (IWMI), and adviser to the World Bank. His expertise encompasses Australia, South-East Asia and North Africa.

Over several decades he oversaw Australian water management through a series of reforms that stabilised both water use and salinity incursion in the one million square kilometres of the Murray–Darling Basin—a catchment comprising 23 river systems (an area equivalent to France and Spain combined).

He pulled Australian water resources from an era of dangerous levels of salinity with devastating effects on agriculture and ecosystems, to a future in which it is feasible to now make environmental water allocations.

"Australian culture is defined around water and water scarcity," Dr Blackmore says. "We have the lowest amount of water per square kilometre on Earth, the highest rainfall variability and evaporation rates. Yet we also have the highest

annual per capita water consumption and we export about a third of this resource as 'virtual water' in exported crops."

These statistics reflect just how effective water-use reforms have been in Australia over the past 25 years.

Dr Blackmore views these reforms through the prism of history in which water management in Australia underwent several, distinct stages, punctuated by periodic drought, dry rivers and devastating effects on agriculture.

The first attempt at a cohesive strategy was in 1923 when an era of massive infrastructure construction—reservoirs and some of the world's then-largest dams—began and consumption was regulated.

"But by the 1970s the Basin was once again running dry," Dr Blackmore says. "The regulatory system had failed due to over-allocation. Besides the threat to livelihoods and economic development, people simply did not want iconic rivers, such as the Murray River, to look like they were being destroyed."

There was also a catastrophic rise in landscape salinity—the economic cost calculated at about A\$300,000 a year for each single electrical conductivity unit (ECU) rise in salinity. Average river salinity is 500 ECU and damage to irrigated

crops begins at about 650 ECU. A turning point was reached when there was sufficient will to shift management to a whole-of-catchment basis through the creation of the Murray–Darling Basin Commission.

"Then in 1994, the real 'eureka moment' occurred," Dr Blackmore says. "The Australian Government and state premiers agreed to rank water as an economic 'good', similar to transport and electricity.

"That meant we could cap water supply to sustainable levels and establish an effective water-trading system. Following a R&D blitz on salinity, the capacity was built to intercept and export salt

Development without recognition of the socioeconomic and environmental realities around water use can backfire. It makes effective reform and management difficult, but the right mix of technical knowledge, social understanding and political will can make a difference.

– Dr Evan Christen

A fish farm in India making use of aquifer water too saline for crops.

PHOTO: MELISSA MARINO



away from the rivers at a rate of one million tonnes a year. Limits were established on how much salt reaches the rivers from activities such as irrigation so that the amount of salt is equivalent to just 30% of the amount extracted annually. It is a system that has worked well and amounts to the world's largest pollution cap-and-trade scheme."

Salt-interception schemes and improved irrigation practices and river flows have reduced salinity in the Murray River by about 200 ECU a year at Morgan in South Australia. The long-term target is to maintain the Murray River below 800 ECU 95% of the time. Change on this scale has never been achieved anywhere in the world.

Agromony research makes it possible to identify ways to manage the land to make best use of available moisture and also to test the most productive and profitable crop rotations, pastures and grazing options.

– Dr Eric Huttner

Research engineer Dr Harminder Singh Sidhu from Punjab Agricultural University (right) with a local grower where the Happy Seeder has been put to work, sowing wheat into rice stubbles.

It required science, plus dialogue between competing interests such as irrigators and environmentalists, and led to what Dr Blackmore describes as the commission's most important decision—to freeze peak water use to 1993 levels. For irrigators the scheme now works like a bank account in which excess water use must be paid back.

EXPERTISE SHARED

As a result of the extensive experience of managing the Murray–Darling Basin, Australia is considered a source of expertise for water-management technology and for strategies for management and policy.

This expertise is relevant to managing geographically and politically challenging regions such as the Mekong River Basin and the river systems feeding the Indian subcontinent—areas of longstanding ACIAR engagement.

Demand from the developing world for ACIAR partnerships relating to water management is high and overseeing these projects is the research program manager for land and water resources, Dr Evan Christen.

ACIAR's assistance covers all scales of water use: on-farm through to catchment and regional-scale assessments.

One current project is helping Laos PDR account for its entire groundwater resources and properties such as water quality and rates of recharge.

For Laos, the knowledge will drive the development of a national water-management policy and assessment of an expansion of dry season cropping through the use of irrigation, without jeopardising drinking-water supplies.

WATER AN ECONOMIC DRIVER

ACIAR's water-management projects highlight the links between the availability of high-quality water and the ability to drive economic development, particularly in poor rural communities.

In India, this includes socially marginalised tribal people who farm poor landscapes on the east-India plateau, a region of endemic poverty associated with food insecurity and civil unrest.

Here, the staple crop is rice, traditionally produced once a year in paddies. Population pressure has pushed the cultivation of rice onto medium uplands unsuited to this form of farming.

ACIAR has been present in this region for 10 years. In that time, researchers have developed ways to safeguard the rice crop from water scarcity and found the means to produce a second crop, including protein-rich legumes such as lentils and high-value vegetables such as tomatoes.

PHOTO: MELISSA MARINO



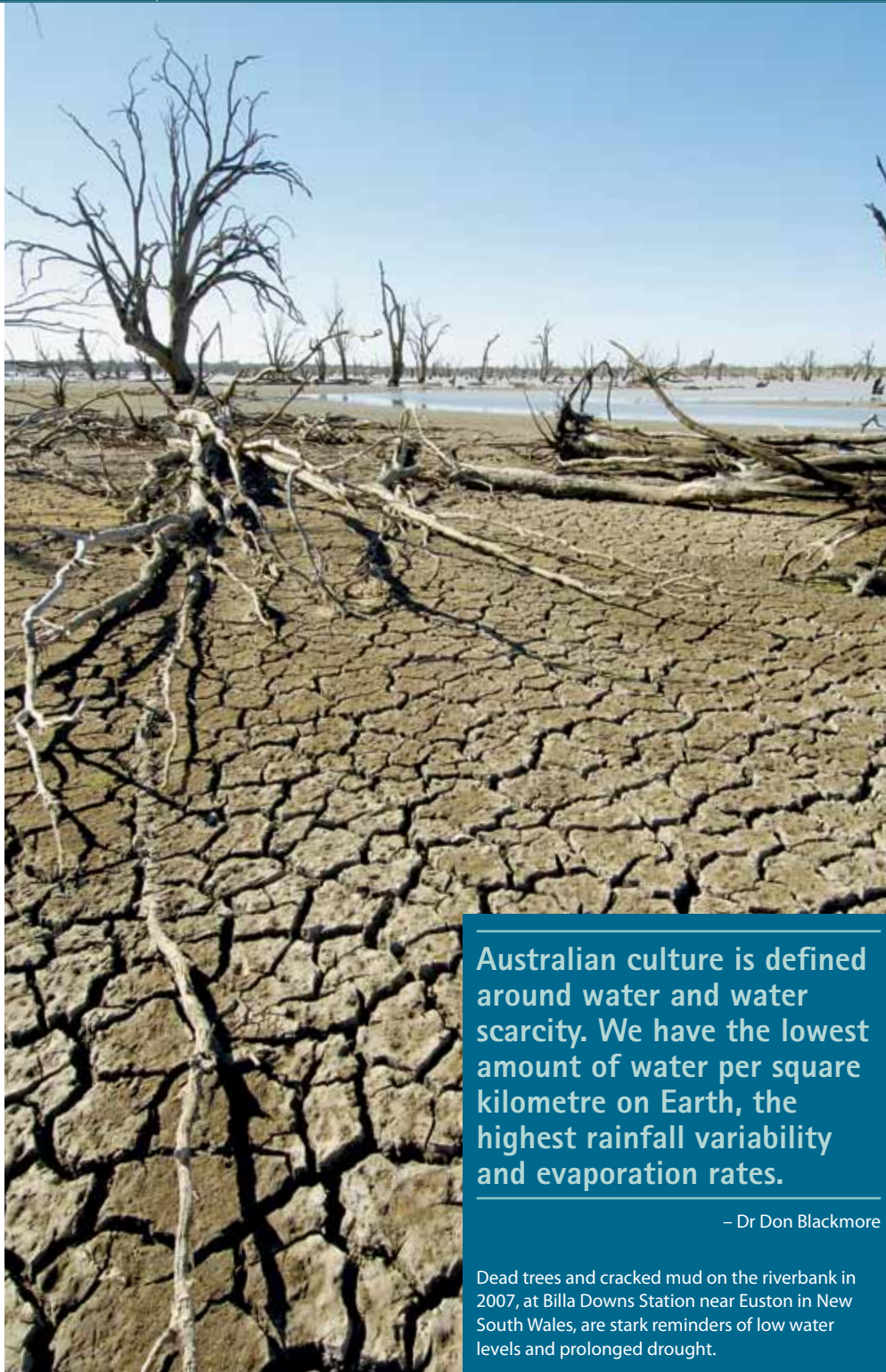


PHOTO: IRENE DOWNY

Australian culture is defined around water and water scarcity. We have the lowest amount of water per square kilometre on Earth, the highest rainfall variability and evaporation rates.

– Dr Don Blackmore

Dead trees and cracked mud on the riverbank in 2007, at Billa Downs Station near Euston in New South Wales, are stark reminders of low water levels and prolonged drought.

“The new farming system retains rice as the staple crop but does away with having to transplant the seedlings,” Dr Christen says. “Instead, rice is directly seeded into the ground using low-tech hand machinery that is less water-intensive, faster and more reliable. This change preserves enough soil moisture, especially in conjunction with short-season varieties, to plant a second crop.”

This new farming system is more resilient, uses water more effectively, requires less fertiliser and creates opportunities for socioeconomic advancement and improved food security.

The new farming model worked so well during trials that a project is now extending the findings to as many farmers in the region as possible. ACIAR is partnering with a leading Indian non-government extension organisation, Professional Assistance for Development Action (PRADAN).

PRADAN was established in 1983 to mobilise people with knowledge and empathy for marginalised communities to work at the grassroots level to overcome poverty. Today, professionals divided into 33 teams work with

about 272,000 families in more than 5,000 villages across seven of the poorest states in India.

ACIAR has found that improved outcomes for the rural poor and marginalised people are also possible where there are conflicting demands for overstretched water resources.

Landless and tenant farmers in the plains of eastern India are an example of this. Here, ACIAR came across conflicting use of small communal ponds for irrigating crops and for fish farming.

By identifying ways to manage the ponds more effectively, including topping up with groundwater at critical times, gains in productivity encouraged farmers to further develop their skills and the management of such small-scale water resources.

Assistance included helping landless, female tenant farmers to grow high-value produce such as vegetables. This lifted incomes and opportunities for social and economic development, such as being able to lease land.

Each region and social system is different. But what remains constant in these ACIAR projects is the broad nature of the benefits that accrue to communities from improved water management.

For example, Dr Christen says farmers find it hard to judge the right level of irrigation and tend to overwater. ACIAR is looking at this issue in African countries such as Tanzania.

Through CSIRO, the ‘Chameleon’ irrigation-management tool has been developed based on soil-moisture sensors that are linked to a three-light system that provides simple visual information about the soil’s moisture levels. Similar technology is also under development to sense changes in salinity in irrigation water.

“We are one year into introducing the technology in Tanzania and already farmers are reporting they have skipped up to two irrigations during the season,” Dr Christen says. “Irrigators further downstream in the small irrigation scheme also report receiving more water.”

The project is also exploring opportunities to develop rural economies through the manufacture of the sensors, lights and readers (currently being undertaken on a small scale in Australia by Measurement Engineering Australia) and for provision of irrigation management services by local farmers.

“Development without recognition of the socioeconomic and environmental realities around water use can backfire,” Dr Christen says. “It makes effective reform and management difficult, but the right mix of technical knowledge, social understanding and political will can make a difference.”

NEW AGRONOMY LESSENS WATER DEMAND

The focus is not just on how people use water. Gains have been possible in the way crops and pasture (and therefore livestock) use water

as well. This too draws on Australian expertise in improving on-farm water use efficiency (WUE).

ACIAR plays a vital role in funding some of this research, making it possible to tap vital and highly novel resources through the formation of international partnerships.

Dr Eric Huttner, ACIAR research program manager for crop improvement and management, says progress is made through a mix of agronomy—which optimises where and when water is available to crops—and breeding that improves a crop's physiological capacity to set seed when water is scarce.

"Agronomy research makes it possible to identify ways to manage the land to make best use of available moisture and also to test the most productive and profitable crop rotations, pastures and grazing options," he says.

The textbook case for agronomy is the practice of conservation agriculture. Also called 'no-till', the idea is to avoid ploughing the land to retain vegetative residue from the previous crop. This helps prevent evaporation and builds up soil fertility.

No-till has been tested, adapted and disseminated for use in the Middle East in partnership with the International Center for Agricultural Research in the Dry Areas. In a completed project in Iraq, agronomists demonstrated that no-till alone is economically beneficial in the production of wheat, even in the context of farms where the retained residue is grazed by livestock.

"Conservation agriculture reduces costs while maintaining the yield potential, making this farming system more economic for farmers," Dr Huttner says. "Even with grazing, farmers can realise a benefit and still accommodate livestock."

Typically built into these ACIAR agronomy projects are the means to solve obstacles in adoption of conservation agriculture—usually issues to do with the need for specialised sowing machinery and the research capacity to run trials.

Small, low-cost and locally produced seeders, such as the Happy Seeder, have proved popular with farmers in India, providing additional opportunities for rural economies and employment through manufacture and the provision of services. Similar seeders have been promoted in the Middle East and Bangladesh, where small-scale manufacturers have commenced production.

Gains have also been made by re-examining crop rotations, identifying ways, for example, to preserve and use post-monsoonal soil moisture for additional crop production in fields that would otherwise lie fallow. Examples of this include a rice/legume rotation in Bangladesh and the introduction of drought-resilient sorghum in India.

Gains made through agronomy can then be further exploited through specialised plant-



A man in Bangladesh pours water into a large pot of uncooked rice.

PHOTO: CONOR ASHLEIGH



David Deery manning the 15-metre High Resolution Plant Phenomics Centre imaging tower used to take infrared thermography images of wheat crops. The imaging technology is being used to improve the water productivity of wheat in dryland farming systems.

PHOTO: CSIRO

breeding programs. A case in point is an Australian Department of Foreign Affairs and Trade project managed by ACIAR in Afghanistan that is supporting the importation and evaluation of wheat and maize varieties from the International Wheat and Maize Improvement Center (CIMMYT) breeding program.

The ACIAR project built the capacity to trial the annual release of CIMMYT varieties and identified lines recommended for release to farmers.

"The CIMMYT material was bred with an eye to building resistance to problematic crop

diseases and we found lines with good levels of disease protection that yield more in a range of environments," Dr Huttner says. "In the process, the project built national capacity so that Afghanistan now has the ability to run these variety trials themselves."

Gains made through breeding, like agronomy, also come with associated challenges. In Afghanistan there are difficulties bulking up and releasing high-quality, pure seed to farmers cheaply. Advice and support is being provided to the Afghan Government and its Department of Agriculture.

"We have built the capacity to test varieties now and into the future," Dr Huttner says. "So with international centres targeting important traits such as heat tolerance, Afghanistan now has the means to test this high-value germplasm and incorporate it into Afghan farming systems."

Overarching these on-farm efforts are projects to develop the next generation of high-value WUE traits. Included is a promising project that CSIRO Plant Industry is undertaking with India. A novel way to adapt crops to drought is being developed through the selection of wheat plants with root architecture better designed to tap into deep soil-moisture reserves. The CSIRO team, led by Dr Richard Richards, pioneered the ability to select for transpiration efficiency, a trait that resulted in a series of new Australian wheat varieties with improved WUE.

The same team has since developed a suite of additional WUE traits that are making their way to Australian growers, including early vigour, longer coleoptiles (the sheath covering an emerging shoot) and dwarfing genes better suited to coexist with WUE traits.

The project is in its final phase and it is expected that wheat varieties in India and Australia will eventually incorporate this trait.

Well-established drought-tolerance traits such as 'stay-green' in sorghum are also being disseminated through ACIAR, with a breeding program underway in Ethiopia and trials in India to supply both food and fodder.

The corollary to a drying landscape is the rise of saline groundwater, which reduces crop production. A project just getting underway, led by CSIRO's Dr Richard James, is attempting to transfer a salt-tolerance gene (*Nax-1*) discovered in Australia for use in crops in Bangladesh.

Through these and related advances in breeding, agronomy and water management, the innovations needed to steer a course to 2050 are taking shape. It means that even a projected peak population of nine billion may still have secure food supplies, health and wellbeing. ■

MORE INFORMATION: Dr Evan Christen, evan.christen@aciar.gov.au; Dr Eric Huttner, eric.huttner@aciar.gov.au

FOCUS SHARPENS ON ASIA-PACIFIC GROWTH

The organisation responsible for coordinating agricultural research, knowledge and innovations for development in the Asia-Pacific region is crafting a vibrant new vision

KEY POINTS

- ACIAR is involved in framing a new vision and agricultural research capacity for the Asia-Pacific region.
- The work is being undertaken through the Asia-Pacific Association of Agricultural Research Institutions.

BY GIO BRAIDOTTI

Given the plethora of agricultural aid programs around the world—public, private and philanthropic, acting at national, regional and international levels—the need for coordinated integration is provided by the Global Forum on Agricultural Research (GFAR), headquartered in Rome.

GFAR's role is to bring together everyone with the power to shape and determine a sustainable future for agricultural productivity and its related food, health, social, economic, trade and environmental implications.

Making up the GFAR are a series of regional forums, with Australia taking active roles within one such grouping—the Asia-Pacific Association of Agricultural Research Institutions (APAARI).

APAARI's executive secretary is Dr Raghunath Ghodake, the former director-general of Papua New Guinea's National Agricultural Research Institute (NARI), where he gained a keen appreciation for ACIAR's presence in the region.

Dr Ghodake says that in promoting coordinated strategies for agricultural development, APAARI consults with 61 different member organisations, including ACIAR, 12 of the Consultative Group on International Agricultural Research (CGIAR) Centres, five international agricultural research centres, universities, non-government organisations, farmer groups, the private sector and 20 national agricultural research systems such as PNG's NARI.

Speaking from APAARI's headquarters in Bangkok, Dr Ghodake says the current focus is on the development of a new vision and an expansion in strategic options available to drive development and prosperity in the Asia-Pacific region.

"Agricultural development is no longer about 'more food and productivity,'" Dr Ghodake explains. "There are now issues beyond productivity relating to agriculture's many links to improved public health, food nutrition and safety, a broader base of economic opportunity, trade,

environmental sustainability, and access to knowledge. These links with farming present both opportunities and challenges to rethink the prospects for our region."

Primarily this means that research-driven development should not be limited to improving the on-farm productivity of marginal and smallholder farmers. "Now, we want to work with the higher-level value chains and integration of broader sectors," Dr Ghodake says.

This entails looking at all the economic activities related to agriculture—value-adding food processing, retail, tourism, forestry, and using oceans as sources of income not just food. By vertically and horizontally integrating value chains with smallholder production systems, APAARI members believe pathways can be found for the rural poor to take a greater share in the GDP.

"Food prices should not go up, so ultimately that limits possibilities for increased income from improving farm productivity," Dr Ghodake says. "So we are thinking about how best to diversify the agricultural sector across the value chains. What we are doing now at APAARI is thinking about how to make that happen—and it is exciting."

It is a vision that has excited Australia's representative on APAARI's 12-member executive committee, ACIAR's David Shearer. However, APAARI does not itself run projects, rather it facilitates, promotes, coordinates, networks and mobilises funding for projects of member organisations and nations.

In 2015–16, APAARI is organising several major events to redefine a vision for the region and identify pathways to coordinated action on new development opportunities. Three events in particular have excited Dr Ghodake and ACIAR alike, with ACIAR's CEO Dr Nick Austin and Mr Shearer helping to organise key events.

The first involves rewriting APAARI's vision, mission and goals for the future. New strategic directions are being envisioned around the emergence of new sciences, the enhanced capacity for collective action on interconnected



PHOTO: APAARI

Executive secretary Dr Raghunath Ghodake at APAARI's headquarters in Bangkok, Thailand.

We need a revolution in agricultural research for development: to mobilise, reorient, strengthen and bring coherence to systems that generate and share knowledge.

– Dr Raghunath Ghodake

PHOTO: RF123.COM



FAST FACTS

- Economic analysis has demonstrated that increases in annual agricultural R&D spending in some nations within the Asia-Pacific region, particularly China, India and Vietnam, greatly contributed to economic growth, agricultural development and poverty reduction.
- While the Asia-Pacific region has left the era of famines behind, about 63% of the world's hungry and malnourished, 50% of the world's extreme poor and 70% of the world's undernourished children and women reside in the Asia-Pacific region.
- The Asia-Pacific Association of Agricultural Research Institutions (APAARI) was established in 1990 by the Food and Agriculture Organization of the United Nations to strengthen the ability of national agricultural research systems to support research for development. Support and membership has since grown to include many sectors with an interest in agricultural research for development.
- The Asia-Pacific region is agriculturally the most vibrant in the world, covering nearly 70% of global food and vegetable markets and 80% of the total aquaculture market, while also producing tradeable agricultural commodities such as cotton and palm oil.

problems, the expanded range of development partners and the greater vertical coordination in supply chains.

"We need a revolution in agricultural research for development: to mobilise, reorient, strengthen and bring coherence to systems that generate and share knowledge," Dr Ghodake says. "We must overcome systematic failings in development outcomes for the poor."

A second event, scheduled for October 2015, is a high-level policy dialogue to enhance investment in the research and innovations that support the region's sustainable development. It is being co-organised by ACIAR and involves traditional organisations, such as the Asian Development Bank, and non-traditional ones, such as the Syngenta Foundation.

The third event is a workshop led by ACIAR to address ways to improve the capacity of the region's national agricultural research systems (NARS) to monitor, evaluate and assess project outcomes and effects. The current lack of such skills is believed to have restricted the ability of these organisations to obtain funding and policy support.

"What excites me is the prospect of what can be achieved if we can enhance the resources of the organisations that provide the research services for development, especially the NARS of developing countries," Dr Ghodake says. "Among APAARI members we are now facing the challenge of how to get it done." ■

MORE INFORMATION: www.apaari.org

CURRENT AND RECENT LEADERSHIP ROLES IN INTERNATIONAL AGRICULTURAL ORGANISATIONS FILLED BY AUSTRALIANS

NAME	ROLE	BACKGROUND
INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER (CIMMYT)		
Dr Andy Barr	Recent chair, Board of Trustees (to April 2015) and former Board member	Australian farmer and senior wheat breeder at seed company Australian Grain Technologies
Nicole Birrell	Board of Trustees, chair of the Nomination Committee and member of the Audit Committee	Economist and risk manager, director of Wheat Quality Australia and the Grains Research and Development Corporation
Professor Rob Lewis	Board of Trustees	CEO, South Australian Research and Development Institute
Professor Tim Reeves	Former director-general	
INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS (ICRISAT)		
Dr Peter Carberry	Deputy director-general—research	Computer modelling of farming systems
Joanna Kane-Potaka	Director of strategic marketing and communications	WorldFish, Bioversity, International Water Management Institute and ICRISAT senior communications and marketing positions
Dr James Ryan	Former director-general	Agricultural economics, development and international agricultural research
Associate Professor Wendy Umberger	Governing Board	Associate professor in the Faculty of the Professions and director of the Global Food Studies Program at the University of Adelaide
Dr Anthony Whitbread	Director, resilient dryland systems research program	Agronomist specialising in mixed, dryland farming systems, recipient of the 2013 CSIRO team medal for 'Impact from Science'
INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI)		
Professor Kaye Basford	Board of Trustees	Professor of biometry, School of Agriculture and Food Science, University of Queensland
Dr Paul Fox	IRRI representative for Bangladesh	Breeder and ACIAR research program manager for crop improvement and management
Dr Matthew Morell	Deputy director-general—research (to take up appointment of director-general in December 2015)	Theme leader (Future Grains, Grain-Based Food and Feed), Food Futures National Research Flagship, CSIRO
Dr Russell Reinke	Senior scientist and temperate rice breeder	Rice breeder at Yanco Agricultural Institute in New South Wales
Dr George Rothschild	Former director-general	Former director of ACIAR and CSIRO
WORLD FISH		
Professor Stephen Hall	Former director-general	CEO of the Australian Institute of Marine Science and professor of marine biology at Flinders University
Dr Nigel Preston	Director-general (commencing November 2015)	Program director, Integrated Sustainable Aquaculture at the CSIRO; fellow of the World Aquaculture Society
Dr Meryl Williams	Former director-general	A member of the Governing Board and chair of the Nominating Committee of ICRISAT, and vice-chair of the Scientific Committee of the International Seafood Sustainability Foundation
Dr Beth Woods	Board of Trustees chair	Deputy director-general of the Queensland Department of Agriculture and Fisheries, and former chair of IRRI Board, member and chair of ACIAR Board of Management Policy Advisory Council
INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE (IFPRI)		
Professor Kym Anderson	Board of Trustees chair	George Gollin professor of economics, University of Adelaide
INTERNATIONAL CENTER FOR AGRICULTURE RESEARCH IN THE DRY AREAS (ICARDA)		
Eve Bosak	Board of Trustees	Accounting, finance, corporate strategy and governance, and director and CEO of Governance Asia Pty Ltd Australia
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI)		
Professor Lindsay Falvey	Board of Trustees	CEO of Coffey-MPW, dean of the School of Land and Environment at the University of Melbourne, director of Hassad Australia, and adviser to government throughout Asia

INTERNATIONAL WATER MANAGEMENT INSTITUTE (IWMI)		
Dr Don Blackmore	Board of Governors chair	Chief executive of the Murray–Darling Basin Commission, deputy chair of Land and Water Australia, and adviser to the World Bank on river-basin management
WORLD BANK		
Dr Jock Anderson	Strategy and policy adviser in rural development	Emeritus professor of agricultural economics, University of New England
Dr Will Martin	Research manager, agriculture and rural development, Development Research Group	Researcher and manager at the Australian Bureau of Agricultural and Resource Economics and Sciences, and senior research fellow at Australian National University
Dr Bill Young	Lead water resources specialist	Project manager of the Murray–Darling Basin Sustainable Yields Project, involved in development and application of the Murray Flows Assessment Tool, adviser on environmental flows for the World Bank in developing countries, member of the World Bank Environmental Flows Advisory Group, awarded the 2008 CSIRO Chairman's Medal
WORLD VEGETABLE CENTER		
Cathy Reade	Board member	Director—public affairs and communication, the Crawford Fund
BIOVERSITY INTERNATIONAL		
Dr Tony Gregson	Recent Board of Trustees chair	Grain grower, agronomist and inaugural member of the CSIRO and Grains Research and Development Corporation boards, member of the CIMMYT, CGIAR Alliance Board and the CGIAR Genetic Resources Policy Committee, chair of Plant Health Australia

AUSTRALIANS HAVE BEEN INSTRUMENTAL IN THE MOVEMENT TO EXPLOIT AGRICULTURAL SCIENCE FOR DEVELOPMENT PURPOSES



SIR JOHN CRAWFORD

- Secretary of the Department of Commerce and Agriculture, 1950–56.
- Adviser to the World Bank.
- Architect of ACIAR and first chair of ACIAR's Board.
- Strong advocate for the development of the Consultative Group on International Agricultural Research (CGIAR) and first chair of the CGIAR Technical Advisory Committee.
- Director, Australian Japanese Economic Research Project.
- Chair, Advisory Board, Australian Development Assistance Agency, 1975–77.
- Australian of the Year, 1981.



PROFESSOR DEREK TRIBE

- The impetus for the establishment of a progenitor of the International Livestock Research Institute and a Board member, 1973–80.
- Played a significant role in the establishment of the Australian Academy of Technological Sciences and Engineering, of which he was a Foundation Fellow, and of ACIAR and the Crawford Fund.
- Was a powerful advocate for Australia's role in the international training of scientists from developing countries and helped many Australian universities make lasting linkages with Asia.



PROFESSOR JOHN DILLON

- Appointed professor of rural economics at the University of New England, 1965.
- Served on the boards of five CGIAR Centres, was chair of three, and twice served as the chair of the committee of the CGIAR Board.
- One of Australia's leading agricultural economists and chair of the ACIAR Board of Management, 1985–94. He played a key role in the review of ACIAR in 1991 that ensured the ongoing role of ACIAR in the Australian aid program.



DR GABRIELLE PERSLEY

- Long association with the International Livestock Research Institute (ILRI) and its predecessors—the International Laboratory for Research on Animal Diseases and the International Livestock Centre for Africa—dating to the mid-1980s.
- Served as deputy director-general—research of the International Laboratory for Research on Animal Diseases for two decades.
- Served as senior adviser to ILRI's director-general, Carlos Seré.
- Founder and chair of the Doyle Foundation, a Scottish-based charity that aims to support and advocate the role of science in international development.
- The impetus for the establishment in 2010 of Biosciences eastern and central Africa (BecA), a regional research platform located in Nairobi, Kenya, that gives scientists and students from across the region access to state-of-the-art facilities in the life sciences.

Healthy sunflowers sown at the correct time with minimum tillage to use residual soil water at the end of the wet season in Pailin Province NW Cambodia.



PHOTO: BOB MARTIN

ACIAR'S VISION

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

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



ACIAR
aciar.gov.au

Front cover:
Ornamental seedlings on a farm outside Nadi, Fiji. ACIAR is supporting a project seeking to use local ornamental varieties that could have commercial landscaping success in Fiji.

PHOTO: CONOR ASHLEIGH